Report

Study on Methodologies for Gas Transmission Network Tariffs and Gas Balancing Fees in Europe

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Executive Summary

Article 13 (2) of Regulation (EC) 715/2009 requires that tariffs for access to and use of gas transmission networks do not restrict market liquidity or distort trade across borders of different transmission systems. Where differences in tariff structures or balancing mechanisms would hamper trade across transmission systems, Art. 3 (2) of Regulation (EC) 715/2009 requires transmission system operators to actively pursue convergence of tariff structures and charging principles, including in relation to balancing.

In addition, Directive 2009/73/EC also calls for a promotion of investments in major new infrastructure while ensuring the proper functioning of the internal market in natural gas, which is also reflected in the stipulations of Art. 13 (1) of Regulation (EC) 715/2009 stating that tariffs shall provide incentives for investment. Finally, Art. 7 and 42 of Directive 2009/73/EC as well as Art. 12 of Regulation (EC) 715/2009 require TSOs and regulatory authorities to cooperate with each other for the purpose of integrating their national markets at regional level, with the ultimate aim of creating a fully liberalised internal market.

Notwithstanding these requirements, which largely correspond to those of the European legislation currently in force,[1] the existing transmission tariff and balancing models throughout Europe are characterised by considerable variety. Experience shows that these differences may create significant barriers and distortions for cross-border trade. Similarly, differences in the regulatory treatment of investments may provide insufficient incentives to invest into new infrastructure.

Based on this background, the Commission has initiated the current study, with the aim of evaluating if and how the existing differences effectively lead to barriers in trade across transmission systems and/or hamper investments in new transport capacities. In addition, this study analyses the scope for resolving these barriers through an increased level of harmonisation and develops recommendations on the minimum level of harmonisation that would be required or at least desirable from a European perspective.

[1] Directive 2003/55 and Regulation (EC) No 1775/2005

This summary presents the main findings of this study, covering the following issues:

- First, the main differences in the existing transmission tariff and balancing models of the Member States;
- Secondly, relevant barriers for cross-border trade and investments which result from these differences; and
- Finally, a summary of our recommendations for harmonisation and improvement of the current market and regulatory frameworks.

Existing Differences in Transmission Tariff and Balancing Models

This study is based on a comprehensive analysis of the structure and regulation of transmission tariffs and the arrangements for residual balancing and imbalance settlement in the EU Member States. Whilst the detailed analysis and findings are discussed in the main part of this report, the following text summarises a selection of the main observations.

With regards to the determination and regulation of transmission tariffs and investments into new infrastructure, it seems worthwhile to mention the following aspects:

- Although all countries have already introduced entry-exit mechanisms, the flexibility of the entry-exit system is reduced through the existence of several market areas or balancing zones in several countries. Moreover, some countries still apply a separate point-to-point regime for transit.
- Prices for interruptible capacities are subject to major variations, with discounts ranging from more than 50% to less than 10%, in many cases without any obvious relation to the risk of interruption.
- Only few TSOs offer non-physical backhaul capacities. Similar to interruptible capacities, prices vary widely (15% - 100% of the price of firm forward capacity).
- Short-term capacities are generally offered at a significant premium to annual capacities, in many cases by a factor of 2 to 4. Seasonal variations are widely applied.
- The regulatory regimes of the individual countries cover a wide range of different approaches. Whilst some countries apply traditional rate-of-return regulation, most

regulators use some form of incentive regulation, such as revenue caps or, in some cases, price caps. Similarly, different approaches are used for the valuation of the regulatory asset base and the determination of the allowed rate of return.

- Only a few countries grant TSOs the right to set the transmission tariffs themselves without any ex ante approval by the regulator or a similar governmental agency.

- Some countries apply various forms of specific incentives. Conversely, whilst several regulatory regimes explicitly provide for the use of benchmarking for comparative efficiency analysis of TSOs, this instrument is not currently applied in practice.

The following differences have been observed with regards to the balancing models applied in the different countries:

- Although nearly 50% of all countries already apply some form of market-based mechanisms for residual balancing, market-based mechanisms continue to play a minor role for the short-term procurement of balancing gas in most cases. As a result, non market-based methods continue to represent the main or often even the exclusive form of procurement in most countries.

- Even where market-based methods are used, the focus mostly is on products with a medium-term time horizon (1 month to 1 year in advance), with only three countries relying exclusively on the use of a day-ahead or intra-day market for the procurement of balancing gas.

- When interpreting these findings, care should be taken to consider the fundamental differences in the availability and ownership of different sources of flexibility, which may often constrain the choice of possible methods in individual countries.

- Although most countries formally apply a daily balancing period, the effective balancing period is often much shorter due to the use of penalty charges with a shorter timeframe (applied for instance on hourly or cumulative deviations during the day).

- The determination of imbalance and penalty charges varies widely, with only a few countries applying market-based charges that reflect the actual costs of balancing. In this context, it is furthermore important to note the often large difference between imbalance or penalty charges and market prices.

Relevant Barriers for Cross-Border Trade and Investments

Many of the differences in the transmission tariff and balancing models of the EU Member States described above may lead to barriers in trade across transmission systems and/or impede investments in new transport capacities. Based on the nature of the underlying differences, these barriers may be categorised into those resulting from differences in:

- Network access and tariff structures;
- Regulation of tariffs and investment planning; and
- Balancing models (residual balancing and imbalance settlement).

The following sections briefly summarise the relevant barriers in each of these areas, describe their impact and provide an assessment of how critical they are with regards to the promotion of cross-border trade and efficient investments into new infrastructure.

To facilitate comparison of the individual aspects, this assessment makes use of a standardised evaluation of each potential barrier as follows:

Highly critical	*Likely to cause major distortions to cross-border trade and/or serious barriers for new investment; Issue should receive immediate / focused attention*
Critical	*Likely to cause significant distortions or barriers, but of lower urgency; Immediate attention desirable but may have to await progress on other issues with higher priority*
Potentially serious	*May potentially cause serious distortions or barriers, although the current impact may be limited due to the existence of other, more critical issues Issue should be addressed at least in the medium-term, although some of its disadvantages may not be relevant at the moment*

Limited impact	*Believed to be of limited impact for cross-border trade (although it may be critical from a national perspective)* *Improvements in other areas should receive priority*
Requiring further study	*Impossible to analyse within scope of current study* *Requires further study to obtain reliable insights*

Barriers resulting from differences in network access and tariff structures

Table 1 below lists a total of 7 potential barriers for cross-border trade that can be traced back to differences in the general network access regime and/or the tariff structures applied by the national TSOs, ranked in order of decreasing importance. The following three items are regarded as most critical:

- The use of **different network access regimes** can create barriers to cross-border and/or domestic trade. The effective application of a point-to-point model in parallel with an unconstrained entry-exit system limits the flexibility of network users by not providing them with the full benefits of a de-coupled entry-exit system. Where separate systems are applied for national and cross-border (transit) flows, two distinct markets for domestic and cross-border trade are created, impeding the entry of external parties into the domestic market.

- The use of **different and often incompatible products** on both sides of the same border results in increased risk and transactions costs for network users and generally makes it more difficult for new entrants to join the market for cross-border trade. In addition, it is likely to result in a sub-optimal use of infrastructure.

- Thirdly, **high premiums applied to short-term capacities** do not seem to reasonably reflect the costs and market value of the corresponding product. Given the general deficit of firm long-term capacities, high prices for short-term capacities potentially discriminate against new entrants and other network users without sufficient long-term capacity rights. Finally, they do not support an optimal use of existing infrastructure by reducing the commercial scope for short-term cross-border trading.

Table 1: Barriers resulting from differences in network access and tariff structures

	Issue	Impact	Assessment
A-1	***Different network access models***	• *Reduced flexibility for use of entry and exit capacities* • *Separation between domestic and international market*	*Critical*
A-2	***Different / incompatible products***	• *Increased risks and transaction costs for cross-border trade*	*Critical*
A-3	***High premium on short-term products***	• *Discriminates against network users without firm LT capacities* • *Reduced scope for short-term trading*	*Critical*
A-4	***Lack of / Premium on backhaul capacities***	• *Prevents efficient arbitrage* • *Sub-optimal use of available capacity*	*Potentially serious*
A-5	***Pancaking / Pricing based on administrative borders***	• *Potential discrimination against cross-border trade* • *Inefficient use of (regional) network*	*Potentially serious*
A-6	***Lack / Determination of locational charges***	• *Inefficient use of network*	*Limited impact / Requiring further study*
A-7	***Allocation of total costs to tariff elements***	• *May result in discrimination of certain (groups of) network users*	*Limited impact / Requiring further study*

In addition to these major barriers, the following two aspects also deserve attention:

- The **lack of backhaul capacities** as well as prices that are likely to be significantly higher than actual costs, prevents efficient arbitrage between neighbouring markets and may contribute to a sub-optimal use of the network.

- The current practice of applying **separate entry and exit charges at administrative borders**, with an often unclear relation between the prices charged and the underlying costs, may discriminate against cross-border trade by exposing it to an over-proportional share of total costs. In combination with the additional effect of 'pancaking', this may result in an inefficient use of cross-border infrastructure.

In contrast, the **lack of locational charges** in many countries and potential problems related to the **allocation of total costs to different tariff elements** do not appear to be of high relevance for cross-border trade. Although they may potentially cause serious distortions, such problems would also apply to the corresponding local market and should hence be treated by the national regulatory authorities. Moreover, the quality of locational charges seems to be of minor importance under the general absence of a market-based pricing of congested capacities (see below).

Barriers resulting from differences in tariff regulation and investment planning

In the area of tariff regulation and investment planning, the lack of coordination in network planning and differences in the regulatory treatment of new investments appear as barriers that are highly critical for the realisation of new investments.

This assessment can be explained as follows (see also Table 2):

- A **lack of coordination of network planning** in terms of location and time, including the use of open season procedures, creates increased uncertainty and risks for network users, who may therefore find it difficult to participate or be forced to over-contract. In combination with an imperfect exchange of information, this may also lead to sub-optimal decisions by the TSOs, potentially resulting in over- or underinvestment.

- Differences and a lack of coordination in **the regulatory treatment of new cross-border infrastructure** create significant regulatory uncertainty and risk for nrtwork operators and users alike. In particular, this may endanger the realisation of individual projects as the commercial viability of new investments may differ at a national level. Furthermore, the complexity of synchronising the different decisions bears a high risk of undesirable delays.

Conversely, any **differences in the national regulatory systems**, including the fundamental regulatory principles and models, regulatory accounting and the determination of the allowed rated of return, can be considered as not critical, as long as the overall regulatory system in each country ensures sufficient revenues and avoids undue regulatory uncertainty. A more detailed investigation of the corresponding differences would have required a detailed country-by-country analysis such that it has not been possible to derive any final insights in this respect in this study. Similarly, this study has not assessed the actual performance of

Table 2: Barriers resulting from differences in regulation

Issue	Impact	Assessment
Lack of coordination in network planning	• *Increased uncertainty and risk for users* • *May result in sub-optimal investment decisions*	*Highly critical*
Regulatory treatment of new cross-border infrastructure	• *Increased risks and delays of new projects* • *Commercial viability of new investments may differ on a national level*	*Highly critical*
Differences in ***- Regul. principles*** ***- Regul. accounting*** ***- Allowed rate of return***	• *Not critical, provided that overall regulatory system ensures sufficient revenues and avoids undue regulatory uncertainty* • *Not possible to evaluate without comprehensive assessment of each local system*	*Limited impact / Requiring further study*

different open season procedures since the implementation of such processes is not directly related to the design and implementation of tariff and balancing models.

Barriers resulting from differences in balancing models

The relevant barriers related to the residual balancing actions to be taken by the TSOs and to imbalance settlement are summarised in Table 3. In total, five different but partially related issues have been identified as potential major obstacles for cross-border trade, including four aspects with at least a 'critical' assessment.

In detail, we note the following issues:

- With few exceptions, **imbalance charges** are **not market-based** and/or do **not reflect the actual costs** of balancing on a daily basis, reducing the scope for the provision of efficient economic signals. In addition, the widespread use of (implicit) penalties may create significant risks for network users and high barriers to entry.

- The **limited size of balancing zones** especially in smaller countries can create significant risks for network users as well as considerable barriers to entry.

- The **lack of market-based mechanisms for residual balancing** by the TSOs effectively de-couples the costs of balancing from the market, thereby reducing the scope for cost-reflective and efficient imbalance charges. This is likely to impair the efficiency of residual balancing and the cross-border exchange of balancing services.

- **Incompatible products for residual balancing** hinder efficiency by reducing the scope for the cross-border exchange of balancing services and creating potential barriers for external participants.

- The **use of different balancing periods and tolerances** increase transaction costs and may result in unreasonable risks for network users. In addition, network users may be able to engage into arbitrage between two neighbouring markets with different balancing periods.

This negative assessment must however be seen in the context of fundamental differences in the availability and ownership of different sources of flexibility and the general stage of de-

Table 3: Barriers resulting from differences in balancing models

Issue	*Impact*	*Assessment*
Lack of market-based / cost-reflective imbalance charges	• *Need to increase (implicit) penalties to avoid arbitrage possibilities* • *Inefficient price signals* • *Risk of punitive imbalance charges* • *Increased risk for network users* • *High barriers to entry*	*Highly critical*
Limited size of balancing zones	• *Increased risk for network users* • *High barriers to entry* • *Reduced scope for avoiding imbalances*	*Critical*
Non-market-based mechanisms for residual balancing	• *De-couples costs of residual balancing from general (commodity) market* • *Inhibits exchange of balancing services*	*Critical*
Incompatible products for residual balancing	• *Inhibits exchange of balancing services* • *Barrier to participation of external bidders*	*Critical*
Different balancing periods	• *Increased risk and transaction costs for users* • *Potentially punitive imbalances* • *Risk of arbitrage*	*Potentially serious*

velopment in the EU Member States. As a result, the introduction of fully-fledged market-based systems may be unjustified or even impossible in some countries. Similarly, the size of many gas markets is the result of exogenous factors rather than conscious design decisions. In both cases, regional integration may be a precondition for mitigating these issues as further discussed below.

Critical Barriers identified by Users and Other Stakeholders

The assessment of potential barriers has been supplemented by a user survey based on standardised telephone interviews with a sample of network users, TSOs and national regulatory authorities from various countries. Out of the total 35 parties contacted, approx. 50% (19) participated in this survey and provided their views on a list of structured questions.

The user survey confirmed many of the previous findings but furthermore highlighted the fact that most stakeholders view the harmonisation and improvement of capacity management and capacity allocation as the primary goal to be pursued, although investments into new cross-border capacity are also seen as essential for establishing a true European market for natural gas. The results of the user survey can be summarised as follows:

- Capacity management and capacity allocation are widely regarded as the issues requiring primary attention;
- Investment in new capacity is considered insufficient and existing tariff regimes are not believed to provide correct investment signals;
- Auctions are regarded as the preferred solution for providing locational signals to network users and identifying investment needs in the international network;
- Although differences in balancing regimes are perceived as less critical than access to cross-border capacities, the lack of harmonisation is clearly seen as a barrier to cross-border trade; and
- Many open season procedures applied today are seen as critical due to the lack of international cooperation and asymmetric commitments of network users and the TSOs.

Recommendations for Harmonisation and Improvements of the Market and Regulatory Framework

Based on the findings of the international comparisons and the assessment of potential barriers, we have analysed a variety of potential options for improving the market and regulatory framework. In the following section, we present our resulting recommendations for harmonisation and potential improvements in the areas of gas transmission network tariffs, the regulation of investments into network infrastructure as well as gas balancing and imbalance settlement.

Network access and transmission tariffs

Our analysis suggest that the need for harmonisation in the area of transmission tariffs is closely related to the arrangements for capacity allocation and congestion management. In general, we therefore fully support the idea of harmonising the rules and principles for this area and emphasise the importance of many of the proposals made in early 2009,[2] including in particular the bundling of entry- and exit-capacities at the same border between two different market areas.

In addition, we specifically point out the following recommendations:

- TSOs should be obliged to offer non-physical backhaul capacities at all internal borders where such capacities are requested by network users, even where these capacities can only be provided on an interruptible basis. In addition, it should be ensured that non-physical backhaul capacities (i.e. capacities against the physical flow direction) are offered at cost-reflective prices and take account of the limited firmness of capacity.

- To promote an efficient use of scarce network capacities and given the lack of available firm long-term capacities, it should be ensured that the pricing of different capacity products does not create any undue barriers for the use of short-term capacities.

[2] ERGEG principles: Capacity allocation and congestion management in natural gas transmission networks. An ERGEG Public Consultation Document. Ref: E08-GFG-41-09. 15 Jan 2008

- To enable an efficient allocation and use of network capacities and to provide adequate locational signals, we recommend that the allocation of cross-border capacities within the Internal Market[3] is at least gradually changed to the application of market-based mechanisms, i.e. auctioning.

- To enable optimal use of the European transport networks and to provide appropriate locational signals, it may be desirable to (partially) replace the current system of separate entry- and exit-tariffs at each (administrative) border by an Inter-TSO Compensation Mechanism. However, as the experiences from the European Electricity Market have shown, the development of a corresponding mechanism represents a highly complex task, which would require far-reaching changes to the current arrangements for the pricing of network capacities. We therefore believe that further studies are required before making a final decision and that this option represents a potential long-term solution only.

In particular the first two aspects but also the third can be largely addressed at a national level. Any potential measures at European level should therefore focus on ensuring that the corresponding principles are introduced and complied with at national level. Conversely, the introduction of an Inter-TSO Compensation Scheme would by definition require a regional or even a European approach and would therefore need to be addressed at the corresponding level.

Network planning and investments into new infrastructure

The lack of coordination in the area of network planning and differences in the regulatory treatment of new investments represent significant barriers for the efficient development of the European gas networks. High priority should therefore be given to further the harmonisation of existing arrangements for the planning, approval and financing of investments into new network infrastructure with a regional scope.

Harmonisation of investments in multiple countries with different legal and regulatory rules will undoubtedly represent a complex task. We therefore recommend a phased approach,

[3] Please note that different mechanisms may be required at the interface to external areas, which are not covered by European legislation.

which should aim at gradually introducing the basis for ensuring the necessary degree of harmonisation at a regional, and ultimately also a European level:

- As a priority, we recommend that European TSOs and regulators should continue their efforts towards developing and implementing arrangements for the coordinated planning and expansion of the European gas networks, which should cover both locational aspects and the timing of investments. Besides the internal planning process of the network operators, it is paramount to also synchronise the mechanisms for assessing the market's need for new capacities and the initial allocation of new transport capacities, for instance by means of coordinated Open Season procedures.

- In parallel, European regulators should develop mechanisms for the coordinated approval of investments with a regional scope, i.e. of investments which have a tangible impact on two or more countries. In addition to a structured exchange of information and joint assessment of relevant projects, these arrangements should support the synchronisation of regulatory decisions on corresponding projects and ensure that national regulators take adequate account of regional aspects when deciding on the approval of individual projects.

- To avoid undue risks for national TSOs and as a precondition for providing adequate incentives to invest, it has to be ensured that national regulation does not conflict with any prior decisions on the approval of investments at a regional level. The legal and regulatory framework for the European gas markets should therefore be developed with a view to ensuring that national regulators take adequate account of such decisions within the regulation of national monopolies and that national TSOs do not face any undue risks as a result of realising the corresponding projects.

- In certain cases, the development of the regional and/or European market will benefit from the realisation of specific investments, which are not directly beneficial for the country where these investments are made. We therefore recommend also studying potential approaches for enabling the joint financing of corresponding projects, potentially in combination with the introduction of an inter-TSO compensation mechanism as mentioned above.

We acknowledge the potential complexity of some of the corresponding solutions and that some far-reaching changes may be required to the existing regulatory arrangements at a national and European level. We therefore emphasise that further study will be required in this

respect and that particularly the latter areas of harmonisation may only be feasible in the medium- to long-term.

Secondly, we point out that the individual areas may be addressed at different levels. For instance, whilst the provision of information on the future development of the European gas networks should obviously be best coordinated at a European level, most underlying planning and allocation processes may continue on a regional level. Similarly, the coordination of investment approvals or the shared financing of investments may potentially be realised at different levels such that we advise studying this in more detail before a final decision is made. However, TSOs and regulators should be obliged to develop corresponding solutions and to implement and apply them once they have been agreed.

Residual balancing and imbalance settlement

In line with the responses received from various market participants, we believe that the existence of different arrangements for balancing does not necessarily represent a fundamental obstacle for non-discriminatory access to the network. However, we also share the belief that the regional integration of balancing mechanisms and an increased compatibility of the arrangements for imbalance settlement would be decisive in reducing overall costs to European consumers and in facilitating efficient use of the gas transmission networks.

In this respect, we also emphasise again the importance of the current efforts by ERGEG to improve the principles for capacity allocation and congestion management. An increased scope for short-term trading and utilisation of network capacities are, amongst other things, believed to result in an improved use of the network and hence a more efficient contribution by market participants to the balancing of the system.

To promote harmonisation and the development of the European gas market, we specifically recommend the following:

- TSOs (and regulators) should work to promote the cross-border exchange of balancing gas, both between themselves and between TSOs and external network users. Amongst others, the products used by different TSOs should be harmonised and, wherever possible, based on trading-oriented products, preferably being traded at notional trading points rather than individual physical locations.

- Where sufficient compatibility of the products for the balancing mechanism has been achieved, the mechanisms used for the procurement of residual balancing gas should be gradually integrated at a regional level. TSOs and regulators should therefore promote the establishment of regional marketplaces, preferably in close cooperation with the operators of energy exchanges, where network users and TSOs can exchange for trading and balancing purposes during the gas day. However, we emphasise that the implementation of corresponding mechanisms require a number of preconditions to be met such that we only view them as a medium- to long-term goal.

- In parallel, the mechanisms for the determination and pricing of imbalances should be developed with a view to ensuring a maximum level of compatibility between neighbouring countries, or market areas. However, we do not believe that full harmonisation, such as the uniform use of a single balancing interval, is required. Instead, it may be necessary to accept different balancing intervals, in order to reflect the underlying physical capabilities of different systems.

Given the lack of any commonly accepted and/or applied best-practice models for the different aspects mentioned above, we do not believe that it would be reasonable to precisely specify the structure and content of the corresponding arrangements. Moreover, the different physical structures of the transmission networks and gas supply in different regions indicate that there may be a need for slightly different solutions in different areas.

At this stage, we therefore believe that the focus at the European level should be on ensuring that corresponding steps are being taken, and different options are explored, with a view to gradually developing a common European approach (or model) which should then be gradually introduced in different regions.

1. Introduction

1.1 Background and Objectives

This study into methodologies for gas transmission tariffs and gas balancing fees was initiated by the European Commission in order to assess the existing European transmission tariff and balancing models, identify differences between them and analyse if such differences have a negative impact on barrier free cross border trade.

Article 13 (2) of Regulation (EC) 715/2009[4] requires that tariffs for access to and use of gas transmission networks do not restrict market liquidity or distort trade across borders of different transmission systems. Where differences in tariff structures or balancing mechanisms would hamper trade across transmission systems, art. 3 (2) of Regulation (EC) 715/2009 requires transmission system operators to actively pursue convergence of tariff structures and charging principles including in relation to balancing. This obligation is to be fulfilled in close cooperation with the national regulatory authorities, responsible for fixing or approving, prior to their entry into force, the tariffs and conditions for the use of gas transmission networks and balancing services according to article 41 (2) of Directive 2009/73/EC[5].

Notwithstanding these requirements[6], it is clear that the national gas transmission tariff and balancing systems still vary due, for example, to differences in their historic gas market development, different underlying policies and regulation traditions. Transmission tariffs and balancing fees are of paramount importance for a non-discriminatory access for network users, as they have major financial impact on gas supply projects.

Even though the expected payments from imbalance charges will always remain to a certain extent uncertain for a network user, it is essential for market entry that both transmission tariffs and balancing fees are predictable for network users. Furthermore, network tariffs should provide appropriate signals where new infrastructure is required. Balancing fees shall be

[4] Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.

[5] Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.

[6] These requirements are already included in the 'old' Regulation (EC) No 1775/2005 and Directive 2003/55/EC.

ideally based upon the costs incurred by the TSO. Overall, both network tariffs and balancing fees shall be fair and non-discriminatory.

Not all regulatory tariff systems equally provide appropriate investment signals. Where such incentives are missing and tariffs only focus on tariff reduction and assess TSO efficiency against the cost level without, for example, taking system flexibility via additional capacities into account, the regulatory tariff system is likely to create a barrier for new investments.

The European Commission therefore has ordered this study to evaluate if, and how, the existing differences effectively lead to barriers in trade across transmission systems and/or hamper investments in new transport capacities. Based on this analysis, this study shall furthermore analyse possible areas for improvement and evaluate the minimum level of necessary harmonisation.

This study has been supported by a Steering Group from ERGEG, which has provided valuable comments to our work. In addition, we would like to express our gratitude to ERGEG and GIE and their respective members, the Florence School of Regulation, participants of the user survey, the organisers of the Virtual Test within the Gas Regional Initiative North-West and various other individuals and organisations, which have supported our work under this project.

1.2 Scope and Structure of this Study

As outlined above, this study assesses the transmission tariff and balancing models in the European Union, with the ultimate objective of developing a set of recommendations aimed at ensuring fair access to all customers in Europe on predictable terms, whilst simultaneously providing sufficient incentives to network operators for investing into new (cross-border) transmission capacities.

Transmission tariffs and balancing models represent key elements of non-discriminatory network access, which is a precondition for the establishment of a functioning gas market. In addition, the successful development of the Internal Gas Market also requires improvements in a number of other areas, such as capacity allocation, congestion management or, more generally, in increased transparency. Many of these aspects are closely related with the issues addressed in this study. However, although reference is sometimes made to other areas, we emphasise that they are outside the scope of this study.

Table 4: Aspects to be considered under Task 1

Area / Relevant for	Transmission tariffs	Balancing
Network operators (TSOs)	*Regulation of transmission tariffs*	*Procurement of balancing gas*
Network users (Network users)	*Transmission tariff structure*	*Settlement of imbalances*

The areas analysed by this study can be grouped into a set of four different categories as illustrated by Table 4. For instance, whilst it is primarily the structure of transmission tariffs that is relevant for network users, the principles for the regulation of transmission tariffs are more important for network operators as they will have a direct impact on incentives to invest into new transmission capacity. Conversely, the mechanisms for residual balancing are of primary importance for the TSOs, whereas network users are more affected by the arrangements for imbalance settlement. The analysis in this report has therefore been generally structured along this division into four different areas, which facilitates both the presentation of information on the existing transmission tariff and balancing models and the subsequent analysis of potential barriers and areas for improvement.

Based on this background, the analysis in this report is structured as follows:

- The following Chapter 2 provides a structured comparison of the applicable transmission tariff and balancing models in all EU Member States. This analysis focuses on a number of important elements and provides the basis for the subsequent discussion of selected areas in the following chapters. The information collected is furthermore supplemented by the fact sheets in the Annex to this report, which provide a more comprehensive summary of the applicable arrangements in each Member State.

- Chapter 2.5 discusses potential barriers for cross-border trade and investments into new cross-border transmission infrastructure in each of the four areas identified. Besides an extensive qualitative discussion, this part of the study includes a quantitative analysis of the impact of different imbalance settlement regimes on network users and presents the findings of a user survey, which has been used to identify areas of concern for network users, TSOs and regulators.

- Based on these findings, Chapter 4 then develops and proposes a set of recommendations that may resolve, or at least help to mitigate, some of the issues identified before, insofar as these would need to be addressed in European legislation. Besides the treatment of the corresponding issues by the existing national authorities, particular emphasis is made on the establishment of regional markets, such as the development and strengthening of trading hubs, the potential introduction of regional balancing mechanisms or the resulting requirements on transmission system operation in an increasingly integrated market.

- Finally, Chapter 5 puts the different findings and proposals into context with each other by highlighting the interaction between different recommendations and identifying a suitable phasing of the individual changes and actions.

2. Country Comparison

2.1 Overview

This chapter compares some important elements of the gas transmission tariff and balancing models in the EU Member States. It is based on a detailed analysis of each country, which we have summarised in the form of fact sheets, one for each country, in the Annex to this report. Whilst the fact sheets provide an overview of the applicable arrangements in each country, the current chapter compares several important aspects, some of which are further addressed by the discussion of relevant differences in chapter 2.5.

To facilitate a comparison, the subsequent analysis follows the same structure as presented in the previous chapter and as also applied for the fact sheets, i.e. the discussion is divided into four major areas:

- Transmission tariff structures;
- Regulation of transmission tariffs;
- Residual balancing; and
- Settlement of imbalances.

In general, this report covers all Member States of the EU-27, exclusive of Cyprus and Malta (which have no gas transmission) and Latvia, which has not yet opened its gas market for third-party access. For similar reasons, several other countries (for instance Estonia and Finland) are dealt with in less detail.

In addition, it is important to note that the analysis in this chapter focuses on comparing important features across different national systems, whilst we refer to the fact sheets for more details on individual countries. Moreover, in some cases it was not possible to obtain all the required information for each country, whereas in other cases certain issues are sometimes simply not applicable in all countries.

Finally, we emphasise that the situation in many Member States is subject to constant change, for instance due to ongoing industry consultations, new regulatory rules and decisions, or more generally the progress made by national TSOs and regulators in further de-

veloping the overall market and regulatory arrangements. As a general rule, the following comparison is therefore based on the status in the EU Member States **as of April 2009**, although we sometimes comment on important developments in certain countries and regions.

2.2 Transmission Tariff Structure

Against the general background provided by Directive 2003/55/EC, the EU Member States have developed a large variety of different products and tariff structures. These differences range from the choice of the general tariff model or the range of products offered to the market to the principles for the determination and pricing of individual products. As a result, it is often not easily possible to directly compare the pricing of individual products in different markets since the corresponding tariffs have to be seen in the overall context of the applicable network access and tariff model in each country.

For these reasons, this section focuses on a comparison of some important principles and aspects which determine the structure and calculation of the tariffs to be paid by users of the transmission network. It provides a general description of the tariffs to be paid by network users for different services and under different circumstances and gives an overview of specific services offered in various countries.

In summary, the subsequent analysis covers the following aspects:

- Choice of the general tariff model (postage stamp, entry-exit, distance-based);
- Use of locational and directional charges;
- Basis for transmission charges (capacity vs. energy);
- Pricing of 'other' types of capacities, such as interruptible contracts, non-physical backhaul flows or short-term capacities;
- Offering of any additional services, such as title tracking, wheeling or quality conversion; and
- Existence of any additional tariff components, such as separate payments for fuel gas or scarcity charges in case of physical congestion.

In addition, we also comment on relevant differences in the treatment of domestic and cross-border trade where these exist.

2.2.1 Basic tariff model and use of locational or directional charges

As the first part of this analysis, Figure 1 compares the basic tariff models applied in the individual Member States. It is not surprising to see that, in line with the preferred model of Directive 2003/55/EC, the majority of EU countries apply an **entry-exit system**, at least for domestic trade and supply. Conversely, several countries effectively apply a separate **point-to-point regime** at least for transits. Moreover, a closer analysis also reveals considerable variety in the implementation of entry-exit systems in individual countries.

Overall, the overview in Figure 1 therefore differentiates between the following approaches:

- Many countries apply truly **de-coupled entry-exit systems**, which principally allow for the separate contracting and use of entry and exit capacities at any point in the network;
- In some countries, this flexibility is reduced by the **existence of several market areas** or **balancing zones** even where the corresponding parts of the network are directly connected to each other and are supplied by the same gas quality,[7] requiring separate capacity bookings for and between each of these different areas;
- Some countries also apply **locational signals** taking into account structural differences or (implicitly) the transport distance, as tariffs tend to be lower for locations nearer to the gas entry;
- In contrast, other countries apply a more simplified version of the entry-exit system, with the entire costs of (domestic) transmission being charged to consumers by means of **postage stamp tariffs**;[8]
- As a fundamental alternative, several countries effectively apply two different tariff systems, with entry-exit tariffs being used for domestic transport, whilst cross-border

[7] In addition, we note that several countries differentiate between balancing zones for high and low calorific gas (for example, Belgium, France or Germany), whilst for instance the Austrian market consists of three geographically distinct areas that are not directly connected to each other.

[8] A postage stamp tariff can be interpreted as an entry-exit system with entry and exit capacities always being required to be equal.

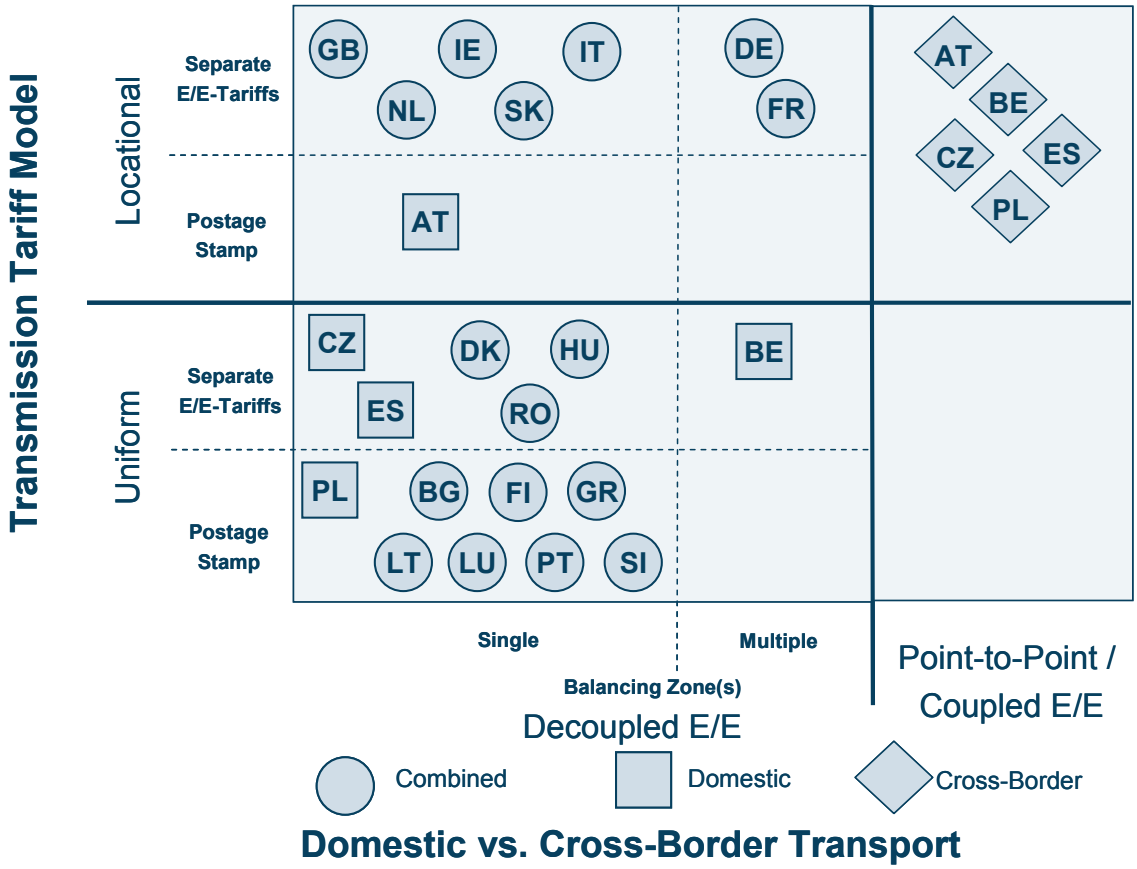


Figure 1: Comparison of basic transmission tariff models in EU Member States

Note: In Finland, network tariffs are implicitly charged through the single buyer – single seller model

transits are subject to **point-to-point tariffs**, limiting the booking of capacity to specified combinations of entry and exit points with charges raised based on distance (except Spain); and

- Even in countries with a de-coupled entry-exit system, some entry or exit points may be subject to **locational restrictions** for individual connections,[9,10] effectively introducing a point-to-point system for individual points in the network only. Similarly in

[9] Such as the so-called 'Zuordnungsauflage' in Germany

[10] Please note that this group does not include the options of shorthaul capacities (discussed as a special service below) or restrictions agreed on a voluntary basis.

Belgium, network users have to specify a 'default' transport route (called contractual link), which becomes binding only in case of internal congestion.[11]

Besides the choice and design of the general tariff model, Figure 1 also shows where transmission tariffs are differentiated by location. As illustrated by the upper part of Figure 1 locational charges are used especially in the large countries and most of the more mature markets in North-Western Europe. Conversely, uniform regional charges prevail in most of the smaller markets but can also be found in some of the larger countries, such as Spain. Figure 1 also shows that a considerable number of countries have further simplified the entry-exit model (for domestic transports) by integrating entry charges into the exit tariff, corresponding to the application of a postage stamp tariff model. A similar approach has finally been chosen for instance by Ireland, which differentiates only the price for entry capacities, whereas there is a single exit point (zone) to the domestic onshore network.

2.2.2 Basis for transmission charging

Throughout the EU, charges for basic transmission services are mainly based on the contracted (i.e. booked) capacity. In addition, 12 out of 22 countries also apply a commodity charge for the energy actually transported. As illustrated by Figure 2 the ratio between **capacity and commodity charges** varies between 70:30 and 95:5. In addition, the countries with commodity charges can be approximately evenly divided into one group, where commodity charges are used to recover between 25% and 30% of total network charges, and a second group where the share of commodity charges is limited to 5% to 10% of total revenues from network charges. The only exemption is Great Britain with commodity based charges amounting to almost 50%; however, there is no fixed split in Great Britain.[12]

As further explained in section 2.2.4 below some TSOs apply separate charges for fuel gas and/or shrinkage or require network users to compensate the corresponding volumes of natural gas in kind. Conversely, these costs are covered by basic transmission charges in

[11] Under normal circumstances, network users are free to nominate outside the contractual link, however in case of congestion the TSO can demand that a network user submits a re-nomination according to this specification.

[12] National Grid levies TO (Transportation Owner) and SO (System Operator) commodity charges on entry and exit users. The TO commodity charges are used to balance any under or over recovery of TO revenue caused by the uncertainty of income from the various auction mechanisms. Whereas the SO commodity charges fund the costs of system operation including the incentive scheme costs and allows additional revenues, for example from incremental release capacity or incremental costs e.g. buy-back above the cap to be flowed back to users.

other countries. These differences should be taken into account when interpreting the differences in Figure 2.

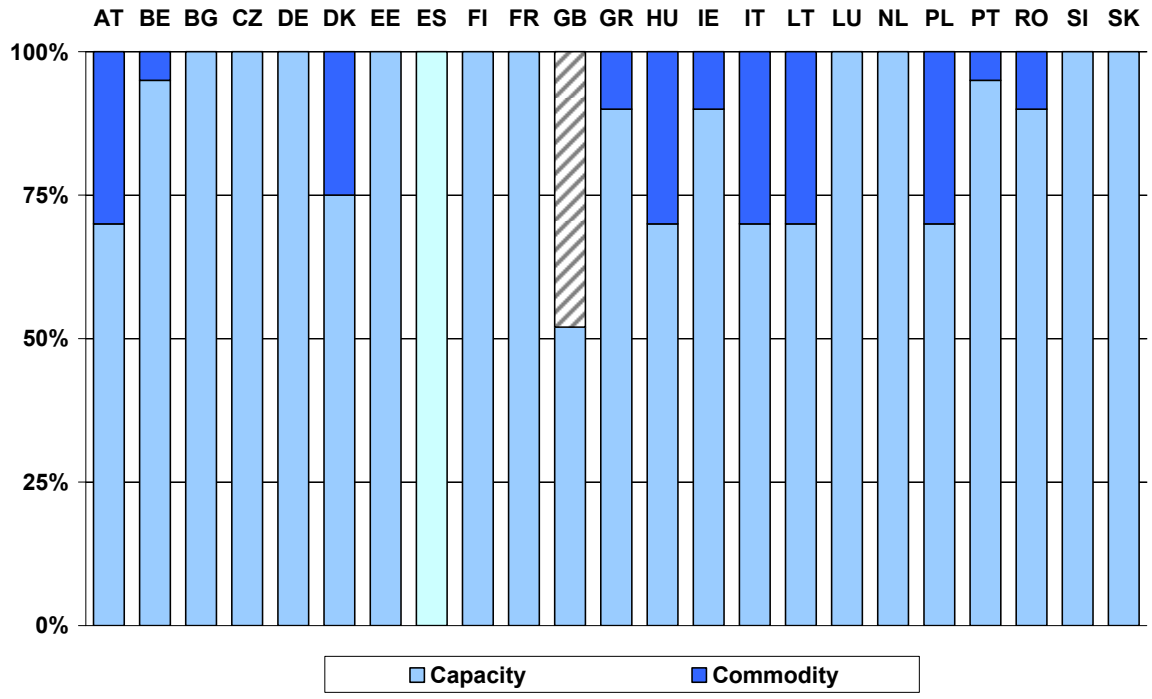


Figure 2: Split between capacity and commodity charges for domestic transmission

Note: 1) No 'target' split exists in GB, figures based on indicative values for regulatory period April 2009 – March 2010
2) In Spain a commodity tariff exists

2.2.3 Pricing of 'other' types of capacities

Interruptible capacity

Besides firm capacities, most TSOs also offer **interruptible transmission capacity**. In contrast, only a few countries (i.e. Finland, Greece, Ireland, Luxembourg, and Portugal) do not offer this service as the TSOs do not expect any congestion problems, whilst in Great Britain this service used to be only available on a day-ahead basis. Moreover, the concept of inter-

ruptible capacities is often limited to cross-border trade,[13] storage, production sites or large consumers, whereas exit capacities to domestic customers are usually provided on a firm basis.

Figure 3 shows the relative price for interruptible capacities in relation to the price for firm capacities at the same entry-exit point and for the same duration. Although most countries offer interruptible capacities at a discount of 10% to 30%, the variation in the relative price of interruptible capacities is large. For instance in France, the discount for interruptible capacity may reach up to 50%, depending on its duration. In the Czech Republic, Hungary or Slovakia, interruptible capacity may, in extreme cases, be available for a price of almost zero, depending on the agreed or the actual level of interruptions during the contract period. In Ger-

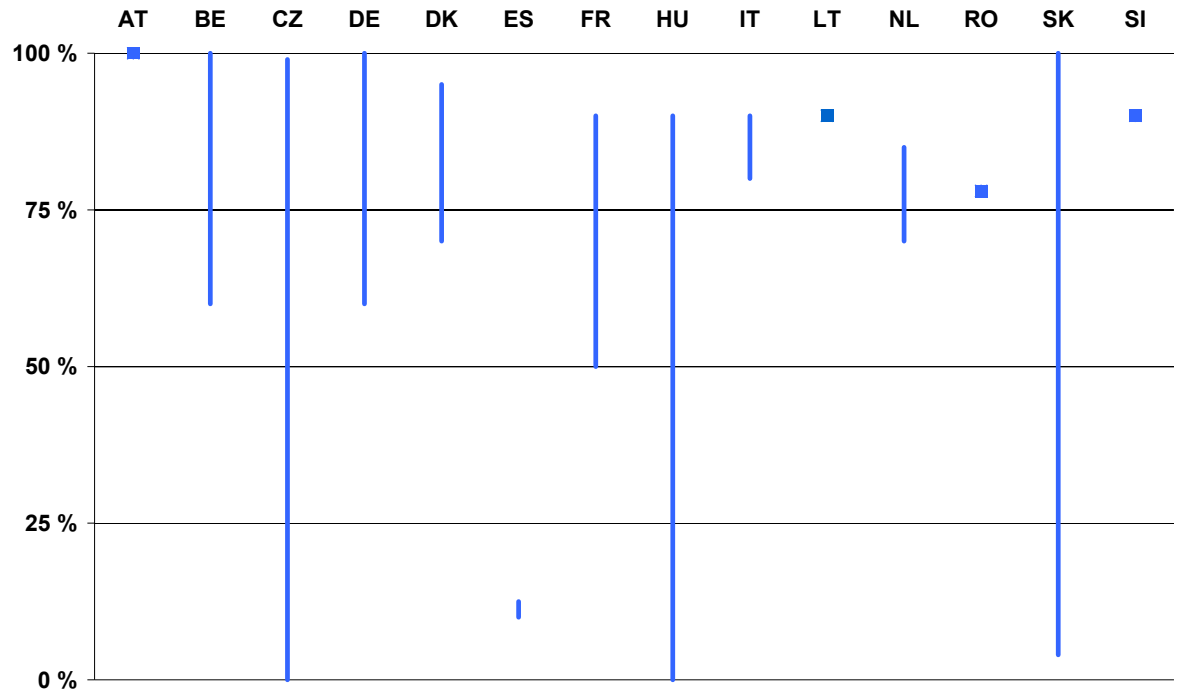


Figure 3: Price of interruptible capacity compared to firm capacity (%)

Notes: 1) Picture shows only countries where interruptible capacity is offered to the market
2) Spanish figures based on capacity tariff only, for commodity an increase of 115% to 167% applies

[13] In the case of France and Germany, including entry and exit capacities between different internal balancing zones.

many almost every network operator uses its own tariff scheme for interruptible capacities. Finally in Great Britain (which is not shown in Figure 3), interruptible capacity used to be offered for entry points only, with the price being determined by daily auctioning.[14]

Also it should be noted that in some cases a reimbursement scheme is in place for the case of supply interruption. For example, in Austria transit tariffs for interruptible capacity are indeed the same as firm tariffs, with network users being compensated in case of interruptions. Similar mechanisms are also widely used in Germany.[15]

In the Spanish system interruptible capacity is available at very low cost. Actual usage of this capacity on the other hand comes at comparably higher commodity charges ranging from 115% to 167% of normal network tariffs.

Non-physical backhaul capacity

Most TSOs do not offer **non-physical backhaul capacity**[16] as a standard service to network users. In addition, this service is only offered to transit customers in Austria or the Czech Republic. However, even where backhaul is not offered as a standard product, it may still be available when a network user asks for it on a case-by-case basis.[17] In some cases a distinction is made between physical or non-physical backhaul capacities (e.g. Austria) or the backhaul tariff is differentiated for the expected risk of interruption (e.g. Netherlands).

Figure 4 compares the relative price of non-physical backhaul capacity in those countries that offer this service, with the relative price being expressed as a percentage of the price for the corresponding type of firm (forward) capacity. It can be clearly seen that the variations in the (relative) price are at least as large as in the case of interruptible capacities. For instance in Hungary, network users have to pay the same price for backhaul as for firm capacity. Conversely, backhaul capacity is offered at a discount of 65% to 85% in Austria and Italy, respectively. In Denmark and the Netherlands, the price of backhaul capacity ranges between 70% and 95% of the price for firm forward capacity.

[14] In April 2009, National Grid introduced a standing offer of daily interruptible ("Off-Peak") Exit capacity according to a rules based assessment of available capacity.

[15] Please note that the German market is very fragmented and that every network operator applies its own scheme such there is no uniform system for interruptible capacities.

[16] In this document, we define 'non-physical backhaul' as backhaul capacities that can only be used in the form of reducing an existing physical flow across a given interconnector, in contrast to physical backhaul, which relates to the option of physically reversing the flow on a given pipeline.

[17] In addition, backhaul may be used implicitly by the TSOs, e.g. to keep the system in balance.

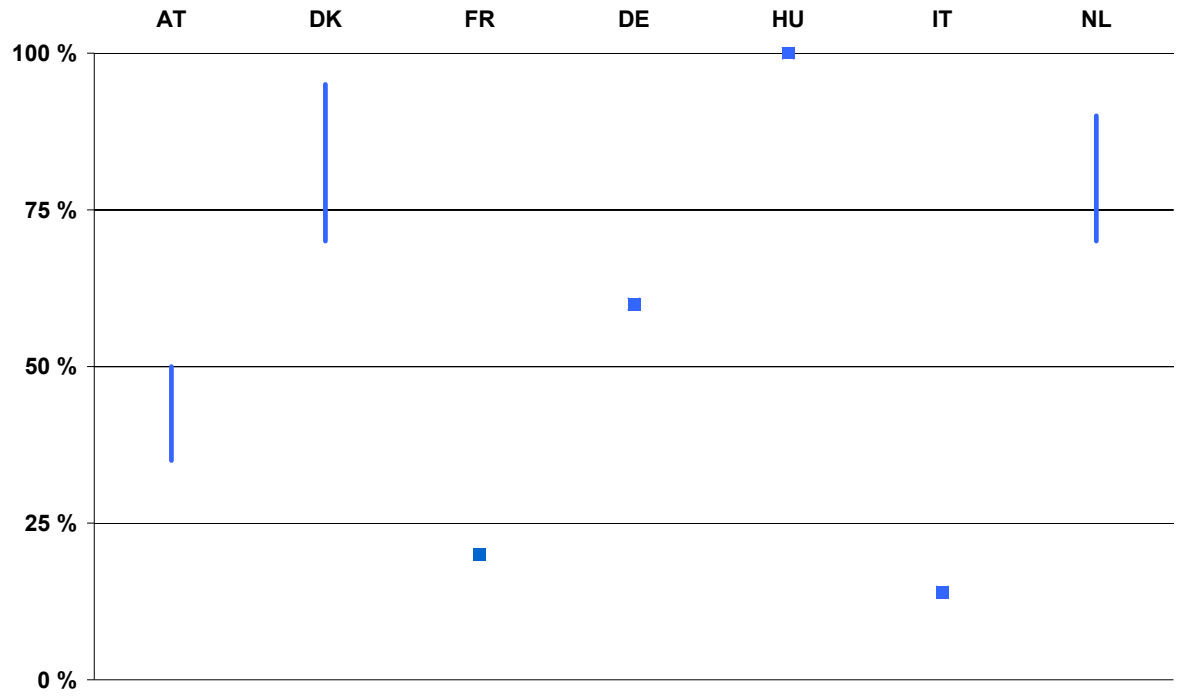


Figure 4: Price of non-physical backhaul capacity compared to firm capacity (%)

Note: Picture shows only countries where backhaul capacity is offered to the market

AT Applicable for transit only.
DE Only some of the transmission system operators offer backhaul capacity.
FR Backhaul capacity offered only at certain points.

Short-term capacity

Capacity contracts are typically offered for one year periods, with the possibility of reserving capacity for longer and, in most cases, also shorter contract durations.[18] In addition, in most countries capacity reservations for (multiple) months and/or (multiple) days can be combined in order to have a profiled capacity contract. Long-term capacities with a duration of one year or more are generally available at the price of annual capacities times contract duration (although in a few countries a discount for multi-annual contracts is offered, e.g. for transit in

[18] Only Austria and Finland do not offer short term capacity contracts.

Austria). Conversely, short-term capacities with a duration of less than one year are usually more expensive than long-term contracts with a duration of at least one year.

To illustrate this effect, Figure 5 compares the (relative) price of firm monthly capacities. First, it can be clearly observed that monthly capacities are significantly more expensive in most countries. The capacity price in Portugal is far lower, however here a high premium on commodity prices during peak hours applies. Secondly, one can see that the price of monthly capacities varies widely within most countries. These variations reflect the use of season dependent prices for short-term capacities, such as summer, shoulder or winter months. Whilst prices are usually higher for winter periods, network users may pay a smaller premium, or even receive a discount, during other (summer) months.

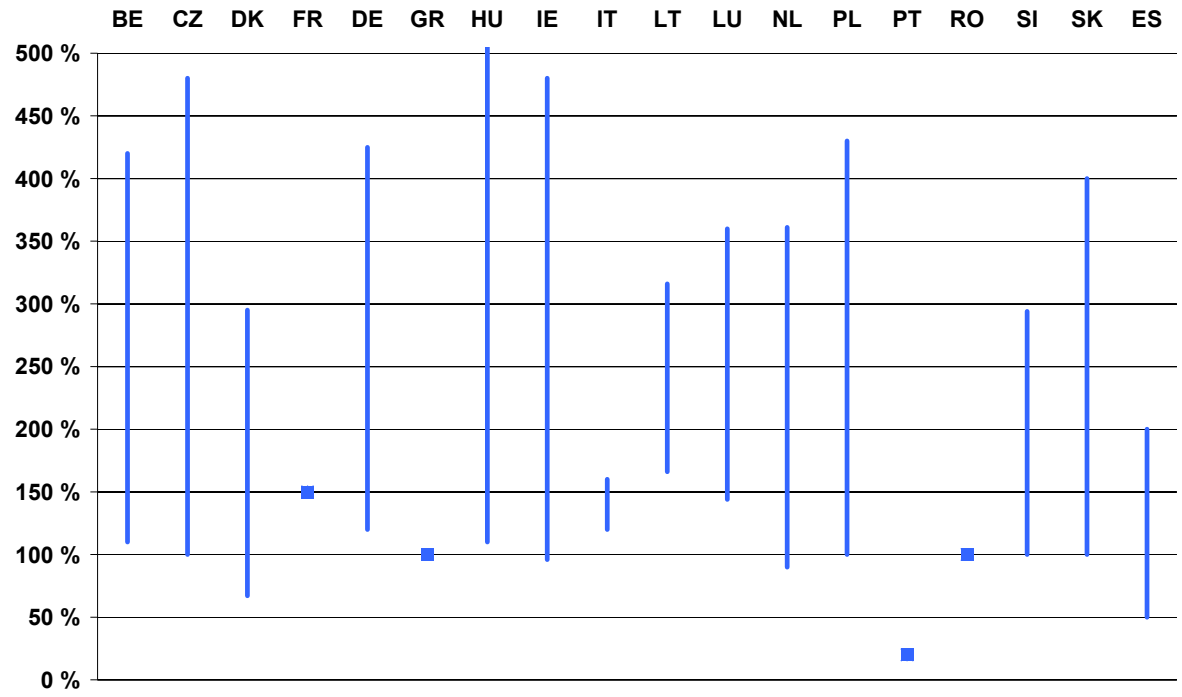


Figure 5: Relative price of monthly capacity (in comparison to annual capacity)

Note: 100% corresponds to 1/12 of the price for firm annual capacity.

DE Varies between TSOs

PT Without consideration of an additional premium of 1300% on energy transported during peak periods (applicable on working days).

In France, the price of short-term capacity is not season dependent, whereas Great Britain is not shown in Figure 5 because prices for both long- and short-term capacities are determined by auctions. In two cases, the variations shown in Figure 5 are furthermore not caused by seasonal differences but are due to the applied pricing scheme. Namely, Hungary and Slovakia apply an approach where the price for the first month is the highest, whereas the incremental price for each additional month decreases with the number of consecutive months booked.

2.2.4 Additional Services and Tariff Components

Besides basic transmission, several TSOs also provide a wide assortment of additional services that are provided on an optional basis, such as wheeling, shorthaul or title transfer services. In addition, some companies apply a more differentiated tariff scheme, with separate charges for certain cost elements, and/or oblige network users to return fuel gas or shrinkage in kind. Due to the sometimes very specific nature of the corresponding services and charges, it is difficult to compare these additional elements in a quantitative way. As an alternative, the following text therefore illustrates some of the common additional services offered as well as examples of special tariff components charged by TSOs.

The range of **additional services** includes amongst other the following items:

- **Shorthaul**
  In some countries shorthaul tariffs are used to adjust for unreasonably high costs of short distance transports in an entry-exit tariff system. Shorthaul tariffs are usually limited to specific combinations of entry and exit points and therefore bear some similarities with point-to-point tariffs. The mechanisms used to apply these tariffs are very heterogeneous. In France for example shorthaul tariffs are used in the form of a discount deducted from network users' monthly invoices for gas transports between specific (and limited) entry and exit points. In Great Britain the shorthaul 'discount' applies only to the TO and SO commodity charges. In Italy shorthaul tariffs are available only for distances of less than 15 km at 1/15 times the distance in kilometres times the normal transport tariff.

- **Wheeling**
  Wheeling is comparable to a shorthaul tariff, often limited to a distance of (almost) zero. Wheeling is offered for example in Austria and the Netherlands. In Austria different wheeling possibilities are on offer, standard wheeling at Baumgarten, storage

wheeling or wheeling between different pipelines at Baumgarten via the OMV system up to a maximum distance of 20 km. In general wheeling tariffs are structured similar to normal transport tariffs.

- **Title transfer**
  Especially in the more mature and larger gas markets, such as Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain or Great Britain, network users are allowed to exchange gas at (virtual) trading hubs. Whilst this option is regarded in some countries as a basic service that is not separately paid for, TSOs in for instance Austria, Belgium, Germany or the Netherlands offer title transfer as a commercial service, in the case of Austria at a physical (Baumgarten) rather than physical hub. In all these cases a fixed monthly membership fee applies plus a volume dependant fee (which is digressive at Baumgarten and TTF).

- **Quality conversion**
  In some countries with different gas qualities (high and low calorific values) a conversion service may be offered, as in Belgium and France. In the Netherlands this service was dispensed as of 1 January 2009 and the costs are now socialised.

- **Other services and fees**
  Apart from the services described above, a large range of other services is offered by some TSOs, including the following:

  - Odorisation (e.g. Belgium, Hungary);
  - Additional tolerance levels for balancing (e.g. Belgium, Denmark); and
  - Capacity transfer between different entry and/or exit points.[19]

Besides basic transmission services, some TSOs furthermore apply **separate charges** for the following costs or services:

- **Overrun / Excess utilisation charges**
  Almost all TSOs have explicit penalties in case of exceeding the booked capacity (or the granted tolerance).

[19] For instance in Belgium, a special service is also offered to transfer gas from a transit delivery point to a transport exit point, thus enabling network users to shift transit volumes to domestic supply.

- **Fuel gas / Shrinkage**
  A few countries do not include fuel gas and losses in the transport tariff but use a special tariff to cover these costs, such as Ireland. Conversely, network users in Austria (transit) or Great Britain have to deliver natural gas in kind to the TSO.

- **Quality conversion**
  In countries with different gas qualities (high and low calorific values) a conversion service is normally offered, as in Belgium and France. In the Netherlands this service was dispensed as of 1 January 2009 and the costs are now socialised.

- **Further differentiation of basic transmission charges**
  Some TSOs (e.g. Great Britain, Hungary) charge a specific system operation fee, whilst for instance the Portuguese TSO uses an additional peak period commodity tariff on working days.

- **Other fees and penalties**

  - In some cases, TSOs apply separate fees for nominations (e.g. Denmark) for redistributing any over- or under-recovery of costs from the imbalance settlement process.

  - In Denmark and the Netherlands a special fee applies for delivery during extreme (cold) weather conditions.

  - In some cases, an explicit penalty applies when delivering off-spec gas (e.g. Denmark).

These examples clearly illustrate that the differences in the detailed structure of national transmission tariffs, which should be taken into account when trying to compare the absolute level of transmission charges in different countries.

2.3 Regulation of Transmission Tariffs

The regulation of transmission tariffs deals with the approach and methodology applied by regulators for determining transmission tariffs or, alternatively, the revenues which network operators may collect from network users. Depending on the regulatory regime, the regulatory risk for the TSO and its incentives for investing into national networks as well as cross-

border capacities may vary considerably. Besides the underlying regulatory model, the practical impact of the regulatory regime also depends for example on the approach for determining the basic elements of the allowed revenue, such as determination of the revenue requirements, establishment of the regulatory asset base, and the method to set the allowed return on assets. Furthermore, some countries also apply separate mechanisms for the regulation of national as opposed to cross-border infrastructure.

In order to compare the regulatory arrangements in the EU Member States, this section specifically considers the following aspects:

- General price control mechanism;
- Regulatory period and cost basis (cap regulation);
- Establishment of Regulatory Asset Base;
- Calculation of cost of capital (rate of return / WACC);
- Investment incentives;
- Application of efficiency analysis (benchmarking);
- Use of auction revenues and overrun fees; and
- Availability of special rules for cross-border infrastructure.

This list already illustrates the degree of freedom which regulators have in designing and implementing the detailed regulatory arrangements in individual countries, and indicates the difficulty of making any direct comparison. In addition, practical implementation often takes into account the specific characteristics or existing rules in each country and in many cases considers general macroeconomic and political objectives connected with the national gas industry.

Despite general similarities in the overall structure, the detailed design of the regulatory framework in individual countries varies widely for the above mentioned reasons. The following provides an overview of some important elements of the overall regulatory framework and principles. It does not however aim to deliver a full-fledged analysis of the regulatory practices in the EU Member States. Such an analysis will require detailed investigation of the energy policy objections, political and social environment, overall economic development

and regulatory traditions in the respective countries. This is therefore beyond the objectives of the current study.

2.3.1 General Price Control Mechanism

The different forms of regulation in the countries considered in this study can be generally categorised into the two basic approaches price regulation uses, i.e. Rate-of-Return regulation and various forms of cap regulation. Under **Rate-of-Return Regulation**, which is also known as 'cost-plus' regulation, the regulator sets the allowed revenue for the utility in such a way that it covers the reasonable cost of production including a return on assets necessary to provide regulated services. Conversely, under **Cap Regulation**, which is often also referred to as incentive regulation, either prices or revenues are set in advance (usually for a regulatory period of three to five years), allowing the company to benefit from any cost savings made during that period. For each price control review the prices or revenues are recalculated for the next price control period in order to bring these back into line with the underlying costs of regulated services.

Table 5 provides an overview of the different types of regulation applied in the EU gas markets. We see that only eight countries use some form of rate-of-return regulation, whereas the remaining 16 countries apply some form of incentive regulation. Regarding the latter group, we furthermore note that caps are imposed on the overall revenues of the TSOs in most countries, whilst the regulators use price caps in four countries only.

Besides the type of regulation, Table 5 also illustrates whether tariffs are determined or approved by the regulator (or the applicable governmental agency) in advance, or whether the role of the regulator is limited to an ex post control of the tariffs set by the TSO. In 18 out of 24 countries tariffs have to be approved or determined by the regulator and are then put into force by regulatory order, ministerial decree or ordinance. Conversely, only six countries restrict themselves to an ex post control of transmission tariffs where the regulator approves only the tariff calculation methodology whilst leaving tariff setting to TSOs. However, even in the first group, tariffs are usually set based on a proposal prepared by the TSO, with the proposal often being approved as long as the proposed tariffs are in line with legislation and allowed revenues.

In most countries with a separate tariff regime for transit, transit revenues are subject to explicit regulation, although the regulatory principles and/or the tariff setting methodology is sometimes different from the setting of domestic transport tariffs. For example in Austria,

Table 5: Comparison of basic transmission price control mechanism

Tariff approval	*Rate-of-Return Regulation*	*Cap Regulation*	
		Revenue Cap	*Price Cap*
Ex ante (18 countries)	*Austria Bulgaria Greece Luxemburg Poland (*) Portugal*	*Belgium Czech Republic (*) France Hungary Ireland Italy Romania Slovenia Spain*	*Estonia Netherlands Slovakia*
Ex post (6 countries)	*Denmark Sweden*	*Finland Germany Great Britain*	*Lithuania*
# of countries	*8*	*12*	*4*

(*) Transit tariffs are not subject to regulation.

transit revenues are subject to rate-of-return regulation, whilst domestic transport revenues are set by ordinance based on rate-of-return regulation. In the Czech Republic domestic tariffs are subject to revenue caps whilst transit revenues are not regulated. Contrary to domestic transport tariffs, transit tariffs are furthermore set by the pipeline owners in both countries, whereas the regulators approve only the methodology and check whether prices are comparable to prices on competing or similar gas routes.

We emphasise that the detailed regulatory arrangements in individual countries often deviate from the standard form of the corresponding regulatory mechanism as laid down in theory. For instance countries formally applying a revenue-cap regulation would normally allow the TSO to freely determine its network tariffs based on its allowed revenues as calculated for the price control period. However in some countries whilst also adopting the revenue cap approach to determine its allowed revenues, the TSO does not have the freedom to determine its tariffs but the tariff setting methodology is stipulated by decree or ordinance.

This however strongly depends on how it is handled in practice. For instance the TSO's tariff proposal is accepted in general by the regulator and thus the TSO has (limited) flexibility to allocate the allowed revenues between different tariff categories (as it is assumed to be in

most countries). For example, in Spain, revenue cap is adopted but tariffs are actually set by ministerial order upon proposal by the regulator.

Another example is in Portugal where rate-of-return regulation is applied with a three year regulatory period including an ex-ante investment approval for the three years, thus bearing some similarities to a revenue cap regulation.

As further discussed in the following section, several countries also apply the so-called building blocks approach, which effectively represents a hybrid method that combines elements of rate-of-return regulation (applied usually for capital expenditures) and incentive regulation (applied usually for operating costs). In this context, we furthermore note the example of Italy where a rate-of-return approach is applied for the allowed return on assets, a revenue-cap method for operating costs and depreciation, and a separate price-cap regulation for the commodity charge.

Normally countries with a revenue-cap regulation apply a correction mechanism for revenues exceeding the allowed revenues, as for example in Germany and France with the regulatory account, or in Finland where the TSO retains the money and a decision is made ex post as to whether the extra earned profits should be deducted from the allowed revenue during the next regulatory period. For revenues less than the allowed revenues, a corresponding correction mechanism is generally used, thus protecting the TSO from volume risks.

Finally, we note that cap regulation can be further differentiated into a number of sub-groups, which each differ in their functioning and the economic incentives they provide. Moreover, cap regulation may include additional variables such as quantity adjustments terms and allowances for specific costs (in particular those beyond the control of the regulated business), some of which are listed further below.

In the following sections, we discuss some of the major determinants of incentive regulation, including the duration of the regulatory period and the treatment of investments (see following section), the establishment of the regulatory asset base (section 2.3.3) and the determination of the allowed rate of return (section 2.3.4) as well as other different in regulatory treatment of cost (section 2.3.5).

2.3.2 Treatment of investments and regulatory period

Under Cap Regulation, regulators generally make use of two basic principles for the establishment of incentive regulation, namely the so-called "building-blocks approach" and the "total cost (TOTEX) approach". Both approaches are applied in practice and differ in (1) their treatment of investment during the regulatory period and (2) the amount of cost that falls under a potential efficiency assessment (benchmarking). From a network operator's point of view, this results in a different degree of decoupling between costs and revenues. This may lead to differences in regulatory risk. These differences are further influenced by the choice between an ex-ante and/or ex-post review of investments which are partially inherent to the respective approach.

In case of the so-called **building-blocks approach**, the regulator needs to assess an efficient level of operational expenditures (OPEX) as well as an efficient level of capital expenditures (CAPEX). In the determination of the efficient CAPEX, the regulator will assess the planned investment for the regulatory period. Under the building-blocks approach, the capital costs of the network operator (depreciation and return on assets) are usually not included in the cost reduction requirements. Provisions for efficient CAPEX could be made for new investment under the approval process. Conversely, under a **TOTEX**-approach, the cap-formula is applied to the sum of capital cost and controllable OPEX, meaning that the capital costs are subject to adjustments for inflation and efficiency increase requirements. The efficiency increase requirements set by regulators are based on hindsight efficiency analysis using the actual total controllable costs observed in a predetermined year.

Especially in the latter case, investments for new capacity may be subject to considerable regulatory risk, since TSOs may fear that they will be unable to recover the corresponding costs at a later stage. For this reason, cap regulation is sometimes supplemented by special provisions for new investments, which are often further differentiated between replacement and extension investments. Such measures may include an increased rate of return or accelerated depreciation of certain investments, or a (partial) exemption from efficiency targets and explicit allowances for capital expenditures.

Table 6: Treatment of CAPEX and length of regulatory period under cap regulation

	Type of Regulation	Building Blocks	TOTEX	Investment Allowances	Length of Regulatory Period
Belgium	*Revenue Cap*	✓			*4 years*
Czech Rep.	*Revenue Cap*	✓			*5 years (2005-2009)*
Estonia	*Price Cap*				
Finland	*Revenue Cap*	*(✓)*			*4 years*
France	*Revenue Cap*	✓		✓	*5 years (2009-2013)*
Germany	*Revenue Cap*		✓	✓	*4 years (2009-2012)*
Great Britain	*Revenue Cap*	✓			*5 years*
Hungary	*Revenue Cap*	*(✓)*			*4 years (2006-2009)*
Ireland	*Revenue Cap*	✓			*4 years*
Italy	*Revenue Cap*	✓			*5 years (2005-2009)*
Lithuania	*Price Cap*	✓			*5 years*
Netherlands	*Price Cap*		✓	✓	*4 years (2009-2012)*
Romania	*Revenue Cap*	✓			*5 years (2007)*
Slovakia	*Price Cap*	*See notes*			*3 years (2009-2011)*
Slovenia	*Revenue Cap*	✓			*1 year (future: 3 years)*
Spain	*Revenue Cap*		✓	✓	*4 years*

DE From the second regulatory period onwards, starting in 2013, a 5 year period is used.
FR Regulatory period of 5 years applies to GRTgaz, for TIGF a period of only 2 years is used (2009-2010).
IT Although being classified as building blocks regulation, Italy applies a productivity increase target on capital costs (2% instead of 3.5% valid of OPEX)
SK Tariffs are basically set by benchmarking with neighbouring countries

Table 6 provides an overview of the mechanisms applied for the treatment of investment in countries applying cap regulation as well as the length of the regulatory period in the corresponding countries. In most countries, capital costs are excluded from general efficiency targets under incentive regulation but are separately accounted for under the building-blocks approach. Within this group, new investments are taken into account during the regulatory period for instance in Belgium, the Czech Republic, Finland or France, in most cases by adjusting the regulatory asset base (RAB) on an annual basis. Other countries, such as Great

Britain, forecast the CAPEX and the resulting capital costs for the whole regulatory period. In contrast, only a few countries, including Germany, Spain and the Netherlands, apply a TOTEX approach decoupling to a certain extent the allowed revenue from the costs of provision of regulated services and imposing an efficiency increase requirements on the total controllable costs.

The regulators of the countries applying the TOTEX approach have explicit incentives to encourage investments. For example the German regulator allows additional budgets (the so-called investment budgets) for specific investments and incorporates the associated capital costs in the allowed revenue without being subject to efficiency analysis targets.[20] In other cases (as in the Netherlands) the regulator applies special arrangements for new investments (shorter depreciation time and higher rate-of-return) that are more favourable than those for the existing assets.

Table 7: Special provisions for new investment (examples)

	Investment incentives
Austria	*Cost of extraordinary investment can be considered in advance*
France	*Extra return may be granted for the new investment upon approval of the regulator*
Germany	*"Investment Budgets": Investments are approved by the regulator and the resulting CAPEX are considered with a t-2 time lag in the allowed revenue. The time lag itself is taken into account by indexation of capital costs. Approval of the investment budget is bound to certain criteria and valid for max. 2 regulatory periods. Afterwards the assets are transferred to the RAB.*
Italy	*Investment premium for new infrastructure of up to +3% over max. 15 years on he allowed return for the new investment.*
Netherlands	*Possibility for extra-income for substantial investments if approved by the regulator*
Portugal	*The cost of capital and the amortisation are smoothed for the concession period (40 years). It is the result of the multiplication of a constant unit capital cost by the amount of natural gas that will predictably be transported in each infrastructure. The cost of capital smoothing is a means of confronting the uncertainty of the quantities to be transported throughout the concession period and adjusting the recovery of investments between current and future users.*
Slovenia	*It is planned to introduce incentives for new investments, for instance an increased rate of return*

[20] At least not in the first years until the approval for the investment budget ceases, usually after one or two regulatory periods

Such incentives are however not necessarily limited to countries applying the TOTEX approach, or incentive regulation in general, but can equally be found in other regulatory systems. For illustration, Table 7 summarises selected examples of countries where special arrangements for investment in network extension are intended to encourage the construction of new infrastructure. Besides investment budgets, such incentives typically focus on the provision of a premium on the allowed rate of return.

2.3.3 Establishment of the Regulatory Asset Base (RAB)

The regulatory asset base (RAB) is defined as the company's fixed assets necessary to provide the regulated service. The RAB drives the capital costs that are an essential component of the company's revenue requirements; these are the return on assets (determined by multiplying the RAB with the allowed rate of return) and the depreciation allowance. Consequently, the regulatory decision as to how to value the RAB is of particular importance as, in the context of price regulation, the RAB is a key determinant of prices that may be charged for regulated services. Hence, the decision on the RAB will have a significant impact on the allowed revenue.

When determining the RAB, regulators have the choice between different methods for determining the asset values to be considered for regulatory purposes. In the countries considered in this study, one can identify the following approaches (amongst others):

- Historic costs, i.e. valuing assets at their original purchase price;
- Replacement value, i.e. at the (estimated) costs of rebuilding the same or an equivalent asset at current cost levels;
- Indexed historic costs, which adjusts historic costs by a suitable index to account for changes in price level in the gas industry or in the economy as a whole; and
- Standard cost methodology, which applies a set of standardised values for the asset groups.

Table 7 shows that regulators apply different valuation concepts. Most countries rely on the indexed historic cost for the purposes of setting the RAB. Some countries like Lithuania, Greece and Slovenia use the asset values from financial accounting. Other countries like Great Britain and Germany apply separate regulatory accounting and derive the asset values using information from this accounting. Overall, the asset values are significantly affected by the accounting conventions and the specific application of the valuation methods.

Table 8: Asset valuation concepts applied

	Historic Cost	Indexed Historic Cost	Comments
Austria	✓		
Belgium	✓		
Czech Republic		✓	
Denmark		✓	
Finland	✓		
France		✓	
Germany	✓	✓	*Depending of the year of purchase*
Great Britain		✓	
Greece		✓	
Hungary		✓	
Ireland		✓	
Italy	✓		
Lithuania	✓		
Luxembourg		✓	
Netherlands		✓	
Portugal	✓		*Standard cost approach is used*
Romania		✓	
Slovakia			*Tariffs based price bench-marking*
Slovenia	✓		
Spain	✓		*Standard cost approach is used*

2.3.4 Calculation of the Cost of Capital (Rate of Return / WACC)

The Weighted Average Cost of Capital (WACC) is a commonly used method for determining the allowed rate of return on assets for the gas transport networks in Europe. The calculation

of the WACC requires regulatory decisions on a number of parameters, such as the applicable return on equity and debt and the gearing. In addition, the final results may vary depending on the use of nominal or real values or whether the WACC includes taxes or not.

To start with, the calculation of WACC needs a decision on the gearing, which is defined as the debt share of total capital. Some regulators, as for example in Northern Ireland, choose gearing close to that implied in the actual capital structure. Most regulators (Germany, Great Britain, Austria, Slovenia etc) apply target gearing aiming to minimise cost of capital. In practice, the majority of regulators apply a gearing ranging from 40% to 60%.

For the calculation of the allowed cost of equity, the Capital Asset Pricing Model is widely used among the regulators (CAPM). The CAPM presents a conceptual framework based on the idea that the return commensurates with the return forgone from comparable risk opportunities that investors expect when they purchase other equity shares of comparable risk. The CAPM takes into consideration only the systematic risk relevant to shareholders. The systematic risk is the risk that cannot be eliminated by diversifying and expanding the portfolio.

The CAPM formula essentially states that the required return of an investor is equal to the risk free rate available in the market, plus a premium above the risk free rate, commensurate with the risk taken by the investor.

Cost of equity= risk-free rate+ market risk premium x equity beta[21],

Where: market risk premium = expected market rate of return - risk-free rate.

The risk free rate is often estimated based on the yield of governmental bonds of the respective country, while the estimation of the market risks is usually based on the international studies and rarely on investigation of national capital markets.[22]

[21] Beta measures the risk of a company relative to a market index. The more sensitive a business is to market conditions, the higher the beta. In theory, the only risk that is captured by beta is systematic risk, which is the risk that cannot be eliminated by the investor through diversification. Mathematically the beta reflects the extent to which possible future returns are expected to co-vary with the expected returns on a broad portfolio of assets, i.e. the degree of co-movement between the company's returns and the market returns.

[22] One of the most comprehensive analyses of historic equity risk premium data is a dataset created by Dimson, Marsh and Staunton. This analysis covered 17 countries over the period 1990 to 2006. The equity risk premium is based on the results of long-term time series evidence on historical equity returns.

For the beta coefficient direct estimates may not be possible unless a company's equity is listed on the stock exchange. Such companies for provision of gas transport services are only limitedly available (e.g. Italy, Spain). Therefore the beta is usually estimated from the betas of peers using large international samples (reference groups) or by simply referring to existing decisions (regulatory precedents) of other regulatory authorities.

The WACC can be measured either in nominal terms or in real terms. A nominal WACC includes inflation, while the real WACC shows the cost of capital excluding the impact of inflation. The WACC should be consistent with the choice of the RAB. If the inflation adjustment is incorporated in the asset values then the WACC should be real. Oppositely, RAB using historic asset costs would require nominal WACC.

Finally, the WACC calculation will look different depending on how taxes are treated in the revenue requirements. One can distinguish between post-tax and pre-tax WACC.

A post-tax WACC is defined as the average rate of return needed to provide an appropriate return to investors in the company concerned, it assumes that the company's business tax has already been paid, i.e. has been included in the revenue requirements. As the tax shield is completely considered through adjustment of debt-component, the taxes reimbursed through the allowed revenue are calculated without any tax shield (excluding no deductible interest).[23]

WACC post-tax: WACC= Cost of Debt*(1-t)*Gearing + (Cost of Equity)*(1-Gearing)

In contrast, a pre-tax WACC is the average rate of return needed to provide an appropriate re-turn to investors in the company concerned and pay the company's business tax. In order to calculate a pre-tax WACC, the estimate of the post-tax cost of capital needs to be increased, by dividing by "(1-tax rate)", so that the tax payments can be met from the pre-tax WACC.

WACC pre-tax: WACC= Cost of Debt*Gearing + (Cost of Equity)*(1-Gearing) / (1-t)

As illustrated by Table 9, most regulators in Europe use a pre-tax WACC in real terms, whilst only few countries use post-tax and/or nominal values. Only four countries (Spain, Czech Republic, Finland and Luxemburg) apply nominal WACC. Only few countries, like Germany

[23] Some regulators apply a "Vanilla WACC" which does not adjust debt and equity returns for taxes. Similarly to the post-tax WACC, taxes are included in the revenue requirements; how-ever they are calculated with tax shield (including deductible interests). Vanilla WACC: WACC= Cost of Debt*Gearing+ Cost of Equity*(1-Gearing)

Table 9: Main parameters for use of WACC in European gas transport networks

	Calculation of WACC					
	pre-tax	***post-tax***	***real***	***nominal***	***value (%)***	***Comment***
Austria		✓			*6.97*	*8.3 pre-tax*
Belgium	✓		✓		*6.21*	
Czech Republic		✓		✓	*6.13*	*Nominal pre-tax: 8.289%*
Finland	✓			✓	*9-10*	
France	✓		✓		*7.25*	
Greece	✓		✓		*6.56*	*Nominal pre-tax: 10.06%*
Great Britain	✓		✓		*6.25*	
Hungary	✓		✓		*6.9*	
Ireland	✓		✓		*5.2*	
Italy	✓		✓		*6.7*	
Lithuania	✓		✓		*6.87*	
Luxemburg	✓			✓	*8.5*	
Netherlands	✓		✓		*5.5*	
Northern Ireland	✓		✓		*6.19*	
Portugal	✓		✓		*8.0*	
Romania	✓		✓		*7.88*	
Slovenia	✓		✓		*5.87*	
Spain		✓		✓	*5.48-5.68*	

AU Example from tariff regulation for a specific project, nonetheless other projects are treated similarly, perhaps except for a project specific mark-up of 0.20 %.

DE Because of change in valuation concept allowed return on equity for assets bought before / after 1 January 2006 differs. Return on Equity for assets acquired before 1 January 2006: 7.56 %, real before corporate tax and after trade tax; for assets acquired after 31 December 2005: 9.29 %, nominal before corporate tax and after trade tax, both applicable on an equity share of 40%. Return on Debt is set equal to the risk-free rate (currently 4.23%) no debt-premium applies.

and Bulgaria do not apply the WACC concept at all but use separate return on equity and debt.

2.3.5 Other Differences in the Treatment of Costs under Incentive Regulation

The initial comparison in section 2.3.1 (see Table 5 on p. 20) seemed to show that the regulatory regimes within Europe are quite homogeneous. Besides the differences mentioned in the previous section (2.3.2 to 2.3.4), it has to be taken into account that, depending on the respective circumstances, different options are chosen for the calculation and determination of each component of incentive based regulation, which finally leads to very different regulatory regimes. In order to demonstrate the differences, we comment below on some other design options and provide examples from the countries analysed in this study. Further details for each country can be found in the country fact sheets in the Annex to this report.

Controllable and non-controllable expenses (OPEX)

Many regulatory regimes differentiate between controllable and non-controllable OPEX cost components whereby non-controllable elements are normally passed-through to the network user and only controllable OPEX are considered under the efficiency increase requirements. In general, taxes and levies or in some cases costs driven by external (technical or environmental) requirements are considered non-controllable. However, such a clear cut approach is not applied in all countries, e.g. Germany has a limited list of items considered as non-controllable, which is not exhaustive by far.

Conversely, France simply uses historic operational costs plus an annual allowed increase as the basis for setting the future allowance. Similarly, Italy does not distinguish whether OPEX is controllable or non-controllable, applying the efficiency target to all OPEX. Other countries not distinguishing between controllable and non-controllable costs are for example Lithuania and Portugal.

Efficiency increase

The efficiency targets under cap regulation are often differentiated into a general efficiency increase (frontier shift)[24] and an individual cost reduction requirement, in order to catch up with best practice. For instance the German regulator applies both efficiency factors, while

[24] The general efficiency increase is applied for all regulated companies.

other regulators in Europe simply refer to a single efficiency factor or have decided not to go for an explicit efficiency increase.

In order to determine the efficiency increase requirements, the option of benchmarking has so far mainly been applied for gas distribution networks but not for gas transmission. In practice, in most countries the efficiency increase factor (if any) is derived from international experience/comparison and negotiation with the TSO (e.g. Italy or Romania) or from comparison with historic values and other sectors, as is for instance applied in the Netherlands.

Inflation component

To take into consideration the inflation component in the cap formula, regulators tend to refer to an appropriate price index from national statistics. Depending on the country, they may choose for example the retail price index or the consumer price index. In Great Britain the retail price index applies, while the regulator in Northern Ireland uses the consumer price index. The Czech Republic uses an industrial producer price index. Other countries use a combination of two or more indices. For instance in Spain, a combination of the consumer and producer price index is used, whilst Austria uses a composite index comprising the consumer price index (30%), official wage index (30%) and building price index (40%).

Regulatory formula

The regulatory formulae used in the individual countries show significant diversity. In many countries, the development of prices and/or revenues are tied to historic indices, such as the last available inflation index. This approach is applied for instance in the Czech Republic, Germany, Italy, Lithuania and the Slovak Republic. Conversely, other countries, such as Romania, rely on forecast values, like expected OPEX or expected inflation. The application of forecast values however requires the inclusion of a correction element to adjust for forecast errors, as is the case for example in Romania.

Irrespective of whether historic or forecast values are used, the difference between allowed and actual revenues is often considered in a so-called correction factor. Alternatively, any corresponding deviations can be taken into account by the end of the regulatory period when determining the allowed revenue for the next regulatory period, whilst accumulating the difference on a regulatory account during the regulatory period, as is the case in France and Germany. In contrast, in Finland the difference is accumulated and a decision as to whether this difference shall be corrected or not is only taken at the end of the regulatory period.

2.3.6 Miscellaneous

Application of benchmarking

As stated above, only very few countries use benchmarking to determine the efficiency targets for gas transmission networks. In regulatory systems as applied for example in Germany, where the overall efficiency target is split into a general and an individual component, the individual component is difficult to determine without the use of benchmarking. A characteristic of the German system is the comparably large number of TSOs, which enables the regulator to conduct a national benchmarking. In systems with only one large national TSO, international benchmarking would be the only possibility. This would nevertheless be highly complicated, as the regulator would be unable to obtain the necessary data in as much detail as in a national benchmarking applied in Germany. Furthermore structural and country specific differences will be larger. The prerequisite of benchmarking is to use preferably a 'large' data sample containing companies with similar characteristics (comparing like with like).

A few countries already include the possibility of efficiency benchmarking in their methodology, however without yet applying it (and not yet defining the parameters) as is the case in the Netherlands and in Slovenia. Other countries are considering conducting a benchmarking analysis in the future, for example Denmark and Hungary.

The German regulator applies an approach using on the one hand two different methods, the data envelopment analysis (DEA) and the stochastic frontier analysis (SFA) and on the other hand calculating the efficiency based on approved as well as on comparable capital costs, using only the highest result in the revenue allowance (so-called best of four approach).[25]

Besides Germany, we identified no other countries where benchmarking is used to set efficiency targets. The Slovak Republic is applying an international benchmarking, but only on the tariff side, using the benchmarking results to directly set transmission tariffs.

Use of auction revenues and overrun fees

In some regulatory systems, mechanisms are in place regarding a special treatment for auction revenues or revenues from overrun fees, normally to ensure financial neutrality of the

[25] With a floor of 60% for the efficiency value at the same time, it is in fact a best of five approach.

TSO if the regulatory system does not allow for an adjustment of the allowed revenues in the following year. Normally these revenues are not treated separately but considered together with any other revenues exceeding the revenue target.

However a special treatment can be found in a few countries. In Austria transit tariff regulation considers both. Auction and overrun fee revenues are accumulated (together with 50% of revenues from interruptible contracts) in a special fund and after four years – following examination by the regulator – are passed through to customers by reducing tariffs (after deducting extraordinary maintenance costs first). In Great Britain entry capacities are allocated by auctions, subsequentially auction revenues comprise the TSO's capacity revenues, overrun fees on the other hand are reconciliated by various processes to ensure the TSO's financial neutrality. In Ireland, overrun fees are disbursed to customers to ensure the TSO's financial neutrality, although the TSO is allowed to keep the part equal to the revenue if the network user had booked sufficient capacity.

Special rules for cross-border infrastructure

Only a few countries apply a separate regulatory regime for the cross-border infrastructure. Even in countries with a separate transit tariff regime, this does not necessarily mean that revenues are also separate from the normally applied regulation. In Belgium and Spain, although there are separate transit tariffs, the TSO's revenues from this business are regulated together with the revenues from domestic transport.

However, in Austria for example cross-border transit is explicitly excluded from the 'normal' regulation. The three transit pipeline operators have their own (although identical) tariff methodologies setting the framework for their cost-based tariffs, the overall revenues are subject to rate-of-return regulation, but with a higher WACC. This is done deliberately, as according to the regulator, transit tariffs ought to be internationally comparable. The Czech system for transit infrastructure regulation seems to be very similar to the Austrian system.

In Poland the main transit infrastructure is completely separated from the rest of the system (i.e. the Yamal pipeline). The pipeline can be exclusively used by two companies up to 2019.

2.4 Residual Balancing by the TSOs

In a liberalised market, system balancing is achieved through the interaction of network users and the TSO. Whilst network users should aim to minimise and be obliged to take the financial responsibility for any deviations between their inputs and offtakes, the TSO remains the only instance that is able to ensure the physical balance of the overall network. These different roles are also clearly specified in the ERGEG Guidelines of Good Practice for Gas Balancing (GGP-GB), which emphasise "*the primary responsibility of network users to balance their own inputs and offtakes*" (§4.1) but also confirm that the TSOs "*retain a residual role to maintain physical balance*" (§3.2).

This section focuses on the role of the TSOs, whilst the applicable rules and incentives for network users are discussed in section 2.5 below. More specifically, the following text deals mainly with the provision and procurement of '**balancing services**' by the TSO, which we define as all services that are used by the TSO to ensure that any deviations between the (aggregate) input and offtake of network users do not cause the system to go beyond its accepted operational limits. In this definition, balancing services include the purchase and sale of balancing gas by the TSO on a daily basis, but may also cover the advance procurement of operating reserves to ensure the availability of flexibility. Besides the need for compensating the net imbalance of the overall system, this definition also covers any locational requirements that may result from an uneven regional distribution of imbalances. In addition, we note that the provision of balancing services may also involve certain dynamic requirements, in contrast to the trading of natural gas as a commodity in the wholesale market.

The arrangements for the procurement of balancing services may differ for instance in terms of the method and time horizon used for procurement and the remuneration for providers of balancing services. The corresponding choices however also depend on the physical availability and ownership of different types of flexibility such that it is helpful to also consider fundamental differences with regards to the role of different sources of balancing services. Finally, it is also interesting to observe major differences in the recovery of the resulting costs and the application of specific incentives for TSOs to reduce the costs of system balancing.

Overall, the comparison in this section therefore covers the following aspects:

- Sources of balancing services;
- Methods for procurement of balancing services;

- Time horizon of balancing services contracted by the TSOs;
- Remuneration of balancing services;
- Cost recovery; and
- Use of specific incentives on the TSO.

Unfortunately, most of the European TSOs do not publish any detailed information on the use of different sources of flexibility for system balancing. Based on information provided by TSOs and regulators, as well as other publicly available reports and studies, it is nevertheless possible to get an indication of the differences within the EU. For illustration, Table 10 provides a corresponding summary, indicating the sources of flexibility that are used for system balancing in selected countries. Although we emphasise that this information should be interpreted with considerable caution as it may not be fully accurate or complete, we nevertheless believe that it helps to demonstrate some of the major differences with regard to the availability and use of different sources of flexibility.

These differences can be illustrated by a few selected examples:

- The British gas market has access to all types of local flexibility. The storage capabilities at the level of regional distribution companies and the linepack of the TSO are generally sufficient to handle diurnal variations most of the time. In addition, ownership of flexibility at production, storage and LNG sites is distributed to a number of different companies, providing a solid base for competition.
- Similarly, the Swedish system benefits from a considerable amount of linepack (30% - 40% of a winter day's consumption), making it the main tool for balancing.
- In many other countries, including Austria, Belgium, the Czech Republic, parts of Germany, Italy, Poland or Slovakia, linepack also represents a major or even the main source of flexibility. In addition, however, most of the TSOs in these countries also have to rely on other sources of flexibility, typically underground storage with an often highly concentrated ownership.
- Conversely, the Dutch gas supply system has been designed with a view to using mainly the Groningen gas field for diurnal balancing, whereas the network itself does have very limited inherent storage capabilities only.

Table 10: Indicative role of different sources of flexibility for system balancing

	Linepack	Production	Storage	LNG	Import
Austria	✓		✓		(✓)
Belgium	✓		✓	✓	(✓)
Czech Republic	✓		✓		(✓)
Denmark	✓	(✓)	✓		
France	(✓)		✓	(✓)	
Germany	✓	✓	✓		✓
Greece	(✓)			✓	
Great Britain	✓	✓	✓	✓	
Hungary	✓		✓		(✓)
Ireland	(✓)		✓		
Italy	✓		✓		
Latvia	✓		✓		
Luxembourg	(✓)				✓
Netherlands	(✓)	✓	(✓)	(✓)	
Poland	✓		✓		
Portugal	✓		✓	✓	
Slovakia	✓		✓		(✓)
Slovenia	(✓)				✓
Spain	✓		✓	✓	
Sweden	✓		(✓)		(✓)

- Some of the smaller gas markets, such as Luxembourg or Slovenia, as well as some of the Austrian and German market areas, finally do not have any tangible or insufficient sources of flexibility of their own such that the corresponding needs have to be imported from neighbouring countries or balancing zones.

It is obvious that these differences will have an impact on the choice of arrangements for the procurement of balancing services and that they should be taken into account when interpreting the comparison of the different national arrangements below.

Based on this background, Table 11 provides an overview of the arrangements used for the procurement of balancing services in the EU Member States. This summary generally distinguishes between the use of market-based and other methods but also differentiates each of the two categories further. For market-based methods, furthermore indicates the time horizon of the corresponding mechanisms.

Table 11: Procurement of balancing services in EU gas markets (excluding linepack)

	Non market-based			Market-based		
	Ownership	Regulated contract	Direct contract	Tender	Separate balancing market	Participa-tion in whole-sale market
Austria					D/A	
Belgium				Annual		
Bulgaria		Storage				
Czech Republic				Annual		
Denmark	Storage		Storage, Other			
France			Storage	Annual		D/A + I/D
Germany		(DSO)	Storage	1a – 1d	(D/A)	D/A + I/D
Great Britain		(DSO)				I/D
Greece		LNG				
Hungary					D/A	
Ireland				Annual		
Italy		Storage				
Lithuania	(Import)					
Luxembourg	(Import)					
Netherlands			Storage	Annual		
Poland			Storage			
Portugal		Storage, LNG				
Romania		Storage				
Slovakia		Storage				D/A + I/D
Slovenia		Import				
Spain		Storage, LNG		Daily		
Sweden						D/A + I/D

D/A: Day-ahead I/D: Intra-day Energy procurement only (opposite to flexibility procurement).

AT Theoretically balancing gas procurement via firm contract with a so-called market-maker possible.

CZ Market based procurement seems to be a rather theoretical option without practical relevance.

DE Tenders are partly for flexibility and partly for energy.

FR Only GRTgaz. 20% of balancing procured on market. Storage capacity procured through annual tenders.

SE Sweden applies the balancing group model, imbalances are 'traded' between TSO and balancing responsible parties.

SK Market based procurement seems to be a rather theoretical option without practical relevance.

In detail, Table 11 differentiates between the following approaches:

- **Non market-based approaches:**
  - In many countries, the TSOs either have ownership rights or a guaranteed access to flexibility. Ownership rights may either be direct, such as in case of the Lille Torup underground storage owned by the Danish TSO Energinet.dk, or take the form of long-term access or lease arrangements (possibly mandated by regulation). In addition, we understand that some of the TSOs still have access to the capabilities of affiliated supply companies, such as in case of Finland (import) or storage (Latvia[26]).
  - In some countries, at least some balancing services are either provided by the DSOs (compensation of the diurnal profile) or have to be made available to the TSO by network users free of charge (Portugal).
  - In addition, various TSOs have entered into direct bilateral contracts with individual market participants, providing them with guaranteed access to storage or (in the case of Denmark) other sources of balancing gas.
- **Market-based approaches:**
  - A number of TSOs procure balancing services through tenders, mostly on an annual basis. Most of these tenders serve to reserve flexibility in advance, even if the TSO only decides on the actual use of these services during the operating day. Alternatively, tenders may also be used to purchase or sell balancing gas as for instance in France or Spain.
  - In Austria and, to some extent, also in a few other countries, the TSOs operate a separate balancing market, which is kept separate from the general wholesale market and serves the only purpose of enabling the TSO to buy and sell balancing gas during the operating day. In contrast to tenders, the TSO is not obliged to decide in advance on the acceptance of any offers, which are typically submitted on the day ahead. Although procurement in most cases is day-ahead, the actual activation can also be possible intra-day.

[26] Please note that the Latvian gas market has not yet been opened for third party access.

- Finally, some TSOs sell and purchase gas for balancing purposes in the general wholesale market, on day-ahead and/or intra-day basis. This approach represents the single means of procuring balancing gas from external parties in Great Britain but is also used to supplement other mechanisms by other TSOs.

A comparison of the different entries in Table 11 reveals some interesting observations with regards to the procurement of balancing services from external parties:

- Most TSOs still rely primarily on non market-based methods, with roughly 50% of all countries not applying any type of market-based mechanisms at all. Conversely, only 6 to 8 of the 25 countries exclusively rely on market-based methods.

- Denmark is the only country where the TSO uses its own storage for system balancing, although several other TSOs have access to for instance underground storage, LNG and/or flexibility from import contracts either on a regulated basis or through affiliated companies.

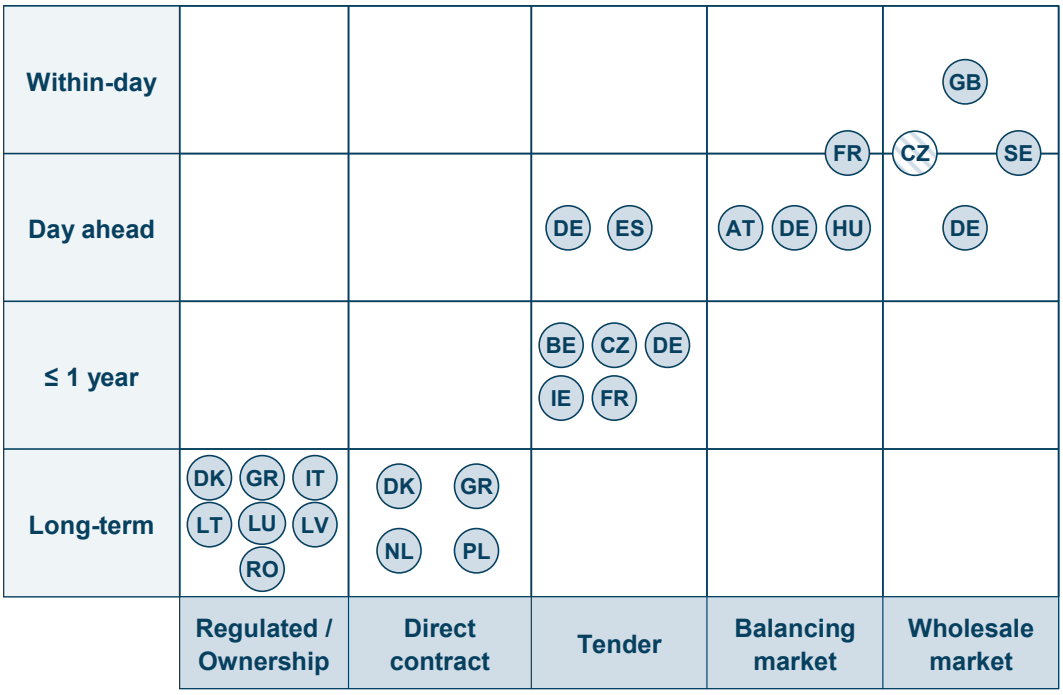


Figure 6: Procurement mechanism and time horizon for balancing services

- Even where market-based methods are used, the focus mostly is on products with a medium-term time horizon of between one month and one year in advance. In contrast, Austria, Sweden and Great Britain are the only markets where the TSOs exclusively rely on the use of a day-ahead or intra-day market mechanism. As shown in Figure 6, there is a clear correlation between the nature of the procurement mechanism (e.g. market-based) and the time horizon (e.g. intra-day) used for procurement.

The remuneration of provision of balancing gas or balancing services is strongly linked to the actual procurement mechanism. In a purely market based system as applied in Great Britain or Austria, remuneration is solely based on the balancing gas bought or sold in the market. In other countries relying on (annual) contracts with balancing gas providers, generally the guaranteed capacity is paid based on the contracted volume and in addition retrieved balancing gas is remunerated based on actually demanded volumes, regardless if balancing is provided by storage, gas delivery from outside or interruptible load, etc.

In some cases flexibility is offered by network users free-of-charge on a 'best endeavour' basis, as for example is the case with some TSOs in Germany. Network users offer flexibility on an annual basis including an offer price and are only remunerated for commodity if their offer is called by the TSO. However, offers are not firm and network users are able to indicate to the TSO if they are able to provide the offered flexibility in advance (e.g. day-ahead).

Countries using auction mechanisms, either as tenders for annual balancing gas contracts or as intra-day markets, in general use the pay-as-bid principle to remunerate providers of balancing services (with calling offers based on economic principles, i.e. at highest price if system is long and lowest price if system is short), as it is for instance the case in Hungary, France, Ireland or Sweden.

Costs of balancing mechanisms are either covered through imbalance charges and penalties or they are (at least partly) socialised over all network users through normal network charges. In Austria for example, the costs of the balancing market operator to run the balancing mechanism are covered by fees paid by the TSOs and thus become part of the transmission costs passed through to final consumers. In the Czech Republic, Slovak Republic and Hungary costs are covered through imbalance charges (and penalties, if applicable), but partly also by network charges. In Spain and Great Britain costs are fully covered by imbalance charges.

In some cases mechanisms are in place to ensure the TSO's financial neutrality with regards to the provision of balancing services.

Occasionally, some TSOs have **specific incentives and constraints** on their residual balancing activities. In Great Britain this has two elements: a price performance measure that seeks to expose the TSO to the costs of its balancing actions and a linepack management incentive that balances the price incentive to ensure an appropriate mix of internal and external residual balancing actions. The price incentive encourages the TSO to trade close to the market price for all of its balancing trades. In Germany, TSOs are obliged to always use their own linepack first, and secondly, they shall exchange balancing gas (linepack) between different market areas. Only after both are exhausted, are the TSOs allowed to access other, i.e. external sources of flexibility.

2.5 Settlement of Imbalances

The settlement of imbalances represents the 'second side' of the balancing model in any liberalised market. The corresponding charges are part of a network user's costs for gaining access to the network. In comparison to network tariffs, balancing fees are less predictable. Depending on the consumption profile and the characteristics of the end customer supplied (different branches of industry, households etc.), the risk of running out of tolerances (if existent) can differ significantly. The costs of imbalances may therefore be far more important for new entrants than network tariffs.

Every system for imbalance settlement is based on a number of key choices related for instance to the balancing interval, the application of tolerances (possibly differentiated by types of network users or season, or in relation to the actual system imbalance), and the pricing of imbalances, including the pricing system and the price basis. The different options are numerous and not mutually exclusive, which results in a large number of possible combinations. This variety is further increased by the fact that several countries apply a combination of different approaches for different types of imbalances. Moreover, any penalties or potential exceptions for cross-border transports may create further complexity in the design of different models.

In this section we briefly present the different models and options applied in the different countries. In accordance with the GGP-GB, we focus on some major characteristics of imbalance settlement systems as follows:

- Definition of balancing interval;
- Imbalance charges (cash-out and penalties);
- Provision of tolerance levels;
- Instruments available to network users to minimise imbalances; and
- Any additional charges (including scheduling and financial neutrality charges)

Besides financial settlement, some countries allow network users to compensate imbalances in kind, i.e. after the gas day. This approach is for instance applied by the Czech Republic or Italy, but is effectively also used in cases where network users are granted a permanent tolerance for the accumulated imbalances as further discussed below. Another approach is used for instance for transit flows in Belgium where the TSO adjusts the exit flows to any physical imbalances on the entry side (or vice versa), thereby avoiding any residual imbalances within the local system in real-time.

In order to facilitate the following discussion, it seems useful to clarify our understanding of certain terms and issues. In particular, we differentiate between:

- **Cash-out charges**, which are payments made by the network user to the TSO, or vice versa, and which result in the corresponding imbalances being returned to zero;
- **Penalties**, which are payments to be made by the network user to the TSO in case imbalances exceed the permitted tolerance level; and
- **Other charges**, which may involve different payments by the network user to the TSO, or vice versa, which are independent from the actual level of imbalances.

Please note that, by definition, only cash-out charges may be reflective of the actual costs, which an individual network user imposes on the system at a given point in time. In contrast, both penalties and other charges resemble some sort of tariff system, which may be used to allocate certain costs across network users, although it appears that most of the penalties applied in practice are not directly based on any associated costs but are mainly with the intention of providing incentives for the avoidance of imbalances.

With regards to the use of different balancing intervals, it is important to note that there may be differences between the notional and effective balancing interval. For example, various

countries notionally apply a daily balancing interval, although imbalances are already determined and penalised on for instance an hourly level. Although imbalance cash-out is typically based on the daily balancing interval, the additional application of penalties effectively implies that the corresponding systems may be more similar to a system with hourly balancing intervals. In many cases, it therefore appears useful to focus on the minimum interval used for imbalance settlement since this may be decisive for network users.

These considerations are important to bear in mind when comparing the approaches applied in different countries as illustrated in Figure 7. This summary shows that the majority of EU countries have a **daily balancing** system in place, where imbalances are cashed-out at the end of the (gas) day. In contrast, Austria represents the only example of a pure **hourly system**, whereas Italy, Portugal, Romania and Spain use **'evergreen' balancing accounts** where imbalances are accumulated until compensated by the network user in kind, whilst financial settlement is limited to penalties. Finally, both the Czech Republic and Greece effectively cash out only the cumulative **monthly imbalance**, although either daily imbalances or the cumulative imbalance that are outside certain tolerances, are already subject to penalties or cash out during the month.

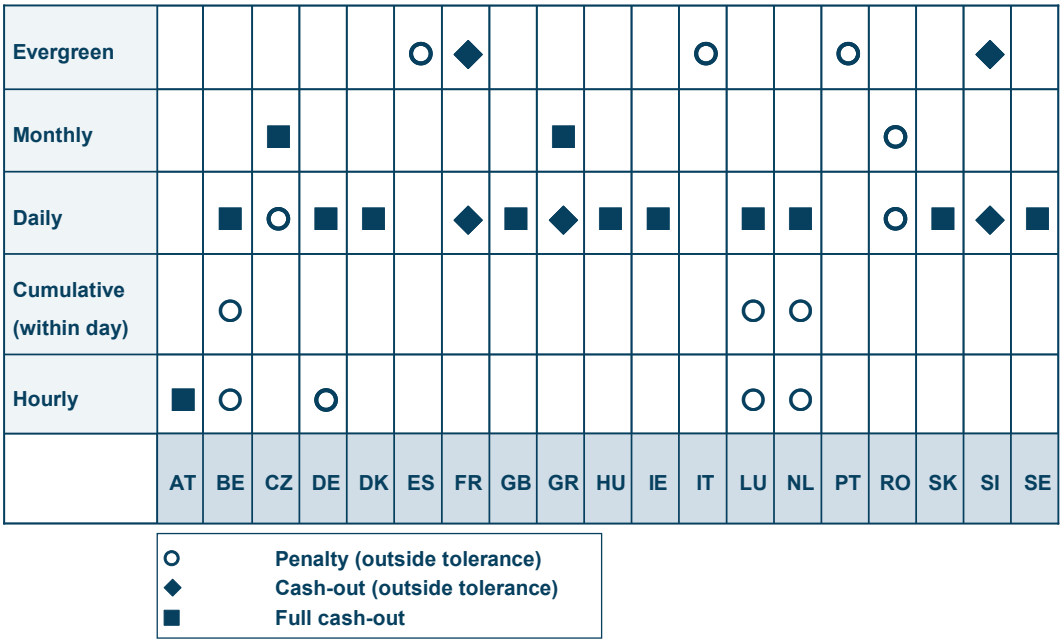


Figure 7: Use of cash-out charges and penalties across different balancing intervals

Although daily balancing intervals are prevailing, we note that pure daily balancing with a full cash-out of all imbalances is limited to only five countries, i.e. Denmark, Great Britain, Hungary, Ireland, and Sweden. Conversely, in France and Slovenia, only imbalances outside the daily tolerance are cashed out on a daily basis but are otherwise booked on an 'evergreen' cumulative balancing account, which is in turn subject to daily (France) or monthly (Slovenia) cash-out outside certain tolerances.

Whilst these countries accumulate imbalances at least on a daily basis, Austria, Belgium, Germany, Luxembourg and the Netherlands are the only countries that consider hourly deviations. Whilst Austria applies hourly cash-out, the other countries apply additional penalties on hourly and (with the exception of Germany) cumulative deviations within the day. A different approach is taken in Ireland and Great Britain, which apply additional **scheduling charges** to encourage accurate hourly scheduling by network users.

In many countries network users are allowed to **re-nominate** their scheduled gas flows also during the gas day, which helps to avoid and/or reduce imbalances. Extended **re-nomination deadlines** and **ex-post trading** of imbalances (Ireland) are other instruments for network users to keep a balanced position. **Ex-post trading** allows network users to trade their positive (negative) imbalance against the negative (positive) imbalance of another network user to a certain extent after the end of the actual balancing interval. In Ireland for example this is possible up to one week after the end of the month (containing the day in question).

Another possibility for network users to reduce their imbalances is if the systems allow for **pooling** of imbalances. Besides the pooling of entry and exit flows of the same network user at different entry and exit points, which is possible in many countries, TSOs in Belgium, France and, in some cases, also Germany additionally offer network users the possibility to pool imbalances across multiple balancing zones. Other countries allow pooling under the balancing group model, which effectively allows multiple network users to aggregate their imbalances within a single balancing group that is represented vis-à-vis the TSO by a so-called balancing responsible party. This model is for instance applied in Austria (for domestic transport), Germany or Sweden.

As already mentioned, **tolerance levels** are often an important element of the arrangements for imbalance settlement. In systems with a pure market-based settlement of imbalance charges, systems tolerances are not usually used (e.g. Austria and Great Britain) or tolerance levels are very low (e.g. Ireland). Conversely, many other countries apply a variety of hourly, cumulative intra-day, daily or even weekly, monthly and evergreen tolerances. Be-

sides a basic tolerance, network users are sometimes able to contract for additional flexibility and/or to trade their tolerances in a secondary market, such as in Belgium, France, Denmark, Luxembourg or the Netherlands.

Basic tolerance levels may be differentiated by customer groups (as in Germany), by type of network users (e.g. pure trading vs. [public] supply activities in Belgium and Hungary) or the size of the network user's total portfolio. For instance in Belgium or the Netherlands, tolerance levels furthermore are temperature-dependent with lower tolerances (smaller bandwidth) in winter periods or at specified low temperatures (e.g. the Netherlands).

Table 12 provides an overview of the systems for **imbalance pricing** prevailing in Europe. There are several options for the basis of imbalance pricing which are shown by the different columns of the table. In this context, we differentiate between the following fundamental approaches for the pricing of imbalance charges:

- **Administrated charges**, which are based on a fixed fee set in advance by the TSO or regulator;
- **Indexed prices**, which are derived by indexation to an external reference price (noting that this may include the local wholesale market price); and
- **Market-based prices**, where the price of imbalances is based on the short-term costs or prices of balancing gas, which in turn have been determined through a market-based mechanism (see above).

In the case of market-based pricing, cash out charges may be determined either by the most expensive option used (marginal cost pricing), or the average costs of buying or selling balancing gas.

As indicated by the rows of Table 12, we furthermore distinguish between one- and two-price systems. In a one-price system, the cash-out price to be paid is irrespective of the direction of the imbalance; for a positive or negative imbalance the same price is paid. In a two-price system, prices differ between a positive and a negative imbalance.

Besides cash out charges, Table 12 also includes penalties and other charges. Whilst cash-out charges are used to partially or fully return a user's imbalances to zero, penalties and other charges represent pure financial payments,[27] which do not however influence the

[27] Please note that this definition of penalty charges is different from the one recently proposed by GiE.

physical (im) balance of a user. By definition, such charges cannot be cost-reflective as they are always set in advance or indexed to an external reference price.

Table 12: Determination of cash-out prices and penalty charges

	Pricing basis			
	Administrated	***Indexed***	***Market based***	
			Average cost	***Marginal cost***
1 price	*IT*	*IE*, NL*	*AT, BG*, FR*, SE**	*-*
2 prices	*ES, GR, SI*	*BE, CZ, DE DK, FR*, LU*, SK*	*-*	*GB*, (SE*)*
Penalties and other charges	*CZ, GR, LT, RO, SI*	*AT*, BE, NL, PT, SK**	*N/A*	

AT Penalties apply only for transit.

BG Actually applied mechanism is not quite clear.

FR Imbalances outside the daily 'mid-range' tolerance but inside the daily max. permitted imbalance are cashed out at the average price of all transactions in the exchange-based tender for balancing gas, whereas imbalances outside the max. permitted imbalance are cashed out a price that is indexed to this price and the Zeebrugge day-ahead price.

GB Highest/lowest marginal price is only used if it is more expensive for the network user compared to system average price (plus/minus a fixed sum).

IE For imbalances outside tolerance a two-price system is used.

LU Price used is the higher of Zeebrugge index or highest price paid by TSO for balancing gas.

SE Imbalance charge equal to costs of compensating balancing gas on a weekly basis, or the least advantageous of this price (±50%) or the price of the marginal bid for balancing gas accepted during that week

SK Penalties are only applied for imbalances if not included in nominations for following day.

3. Relevant Differences and Resulting Barriers

3.1 Tariffs and Regulation

3.1.1 Co-existence of Different Network Access Models

Our comparison of transmission tariff structures in section 2.2 above has revealed considerable differences in the design of the network access regimes applied in practice. Whilst most countries formally apply an entry-exit system, other markets still use a point-to-point regime. Furthermore, a number of countries with an entry-exit system require combined bookings of entry- and exit-capacities, which effectively resemble the use of the point-to-point model. In some cases, different systems are used for internal and cross-border trade, for instance with an entry-exit system for deliveries from or to local entry and exit points, respectively, whereas a point-to point model is used for transit flows.

In contrast to a true entry-exit system with fully separated entry- and exit-capacities, any coupling of entry- and exit-capacities limits the flexibility of network users in the use of their capacities. As a result, liquidity in the local market may be reduced since it is distributed on several geographically distinct points (or physical hubs) with a limited potential for exchanges between each other, instead of being concentrated on a single (virtual) hub. This well known feature of the point-to-point model is the reason why entry-exit systems are commonly regarded as superior in terms of promoting competition in the gas market. It is therefore clear that the existence of point-to-point regimes or coupled entry-exit tariffs can also be considered as a barrier for cross-border trade.

With regards to the particular focus of this chapter, one may furthermore question the extent to which any differences in the detailed design of the network access regime may represent additional barriers for cross-border trade. In this context, we differentiate between the following two cases:

- Application of different network access models for internal as opposed to cross-border trade; and
- Impact of the point-to-point model on neighbouring countries.

The use of two different systems within a single country, such as the application of the entry-exit system for domestic transmission but of a point-to-point model for cross-border trade, effectively also divides the overall market in two systems. Whilst domestic transmission may benefit from the flexibility of trading at a virtual hub under the entry-exit system, cross-border trade is limited to transactions at each of the cross-border points and exchanges between those combinations of cross-border points which are permitted under the point-to-point model. In addition to the general disadvantages of the point-to-point model mentioned above, this case has the additional disadvantage of creating a clear separation between the domestic market, on the one side, and cross-border trade, on the other side. This will not only reduce liquidity in both markets but may also discriminate against foreign network users by creating barriers to entry.

Similarly, the use of a point-to-point regime reduces the flexibility of network users in trading with neighbouring countries, at least where the two countries have multiple connections. Even if network users are principally able to flexibly use their corresponding entry and exit capacities in the neighbouring country, this flexibility will be undermined by the fact that the network user does not have the same possibility on the other side of the border. This effect is indicated by the left side of Figure 8 where the application of a point-to-point model in

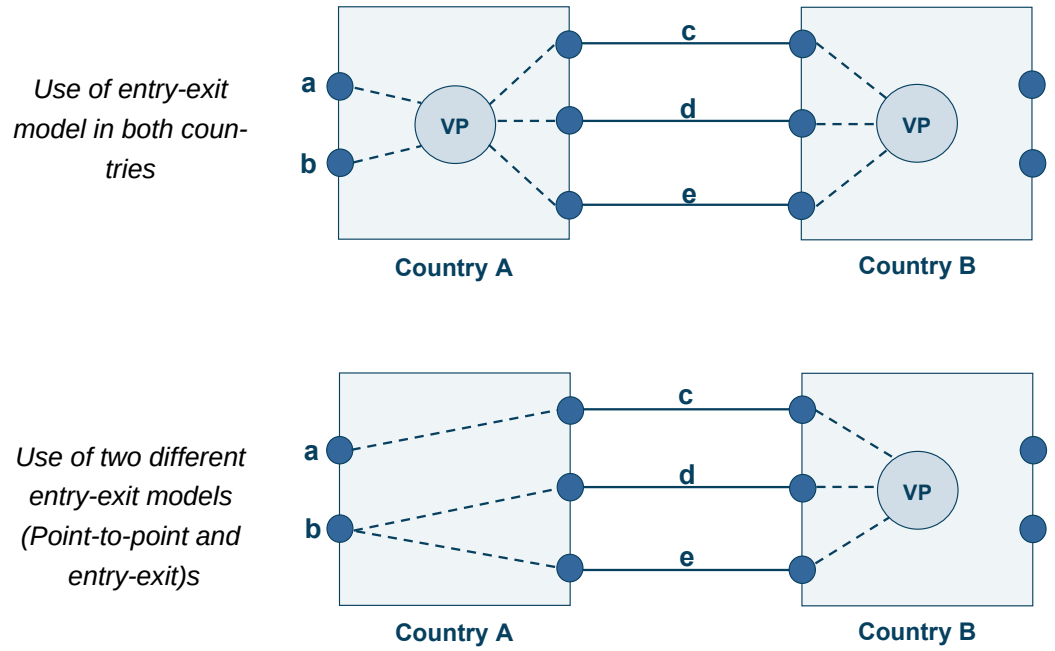


Figure 8: Impact of a point-to-point model on the entry-exit system in a neighbouring country

country A creates an implicit link between individual entry-exit points in country B and entry-exit points a and b in country A. As a consequence, a network user would need to obtain exit capacities at multiple entry-exit points in country B in order to gain access to entry-exit points a and b. Conversely, if both countries applied the entry-exit system it would be sufficient for a network user to book capacity at one of the entry-exit points c to e.

Despite this criticism, we note that the same effect may occur at the border between one larger country and several smaller countries. To some extent, it is thus also related to the size of individual market areas, or balancing zones, and the use of administrative boundaries (compare section 3.1.2.4).

Moreover, we also acknowledge the particular situation of some countries or networks where transit flows are of a similar size, or even significantly larger than local consumption. It is however beyond the scope of this study to assess whether it is always technically possible to apply an unconstrained entry-exit system in such cases, or whether certain measures may be required to limit the uncertainty on the regional distribution of flows across a given network, which might otherwise result in an excessive reduction of the capacities that can be made available to the market. Nevertheless, we also present an approach in section 4.1.4 which might ensure the compatibility of flexible entry-exit systems with the need for taking corresponding physical constraints into account.

Overall, we view the existence of different network access models in neighbouring countries or even within the same country as a potentially serious barrier for cross-border trade. However, our considerations above imply that their generally detrimental impact on cross-border trade might have to be weighted against potential physical constraints of certain networks, especially in smaller countries with large transit flows. In this context, we also note that Art. 13(2) of Regulation (EC) 715/2009 does not allow the use of the point-to-point model after 3 September 2011. In turn, this means that the problems addressed in this section can be considered as transitional only, since they should disappear by this deadline. As further discussed in section 4.1.4 we therefore recommend assessing specific mechanisms that are aimed at enabling the consideration of corresponding technical restrictions even when applying an unconstrained entry-exit system.

3.1.2 Transmission Tariffs

3.1.2.1 Limited compatibility of capacity products and lack of short-term capacities

From the previous chapter it is clear that there are many differences concerning the definition of gas capacity products. For the purpose of this study, we focus on corresponding differences with regards to the duration of different products and the specific conditions applying to interruptible products, such as differences in the reasons for and the risk of interruption. Conversely, we do not address various other aspects which also differ between systems, such as allocation and nomination rules (pro-rata, first-come-first-served, auction), capacity calculation, gas quality, etc. since these are not directly related to the question of transmission pricing.

As presented in section 2.2, most countries offer long-term capacity contracts in the form of yearly or multi-annual capacity. In addition, monthly contracts are available in most countries. In contrast, not all countries offer other short-term products, such as end-of-month, weekly, daily or day-ahead capacities, or where these are offered, they may be subject to differing product specifications. Similarly, the detailed rules governing the use and interruption of interruptible capacities typically vary for each country.

Such differences may result in a possible mismatch of the capacities available on both sides of the border. Network users may try to solve such problems for instance by contracting for additional amounts of capacity (in terms of volume and/or duration) on one or both sides of the border. Nevertheless, this will lead to increased (transaction) costs for network users.

Especially in case of interruptible capacities, such measures are furthermore likely to be insufficient for removing the additional risks caused by the incompatibility of the different product specifications. For network users it is important to have transparency on (historic) interruptions in order to assess whether or not to buy interruptible capacity. If the risk of being interrupted (or indeed transparency) widely differs between two systems, again the worst system is likely to determine how much interruptible capacity will be booked.

Besides the additional risks and costs for individual network users, the limited compatibility of capacity products may thus implicitly result in additional ‘hoarding’ of capacity as network users are forced to contract for more capacity than they actually need. Whilst this may not be relevant in a system with sufficient spare capacities, it is certainly undesirable in a situation

with (contractual) congestion as is currently the case at many cross-border points in the European gas market.

A particular problem finally relates to the fact that truly short-term products such as day-ahead or within-day capacity are currently offered in very few countries only. Such products may however provide an important instrument for enabling network users to take advantage of short-term arbitrage potentials between neighbouring markets, thereby promoting to market integration and the convergence of market prices.[28] In addition, the lack of corresponding products also increases the risk of market foreclosure.

Although not directly related to the structure of transmission tariffs, we therefore believe that differences in the range and specification of different products offered to the market create additional barriers to cross-border trading, which may be particularly severe at borders with a significant degree of (contractual) congestion.

3.1.2.2 High premium on short-term products

Section 2.2.3 above has illustrated that in most markets a premium on short-term products can be observed, with monthly capacity sometimes several times more expensive than annual capacity rights. Although there are reasons why short-term capacity should be more expensive under certain circumstances (see section 4.1.1 below for a more detailed discussion), the differences observed in practice may also have several undesirable effects and establish additional barriers to cross-border trade.

In particular, we note the following issues:

- High prices for short-term capacities reduce the scope for an efficient utilisation of available capacity since they may make the reservation and use of capacities commercially unattractive even where such capacities are already available but not used by other users. In a way, high premiums on short-term capacity may thus effectively represent a penalty on short-term trading. In addition, it also obstructs short-term / spontaneous arbitraging of price differences in markets, which would strengthen competition and lead to lower (competitive) prices.
  For illustration, we refer to the fact that wholesale market prices between two neighbouring markets sometimes show a difference which is below the (capacity)

[28] Compare also ERGEG Public Consultation Document. Ref: E08-GFG-41-09, 15 Jan 2008

price of short-term capacities, whilst in excess of the commodity price (if any) for long-term capacities.

- Given the lack of available long-term capacities, the premium on short-term capacities furthermore creates additional barriers for new entrants as they may not have access to long-term capacities.

- The associated risks, as well as the fact that the costs of short-term capacities are often equivalent to that of long-term capacities already after 3 – 5 months, may also lead network users to be in favour of buying long-term capacity, if available, to secure market access and take future demand increases into account or just simply because it is cheaper. This may be the case even where the corresponding capacities are not really required by the user for a considerable part of the year.
  Apart from the additional costs for the user, this effect may further contribute to the existence of contractual congestion.

Due to these reasons, we consider the use of high premiums on short-term capacity as a potentially serious barrier to cross-border trade. Nevertheless, we also note these issues are closely interrelated with the generally limited availability of cross-border capacity and the arrangements for capacity allocation. In this context, we also refer to one of the findings of the user survey, i.e. that under current circumstances participation in the market is primarily based on the question of whether a network user has been able to obtain capacity rights or not, whilst the price of capacity is of secondary importance.

3.1.2.3 Lack and inefficient pricing of non-physical backhaul capacities

The comparison of the national tariff regimes in section 2.2.3 has shown that only a small number of countries currently offer non-physical backhaul capacity on a regular basis. In this context, it is important to note that non-physical backhaul capacities represent ‘paper trades’, which can only be used to reduce an existing firm forward nomination. One might therefore argue that non-physical backhaul capacities are not essential to the market since they will generally only be available on an interruptible basis and they do not enable any additional transports in the direction of the prevailing physical flow.

Nevertheless, non-physical backhaul capacities may play an important role with regards to the integration of separate national markets into a single regional market. Although they can only be used to reduce the (nominated) physical flow on a given interconnector, they are essential for facilitating efficient arbitrage by market participants and the convergence of mar-

ket prices, which in turn will promote an optimal physical use of available capacities. In the absence of non-physical backhaul capacities, it is possible that natural gas will be transported from one area to a neighbouring region with lower prices, for instance due to long-term commitments under take-or-pay contracts. Although such instances represent an inefficient outcome, other network users are not able to take advantage of the resulting arbitrage possibilities as long as they do not have access to at least interruptible backhaul capacities.

Backhaul capacities, whether in the form of (firm) physical or (interruptible) non-physical capacities therefore represent an essential element for a functioning market, whilst their absence clearly creates scope for inefficiency and barriers to efficient trading.

Besides the general availability of non-physical backhaul capacities, current prices also provide reasons for concern. As illustrated in section 2.2.3, the prices of non-physical backhaul capacity range between 60% and 100% of the price of firm forward capacity in 4 out of 7 countries where this service is offered at all. Similar to the case of the premiums applied to short-term capacities (see previous section), these prices may create barriers to the reservation and use of corresponding capacities as they will only become commercially attractive at relatively large price differentials between both markets. By effectively limiting the scope for the use of minor arbitrage possibilities to the holders of firm forward capacity rights, these prices may furthermore create additional barriers to entry.

Overall, these considerations imply that both the lack and the pricing of non-physical backhaul capacities may potentially create serious barriers to cross-border trade and efficient utilisation of the available network infrastructure.

3.1.2.4 Pricing at Administrative Borders / Pancaking

With few exceptions, tariffs in most Member States are already based on the entry-exit system, with separate charges for entry and exit points. Besides national entry and exit points, entry and exit tariffs are also applied to cross-border points. As a result, network users typically have to pay separate entry- and exit charges for each border they want to trade across. Besides potential problems related to the use of different products, or the need to separately secure capacity for both sides of the border, the use of national borders as the basis for transmission charges may also give rise to further barriers to cross-border trading.

In practice, the application of separate charges at each border results in the well known effect of ‘pancaking’, which may be further differentiated into price pancaking and contractual pancaking. Price pancaking simply refers to the effect of multiple charges being added to

each other, whereas contractual pancaking refers to the need to enter into separate contracts. Although especially the former may not be problematic as long as the resulting charges are cost-reflective, both forms may create obstacles for cross-border trading.

To start with, the need to enter into separate contracts for each border crossed certainly results in additional transactions costs and associated contractual risks for network users. This may become particularly problematic where the applicable products, contracts and tariffs in the countries concerned are incompatible with each other. Some of the related issues have however already been addressed in section 3.1.2.1 above. Moreover, we note that the issue of contractual pancaking cannot be avoided without fully harmonising adjacent systems and/or establishing a fully integrated regional system with the opportunity to book multiple capacities by means of a single capacity booking.

Conversely, price pancaking may be more critical, although it will not have any detrimental impact on the market as long as the charges applied are fully cost-reflective. Amongst others, this would however require entry-exit charges with clear location differences, which is obviously not the case in many European countries. Moreover, it is a well known fact that it is not possible to create a system of locational prices, which both delivers perfectly efficient locational signals and ensures that tariff revenues are exactly equal to costs. In practice, it is therefore always necessary to accept some simplifications and compromises with regards to locational differentiation and/or to adjust the resulting charges, in order to avoid any over- or under-recovery of actual costs for the TSO.

Although these problems principally apply to any scheme of locational charges, this may become particularly relevant when the resulting errors are aggravated by means of pancaking. Due to the need to ensure cost-recovery for TSOs, it is likely that actual charges may be higher than justified based purely on locational differences. In the case of cross-border trade, the necessary capacity reservation may be exposed to this effect multiple times, i.e. once for each reservation of capacity at an entry or exit point. Besides additional costs for cross-border trade, this may also result in a suboptimal utilisation of the existing infrastructure.

Further barriers may result from a cost difference for alternative routes due to pancaking. It seems reasonably to assume that cheaper routes will be more heavily congested than comparably more expensive routes, which may pose a barrier to entry for new market players, as incumbents will have secured the capacity for cheaper routes for themselves. The physical transport route however should not be dependent on the contractual transport paths but be determined by the TSOs involved, taking into account physical constraints, actual demand, maintenance and seasonal flow patterns.

Overall, the effect of pancaking may thus result in an inefficient use of (regional) networks and potentially discriminate against cross-border trade in general as well as new entrants in particular. Although it is difficult to asses the exact scope of the corresponding problems without a more detailed analysis, which is beyond the scope of this study, it nevertheless appears that the effect of pancaking may create potentially serious barriers for cross-border trade in the European gas market.

3.1.2.5 Lack and Design of Locational Pricing

Although most Member States already apply an entry-exit tariff system, the comparison in section 2.2 has shown that only a limited number of countries differentiate tariffs by location. Moreover, even where locational prices are applied, the principles for regional differentiation are not always transparent. Both aspects may give rise to inefficiency and may potentially create barriers to cross-border trade.

To start with, the lack of regional differentiation by definition involves some element of socialisation and is unable to reflect any locational differences in costs. This may result in an inefficient use of the network as network users do not receive correct signals of the costs they create for the system. Moreover, uniform regional prices may discriminate against certain users, who have to bear a higher share of total costs than justified by their individual use of the network.

The relevance of any corresponding problems strongly depends on the size and physical structure of the network question. For instance in a small network, regional differences may be limited such that any locational differences would only be marginal. Similarly, the application of locational prices is difficult where the underlying network lacks a clear structure of prevailing power flows, which may especially be the case in meshed systems with several alternative sources of supply.

With regards to current practices in Europe, we note that uniform regional prices can mostly be found in small countries or markets without a (significant) share of transit flows. In these cases, the lack of locational prices, whilst possibly having an impact on local customers, is unlikely to create serious barriers for cross-border trade. In contrast, we note that most of the large markets as well as the main transit countries apply locational prices, whether in the form of regionally differentiated entry-exit charges or separate (distance-based) tariffs for

transit.[29] It therefore appears that the lack of locational prices is unlikely to be a major barrier to cross-border trade in the European gas market.

As noted, further inefficiencies may arise from the design of locational tariff systems. For instance, where locational tariffs structurally discriminate in favour of shorter or longer transport distances, this may create barriers to cross-border trade. The opposite is equally possible. A robust assessment of the corresponding impact of the different national tariff systems would however require an in-depth analysis of the individual tariffs and the underlying physical flows in each network, which was however not possible within the scope of this project. As a consequence, our analysis therefore does not provide any indications that the locational tariff system applied in some of the Member States inhibit cross-border trade.

In addition, it is however also worth asking whether the locational tariffs applied today address the right areas and whether they are at all able to provide efficient locational signals? In this context, the responses from the user survey have shown that many network users do not consider current differences in transmission tariffs relevant since they do not at all reflect the value and scarcity of different routes. Indeed, many of the respondents were in favour of auctions to provide the market with clear price signals on congested pipelines.

In contrast, the current combination of regulated tariffs and the continuation of historic long-term contracts may create entry barriers for and discriminate against new market players who may find it impossible to get access to capacity in highly congested areas. Simultaneously, the lack of market-based prices for scarce transport capacity may protect the status of incumbents, who probably have secured their capacity rights for years in advance, whilst only paying the much lower regulated tariffs. This aspect is therefore further addressed in section 4.1.3 below.

3.1.2.6 Allocation of costs to different tariff components

The analysis of the tariff methodologies and the current tariff regimes has revealed a considerable degree of diversity both with regards to the structure of transmission tariffs and the allocation of costs to different tariff components. Examples include the split between capacity and commodity charges, the share of costs being allocated to entry- as opposed to exit charges, or the use of additional fees and charges for specific services and costs.

[29] In practice, it appears that Denmark and Hungary are the only countries with a sizeable share of production or transit flows that do not differentiate tariffs by location.

In principle, such differences may discriminate against certain users. For example, the use of pure capacity charges may be disadvantageous from the perspective of a user with a more 'peaky profile' and hence a lower annual utilisation, whilst an excessive allocation of costs to commodity charges could discriminate against users with a high utilisation of their capacity. To some extent, these issues are however inherent to any tariff system, as tariff setting always represents a compromise between the objectives of economic efficiency, cost recovery, transparency, stability and sufficient ease of use.

These considerations equally apply to domestic and cross-border trade. Moreover, the impact of corresponding differences usually remains limited such that they should only be considered critical in case of serious distortions, in which case they would however have to be addressed on a national level in any case. Two main exceptions could occur where:

- Cross-border trade is treated differently from local trade; or
- Tariff design favours a particular group of network users compared to competing users in other markets.

The former is obviously the case in those countries where different tariffs are applied for transit. Without a detailed case-by-case analysis, it is however difficult to assess the extent to which these systems may potentially discriminate against, or in favour of, transit as opposed to local trade and pure export / import transactions. Moreover, we have also noted in section 3.1.1 above that Art. 13(2) of Regulation (EC) 715/2009 requires all countries to apply fully de-coupled entry-exit tariffs by 3 September 2011.

Conversely, concerns with regards to the second aspect could for instance arise in case of major variations in the split between entry and exit charges between different countries since this might enable producers in one country to access the market at lower costs than their competitors from another country. Although the entry-exit split does indeed differ substantially within the European gas market,[30] we note that the impact of these differences is more likely to be seen in the relative levels of wholesale market prices, whilst they may not have any direct impact on the competitive position of network users from different countries.

[30] Compare for instance ERGEG. Gas Transmission Tariffs - An ERGEG Benchmarking Report. Ref: C06-GWG-31-05, 18 July 2007, p. 16

This reasoning can be illustrated by the following example:

- Suppose that two producers with equivalent production costs are located in neighbouring countries with equivalent networks in terms of size and costs.
- If the entry-exit split in both countries was 50:50, both producers would be able to access the local market at a price equal to 50% of the total transmission tariff, whereas they would face a disadvantage of 100% of the total transmission tariff when trying to compete against the second producer in the other market.
- Conversely, if one country allocated all costs of transmission exclusively to entry tariffs but the other to exit tariffs, the producer in the first country would be able to access the local market without any additional costs but have to pay the equivalent of twice the total national transmission tariff to access the second market. In contrast, the producer in the second market would have to pay 100% of the national transmission tariff to access both the national and the foreign market.
- As a consequence, each producer would still face a disadvantage of 100% of the total transmission tariff when trying to compete against the second producer in the other market. In addition, however, it is likely that wholesale market prices in the two countries will be affected and that producers / importers will ask a higher price in the second market, whilst the opposite will be true in the first country.

We acknowledge that this example is highly simplified and neglects for instance the difference between capacity and commodity charges. However, it serves to show that any differences in the entry-exit split are neutralised by the fact that any 'transit' from a local entry point (i.e. production, storage or import) to another country will always be subject to the local entry and exit tariff.

Strictly speaking, these considerations are only true if one considers the total annual costs of different network users. In contrast, the situation becomes more complex if one also considers differences in the split of capacity to commodity charges. In this case, a network user from a country with commodity charges will have to account for these costs when offering additional amounts of gas into the (regional) market, whilst this is not the case for a network user from another country that only charges capacity tariffs. As a result, the former will face comparatively higher short-term incremental costs of access to the market. Although this disadvantage will be at least partially compensated by lower costs for the reservation of ca-

pacity, this difference will certainly influence the short-term position of both network users in the market.

Finally, we note that the situation would change fundamentally as soon as domestic and cross-border points were being treated differently, which would for instance be the case when introducing an Inter-TSO compensation mechanism as discussed in section 4.1.5 below. In that case, substantial differences in the allocation between entry and exit charges could potentially create major distortions and discrimination between parties injecting and/or extracting natural gas from the network in different countries.

3.1.3 Regulation

3.1.3.1 Differences in fundamental regulatory principles

It has to be taken into account that the implementation of regulation varies considerably even though the European Directives provide a common basis. Reasons for this could be manifold: Regulatory tradition and the timing of the start of cost or incentive regulation differ considerably between the countries. In addition, there is no commonly accepted 'best practice' for regulation of energy networks: Although Cap regulation is widely regarded as granting superior incentives for economic efficiency, there is (1) no uniform agreement on it being superior to traditional RoR regulation and (2) no uniform way of implementing Cap regulation. The country studies show that mostly a type of incentive regulation is applied and only a few regulators state that they remain applying RoR regulation.

In theory, Cap regulation (incentive regulation) is based on the concept of mimicking competition, i.e. exposing regulated companies to certain risks in exchange for higher profit potential. In practice this means the provision of efficiency increase requirements over a multi-year regulatory period. Extra efficiency gains stay with the network operator during that period. It is however difficult to identify these strict theoretical criteria and characteristics of Cap regulation in practice. Only few countries apply efficiency increase requirements. Overall, this leads to the first conclusion that different regulatory principles are applied in Europe. In terms of the level of influence on tariff / the cross-border trade, we only see a low impact on the tariff side stemming from the application of different regulatory principles. Regardless of the regulatory principle applied, tariffs are nevertheless derived and published.

From the determination of the allowed return there is no impact on the tariff structure and only a slight impact on the tariff level given that the different regulatory regimes may lead to

similar results in practice. The impact of the different regulatory principles could be more severe and potentially serious on investment incentives. Under Cap regulation especially the use of the building blocks approach of this regime focuses more on efficiency gains and cost reduction, thus investment incentives might be reduced in general compared with RoR regulation. The reason for this is that efficiency analysis focuses on the reduction on controllable OPEX and therefore incentivises the network operator to focus on reducing its cost in this area to achieve its efficiency gains. Therefore it could be considered that efforts from the network operator are concentrated here and investments to the network are neglected as the 'correct' mechanisms are not in place to encourage investments to the network.

Especially under the TOTEX approach there could be a negative impact on the amount of investment. From the regulatory perspective, the advantage of the TOTEX approach is that it can capture the trade-off that is generally present between the two categories of cost i.e substitution. Secondly, and more importantly, is that it removes the incentive for over-capitalisation. However, for investment in network expansion, there are additional mechanisms such as investment approval and guarantee of an adequate return in all types of regulatory regimes given the long lifetime of the asset and the uncertainty on future developments in regulation.

3.1.3.2 Differences in regulatory accounting and calculation of the WACC

The country comparison in chapter 2 has revealed that the rate of return (WACC) allowed to the regulated transmission network providers differs considerably between the Member States. This might be perceived as an obvious barrier for investments as different TSOs seem to earn a different return on their investments. However, many of the observed differences in the level of WACC are simply dictated by the specific properties of the regulatory arrangements in the countries. As a result different rates of return (WACC) are not always comparable with each other.

For example, the WACC may be defined in nominal or real terms, where the former will incorporate an inflation allowance and the latter not. The decision to use real or nominal WACC is strongly associated with the decision on how to value assets. As explained earlier in the report, the European regulators apply different approaches for the establishment of the regulatory asset base, which amongst others includes the choice between the use of historic costs or a proxy of replacement values. Inflation may either be included in the allowed cost of capital by using a nominal WACC definition but valuing assets at historic costs, or be in-

corporated in the RAB by using replacement cost or indexed historic costs. In the latter case, the WACC will be defined in real terms and will exclude inflation.

Similarly, the WACC calculation will also differ depending on how taxes are treated in the revenue requirements. A post-tax definition of WACC will lower its level but it will require inclusion of taxes in the allowed revenue. In contrast, a pre-tax definition of WACC will increase its level but will disallow inclusion of taxes in the revenue requirements.

Similarly, the implied gearing in the WACC formula will affect its level even if cost of debt and equity are equal, and identical definition is used with respect to inflation and taxes. This is simply because the allowed shares of equity and debt will allocate different weights to the cost of equity and debt.

Finally, it is worth noting that the risk free rate is often estimated based on the yield of governmental bonds of the respective country, which again may vary by country.

Based on the above stated arguments, we conclude that it is not possible to directly compare the WACC levels in the investigated countries. Conversely, a robust comparative analysis would require a detailed investigation of the regulatory arrangements in each individual country, covering at least the establishment of the RAB, definition and setting of the WACC components, and setting of the revenue requirements. Such an analysis is beyond of the scope of the current study.

Moreover, an isolated assessment of the rate of return will remain incomplete as long as it does not discuss the associated risks to which each regulated company in the specific country is exposed. Besides the business risk, this also includes the regulatory risk implied in the regulatory arrangements dealing with the recognition of capital expenditures in the allowed revenue, use of efficiency assessments and setting efficiency targets, treatment of interim efficiency gains etc.

Overall, the different levels of WACC will necessarily result in barriers to investment, provided that they are part of a regulatory framework characterised by sufficient and balanced incentives for investments. For this reason, a harmonisation of the principles of setting the WACC does not appear necessary. Moreover, such a harmonisation is practically impossible without the harmonisation of several other components of the regulatory arrangements. We therefore believe that, instead of striving at a harmonisation of the principles of setting the WACC, the focus should be on ensuring that sound and consistent frameworks at a national level provide a reasonable rate of return and regulatory certainty to network operators.

3.1.3.3 Sufficiency of investment incentives

Most regulatory authorities distinguish between:

- Extension investments: all investments needed for meeting the change of load in the future;
- Replacements investments: all investments related to replacement of aged (technically or economically) equipment.[31]

The treatment of such investments may also differ between different jurisdictions and regulatory frameworks therefore a comprehensive assessment whether investment incentives are insufficient or not needs to have a closer look at single projects (i.e. extensive, replacement and/or exceptional investments), the regulatory policy and the investment risks. This is obviously beyond the scope of this project. Below we provide a condensed analysis of the general properties of the regulatory models towards investment incentives.

The country studies show that most regulatory regimes foresee an ex-ante approval of investments. Usually at the start of the regulatory period, the companies are asked to provide the regulator with an overview of its intended investments during the next regulatory period. The regulator may then develop a view of which investments to include in the regulatory asset base (RAB) or simply accept the company's projection as it is. This is relevant for investments in network extensions and in the countries using rate-of-return and caps with building-blocks also for replacement investments.

Investments that have been allowed into the RAB will be completely recouped through the allowed depreciation while the company would also earn a rate-of-return over the undepreciated portion of these investments. This approach is attractive because it links revenues to costs, allowing for efficient costs and the risk-adjusted rate of return to be considered, and efficiency gains to be identified for sharing with customers. Where there are strong investment needs in the near future, the regulation will enable a specific allowance to be made for the higher investment.

Under the TOTEX approach, the regulator does not need to develop a view on whether a given investment proposal should be allowed or not. Rather, the regulator considers the ac-

[31] Some distinguish also exceptional investments: investment resulting from e.g. new legal obligations. For example, new safety measures may lead to investments, without however increasing capacity or replacing aged components

tual total costs (including investments) incurred by the company and sets the efficiency increase based on a benchmarking analysis of these costs. Furthermore, under the TOTEX regime, companies have more discretion whether they invest or not. The threat that investments may be rejected, or partially disallowed, in the process of benchmarking would provide an incentive to the regulated company to only undertake efficient investment. Such an incentive is necessary because the regulated company is likely to hold better information than the regulator about the prospective efficiency of a proposed investment. Therefore, by making the company accept the consequences of its investment decisions, the probability that inefficient investment will take place is weakened.

On the other hand, the regulatory threat that due to the ex-post benchmarking, capital costs of investments can be disallowed and this could discourage regulated companies to implement even good investment projects. Also, there may be capital expenditure that is planned and conducted in good faith that eventually proves “imprudent” on an ex-post basis. Obviously, the straight application of the TOTEX model without supplementary schemes may disregard the prospective needs of network investments. Therefore regulators apply explicit investment allowances, in particular for extension investments.

There are several issues that may negatively affect investments in the context of both approaches. The first one relates to the treatment of construction work in progress and the incorporation of the return on assets in construction in the allowed revenue. The main question is how the regulated companies should be compensated for the cost of financing on assets in construction. One option is to simply add “bridging” finance costs to the eventual value of the asset. However, this may not appropriately compensate for the risks involved. Another option is to roll forward expenditures already incurred with an accumulated rate of return equal to that for operational assets to reflect final cost. The accumulated amount would be the amount added to the RAB when the assets become operational or simply added to the allowed revenue.

Another issue, in particular relevant for the application of TOTEX-approach, is whether the approved investment should be incorporated in the future efficiency analysis. The risk that due to the inclusion in the ex-post benchmarking, capital costs of approved investments can be disallowed and could therefore discourage regulated companies to implement investment projects. Therefore, TSOs argue permanently that regulatory regimes do not provide adequate incentives for investments and demand a stronger regulatory commitment in terms of guaranteed inclusion of investments in the RAB.

3.1.3.4 Lack of coordination – network planning and open season processes

At many borders in the European gas market, cross-border trade is inhibited by congestion. Investments into new network infrastructure are therefore widely seen as essential as they may enhance possibilities for gas trading and reduce the degree of congestion. In practice, investments are required into the extension of both national network infrastructures and cross-border pipelines. Both are strongly interrelated, which leads to the issue that a lack of coordination of national investment efforts constitutes one of the major obstacles to a real trans-European gas market. Consequently, a lack of coordination of investments is highly critical for network users and TSOs/regulators alike.

In this section, we focus specifically on the effects which a lack of coordination in network planning and open season processes may have on network users, whereas the following section 3.1.3.5 deals with additional issues that are of particular relevance from the perspective of TSOs, i.e. insufficient coordination in the regulatory treatment of new investments.

The issue of insufficient coordination in the area of network planning has long been identified as a key area of concern, as also illustrated by the requirement of Directive 2009/73/EC for the establishment of a community-wide ten-year network development plan.[32] Market participants have reported various cases of insufficient coordination of investment decisions and open season processes, including both locational and timing aspects. The main issues that are addressed in this context are:

- Even where several TSOs have started to cooperate, seams issues with other areas remain, creating significant risks for “external network users”;
- For the open season procedures a lack of synchronisation implies that network users have to take firm decisions before knowing the outcome or even the possibilities in another open season process in another area / country;
- Risks are further aggravated by the time lag between firm commitments made by network users and the final decision on allocated capacities and resulting prices by TSO(s).

Although a significant number of open seasons have been launched in recent years, many of these have been facing difficulties.[33] Whilst most of these open season procedures were

[32] See in particular Art. 22

[33] ERGEG, GRI-NW, Open Season coordination. 28 April 2009.

carried out on a purely national scale, the joint open season of GRTgaz and Fluxys in 2007 was the first experience of cooperation and sharing information between TSOs and regulators, which was furthermore coordinated in time with the parallel open season of Gastransport Services for the year 2012.

Although the experiences with the joint open season process were generally positive, some difficulties were revealed:

- The open season was delayed for more than one year due to discussion on transit tariffs in Belgium. As a result, the open season of Gastransport Services was affected. Gastransport Services was forced to split their open season in two phases.
- There was a significant divergence between bids submitted in the first and second (binding) phases.
- Differences in regulatory rules between the countries were identified, e.g. on the reservation of capacity for short term needs.
- In addition, confidentiality clauses proved to be a major obstacle to the coordination of open seasons.

Overall, these observations clearly illustrate the scope for considerable improvements for the coordination of network planning on a regional scale in general, as well as with regards to the coordination of open season process in particular. Given the degree of congestion at many borders and the general view that additional investments are key to the establishment of an integrated European gas market, a lack of coordination does not only lead to increased uncertainty and risks for network users but may also result in sub-optimal investment decisions by network operators. In summary, it therefore appears that further improvements in this area are critical for the further development of the European gas market.

3.1.3.5 Lack of coordination – regulatory treatment

Apart from potential barriers associated with insufficient coordination in the area of network planning, further problems may arise from differences in the regulatory treatment of the resulting investment projects. Since decisions on cross-border projects are subject to national regulation, differing legal and regulatory rules and practices may create additional barriers to the realisation of efficient investments even where the TSOs concerned have perfectly coordinated in advance. Indeed, we have learned from TSOs and some regulators that differ-

ences in the regulatory rules governing the assessment and approval of investment proposals have created additional difficulties or even turned out as one of the major problems in practice, especially with regards to the coordination of different open season processes, whether formal or informal.

The corresponding issues have also been clearly illustrated by the recent findings of the 'Virtual Test' within the Gas Regional Initiative North-West (GRI NW).[34] Although the activities under the Virtual Test also addressed a number of other aspects, such as differences with regards to determination of the applicable costs of cross-border infrastructure, the most important results of the Virtual Test for the purpose of this section relate to the regulatory decisions on the virtual case simulated within this project.

More specifically, and despite agreement on common principles for the assessment of investment costs and the determination of transmission tariffs, the Virtual Test found that the corresponding investment would not have been realised in practice. However, rather than being the result of insufficient interest by network users, this outcome resulted from differences in the investment triggers to be met in the different countries for the corresponding investments to be approved under national regulatory rules. Moreover, it is also interesting to note that corresponding problems did occur in the 'transiting' countries, whilst the investment would have been approved in those countries that would ultimately have benefited from the additional transport capabilities.

In addition to the other findings of the Virtual Test, it therefore represents a perfect illustration of the potential barriers resulting from different rules for the regulatory approval of cross-border investments.

In particular, we believe that the following two aspects are worth mentioning:

- Lack of coordination and/or compatibility between the principles used by different countries for deciding on the approval of the same investment; and

- Use of a national rather than a comprehensive regional perspective when evaluating the potential costs and benefits of the investment.

Similar to the case of network planning, we therefore believe that an insufficient degree of coordination amongst national regulators, or more generally the applicable regulatory rules

[34] Compare the GRI NW workshop "Virtual investment (test) case", Stockholm 24 September 2009

on a national level, represents a potentially serious barrier for new investments into cross-border infrastructure, which may become highly critical for the further development of the European gas market.

3.2 Residual Balancing and Imbalance Settlement

3.2.1 Lack of Market-Based Mechanisms for Residual Balancing

The comparison in section 2.4 has revealed large differences in the arrangements for residual balancing in the European gas markets. Amongst others, most TSOs rely on regulated and/or negotiated contracts, whilst only a small group of countries already apply market-based mechanisms. Besides its impact on the local markets, the lack of market-based mechanisms may also impede cross-border trading and regional integration, firstly by establishing additional barriers for the provision of balancing services by external parties and, potentially, also by reducing the scope for market-based pricing of imbalances.

The use of regulated and/or negotiated arrangements for the provision of balancing services by definition creates a separate 'market' that is based on some form of medium- or long-term arrangements and is not accessible to network users on a daily basis. These features naturally establish barriers to entry for domestic and foreign parties alike. In the particular case of external parties, these barriers are further aggravated by the need to also secure firm transport capacities into or out of the local market area over the corresponding time frames. Even where it is principally possible for foreign parties to become a provider of balancing services, these restrictions are likely to inhibit the potential exchange of flexibility between different market areas, resulting in reduced scope for cross-border trade in corresponding services and a general loss of efficiency.

A second potential barrier results from the relation between the costs of residual balancing and the pricing of imbalances. As further discussed in section 3.2.5 below, the lack of market-based pricing of imbalances can be considered as another potential barrier for cross-border trading. Market-based pricing of imbalances requires the costs of balancing gas reflect to its market value. The procurement of balancing gas by other non market-based mechanisms however removes this crucial link and thereby also reduces the scope for market-based imbalance settlement.

In principle, the lack of market-based mechanisms for the procurement of balancing services can therefore clearly be regarded as a potentially critical obstacle to cross-border trade. Consequently, Directive 2009/73/EC[35] advocates the use of market-based mechanisms for the supply and purchase of balancing gas, whilst Art. 21 (1) of Regulation (EC) No 715/2009 explicitly states that balancing rules shall be market-based. But the same article also concedes that balancing rules have to take "*into account the resources available to the transmission system operator*". Similarly, Directive 2003/55/EC[36] mentions the need for sufficient liquidity as a precondition for setting up a market-based mechanism for the supply and purchase of balancing gas.

In this context, it is worth noting the fundamental differences in the availability and ownership of different sources of flexibility. As already mentioned in section 2.4, some countries benefit from the availability and dispersed ownership of flexibility, whilst others have a very limited choice or are even largely dependent on neighbouring countries. Moreover, several TSOs have sufficient flexibility of their own (linepack) such that they do not need to rely on external sources of balancing gas on a daily basis. It is clear that such differences, as well as the general level of liquidity in a given market, also influence the potential for the market-based procurement of balancing gas. Indeed, it seems that many TSOs may face considerable difficulties or even be unable to introduce corresponding mechanisms, or only in combination with other supplementary measures.

Whilst the design of possible options in individual markets is beyond the scope of this study, the limited scope for competition in many markets is also related to the small size of the corresponding systems. To some extent, the lack of market-based mechanisms for residual balancing is therefore also related to the small size of many markets as further discussed in section 3.2.3 below.

3.2.2 Incompatible Products for Residual Balancing

Besides the general difference between the application of market-based and other approaches, section 2.4 has also commented on the diversity of the mechanisms and products used in those countries that already rely on market mechanisms. Unfortunately, the characteristics of the corresponding balancing services are often incompatible with the products commonly traded in the commodity market or similar services being used in other countries.

[35] See preamble, §31

[36] See preamble, §15

To start with, about half of the corresponding countries use tenders with medium-term time horizon, mostly on an annual basis. Moreover, the corresponding products can generally be described as reserve contracts with specific requirements on availability, conditions of use and remuneration. Although the corresponding conditions are not always published, we understand that each TSO applies its own set of specific requirements, which are tailored to its own needs and local circumstances. As a result, the balancing services procured under tenders are mostly quite different from standard products traded in the commodity market and are also unlikely to be compatible with each other.

Conversely, in the group of countries using short-term mechanisms on a daily basis, most TSOs already procure standardised energy products that are also traded in the commodity market. The Austrian balancing mechanism, however, is again based on a specific hourly product that to our knowledge is unique to the Austrian market. Similarly, the German TSOs apply a variety of different mechanisms and product definitions that are not directly compatible with each other.

We acknowledge that some of these differences, especially concerning the need for the guaranteed availability or maximum response times, appear justified with regards to the specific requirements of operational balancing in real-time. Moreover, one also has to take into account that most of the corresponding mechanisms are relatively new and that, in fundamental contracts to the European electricity markets, TSOs have not been able to rely on harmonised standards and practices in this respect. As such, it seems only natural to the current degree of diversity and lack of harmonisation. As such, the current degree of diversity and lack of harmonisation seems only natural.

Nevertheless, we also believe that the wide range of different and often incompatible products and approaches complicate the participation of external bidders. Moreover, this is also likely to function as a barrier for the mutual exchange of balancing services between neighbouring services, which may potentially provide for significant benefits with regards to regional integration (see sections 4.3.1 and 4.3.2).

3.2.3 Limited Size of Market Areas and Balancing Zones

The European gas market is characterised by extreme differences in the size of the individual markets, both in terms of geographical size and physical volumes. Although these differences largely reflect the decentralised political and administrative structure of Europe, they

nevertheless serve as a barrier to cross-border trade. Moreover, several countries have further split their markets into several market areas, or balancing zone.

This high degree of fragmentation has a number of negative impacts on the development of truly functioning and competitive European gas markets, including the following:

- Limited scope for competition in smaller areas;
- Separate allocation and pricing of cross-border capacities at each border;
- Diversity of rules; and
- Reduced benefits from pooling of imbalances.

It is a fundamental finding of economic theory that small and fragmented markets reduce the scope for competition, whilst larger markets help to promote competition by increasing the number of players and reducing the potential influence of dominant market participants. This conclusion is universal and also applies to the European gas markets. Moreover, as already mentioned in section 3.2.1 above, it is not limited to the commodity market but is equally valid for the procurement of balancing services. Although the small size of individual markets has primarily a negative impact on these markets themselves, it also creates barriers for cross-border trading by reducing liquidity and transparency and hence making it more difficult for external parties to enter the local market.

We have already commented above on the problems related to the separate allocation of transport capacities at each border and the related issue of pancaking and we refer to the corresponding discussion in chapter 3.1.2.

From the perspective of network users, the diversity of national rules in individual countries represents another major obstacle for cross-border trading as it increases complexity and transactions costs. This issue has also been clearly raised by the participants in the user survey (see section 3.3 below), emphasising in particular the differences in the areas of capacity allocation and congestion management as well as balancing and imbalance settlement.

The latter aspect also relates to the last issue listed above, namely the reduced scope for pooling of imbalances. Although Art. 21 (2) of Regulation (EC) No 715/2009 explicitly calls for imbalance charges to provide "*appropriate incentives on network users to balance their input and off-take of gas*", it is clear that the scope for self-balancing by network users is lim-

ited by the inevitable inaccuracy of load forecasts and imperfect information on the actual status of a network user's overall portfolio during the gas day. Consequently, network users will always remain exposed to a residual imbalance risk. This risk is partially determined by stochastic effects, such as differences in the behaviour of individual customers or the quality of local or regional weather forecasts. It is therefore a trivial fact that the aggregation (or 'pooling') of individual imbalances helps to mitigate the influence of inevitable deviations.

Section 2.5 above has shown that most TSOs already allow network users to pool imbalances at least for all deliveries in the domestic market. The degree to which network users can benefit from this possibility amongst others depends on the size of the relevant market area or balancing zone. As also illustrated by the quantitative analysis of imbalance charges in section 3.2.6 below the fragmentation of the overall gas market into smaller market areas clearly creates additional risks for network users. In combination with the use of divergent and sometimes relatively harsh principles of imbalance settlement (compare section 3.2.4 and 3.2.6), this effect creates barriers to cross-border trade as also emphasised by corresponding responses to the user survey (see section 3.3)

In summary, these considerations clearly illustrate the negative impact of small and fragmented market areas and/or balancing zones on the development of competitive gas markets. We believe that the status quo can therefore be regarded as a serious obstacle to cross-border trading. In this context, we also note the strong emphasis of the recently adopted Directive 2009/73/EC[37] and Regulation (EC) No 715/2009[38] on regional cooperation and the establishment of regional markets as further discussed in sections 4.3.1 to 4.3.3.

3.2.4 Use of Different Balancing Periods

The length of the balancing period represents one of the most important choices in the design of any system for imbalance settlement. According to §1.7 of the GGP-GB, a daily balancing period is principally preferred by the European regulators. The user survey has shown that most network users share this view, which is also in line with various presentations, reports and surveys by different organisations. In addition, network users as well as §1.6 of the GGP-GB point out the need for harmonisation or at least compatibility of balancing periods in interconnected gas systems.

[37] See for instance Art. 7

[38] See for instance Art. 12

Based on this background, the comparison of current arrangements in section 2.5 has shown that most Member States at least formally apply a daily balancing period. In addition, several countries even apply a longer or no pre-defined balancing period (compare §1.7 GGP-GB). Conversely, an hourly balancing period is used in Austria as well as for transit flows in several other countries.

Moreover, we have emphasised in section 2.5 above that it is important to clearly differentiate between the formal and effective balancing period. As a matter of fact, various countries have combined a notional daily balancing period with additional hourly and/or cumulative constraints. Depending on the treatment of any imbalances arising within these shorter timeframes, these additions may effectively create a system which more closely resembles the use of hourly or at least sub-daily rather than daily balancing periods.

As also illustrated by the examples in section 3.2.6, it is clear that the impact on network users will be different under a system with pure daily balancing than, say, when applying a daily balancing period in combination with additional penalties on hourly imbalances. Moreover, the examples in section 3.2.6 also show that the use of different balancing periods in interconnected systems may make it impossible for network users to correctly balance a combined portfolio of customers in different market areas without having access to local sources of flexibility in certain areas.

These observations highlight the potential barriers for cross-border trade that may arise when applying different balancing periods, including as a result of using additional tolerance levels within the general balancing period. In addition, we note that within-day flexibility in a system with daily balancing may potentially also be used for cross-border arbitrage of imbalances.[39] Although the latter possibility does not create a direct disadvantage for network users, it clearly contradicts another fundamental principle of Directive 2009/73/EC and Regulation (EC) No 715/2009, namely that the balancing system shall *"provide appropriate incentives for network users to balance their input and off-takes"*.[40]

Nevertheless, we acknowledge that the choice of the balancing period has to be compatible with the underlying physical characteristics of each balancing zone. For instance, we have pointed to the lack of inherent flexibility in some of the European markets, which implies that the corresponding TSOs will have to rely on external sources of balancing gas much faster

[39] Compare NERA / TPA Solutions. Gas Balancing Rules in Europe, A Report for CREG. Appendix B. London / Solihull. 23 December 2005

[40] See for instance Art. 41(6)(b) of Directive 2009/73/EC

and more often than in other countries with large amounts of linepack (in relation to the transported volumes). Moreover, the objective of cost-reflectivity implies that any system for imbalance charging should also consider the average transport distance between the main entry and exit points in a given system. This is essential to ensure that the length of the balancing period roughly corresponds to the time lag between the occurrence of any deviations at the exit side and the impact of any compensating measures taken at the entry side.

Depending on the size of the underlying system, it may therefore be appropriate to apply either a shorter or a longer balancing period. These differences are also reflected by the GGP-GB, which state that there may be "*technical/operational reasons that mean that a different balancing period is necessary to ensure that the system can be balanced and/or for safety and security reasons*" (§1.7) or that also a longer period may be used "*as long as the cumulated imbalance of a network user is kept within specified tolerance levels*" (§1.8).

Despite these limitations, we generally regard the use of different balancing periods as a potentially serious barrier to cross-border trade. In this context, we furthermore note the recommendations in the recent Monitoring Report by ERGEG on the implementation of the GGP-GB,[41] which suggest the use of a standardised balancing period in all systems and reiterate ERGEG's preference for a daily balancing period.

3.2.5 Lack of Market-Based and Cost-Reflective Imbalance Charges

The legal and regulatory framework for the European gas markets establishes a number of important principles for the determination of imbalance charges. Besides the requirement for fair and non-discriminatory charges providing appropriate incentives for network users to balance (Directive 2009/73/EC, Art. 41(6)), Art. 21(2) of Regulation (EC) No 715/2009 specifies that "*imbalance charges shall be cost-reflective to the extent possible*". In addition, Art. 21(1) of the Regulation states that balancing rules, which include rules for imbalance charges (see Art. 8(6)), shall be market-based. In addition, §1.13 of the GGP-GB demands that any costs that cannot be targeted in accordance with the 'causer pays' principle should be allocated back to all network users.

[41] ERGEG. 2008 Monitoring Report: Implementation of the ERGEG Guidelines of Good Practice for Gas Balancing (GGP-GB). Ref: E08-GMM-03-03. Brussels. 10 December 2008

In contrast, the recent monitoring report on the implementation of the GGP-GB[42] reports that 55% of users consider the charges to be non-discriminatory. The same report also confirms our findings from section 2.4 that only very few TSOs already apply market-based mechanisms for the procurement of balancing services, which naturally limits the application of market-based imbalance charges (see also the discussion in section 3.2.1 above). Furthermore, almost half of the TSOs responded that penalty charges either exceeded the actual costs of balancing or that they were not able to assess whether this was the case. As a consequence, it seems unlikely or even impossible that at least the penalty charges in the corresponding countries were reflective of actual costs incurred.

These findings are partially supported by our analysis of the principles for the determination of imbalance and penalty charges in section 2.5. As illustrated by **Error! Reference source not found.** on p. 46 most countries apply administrated and/or indexed charges for imbalances. Conversely, prices for imbalance cashout are based on the costs of the market-based procurement of balancing gas in the same balancing period in very few countries only. In the latter case, imbalance charges can correspond to the costs actually incurred by the TSO. In addition, they will also reflect the market value of balancing gas, assuming a competitive market for balancing gas.

In all other countries, however, imbalance and penalty charges will deviate from at least one of the basic principles mentioned above:

- In case of administrated prices, which are constant over an extended period of time, it is clear that the resulting charges cannot reflect either the actual costs or the market value of balancing gas in each individual balancing period, even if the corresponding charges are set with respect to recovering the costs of balancing services in the total period.

- Conversely, whilst indexed prices may be linked to the commodity market, they will usually deviate from the actual costs of balancing gas that is bought or sold during the day (unless the price of balancing gas is administratively subject to the same indexation). With the exception of the Netherlands, cashout prices are furthermore linked to the price of external markets such that they are also unlikely to reflect the true market value of balancing gas bought or sold by the TSO.

[42] ERGEG. 2008 Monitoring Report: Implementation of the ERGEG Guidelines of Good Practice for Gas Balancing (GGP-GB). Ref: E08-GMM-03-03. Brussels. 10 December 2008

- Penalty charges finally will by definition deviate from actual costs since they are nowhere based on the costs of separate actions required for balancing only those deviations outside the permitted tolerances.

One might of course argue that the determination of imbalance and penalty charges will not have any distorting impact on cross-border trade. In our view, however, the lack of market-based or cost reflective charges is likely to have a negative impact as it will always create differences between the price and market value of imbalances.

On the one hand, it is principally possible that imbalance charges are set too low such that it becomes profitable for network users to either 'buy' or 'sell' imbalances from the TSO. If there are different arrangements in neighbouring countries, this may also result from the opportunity of arbitrage between different countries. In both cases, imbalance charges would obviously fail to provide sufficient incentives for staying in balance.

In order to minimise any corresponding risks, it is therefore likely that imbalance and penalty charges that are not based on the costs of a market-based mechanism for the procurement of balancing gas will be set at an arbitrary level that is high enough to prevent arbitrage by network users. This consideration is supported by an analysis of the spread between charges for positive and negative imbalances and the penalties applied (compare section 3.2.6 below). For instance, penalty charges may amount to up to 50% of an assumed market or 'neutral' gas price. Especially when being applied to hourly imbalances such charges may have a very punitive effect on network users.

In our view, the lack of market-based and cost-reflective imbalance charges therefore represents a serious barrier for cross-border trade. The corresponding risks are further aggravated by restricted access to instruments for self-balancing in many markets and cross-border capacities.

3.2.6 Quantitative Analysis of Imbalance Charges

As explained in the previous section the rules for imbalance settlement vary widely across the EU Member States. In accordance with the Terms of Reference, the qualitative discussion has therefore been supplemented by a quantitative analysis of the impact of such differences on several hypothetical multi-site customers with a portfolio of industrial and/or power generation sites in one or more countries. For this purpose, we have carried out an

extensive quantitative analysis of the balancing regimes in various countries and their effect on network user's payments under various assumptions.

In order to analyse the corresponding differences, we have specifically considered 15 individual profiles representing the following three customer groups:

- Large industrial 'flat' customers with an annual consumption of 900 / 2,700 GWh[43] and an annual utilisation of approx. 7,000 h;
- Medium-sized industrial 'swing' customers with an annual consumption of 50 GWh and an annual utilisation of approx. 3,000 h to 4,000 h, representing different production patterns (e.g. two- or three shift operation, weekday vs. 7 days/week production); and
- Gas-fired power plants with an annual consumption of approx. 2,500 GWh, which are participating in the intra-day and/or balancing market for electricity.

The hourly demand profiles for the first two customer groups were derived from real life examples, which we have scaled to the applicable annual consumption in the respective group. Since we only had access to metered values, (day-ahead) nominations were synthetically established based on a simplified statistical analysis of the underlying daily and weekly profiles, taking account of seasonal variations during the year where applicable. Whilst we used typical daily profiles for swing customers (which were differentiated by different days of the week in some cases), we took the simplified assumption of always using a flat daily nomination for 'flat' customers. In addition, demand forecasts were corrected for obvious short-term production outages (of flat customers) and made subject to a stochastic, normally distributed daily imbalance with a mean error of zero. Finally, the hourly forecasts were adjusted by a constant factor to ensure that the aggregate annual forecast was always equal to actual consumption.

For gas-fired power plants, we have considered modern 400 MW combined-cycle gas turbine units (CCGT) with a maximum efficiency of 55%. Once in operation, these plants can be quickly ramped up or down, providing a valuable source of fact-acting reserves. In addition, they may be used for self-balancing as well as for transactions in the intra-day market. To take account of these different possibilities, we have modelled several different cases:

[43] In detail, we modelled 5 flat customers with an annual consumption of 900 GWh, whilst one profile was additionally scaled up to an annual consumption of 2,700 GWh.

- Power plant providing a regulation band of ±100 MW for secondary reserves, which is assumed to be activated in proportion to the minute-by-minute imbalance of the local control area;

- Power plant offering specific blocks of tertiary reserves (±100 MW, or +200/-200 MW at different times of the day), which are always activated in full; noting that this case was also used to simulate the possible participation in the intra-day market; and

- Power plant being used for load following of the producer's own supply portfolio, scaled to a maximum forecast error of ±100 MW.

The first two cases were modelled based on real quarter-hourly values of secondary and tertiary reserves activated by several Austrian and German TSOs, resulting in an annual utilisation of the corresponding reserves of between 1,500 h and 3,000 h. Conversely, the third case was based on the hourly load forecast error of a European control area, which was used as a proxy for the individual imbalance of a supply portfolio.

For simplification, most cases were furthermore based on the (simplified) assumption of the power plant being operated at a constant output of 300 MW, or 75% of installed capacity, making it possible to use a symmetrical band of ±100 MW for the provision of the desired service. In addition, we also considered a case where the power plant was operated at full load during the day but at 50% of capacity during the night, with 200 MW of negative reserves being offered during peak and 200 MW of positive reserves during off peak hours.

For both gas-fired plants and flat industrial customers, we have finally assumed that hourly meter values are available on a daily basis, allowing network users to compensate any resulting imbalances on the following day (where applicable). Conversely, for swing customers we have assumed that this information is only available once a month, with the net cumulative imbalance being equally spread over all hours of the following month.

Table 13: Main parameters of imbalance settlement of the countries considered for the quantitative analysis

	Austria	Belgium	Czech Republic	Denmark	France	Germany	Great Britain	Netherlands
Balancing interval	*Hour*	*Day*	*Day*	*Day*	*Day*	*Day*	*Day*	*Day*
Penalties	*-*	*H, I*	*D*	*M*	*C*	*H*	*D*	*H, I, D*
Cumulative account	*-*	*Daily*	*Month*	*(Month)*[1]	*Unlim.*	*-*	*-*	*Daily*
Cash-out price	*Cost*	*Index*	*In kind*	*Index*	*Costs, Index*	*Index*	*Costs*	*Index*
Other	*-*	*-*	*-*	*Admin charge*[2]	*-*	*Neutr. Levy*[3]	*Sched. Charge*[4]	*-*

Notes: H – Hourly, I – Intra-day, D – Daily, M – Month, C – Cumulative (unlimited); Unlim. – Unlimited; [1] – Applied to cash-out charges for imbalances outside a monthly limit; [2] – Annual fee for administration of imbalance settlement; [3] – Used to compensate for past over-/under-recovery of the settlement mechanism (does not apply to very large customers); [4] – Scheduling charges

In order to obtain a comprehensive view of the different balancing regimes across Europe, the simulations should ideally have been carried out for all countries where imbalances are settled. Besides the lack of detailed data in some cases, we also note that various countries apply either compensation in kind and/or settle only the resulting net different per month. After careful analysis of the different balancing regimes, we have chosen to focus on the North-Western European market where more sophisticated and rather diverse models for imbalance settlement can be found. This group of six countries has been supplemented by Austria and the Czech Republic as important adjacent countries, noting that Austria operates a truly market-based system with hourly cash out, whereas the Czech system represents an example of a country with imbalances being settled in kind (subject to some penalties).

Table 13 summarises some key features of the different models for imbalance settlement in the eight countries being considered for the quantitative analysis. It is clearly visible that they represent a selection of very different approaches, including cases of pure hourly and daily

cash out, various examples for the use of hourly, cumulative and/or daily tolerances and penalties as well as systems with market-based and indexed cash-out charges.

For each of these countries, we have developed a detailed spreadsheet model that allows determining the different payments applying under penalty and cash-out charges,[44] taking due account of the chronological development of imbalances and their impact on the use of any cumulative tolerances where these exist. In addition, the model also considers the size of each portfolio and any resulting variations in the tolerance levels granted by the TSOs. Please note, however, that our simulations have been limited to the basic flexibility, whilst we have neglected any options of purchasing additional tolerances from the TSO and/or trading such flexibility services in the secondary market where such possibilities exist.

The model allows for the calculation of balancing costs of a specific customer profile in a specific country but also supports the analysis of customer portfolios. In each case, the model separately reports the net costs of cash-out as well as any other administratively set charges, such as penalties. To allow for a comparison across several countries with different market prices, only the effective net costs of cash-out have been considered, which has been achieved by always subtracting (or adding, as the case may be), the market value of the gas bought or sold during imbalance settlement. As market prices, we have used either the daily indices of the respective organised markets (e.g. EEX-EGT, OCM, Powernext, APX-TTF, Zeebrugge), the monthly 'neutral' gas price used in Denmark or the Czech Republic, respectively the moving average between the price for buying and selling balancing gas price in Austria.

This approach is illustrated by the example presented in Figure 9. As shown the costs of imbalance settlement basically comprise of 1) payments by the network user for negative imbalances (deficit energy), 2) payments received from the TSO for positive imbalances (excess energy) and 3) the sum of various penalties and other administrative charges. A simple comparison of these numbers is however misleading where a customer has a structural deficit or surplus, or when comparing the results for several countries with different market prices. We have therefore additionally considered the revenues (costs), which the network user has realised before when selling (purchasing) the corresponding volumes of natural gas in the wholesale market. The final analysis is then limited to only the resulting net costs of imbalance settlement as represented by the dark blue bars in each category.

[44] The model was configured for a period of one year ranging from October 2008 until September 2009, i.e. prices and rules applied during this period were used. In cases were the imbalance settlement mechanisms were changed during this period, the mechanism as applied at the beginning of 2009 was used in the model.

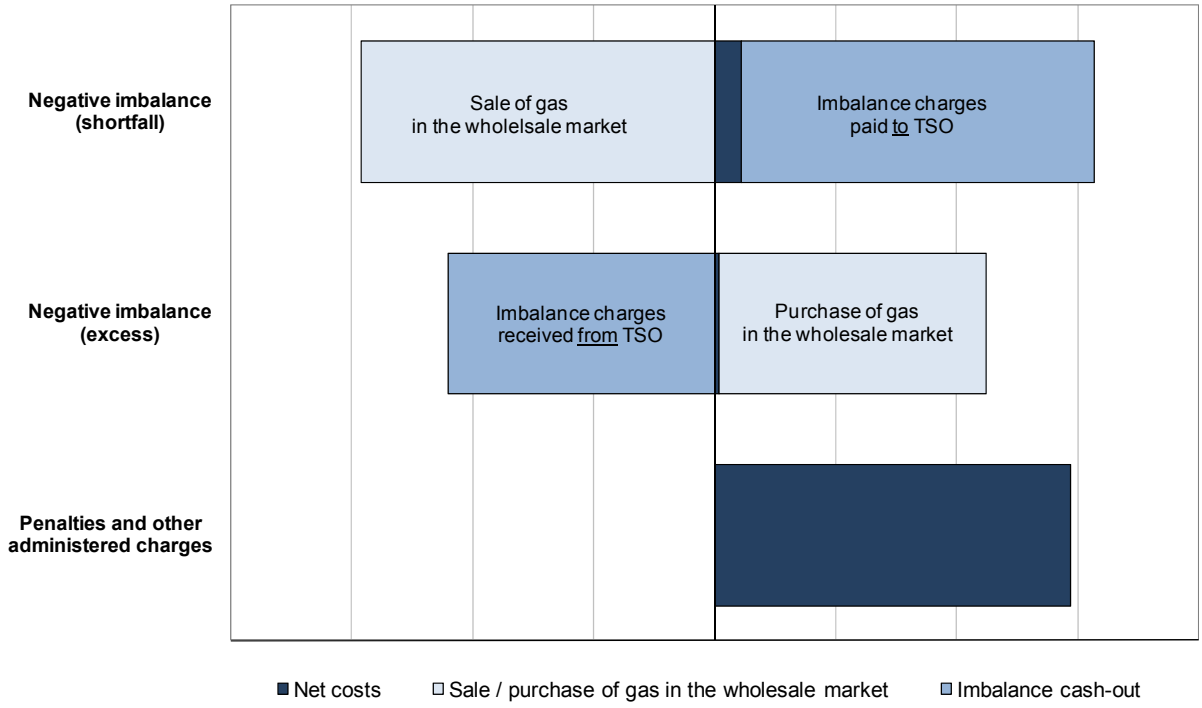


Figure 9: Determining the net costs of imbalance settlement

To take the different sizes of the basic case customer profiles into account, all results have finally been put into relation to the annual consumption of each customer group, resulting in an easy-to-use specific price (€/MWh). Based on this approach, the following Figure 10 to Figure 12 provide a summary of the range of results for the individual customer profiles in the eight countries considered. To facilitate comparison, the values in all three figures are presented against the same scale. For each country and customer group the best case, the worst case and average result are shown. In addition, the costs for an aggregate portfolio of all customers from the corresponding group in each country are shown.

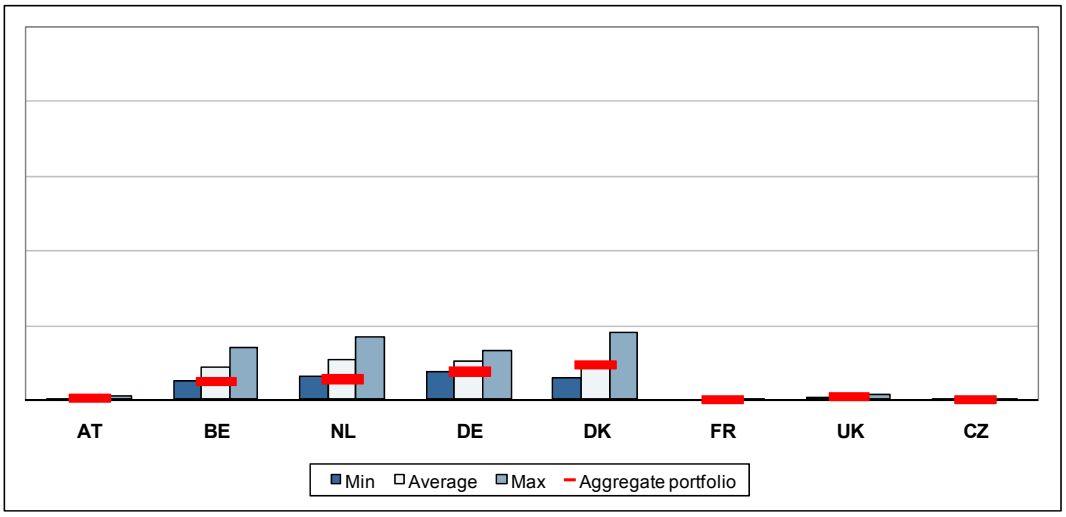


Figure 10: Range of average imbalance costs for individual flat customers

When comparing the results of the three different customer groups, it is easily visible that flat customers generally face the lowest relative charges. This also seems reasonable since these customers have, on average, relatively low deviations that are distributed over large volumes of energy (relative to contracted capacity). Conversely, the costs for swing customers are in a similar range as those of CCGT plants in most countries, although the results for CCGT plants vary across a much larger range than swing customers, which seems to reflect the more extreme variations in the assumed operating patterns of the CCGT plants. Finally, we note that an aggregate portfolio of all customers in the respective group results in costs that in most cases are, in some cases by a significant margin, below the simple average of

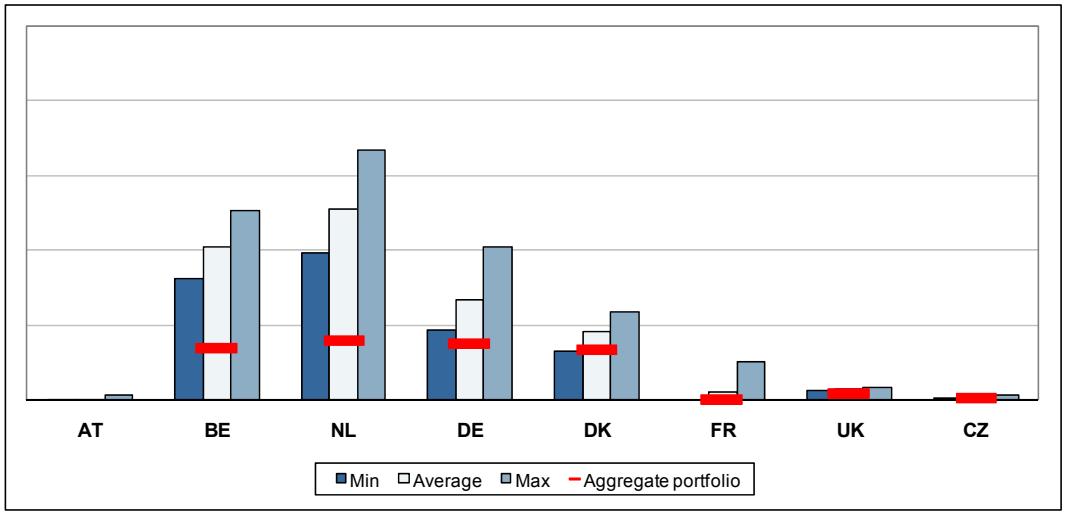


Figure 11: Range of average imbalance costs for individual swing customers

the individual values.

Apart from the differences between the individual customers groups, it is particularly interesting to compare the variations of results across the eight countries considered. In general, all three graphs show a similar pattern, with very low costs of imbalances in Austria, France, Great Britain and the Czech Republic, but much higher values in the remaining four countries. In the latter case, we furthermore observe that swing customers and CCGT plants may be subject to much larger costs in Belgium and the Netherlands, whereas the results are by and large comparable for flat customers.

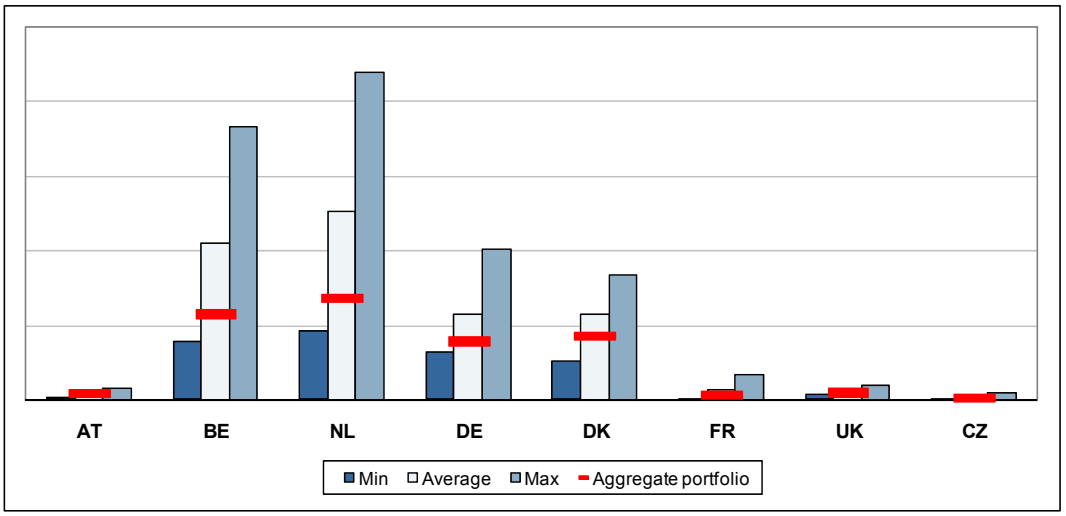


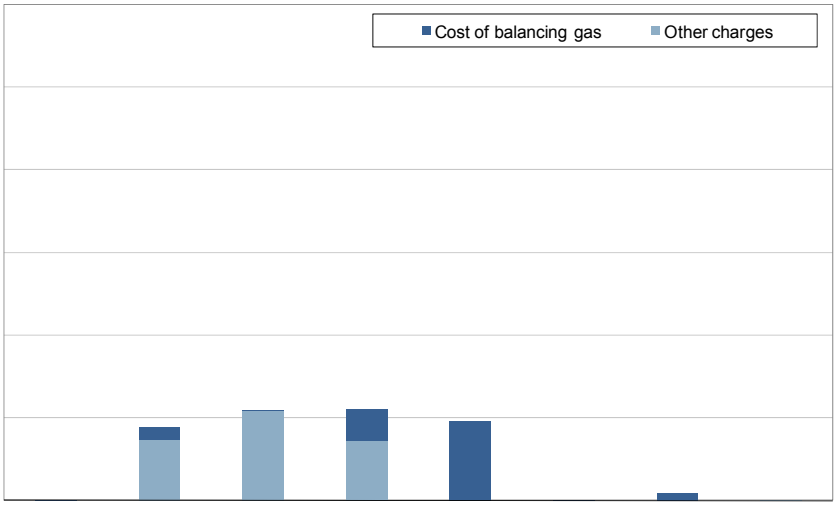
Figure 12: Range of average imbalance costs for individual CCGT plants

In this context, it is furthermore interesting to note that the four countries on the left-hand side of Figure 10 to Figure 12 either use hourly balancing intervals (Austria) or apply hourly penalties to those customers groups considered in this analysis. Conversely, imbalance settlement is based on daily balancing without penalties for intra-day deviations in the four countries on the right-hand side. This observation shows that neither daily nor hourly balancing intervals are *per se* more or less punitive from a network user's point of view but that both approaches may lead to similar results.

Another major difference in the group of countries considered relates to the use of penalties and administratively-set imbalance charges. In Austria, France and Great Britain, imbalances are cashed out at a price that is based on the costs of balancing gas procured by the TSO through a daily market mechanism, whereas the use of penalties is limited to deviations outside a relatively generous daily tolerance band in France or more nominal scheduling charges in Great Britain. In contrast, charges for imbalance cash out in the other countries

are indexed to market prices, with separate prices being used for positive and negative imbalances in Belgium, Denmark and Germany. In addition, all four countries apply additional penalties, either in the form of hourly and, potentially, also cumulative penalties (Belgium, Germany, the Netherlands) or a minimum spread of 300% between the price of positive and negative imbalances in Denmark.

It is again interesting to note that these differences correspond to the marked difference in the net costs of imbalances as mentioned above. Whilst the costs of imbalances are low in those countries where imbalances are cashed out at price that reflect the short-term costs of balancing[45], the presence of high costs coincides with the use of penalties in the other countries. Moreover, costs are generally highest in Belgium and the Netherlands, which both apply a combination of hourly, cumulative and daily penalties. These findings suggest that the primary use of penalties, which is largely inevitable in a system that cannot rely on market-based prices of balancing gas, may result in larger differences than the choice of either daily



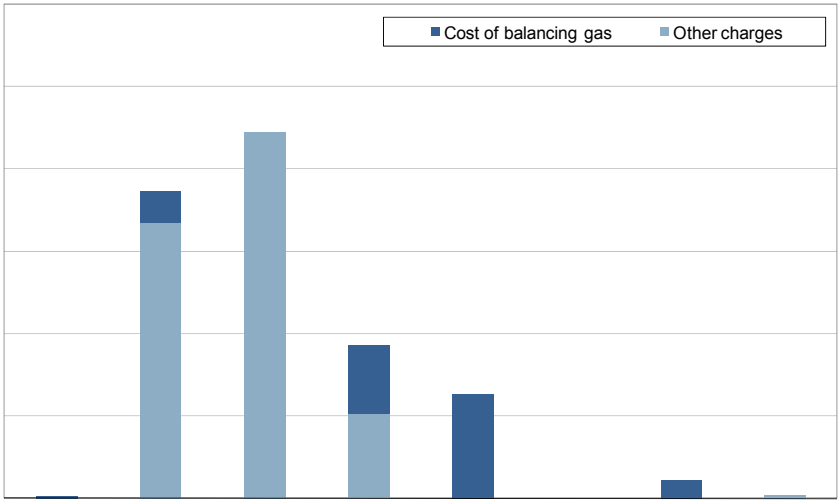
Share of total charges	AT	BE	NL	DE	DK	FR	GB	CZ
Imbalance cash-out (1)	100%	17%	0%	34%	100%	100%	99%	0%
Costs of balancing gas (2)	100%	0%	0%	0%	0%	23%	99%	0%

Figure 13: Composition of total imbalance charges (flat customer)

Notes: (1) – Net costs of imbalance cash out; (2) – Share of imbalance charges being directly related to price or costs of balancing gas

or hourly balancing.

Figure 13 to Figure 15 show a different view of net imbalance charges. These three graphs show the composition of net imbalance charges for one example of each customer group, differentiated between the net costs of imbalance cash out and other charges (i.e. penalties and administrative charges). It is visible that imbalance charges in Austria, France and Great Britain are (almost) entirely based on imbalance cash out, although customers may face a limited amount of scheduling charges in Great Britain. In contrast, imbalance cash out represents only a limited fraction of total net costs in Belgium, Germany and the Netherlands, i.e. the costs of imbalance settlement are primarily determined by penalties and other administrated charges.



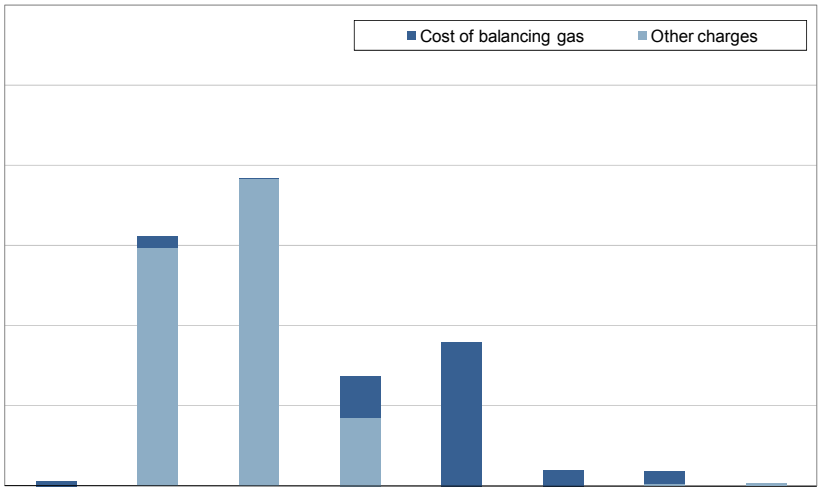
Share of total charges	AT	BE	NL	DE	DK	FR	GB	CZ
Imbalance cash-out (1)	100%	10%	0%	45%	100%	0%	100%	0%
Costs of balancing gas (2)	100%	0%	0%	0%	0%	0%	100%	0%

Figure 14: Composition of total imbalance charges (swing customer)

Notes: (1) – Net costs of imbalance cash out; (2) – Share of imbalance charges being directly related to price or costs of balancing gas

[45] The fourth country in this group, the Czech Republic, allows network users to compensate their imbalances in kind (except for minor penalties on deviations outside a certain monthly tolerance band).

In reality, however, these numbers are still misleading as they reflect the nominal costs of imbalance cash out but not the actual costs of balancing. Each of Figure 13 to Figure 15 is therefore supplemented by a table underneath, which also shows the share of the actual costs of balancing gas, insofar as these are directly reflected in imbalance charges. This additional comparison highlights that the net costs of imbalance settlement in Belgium, Denmark, Germany and the Netherlands are exclusively caused by penalties and other administrated charges, whilst they do not necessarily reflect the actual short-term costs of balancing. Again, we note that these cases correspond to the group of countries with significantly higher costs of imbalances.



Share of total charges	AT	BE	NL	DE	DK	FR	GB	CZ
Imbalance cash-out (1)	100%	4%	0%	38%	100%	100%	85%	0%
Costs of balancing gas (2)	100%	0%	0%	0%	0%	5%	85%	0%

Figure 15: Composition of total imbalance charges (CCGT plants)

Notes: (1) – Net costs of imbalance cash out; (2) – Share of imbalance charges being directly related to price or costs of balancing gas

So far, the discussion has been limited to the comparison of different customer portfolios within a single country. In order to further assess potential barriers for cross-border trade resulting from different balancing arrangements, the analysis is now expanded to the case of an international portfolio with customers spread over several countries. To limit the number of possible combinations, these calculations only consider the remaining five countries, i.e. Austria, Belgium, Germany, Denmark and the Netherlands. In contrast, the following analy-

sis neglects Czech Republic, France and Great Britain where the costs of imbalances are very low even for individual customers. For these five countries, we have determined the imbalance charges which a supplier would face when supplying a given portfolio of customers either in a single country or in different countries.

In a first step, this analysis has been carried out for three portfolios of equivalent customers, representing the three different types of typical profiles already considered above. For each of these groups, Figure 16 shows the range of total payments, which a network user might face when supplying these customers either in a single country[46] or as an international portfolio across all five countries, taking account of all possible combinations. It is clearly visible that international portfolios will generally incur higher costs, with both minimum and, with the exception of flat customers, also maximum possible costs being significantly higher than in case of a single national portfolio. In the particular case of swing customers, even the minimum costs of an international portfolio are higher than the maximum costs of any single national portfolio. Overall, network users supplying a dispersed set of customers in multiple countries therefore appear to face much higher risks than other (incumbent) suppliers which are benefiting from a larger portfolio within a single country.

One might argue that the case of a network user supplying individual customers of the same size and type in several countries may not be realistic. We have therefore carried out an additional analysis that is based on a large portfolio of different types of customers with a total annual consumption of 7,500 GWh. More specifically, we have considered a supply portfolio consisting of two individual flat customers, a pair of swing customers with a combined consumption of 100 GWh, a portfolio of two types of swing customers with an aggregate consumption of 700 GWh[47] and one power plant. Again, we have determined the imbalance charges which a supplier would face when supplying this portfolio of customers either in a single country or in any combination of being distributed over all five countries.

[46] Please note that the range of imbalance costs for delivery in a single country corresponds to the values represented by red horizontal bars in Figure 10 to Figure 12 above.

[47] This portfolio has been synthetically created by multiplying the basic customer profiles, with the individual profiles being 'shifted' by several weeks, in order to simulate the portfolio effects of an enlarged customer group.

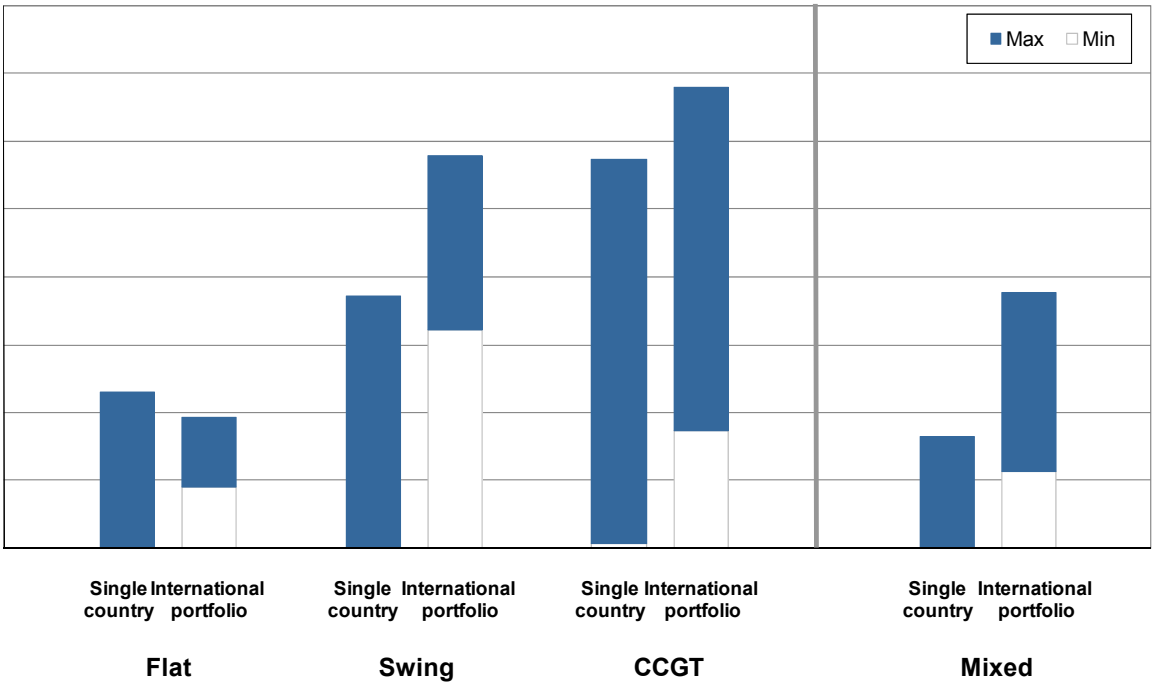


Figure 16: Comparison of national and international portfolio of single-site customers

As illustrated by the right-hand side of Figure 16, the costs for this mixed portfolio are considerably lower than those of either swing customers or CCGT plants, obviously reflecting the benefits which a larger customer group enjoys due to the portfolio effect. When comparing the single national against the distributed international portfolio, however, the results are basically comparable to those analysed before. I.e., we again observe that the international portfolio may potentially face much higher costs than a user supplying the same group of customers within a single country. In addition, it is interesting to note that the range of possible costs is now larger for the international portfolio than the differences between the costs in individual countries.

Overall, these results illustrate the influence which different arrangements for imbalance settlement may have on different types of consumers in general, and on network users supplying customers in several countries in particular. Perhaps most importantly, the calculations show that both daily and hourly balancing intervals may lead to very similar results, provided that the costs of imbalance settlement reflect the costs of short-term balancing. Conversely, the simulations also show that the extensive use of penalties and other administrated charges bear a significant risk of resulting in overall imbalance charges that are far in excess of the actual costs of short-term balancing as experienced in other countries.

Although we do believe that the quantitative analysis carried out in this section provides useful insights, we also emphasise that the results are based on a set of standardised assumptions and consideration of only a share of the overall costs faced by network users in different countries. In particular, we note that:

- As mentioned in the introduction to this section, our calculations have been based on the base tolerance levels, which are available to network users in each country. In contrast, we have not analysed the scope for reducing the costs of imbalances for instance by contracting for additional tolerance levels where this is possible under local market rules.[48] As stated in an earlier benchmarking report by ERGEG,[49] however, the use of such additional possibilities may enable certain users to reduce their costs.

- Similarly, we have assumed that network users generally try to base their nominations on their best knowledge of forecast load and that they refrain from any strategic actions aimed at minimising their costs of imbalances, such as by wilfully injecting too much (or too little) gas.

- The demand forecasts used for our analysis were structured with a view to avoiding any structural over- or under-estimation of the average daily volumes. This assumption may however not always hold in practice. In some countries, such as in France, a structural error with a persistent surplus or deficit may however result in significant risks for individual users, which are not reflected in our results.

- Similarly, we have assumed that network users are able to inject an hourly profile and follow the expected pattern of hourly consumption. In reality, not all users may have access to the necessary flexibility such that they may, in an extreme case, be limited to the deliver of a constant amount of gas over the entire gas day. In particular, this may be the case for a user that is otherwise active only in a market with true daily balancing (i.e. without any intra-day penalties).

- In accordance with the Terms of Reference for this project, our analysis has been limited to the case of (large) industrial customers and power plants. Conversely, we have not considered the case of small and medium-sized residential and commercial

[48] The influence of additional tolerance margins was modeled with Belgium and Denmark as exemplary cases to estimate the impact of additional margins. Results show that costs can be reduced to 50%, it should be noted however that additional margins are subject to availability.

[49] ERGEG. Gas Transmission Tariffs - An ERGEG Benchmarking Report. Ref: C06-GWG-31-05, 18 July 2007

customers, which typically represent a major share of overall gas consumption.[50] These customers are typically characterised both by a different load patterns and a different distribution and scale of forecast errors. In some countries, these customers furthermore benefit from special provision, such as a complete exemption from any imbalance risk in Germany. It is therefore very well possible that the results for this customer group might partially have been different from those presented and discussed in this section.

- Last but not least, we note that our analysis has been limited to only those costs and charges, which are explicitly used in the context of imbalance settlement. In contrast, we have not been able to estimate the 'hidden' costs of flexibility of for instance line pack or other sources of flexibility that are owned or contracted by the TSOs under separate contracts and where the corresponding costs are socialised through transmission charges, such as for instance in Austria, Denmark, France, Great Britain or the Czech Republic. Noting that these examples include in particular those countries with the lowest average costs shown above, it is therefore possible that a more comprehensive estimation of the associated costs might have resulted in different results with regards to the costs of the different countries relative to each other.

These limitations should be taken into consideration when interpreting the results presented in this section. We therefore emphasise that the focus of any analysis should not be on a direct comparison between different countries but rather on the relative impact of different approaches and systems. Moreover, we note that these aspects are unlikely to have a substantial impact on the differences arising in case of a multi-client portfolio being supplied in several countries instead of a single national portfolio.

3.3 Results of Stakeholder Survey

One part of the study included a user survey of market participants and stakeholders involved, in order to obtain a comprehensive picture from the market side. For this purpose a questionnaire was developed. Over 35 parties, among them TSOs, NRAs and other stakeholders (exchanges, associations, producers, traders, incumbents and suppliers), from

[50] Please note that a corresponding analysis would additionally have required a detailed simulation of the applicable arrangements for the delivery of customers on the basis of standardised load profiles in several countries.

across Europe were invited to give their views on a limited number of questions related to tariffs, tariff regulation and balancing.

Of the total of 35 parties contacted, we received responses from:

- 8 market participants;
- 5 TSOs; and
- 6 regulatory agencies.

During the survey it became clear that all market parties (network users, TSOs, regulators) share similar views on some topics, whereas on other issues there is an obvious discrepancy between the different groups. In addition, respondents were asked to prioritise the issues to be tackled. As mentioned below, the answers suggest that access to cross-border capacities as well as investments in new capacity are clearly seen as the main obstacles to cross-border trade and the establishment of a European market for natural gas. The diversity of balancing regimes is widely seen as another important issue to tackle, whilst the harmonisation of tariffs and tariff regulation has often been described as desirable but less urgent.

The main results of this user survey, which are explained in more detail below, can be summarised as follows:

- Capacity management and capacity allocation are widely regarded as the most pressing problems;
- Investment in new capacity is considered to be insufficient and existing tariff regimes are not believed to provide correct investment signals;
- Auctions are regarded as the preferred solution for providing location signals for network users and identifying investment needs in the international network;
- Although differences in balancing regimes are perceived as less critical than access to cross-border capacities, the lack of harmonisation is clearly seen as a barrier to cross-border trade; and
- Open season procedures as applied today are seen as critical due to the lack of international cooperation and asymmetric commitments of network users and the TSOs.

3.3.1 Tariffs

Insufficient transparency

In general, differences in tariffs structure, tariff level and product structure are not regarded as the major problem in the gas capacity market. It is even argued that these differences and imperfections in the system enable arbitrage and trade. There is general consensus for harmonisation (or integration) of systems, but it should be running along physical gas flows and along the borders of well interconnected and deeply interrelated systems, e.g. if flexibility in one country is solely provided by a neighbouring country. One of the main issues for all respondents is that tariffs and product structures often lack sufficient transparency and that this poses a serious obstacle for new market entry and subsequently for competition. As long as the rules are transparent and non-discriminatory, the market is able to handle differences in tariffs and products.

Limited importance of tariff levels

In this context it was also stated (mainly by TSOs and network users) that the absolute height of tariffs is not regarded as a problem, as the value of the gas commodity can hardly be compared to the relatively low costs of transport. It was stressed several times that instead the main problem is the unavailability of capacity.

Harmonisation needed

All respondents want harmonisation of products, e.g. bundled products, harmonisation of booking periods, use of same units. Most parties agree that harmonisation of regulatory methodologies is not needed or is a bridge too far at the moment, for example for cost determination. Harmonisation is not necessarily making everything the same, but can also mean making items compatible. Harmonisation should be on capacity products, balancing arrangements, operational rules, maintenance coordination, information flows between TSOs, etc.

One of the minor problems mentioned (mainly by trading parties), which could be relieved by harmonisation, was the difference in the definitions of capacity (technical, interruptible, backhaul, short-term), periods (booking, nomination, gas day), definition and (risk-reflective) pricing of interruptible capacity which increases the complexity and hereby transaction costs

and thus poses a barrier to entry for potential new entrants. Some parties opted to only charge an exit tariff or to incorporate exit charges in the distribution tariffs as is done in the electricity sector. This would prevent pancaking of tariffs and make trade between hubs easier.

Heterogeneous views regarding the use of separate transit tariff regimes

Individual answers do not add up to a homogenous or clear picture regarding the issue of a separate tariff system for domestic and cross-border transport. Whereas some parties defend the existence of separate systems, especially in countries with a very high cross-border volume compared to the domestic transport volume, others state that there is no claim for separate treatment, as making a difference decreases liquidity in the respective markets.

Interestingly, some parties raised the argument that cross-border transport tariffs should be higher than domestic tariffs, as transit flows are less predictable in the long-term (e.g. with new international pipelines to be built in the near future), and therefore the volume risk should be reflected. Making no distinction (in regulation) between domestic and cross-border investments would in fact mean socialising of costs. Applying Article 22 of the Directive is a way to distinguish between this. On the other hand, some parties stated that cross-border tariffs should indeed be lower than domestic tariffs, as international transit flows are more stable and more easy to administrate, and thus would lead to a positive impact on the overall stability of the whole system.

Regarding separate tariff systems on transit and domestic transport, interestingly enough, the different positions are not taken up by different groups of stakeholder as regulators or network users, but lines were rather running along the national borders of systems applying such a separation and those who do not.

3.3.2 Investments

Insufficient investment signals

Almost all interviewed parties agree that investment signals as part of the overall tariff structure are either non-existent or not working well. It is stated that current tariff levels and structures have no impact whatsoever on investments, i.e. they do not trigger investments. Some parties even claim that in fact, regulated tariffs cannot signal investments, they can merely

allow for investments, and that tariffs are thus mostly set without reflecting congestion at certain points or in certain pipelines. At the same time, most parties wish that investment signals were visibly included in the overall 'tariff' structure. The appropriate mechanism mentioned by many of the respondents should be market based, e.g. auctions.

Open season procedures need (more) cooperation

Open season processes are criticised by most parties, at least the way in which they are operated today. Most complaints from the network users' side refer to the lack of cooperation and coordination of open season processes between neighbouring countries and national TSOs and NRAs, as well as the long time these processes take. Conversely most TSOs and NRAs do not mention a lack of coordination or even explicitly mention the high level of cooperation achieved nowadays. However everyone agrees that coordination is necessary if not crucial. The focus is seen as still being quite national instead of regional, and sometimes national legislation goes beyond European legislation, making coordination very difficult.

Interestingly, while on the network users' side the issue was raised that not all the capacity they committed to in an open season was built, regulators stated that capacity committed in open seasons was much too high and would lead to excessive capacity. Network users also especially criticise that the commitment is asymmetric, as they have to commit themselves firmly without the certainty of knowing what they will get in the end. Moreover, network users complain that they have to commit to long term capacity contracts while tariffs can change during this period.

Network users press for more international cooperation between TSOs and NRAs, in order to prevent a mismatch of capacity. It is mostly agreed that at EU level the principles for such coordination can be set, whereas actual implementation is more likely at regional level (e.g. Regional Initiatives). In the current system it is considered difficult to invest in one country if this improves the performance of the gas market in a neighbouring country, as no cross-border compensation mechanism is in place (the interviewed parties mentioned in particular the investment into compression capacity to redirect flows to neighbouring countries in case of a major crisis, e.g. interruption of gas supplies via Ukraine).

3.3.3 Balancing

Differences of balancing regimes hamper cross-border trading

Existing differences in balancing regimes are not seen as impregnable barriers to trade. If the rules are transparent and non-discriminatory the market is able to handle these differences. It was stated that when this is not the case, potentially avoidable costs arise and thereby competition is distorted, especially between (large) incumbents and (small) new entrants, which is an issue mainly pointed out by regulators and new entrants.

Balancing gas procurement and balancing period should be harmonised

Regarding harmonisation of balancing regimes there are two topics which were mentioned by all parties interviewed. Firstly, there is consent on the fact that procurement of balancing gas should be market based, and thus the resulting imbalance charges should also be market based and thereby cost reflective. This would result in a neutral financial position for TSOs, as expressively mentioned by some parties (mostly from the network users' side). Secondly, all parties agree that the balancing period, i.e. daily vs. hourly balancing, should be harmonised. Most parties are in favour of a daily balancing system, possibly with within-day constraints where network users are responsible for staying in balance and the TSO takes care of the residual balancing.

Need to prevent arbitrage between different balancing systems

Almost all parties stressed the fact that different systems do not only lead to increased costs, but could (theoretically) enable market players to exploit the differences in the systems by exporting their imbalance to the country that is least expensive for them. In practice this depends on functioning markets and the ability to acquire the capacity needed for such short-term transactions. There is consent that shifting imbalances from one system to another is justified as long as it mirrors the different physical abilities of these systems to provide flexibility. However, it was also mentioned in several interviews that a shifting conducted against the overall advantage of the whole system should not be tolerated.

Regional balancing appreciated

All parties seem to welcome the idea of regional balancing. According to the respondents, it would be even more important for the integration to run alongside the major gas flows and only where sufficient cross-border capacity is available, with the size of a balancing region depending on the physical properties of the network and the availability of flexibility tools.

The widespread opinion is that this process would fit well with the integration of market areas, or, in other words, regional balancing would expectedly lead to the integration of market areas.

4. Possible Areas for Harmonisation

4.1 Tariffs and Products

4.1.1 Limit premium on short-term products

As we have seen in section 3.1.2.2, high tariffs for short-term capacity may lead to capacity hoarding, reinforce congestion and hamper new entry to the market. However, the use of higher prices for short-term capacity reservations is based on standard economic theory. Indeed, the costs of gas transmission networks primarily depend on installed capacity, which in turn is largely determined by the need to accommodate the maximum expected and/or guaranteed flow. These considerations suggest the use of capacity charges, which indeed account for most of the revenues under transmission tariffs (compare section 2.2.2 above). Furthermore, it also follows that capacity charges should ideally be based on each party's use of the network at the time of overall peak utilisation. This form of peak load pricing generally encourages a more efficient use of existing capacity as it may shift flexible users away from the times of peak demand towards times of lower utilisation.

Based on these considerations, it appears on first sight that the premiums currently used for short-term capacities correspond to economic theory and support an efficient use of the network. However, as noted above, the use of peak load pricing should be combined with a measure of capacity that is based on each party's utilisation of the network at the time of overall peak utilisation. In case of a network with a clear seasonal pattern of use, this would imply that the price of short-term capacity would indeed have to be significantly higher during the period of annual peak utilisation, whilst prices should be substantially lower during the remaining parts of the year. In practice, however, it appears that Denmark, Portugal and Spain are the only countries that grant a discount on the price of short-term capacities.

Secondly, and perhaps most importantly, we note that the concept of peak load pricing is based on the two fundamental assumptions of network users having a choice of whether to contract for capacity on an annual basis or only for limited periods of time, and that any reservation of short-term capacity creates a binding commitment on the network operator to make the corresponding capacities available to the network user.

In the current reality of the European gas markets, however, firm long-term capacity at many borders is already reserved under long-term agreements. In these cases, new entrants do not have the choice between annual or short-term capacities but can only accept the latter or try to rely on the use of interruptible capacities. It therefore follows that the first condition is not met since the corresponding users obviously do not have access to capacity rights, which may create a commitment on the TOS to expand the network. Conversely, they are only given a chance to use a part of overall capacity that is already reserved by other users during periods of peak utilisation, or of additional capacity that can only be made available during certain parts of the year. It therefore appears that the principles of peak load pricing may no longer be applicable but that the price of short-term capacities in these circumstances should rather reflect the incremental costs of making this capacity available for short-term use during the corresponding periods.

Secondly, different circumstances also apply to the potential offering of for instance day-ahead capacities, which are only offered to the market shortly before delivery. In many cases, this additional offering will be based on the use of capacities that have already been reserved for a longer timeframe before, but which have not been (or are unlikely to be) utilised by the original holder of capacity rights. There is thus neither a commitment on the TSO to potentially expand his network as a precondition for making this capacity available, nor any guarantee for network users that such capacities will actually become available on the day-ahead. (In a way, day-ahead capacities thus bear some similarities with interruptible capacities, with the main difference being the time of allocation and the degree of firmness once the capacity has been allocated.) Similarly, even where a TSO decides to reserve a certain share of the overall transport capacity for allocation on the day-ahead, network users do not have any guarantee of actually getting access to day-ahead capacity.

Similar to the limited availability of long-term capacities, it therefore follows that network users do not really have an alternative choice between the use of either long-term (annual) or day-ahead capacities. If a network user nevertheless agrees to rely entirely on the use of day-ahead capacities, this user would effectively accept the risk of only being able to use the network when otherwise unused capacity becomes available, which by definition will not require any additional investments by the TSO.

In summary, these considerations imply that the premiums currently applied to short-term capacities may not be justified even by the concept of peak load pricing in many cases, and that they are almost certainly inadequate for the case of capacities that are offered to the market with a short lead time until delivery only. In addition, we have explained in section 3.1.2.2 above the potential barriers that may result from the high premiums applied today.

Consequently, it appears that it would be more efficient if short-term capacities were offered at lower premiums or even at a discount to long-term capacities, at least during periods outside the peak utilisation of the network.

We acknowledge however that determining the 'true costs' of short-term capacities outside periods of peak utilisation is a complex task and necessarily involves some compromises between the partially conflicting objectives of cost recovery, economic efficiency, non-discrimination and limited complexity. In addition, we are also aware that not all networks are characterised by a clear seasonal pattern of use but that some pipelines may experience their peak load at different times during the year.[51]

In the particular case of capacities being allocated only shortly in advance of the gas day, one possible option could be setting the price of corresponding capacity based on the short-term incremental costs of enabling the use of these capacities. In many cases, these costs will be largely limited to the additional variable costs of operation (i.e. fuel gas / shrinkage). It therefore appears useful to review the share of capacity charges in this respect.

As further discussed in section 4.1.3 below, an alternative could be to rely on the market-based allocation and pricing of short-term capacities. This would resolve the issue of determining the 'true costs' of short-term costs as the prices would be set by the market, which would implicitly also ensure that the price of short-term capacity during periods of peak utilisation would reflect the degree of scarcity, as well as the actual value of the available capacity in the market. In this context, we finally note that Art. 14 (2) of Regulation (EC) No 715/2009 explicitly recognises the importance of short-term products reflecting the market value:

> "*transport contracts signed […] with a shorter duration than a standard annual transport contract shall not result in arbitrarily higher or lower tariffs that do not reflect the market value of the service*".

Finally, we note that regulatory action required to relieve this problem may not be very hard-handed and could probably be implemented relatively easily.

[51] For instance, peak demand may occur both during the winter, when consumption is the highest, or in the summer period when underground gas storages are being filled.

4.1.2 Improved offering of non-physical backhaul capacities

We have argued above that the lack of non-physical backhaul capacities as well as the tariffs currently applied to this product in some countries may create barriers to cross-border trade and an efficient utilisation of existing network infrastructure. An obvious option therefore is to ensure that, first, non-physical backhaul capacities are made available to network users at least on request, and that secondly, prices reflect either the market value (compare section 4.1.3) or the actual costs of providing this service.

As already mentioned in section 3.1.2.3 and provided that they are available on an interruptible basis only, non-physical backhaul capacities do not create any additional flows on the network but may only serve to reduce flows that have been nominated by other users. Consequently, the real costs of non-physical backhaul capacities are basically limited to the incremental costs for capacity reservation, allocation and nominations, which can however be considered to be marginal. Conversely, this service does not require any (additional) investments into the network and may even help to reduce the variable costs of operation.

These considerations imply that the price of non-physical backhaul capacities should tend to be very low, or may even have to be negative. On the other hand, it certainly represents a product that may have a certain value attached to it. Similar to the case of short-term products as discussed before, non-physical backhaul capacities therefore appear particularly suited for a market-based allocation by means of auctions.

Overall, we assume that non-physical backhaul capacities can be implemented relatively fast and with very limited costs to the TSOs, whilst they might enable 'quick wins' for the market as a whole. As a result, we suggest that the offering of non-physical backhaul capacities and adjustments to the pricing of this product should be addressed with priority, noting also the actions taken recently by the European Commission in this respect.[52]

4.1.3 Market-based allocation of cross-border capacities

Art. 12 (1) of Regulation (EC) No 715/2009 calls on TSOs to promote the allocation of cross-border capacity through market-based solutions. In contrast, our review of the current arrangements in the EU gas markets (see chapter 2) has shown that Great Britain is the only

[52] Compare IP/09/1035. Commission acts to ensure effective and competitive energy market across Europe. Brussels. 25 June 2009

market where auctions are already used as the default mechanism for allocating scarce transmission capacities. In contrast, all other countries usually apply other, non market-based mechanisms at (potentially) congested borders, in most cases in the form of the simple 'first come-first served' (FCFS) rule.

It is widely accepted in academic literature that market-based allocation mechanisms, i.e. auctions, are clearly superior to the use of other non market-based approaches, such as the FCFS principle or a pro rata allocation. Besides providing for a fair, transparent and non-discriminatory process, an auction-based allocation has the major advantage of promoting economic efficiency by allocating scarce resources to those parties who value it most, i.e. those who can realise the largest value from using the corresponding capacity. It is therefore interesting to note that the current practice in the European gas sector represents a fundamental difference to the situation in the European power markets where auctions have long become the standard instrument for allocation of congested capacities. However, we note that for instance ERGEG has also expressed a preference for the use of auctions in its recent proposals on principles for capacity allocation and congestion management.[53]

We acknowledge that the principles for the allocation of cross-border capacities are not directly related to the transmission tariff or balancing models and therefore extend beyond the scope of this study. However, the potential auctioning of cross-border capacities would have a direct impact both on the pricing of transmission capacities at the corresponding entry-exit points as well as on the overall revenues of TSOs. In this context, we note that several participants in the user survey (see section 3.2.6) have explicitly stated their preference for an auction-based allocation of cross-border capacities, and that they view this as an issue of priority, not only for reasons of ensuring a fair and non-discriminatory allocation of scarce capacities, but also as a means of providing effective locational signals on the necessity and importance of cross-border capacities.

More specifically, we emphasise three advantages of a market-based allocation of cross-border capacities that are of particular importance with respect to the scope of this study:

- Efficient allocation of scarce capacities;
- Provision of explicit locational signals on the need for and value of new capacities; and

[53] ERGEG. ERGEG principles: Capacity allocation and congestion management in natural gas transmission networks: An ERGEG Public Consultation Document. Ref: E08-GFG-41-09. Brussels, 15 Jan 2008

- Potential generation of additional income for financing the availability and/or extension of congested capacities.

The first aspect relates to the detrimental impact of non market-based methods on the allocation and use of scarce capacities, as illustrated by the wide-spread existence of purely contractual congestion at many European borders. In contrast, the use of auctions reduces barriers for cross-border trade by avoiding discrimination between old and new network users and reducing incentives for potential hoarding of capacities.

As an important side effect, auctions may therefore result in additional capacities becoming available to the market since it is no longer possible to acquire capacity rights at a price below the market value. Conversely, and provided that all or at least some of the auctions are not subject to any reserve prices (compare sections 4.1.1), a market-based allocation may also enable an optimal utilisation of existing network infrastructure, which may otherwise remain under-utilised when applying prices that are based on the full costs of the overall network.

Secondly, the prices resulting from an auction provide clear economic signals to network users, TSOs and the regulators on the need and value of new capacities. On the one side, network users thus receive a transparent and reliable indicator of the price which they expect to pay for one or several alternative transport routes. Amongst others, they may use this information in guiding their decisions when participating in any mechanisms for the long-term booking of capacities, such as an Open Season process.

Perhaps even more importantly, the same information is also available to TSOs and regulators, providing them with a clear and regular view of the value, which the market assigns to additional capacities at different places in the network. More specifically, a comparison of the average auction price (over a certain period of time) against the incremental costs of increasing available transport capacity gives at least a first indication of whether it is beneficial to construct new network infrastructure.[54] A market-based allocation therefore provides important inputs for assessing the need and potential benefits of possible investments into new network capacity, even in the absence of a formal Open Season process.

From the perspective of the regulators, this information may furthermore be used for reviewing the investments proposed by network operators and checking whether they correspond

[54] In practice, it is of course also necessary to consider a potential decline in auction prices when new capacity is being built.

to the needs of the market. Besides the direct profitability of individual projects, this may also include an assessment of the overall economic benefits for the combined market, such as the ability to promote regional integration and increase competition by removing, or at least reducing, congestion between different market areas. Overall, these considerations are therefore closely related to the discussion of coordinated network planning in section 4.1.5.

Last but not least, the use of auctions at congested borders often generates revenues in excess of the actual costs of the underlying infrastructure. Besides a general reduction in network tariffs, this additional income may be specifically used to either:

- Provide additional funds for the financing of network extensions; or
- Finance the application of operational measures that may be used to ensure the firmness of capacity, which may otherwise be available on an interruptible basis only.

Whilst the first option is limited to reducing congestion in the long-term, the second alternative makes it possible to increase the level of firm capacity in the short-term, i.e. without any investments into physical infrastructure. The latter alternative involves any measures by the network operators on both sides of a congested part of the network that are aimed at reducing the resulting commercial flow (i.e. the net nominations) to the physical transport capability (i.e. technical capacity) of the network. Besides **capacity buy-back**, as for instance applied by National Grid in the British gas market, this option also involves the use of **counter trading**, which can be described as an additional transaction (and nomination) between both TSOs against the direction of the prevailing flow on the interconnector.[55]

Although these measures are not commonly applied in the European gas markets, they have been successfully proven for instance in the European electricity markets, including the regular use of counter trading in the Nordic power market. Moreover, we note that Art. 16 (6) of Regulation (EC) No 714/2009 explicitly limits the use of auction revenues to these purposes in the electricity sector.[56] In our view, this approach is principally also applicable to the European gas markets.

[55] In addition, counter trading requires two additional transactions of both TSOs in their respective market areas to sell (in the exporting area) or purchase (in the importing area) the energy required for this purpose.

[56] With the additional option of using this income for covering the overall costs of the network if these revenues cannot be efficiently used for either of these two purposes.

Notwithstanding this general positive assessment, we also acknowledge that the allocation of cross-border capacities by auctions also involves certain preconditions and risks. In particular, we believe that the following issues need to be taken into account:

- Need for potential access to competing sources of commodity at least on the exporting side of the congested interconnector;
- Treatment of existing long-term contracts; and
- Potentially reduced incentives for TSOs to invest (efficiently).

To start with, any market-based mechanism will only work where the preconditions for competition are met. In the particular case of cross-border capacities, this corresponds to the need for effective access of multiple sources of commodity at least on the exporting side of the congested interconnector. Conversely, in the case of a market without effective access for new entrants to alternative sources of supply in the exporting market, there is a considerable risk that the application of auctions will not reflect the true market value of capacity but simply result in the capacity being sold at the auction reserve price. As a result, auctions therefore appear well-suited for interconnectors with sufficient scope for competition at least in the exporting market area, whereas they appear less suitable at borders where new entrants are unable to get access to gas in the exporting country or area.

Secondly, it is important to consider the relation to existing (long-term) capacity reservations. As mentioned above, the market-based pricing of cross-border capacities will usually result in prices being different than under the current cost-based approach, equivalent to a corresponding difference in the price between "new" and "old" capacity rights. At congested borders, auction prices are furthermore likely to exceed the regulated price of capacity. Assuming that network users have been valuing their existing capacity rights at the price of primary capacities in the past,[57] this could correspond to a potentially considerable 'windfall profit' for incumbent capacity holders. Although this may be perceived as a problem, we note that this difference between the formal price and the actual value of capacity has existed in the past. Strictly speaking, this issue therefore is primarily a question of political acceptability but not a fundamental barrier from an economic point of view.

[57] Although such behaviour would not be economically efficient, we note that various countries have imposed restrictions which do not allow the sale of capacity in the secondary market for a price (well) above the original price of the primary capacity.

Finally, it is possible that the additional revenues from auctions for cross-border capacities may reduce incentives for TSOs to invest. Experience from the European power markets has shown that the auctioning of cross-border capacities may render significant revenues, amounting to some € 1.7 billion in 2007.[58] In most cases, the income from cross-border auctions is considerably higher than the costs of counter trading or similar short-term measures. It is therefore sometimes argued that TSOs are not interested in investing in measures that would effectively remove congestion, since this would endanger one of their major income flows. Moreover, TSOs (and regulators) are sometimes accused by market participants of investing into projects which primarily serve other purposes, of no longer being concerned about the efficiency of corresponding investments, or of simply using this income to reduce the nominal tariff to be charged from network users.

We emphasise that there is no clear evidence of any corresponding behaviour. Moreover, these concerns may not be valid where congestion is contractual rather than physical, i.e. where not investments into the physical expansion of the network are required. Also, a set of rules and codes can be developed which determine from the auction bids when a TSO has to provide additional capacity/investment. This could mitigate concerns that a TSO will recover revenue and not invest to alleviate congestion.[59]

Nevertheless, these discussions highlight the need for supplementary measures, such as transparency on the use of auction proceeds. Moreover, this discussion also has to be seen in the context of regional planning and investment approvals (compare section 4.1.5 below).

Overall, we clearly believe that an auction-based allocation of cross-border capacities would help to reduce barriers for cross-border trade, promote efficiency, and create additional incentives to invest at critical points in the network. Moreover, experience has shown that auctions can be introduced with limited complexity and within a limited amount of time. Furthermore, an auction-based allocation fully satisfies the requirements of Art. 16(2) (b) of Regulation (EC) No 715/2009 as well as point 2.1 (1) of the Guidelines annexed to this Regulation, namely that the allocation mechanism shall be compatible with the market mechanisms including spot markets and trading hubs.

[58] COM(2009) 115 final. Report on progress in creating the internal gas and electricity market. COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT. Brussels, 11.3.2009

[59] An example of this is the NPV test used in GB as set out in the incremental entry capacity release methodology statement.

We therefore recommend a transition from the current use of the 'first come-first served' principle or pro-rata allocations to a market-based allocation by auctions. We also believe that this mechanism can be relatively easily applied to any new capacities that become available, either as a result of network extensions or due to the end of existing capacity reservations. Moreover, we note that this model is principally supported by the recent proposals by ERGEG, which may facilitate further progress in this respect.

However, as mentioned above, we also believe that the focus in introducing auctions should be on those borders with sufficient scope for competition. In this context, we furthermore believe that the introduction of auctions should best be accompanied or preceded by the combination of separate entry and exit capacities at each border into bundled products as recently proposed by ERGEG.[60] For these reasons, it appears that this option may be a suitable option already in the short-term.

4.1.4 Coordinated allocation of virtual hub-to-hub products

In section 3.1.1, we have analysed the barriers resulting from the fact that several countries still appoint a point-to-point regime or bundled entry-exit capacities within individual market areas. In accordance with Art. 13(2) of Regulation (EC) 715/2009, this practice will no longer be allowed after 3 September 2011. In the same section 3.1.1, we have also commented on the issue that especially smaller markets with a significant proportion of transit flows may find it difficult to guarantee unlimited flexibility in the combination of entry and exit capacities. Some TSOs are currently addressing corresponding problems through the use of locational restrictions for individual customers. Although such measures may be required in certain situations, their application should be limited to where this is really required, also taking into account the spirit of Art. 13(2) of Regulation (EC) 715/2009.

Indeed, the choice between the desire for utmost flexibility in the market on one side, and the need to take account of physical constraints in the underlying technical infrastructure on the other side, represents an inherent conflict of any entry-exit system. Ideally, the network access model should therefore be designed in such a way as to find a suitable compromise which resolves or at least mitigates this potential problem.

[60] Please note that hub-to-hub products can already be introduced on a bilateral basis between two adjacent countries or market areas. They are thus different from the concept of virtual hub-to-hub capacities discussed in the following section 4.1.4.

In this context, we note that a significant proportion of the existing transit contracts are, and are likely to remain, based on voluntary agreements between the corresponding network users and the national TSOs. Given the uneven distribution of sources and demand for natural gas, transits will certainly represent a significant proportion of the overall utilisation of the natural gas network in various European countries. Under these circumstances, many network users may be willing to accept locational restrictions, in terms of access to certain local markets, as long as these do not interfere with their underlying transport needs.

Conversely, we have raised the problems related to the separate allocation of entry and exit capacities at each border. In other words, many network users might not only be willing to accept certain restrictions in individual countries but may furthermore be interested in the opportunity to simultaneously book capacities at several borders, in order to avoid the risk of not being able to contract for the entire physical path between the origin and the final source of the intended transaction.

Finally, we note the recent proposal by ERGEG for the introduction of bundled capacity products at interconnection points. In contrast to the bundling of entry and exit capacities at different points within the same area, which functions as a barrier for cross-border trade, the successful experience from the European power markets has shown that this type of bundling has an opposite effect, i.e. it facilitates cross-border trading and market integration.

Based on these considerations, the following concept might provide a possible solution to the conflict mentioned above:

- Capacities at all borders in a given region (ideally the European market) are simultaneously offered to the market in a coordinated mechanism by all TSOs concerned;
- Network users may bid for any combination of hub-to-hub capacities, including for hubs that are not directly connected with each other; and
- All available capacities are simultaneously allocated by the TSOs, taking into account all requests from network users as well as any potential constraints on the distribution of potential flows in individual systems or regions.

This mechanism crucially differs from current arrangements in several aspects. To start with, it requires full cooperation between all TSOs concerned, in order to set up a joint mechanism for allocating available network capacities. This could either be achieved by delegating the corresponding functions to one single TSO, or by establishing a joint allocation office that is

jointly owned and operated by the different TSOs. Successful precedents exist both in the European gas and electricity sectors. For instance in the German gas market, several services of the combined market area for high calorific gas of E.ON Gastransport and Bayernets are offered via the joint organisation NetConnect Germany. Similar models are either used or intended also for other cooperation projects in the German gas market.

In the European electricity sector, for instance the Dutch TSO TenneT has been responsible for jointly allocating cross-border capacities at all borders of the Netherlands on behalf of 4 other TSOs since 2001, whilst the Czech TSO ČEPS organises a coordinated auction for cross-border capacities between Poland, Germany, and the Czech Republic. Similarly, three TSOs from Denmark and Germany have established a joint Auction Office within the context of the envisaged market coupling between EEX and Nord Pool, whilst a similar project is in preparation for the coordinated auctioning of cross-border capacities in the ERGEG Regional Initiative Central-East. Although the delays in the legal establishment of the latter organisations also indicate the legal and regulatory complexity in setting up such joint organisations,[61] the progress already achieved clearly shows the principle feasibility of this approach.

The second major difference between the concept mentioned above and the current status relates to a fundamental change in the definition of transport capacities. As already mentioned, it is based on the recent proposal by ERGEG for the offering of bundled hub-to-hub products as opposed to separate entry and exit capacities at each interconnection point.[62] As illustrated by Figure 17, however, the proposed concept is not limited to capacities between neighbouring regions which are physically connected with each other, but also allows for virtual capacity products between any combinations of two virtual hubs in the interconnected region.

For instance, rather than requesting separate capacities between hubs A and B as well from B to C, a network user may simply submit an application for capacity from A to C despite the lack of any direct interconnection between these two areas. Of equal importance, the network user is not required to specify the ‘contract path’, which is instead implicitly decided by the subsequent allocation process (see below). In other words, any request for (virtual) ca-

[61] In both cases, the legal establishment of the corresponding organisations faced considerable delays due to the need for prior authorisation under national and European competition law.

[62] Strictly speaking, the limitation to hub-to-hub products is effectively a result of the concept discussed in this section rather than a precondition for it.

pacity between hubs A and C automatically refers to all possible physical routes in the overall regional network (see dotted lines in Figure 17).

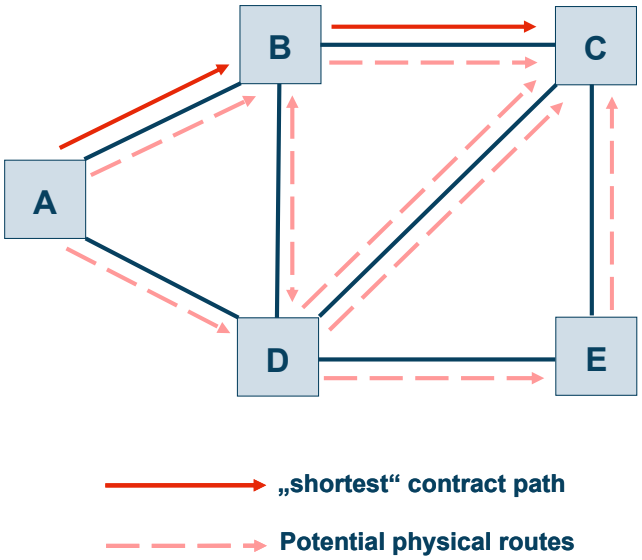


Figure 17: Illustration of virtual hub-to-hub capacities

The actual 'allocation' of the network user's request to individual interconnectors and market areas is achieved through the joint allocation process operated by the TSOs. This process simultaneously takes into account all requests for capacity, with the objective of finding an 'optimal' solution whilst satisfying all physical constraints defined by the TSOs. In case of a market-based allocation, the objective function of the process would simply be defined as generating the maximum possible income from the auction.[63] At the same time, the allocation algorithm can easily take account of different types of constraints, such as '*the flow from A through D to C must not exceed a level of x*'.

The combination of flexible bids and side constraints therefore ensures that the resulting solution is both economically optimal as well as technical feasible. This concept therefore represents a potential solution for solving the inherent conflict between the desire for full unbundled entry-exit capacities, on the one side, and the need to take account of certain technical restrictions especially in systems with limited physical flexibility, on the other side. In addition, the high degree of regional integration also generally facilitates cross-border trading by providing simultaneous access to capacities throughout the region in a transparent way.

[63] Given that the auction bids reflect the value that network users have assigned to capacity, this principle ensures an economically optimal allocation.

Given the current status of the European gas markets, one might argue that this concept is of very limited practical relevance and may not be feasible in reality. However, corresponding mechanisms have long been successfully applied in the European and international electricity markets where the issue of locational constraints is arguably of at least equal, if not even higher, importance than in the natural gas sector.

To start with, we have already mentioned the coordinated auctioning of cross-border capacities in Central Eastern Europe. Although the current mechanism is restricted to transports between neighbouring countries, the allocation of available capacities to individual borders is determined through the auctioning process rather than set in advance by the TSO. As illustrated by Figure 18 this is achieved through the definition of combined 'technical profiles' for exports and imports, which always apply to multiple national and/or administrative borders. For instance, the Polish system operator PSE-O applies a single export profile for all exports to Germany, the Czech Republic and Slovakia, without assigning any share of this capacity to individual borders. Similarly, the German system operator VE-T use combined technical profiles for exports and imports to and from Poland and the Czech Republic.

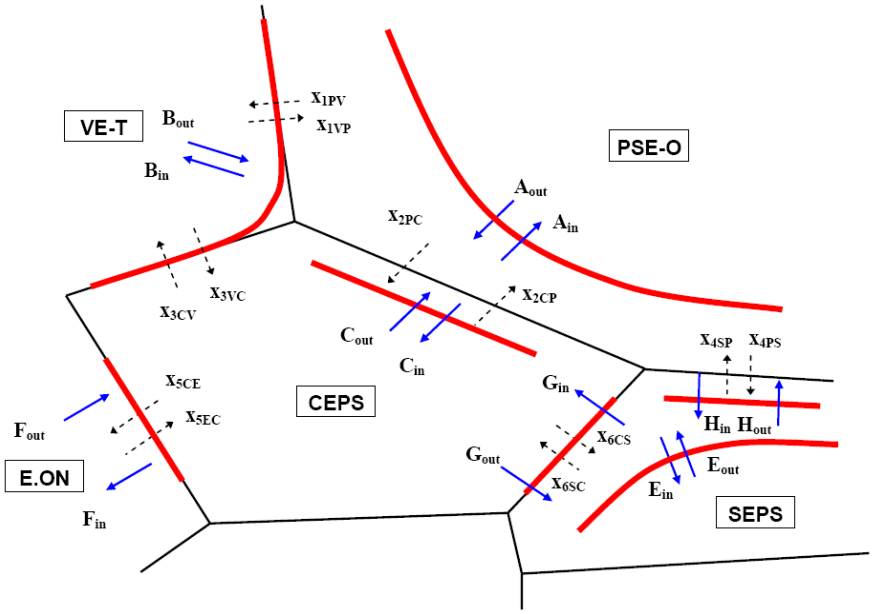


Figure 18: Auction-based allocation of cross-border capacities to individual borders in Central Eastern Europe (electricity)

Source: www.e-trace.cz

The mechanism illustrated in Figure 18 is still limited to direct capacity rights between two neighbouring countries (or market areas). Conversely, the current initiatives for the introduction of market coupling in the Electricity Regional Initiative Central-West and the establishment of a regional auction office in the Electricity Regional Initiative Central-East are both based on the concept of a 'flow-based' allocation, which also allows for 'virtual capacities' between any two market areas in the corresponding regions. Moreover, it is worth mentioning that the concept of flow-based allocations is comparable to the notion of nodal pricing, which has for instance been successfully used for managing network constraints in various electricity markets in Northern and Latin America, New Zealand or Australia for many years.

For a detailed description of the concept of flow-based allocations, we refer to a number of documents published by ETSO and EuroPEX.[64] For the purpose of this section, it is however important to note that the concept of flow-based allocations meets two of the main criteria mentioned for the concept presented in this section, namely that it:

- Allows market participants to bid for capacities between different locations (hubs), even if those are not directly connected with each other; and
- Ensures technical feasibility by allowing the TSOs to integrate relevant technical constraints into the algorithms used for determining an optimal solution.

Overall, these examples clearly illustrate the principal feasibility of offering virtual hub-to-hub capacities in a liberalised energy market. Despite fundamental differences in the regional distribution and operational control of load flows in gas as opposed to electricity networks, we believe that a corresponding approach could also be applied to the European gas markets. However, we also acknowledge that implementation of such a model would require far-reaching changes and represent a fundamental difference to current practices.

Perhaps most importantly, the introduction of flexible virtual hub-to-hub capacities would require a very high degree of cooperation and harmonisation between all TSOs in a given region. This is likely to be a complex and time-consuming process, also with regards to the need for regulatory approvals and/or a simultaneous adjustment of the regulatory framework. Furthermore, as experience from the electricity sector has shown, it may be extremely difficult to agree on a common scheme for distributing the income from the allocation of capaci-

[64] C.f. e.g. ETSO. Cross-Border Electricity Exchanges in meshed AC Power Systems. April 2004, ETSO/EuroPEX. FMC-Flow-based Market Coupling - A joint ETSO-EuroPEX Proposal for Cross-Border Congestion Management and Integration of Electricity Markets in Europe. September 2004. ETSO. Regional Flow-based allocations – State-of-play. March 2007

ties, especially where it is impossible to create a 1:1 relation between virtual capacities and physical connections.[65] This aspect highlights again the need for effective coordination, not only between TSOs but also between regulators.

Another aspect worth considering is the underlying method for capacity allocation. In our discussion above, we have implicitly assumed the use of auctions since this method allows for a straight and unambiguous mathematical formulation, which can easily be expanded to also consider potential (physical) constraints. Although we have recommended a general transition towards an auction-based allocation of cross-border capacities (see section 4.1.3), it seems reasonable to assume that this step may further contribute to the time required for introducing the coordinated allocation of virtual hub-to-hub capacities.

Based on these considerations, it seems clear that this method cannot be implemented in the short-term. Moreover, we have also highlighted some of the fundamental changes that would be required in comparison to the status quo. In our view, any decision for the introduction of a corresponding model would therefore require further in-depth analysis, in order to develop a detailed model and study any relevant benefits, risks, preconditions and constraints. Overall, and in contrast to the transition to a market-based allocation of cross-border capacities, we therefore view the coordinated allocation of virtual hub-to-hub capacities as a potential long-term option only, which would require further study.

4.1.5 (Partial) Replacement of cross-border tariffs by Inter-TSO compensation mechanism

As explained in section 3.1.2.4 the application of separate entry and exit tariffs at each border may have several disadvantages. First, it may reduce the scope for cross-border trade by imposing unnecessarily high fees on international transactions through several countries ('pancaking'). Secondly, it is also generally questionable whether the use of administrative boundaries can provide the basis for economically efficient locational signals. Finally, especially in smaller systems with a high share of transit flows, national transmission tariffs may be subject to sudden changes when major new infrastructure is built.

An alternative approach, as already indicated in the Terms of Reference for this project, could again be based on experiences from the European power market, namely on the con-

[65] As a matter of fact, the distribution of congestion rents has emerged as one of the most critical aspects in the Electricity Regional Initiatives Central-East and South-East.

cept of the so-called 'Inter-TSO Compensation Mechanism', or ITC. This mechanism was initially introduced in 2002 when eight European TSOs voluntarily signed the first Inter-TSO Compensation[66] agreement. This first ITC agreement was introduced with the aim of abolishing cross-border tariffs, as a measure of facilitating and increasing the efficiency of cross-border trade, whilst simultaneously introducing a financial mechanism for compensating national TSOs for the costs incurred as a result of cross-border flows.[67]

Whilst the ITC was initially limited to only a few countries, its regional scope quickly expanded and it now covers almost the entire European market. As indicated by a total of 35 participating countries in the current mechanism, the scope of the ITC is furthermore not limited to Member States but also covers a number of countries that are not members of the EU. On a European level, the need for an ITC was formalised in 2004 when Regulation (EC) No 1228/2003 came into force (now replaced by Regulation (EC) No 714/2009).[68] The detailed elements of ITC are however not specified in the Regulation, and since their adoption has been left for the voluntary agreement of the TSOs.

In practice, the development of the principles for the determination and distribution of compensation payments has proven to be the most difficult part of the ITC agreement. Hence, although the basic principles as stated above have remained unchanged and all tariffs for exports and imports between different market areas have been completely abolished,[69] the development of a corresponding methodology has been controversial.

Whilst the initial ITC mechanism was based on a relatively simple approach using the regulated costs of transmission in each country and tried to approximate the share of transit flows on each national grid, this approach was strongly contested for being too simplistic and not sufficiently reflective of the actual costs of transit. Over time, a range of more complex models have therefore been developed,[70] which were however rejected as being too intranspar-

[66] Please note that the ITC mechanism was initially referred to as the 'Cross-Border Trade' or CBT mechanism.

[67] For further information on the development of the ITC and the different concepts and models proposed, please refer to the following documents: ETSO 2004 CBT Mechanism, ETSO, 8 April 2004, The current ETSO ITC Model and possible development, ETSO 28 June 2005, Explanatory Note to ITC 2008-2009 Agreement, ETSO, 14 January 2008.

[68] Please note that the applicable stipulations with respect to the ITC have basically been maintained without major changes by the new Regulation (EC) No 714/2009, which has replaced Regulation (EC) No 1228/2003.

[69] With the exception of imports from so-called 'perimeter countries', which currently are subject to a nominal charge on nominated flows of 1.4 €/MWh.

[70] These approaches were largely based on complex power flow models and attempted to replicate the impact of cross border flows of electricity on the interconnected network in its full complexity. Besides the 'With and Without Transit Model', which has been used in recent voluntary agreements for the purpose of assessing losses as a re-

ent and sensitive to changes in assumptions and input data. The most recent proposal[71] from ETSO (now part of ENTSO-E) for a possible long-term solution is finally based on the combination of two different approaches:

- For the costs of infrastructure, a fixed framework fund of somewhere between 50 and 150 M€ is proposed, which shall be distributed based on two components. The so-called 'transit factor' represents the share of transit flows in a given country from total transit flows in Europe and shall account for 75% of total compensation payments. A a second 'load factor' shall furthermore take into account the proportion between transit flows and domestic consumption in each country.

- Conversely, the compensation for the costs of losses shall be based on a comparison of network losses 'with and without transit' (WWT)[72] for 72 defined snapshots during the year, valued at the costs approved by the respective national regulator.

In practice, the ITC mechanism has certainly been successful in terms of facilitating cross-border trade in the European electricity. The abolition of cross-border tariffs means that cross-border transactions are subject to the same charges as those applying for domestic trade, whilst the application of auctions at potentially congested borders ensures that capacity is allocated in an economically efficient way and that the price of scarce capacities reflects its market value (compare section 4.1.3 above).

Based on these obvious benefits, it seems only natural to also consider the potential application of a similar approach for the European gas markets. In accordance with the basic principles underlying the ITC mechanism in the European power market, such a mechanism would need to comprise of the two following essential elements:

- Reduction of entry and exit charges at all borders between different countries and/or balancing zones (possibly to a level of zero); and

sult of hosting transits, other proposals included the 'Marginal Participation' and 'Average Participant' methods (being based on a water flow rather than power flow models) or the 'Improved Model for Infrastructure Compensation' (IMICA).

[71] ETSO. ETSO Response to EC Consultation Paper on the Inter-TSO Compensation Mechanism. Brussels. 17 March 2009

[72] The WWT method uses a counter-factual of national network cross border flows with transits of electricity removed.

- Introduction of a separate financial mechanism for (partially) compensating different TSOs for the costs of cross-border flows through their networks.

As indicated by the text in parentheses, the scope of these measures could potentially aim for the full removal of entry-exit charges at all borders but might equally be limited to only a partial reduction. Since the basic issues are comparable in both cases, the following discussion focuses on the former option, which also represents the most extreme concept.

Introducing an ITC mechanism might potentially render the following major benefits:

- Removal of administratively-caused barriers to cross-border trading;
- Creation of a level playing field for local and external network users; and
- Provision of locational charges on a European scale.

To start with, the ITC mechanism would obviously resolve the barriers associated with the use of mainly administrative borders as the basis of transmission charging (compare section 3.1.2.4 above). Most importantly, it could promote an efficient utilisation of the network and convergence of market prices by ensuring that especially short-term transactions are not hampered by network charges, which exceed the short-term incremental costs of the additional flows. Provided that network users are able to obtain access to capacity rights, this would furthermore contribute to the creation of a level playing field for local and external network users since the latter would no longer face the risk of being put at an disadvantage by unnecessarily high charges for the additional transport volumes.

The third benefit is related to the fact that the two essential elements mentioned above implicitly require that the costs of cross-border flows, which are no longer covered by separate entry-exit charges, must now be collected from network users at those points where natural gas physically enters or leaves the overall regional network. For instance, when assuming that the ITC fairly reflected the actual costs of cross-border flows on each network, one would expect that countries where major cross-border flows either originate or end would be net payers into the ITC mechanism. In contrast, countries hosting transits should expect to receive net payments, ideally equivalent to the actual share of transit flows from the total costs of the respective national system.

To illustrate the functioning of an ITC mechanism, we now consider an example that is based on five interconnected areas as shown in Figure 19. Besides the flows between the different areas, Figure 19 also provides, for each area, information on local consumption, on

the one side, as well as production and imports from third countries, on the other side. For simplification, we assume all flows to be constant over time and also neglect the use of storage. In addition, we assume that the networks in all five areas have the same specific costs for each unit of natural gas transported and that the costs of the local network are always allocated to entry and exit capacities on a 50:50 basis, including imports and exports. Finally, we assume a set of 'market prices', separately for production and consumption in each area, which we assume to be set by the costs of production / imports in area E.

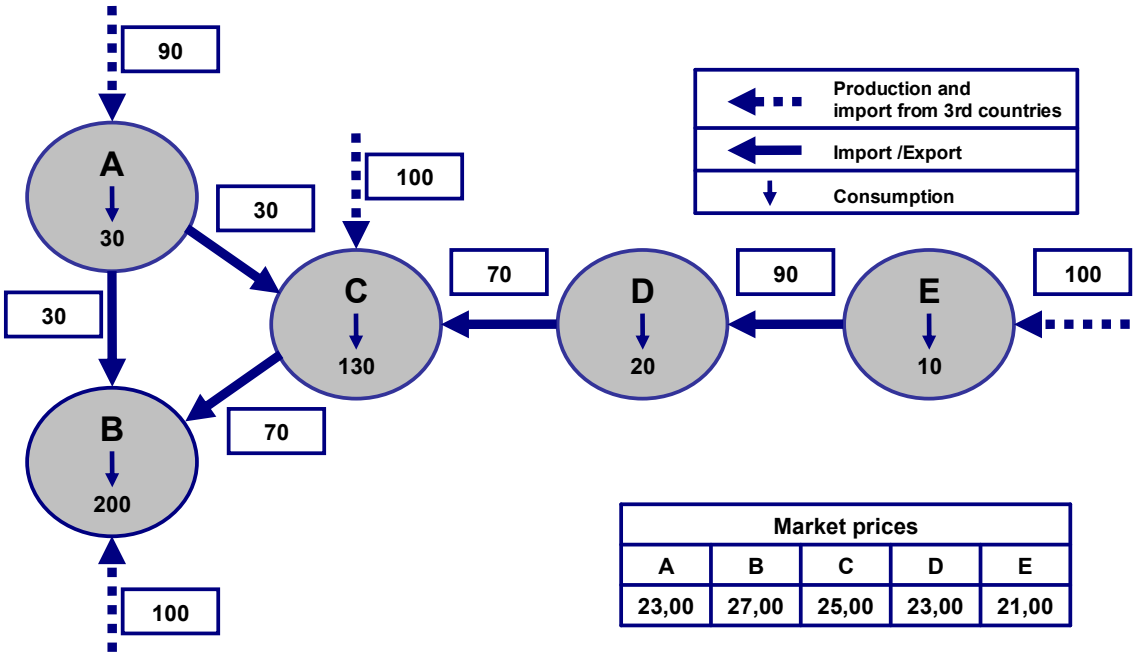


Figure 19: Example network used for illustration of ITC mechanism

Based on the assumptions, we now apply the so-called 'average participation method', which is based on a water flow model and was earlier proposed for the ITC mechanism in the electricity sector. Put simply, this method allocates the costs of all flows leaving (entering) a certain area to all flows entering (leaving) the same area in proportion to their share of total incoming (exiting) flows in the corresponding area.

Table 14: Example of entry-exit charges resulting under an ITC mechanism

	Area				
	A	**B**	**C**	**D**	**E**
Entry tariff	*1,78*	*1,00*	*1,35*	*2,05*	*2,85*
Exit tariff	*1,00*	*1,80*	*1,85*	*2,00*	*1,00*
Net ITC payments [(1)]	*10,5*	*59,5*	*-24,5*	*-140*	*94,5*

[(1)] *– Positive (Negative) payments indicative payments into (out of) ITC*

The functioning of this mechanism can be explained by the following two examples for the determination of entry charges:

- For instance in area B, 50% of the costs of the local network (200) are charged to local production and imports from areas A and C in a ratio of 10:3:7, resulting in costs of 100, 30 and 70, respectively, and a national entry tariff of 1.

- Similarly, the sum of 50% of the costs of the local network in area C (200) and the costs for exports to area B (70), i.e. a total of 270, are split between imports from areas A and D as well as local production in a ratio of 3:7:10, or costs of 40.5, 94.5 and 135, respectively. These values correspond to an entry tariff of 1.35.

Using these assumptions and the average participation method results in a set of national entry-exit tariffs as well as (bilateral) compensation payments between (neighbouring) countries as summarised in Table 14. The resulting entry and exit charges in each region provide for clear locational signals, with network users injecting gas into areas ‘upstream’ of the overall system paying significantly higher charges than those in the ‘downstream’ parts of the system, whilst the opposite holds for consumers and exports to third countries.

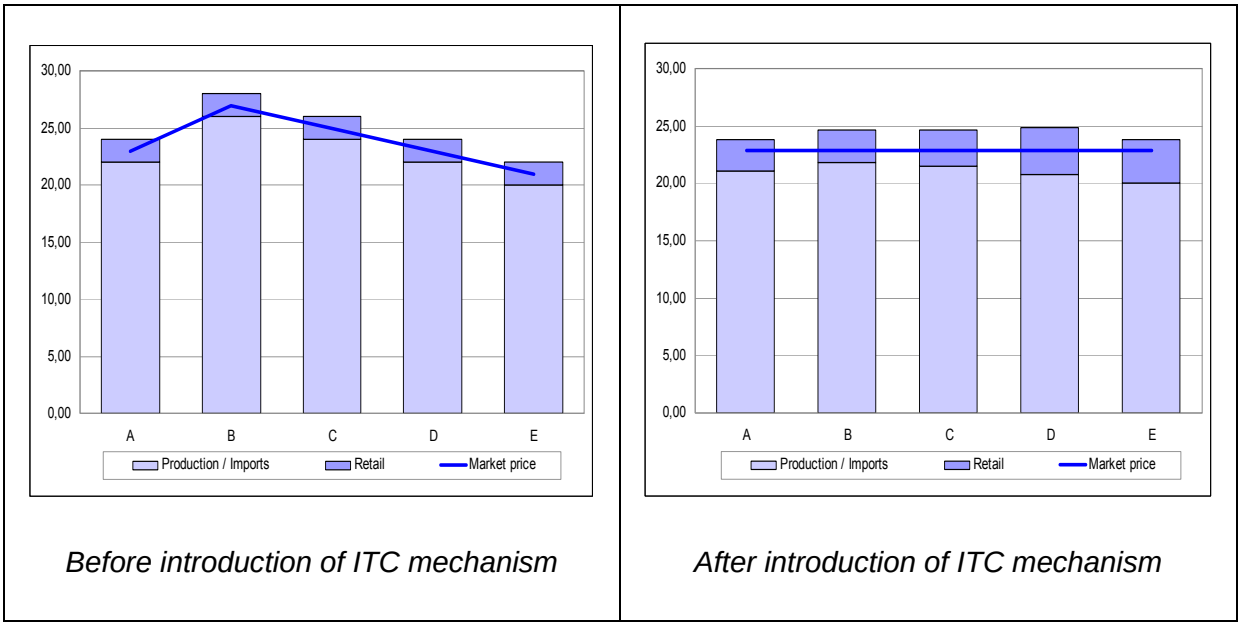


Figure 20: Possible impact of ITC on market, consumer and producer / import prices

Note: Consumer prices inclusive / Producer prices exclusive of network charges

Assuming that wholesale market prices are again set by the costs of production or imports into area E, Figure 20 presents a view of the possible changes to the wholesale market, consumer and producer / import prices, which may result from the introduction of an ITC mechanism as described above. Although we emphasise that these results clearly depend on the specific assumptions taken for this example and the particular method chosen for allocating the costs of the network to national and external users of the grid, this picture nevertheless highlights some fundamental features of an ITC mechanism:

- First, Figure 20 clearly illustrates the single most important advantage of an ITC mechanism. Whereas the use of separate entry-exit charges at each border by definition leads to different prices in each area (as a result of pancaking), application of an ITC mechanism may, in the absence of congestion, result in a single wholesale market price throughout the region, thereby effectively creating a single regional market and facilitating cross-border trade.

- Secondly, this particular example also shows that an ITC mechanism may lead to a general convergence of both producer and consumer prices, despite locational differences in transmission charges.

Apart from these observations, it is important to note that the total revenues of each TSO remain unchanged. Ideally, the ITC mechanism is limited to a different distribution of total costs to different network users, whilst it does not necessarily affect the individual financial position of a TSO.[73]

Similarly, we emphasise that the application of an ITC mechanism does not necessarily require full harmonisation of national tariff structure or introduction of a regional entry-exit system (REETS), such as the concept investigated for the Gas Regional Initiative South-South East.[74] Although the REETS study addressed some aspects that are also relevant for an ITC mechanism, we note that different principles are still applied for the determination of transmission tariffs in the European electricity market, including the split between generation and load, i.e. the equivalent to entry and exit charges. Although the potential problems resulting from corresponding differences have been clearly recognised, the focus in the European power market has been on harmonising this so-called 'G to L split', whilst leaving the development of the detailed tariff structure to the discretion of national regulators and TSOs.

This last aspect already relates to the considerable complexity and difficulties associated with the introduction of an ITC mechanism. Without going into detail, we briefly summarise some of the most important aspects, partially drawing on the example above as well as experiences from the electricity market:

- Apart from the positive impact on regional integration, Figure 20 above has also shown that the introduction of an ITC mechanism may affect the prices paid respectively received by network users in different parts of the region, which would obviously have an impact on the competitive position of individual market participants. In addition, we note that the relative position of individual countries and/or user may change significantly when a different method for determination of payments under the ITC is applied or if different assumptions on the resulting price levels in the wholesale market are used.
  Overall, these observations indicate that the results of an ITC mechanism may be **unstable** and highly **sensitive to subjective decisions and assumptions**.

[73] In the particular example chosen, one potential area of ambiguity applies to the congestion rent for the connection between areas A and B (which we have assumed to be congested), which would be reduced to zero after introduction of the ITC mechanism.

[74] C.f. ERGEG. Gas Regional Initiative - Region: South-South East. The opportunity and require-ments to introduce a regional entry-exit tariff system - A preliminary study. Draft version, 16 February 2007

- Amongst others, these problems strongly depend on the **methodology for distribution of network costs**. As illustrated by the experiences from the European electricity sector, the development of an appropriate methodology may be very complex and highly controversial. Given the absence of unintended 'loop flows'[75], which are at heart of the problem in the electricity sector, the ability of direct flow control and the fact that cross-border flows of natural gas can be identified more easily, the development of a suitable methodology might arguably be much easier for natural gas. However, we believe that it would nevertheless represent a highly complex task.

- Another issue relates to the **determination of costs**, which represents the second fundamental element of an ITC mechanism. As already discussed above, each country applies its own standards and practices in this respect, with major differences especially with regards to the valuation of investments, depreciation and the decision on an appropriate rate of return. Although we have argued above that such differences are not necessarily fundamental barriers to cross-border trade and investments, this view no longer holds if the resulting cost values are to be used for compensation payments between different countries.

  In the electricity sector, significant efforts have therefore been spent on trying to develop a standardised approach for removing the impact of different regulatory treatment of costs. Similar to the application of benchmarking, however, these efforts have been hampered by fundamental differences not only in accounting standards but also the design and costs of different types of equipment in different countries. In our view, there are no reasons to assume that these issues may be fundamentally different for gas transmission networks.

- As explained in the introduction to this section, current proposals by the European TSOs in the electricity sector foresee the use of relatively simple export-import models, with an ex-ante decision on the total volume of annual payments to be made for compensation of the fixed costs of network assets that are used for transit. In addition, these proposals provide for a reduction of the initial ITC fund from some € 300 million annually to only € 50–150 million.

[75] So-called 'loop flows' are caused by the fact that, in a meshed electric network with alternating current, both national and cross-border flows flow in parallel across all existing connections between the two locations where additional energy is injected into (taken off) the grid.

These amounts represent only a small fraction (approx. 1%) of the total annual costs of the electricity transmission networks in the EU/EEA countries, which have been estimated at some € 10-11 billion.[76] In contrast, the income from congestion management alone amounted to approx. € 1.7 billion in 2007.[77] Given the marginal role of payments under the ITC in this context, the question of whether the mechanisms applied in the electricity are truly cost-reflective, may therefore be of limited importance.

In contrast, it seems reasonable to assume that the costs of cross-border transport of natural gas, with large volumes being transported over long distances, will represent a much higher proportion of the total costs of transmission in the gas market. As a consequence, it also appears that an ITC mechanism for the gas market might need to have a much larger financial volume than its equivalent in the power sector. In this case, it would obviously be far more important to apply a methodology that ensures a fair compensation of the costs caused by cross-border trading especially if this was accompanied by a simultaneous reduction or even abolition of entry-exit charges for cross-border transports.

- Implementation of an ITC mechanism would obviously require the establishment of an appropriate contractual and regulatory framework, which does not exist today. One option might be a voluntary multilateral agreement between all TSOs concerned. However, it would need to be ensured that the resulting payments are accepted as non-controllable costs or revenues by national regulators and do not become subject to efficiency targets on a national level. Moreover, experience from the electricity sector clearly shows that reaching voluntary agreement on such a complex subject as the ITC mechanism is extremely difficult and may take a long time.

  Alternatively, one might attempt to introduce binding rules at the European level that would specify the methodology and the procedures to be applied. It seems however questionable whether a corresponding approach would be appropriate as long as no proven concept exists, which has been thoroughly discussed and tested in practice.

[76] European Commission. Commission Staff Working Document. Accompanying document to the Inter Transmission System Operator Compensation Mechanism and Harmonisation of Transmission Tariffs for Electricity - Summary of IMPACT ASSESSMENT, Draft SEC(2008) yyy, Brussels, 3 July 2008

[77] COM(2009) 115 final. Report on progress in creating the internal gas and electricity market. Communication from the Commission to the Council and the European Parliament. Brussels, 11.3.2009

Based on these considerations, we conclude that the introduction of an ITC mechanism in the natural gas market would appear premature at this stage, due to the substantial number of highly complex aspects that would need to be resolved first. However, the major benefits which a functioning and comprehensive ITC mechanism could possibly create for the European gas market also imply that it would be equally inappropriate not to pursue any progress in this respect. Overall, we therefore propose that the possible application of an ITC mechanism, and the development of suitable methodologies for the determination and distribution of compensation payments to be made, should be further analysed, in order to enable an informed decision at a later stage.

When analysing potential options and alternatives, care should be taken to establish clear objectives for any future mechanism. As a starting point, the specific objectives as defined for the development of a corresponding mechanism in the electricity sector may be used:[78]

- Accurate – an ITC mechanism should accurately reflect the share of network capacity that is required to enable and/or used by cross-border flows;
- Compensatory – compensation payments should be set with due consideration of both the costs and benefits of cross-border flows, including any supplementary incomes like potential revenues from auctioning of cross-border capacities;
- Transparent and stable – the method should be transparent and easy to understand, and the resulting payments should be stable and respond in a reasonably predictable manner to changes in the underlying costs as well as the physical structure and use of the network;
- Implementable / Low administrative burden – an ITC mechanism should not create excessive costs for national regulators and TSOs, be practical and require only a reasonable level of complexity in terms of data and methodology for implementation.

[78] European Commission. Commission Staff Working Document. Accompanying document to the Inter Transmission System Operator Compensation Mechanism and Harmonisation of Transmission Tariffs for Electricity - Summary of IMPACT ASSESSMENT, Draft SEC(2008) yyy, Brussels, 3 July 2008, section 3.1, p. 4

4.2 Network Planning and Investments

4.2.1 Coordinated network planning

In section 3.1.3.4 we have outlined the problems related to the issue of network planning across borders and the current efforts to relieve these problems. The problems mainly relate to coordination of network planning in terms of location and time and the associated risks of delays or inefficient investments. It therefore seems clear that additional efforts should be taken to ensure an improved level of cooperation and coordination in this respect.

In this context, we also note the current provisions in the EU gas legislation which clearly support the idea of coordinated network planning both at Community level and regional level. For example, Art. 8 (3) and (10) of Regulation (EC) 715/2009 requires that the ENTSO for gas shall adopt and publish a non-binding **Community-wide ten-year network development plan** every two years. The Community-wide network development plan shall include the modelling of the integrated network, scenario development, a European supply adequacy outlook and an assessment of the resilience of the system.

In particular, the Community-wide network development plan shall:

- Build on national investment plans and take into account regional investment plans (see below) and Community aspects (including guidelines for TEN);
- Regarding cross-border interconnections, build on the reasonable needs of network users and integrate long-term commitments from investors;[79] and
- Identify investment gaps, notably with respect to cross-border capacities.

In addition, Art. 12 of Regulation (EC) 715/2009 requires TSOs to establish regional cooperation within ENTSO-G and in particular to publish a **regional investment plan** every two years.

We strongly support the idea of developing and publishing Community-wide and regional investment plans, since these plans would provide consistent and transparent information for

[79] Regulation (EC) 715/2009 explicitly mentions that a review of the barriers to increasing cross-border capacity of the network arising from different approval procedures or practices may be annexed to the Community-wide network development plan.

network users regarding future capacity availability. However, we would like to stress that such coordinated network planning should go beyond a mere assembly of national network development plans. Indeed, we believe that there is a need for a mechanism or procedure for coordination and synchronisation of network planning, at least on a regional scale, which should ideally lead to a joint agreement on assumptions, scenarios and criteria used.

Such a joint agreement on starting points and criteria is a prerequisite to a successful investment plan. It should include a coordinated assessment of different options for investment, including their impact on the regional and European network. Moreover, we suggest that a coordinated investment plan should ideally be based on a combination of bottom-up and top-down approaches, however a detailed elaboration of how to make such an investment plan goes beyond the scope of this study.

Finally, we note that the coordinated investment plan has to be seen in the context of the measures described in the following sections 4.2.2 and 4.2.3 on coordinated investment approval and (joint) financing of investments with a regional benefit.

4.2.2 Coordinated approval of investments with a regional scope

Although increased coordination by the TSOs for the organisation of national and regional planning is certainly desirable, its value will be limited if it is not supplemented by a similar cooperation of the regulatory authorities. Indeed, section 3.1.3.5 has highlighted a few examples of how cross-border investments may not only be hampered by imperfect coordination of network planning and open season procedures but also by differences in the timing and principles of regulatory decisions on the approval of such investments.

In our view, it is therefore paramount that any efforts to improve the transparency and coordination of the planning process by the TSOs are accompanied by similar improvements on the side of the regulators. Such measures should include improved communication between different national regulatory authorities as well as the development of principles and procedures for facilitating a joint or at least coordinated decision on the approval of investments that have an impact of several countries.

Such efforts could obviously build upon the framework provided by Directive 2009/73/EC (Gas Directive) in combination with Regulation 715/2009 and Regulation 713/2009 on the establishment of an Agency for the cooperation between energy regulators. In this context, it seems worth noting the following provisions in particular:

- At the national level, Art. 22 of the Gas Directive empowers the national regulators to amend, approve and execute national investment plans, whilst corresponding provisions do not currently exist at the regional and Community level;

- In accordance with 8 (11) of Regulation 715/2009, the Agency shall review the national ten-year network developments or investment plans to assess their consistency with the Community-wide plan; in case the Agency identifies inconsistencies, it may recommend amending either the national or the Community-wide plan;

- Art. 42 of Directive 2009/73/EC requires close consultation and cooperation between national regulators on cross-border issues; which includes the provision of information between national regulators and the Agency;

- Art. 9 (1) of Regulation 713/2009 authorises the Agency to decide on exemptions as provided for in Art. 36 (4) of the Gas Directive where the infrastructure concerned is located in more than one Member State; and

- Art. 8 (1) of Regulation 713/2009 gives the Agency decisional regulatory power on cross-border infrastructure in specified cases.

These provisions enable important improvements with respect to the approval of cross-border investments. However, we note that these stipulations do not include any binding provisions with regards to the coordinated approval of regional investments.

Such coordination may take different forms but we principally believe that there are several basic options for deciding on investments that have been identified as relevant from a regional perspective:

- Approval at the national level by the national regulator in each country concerned;

- Joint decision at the regional level (for instance within the scope of a successor of the Regional Initiatives); or

- Centralised approval by the Agency.

Clearly, each of these different approaches has its particular merits and drawbacks. For instance, whilst the first option is fully compatible with the current legal and regulatory arrangements, it also offers the lowest degree of regional coordination. In contrast, the other options would require the development and agreement of principles and rules to decide un-

der which conditions a decision might be taken beyond the national level and how to ensure that such decisions become binding and do not conflict with national legislation. Moreover, a centralised decision by the Agency could be seen to run counter to the principle of subsidiarity and could also result in the least degree of flexibility. On the other hand, it might avoid unnecessary delays, whereas the decisions made by a regional body could potentially face major difficulties in reaching agreement.

Moreover, we emphasise that the scope of coordination should not be limited to interconnectors but may also need to cover certain investments within the national networks. As a matter of fact, investments into the national infrastructural of a single country may sometimes be required to facilitate regional integration such that it might be desirable to also provide for the option of investments being either triggered or, in an extreme case, possibly even being 'imposed' by a prior decision at the regional or community level.

Especially the latter would represent a drastic intrusion into the autonomy of national regulators and might have far-reaching implications. Overall, these considerations highlight the associated complexity and suggest that possible solutions need to be developed and carefully analysed and tested before they can be applied in practice. We therefore believe that a gradual transition will be necessary, with an initial focus on improved communication and the analysis of potential models for increased coordination. In contrast, we expect that any binding decisions can only be taken at a later stage. Finally, we note that the coordinated approval of investments may also require arrangements for the regional and/or external financing of certain investments. This topic is further discussed in the next section.

4.2.3 Financing of investments with a regional benefit

Regional decisions on investments (see previous section) may result in situations where individual countries have to realise projects that are not directly beneficial or even detrimental to the local market. Under such circumstances, the local TSO, and hence users of the local network, might face additional costs without being able to gain from the associated benefits. Although this may be acceptable where the corresponding costs remain low in relation to the overall costs of the local network, it clearly illustrates the need for potential action, especially where decisions on corresponding investments could be taken at a regional level.

Apart from the direct costs of the investment, such instances may also be the result of indirect effects of changes in the network. For instance, whilst network reinforcements or a new line may help to relieve congestion at that point it may be insufficient to resolve the issue on

a regional scale. As a result, congestion may simply be 'shifted' to another place in the network. Although this may not necessarily be critical, there are two potential effects which may create incentives for the local TSO and regulator to not exercise a given investment:

- First, the local market may move from one side of the constraint to the other, which could also result in a different price level for the wholesale market. Although this would obviously be desirable if congestion was removed on the 'upstream side' with lower prices, the situation would obviously look different if the investment resulted in local market prices converging upwards to the level of a neighbouring (downstream) market.

- Secondly, if cross-border capacities were allocated by market-based mechanisms the 'relocation' of the network constraint may also result in a regional shift of congestion revenues, which could mean that the local TSOs loses some or all of the income from auctions for cross-border capacity.

Experience from the European power market shows that both cases are realistic and that they may indeed result in opposition by TSOs, regulators and governments to investments, which are however beneficial from a broader regional perspective.

In order to address corresponding issues, one approach might be to provide for some sharing of related investments across the countries concerned. For instance, TSOs and regulators might agree on the sharing and/or joint financing of certain investments on a case-by-case basis, possibly in the form of bilateral or multilateral agreement. Such agreements could be tailored to specific situation in each case and may also help to allow for the realisation that are deemed to be essential by one country, whilst being regarded as bearing too large a risk for local network users in another.[80] However, this is likely to be a complex and lengthy process, which has to be repeated for each new investment project. In addition, the enforceability of the agreed cost-sharing may be difficult.

The question arises as to whether general rules are required for cost-sharing and financing of cross-border investments. At first glance this seems to be a reasonable proposition. However, in practice this could require harmonisation with regards to the determination of the reasonable costs of the associated investments, including for instance allowed depreciation periods or the rate of return. Due to the fundamental differences between the Member states in this respect (compare section 2.3), this may be a task that is extremely complex to ac-

[80] Compare also the findings of the 'Virtual Test' in the GRI North-West

complish. Moreover, it would need to be clarified whether national regulators or TSOs would be entitled to pay other countries out of the revenues from local network charges.

Thirdly, one could aim at establishing some sort of mutual funds from which regional investments are paid. Although this model bears some similarities with the concept of an inter-TSO compensation mechanism as discussed above (see section 4.1.5), it would likely be equally difficult to decide on the use of the corresponding proceeds and might result. Especially in this case, the external financing of certain investments might furthermore create perverse investments to delay the realisation of certain investments until they have been incorporated into the regional plan and are entitled to co-financing from other countries.

Despite its potential merits and the obvious need for action in some cases, we therefore believe that the idea of a possible co-financing of investments with a regional scope requires careful and detailed analysis, which goes well beyond the scope of this study.

4.2.4 Ensure compliance with regional decisions at national level

In an ideal case, implementation of the concepts discussed in the previous sections might result in a perfect coordination and approval of network planning, supplemented by regional agreements on joint financing of such projects. Even in such an ideal setting, however, there remains the risk that the various TSOs will have a different view on the commercial viability of the corresponding investments. More precisely, the investment decisions of a TSO will not only take into account the overall costs and economic benefits of an individual project, but also the revenues which the TSO can expect to earn from this investment under the local regulatory regime. The profitability of an individual project may therefore look very different to the different TSOs.

Besides variations in the permitted rate of return, depreciation times etc., one important aspect also relates to the risk that national regulation may not allow the full recovery of costs, if this results from investments previously decided at regional level. Possible reasons may include the various types of incentives for efficiency applied in individual countries, such as over-ambitious efficiency targets under cap regulation, deemed inefficiency under a system of benchmarking, or a claw back on past investments. Nevertheless, if a given project appears as unprofitable to the TSO, the TSO may be obliged under Art. 22 (7) of Directive 2009/73 to execute the corresponding investment.

Although one may reasonably assume that regulators will attempt to treat TSOs fairly, corresponding measures may nevertheless create substantial regulatory uncertainty, which may undermine incentives for individual TSOs to invest. As an example, we refer to the potential application of benchmarking for transmission networks. Where certain investments have previously been decided or even mandated at a regional level, possibly based on an assessment of the regional benefits (compare sections 4.2.1 and 4.2.3 above), there is a considerable risk that these investments may appear as 'inefficient' when assessed on a purely national scale. Also, we are not aware of any extensive experience with regulatory benchmarking of gas transmission grids, which we expect to be a highly complex task. In this context, we furthermore note that the (limited) experiences from the European electricity sector do not, in our view, serve to remove any corresponding concerns, whilst they have clearly shown the difficulties of trying to compare transmission networks from a diverse set of countries with very different norms and operational practices.

One important addition to the approaches discussed in the previous sections should therefore be to ensure that national regulation does not conflict with prior decisions on efficient investments at regional level, i.e. that national regulators should refrain ex-post declaring, directly or indirectly, the decision for certain investments as inefficient where such investments have previously been requested or even mandated at regional level. In an extreme form, this could mean that corresponding investments should be exempted from the normal regulatory process, which would however represent a fundamental contradiction to the principle of subsidiarity, such that it would seem difficult to justify such a strong intrusion into national regulatory systems. Moreover, it is also important to consider the problem of clearly identifying individual investments as being of a 'national' or 'cross-border' nature (see section 4.2.3 above) and the fact that it is hardly possible to consider isolated elements of the overall regulatory system in a given country only. Finally, it is clear that these restrictions should only apply to the general decision for an investment, whilst a TSO should still be obliged to realise the corresponding investment in an efficient way.

In summary, and also taking into account the provisions of Art. 22 (8) of Directive 2009/73, we therefore recommend that the potential introduction of the measures described in the previous three sections be supplemented by additional arrangements to ensure that a TSO does not face any unreasonable risks when executing any investments that are primarily aimed at facilitating cross-border trade and regional integration. At the same time, we emphasise the importance of avoiding or at least minimising any distortions of the 'normal' regulatory arrangements at the national level.

We acknowledge that the development of a corresponding scheme may be rather complex. Furthermore, the diversity of regulatory arrangements may require tailored solutions to be applied in different countries. For illustration, the following list nevertheless provides some first tentative ideas of specific approaches and incentives that might be used in this respect:

- Similar to the current practices in some countries (compare section 2.3.5 above), regulators might allow a specific (i.e. increased) rate of return for investments executed for the sole purpose of benefiting the regional market, although care would have to be taken to avoid potential conflicts with the remuneration of purely 'national' investments;

- Especially where an investment has been 'imposed' on a given country or TSO for the purpose of its overall benefits for the regional market, it would seem justified to ensure that this investment cannot be later removed from the regulatory asset base;

- If benchmarking is applied to set the allowed revenues of a TSO, it may be necessary to exclude any assets of a 'regional nature' from the potential analysis of the 'optimal structure' of the network, whilst the benchmark may still cover the costs of constructing and operating the corresponding assets;[81]

- In cases where joint financing or compensation of corresponding investments has been agreed on a regional level (see section 4.2.3), it might furthermore be useful to consider only the residual costs of the corresponding assets, i.e. net of any contributions received from other countries.

4.3 Residual Balancing and Imbalance Settlement

4.3.1 Promote cross-border exchange of balancing services

In sections 3.2.1 to 3.2.3 above, we have commented on the barriers resulting from the lack of market-based mechanisms for the procurement of balancing services and the related constraints caused by the existence of many small market areas or balancing zones. In the

[81] Please note that a similar approach was used for a benchmarking of more than 20 European TSOs in the electricity sector that was carried out on behalf of a group of European regulators in 2008. Nevertheless, this project also clearly illustrated the difficulties of developing a reliable comparison of different transmission grids.

same context, we have also highlighted the uneven distribution of flexibility in different gas systems throughout Europe. In this situation, the possibility for the mutual exchange of balancing services between different countries certainly represents a promising solution, which is also in line with the focus of Directive 2009/73/EC on regional integration (see Art. 21 (4)).

As further discussed in section 4.3.2, this should ideally be achieved through regional integration of the markets for balancing gas and intra-day trading. Taking into account the complexity and hence time required for a corresponding approach, a first transitional step might therefore be to start by promoting the cross-border exchange of balancing services between the existing national systems. Taking into account the overall purpose of within-day balancing in the gas market, corresponding steps should focus on the following areas:

- Facilitating the cross-border trade on the day-ahead and within-day markets;
- Increased use of the short-term and intra-day markets for the procurement of balancing gas;
- Ensuring compatibility between the specification of balancing services used by the TSOs for residual balancing and the products commonly traded in the commodity market, as far as possible; and
- Harmonising the balancing services used by different TSOs.

The first item focuses on the ability of network users to apply their own means for compensating any deviations that can be forecasted and/or become visible within sufficient timescales during the operating day. It is clear that any improvements in this respect may provide additional flexibility to network users and allow them to compensate themselves at least part of the imbalances, which today either have to be offset by the TSO and/or create barriers to entry. Corresponding improvements would mainly be required with regards to the allocation of cross-border capacities and congestion management and have also been addressed in the recent suggestions by ERGEG on further developments in this area.

The second and third points above can be partially seen in combination. As a general rule, the costs of residual balancing may be reduced and be more related to the day-to-day situation in the market when TSOs were able to buy or sell balancing gas in the commodity market whenever this is commercially advantageous. However, it might still be necessary to provide for additional mechanisms to either ensure the availability of sufficient balancing

services (see below) and/or to comply with additional dynamic constraints that are not provided by the products traded in the commodity market.

In these cases, it would nevertheless be beneficial if the definition of such products reflected the structure of 'normal' commodity products as closely as possible, in order to make it easier for market participants to share their flexibility between both markets and offer market-based price for balancing services. Amongst others, this also implies that the TSOs should aim at buying and selling balancing gas at the same notional points as also used for commodity trading (notional balancing point or virtual trading point), whilst keeping the need for locational products to a minimum.

Finally, we recommend that the TSOs should also aim at harmonising the balancing services used in different countries. Harmonisation should obviously focus on those products that have the largest degree of compatibility with the commodity market but may also entail other tailored products, potentially including the definition of reserves that are contracted in advance. In this context, it may also be possible to rely on existing experiences from the European power markets, although the corresponding developments also show the complexity of this process. The use of harmonised products would have a dual advantage as it would facilitate the:

- Provision of balancing services by external parties; and
- Exchange of balancing services directly between two neighbouring TSOs.

In our view, certain improvements in this area should be possible with limited efforts, whilst further harmonisation may be more complex and time-consuming. Moreover, it is also important to note that any progress in this respect also depends on the availability of cross-border capacities and is hence closely related to the current activities of ERGEG in the area of capacity allocation and congestion management.

Finally, it is also possible that, in case of drastically improved possibilities for the exchange of balancing services, or flexibility in general, certain countries suddenly find themselves in a situation where local flexibility is 'exported' to other countries, in extreme cases causing a potential deficit in the local market. In principle, such situations should not occur, or result in an economically efficient outcome, where the corresponding flexibility is 'traded' in fully competitive market-based mechanisms in all corresponding countries. In order to take account of the potential lack of market-based mechanisms in some countries and to ensure the reliable operation of the local system, it may therefore become necessary to supplement these de-

velopments by additional arrangements aimed at ensuring the local availability of 'operating reserves' also throughout the gas day.

4.3.2 Regional coupling of balancing and short-term markets

As already mentioned in the previous section, the changes aimed at promoting the cross-border exchange of balancing services should only be seen as a first step towards further regional integration of the balancing regimes in the Member States (see also Art. 21 (4) of Directive 2009/73/EC). In parallel, we recommend that TSOs and regulators should take the necessary measures for 'coupling' of both short-term and balancing markets.

On the one side, this may involve any developments aimed at the introduction of 'market coupling' for gas a commodity, i.e. including the day-ahead and intra-day markets. As the experiences from the European power markets have shown, market coupling by means of 'implicit auctions' promotes both the development of liquid and competitive markets as well as regional integration by ensuring an optimal allocation and use of cross-border capacities. With a view to the particular focus of this study, it is furthermore worth mentioning that the application of market coupling is also beneficial for system balancing as it makes it easier for network users to optimise and balance their production, trading and supply. These benefits are also explicitly mentioned Art. 12 (2) of Regulation (EC) No 715/2009 as follows:

> '*Transmission system operators shall promote operational arrangements […] and shall promote the development of energy exchanges […], paying due attention to the specific merits of implicit auctions for short-term allocations and the integration of balancing mechanisms.*'

This provision already indicates that regional integration should not be limited to the coupling of commodity markets but also extended to balancing markets. Indeed, market coupling in a traditional sense is useful only for facilitating self-balancing network users by network users and, possibly, providing the TSOs with access to additional sources of commodity gas during the operating day. In contrast, it does not have any direct benefits for the provision and use of balancing services outside the commodity market.

Irrespective of whether it is possible for the TSOs to exclusively rely on the commodity market for the procurement of balancing services or not, regional integration of the balancing markets may thus offer significant additional benefits. In both cases, regional integration potentially increases the range of flexibility available to individual TSOs. Moreover, the

enlarged regional scope improves the potential for competition and may therefore promote liquidity or even enable the use of market-based mechanisms where this would not otherwise have been possible.

In practice, the regional integration of balancing markets may take several forms. For those balancing services that are completely decoupled from the commodity market, the TSOs could for instance make local offers for balancing services available to each other on a bilateral basis. Preferably, however, they should set up a joint balancing platform, which combines all offers for balancing services within a given region and makes them available to all TSOs (subject to the availability of sufficient transport capacities). Both approaches render significant benefits and are successfully used in the European markets. Whilst the first model is applied for instance between France and Great Britain, the Nordic TSOs have established a common Nordic balancing market, which ensures an optimal use of available sources of flexibility on a regional scale.

A similar approach should obviously also be taken for those balancing services that can be procured from the commodity market, or at least be integrated into a corresponding market with limited additional complexity (such as the use of physical and location offers in the British balancing mechanism). Ideally, this should result in a regional marketplace, possibly operated by one or more of the European energy exchanges, where network users and TSOs can exchange gas both for trading and balancing purposes during the day.

4.3.3 Ensure compatibility of imbalance pricing and promote market-based pricing of imbalances

In section 3.2.4 we have commented on the barriers created by the use of different balancing periods. Moreover, as also emphasised by the results of the user survey, the large diversity of the current existing pricing and penalty schemes for imbalances causes additional risks and transaction costs for network users. We therefore fully agree with the conclusions of ERGEG in their 2008 Monitoring Report on the implementation of the GGP-GB that further harmonisation of balancing regimes and balancing rules is needed. We also share the view that the use of a standardised balancing period would be beneficial from the network users' point of view.

In contrast, we are however not convinced that it is absolutely necessary to apply a uniform balancing period throughout Europe. Moreover, as already discussed in section 2.5, the simple definition of the same notional balancing period does not at all imply that it is compa-

rable to other balancing regimes. Instead, we believe it is necessary to consider the effective length of the balancing period taking into account additional parameters such as the application of tolerance levels and penalty charger for shorter time periods. In addition, the use of a standardised balancing period may conflict with local technical and operational constraints as already mentioned in section 3.2.4.

In our view, it is therefore equally important to address the following issues besides the length of the balancing period:

- Additional penalties with a time horizon below the length of the balancing period;
- General pricing, and especially the resulting spreads, both for imbalance and penalty charges;
- Restrictions on the ability to pool imbalances or other means of managing a network user's imbalance position;
- Use of separate balancing regimes for national and cross-border transactions.

Perhaps even more important than some of these aspects may be a (gradual) transition to the use of market-based imbalance charges, which in many cases also allows for the abolition of additional penalty charges. As discussed in section 3.2.5, such a move would ensure that balancing charges are cost-reflective whilst avoid potential problems with regards to arbitrage between the settlement of imbalances and the commodity market. Nevertheless, we acknowledge that the application of truly market-based imbalance charges implicitly requires the use of market mechanisms for the procurement of balancing gas. Consequently, this aspect is closely related to the other potential developments discussed in the previous section, namely the use of market-based mechanisms and regional integration of the balancing markets.

5. Interaction and Phasing of Recommended Changes

The previous section has analysed a variety of actions and areas of harmonisation that may be pursued in order to promote cross-border trading and investments into new infrastructure. Although the different measures have been discussed separately, care has been taken to ensure that the individual parts are consistent with each other and can be combined into a comprehensive framework of possible actions for further improving and developing the transmission tariff and balancing models in the European gas market. Moreover, many of the proposed changes are also interrelated, i.e. measures in one field more often than not also affect measures in other areas.

The current chapter builds upon the results of the previous section by putting the findings and proposals into context with each other, with a view to highlighting the interaction between different recommendations and identifying a suitable phasing of the individual changes and actions. The following text therefore summarises potential actions in the various fields and provides some suggestions for prioritisation. Moreover, we also comment on how, in which order and at what time the respective measures might be implemented.

The recommendations developed in the previous chapter cover a wide range of different issues. To facilitate the subsequent discussion, we have therefore used the same structure as above and grouped them into the following four major areas:

- Network access and pricing;
- Regulation and investments;
- Residual balancing; and
- Imbalance settlement.

Figure 21 provides an overview of how the different items in these four groups interact with each other and what impact they have on a number of selected objectives. It is easy to see that there are various interrelations between the different groups, in particular between the area of network access and pricing, on the one hand, and the areas of regulation and investment as well as residual balancing, on the other hand. Similarly, it is not surprising to see the direct impact of the latter on possible improvements in the area of imbalance settlement.

In addition, Figure 21 also illustrates that one particular group of measures, i.e. the possible introduction of an Inter-TSO compensation (ITC) mechanism (see centre left), effectively combines measures related to two different areas, i.e. network access and pricing as well as regulation and investment. Since this ITC mechanism would furthermore have some specific requirements, we treat it as a separate area for the subsequent discussions. Overall, the following sections discuss a total of five individual areas in more detail, whilst section 5.6 provides a summary of suggested actions for further progress and implementation.

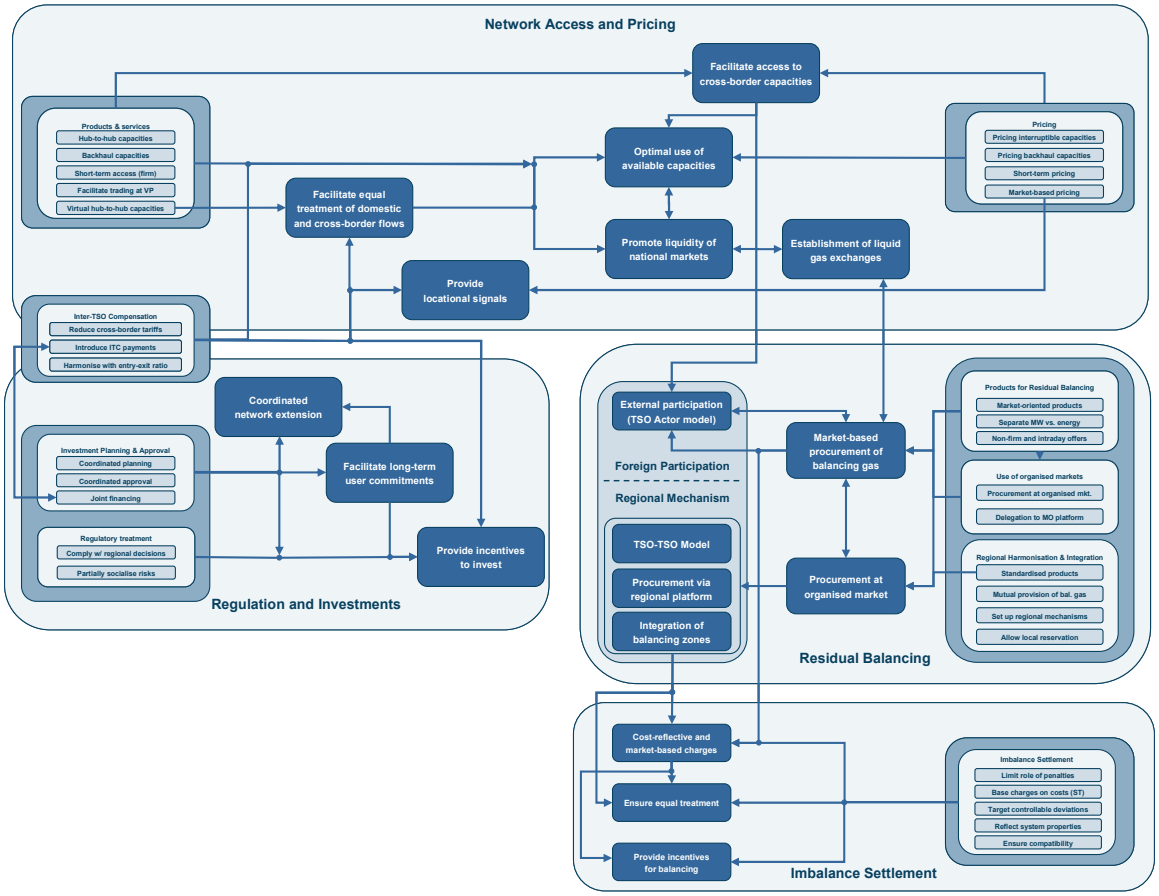


Figure 21: Interaction and impact of different measures

5.1 Network Access and Pricing

The measures in the first group are principally aimed at improving the scope for an optimal use of the transmission network. As illustrated by Figure 22, the individual measures in this group can be further divided into those related to the services and products available to us-

ers, on the one side, and the pricing of certain services, on the other. Whilst the latter are directly associated with the design of transmission tariffs, the former additionally concern important elements of capacity management which are beyond the direct scope of this study. We therefore emphasise that the following discussion is limited to only those aspects directly related to the structure and determination of transmission tariffs, whilst we do not generally consider any further aspects, such as allocation procedures or measures to be taken in case of congestion.

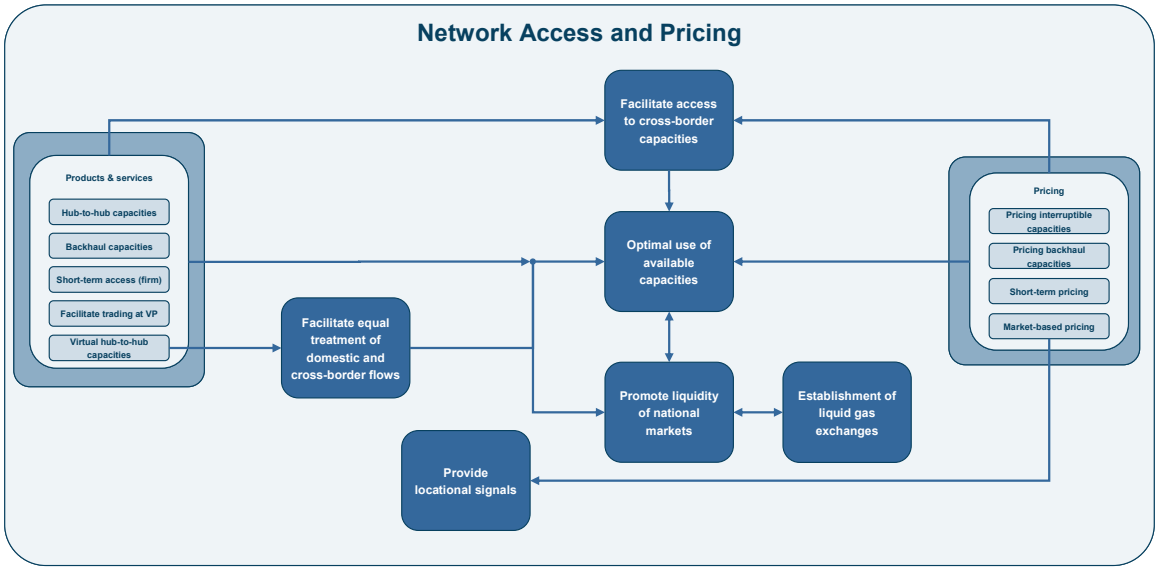


Figure 22: Interaction and impact of measures related to network access and pricing

Overall, we specifically recommend considering the following principles and potential changes within this group:

- **Products and Services**

  - Cross-border capacities should preferably, where possible, be made available to network users as hub-to-hub products, combining exit capacity from one market area with a corresponding amount of entry capacity into the other market area for all interconnections between two neighbouring market areas.

  - Network users should be generally given the opportunity to obtain non-physical backhaul capacities at all borders, at least on an interruptible basis. Where no demand currently exists, this product should at least be available on request. Where it is not made available, the TSO should provide the market with a reasonable explanation.

- To the extent possible, unused capacities should be made available to network users as firm capacity at least on a day-ahead basis. The firmness of capacity should be ensured through appropriate measures, which may potentially include (partial) restrictions for network users that have not used their capacities reserved in advance and/or through the use of instruments that enable the TSOs to reduce nominated and/or actual flows in case of physical congestion.

- Within each system, network users should be given the opportunity to exchange gas at a (virtual) trading point. Specific charges for this service (if any) should be set with a view to not discouraging the use of this service.

- TSOs and regulators should investigate the feasibility and potential benefits of introducing virtual hub-to-hub capacities.

- **Pricing**

  - Prices for interruptible and non-physical backhaul capacities should take due account of the risk of interruptions and the resulting impact on the value of these capacities. Tariffs should furthermore provide for an adequate differentiation between firm and non-firm capacities, in order to reflect the underlying differences in costs to be committed by the TSOs, whilst recovering at least the incremental costs of making interruptible and/or non-physical backhaul capacity available to users.

  - The default price to be paid for short-term capacity, including either any fixed tariff elements or a potential reserve price in case of an auction, should reflect the costs of making these capacities available on a short-term basis as well as the variable costs of transportation. At borders with contractual congestion, prices for short-term capacity should take account of the fact that network users have no guarantee of the required levels of short-term capacities available on the day ahead.[82]

[82] Where a certain share of short-term capacity is reserved for allocation on the day-ahead, for instance in order to foster market integration and the liquidity of the short-term market, it may be more appropriate to socialise the corresponding costs over all users rather than trying to differentiate between 'guaranteed' and 'additional' volumes of capacity available on the day ahead. Ich würde die Fußnote in den Text reinnehmen.

- Where the necessary preconditions are met, the price of cross-border capacities should preferably be determined through market-based mechanisms, i.e. auctions, in order to reflect the true market value of capacity.

As illustrated by Figure 22 these measures are primarily intended to facilitate access to cross-border capacity, which in turn is an important means of contributing to an optimal use of available capacities. Moreover, it also helps to increase liquidity on individual national markets and supports the establishment and use of market-based mechanisms for the procurement of residual balancing gas by means of the TSO-Actor model (see section 5.4 below). Liquidity in the national markets, which also supports the development of organised gas markets (e.g. gas exchanges), (and vice versa), would be further promoted by facilitating the exchange of gas at a single notional point in each system.

As explained in section 4.1.4 above, the offering of virtual hub-to-hub capacities would furthermore facilitate an equal treatment of both domestic and cross-border flows within a single integrated tariff system, which again would be beneficial to both the liquidity of national markets and the efficient utilisation of cross-border capacities. Finally, the market-based pricing of cross-border capacity would also serve to create locational signals in the regional gas market by reflecting the value of different transport paths.

These changes appear to be of particular importance for the further development of the European gas markets. Although we acknowledge that the first group of measures is not directly related to the design of transmission tariff and balancing models, we have already commented on the importance of these aspects before and note that the user survey has also identified capacity allocation and management as an area requiring primary attention. Overall, we therefore believe that these measures should receive clear priority and be addressed in the immediate future.

Implementation of these measures clearly requires changes to the detailed specification of corresponding products and the principles for pricing and allocation, which are largely defined at a national level. Depending on the legal and regulatory framework in each country, this will at least depend on corresponding modifications to the applicable regulatory and contractual arrangements but may, in certain cases, also require prior changes of primary and/or secondary legislation. In addition, the introduction of hub-to-hub products would obviously require further agreements between neighbouring TSOs (and regulators), although experience has shown that corresponding changes may be relatively easy to realise on a bilateral basis.

Finally, we believe that the main principles underlying the proposed changes are applicable throughout Europe, without any major variations between individual countries or regions. As a result, we furthermore believe that they are potentially suitable for treatment at European rather than regional or national level.

5.2 Inter-TSO Compensation Mechanism (ITC)

In section 3.1.2.4, we have argued that the determination of entry-exit charges based on administrative (e.g. national) borders may impair cost-reflectiveness and create barriers for cross-border trading. In this context, we have furthermore analysed the potential application of an inter-TSO compensation mechanism (ITC), which has already been applied in the European power sector since 2002 and which has also been suggested as a potential solution for the gas market.

The idea of an ITC mechanism would solve or at least mitigate this problem, whilst still allowing for the co-existence of (different) national tariff regimes. In order to achieve these objectives, this concept is effectively based on the simultaneous application of three different basic measures as follows (see also Figure 23):

- Reduction or even abolition of explicit cross-border tariffs;
- Introduction of a financial compensation scheme (ITC) between several TSOs that compensates each of them for the costs of enabling cross-border flows through its network; and
- Harmonisation of the split between entry- and exit-charges in national tariff systems with the principles for the distribution of costs under the ITC.

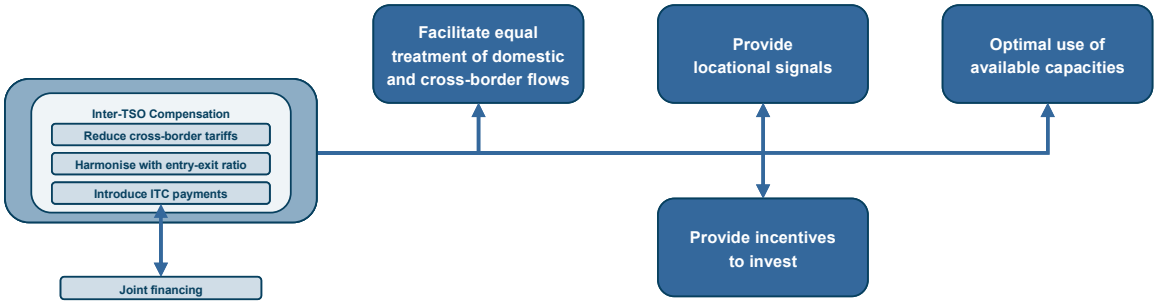


Figure 23: Interaction and impact of measures related to regulation and investments

The first element would obviously improve the scope for the (efficient) use of available capacities and promote convergence of wholesale prices by reducing the specific costs of cross-border transactions. Conversely, the second element is aimed at ensuring that each TSO or national system is fairly remunerated for the costs of providing capacity for cross-border flows. This measure effectively provides for an instrument of joint financing of investments with a regional scope (see also section 5.3 below) and should therefore help to ensure the realisation of investments that are required to expand cross-border capacity. Since the corresponding costs have to be incorporated into domestic tariffs, this measure implicitly results in locational signals as it will cause national transmission tariffs to vary.

Depending on the principles for the distribution of costs on a regional scale, individual countries may experience significant net costs or revenues, which will, amongst others, depend on the (relative) role of injections into or offtakes from the grid in each country. To ensure a level playing field between different groups of market participants, such as producers, importers, users of storage, exporters and suppliers to final end users, these measures finally should be supplemented by adjustments to the ratio between entry- and exit charges in different countries. Provided that these preconditions are met, the three measures listed above would finally also facilitate the equal treatment of domestic and cross-border flows under an entry-exit regime, even in a system with a significant share of cross-border flows.

This discussion already indicates that the development and introduction of a functioning ITC would require considerable efforts. First and foremost, it would be necessary to develop and agree on the principles for determining and distributing the costs related to cross-border flows. The complexity of this task has been clearly illustrated by the difficulties in deciding on a commonly agreed permanent mechanism in the European electricity sector where a similar model has already been applied for more than five years. Taking into account the much higher share of cross-border flows (and the average transport distance) in the European gas market, the development of a suitable methodology obviously represents an important pre-

condition that should be addressed at an initial stage. Especially if capacity was expanded to enhance security of supply, it would also need to be decided to which extent a corresponding system should be based on the capacity being made available, contracted and/or actually used in each country.

For similar reasons, it is likely that the application of a comprehensive ITC mechanism may result in significant changes of the costs to be recovered under entry-exit charges in certain countries. Besides political opposition in those cases where transmission costs would be increasing, such changes may have distorting effects on wholesale market prices during a transitional phase. In addition, fundamental variations in the relative share of transport and wholesale prices may be problematic where historic long-term contracts with fixed tariffs for transport and energy exist. Even in the absence of a regional tariff scheme,[83] and partially in contrast to the electricity market, it would be necessary to differentiate the allocation of the resulting payments through the ITC to entry and exit charges in a harmonised way, such as to ensure that both entry and exit charges reflect the desired locational signals.

If cross-border capacities in the region were at least partially allocated by auctions, another aspect to be studied concerns the treatment of auction revenues, in order to avoid a situation where individual TSOs may be remunerated twice for the same capacity, i.e. once through the ITC and once through congestion rents. This would be particularly relevant where the resulting revenues are significant in comparison with the payments to be made and the corresponding variations in entry and exit charges in different countries, since the positive effects of the ITC in the form of providing locational signals may otherwise be weakened or distorted by the difference in wholesale market prices.

Last but not least, implementation of an ITC would require the development of a suitable contractual and regulatory framework to enable the realisation of the desired financial flows. This would obviously require relevant agreements at a regional level to be concluded between the TSOs concerned, although at least the consent of the individual regulators in the region would also be needed. In some cases, it may also be necessary to adjust the legal framework in individual countries to allow for corresponding payments to be made to or received from other countries.

In summary, we believe that significant work still needs to be done before a final decision on the introduction of an ITC mechanism in one or more regions, or even on a European scale,

[83] Such as the 'Regional Entry-Exit Tariff System' (REETS) that has been studied in the Regional Initiative South-South East

can be taken. Due to the complexity of the task, it furthermore seems beneficial to initially restrict the efforts to a limited region, which should combine systems with varying shares of cross-border flows and, preferably, also be supplied from multiple sources, in order to test the robustness of the methodology developed against variations in regional flows. These considerations suggest that the corresponding issues would best be treated at regional level, for instance in one or more of the Regional Initiatives, potentially building upon the progress already made in the RI South-South West. Conversely, we believe that it would be premature to take any definitive decisions at a European level at this stage.

5.3 Regulation and Investments

The different measures within this group can be roughly split into two distinct areas; first, the procedures for harmonising the planning, approval and financing of cross-border investments at regional level and, secondly, the treatment of corresponding investment within the national regulatory framework of each country. When using this differentiation, the potential measures in this area can be summarised as follows (compare **Error! Reference source not found.**):

- **Planning, approval and financing of investments**
    - TSOs and regulators should continue their efforts for developing and applying a comprehensive scheme of coordinated regional planning, including synchronisation of the applicable timeframes for provision of information and commitments to be entered into by users.
    - Regulators should develop principles and procedures for assessing and deciding on investments of a regional scope in a coordinated manner. Such principles should preferably provide for the option of approving investments that might not otherwise be accepted on a national scale and ensure that the corresponding decisions at regional and national level are synchronised with each other.
    - Regulators should investigate the potential benefits of ensuring the financial viability of investments that have been identified as necessary for regional integration but which are not commercially viable under national rules through

financial compensations to be made between different countries on a bilateral and/or multilateral basis.

- **Regulatory treatment**

  - Regulatory rules should ensure that TSOs are not exposed to undue regulatory risk when realising investments previously identified as necessary for regional regulation. In particular, it should be safeguarded that the decision to realise the corresponding investments is not subsequently qualified as 'inefficient' by national regulation, including in future regulatory periods.

  - As a supplement and/or alternative to the option of joint financing (see above), regulators should investigate the potential benefits of at least partially socialising the risk of investments in new infrastructure becoming 'stranded', for instance by creating a firm commitment to accept the reasonable costs of corresponding investments under national regulation.

As illustrated by **Error! Reference source not found.** the first group of measures would specifically contribute to the coordinated extension of the European transmission grids. In addition, they would also facilitate long-term commitments by users, which in turn would further strengthen the potential for coordinated development and support the commercial viability of new investments. Conversely, the options in the second group are mainly aimed at

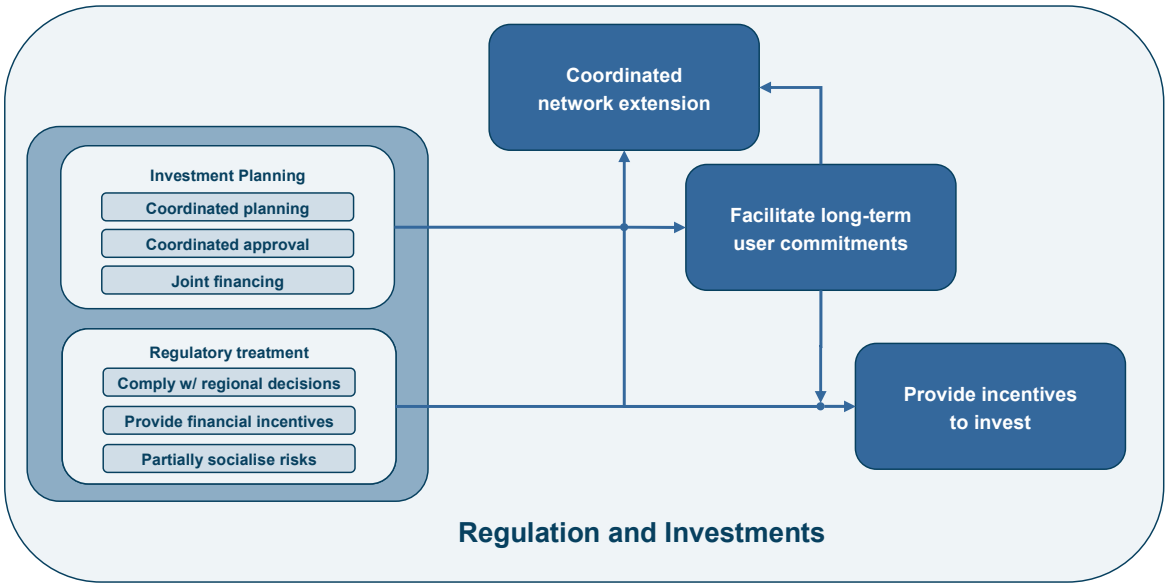


Figure 24: Interaction and impact of measures related to regulation and investments

providing sufficient incentives to invest into new infrastructure that has previously been identified as desirable or even required from a regional perspective.

Although the general case for these measures seems to be straightforward, the corresponding principles and procedures will have to be carefully developed, in order to avoid undesired interferences with national regulation and to ensure that any corresponding support is indeed targeted at efficient investments. In this context, we note that no readily available 'blueprints' of corresponding solutions exist which could be easily applied across Europe. Moreover, care has to be taken to ensure that any corresponding mechanisms are compatible with the diverse regulatory arrangements in different European countries. Finally, it is important to note that, due to the long lifetime of the corresponding assets, any decisions to be taken in this context will have a long-lasting impact on the future development and costs of the gas transmission networks concerned.

These considerations indicate that a final solution may only be obtained through a gradual learning process and that options with direct commercial impact may have to be tested in limited pilot cases first. Similar to the case of the ITC mechanism (see section 5.2), it therefore appears that the corresponding issues should preferably be initially tested in one or more regions, although they should also be studied and discussed at European level. Conversely, it would seem premature to already engage in any binding European concepts and/or decisions. Finally, it seems useful to investigate in parallel the scope for removing the underlying barriers to cross-border investments by modifications to the respective national legal and regulatory arrangements.

5.4 Residual Balancing

The next group of possible measures combines different options for improvements in the area of residual balancing by the TSOs, both at national level and with regards to regional integration. As illustrated by the upper left part of Figure 25, many of these measures are related to the general definition of the products used for residual balancing by the TSO and would thus more generally support the transition to the market-based procurement of residual balancing gas. The same is true for the second group, which represents two possible approaches for utilising the services of organised platforms for this purpose. Finally, the possible options in the third group are specifically aimed at regional harmonisation and integration of different (national) arrangements.

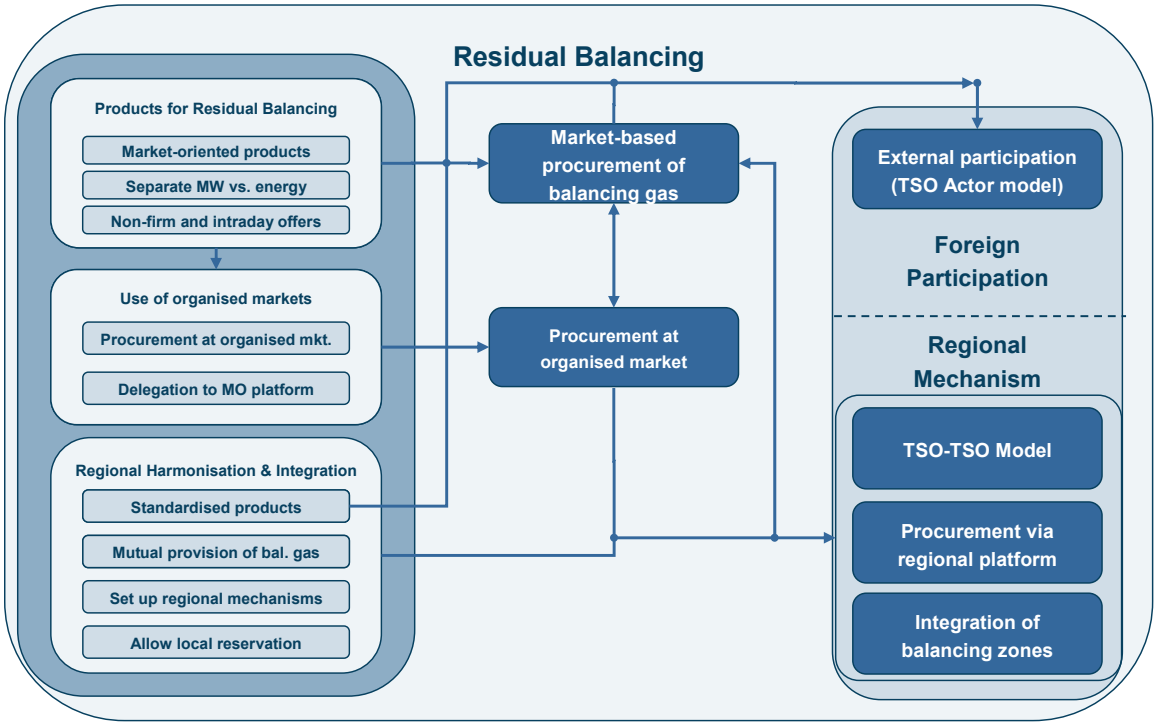


Figure 25: Interaction and impact of measures for procurement of balancing services

Concerning the first group of measures, we specifically suggest that the European TSOs consider the following principles for further developing the products to be procured as balancing services:

- **General product definition**
    - Balancing services should be designed to correspond as closely as possible to products already available in the wholesale market, including aspects such as the general product specification (e.g. daily, hourly or end-of-day products), exchanges at the notional trading point, or compatibility with general nomination deadlines.
    - Where more bespoke products or the advance procurement of flexibility are required for operational reasons, these should preferably be restricted to only a limited share of the overall need for balancing services. Moreover, such specialised products should be designed in such a way that they can be combined with other trading-oriented products, if possible in a single mechanism.

- Subject to the potential need for ensuring a minimum level of guaranteed services, network users should be allowed to offer (additional volumes of) residual balancing gas on a non-firm basis. This may include the provision of additional offers, which network users have not committed themselves to provide in advance, as well as the ability to submit new and/or modify existing bids and offers also during the operating day.

These measures primarily aim at facilitating the market-based procurement of balancing services by improving the compatibility of the corresponding mechanisms with the products traded in the wholesale gas market. Whilst this change can already be believed to increase the efficiency of the balancing process, it may be further improved by the fact that these measures would also serve to increase the scope for participation of foreign participants under the 'TSO-Actor' model, i.e. with external parties offering their services to the local TSO on an individual basis, whilst being themselves responsible for organising and ensuring the transport from the original source of flexibility to the local balancing zone. Besides the direct benefits for the process of residual balancing, the transition to a market-based process would furthermore have the major advantage of also creating the preconditions for the use of market-based and cost-reflective imbalance charges (see Figure 21 above).

The second group of potential measures relates to the use of organised markets, both at the national and regional level, for the procurement of residual balancing gas. As also shown by the left block in Figure 25, this group covers in particular the following two alternatives:

- **Use of organised markets**
  - Where organised markets (gas exchanges) with day-ahead and/or intra-day products are available, TSOs should consider these markets as a potential source of balancing gas at market-based prices, even where this would only supplement the use of other balancing services.
  - To the extent that residual balancing is mainly based on services that are compatible with products commonly traded in the wholesale market, TSOs may furthermore consider using an organised market for wholesale trading as the primary instrument for procuring gas for residual balancing purposes, possibly subject to some adjustments of the products traded in the organised market, which would need to be agreed upon in cooperation with the operator of the corresponding trading platform.

As can be seen in Figure 25, the direct effect of both measures would be limited to making an organised market an additional or even the main source of balancing gas. Similar to the previous group, these changes would thereby facilitate the market-based procurement of balancing gas and could possibly create some of the necessary preconditions for the subsequent establishment of an organised regional market platform for trading of balancing gas. In addition, it seems reasonable to assume that the use of an organised market for the residual market would benefit from the existence of a liquid gas exchange (see section 5.1 above) and vice versa.

Whilst the first two groups of measures serve to improve the process of residual balancing in general, the last set of possible changes is specifically related to regional integration. In particular, it may be worthwhile to consider the following measures:

- **Regional harmonisation and integration of residual balancing by the TSOs**
    - TSOs should endeavour to develop standardised types of balancing services that can be easily exchanged between different countries. Besides the trading of balancing gas, standardisation should particularly be sought for other types of more specialised services, such as products with certain dynamic requirements or the advance procurement of reserve capacities.
    - Especially where residual balancing gas is already procured via market mechanisms, TSOs should investigate the scope for the mutual exchange of balancing gas during the operating day, providing each other with additional sources of flexibility and the ability to offset opposite deviations in their grids.
    - Ideally, mutual cooperation between TSOs should result in the establishment of regional mechanisms that provide a common platform for the procurement and exchange of balancing gas and, potentially, also other balancing services, between multiple TSOs.
    - Where necessary, the mutual exchange and sharing of balancing services may have to be supplemented by the introduction of specific measures to ensure the availability of a certain minimum volume of specific services for the local TSO.

The use of standardised products would obviously facilitate the provision of balancing services by external parties ('TSO-Actor' model). Even more importantly, it would create the basis for the effective sharing and exchanging of corresponding services between different TSOs, which we consider the starting point for the future development of a fully integrated regional mechanism for balancing. As illustrated by the different models in the bottom right of Figure 25, such exchange may take several forms, ranging from the direct exchange between individual models (TSO-TSO model) via the use of a common regional platform (which may be operated either by the TSOs or be part of a wholesale trading platform) to a fully-fledged merger of different balancing zones.

Irrespective of the specific characteristics and advantages of the different approaches, we recommend that efforts should be targeted at gradually developing the existing arrangements towards one (or more) of these models, in order to achieve full regional integration in the area of residual balancing, which will not only increase competition and promote efficiency but also provide the basis for a maximum degree of harmonisation in the area of imbalance settlement.

Although it may appear surprising on first sight, the fourth measure mentioned above supports this process by allowing individual TSOs to take account of specific local circumstances, which may include operational requirements, a limited availability of flexibility or insufficient scope for full-scale competition. In this context, we emphasise again that it may not be possible, or even desirable, to pursue a uniform approach with regards to residual balancing throughout Europe and that some of the measures may not be applicable in all regions. For instance in those countries where the TSO is usually able to rely on the use of linepack for residual balancing, there may only be a limited economic rationale for introducing a sophisticated market-based system, especially if it was not required on a regular basis. Similarly, where insufficient scope for competition between different providers of balancing services exists, additional measures may be required to limit the application of market-based mechanisms to only the part of the required services that can be procured on a competitive basis.

Taking into account these considerations, we believe that a differentiated approach is required, with sufficient flexibility to adjust to the different structures and stages of development in different countries and regions. As a consequence, and also in accordance with the parallel development in the European power markets, we therefore recommend that further progress should be mainly sought at regional (as well as national) level, for instance within the context of the Regional Initiatives. In our view, this flexibility should also be used to iden-

tify, develop and potentially test different approaches rather than immediately embarking on a final solution that has not been proven in practice.

Nevertheless, we also recommend that the European TSOs, in conjunction with the regulators and other stakeholders in the market, should now focus on developing a standardised set of (market-oriented) balancing rules, which can serve as the basis for the gradual introduction and/or harmonisation of the corresponding products. In addition, we suggest that activities should initially focus on making use of organised trading platforms that already exist, especially since this may be achieved at very limited costs whilst promising the dual benefit of promoting the market-based procurement of balancing gas and stimulating liquidity in the corresponding part of the wholesale market.

Conversely, the relatively early stage of development in most European gas markets seems to suggest that further initiatives towards true regional integration through direct TSO to TSO cooperation should only be focused upon once and where a sufficient degree of harmonisation has already been achieved and where at least some form of market-based mechanism is already in place. However, especially in case of smaller market areas, regional cooperation and/or a joint approach may represent a precondition for achieving any tangible progress in this direction.

5.5 Imbalance Settlement

As already discussed residual balancing and imbalance settlement are closely related to one another as they effectively represent two sides of the same coin. Ideally, imbalance charges should reflect the costs of residual balancing. Consequently and as already indicated by Figure 21 especially the transition to the market-based procurement and pricing of balancing gas would also enable major improvements in the area of imbalance settlement.

In the following section, we specifically consider the following measures that may help to reduce potential barriers caused by current principles and differences of imbalance settlement:[84]

[84] Please note that the following list is not conclusive and does contain some other objectives or requirements which are commonly demanded, such as the pooling of imbalances, market information and transparency, or the financial neutrality of the overall arrangements for balancing.

- Wherever possible, imbalance settlement should be primarily based on cash-out charges. Conversely, the role of penalty charges should be limited to providing additional incentives which cannot be achieved through cash out charges alone, and that are targeted at preventing any abuse of potential flexibility within the system.

- In order to ensure that imbalance cash out charges are truly cost reflective and provide the right incentives to users, they should be optimally based on the short-term costs of residual balancing, i.e. the incremental costs of balancing the system on a daily basis.

- Care should be taken to ensure that any incentives provided by imbalance settlement are targeted at deviations that can actually be influenced by users.

- The key parameters of imbalance settlement should be designed with a view to reflecting the actual physical capabilities and constraints of the respective system.

- TSOs and regulators should aim at ensuring compatibility between the structure and level of imbalance cash out and penalty charges as well as any associated tolerances (where applicable) of neighbouring countries or market areas.

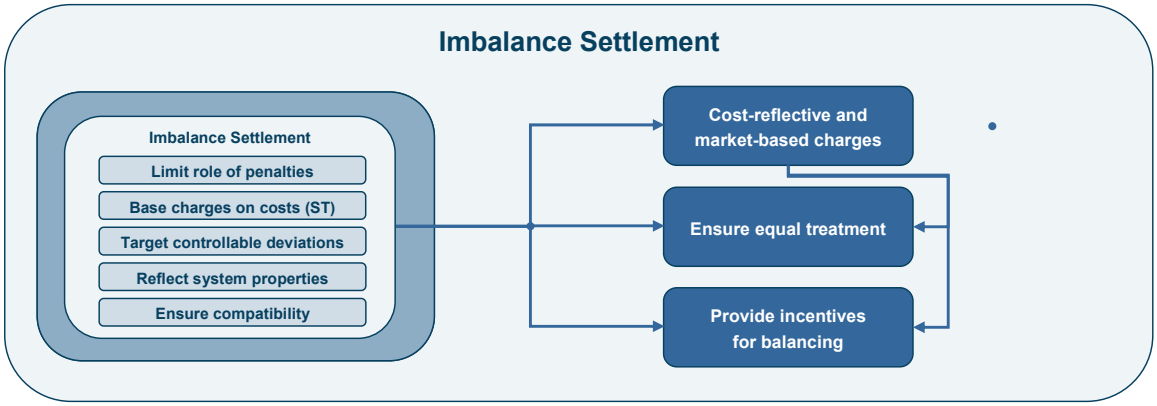


Figure 26: Interaction and impact of measures for imbalance settlement

As illustrated by Figure 26, most of the aspects mentioned are aimed at enabling the application of truly cost-reflective and, in combination with the market-based procurement of residual balancing gas (see section 5.4 above), market-based cash out charges, which in turn will help avoid discrimination and provide incentives for balancing to users. In contrast to most of the measures discussed in section 5.3, the different principles are however strongly interrelated and cannot simply be regarded as complementary but largely independent

measures. For instance, although imbalance charges should generally follow the 'causer pays' principle, the resulting incentives for balancing will only be efficient if they reflect the true costs of balancing and are applied to those imbalances which a user can control. Conversely, excessive penalties on any inevitable deviations which a user cannot influence (or only at unreasonable costs) will only be of a punitive nature and can even reduce rather than increase the efficiency of the balancing process.

Similarly, imbalance charges can only be truly cost-reflective where they also reflect the flexibility and constraints of the respective system. Consequently, underlying differences in the physical structure of individual systems and their inherent flexibility may require the use of different balancing intervals or other major determinants of imbalance settlement. For these reasons, we also believe that further development should be primarily aimed at ensuring compatibility between neighbouring systems, whilst further harmonisation should be pursued where this is reasonably possible.

Taking into account the potential need for differing solutions, it appears that the corresponding measures should be mainly pursued at national and, where practical, also regional level (for instance within the framework of the Regional Initiatives). Moreover, the full transition to market-based and cost-reflective imbalance charges is obviously subject to the market-based procurement of residual balancing gas and will, in many cases, require a major reform of the overall arrangements for imbalance settlement.

Overall, we therefore believe that it may be beneficial to initially concentrate on improvements in the area of residual balancing, particularly with regards to the market-based procurement of residual balancing gas, which should then also be reflected in imbalance cash out prices. Moreover, even in the short-term, it may already be possible to focus on the review and, potentially, reduction and/or removal of any undue penalties and/or to generally review whether the current structure of penalty and cash out charges reflects the inherent flexibility and constraints of the local system.

5.6 Suggested Actions

The previous sections have briefly discussed and illustrated the impact and interactions of a variety of different measures that may be considered to improve the scope for an optimal use of the transmission networks, enabling investments into efficient expansions of the cross-border transmission structure, and removing barriers for cross-border trade created by

current arrangements for residual balancing and imbalance settlement. For each area, we have also commented on how these improvements might best be progressed and at what level the underlying legal and regulatory arrangements may be made.

Based on these discussions, the following table provides a summary of proposed actions in each area over three different timescales (immediate action, follow-up and long-term). As indicated in the table, we assume that the first of group of 'immediate actions' would start straight away and be completed within a maximum of 2 years. In contrast, 'follow-up' actions are suggested to be dealt with in the medium term (approx. 1 – 5 years from now), whilst long-term actions would only be realised after 3 years or more.

Table 15: Summary of proposed actions

Immediate action (0 – 2 years)	***Follow-up (1 – 5 years)***	***Long-term (≥ 3 – 5 years)***
Network Access and Pricing		
• *TSOs to offer backhaul capacities (at least on request)* • *TSOs and regulators to review / adjust pricing of backhaul and interruptible capacities* • *TSOs and regulators to develop concept for implementation of short-term products (including pricing)* • *TSOs to enable trading of exchange at notional point (review pricing)* • *TSOs and regulators to start developing common principles for the offering and pricing of long- and short-term capacities, including backhaul and interruptible capacities*	• *Offer cross-border capacity as hub-to-hub products* • *Introduce short-term products* • *Migrate to market-based allocation of cross-border capacities (where possible)* • *TSOs and regulators to finalise common principles for the offering and pricing of long- and short-term capacities, including backhaul and interruptible capacities* • *TSOs and regulators to study and test feasibility of virtual hub-to-hub capacities, paying particular attention to the following:* o *Product definition* o *Determination, allocation and pricing of available capacities* o *Nomination and delivery, including optimisation of flows (in case of multiple possible paths)* o *Distribution of income* o *Information to be exchanged between TSOs* *Decide on implementation*	• *TSOs to implement virtual hub-to-hub capacities (subject to positive decision before)*
Inter-TSO Compensation Mechanism		
• *Regulators and TSOs to analyse results of experience from European electricity market and RI South-South East (REETS)* • *Regulators to determine scope of aspects to be analysed* • *TSOs and regulators to start studying issues identified*	• *TSOs and regulators to develop and test different models* • *TSOs and regulators to develop appropriate legal, regulatory and contractual arrangements for implementation of ITC* • *TSOs and regulators to decide on implementation of ITC*	• *TSOs and regulators to implement ITC (subject to positive decision before)*

Immediate action (0 – 2 years)	*Follow-up (1 – 5 years)*	*Long-term (≥ 3 – 5 years)*
Regulation and Investments		
• *Regulators and TSOs to follow up on 2009 consultations for long-term development plan* • *Regulators to start developing principles for identifying and dealing with deviations between Community-wide and national development plans* • *Regulators (and TSOs) to identify risk of national regulation conflicting with regional decisions on necessary investments*	• *TSOs to prepare and publish updated versions of 10-year development plan* • *Regulators to study feasibility and options of* o *Regional assessment and approval of investments* o *Joint regional financing* • *Regulators to develop options for ensuring that national regulation supports regional decisions on necessary investments* • *Regulators to explore benefits of increasing socialisation of risks for expansion investments*	• *Decide and implement on areas studied under follow-up actions*

Immediate action (0 – 2 years)	*Follow-up (1 – 5 years)*	*Long-term (≥ 3 – 5 years)*
Residual balancing		
• *National TSOs and regulators to analyse scope for introduction of market-oriented products* • *TSOs to facilitate provision of residual balancing gas at notional trading points* • *TSOs to investigate scope for procurement of balancing gas from organised market (in selected countries)* • *TSOs to investigate scope for mutual exchange of balancing gas*	• *TSOs to procure balancing gas via market-based mechanisms (where feasible and useful)* • *TSOs to develop standardised set of market-oriented products for residual balancing (incl. reservation of capacity where necessary)* • *TSOs to investigate scope for procurement of balancing gas from organised market (in selected countries)* • *TSOs and market operators to study possible cooperation for procurement and exchange of balancing gas* • *TSOs to develop concepts for standardised exchange of balancing gas (TSO-TSO model)* • *TSOs and regulators to investigate scope for merging small balancing zones with neighbouring / larger systems*	• *TSOs to procure standardised set of market-oriented products for residual balancing* • *TSOs to implement TSO-TSO model and/or procurement via regional trading platform (where feasible / applicable)* • *TSOs and regulators to investigate scope for merging small balancing zones with neighbouring / larger systems*
Imbalance settlement		
• *Regulators and TSO to review role of penalty and cash out charges in national systems*	• *Regulators and TSO to reduce role of penalty charges in national systems* • *Regulators and TSO to ensure that cash out charges reflect short-term costs of residual balancing*	• *Same as follow-up*

6. Appendices

6.1 References

6.1.1 Legislative sources

Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC

Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC

Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003

Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005

Regulation (EC) No 1775/2005 of the European Parliament and of the Council of 28 September 2005 on conditions for access to the natural gas transmission networks

6.1.2 Other sources

ERGEG. ERGEG Guidelines of Good Practice for Gas Balancing (GGPGB). Ref: E06-GFG-17-04, 6 December 2006

ERGEG. Gas Regional Initiative - Region: South-South East. The opportunity and requirements to introduce a regional entry-exit tariff system - A preliminary study. Draft version, 16 February 2007

ERGEG. Gas Transmission Tariffs - An ERGEG Benchmarking Report. Ref: C06-GWG-31-05, 18 July 2007

ERGEG. Secondary Markets - the way to deal with contractual congestion on interconnection points – An ERGEG Conclusions Paper. Ref: E07-GFG-22-14b 18 October 2007

ERGEG. ERGEG principles: Capacity allocation and congestion management in natural gas transmission networks: An ERGEG Public Consultation Document. Ref: E08-GFG-41-09. Brussels, 15 Jan 2008

ERGEG. 2008 Monitoring Report: Implementation of the ERGEG Guidelines of Good Practice for Gas Balancing (GGP-GB). Ref: E08-GMM-03-03, 10 December 2008

ERGEG: ERGEG principles: Capacity allocation and congestion management in natural gas transmission networks An ERGEG Evaluation of Comments Paper. Ref: E09-GNM-07-03, 24 August 2009

ETSO/EuroPEX. FMC-Flow-based Market Coupling - A joint ETSO-EuroPEX Proposal for Cross-Border Congestion Management and Integration of Electricity Markets in Europe. September 2004

ETSO. Cross-Border Electricity Exchanges in meshed AC Power Systems. April 2004

ETSO. ETSO 2004 CBT Mechanism. 8 April 2004

ETSO. The current ETSO ITC Model and possible development. 28 June 2005

ETSO. Regional Flow-based allocations – State-of-play. March 2007

ETSO. Explanatory Note to ITC 2008-2009 Agreement. 14 January 2008

ETSO. ETSO Response to EC Consultation Paper on the Inter-TSO Compensation Mechanism. 17 March 2009

European Commission. Commission Staff Working Document. Accompanying document to the Inter Transmission System Operator Compensation Mechanism and Harmonisation of Transmission Tariffs for Electricity - Summary of IMPACT ASSESSMENT, Draft SEC(2008) yyy, Brussels, 3 July 2008

European Commission. Consultation document on the inter-TSO compensation mechanism and on harmonisation of transmission tarification, "Towards fair and non-disriminatory arrangements for trans European cross-border power flows", DG TREN / C2, 9 December 2008.

European Commission. COM(2009) 115 final. Report on progress in creating the internal gas and electricity market. Communication from the Commission to the Council and the European Parliament. Brussels, 11.3.2009

European Commission. Press Release IP/09/1035. Commission acts to ensure effective and competitive energy market across Europe. Brussels, 25 June 2009

GTE+. GTE+'s Consultation Document on Capacity Products Coordination. Ref: 08GTE+300, 28 October 2008

GTE+. GTE+ Capacity Product Coordination First Phase Report. Ref: 09GTE+107, 27 March 2009

Hunt, Paul. Entry–Exit Transmission Pricing With Notional Hubs, Oxford. February 2008.

NERA / TPA Solutions. Gas Balancing Rules in Europe, A Report for CREG. Appendix B. London / Solihull. 23 December 2005

6.2 Background Information on User Survey

Over 35 parties, among them TSOs, NRAs and other stakeholders (exchanges, associations, producers, traders, incumbents and suppliers) over the whole European region were invited (cf. 6.2.10425169 \r \h **|**7.1.1**}**) to give their views on tariffs, tariff regulation and balancing. The parties were asked to answer a questionnaire prepared by KEMA. The questionnaire was sent to all parties in advance and answers were then gathered during telephone interviews of 1 or 1.5 hours. Recorded answers were then sent to the interviewed parties to prevent any misunderstandings and to give respondents the chance to further elaborate on issues missed during the interview.

Of the 35 parties invited 19 responded and answered the following questionnaire:

- **Tariffs & Regulation**
    - In what way do current tariff and product structures and particularly differences between several countries impede cross-border trading? (Bundled products, duration, capacity-vs.-energy charges, pancaking etc.)
    - To what extent do current tariff structures signal the need for (economically justified) investments at certain parts of the trans-European gas network?
    - Is there, in your view, any necessity to treat cross-border investments and/or tariffs differently from domestic ones?
    - Where countries apply different arrangements for the regulation and pricing of investments aimed at domestic or cross-border transports, how do you view their compatibility with each other?
    - Does national regulation (in different countries) provide explicit or implicit incentives for efficient (cross-border) investments and if so, how do you view them?
    - Have you observed any problems with regards to investments into new transport infrastructure (including open season procedures), what were the reasons and how were such problems dealt with?

- Do different national procedures, for instance with regards to decisions on investment approval or the remuneration of future and/or past investments, hinder efficient investment and how?
- Is there any need for increased cooperation between regulators and TSOs from different countries and how might this be achieved? Is it sufficient to deal with cross-border tariffs and investments on a national level, or is there any need for a regional and/or European level?
- Do you see any need for further harmonisation of regulatory principles and procedures, including timing issues, between different countries?

- **Balancing**
  - In what way do (different) arrangements for balancing and imbalance settlement impede cross-border trading?
  - Do you see any risks that such differences may be exploited at the expense of other (neighbouring) countries or market areas, and how?
  - What is your view on the main determinants and principles of an "optimal balancing regime", including the procurement of residual balancing gas (including the role of the TSO for balancing) as well as the different aspects of imbalance settlement (e.g. settlement intervals, tolerance, imbalance pricing, ex-post trading etc.)?
  - What are the main elements of balancing and imbalance settlement that should be harmonised on a regional / European level and why (not)?
  - What is your view regarding regional balancing? What (dis-)advantages, potential pitfalls, major preconditions and regulatory requirements do you see? What should it entail?

- **General (going beyond the areas covered before)**
  - What are the main barriers to cross-border trade and the realisation of efficient investments to increase cross-border capacity? (required by whom and why?)

- Which elements of the national market arrangements should be harmonised on a regional and/or European level in order to promote cross-border trade?
- How do you see the importance of tariffs, regulation and balancing / imbalance settlement in this context?

6.2.1 List of Contacts for User Survey

TSO	*OMV Gas GmbH, Austria*
	Fluxys SA, Belgium
	GRTgaz, France
	WINGAS Transport GmbH & Co. KG, Germany
	MOL Gas Transmission Plc., Hungary
	Snam Rete Gas S.p.A., Italy
	Gas Transport Services B.V., Netherlands
	Eustream a. s., Slovak Republic
	National Grid, Great Britain
NRA	*Energie-Control, Austria*
	CREG, Belgium
	CRE, France
	Bundesnetzagentur, Germany
	AEEG, Italy
	NMa / Energiekamer, Netherlands
	URE; Poland
	ERSE, Portugal
	AGEN, Slovenia
	Ofgem, UK

Producers / Traders / Suppliers	*Essent Energy Trading BV, Netherlands*
	GDF SUEZ SA, France
	E.ON Energy Trading SE, Germany
	RWE Supply & Trading GmbH, Germany
	ENDESA S.A., Spain
	Statkraft Markets GmbH, Germany
	Shell Energy Deutschland GmbH, Germany
	Esso Nederland BV, Netherlands
Exchanges	*APX B.V., Netherlands*
Associations	*Eurogas*
	GEODE
	European Chemical Industry Council
	Eurelectric
	IFIEC Europe
	EFET
	Association francaise du gaz, France
	International Association of Oil & Gas Producers