Initial Impact Assessment

for

the Framework Guidelines
on
Electricity Balancing

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1 Procedural issues and consultation of interested parties

1.1 Identification

Electricity *balancing* covers all the actions and activities performed by a Transmission System Operator (*TSO*) to ensure that in a *control area*, total electricity withdrawals (including losses) equal total injections in real time operation. These activities, simultaneously performed in all *control areas* and between *control areas*, contribute to ensuring the balance and stability in the synchronously operated electricity system.

Not only are the *balancing* mechanisms technical arrangements set out to ensure system stability; they also have implications on competition as procuring operating reserve capacities and *balancing energy* normally entails commercial arrangements with *imbalances* levied on the market through settlement mechanisms.

As national grids and electricity markets have become more interconnected, the interest in cross-border *balancing* has grown. When national *control areas* are synchronously connected, the physical characteristics of power flows require that national *TSOs* cooperate in order to balance the entire system.

Cross-border *balancing* arrangements can also play a role in interconnected markets between non-synchronous areas, as one can see from the BALIT arrangements, which have been in place on the IFA interconnector since December 2010.

1.2 Rationale behind the Initiative and the *Agency*'s Mandate

At the heart of the third legislative package is the development of EU-wide Network Codes on topic areas for the integration of EU electricity and gas markets. The objective of these codes is to promote the completion and functioning of the internal market in electricity and cross-border trade and to ensure the optimal management, coordinated operation and sound technical evolution of the electricity transmission network in Europe. The process for developing these codes is stipulated in the Third Energy Package legislation. It includes the elaboration of Framework Guidelines by the *Agency*, which set out the key principles for the development of the Network Codes by the European Network of Transmission System Operators for Electricity ("ENTSO-E").

The Framework Guidelines on Electricity Balancing ("Framework Guidelines") aim at setting out clear and objective principles for the development of network codes pursuant to Article 6 paragraph 2 of Regulation (EC) No 714/2009 (the "Electricity Regulation"). They cover the areas pursuant to Article 8 (6) (h) and (j) of the Electricity Regulation (EC). The network code adopted according to these Framework Guidelines ("Network Code on Electricity Balancing") will apply to the rules for trading related to technical and operational provision of system *balancing* and the *balancing* rules including network-related reserve power rules between the zones in the EU electricity market. The Network Code on Electricity Balancing shall be without prejudice to the Member States' right to establish national Network Codes, which do not affect cross-border trade[1];

Framework Guidelines address the integration, coordination and harmonisation of the *balancing* regimes, in order to facilitate electricity trade within the EU in compliance with Directive 2009/72/EC (the "Electricity Directive") and the Electricity Regulation.

[1] Article 8.7 Regulation (EC) No 714/2009, OJ L211/15, 14.8.2009

The European Regulators' Group for Electricity and Gas ("ERGEG") developed Guidelines of Good Practice for Electricity Balancing Markets Integration (GGP-EBMI) in 2009. These GGP contained ERGEG views on electricity balancing markets integration, in the sense of Articles 11.7, 14.6 and 26.2(b) of the Electricity Directive (2003/54/EC). The final GGP-EBMI (E09-ENM-14-04) was published in September 2009. To draft the GGP-EBMI, NRAs cooperated with consultants working on a study about *balancing*, *intraday* and ancillary services for the European Commission. The conclusions of this study also constitute the relevant background information and were considered in the preparation of the Framework Guidelines.

The 15th Florence Forum, held November 2008, invited ERGEG to establish a Project Coordination Group of experts, with participation of relevant stakeholders and with the tasks of developing a target model for five key areas: capacity calculation, long-term capacity allocation, *day ahead*, *intraday* and *balancing*. Although a multilateral *TSO-TSO* model with common *merit order list* was seen as the long-term target model, the agreed medium-term target model for cross-border *balancing* exchanges was a multilateral *TSO-TSO* model without common *merit order list*. In December 2009, the Florence Forum welcomed the initiative, the work done and the target model proposed by the Project Coordination Group. This broad agreement could facilitate the agreement on the content of the Framework Guidelines and Network Code on Electricity Balancing and on the concrete implementation of balancing markets integration projects.

In mid-2011, ENTSO-E published a position paper on cross-border *balancing*[2] in which several issues related to implementation of the target model are highlighted, in particular, preserving high levels of security of supply enjoyed to date, consistency of target model with other areas of market development and clearly defined responsibilities of each *TSO* in cross-border *balancing* schemes.

In mid-2011 the *Agency* also established a dedicated team responsible for drafting the Framework Guidelines which started by focusing on defining the scope of the Framework Guidelines. The scoping phase ended in December 2011 and the following issues to be covered in Framework Guidelines were identified:

- set out the roles and responsibilities of both *TSOs* and *BSPs*;
- set out harmonised technical specifications for facilities providing *balancing services*;
- define compatible *balancing* products and timeframes for the procurement of *balancing services*, and prepare harmonised rules for selection and remuneration of these services;
- set out a harmonised and non-discriminatory framework for settling system *imbalances* with the *BRPs*, including calculation of *imbalances*, pricing of *imbalances*, imbalance periods, settlement timeframes, clearing requirements;
- set out rules for the use of *cross-border transmission capacities* for the exchange of *balancing services*. The rules should also consider how access arrangements can efficiently accommodate both requests for *balancing* purposes and for firm commercial deliveries.

In addition to the issues above, the scoping phase also identified the need for the Framework Guidelines to anticipate further developments such as increasing intermittent generation and the more active role for consumers.

1.3 Organisation and timing

The European Commission invited the *Agency* to draft the Framework Guidelines on Electricity Balancing, taking into account overlapping conclusions from the Framework Guidelines on

[2] https://www.entsoe.eu/fileadmin/user_upload/_library/position_papers/110531_AS_TOP_08_XBBalancing_Consolidated_Final.pdf

Electricity System Operation and acknowledging links with the Framework Guidelines on Capacity Allocation and Congestion Management (CACM). The invitation letter from the European Commission acknowledged the conclusion of the scoping phase and requested the Framework Guidelines to set the framework for competitive, harmonised and effective EU-wide *balancing* arrangements.

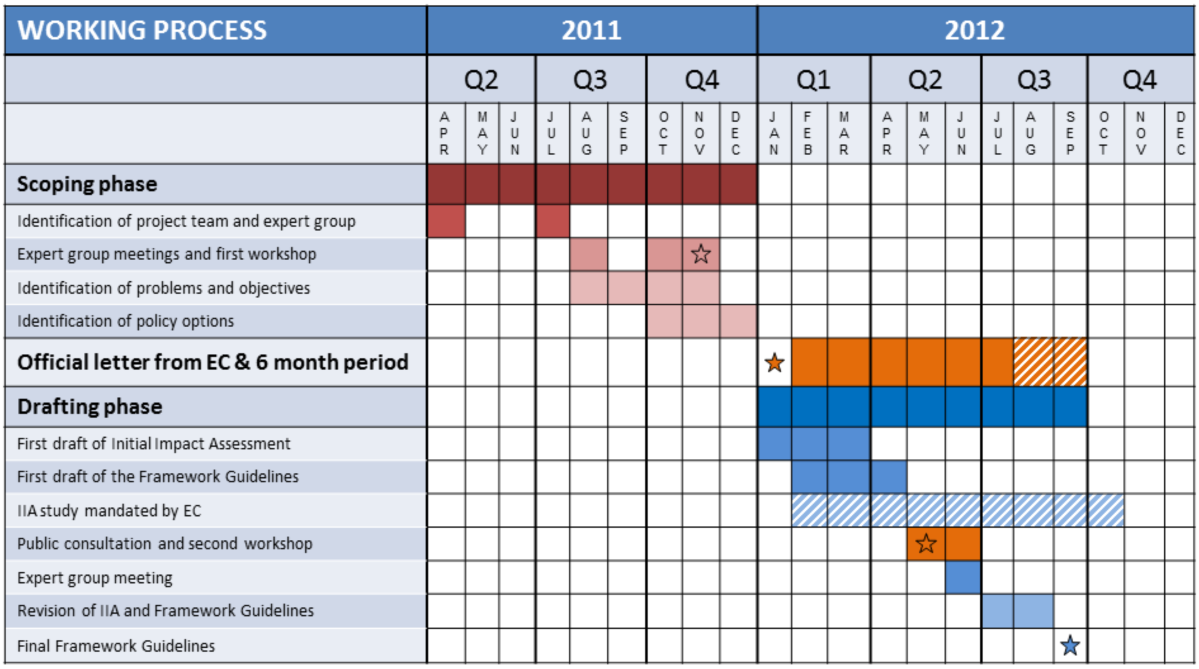


Figure 1: Project plan or development of Framework Guidelines

1.4 Consultation and expertise

The *Agency* has set up an informal "ad hoc" group of experts on electricity balancing. The goal of this group is to provide expert support to the *Agency* during the development of the Framework Guidelines on Electricity Balancing. The expert group consists of experts with a diverse background - ranging from *TSOs*, generators, end users, consultants and academics - who do not represent interests in their companies. The details on the roles of these experts are described in the invitation letter and are available on the *Agency's* website. The members are:

Javier Alonso Perez (Endesa)
Christopher Proudfoot (Centrica)
Nigel Hawkins (Enel)
Rudi Hakvoort (D-Cision)
Goran Strbac (Imperial College)
Gerard Doorman (Norvegian University of Science and Technology)
Susanne Dornick (E.ON)
William Chan (Air Liquide)
José Ignacio de la Fuente (REE)
Yves Harmand (RTE)
Emeline Spire (Elia)
Lasse Sundahl (Energinet)
Christian Hewicker (KEMA)
Marcus Stobrawe (Amprion)

The expert group met with the drafting team in three meetings during the scoping phase, on August 28th, October 11th, and November 29th 2011. One informal meeting also took place in Paris during the consultation phase, on June 12th 2012.

On October 24th 2011, the *Agency* hosted a first workshop on electricity balancing in Ljubljana. The *Agency* presented its initial views on the main policy options available and invited stakeholders to express their opinions. The summary of the workshop can be found on the following link[3].

In January 2012, the European Commission awarded a consortium of consulting companies to assist the *Agency* in drafting an impact assessment for the Framework Guidelines on Electricity Balancing. The purpose of this contract is to assist the *Agency* in preparing an Initial Impact Assessment for the Framework Guidelines on Electricity Balancing. The task includes:

(1) Identifying together with the *Agency* the issues and options for European electricity balancing market based on the target model.

(2) Analysing the feasibility and technical, economic and social impacts of the identified options.

(3) Proposing the key design elements for a European balancing market to be included in the framework guideline.

(4) Proposing a tentative roadmap for implementing a European balancing market.

On April 26th the *Agency* launched a public consultation on the draft Framework Guidelines lasting for two months, and hosted a Presentation of the draft Framework Guidelines in Ljubljana on May 29th 2012. The *Agency* presented the content of the draft Framework Guidelines and invited stakeholders to express their opinions. More information can be found on the following link[4].

During the consultation phase, the *Agency* received 48 responses from stakeholders. The responses and evaluation of responses are available on the following link[5].

[3] http://www.acer.europa.eu/Media/Events/ACER_Workshop_on_Electricity_Balancing_FG/default.aspx?InstanceID=1

[4] http://www.acer.europa.eu/Media/Events/Presentation_of_the_Draft_FG_on_Electricity_Balancing/default.aspx

[5] http://www.acer.europa.eu/Official_documents/Public_consultations/Closed%20public%20consultations/DFGEB-2012-E-004_FG_on_Electricy_Balancing/default.aspx

2 Problem definition

2.1 What is the issue or problem that may require action?

System *balancing* is a complex task, which requires from *TSOs* to take actions to ensure that electricity demand and supply are equalled in real-time in order to preserve the operational security of the system.

Background

Liberalisation of the electricity market introduced the concept of *balancing* as a competitive market, where the demand and supply for *balancing services* are met. Thus, the *balancing* is characterised by two core components: the procurement of *balancing services* and the settlement of *imbalances*, as illustrated in figure 2.

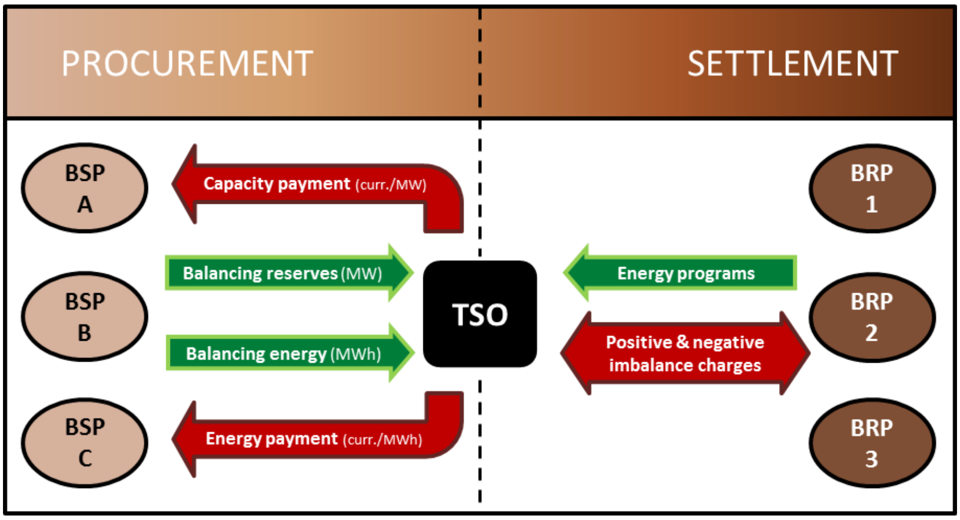


Figure 2: General description of typical balancing markets

Procurement of balancing services

Being responsible for the safe and secure operation of electricity systems, the *TSOs* manage the physical equilibrium on the grid by securing a set of *balancing services* to cope with supply/demand deviations. *Balancing services* can be secured by means of contracted and/or non-contracted services delivered by different parties - referred as Balance Service Providers (*BSP*) - over different timescales.

In *balancing*, the *TSOs* need to ensure that they will always be able to activate sufficient amount of energy to balance the deviations between supply and demand in real time. This defines the concept of "*balancing energy*", which is provided by the *BSPs* that are able to meet the necessary technical requirements to deliver this service. As *TSOs* are faced with the risk that they will not have enough offers for *balancing energy* from *BSPs* in real time, they can hedge this uncertainty by securing in advance sufficient amount of power capacity available in their *control area*. An option, giving the *TSOs* the possibility to activate the certain amount of *balancing energy* within a certain timeframe, is defined as "*balancing reserve*". It is typically defined as the available generation or demand capacity, which can be activated either automatically or manually, to balance the system in real time. The *TSOs* usually check and/or strike contracts to guarantee they have access to these *balancing reserves* ahead of real time.

The *balancing energy* in real time can thus be provided by the *balancing* resources, which were secured in advance as *balancing reserves,* or by other *balancing* resources that are offering *balancing energy* on a voluntary basis, subject to their availability in real time.

In order to deal with disturbances, system operation involves three types of *balancing reserves*: *Frequency Containment Reserve* (FCR), *Frequency Restoration Reserve* (FRR) and *Replacement Reserve* (RR). They are part of a sequential process based on successive layers of control.

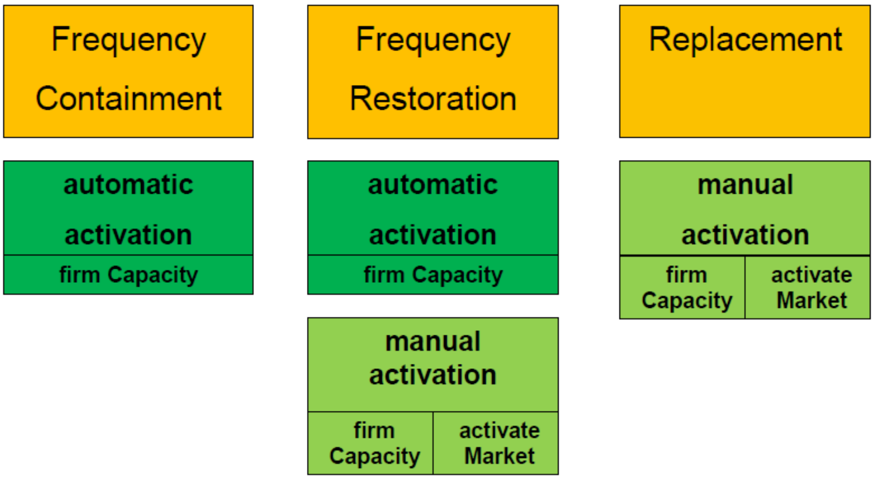


Figure 3: Different kinds of Reserve and Sourcing (ENTSO-E)

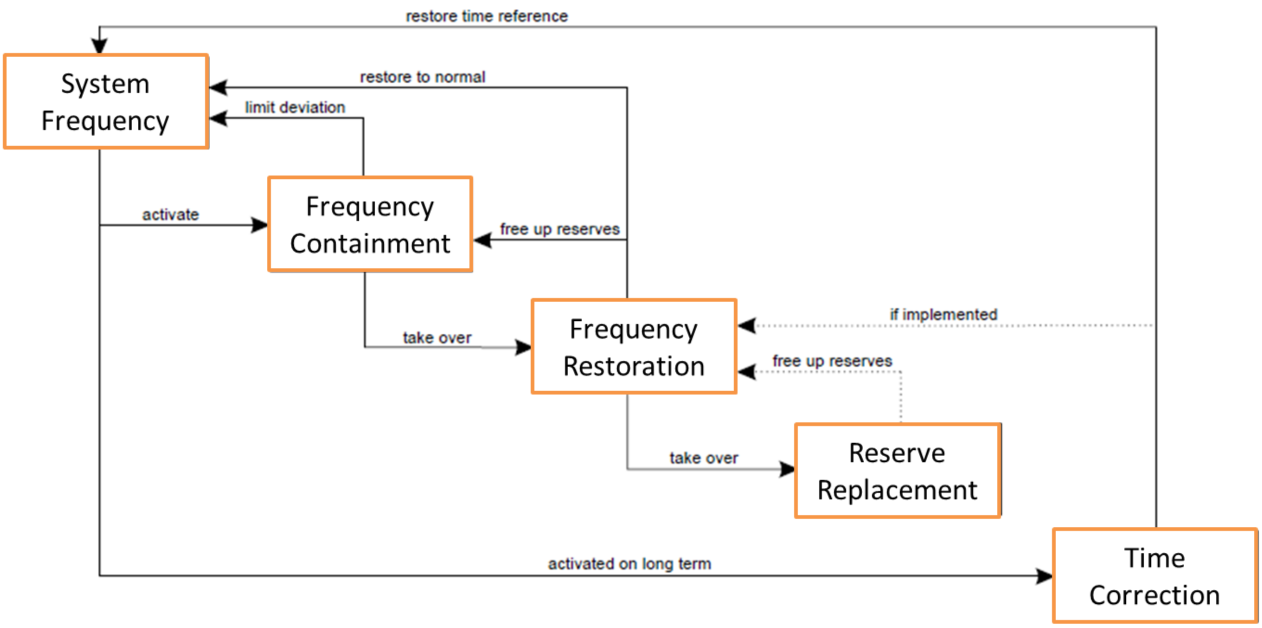


Figure 4: Interactions between operational reserves (ENTSO-E)

A balancing market is typically organised by the *TSO*, which acts as a single buyer, and *BSPs* submit incremental and decremental *balancing energy* (and possibly reserve) bids. In accepting these bids, the *TSO* can therefore ensure an overall balance in supply and demand, but may also use them for congestion management purposes.

The settlement of imbalances

In a liberalised market, the market players also have an implicit responsibility to balance the system through the balance responsibility of market participants, the so called "balance responsible parties" *BRPs*. In this respect, the *BRPs* are financially responsible for keeping their own position (sum of their injections, withdrawals and trades) balanced over a given timeframe – the *imbalance settlement* period. The remaining short and long energy positions in real time are described as the *BRPs*' negative and positive *imbalances* respectively. Depending on the state of the system, an imbalance charge is imposed per settlement period on the *BRPs* that are not in balance. This defines the *imbalance settlement*, which is a core element of balancing markets. It typically aims at recovering the costs of *balancing* the system and may include incentives for the market to reduce *imbalances* – e.g. with references to the wholesale market design – while transferring the financial risk of *imbalances* to *BRPs*.

Cross-border balancing

Cross-border *balancing* refers to the exchanges of *reserves* and/or *balancing energy* under normal operating conditions. Cross-border balancing markets can be approached twofold:

- Cross-border procurement of *balancing services*: *TSOs* and *BSPs* are committed in an exchange scheme (e.g. *BSP* to *TSO* or inter-*TSOs* approaches, bilateral of multilateral models, etc.);
- Cross-border settlement: *TSOs* and *BRPs* are involved in a cross-border trade of *imbalances*.

With *cross-border* capacities not being fully used[6] and the *balancing* need not always being in the congestion direction, there is also room for improving competition by means of *cross-border balancing* exchanges. Figure 5 shows an example of average available transmission capacity after intraday gate closure on French borders in 2011.

Table 1: Average available transmission capacity on French borders after intraday gate closure in 2011

Adjacent areas	Average hourly available capacity in MW *(and percentage of time when it exceeds 100 MW)*	
Direction (from France)	*Import*	*Export*
Belgium	2107 *(100%)*	2189 *(99%)*
Germany	2844 *(93%)*	1741 *(77%)*
Great Britain	1775 *(93%)*	716 *(56%)*
Spain	742 *(62%)*	827 *(68%)*
Italy	2851 *(100%)*	98 *(23%)*
Switzerland	4050 *(100%)*	169 *(34%)*

Source: Commission de régulation de l'énergie

[6] See as an example the CWE report on electricity interconnection management and use in 2008: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_ACTIVITIES/EER_INITIATIVES/ERI/Central-West/Final%20docs/Report%20on%20electricity%20interconnection%20-%20CWE%20region%20-%20200.pdf

Variety of balancing market designs across Europe

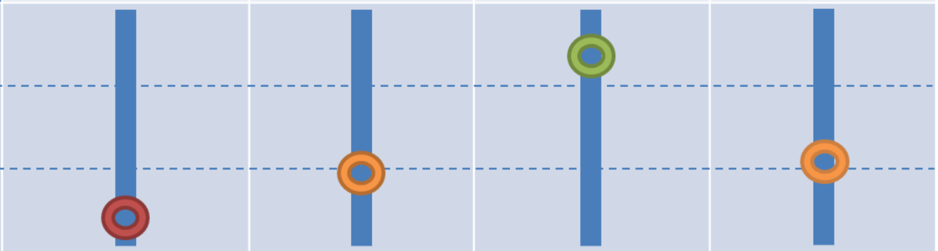
Balancing has been historically entrusted to individual *TSOs*, as the single entities with sufficient information on system frequency, national generation, consumption and network topology to balance the system efficiently. Consequently, *TSOs* established – after extensive market consultation and approval by NRA's – their national *balancing* systems. Being designed according to historical national specificities (generation portfolios, significant presence of internal congestions and level of interconnections with foreign markets), these systems can significantly differ from one country to another[7]. The wide variety of balancing market designs existing in Europe is generally perceived as an important barrier for the integration of balancing markets into one single European balancing market.

Lack of competition

The European Commission's sector enquiry revealed high levels of concentration within national balancing markets[8]. This, combined with a low degree of integration, enables generators to heavily influence the balancing market outcome. This effectively creates barriers to market entry for suppliers, who face imbalance price risk and/or high network charges (to the extent that *balancing* costs are included in the costs of the network)[9]. The enquiry further identifies the possibility that this balancing market concentration could be decreased through a higher degree of cross-border integration, a reduction in entry barriers and an improvement in market efficiency. This could be done through the introduction of more competition between *BSPs* and increased liquidity in *balancing energy* trading.

Table 2: Illustrating the lack of competition in some balancing markets using HHI calculation[10]

Area		France	Netherlands	Great Britain	Spain
Type of balancing market		Upward manually-activated energy from FRR and RR (2011)	Upward energy from FRR (2011)	Upward and downward balancing energy (2010)	Automatically-activated FRR capacity (2011)
HHI value		3894	2639	1300	2494
Level of market concentration	Unconcentrated HHI<1500				
	Moderately concentrated 1500<HHI<2500				
	Highly concentrated HHI > 2500				



Sources: National Regulatory Authorities

Market distortions

At present, the access to *balancing* resources is mostly limited to national markets. This lack of market integration has also been identified by a study commissioned by the EC[11]. The study

[7] https://www.entsoe.eu/fileadmin/user_upload/_library/position_papers/ENTSO_BalancingMaps_Final.pdf
[8] DG Competition report on energy sector inquiry (SEC(2006)1724, 10 January 2007)
[9] Energy sector inquiry, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52006DC0851:EN:NOT
[10] Herfindahl-Hirschman Index (HHI) Calculator is often used to measure market concentration, and is calculated by summing the squares of the percentage market shares held by the respective market participants.
[11] TREN /C2/84/2007: *Study of the interactions and dependencies of Balancing Markets, Intraday Trade and Automatically Activated Reserves.*

highlighted the risk of migration of *imbalances* from one country to another due to cross-border trade between different market designs, as market participants are not confronted to equivalent *balancing* incentives in the different countries.

Distortions in the balancing market may have significant impacts on the functioning of the wholesale markets, which are more and more integrated. Relevant price signals are quite important to enhance the efficiency of balancing markets as they have a direct impact on the volume of residual *imbalances* to be balanced by *TSOs*. Consistency between market designs is therefore essential, and in particular, well-designed and liquid *intraday* markets, where market participants are able to optimise and bring their position into balance by closing trades throughout Europe, are a key driver to maximise the overall efficiency.

Harmonisation of national *balancing* arrangements is required to a certain extent in order to improve security of supply, avoid market distortions and refrain from discrimination among *BSPs* participating in different markets. Removal of market distortions and increased competition on balancing market are likely to reduce the overall costs of *balancing* the system.

Security of supply

To ensure an adequate level of security on mainly isolated balancing markets, *TSOs* procure *balancing reserves* within their *control area*. The development of cross-border *balancing* may reduce the need for *reserves*, ceteris paribus, and increase competition on the balancing market, thereby improving reserve procurement efficiency and reducing the costs of *balancing* the system.

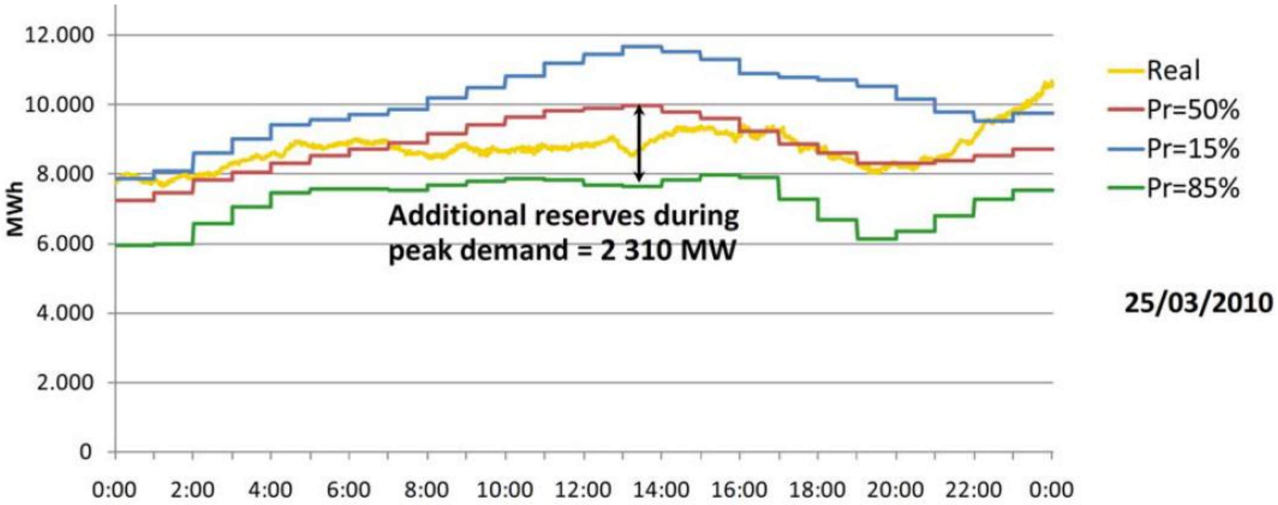
Nevertheless, the development of cross-border exchanges closer to real-time emphasises the importance of *TSOs*' task of *balancing* the system, since it may influence the level of resources available to them. Consequently, it is required that the on-going market integration process also prioritises the integration of balancing markets[12].

Integration of renewables

The increasing amount of generation from renewable energy sources (RES), with variable or intermittent levels of output and concentrated in certain areas of the system, may increase the needs for *balancing* resources for *TSOs* to balance the system and at the same time decrease the short-term availability of traditional *balancing* resources (others things being equal). The integration of RES will therefore have important impacts on the balancing markets, even more on electricity consumers. This implies the need to identify areas in which there is some room to reduce the costs of such integration by making appropriate amendments to relevant (e.g. *balancing*) market mechanisms, for the sake of overall efficiency.

Such developments may require a new approach in the management of interconnected electricity systems, allowing national systems to exchange *balancing* resources. Developing cross-border *balancing* can be considered as essential in accommodating an increasing amount of intermittent generation without jeopardising the European system and inducing high additional *balancing* costs.

[12] See as an example Eurelectric position paper towards market integration of reserves and balancing markets: http://www2.eurelectric.org/DocShareNoFrame/Docs/1/NHHLPMCDKOINAPGJLFKHMGLE77VD8TBOQHUHMJHNHT5D/Eurelectric/docs/DLS/IntegrationofReserveBalancingMarketsFINAL-2008-396-0004-2-.pdf



Source: Red Eléctrica de España

Figure 5: Wind energy generation forecasting with different confidence intervals

Participation of demand response

In consistency with key European energy policies (ensuring consumer benefits, meeting the carbon emission targets, increasing energy efficiency, etc.) there is no denying that *demand response* can add value to the European electricity markets by providing *balancing services* to *TSOs*. The increased need for *balancing* products may partially be satisfied by an increasing participation of *demand response* in *balancing reserve* and *balancing energy* markets, on equal terms as and in competition with similar services procured from generation facilities. Today however, some national balancing market rules - historically driven by generation constraints - may not necessarily ensure that *demand response* and generation are on a level-playing field.

Low market integration

The on-going market integration process to achieve the Internal Electricity Market involves timeframes prior to *balancing* timeframe, such as the *day ahead* and *intraday* timeframes. Implementation of cross-border balancing markets therefore constitutes a necessary next step[13]. Despite the potential gains evoked above, very few initiatives have emerged so far to develop cross-border *balancing*, with a relatively limited geographical scope and low coordination to ensure compatibility of different practices. In the meantime, a large variety of existing *balancing* arrangements, as also reported by EN*TSO*-E, may hamper the process of market integration in other timeframes as well as *balancing* or discriminate among market participants.

The impact the development of cross-border *balancing* has on all market timeframes should encompass European harmonisation.

Lack of competition, risks to security of supply and high *balancing* costs are amongst the main concerns that are currently being raised in the discussion on balancing markets. From this perspective, cross-border integration of national balancing markets could be a viable solution that would assist in developing competition, increasing security of supply and reducing *balancing* costs.

[13] D/2011/7515/19, *Design and integration of balancing markets in Europe* (Leen Vandezande, Feb. 2011)

3 Objectives

3.1 General policy objectives

Following legislative provisions of the EU Third Energy Package the overarching policy objective is to achieve a well-functioning, open and efficient Internal Electricity Market within Europe. Balancing market integration has been highlighted as a necessary step to achieve this goal. Given this context, the Framework Guidelines aim to provide an adequate framework to foster integration of EU balancing markets.

3.2 Specific policy objectives

The policy options will be evaluated and considered in light of the following objectives:

3.2.1 Guarantee / enhance operational security

TSOs ensure that the real-time balance of production and consumption is maintained, which means the short-term operational security is not compromised. The development of cross-border balancing must maintain, at a minimum, the level of operational security at an adequate level. The relevant question with respect to this objective is therefore:

- How does the proposed option affect the operational security?

3.2.2 Improve competition in balancing markets

Competition is crucial to the proper functioning of the Internal Electricity Market. For the provision of *balancing services,* the current lack of integration between European balancing markets may affect price formation and market liquidity. Moreover, as described in the previous paragraphs, balancing markets are generally national and – in consideration of existing limitation (internal congestions, available generation portfolios) to the number of potential *BSPs* - highly concentrated, which gives generators a room for exercising market power.

Reducing possible entry barriers for *BSPs* and facilitating wider participation of *demand response* and renewable sources of energy may improve the liquidity and the competition in the balancing markets.

Increasing cross-border *balancing* exchanges may (as it is true for the integration of European markets in general) improve the efficiency of balancing markets and reduce overall costs, allowing that only most efficient generators are used to balance the system, in consideration of all the network limitations. The relevant question with respect to this objective is therefore:

- What is the impact of the proposed option on competition in the balancing market, and on the EU electricity market in general?

3.2.3 Increase social welfare

Today, there is a low degree of cooperation and coordination between *TSOs* for *balancing* purposes. Increasing competition in balancing markets, improving cooperation between *TSOs*, developing cross-border *balancing* and/or giving the right incentives to market players may limit the overall amount of needed *reserves* and *balancing energy* as well as to improve the efficiency of their use and therefore reduce the overall costs of *balancing*, while preserving the required security standards. This could increase the efficiency of system *balancing* and have positive impacts on the electricity market in general. However, increasing competition in national balancing markets and developing cross-border *balancing* should not lead to adverse effects in other electricity markets. The relevant question with respect to this objective is therefore:

- What is the impact of the proposed option on the overall social welfare[14]?

3.2.4 Facilitate integration of intermittent generation from renewable energy sources

With a growing share of intermittent generation from renewable energy sources in the generation mix, the system *imbalances* may increase in the future. Thus, the need for flexible *balancing* resources will tend to increase, in particular if the balancing markets remain national and not integrated. Integrated balancing market is expected to utilise the existing and future *balancing* resources more efficiently, and could help to lessen the overall needs for *balancing* resources, compared to the situation where balancing markets are not integrated. Thus, the integration of balancing markets will enable higher penetration of renewable energy sources and less pressure to invest in new flexible *balancing* resources. The relevant questions with respect to this objective are therefore:

- What is the impact of the proposed option on the integration of intermittent generation?
- Does the proposed option limit or induce barriers to market entry for intermittent generation?

[14] The analysis should not only take into account the reduction of costs but also the side effects on the overall market.

4 Evaluation criteria for the policy options

For each of the identified problem areas that require action, and in relation to the objectives defined in preceding chapters, we describe and assess most suitable solutions and put forward a preferred option.

From a high-level perspective, options range from maintaining the status quo ("Option A") to detailed legislative requirements for full harmonisation of balancing market aspects ("Option D"). The options between A and D, leave some scope for national and regional arrangements, recognising that different areas and problems may need different approaches.

The way a certain option is implemented depends on a number of aspects in the policy assessment. To achieve the desired result, different combinations of mechanisms can be considered alongside particular policy options. An impact assessment should underline where a determined mechanism would have a significant role in driving the impact of a policy option.

According to the EC Impact Assessment Guidelines[15], the screening process should consider the main policy options and then eliminate the not-applicable ones immediately.

Moreover, for the policies considered (including Option A), it is important to consider all the relevant positive and negative impacts alongside each other, regardless of whether they are expressed in qualitative, quantitative or monetary terms.

A screening process should consider the main policy options to meet the policy objectives and then eliminate the non-applicable ones. This process may be based on the following criteria:

- <u>Effectiveness</u>: to what extent the options can be expected to achieve the abovementioned objectives?
- <u>Time of implementation</u>: how long could the option take to be implemented?
- <u>Efficiency</u>: what are the expected benefits of the option compared to the costs of implementation?
- <u>Coherency</u>: are the options coherent with other energy markets, as well as other overarching EU objectives (e.g. energy sector or environmental policies and targets)?

Policy options scoring high in screening process may be subject to a cost-benefit analysis for diverse parties affected. Although a quantitative approach is not straightforward at this stage, a differentiated view on all influencing and influenced factors is provided.

[15] http://ec.europa.eu/governance/impact/commission_guidelines/commission_guidelines_en.htm

5 Description of the identified options

5.1 Interaction between integration and harmonisation issues

The functioning of balancing markets could be improved along two dimensions:

- by enhancing and harmonising national market designs and
- by integrating balancing markets across Europe.

As an alternative, one could envisage that a stronger harmonisation is pursued in the first place, which aims to facilitate stronger integration of balancing markets and to create a level-playing field for the wholesale markets (long-term, *day ahead* and *intraday*).

As another alternative, one could also envisage to focus directly on the integration of balancing markets and expecting that necessary harmonisation will come along in the implementation phase.

Nonetheless, in accordance with the principle of subsidiarity, Member states shall keep the rights to establish national network codes that do not affect cross-border trade, in accordance with Article 8(7) of the Electricity Regulation.

However, it is important to note that the existence of fragmented and non-harmonised national balancing market arrangements could result in distortions that may create substantial implementation challenges for wider integration of balancing markets.

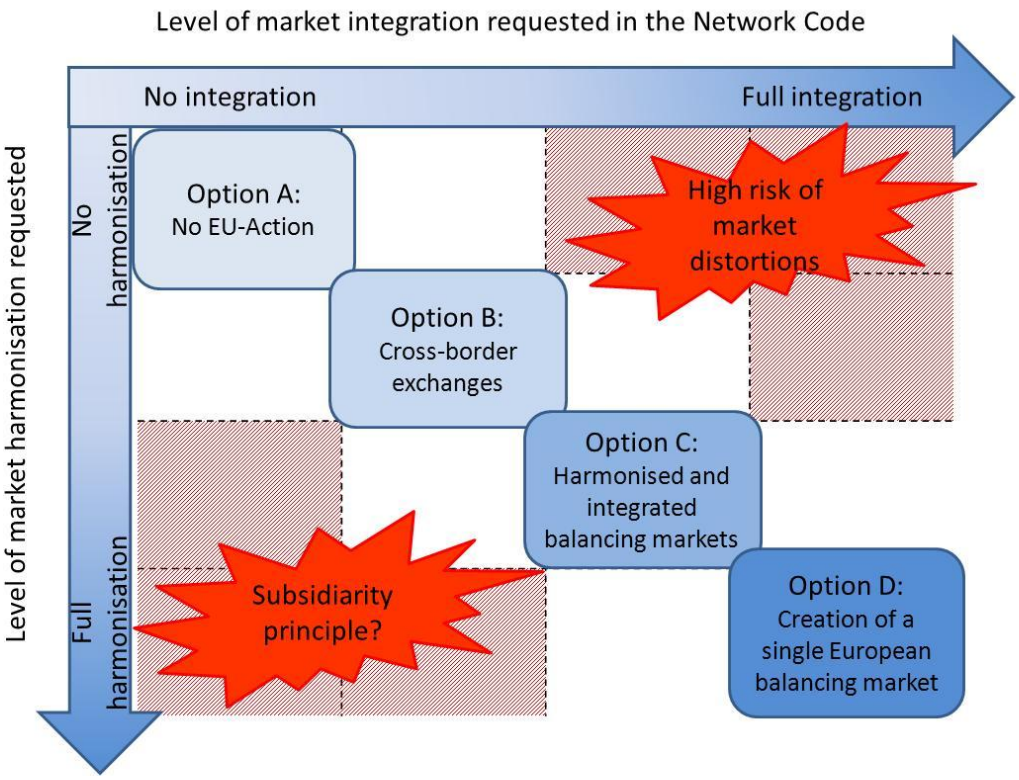


Figure 6: Interaction between harmonisation and integration of balancing markets considering the different options

Therefore, there is a need to ensure consistency between requirements in terms of harmonisation and requirements in terms of integration of balancing markets.

The following chapter considers this issue by describing identified models to exchange *balancing energy* consistent with the options to create a European-wide *balancing* mechanism.

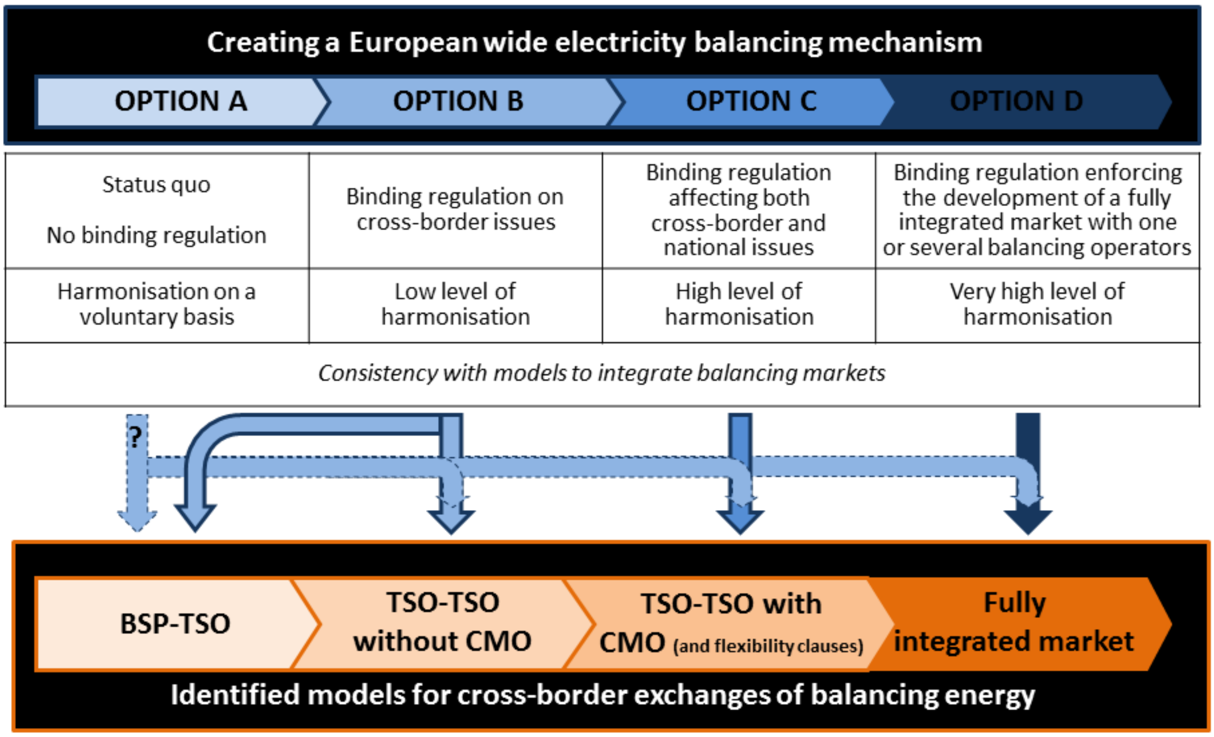


Figure 7: Link between identified options and the models to integrate the balancing markets

5.2 Option A: status-quo

This option consists of a voluntary approach to evolve without a binding European regulation in place. In this way, the existing on-going experiences will be free to develop further and integrate, if so decided by the participating parties.

For instance, projects such as the Balancing Inter *TSOs* (BALIT) and the international Grid Control Cooperation (iGCC) have grown in importance during the years, gathering new participating systems: this suggests that a pure voluntary approach may deliver some level of integration over time. However, such developments do not appear to be converging. Without any common binding regulation, isolated (and possibly incompatible) projects may be implemented across Europe.

With this option, some countries may decide not to share their internal resources or to take part in the integration of balancing markets. This would results in a situation where expensive resources are often activated in some countries, while in other countries cheap resources are being kept locally for security reasons, but are rarely activated. This option may also suggest that a fully integrated European balancing market may never be achieved as one could expect an evolution of the decentralized regional or bilateral experiences, without any proper harmonisation requirements.

5.3 Option B: creating a European exchange of balancing services through a legally binding regulation defining minimum harmonisation requirements necessary to develop cross-border exchanges

Scope of EU regulation

This option consists in developing a binding European regulation that focuses on cross-border (or cross *control area*) exchanges of some *balancing* resources. In order not to interfere with national arrangements, such regulatory framework would need to be compatible with national legislations.

In this framework, a limited set of *balancing* products – "cross-border" *balancing* products – would be identified and each participating *TSO* may or would be required to share these products with other European *control areas*. The rules governing the national markets would however not be subject to any binding European regulation and would remain in the scope of the national regulations. The European binding regulation may only request the harmonisation of the characteristics of national balancing markets, which is necessary to enable cross-border exchanges. However, this option would not require harmonisation of *balancing* products and other means would be utilised by *TSOs* (such as creating cross-border products out of national products) to enable the exchange of *balancing services* across the borders.

Under this option some harmonisation of national market designs could emerge, but there is no guarantee that an adequate level of harmonisation, enabling a level playing field, would be reached.

Interactions with system security

The *TSOs* are responsible for organising balancing markets, which are designed to ensure full compliance with the system security requirements. The principles of mutual trust and cooperation between *TSOs* in Continental Europe remain, and each *TSO* must comply with common standards. However, the way to meet them would still remain an individual *TSO*'s responsibility. The European binding regulation may therefore call for the development of cross-border exchanges on the basis that control area responsibilities – including meeting the frequency quality targets and ensuring security criteria - are unchanged.

Cross-border energy schemes and procurement of balancing energy

With this option, the development of *cross-border* exchanges is based on exchanges of a limited amount of *balancing* resources. Such exchanges would likely involve surpluses that are not needed locally to meet the security criteria and/or *balancing* expectations, to be exchanged after the *gate closure time* of the cross-border *intraday* market and based on the availability of sufficient transmission capacity.

As balancing market designs may differ among *control areas* because of the technical characteristics of *balancing* resources being available locally as well as *balancing* needs (generation mix, consumption pattern, etc.), several independent models derived from this concept may be considered to address the regionally specific needs. To foster the exchanges of *balancing energy* from *replacement reserve* (and possibly manually activated *frequency restoration reserve*), *BSP-TSO* and a *TSO-TSO* without common *merit order list* schemes could be developed. To foster the exchanges of *balancing energy* from automatically activated *frequency restoration reserve*, an imbalance netting mechanism could also be considered. Full description of these models is given in Section 8.4. The challenges in implementing such approaches depend on the considered products – from either manually or automatically activated *reserves* – but are considered as simpler than solutions aiming at European-wide platforms for exchanging all *balancing energy*. In this respect, the European binding regulation would only request the harmonisation of the characteristics of national balancing markets, which is necessary to enable cross-border exchanges. Yet the standardisation of the key elements of national balancing markets would not be applied in this option. Nevertheless, coordinated *gate closure times* (for both cross-border *intraday* markets and firm submission of bids) are highly desirable to promote liquidity of markets. Moreover, common principles for the pricing method of *balancing energy* products - related either to products delivered by *BSPs* or created by *TSOs* – would also considered.

An implementation roadmap would be foreseen to ensure a step-by-step implementation of a common platform to exchange *balancing energy* in a mid-term perspective, as well as a common *imbalance netting* mechanism. The approach may also encompass the description of the long-term vision, which relies on the definition of a common *merit order list.*

Cross-border reserve schemes and procurement of balancing reserves

For efficiency reasons, *TSO* contracted *reserves* should be limited to their needs. In some synchronous areas, requirements on *frequency restoration reserves* and *replacement reserves* are calculated per *control area* or block, and *TSOs* mainly procure them from local *BSPs*. However, significant savings could result from the allocation and the use of the *reserves* on larger areas.

This option does not include the standardisation of *balancing reserve* products. To satisfy *TSOs*' different *balancing* needs across Europe, the existence of non-standardised and specific reserve products, as well as different principles of reserve procurement, are still possible. From this perspective, exchanges of *balancing reserves* are likely to be limited, even though the European binding regulation could allow for:

- The development of exchanges of surpluses of *balancing reserves* through bilateral trading model(s) between *control areas*, in which reserve procurement processes are not integrated nor harmonised, in order to reduce procurement costs of such resources. As such exchanges might be subject to *reservation of cross-border capacity*, impacts on overall social welfare would need to be analysed on a case by case basis;
- The sharing of *reserves*[16] , possibly to diminish the amount of contracted *reserves*.

Procurement arrangements – including technical requirements, duration of contracts, etc. – should be set at least to facilitate the participation of *demand response* and renewable energy resources.

Balance responsibility, price signals and interdependencies with wholesale markets

Under this option, general principles ensure a proper cross-border settlement of *imbalances*. In particular, it defines a settlement methodology which guarantees an appropriate treatment of financial impacts and a fair allocation of the benefits of exchanges between *TSOs*. Moreover, cross-border exchanges of *balancing reserves* and *balancing energy* do not require the standardisation of *imbalance settlement* arrangements. From this perspective, the European binding regulation may at least ensure that national *imbalance settlement* period, imbalance calculation and imbalance pricing are defined to encourage *BRPs* to minimise their *imbalances* in real time or help the system to restore the balance.

[16] The sharing or reserves is a TSO-TSO agreement that allows TSOs to share part of their reserves between each other: a reserve capacity is shared when it is made available for two or more TSOs.

5.4 Option C: creating a European exchange of balancing services through a legally binding regulation imposing a defined level of harmonisation of the balancing mechanisms adopted by each Member State to facilitate cross-border exchanges

<u>Scope of EU regulation</u>

This option involves the setup of a European binding framework in which the harmonisation of key elements of the current national balancing markets is addressed with the aim to facilitate the development of cross-border exchanges of *balancing energy* and, to some extent, of *balancing reserves*. Therefore, it implies a significant level of integration of balancing markets compared with current practices. Such integration is conducted in a way that does not threaten the system security, and most of the benefits are expected with limited fundamental revision or dilution of *TSO*s' *balancing* responsibility.

<u>Interactions with system security</u>

The option implies a higher level of coordination between European *TSOs*, as it assumes an extensive standardisation of *balancing energy* products and some coordination of operational processes. In terms of frequency control, such coordination still relies – at least in Continental Europe - on the concept of local responsibility of individual control blocks, and remains compatible with current operational security principles.

A learning-by-doing approach is foreseen in this option: *TSOs* get involved in projects where they make sure that they continuously have access to the adequate amount of *reserves*, while the sharing of manually activated resources based on a European-wide *Common Merit Order*[17] list is implemented in a progressive way. This enables *TSOs* to gain experience in a secured way and to consider gradually possible new operational standards in case legal and technical responsibilities are revised to cope with further integration of balancing markets.

<u>Cross-border energy schemes and procurement of balancing energy</u>

This option fundamentally relies on the concept of *Common Merit Order* list. *TSOs* share their *balancing* resources and optimise their activation in order to minimise the cost of *balancing* by gathering in a common list the *balancing* bids and offers that are available in their *control areas*, and activate them according to the *merit order list* subject to operational security limits. The European binding regulation could foresee some flexibility to modify some features of the European-wide *TSO-TSO* model with common *merit order list* if they are proved to be infeasible or do not bring positive net benefits. This would allow *TSOs* to perform Load Frequency Control operations based on manageable real time processes, and to ensure operational robustness in the activation of *balancing energy* through a common *merit order list*,

Option C considers a progressive approach on exchanges of *balancing energy* to ensure a proper level of integration. However, different roadmaps are foreseen for manually and automatically activated *reserves*.

Models for exchanges of manually activated *balancing energy* would be based on a *Common Merit Order* list and achieved in three steps:

- First, *TSOs* would need to coordinate and optimise the activation of *balancing energy* from resources that are used as *replacement reserve*;

[17] Description of the concept of *Common Merit Order* is provided in section 8.4.4.

- Then, *TSOs* would need to coordinate and optimise the activation of *balancing energy* from resources that are used as manually activated *frequency restoration reserves* and *replacement reserves*;
- Finally, *TSOs* would need to coordinate and optimise the activation of all manually activated *balancing energy* using a European-wide platform.

Models for exchanges of automatically activated *balancing energy* would also be based on the *CMO* concept and achieved through the following steps:

- First, *TSOs* would need to coordinate in order to perform *imbalance netting* when economically efficient;
- Then, *TSOs* would need to coordinate and optimise the activation of automatically activated *balancing energy*.
- Finally, *TSOs* would need to define a common target model for the exchanges of *balancing energy* from automatically activated *frequency restoration reserve* based on a common *merit order list* or a similar approach and implement it at the European-wide scale.

Cross-border reserve schemes and procurement of balancing reserves

In this option, the binding European regulation would allow for the sharing of *reserves*, as well as cross-border exchanges of *reserves*[18], with arrangements such as:

- The exchange of surpluses of *reserves* through bilateral reserve trading models between adjacent *control areas* in which reserve procurement processes have not been integrated nor harmonised;
- The exchange of *reserves* through a multilateral reserve trading model involving *TSOs* and *BSPs* of two or more *control areas*, in which reserve procurement processes have been harmonised and integrated into a common procurement process.

A strong coordination of *TSOs* is required in order to determine the amount of *reserves* that are necessary in their *control areas*, taking into account the consequences of cross-border exchanges of *balancing energy*. This option foresees a certain level of harmonisation of *balancing reserve* markets to foster their integration. Similarly as for the *balancing energy* products, this would include the elaboration of standard reserve products used to balance the system, with the possibility for *TSOs* to define specific products as long as this does not create significant inefficiencies or distortions with adjacent markets. Common principles for the procurement of *reserves* – including technical requirements, duration of contracts, etc. – would need to be defined to facilitate the integration of balancing markets, in particular the participation of *demand response* and renewable energy resources.

Balance responsibility, price signals and interdependencies with wholesale markets

As foreseen in Option B, the general principles would ensure a proper cross-border settlement of *imbalances*, and a settlement methodology would need to be built to guarantee an appropriate treatment of financial impacts and a fair allocation of the benefits of exchanges between *TSOs*.

In this option, the binding European regulation would need to define clearly the role of *BRPs* in the balancing markets. To achieve an efficient integration of the balancing markets and avoid distortions, the concept of a *Common Merit Order* would need to be considered together with the

[18] TSOs do not reserve transmission capacity for balancing, except for cases where a cost-benefit analysis demonstrates that such reservation can result in increased overall social welfare; the modalities for the assessment of cross-border capacity reservation would need to be defined so that there is no undue discrimination between TSOs and market participants using the cross-border capacity.

harmonisation of key features of *imbalance settlement*. Taking into account the interactions between balancing market and wholesale markets, a common design of *imbalance settlement* would ensure that national *imbalance settlement* period, imbalance calculation and imbalance pricing would be defined to encourage *BRPs* to minimise their *imbalances* in real time or help the system to restore the balance.

5.5 Option D: creating a European exchange of balancing services through a legally binding regulation defining a single European balancing mechanism, including creating one or several regulated entities to perform the tasks of supranational balancing operators

Scope of EU regulation

This option would result in a significant evolution of the current design in which European electricity systems are operated. In order to fully exploit the benefits of the exchanges of *balancing* resources, only a supranational approach to *balancing* can ensure that when *balancing energy* is required the most efficient *balancing* resource is activated at European level, taking in due consideration the operational security limits,

A legally binding European regulation would be developed to ensure that a single balancing market design is adopted all over Europe[19], or as a minimum at the level of synchronous areas.

The European regulation would foresee the harmonisation and common rules on all main *balancing* arrangements: roles of *BSPs* and *BRPs*, definition and procurement of *balancing services*, as well as balance responsibility and *imbalance settlement* rules.

Interactions with system security

Such level of integration would require a very strong coordination of European *TSOs*, to the extent that *balancing* responsibility is given to a centralised entity responsible for *balancing* the whole system based on full information on *balancing* received from *TSOs* (local network situation, system imbalance forecasts, availability of *balancing* bids, etc.). This would have a major impact on the current design of system operation procedures and responsibilities, including operational security, planning and scheduling, load frequency control and emergency measures.

Compared with previous options, a significant increase of benefits is expected to arise from joint operational processes that come with a common approach with respect to security criteria (centralised sizing, sourcing and procurement of *reserves*, centralized management of critical situations, etc.).

In this respect, the European binding regulation would need to consider a transition from several existing *control areas* to one global *control area*, with possibly one or several supranational entities that will be responsible for operating the balancing markets in selected regions, covering wide areas (e.g. synchronous areas).

Cross-border schemes and procurement of balancing services

[19] Taking into account limited available cross-border capacity and the need for a minimal distribution of reserves.

In this option, common *balancing* operator(s) would coordinate and optimise the activation of *balancing energy* from resources that are used as *Frequency Containment, Frequency Restoration Reserves* and *Replacement Reserves*. In a fully integrated cross-border balancing market, all *balancing energy* bids would be activated based on common system needs, using a single pool of offers and bids gathered in a *common merit order* list. A very high level of coordination ensures the use of the most efficient *balancing* resources that are offered in the common platform, taking into account the operational security limits. The option includes:

- A strong standardisation of *balancing reserve* and *balancing energy* products, with very limited use of specific products;
- Common pricing methods for both *balancing reserve* and *balancing energy* products;
- Harmonised *gate closure time* for both submission of bids and *intraday* markets;
- An obligation for *TSOs* to share all *balancing energy* bids;
- An obligation for all *control areas* to participate.

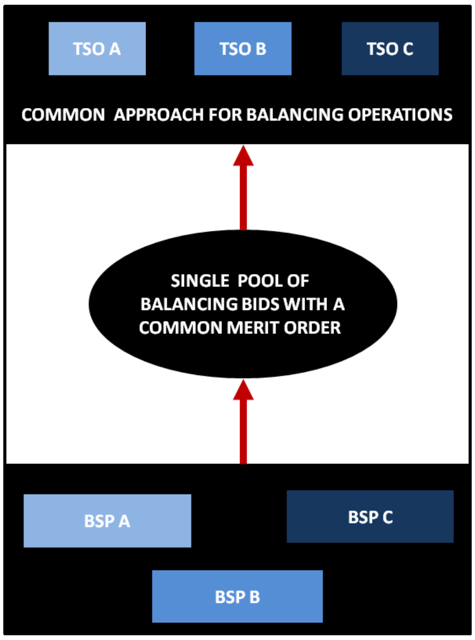


Figure 8: Fully integrated balancing market

The binding European regulation would foresee that reserve markets become more integrated, taking into account the optimal allocation of *cross-border capacity* between energy market and reserve markets. Such allocation could foresee a European-wide auction for *balancing reserves* and cross-border exchanges of these *reserves* with hybrid market coupling, where *reserve* bids would compete with energy bids for the allocation of *cross-border capacities*. Balancing operator(s) would need to strongly coordinate for the exchanges and harmonise the sizing of *reserves*.

Balance responsibility, price signals and interdependencies with wholesale markets

In this option, the binding European regulation would clearly define the role of *BRPs* in the balancing markets. To achieve an efficient integration of the balancing markets and avoid distortions, the definition of a pan-European market would be considered together with the harmonisation of *imbalance settlement*. Taking into account the interactions between balancing and wholesale markets, a common design of *imbalance settlement* would ensure that national *imbalance settlement* periods, imbalance calculation and imbalance pricing are fully harmonised and defined in a way to encourage *BRPs* to minimise their *imbalances* in real time or help the system to restore the balance.

To begin with, each *balancing* operator, being responsible for cancelling out the energy *imbalances* in its own control area, may act as a *BRP*. The residual overall *imbalances* are compensated for by unbalanced *control areas*. Then, existing *control areas* would be merged into one single or possibly few regional *control areas*, together with a transfer of responsibility to one or few supervisory entities. If one entity is defined, a single design of *imbalance settlement* would be set up and would affect each *BRP* in the single area. In case several entities remain, general principles would ensure a proper cross-border settlement of *imbalances*, and a settlement methodology is built to guarantee an appropriate treatment of financial impacts and a fair allocation of the costs and benefits of exchanges between these *control areas*.

5.6 Summary of the identified options

Implications of the identified policy options in terms of…	OPTION A	OPTION B	OPTION C	OPTION D
…Balancing energy				
Schemes to exchange manually-activated energy				
• Exchange of surpluses (BSP-TSO or TSO-TSO)	-	Required	X	X
• Common Merit Order (CMO)	-	Possible	Required (with flexibility)	Required
Schemes to exchange automatically-activated energy				
• Imbalance netting	-	Required	Required	Required
• Models to be defined afterwards, based on CMO	-	Possible	Required	Required
Procurement arrangements				
• Standardisation of products (with possibly specific ones)	-	Required (XB only)	Required (all)	Required (all)
• Harmonisation of pricing method	-	Desired (XB only)	Desired (marginal pricing)	Required (marginal pricing)
• Harmonisation of gate closure times (ID & balancing bids)	-	Possible	Desired	Required
…Balancing reserves				
Exchange of balancing reserves (models to be defined)	-	Possible	Possible	Required
Sharing of balancing reserves (models to be defined)	-	Possible	Possible	-
Common procurement of reserves	-	Possible	Possible	Required
Reservation of cross-border capacity	-	Possible (well-framed)	Possible (well-framed)	Possible
Procurement arrangements				
• Standardisation of products (and possibly specific ones)	-	Possible	Required	Required
• Standardisation of duration of contracts	-	Possible	Possible	Possible
• Harmonisation of pricing method	-	Possible	Desired	Required
…Imbalance settlement				
General principles (competition, non-discrimination, etc.)	-	Required	Required	Required
• Harmonisation of settlement periods	-	X	Desired	Required
• Harmonisation of calculation	-	X	Desired	Required
• Harmonisation of pricing	-	X	Desired	Required

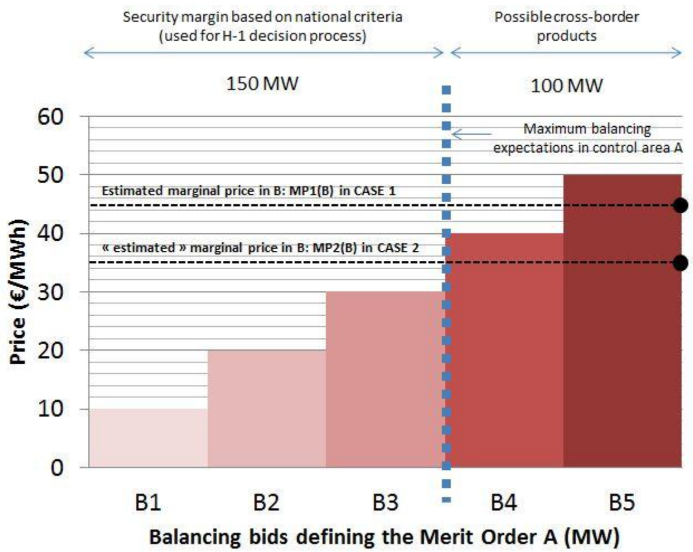
Figure 9: General picture of the identified policy options

6 Analysis of the identified options

<table>
<tr><th></th><th>POLICY OPTION ANALYSIS</th></tr>
<tr><td>Effectiveness to guarantee or enhance the level of security of supply</td><td>
(A): A voluntary approach with no European wide regulation may lead to the development of regional projects aiming at fostering cross-border exchanges of balancing energy. Depending on the nature of these projects, a certain level of integration may be obtained and security of supply may be enhanced. Unfortunately, such approach does not ensure that full integration of balancing markets will ever be reached. As this option gives no priority or incentives to TSOs to implement these projects and without regulatory framework, this might lead to the absence of coordination between projects. Thus, the integration may be even harder to achieve once different approaches have been implemented. This would not lead to the more efficient use of balancing resources across Europe to address the increased balancing needs anticipated by TSOs due to higher RES penetration ant to maintain the satisfactory level of system security in the coming years with lowest costs. Thus, option A is likely to lead to increased problems in providing sufficient and guaranteed level of security of supply.
(B): Sharing a limited set of balancing resources would most likely involve resources that are not required to meet local security requirements. A priori, the level of security of supply may not be jeopardized, provided that the considered timing for exchanges (e.g. after intraday gate closure times) give sufficient flexibility to the TSOs to cope with the exchange process and prevent them from putting the system at risk. Security of supply may possibly increase, as some TSOs would benefit from higher liquidity of balancing markets. The netting of imbalances may significantly reduce the need for activation of frequency restoration reserve, thus leading to a better availability of these reserves and moving towards an enhancement of security of supply.
However, as imbalance netting affects system flows in real time, ad-hoc rules may be needed to guarantee operational security and avoid undesired risks. In a BSP to TSO mechanism, there is also a risk that one control area benefits from an increased security of supply to the detriment of the other, since no reciprocity in sharing is guaranteed.
(C): Standardisation of balancing reserve and balancing energy products is likely to lead to easier and reciprocal sharing of majority of balancing resources, thus the TSOs would benefit from higher market liquidity, which would lead to increased availability of resources to satisfy the security criteria that are still defined at the national level. The possible future development of well-supervised cross-border exchanges of reserves may be facilitated with strong requirements on the harmonisation of procurement processes, which in turn will boost market integration and significantly enhance the level of security of supply within participating control areas.
In order to deal with the significant implementation challenges and to avoid risks and unintended consequences, a learning-by-doing approach together with a stronger cooperation between TSOs – as foreseen in option C - will be essential to ensure that the level of security of supply enjoyed to date is enhanced or, at least, not altered.
(D): A common approach is chosen for security criteria and responsibilities with respect to electricity balancing, and an intensive coordination between balancing operator(s) in implementing cross-border exchanges of balancing reserves and balancing energy is foreseen. Thus, a theoretically optimal level of security of supply is reached within the region.
However, this option would imply a complete change of the way balancing is done today, introducing balancing operators (possibly a centralised entity) with some powers that today are held by the TSOs. Separating some of the powers from the TSOs that would still be responsible for key system operation decisions might impose a threat to system security if imposed without adequate care.
</td></tr>
</table>

Effectiveness to improve competition and economic efficiency	**(A):** Voluntary initiatives may contribute in creating the level-playing field in balancing markets and would allow for reduction of total *balancing* costs. However, without any binding regulation, such effectiveness remains hypothetical and high levels of competition and economic efficiency may as well never be reached. Thus, the likelihood of creating significant benefits within a reasonable timeframe is very low in this option. **(B):** A consistent framework designing the prerequisites to foster cross-border exchanges of limited set of *balancing* resources is likely to emerge. The option may ensure that the level of competition is increased with a positive influence on the liquidity of cross-border balancing markets. Compared with isolated systems where some bids may not be economically advantageous for the local *TSO*, such exchanges are likely to be beneficial. However, most of the cheapest bids would still be kept out of the scope of cross-border exchanges for security reasons, while rarely used. In some circumstances, limited transparency may also hamper the confidence of market players to participate in the market. National-only and tradable cross-border *balancing* may still co-exist, and prevailing national rules for procuring *reserves* and settling *imbalances* might hamper a fair competition among *BSPs* or distort the behaviour of participants. Differences in balancing markets (e.g. *gate closure times*, national rules) may remain and lead to asymmetry in market opportunities on each side of the border. Moreover, a limited integration and harmonization would make it difficult to achieve a reduction of *balancing reserves*, and could confine the development of exchanges of such *reserves*. *TSO-TSO* models (see 8.4.3) may ensure that the selling of *balancing services* is a rather simple task to achieve, as *BSPs* only contract with their *TSO* and then comply with the rules of their local balancing market. In case specific (non-flexible) products - which only partially satisfy the needs of *TSOs* - are defined, this may limit economic efficiency and increase the complexity arising from fragmentation of the cross-border markets. The products, which are built based on the most expensive bids, may barely be used by the requesting *TSO*, depending on the real-time characteristics of the requesting balancing market. The following page illustrates possible inefficiencies arising from this option by considering an academic example of exchange of not needed *balancing energy* bids (i.e. surpluses) between two *control areas*. **(C):** The harmonisation of main arrangements of balancing markets is expected to facilitate the exchanges of *balancing services*, with significant benefits in terms of competition and economic efficiency. Compared to concentrated balancing markets inducing market power and potential artificially increased prices, competition is increased here as the most competitive bids from every *control areas* are compared using a common platform, and activated according to the *common merit order* list. The standardisation of products fosters the liquidity of balancing markets. The possible development of a common process to procure *balancing reserves* emphasizes such expected gains. The alignment of the main features of *imbalance settlement*, including incentives that take into account the impacts on the functioning of wholesale markets, is expected to provide the *BRPs* with a proper level playing field[20]. Selling of the *balancing services* is simpler. This option includes complete consistency between offers from *BSPs* and the energy that is actually activated. The allocation process is easily managed and transparent exchange information easily displayed. The economic efficiency of the models depends on the level of harmonisation in procuring *balancing services*, as well as *intraday* markets in the areas they are implemented. It is expected that the design of a common pricing method, together with compatible timing processes, will help the integration and therefore deliver a very satisfactory level of economic efficiency. **(D):** The *BSPs* are subject to common rules and are able to participate in a common *balancing energy* market. Maximum competition arises from a fully integrated model. An optimal pooling of *reserves* and allocation of resources may deliver considerable efficiency benefits. The cheapest bids are selected first to satisfy *balancing* needs. The process is transparent and easy to monitor for stakeholders and NRAs in different areas. Benefits in terms of economic efficiency and cross-border competition at European level are therefore larger than in all other options.

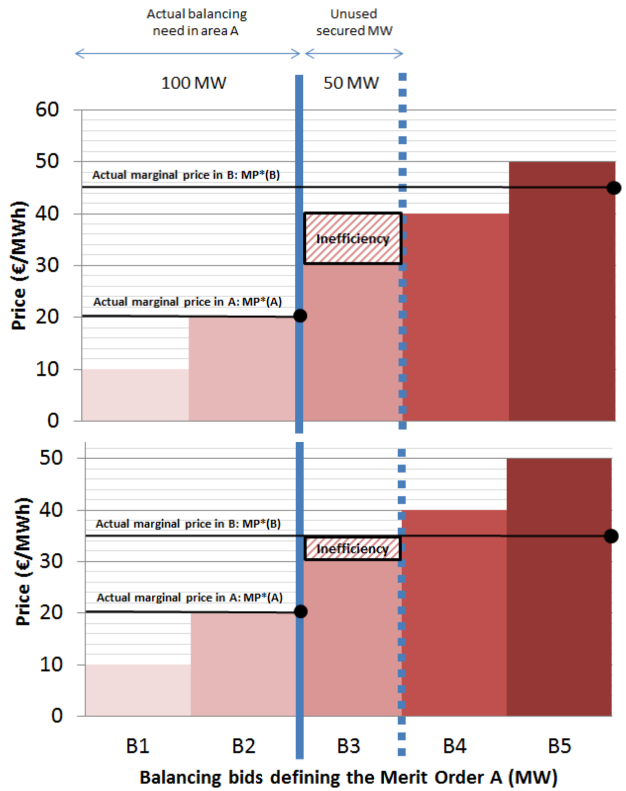
[20] D/2011/7515/19: *Design and integration of balancing markets in Europe*, Leen Vandezande



(B): To illustrate the possible inefficiencies arising from the concept of surplus to exchange *balancing energy*, let us consider an illustrative example with *control area* B that can benefit from an exchange of surpluses of *balancing energy* from *control area* A. According to ex-ante estimations, *control area* A secures 150 MW of *balancing* power locally. As B4 and B5 are not likely to be needed in *control area* A, the *TSO* A offers them as cross-border products. However, in real time, the actual *balancing* need in *control area* A is 100 MW. Let us consider the two cases below.

CASE 1: TSO B needs 50 MW and price of B4 is lower than marginal price in area B, so B4 is part of Merit Order B;
CASE 2: price of B4 is higher than marginal price in area B, hence B4 is not part of Merit Order B.

Bid ladder A	Bid B1	Bid B2	Bid B3	Bid B4	Bid B5
Power (MW)			50		
Price (€/MWh)	10	20	30	40	50



1a) B4 is activated to satisfy *balancing* needs in *control area* B, while {B1, B2, B3} are kept for *balancing* in *control area* A. B3 would be available for cross-border exchange, but it wasn't activated and the *BSP* did not receive any payment.

1b) In practice, *TSO* A would activate B3 instead of B4 to satisfy the *TSO* B *balancing* needs, since this is more economically efficient. This example raises the issues of:

- Allocation of benefits: *TSO* A gets an extra revenue (500€/h) to be possibly reallocated;
- Lack of transparency and non-consistency between the cross-border product (B4) and the bid that is actually activated (B3). This was an important concern that was raised by some participants during expert group meetings.

2) As the price of B4 is higher than marginal price in area B, B4 is not activated. However, the real-time system state shows that the *balancing* need in area A is eventually 100 MW: B3 is actually not needed in area A.

- B3 could have been used for cross-border exchange to satisfy *balancing* needs in area B;
- Missing opportunity: the *BSP* was not activated, although he was in the money in area B.
- In such cases where *TSOs* may allocate *balancing energy* bids in a non-transparent and inefficient way, *BSPs* advocate that they would rather choose themselves in which market they bid.

Effectiveness to facilitate integration of variable generation from renewable energy sources	**(A):** The need to accommodate massive penetration of generation units delivering variable generation suggests the need for additional measures aim to guarantee that sufficient products are available for *TSOs* to meet the growing demand in *balancing energy*. Cross-border *balancing* may be an essential element to achieve this. In this respect, Option A is likely not to address these needs adequately. **(B):** The option is a step in the right direction to tackle the future challenges related to the penetration of renewables. For instance, the implementation of an *imbalance netting* mechanism may significantly reduce the need for activation of automatically activated *balancing energy*, and may provide to participating *TSOs* a better availability of *reserves* in order to accommodate the integration of renewable generation. However, sharing only the surpluses does not allow for the best allocation of resources and would significantly limit the amount of exchanges of *balancing energy*, thus making difficult for the *TSOs* to fully benefit from the complementarity of different resources across Europe. Moreover, this option does not require harmonisation of timing processes that could allow generators to modify their output close to real time to cope with uncertain intermittent generation. For these reasons, developing cross-border exchanges based on this option is unlikely to be an adequate policy to accommodate RES generation in the electricity grids. **(C):** With highly integrated balancing markets, system *imbalances* in *control areas* caused by the forecast errors of renewable generation could be smoothened out by *TSOs* using a greater range of *balancing* resources available over larger areas[21]. The presence of a European-wide *Common Merit Order* to exchange *balancing energy* may enable *TSOs* to better accommodate such generation close to and in real time, as it is likely to provide high liquidity within the common market. In addition, with a higher level of coordination between *TSO*s, it is likely that common processes to optimise the procurement of *balancing reserves* will gradually emerge, therefore increasing the ability of the future European system to "absorb" intermittent generation without significant costs that could be expected from the procurement of additional flexible operating reserves. **(D):** A global system overview, together with an optimal procurement of *balancing reserves* and allocation of *balancing energy* across Europe, allows the balancing operator(s) to optimise the use of *balancing* resources, which would enable efficient accommodation of intermittent generation. From this perspective, option D may be better in facilitating the penetration of renewable energy sources.

[21] *Developing balancing systems to facilitate the achievement of renewable energy goals,* ENTSO-E, November 2011.

Time of implementation

(A): As no regulation will impose any implementation roadmap, this option effectively requires no time for implementation.

(B): The rules governing national balancing markets are not subject to any binding European regulation and remain in the scope of the national regulations. Implementation time for this option may depend on whether the binding regulation asks for a European-wide or regional implementation, as well as the type of models considered to exchange *balancing energy*, which are derived from the concept of surpluses. Implementation challenges may not include revisions in the *gate closure times* and technical characteristics of *balancing* products, as they are not the prerequisites for such approach to apply.

- *Imbalance netting:* the GCC project within Germany was implemented relatively quickly due to the existing similarities in the different German *control areas* (*balancing* management, common processes and tools, etc.). The time needed for the technical implementation is quite low after an agreement for financial settlement of the transferred energy has been found between the participating *TSOs*;
- With implementation time of few years, a *BSP to TSO* approach is used today between some *control areas* where bidding rules of balancing markets allow for the process of cross-border exchanges (which are seldom, if ever, optimal, due to non-reciprocal exchanges). In case incompatibility between markets become a strong impediment, a certain period to implement the change in market designs may need to be envisaged;
- The *TSO to TSO model* is already implemented at the BALIT mechanism. This approach calls for the development of ad-hoc rules and a common platform. It requires *TSOs* to be able to handle cross-border exchanges in the price formation and *imbalance settlement* processes within local markets, to update available transmission capacity close to real time, and ensure coherency between possible liquid *intraday* markets and balancing markets taking into account the cross-border exchanges. Hence, several years may be necessary to implement the model.

(C): This option implies some minimum changes in the roles and responsibilities in terms of operational security. As it requires at least, in addition to the development of a single IT platform, the standardisation of *balancing* products in order to create a trustful liquid balancing market[22], as well as a harmonisation of other key aspects needed for European wide *TSO-TSO* model with a common *merit order list*, such harmonisation may take a longer time to set up. It may also face some reluctance from *TSOs* as it actually affects the national *balancing* arrangements. Depending on the geographical scope of the projects, a certain amount of time - typically several years - may be necessary to achieve a well-functioning balancing market on a basis of a *Common Merit Order*. As a second step, such developments may provide *TSOs* with fruitful experience and useful tools to adapt their operational processes on a step-by-step basis in order to optimise the use of *balancing energy* from automatically activated resources at pan-European level. On top of that, the emergence of cross-border exchanges of *balancing reserves* depends on the dynamics and the relevance of projects based on voluntary initiatives. In any case, designing a common reserve procurement to implement a multilateral reserve-trading model is challenging and requires a careful step-by-step process allowing for learning effects.

(D): As described above, a European-wide platform to exchange *balancing services* may take a long time to be established. This option may lead to the development of common control centres, common security analyses and platforms for real-time frequency management, based on current international initiatives (such as CORESO or TSC). Centralised governance in Europe may be very challenging to achieve in practice, as the option implies a significant revision of roles and responsibilities with respect to system operational security. The related time of implementation depends on many factors, but in any case, it is likely to be much higher compared to other options.

[22] Experience from the Nordic system and other current initiatives (e.g. Germany) may be a relevant basis to develop projects and evaluate the necessary time for implementation.

<table>
<tr><td rowspan="3">Efficiency</td><td> (A): On the one hand, voluntary approaches are likely to be considered only in case of a positive cost-benefit analysis. On the other hand, given the small likelihood that strong integration of balancing markets will occur within a reasonable timeframe, the efficiency gains resulting from (possibly non-compatible) projects are likely to be significantly below the optimum. (B): The core elements of this option are already implemented with different forms across several interconnectors. Thus, the efficiency can roughly be assessed by evaluating the related costs and benefits of existing arrangements, even though such quantification can prove to be challenging given the complexity of real world systems and the data granularity. </td></tr>
<tr><td> An imbalance netting mechanism may have a good level of efficiency, as it may reduce overall balancing costs with relatively few implementation costs. In the German Grid Control Cooperation, the counteracting SCP avoidance (module 1) led to a saving of approximately 120 Million €/year[23]. First estimations of TSOs suggest that expanding the iGCC to neighbouring countries and control areas can lead to additional savings of 10 Million €/year/border or even more depending on the size of the country that joins the iGCC. A BSP to TSO approach has been running on some interconnections for several years – for instance between France, Germany, and Switzerland. It is a proven concept with very few implementation costs and it generates interesting savings (e.g. around 10 Million € in 2010 according to internal NRA's analysis). However, the main consequence of implementing a BSP to TSO model is a suboptimal use of balancing services as well as transmission capacity, leading to an insufficient increase of social welfare. A TSO to TSO model may also reduce balancing costs within the requesting control area with few implementation costs. According to internal NRA's appraisal, the introduction of first BALIT arrangements generated a gain of approx. 3 Million € for RTE in 2010[24]. At the time the document is written, the total yearly costs supported by RTE for the implementation, operation and maintenance of the BALIT platform do not exceed 300 k€[25]. </td></tr>
<tr><td> In the concept of surpluses, it is unlikely that the best available offer is used, since these are usually kept for local security (worst-case) needs. Such sub-optimisation of balancing services may lead to significant loss of social welfare. (C): With a binding European regulation enforcing the harmonisation of key balancing features, the implementation of a common merit order list to exchange balancing energy will boost. The total implementation and operational costs may be significant, including (but not limited to) changes in operational procedures, IT platform operation and maintenance, internal tests, maintenance of servers, software licences, workforce development and training. However, a well-functioning common balancing market may demonstrate huge benefits coming from the activation of the most competitive bids, allowing for a better allocation of resources and an increase in social welfare. It has been estimated that the implementation of such a model between Belgium and the Netherlands in 2008 would have reduced global balancing costs by 22%[26] in the joint area. Likewise, cost reduction of cross-border balancing between Northern Continental Europe and the Nordic system would have been about 44% in 2009, although assuming that 10% of cross-border capacity is allocated for balancing trade[27] with no assessment of the welfare loss in the energy market. Such benefits may also be expected in case of ambitious projects are carried out to foster the exchange of balancing reserves across Europe. (D): A cost benefit analysis may theoretically demonstrate very high benefits arising from a common consideration of system security management and the activation of the most competitive bids. It allows for a better allocation of resources and enables to reach an optimal level of global social welfare. Nevertheless, the huge challenges with respect to responsibilities and operational security may prove detrimental to overall efficiency. Experience from Nordic system and some US systems show that it is worthwhile centralising some responsibilities without decreasing the required level of operational security, as this does not prevent sharing of responsibilities between global and local entities. </td></tr>
</table>

[23] The simulation tends to overestimate activated energy and costs, but overestimation error is smaller than 10%; See *Grid Control Cooperation – Coordination of Secondary Control*, Pavel Zolotarev (University of Stuttgart).
[24] The analysis tends to underestimate the gains, and the results do not include larger gains in the GB system.
[25] *Development and Implementation of cross-border balancing mechanisms in the SWE region – interim solutions* », ENTSO-E, (2012).
[26] D/2011/7515/19: *Design and integration of balancing markets in Europe*, L. Vandezande (2011).
[27] *Effect of integrating regulating power markets of Northern Europe on total balancing costs*, A. Abbasy (2009).

Coherency	**(A):** For the reasons listed above, following this option may not lead to an efficient integration of balancing markets in Europe, therefore being inconsistent with the idea of achieving a well-functioning Internal Electricity Market. *TSOs* may not have sufficient incentives to benefit from wider sourcing areas to perform new challenging tasks that are expected in the energy sector in the coming years, notably to accommodate the renewable sources and other objectives pursued by the European energy and environmental policies. **(B):** The concept of surpluses is the cornerstone of Option B. The development of new arrangements to materialise this concept is a positive step towards the integration of balancing markets as it may provide experience in coordinated *balancing* and thus increase the level of cooperation. However, it is likely that the fundamental characteristics of the balancing markets will need to be changed again to match the requirements of the long-term vision. This option may hardly help the development of a common European electricity market, Since the regulatory framework is designed only to be compatible with national regulations, the option may provide limited results in terms of increased competition and efficiency. This may in turn hinder the development of new efficient and environment-friendly *balancing* resources, therefore being inadequate to achieve European economic and environmental policy targets. **(C):** In general, Option C is foreseeing a deeper integration of balancing markets, in consistency with the binding European regulation affecting electricity wholesale markets. A careful and stepwise implementation of a *common merit order* for manually activated *balancing energy* may consist in the best option to be considered for all the reasons listed above. Even though a looser regulation is advocated here concerning the exchange of *balancing reserves*, a stronger coordination of *TSOs* based on learning-by-doing approach is likely to stimulate further integration of both *balancing reserve* and *balancing energy* markets. Hence, it is more consistent with the objective of building the Internal European energy market. As it permits to better address the challenges related to variable generation on the grid, it is coherent with European targets on renewables. The option is in line with other principles set forth in European economic, energy and environmental policies. By enhancing competition, economic efficiency and creating a level playing field for market participants, this option may in particular help the development of new *balancing* resources such as renewable energy sources and *demand response*, thus having high potential in meeting key environmental targets such as the reduction in GHG emissions and energy efficiency. **(D):** This option will introduce a true common European balancing market. However, the challenges coming with its implementation may be very complex and not perfectly understood while drafting this Initial Impact Assessment. Checking consistency of such approach with other overarching European objectives may prove challenging. The model may merit further careful consideration to identify well the related implications. However, assuming this option can be designed in a way not to endanger operational security of the European power system; it is likely that general principles behind this option would enable better facilitation of the main European energy, economic and environmental policies.

7 Preferred policy options

7.1 Synthesis of evaluation of policy options

The analysis of the options in the previous chapter suggests that the potential gains from strong harmonisation and integration of balancing markets across Europe (Options C and D) are substantial as it would increase competition, generate higher social welfare and facilitate the integration of renewables and intermittent generation into the network.

Table 3: Summarised picture of the screening process of identified options

Criteria		Option A	Option B	Option C	Option D
Effectiveness	Security of supply	-	+	+	++
	Competition	-	+	++	+++
	Social welfare	-	+	++	+++
	Renewables	- -	+	++	++
Time of implementation		+ +	+	-	- - -
Efficiency		-	+	++	? (+)
Coherency		-	+	++	? (+)

7.2 Long-term preferred policy option

In the long-term, option D appears to be the best solution in terms of effectiveness and its implementation would allow for the creation of a single European balancing market, in line with the targets for wholesale markets (long-term, *day ahead*, *intraday*). In addition to substantial gains in terms of social welfare, Option D would induce a harmonisation of *balancing* rules and incentives, which would create a level-playing field for all market participants, not only in the balancing market, but also in the wholesale markets. Consequently, competition would be fostered in all markets. In addition, it would force *TSOs* into a strong cooperation, which would end up with a reinforced security of supply in Europe and would exploit synergies between systems. By using jointly all *balancing* resources across Europe, *TSOs* would be able to size the *balancing reserves* in a centralised and more efficient way and therefore to limit these *reserves* and the associated costs.

Hence, Option D could be contemplated as a long-term perspective and could serve as a visionary goal when drafting the Framework Guidelines on Electricity Balancing. However, some important aspects of this solution cannot be fully evaluated at this stage. The present analysis does not provide enough reassurance that option D is the most efficient and coherent approach to integrate the balancing markets, mainly because it would not deliver the desired benefits within the timeframes considered feasible for binding European regulation. A strong integration of balancing markets, especially through the complete sharing of *balancing* resources, requires significant changes in the current practices (e.g. system operation rules, legal and technical responsibilities). Some of these changes will be considered in the Network Codes on Operational Security, on Operational Planning and Scheduling and on Load-Frequency Control and Reserves, while other changes appear to be much more challenging, and would certainly require more time to be implemented. Feasibility and benefits should be further assessed and the related implications should be carefully identified. Thus, drawing on the learning effects from the implementation process of different elements of balancing market integration, this option could be considered for the next phase of European energy market integration that could probably be endorsed by the new energy legislative package.

7.3 Medium-term preferred policy option

For the reasons described above, the Initial Impact Assessment advocates the definition of a consistent and binding European framework to generate most of the benefits of market integration with limited fundamental revision of technical and legal *balancing* responsibilities. From this perspective, Option C should be the key reference for the elaboration of the Network Code on Electricity Balancing.

7.3.1 Procurement and exchanges of balancing energy

- *The concept of Common Merit Order as the keystone of option C*

In this option, building on towards the long-term model, all manually activated *balancing energy* bids and offers are gathered centrally through the *TSO-TSO* model with *common merit order* list. As local *balancing* responsibility in frequency control is still a cornerstone of the operation of the largest synchronous power system, the activation of bids and the corresponding decision processes remain largely decentralised.

As a transitory measure to enable *TSOs* to learn and gain experience with common *merit order list*, this options allows *TSOs* to keep some *balancing energy* bids ("unshared bids") at national level to be able to meet the security criteria. These unshared bids should gradually phase out and should include only the most expensive bids[28], to ensure that the cheapest bids are activated at a European level and that global social welfare is enhanced. The definition of these unshared bids and the methodology to calculate them should be such that it may avoid any free-riding behaviour and incentivise *TSOs* to share as much as possible in the *common merit order* list.

While the first economic estimations suggest that a *Common Merit Order* taking into account all *balancing energy* bids brings about high efficiency gains, it is expected that the transitory measure will generate most of these gains insofar as the unshared bids are defined in an efficient way and are kept to a minimum. These unshared bids and the related efficiency loss should be carefully monitored, and they should gradually converge to zero.

Applying the concept of *common merit order* to automatically activated *balancing energy* should also deliver significant efficiency benefits. Nevertheless, since *common merit order* for automatically activated *balancing energy* is more challenging, it should be possible for *TSOs* to explore a variety of options and demonstrate which approach is most suitable in terms of technical feasibility and economic efficiency. Thus, the Network Code on Electricity Balancing should ensure

[28] Details in section 8.4.4.

that such model is carefully assessed and envisage a consistent process with a proper involvement of the *Agency*, NRAs and stakeholders.

➢ *The necessary standardisation of balancing products*

Moreover, taking into account the benefits of having access to a wide European electricity balancing market, *TSOs* will be able to reduce the *balancing reserves* they contract in advance and to coordinate the amount of *reserves* they contract and the way they procure them.

Standardisation of *balancing* products is required to increase competition among *BSPs* and to increase the liquidity of these products as well as to simplify the *TSOs* decision process to balance the system in a most efficient way. Nonetheless, in the light of the differences in terms of operational security limits, generation mix, structures of balancing markets, etc., it is important to allow for some products that are adapted to these local or national specificities, in order not to lose specific *balancing* resources when the supply of standard products would be insufficient to balance the system.

➢ *Implementation roadmap towards an integrated balancing energy market*

Exchanges of *balancing energy* from…	**Manually activated reserves**	**Automatically activated reserves**
BSPs provide *balancing energy* products and they are remunerated based on a common pricing method.		
First step	After elaborating standard *balancing energy* products, *TSOs* get involved in project(s) to exchange *balancing energy* from *Replacement Reserve* and activate these products using a common *merit order list*. Non-standardised products may be defined as well to compensate for insufficient supply of standard products	*TSOs* develop a joint automatic control system in order to exchange real-time information and perform netting of system *imbalances*. This includes the development of a financial settlement mechanism to settle the *balancing energy* exchanged in this way. No strong harmonisation requirements are prescribed and a short lead-time for implementation is foreseen.
Assuming that some experience is gained from developing exchanges of *balancing energy* from *Replacement Reserve*, *TSOs* elaborate the model to exchange automatically activated *balancing energy* and the *Agency* and NRAs decide on the way forward based on *TSOs*' proposal.		
Second step	*Balancing energy* products from manually activated *Frequency Restoration Reserve* are also shared in the common *merit order list*.	*TSOs* coordinate and optimise the activation of *balancing energy* from automatically activated *Frequency Restoration Reserve*.
Third step	A European-wide common *merit order list* is used to exchange all *balancing energy* bids from all manually activated *reserves*.	*TSOs* exchange *balancing energy* from automatically activated *Frequency Restoration Reserves* based on the proposed and/or approved model.

7.3.2 Procurement and exchanges of balancing reserves

As regards *reservation of cross-border capacity*, this issue should be addressed in a cautious way since the negative impacts on commercial cross-border exchanges in the traded markets (long-term, *day ahead* and *intraday*) may exceed the gains from *reservation of cross-border capacity* for exchanges of *balancing services*. Thus, a detailed cost-benefit analysis must be carried out, and *reservation of cross-border capacity* should only be allowed if the overall welfare gain is higher.

In consequence, exchanges of *balancing reserves* are not foreseen to be pursued to a great extent, in particular, since ENTSO-E considers that *reservation of cross-border capacity* is a prerequisite for exchanging of *balancing reserves*. The Framework Guidelines on Electricity Balancing are therefore less prescriptive on the model for exchanges of *balancing reserves*. Nonetheless, if exchanges of *balancing reserves* are frequent, procurement mechanisms should be harmonised and integrated.

Lastly, exchanges of *balancing reserves* should also be envisaged without *reservation of cross-border capacity* by coordinating the procurement and the sizing of the *balancing reserves*, as well as sharing them, possibly through stochastic forecasts and analyses.

7.3.3 Balancing responsibility and imbalance settlement

An efficient functioning of a common *balancing energy* market requires the harmonisation of some features of *imbalance settlement*. The Initial Impact Assessment suggests that marginal (i.e. pay-as-cleared) pricing is the most relevant mechanism[29] for pricing activated *balancing energy*, so that an uniform price for *balancing energy* is applied in areas without congestion. However, if it can be demonstrated that another pricing method is more efficient in pursuing the general objectives defined in section 3, *TSOs* may still consider other alternatives.

Incentives for market participants' behaviour should also be harmonised to a certain extent to avoid having *TSOs* coping with completely different situations. In particular, to achieve an efficient integration of the balancing markets and avoid distortions, *imbalance settlement* should progressively evolve towards a more harmonised mechanism.

Taking into account the interactions between *balancing* and wholesale markets, a common design of *imbalance settlement* should ensure that national *imbalance settlement* periods, calculations and pricings are defined - at least but not limited - to encourage *BRPs* to minimise their *imbalances* in real time or help the system to restore the balance.

[29] Details in section 8.5.1

8 Annexes

8.1 Definitions

The following definitions are intended to clarify the provisions of this Initial Impact Assessment.

- **Agency** – Agency for the Cooperation of Energy Regulators, as established by Regulation (EC) No 713/2009.
- **Annual report** – report to be published by ENTSO-E on a yearly basis, in accordance with Section 2.5 of these Framework Guidelines.
- **Balancing** – all actions and processes through which *TSOs* ensure that the total electricity withdrawals are equalled by the total injections in a continuous way, in order to maintain the system frequency within a predefined stability range.
- **Balancing Energy** – energy (MWh) activated by *TSOs* to maintain the balance between injections and withdrawals.
- **(Balancing) Reserves** – power capacities (MW) available for *TSOs* to balance the system in real time. These capacities can be contracted by the *TSO* with an associated payment for their availability and/or be made available without payment. Technically, *Reserves* can be either automatically or manually activated.
- **Balancing Services** – *balancing reserves* or *balancing energy*.
- **Balance Responsible Party (BRP)** – a market participant or its chosen representative responsible for its *imbalances*.
- **Balance Service Provider (BSP)** – a market participant providing *balancing services* to one or several *TSOs* within one or several *control area(s)*.
- **Bidding zone** – the largest geographical area within which market participants are able to exchange energy without capacity allocation.
- **Control Area** – a coherent part of the interconnected system, operated by a single *TSO* responsible for *load-frequency-control* for physical loads and generation units connected.
- **Cross-border balancing** – exchanges of *balancing energy* and/or *reserves* between *control areas* and/or between *bidding zones*.
- **Cross-border (Transmission) Capacity** – a capacity to transfer the energy from one congestion management *bidding zone* to another one.
- **Day-Ahead** – market timeframes where commercial transactions are executed prior to the day of delivery of traded products.
- **Demand response** – Changes in electric usage by end-use consumers from their normal load patterns in response to changes in electricity prices and/or incentive payments designed to adjust electricity usage, or in response to acceptance of the consumer’s bid, alone or through aggregation.
- **Frequency containment reserves** – operating *reserves* necessary for constant containment of frequency deviations (fluctuations) from nominal value in order to constantly maintain the power balance in the whole synchronously interconnected system. Activation of these *reserves* results in a restored power balance at a frequency deviating from nominal value. This category typically includes operating *reserves* with the activation time up to 30 seconds. Operating *reserves* of this category are usually activated automatically and locally.

- **Frequency restoration reserves –** operating *reserves* used to restore frequency to the nominal value and power balance to the scheduled value after sudden system *imbalance* occurrence. This category includes operating *reserves* with an activation time typically up to 15 minutes (depending on the specific requirements of the synchronous area). Operating *reserves* of this category are typically activated centrally and can be activated automatically or manually. In these Framework Guidelines the automatically activated *reserves* refer to *reserves* activated by an automatic controller.
- **Gate Closure Time** – deadline for the participation to a given market or mechanism.
- **Imbalances –** deviations between generation, consumption and commercial transactions (in all timeframes – commercial transactions include sales and purchases on organised markets or between *BRPs*) of a *BRP* within a given *imbalance settlement period*.
- **Imbalance Settlement** – a financial settlement mechanism aiming at charging or paying *BRPs* for their *imbalances*.
- **Imbalance Settlement Period –** time units used for computing *BRPs*' *imbalances*.
- **Intraday –** market timeframe beginning after the *day-ahead gate closure time* and ending at the *intraday gate closure time*, where commercial transactions are executed prior to the delivery of traded products.
- **Merit Order List** – in the *balancing* markets a *merit order list* is a list of all valid *balancing* bids submitted by *BSPs* and sorted in order of their bid prices.
- **Program Time Unit –** time units used for scheduling and programs.
- **Replacement Reserves** – operating *reserves* used to restore the required level of operating *reserves* to be prepared for a further system *imbalance*. This category includes operating *reserves* with activation time from 15 minutes up to hours.
- **Reservation of *cross-border transmission capacity*** – a portion of available *cross-border capacity* which is reserved for cross-border exchange of *balancing reserves* and thus is not accessible to market participants for cross-border energy trade.

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8.4 Description of the identified models to exchange balancing energy

8.4.1 Imbalance netting

It is inherent to each electricity system that there are time periods when some *control areas* are short (power shortage) while other *control areas* are long (power surplus) at the same time. This leads to a “demand” for a simultaneous activation of positive and negative *Frequency Restoration Reserve* in the respective control areas.

The approach of *imbalance netting* is to exchange the *imbalances* with opposite signs in a controlled manner in order to avoid counteracting activation of *balancing energy*. Such netting can also be obtained between separate synchronous zones linked with DC interconnectors.

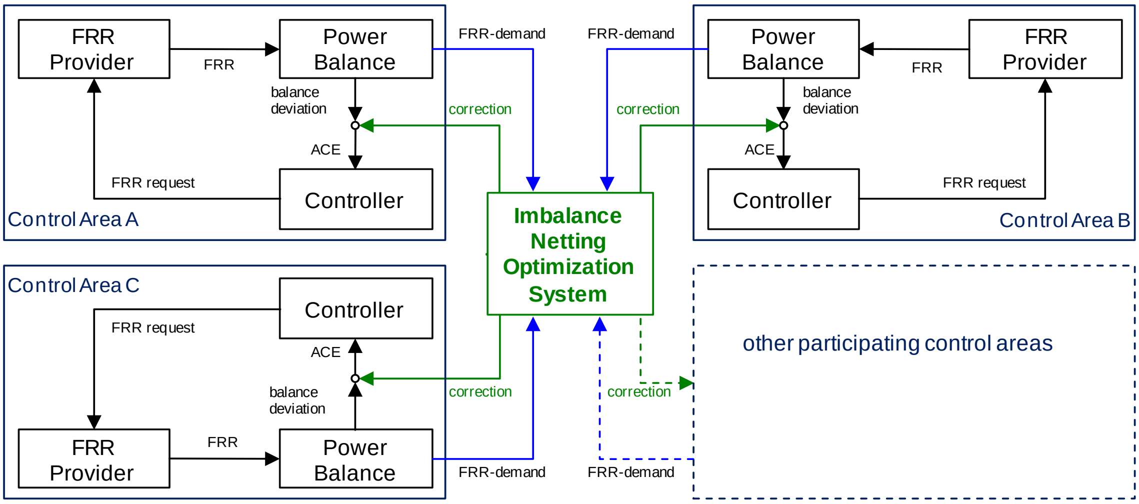

Figure 10: Imbalance netting between several control areas

The model consists in an exchange of information of control zone imbalances and automatic netting of opposing energy imbalances in real time, subject to available transmission capacity. In that way, the balancing energy from *Frequency Restoration Reserves* needed to restore the balance in the power system is reduced leading to a higher efficiency and cost savings while the security of the power system is elevated due to a lower amount of required control actions.

The functioning of imbalance netting process can be summarized in three key steps

- The respective demands are reported to the coordinating imbalance netting optimization system in real-time;
- The optimisation system uses the demand values to calculate the correction signal values;
- These values are added to the power balance deviations of the participating control areas;

In result, the inputs of the single control loops are coordinated so that the counteracting imbalances are eliminated and all participating TSOs request *Frequency Restoration Reserve* with the same sign.

8.4.2 BSP to TSO model

A *BSP* to *TSO* model enables a *BSP* to provide *balancing services* directly to a requesting *TSO* situated in another *control area*, if sufficient *cross-border capacity* is available after the *gate closure time* of the last relevant market (likely to be cross-border *intraday*).

The providing *BSP* is responsible for building the *balancing* product, as well as notifying the change in generation and/or consumption schedules (and possibly interconnection capacity acquisition) to both requesting *TSO* and local *TSO*, with respect to the rules for scheduling generation, consumption and cross-border exchanges.

The providing *BSP* needs to comply with the *balancing* rules that are established in the *control area* it is bidding in, and the financial settlement is foreseen with the requesting *TSO*.

Such scheme may be based on two different designs:

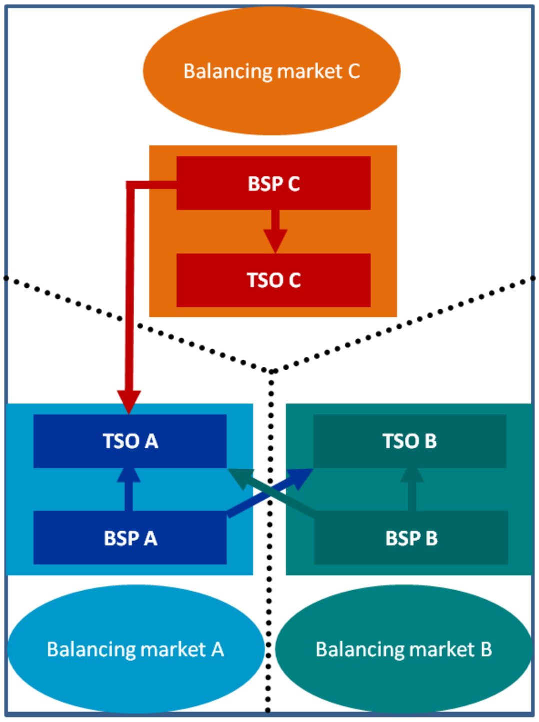

Figure 11: BSP-TSO model for exchanges of balancing services

- *BSPs* are allowed to bid in one market only and they need to identify themselves in advance what is the best possible allocation of their resources among different *control areas*, based on the available information;
- *BSPs* are allowed to bid in both systems. In this case the *TSOs* would use the *balancing energy* bids on the basis of a defined allocation process (e.g. optimisation algorithm or first-come-first-serve).

The involved *TSOs* have agreed procedures for the event of acceptance of a bid/offer:

- For a proper assessment of the impacts of cross-border exchanges, the decision process is based on transparent rules for scheduling generation, consumption and cross-border exchanges;
- For security reasons, the local *TSO* (in the *control area* where is located the providing *BSP*) has the possibility to veto the change in the *BSP*'s program and inform the requesting *TSO* that the offer is not available.

8.4.3 TSO to TSO without common merit order

This approach conceptually deals with the exchanges of limited set of manually activated *balancing energy* (surpluses) between *TSOs* after the *intraday* markets *gate closure time,* based on the volumes over and above those required to meet local security standards. It can take different forms:

- The local *TSOs* act as an "intermediary" between the *BSPs* in its area and the requesting *TSO*. From a market point of view, such model is equivalent to the second alternative for a *BSP-TSO* model as described in 8.4.2;
- The local *TSO* is an active provider of *balancing services*, and acts as the commercial counterpart to the requesting *TSO*, which has no direct link with *BSPs*. In the following, we only describe this second form.

The bids in the balancing markets become available for activation for other *TSOs* by decision of the providing *TSO* after defining the amount of *balancing energy* that can be exchanged based on security criteria and/or *balancing* expectations as well as available *cross-border capacity*. The providing *TSO* can offer the not needed bids directly to other *TSOs* or it can compile new products to be exchanged across the border. The ability to activate bids and offers across the border will depend on the availability of *cross-border capacity*. *TSOs* thus identify available surpluses of *balancing energy* and offer them directly or through aggregation to be traded on a specific common pool that gathers offers and bids from the providing *TSOs*. This common pool represents an additional *merit order list* complementing the local *merit order list*. The requesting *TSOs* can thus decide to activate the most economically advantageous bid or offer from local *merit order list* of from the specific *merit order list*. The energy is delivered and settled at a given price, depending on the retained rules.

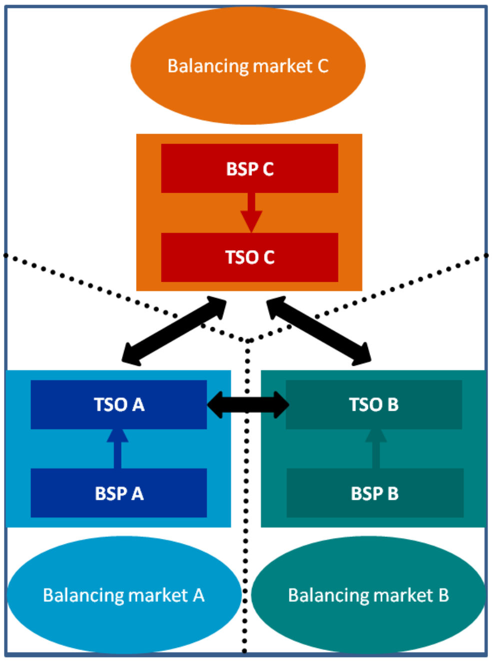

Figure 12: TSO-TSO model without common merit order list for exchanges of balancing services

In practice, exchanges could be implemented twofold:

- Through blocks of energy pre-scheduled before a fixed deadline. One concrete example is the BALIT mechanism implemented between France and GB, based on standard products of e.g. 1 hour duration;
- Through a flexible product directly activated via continuous process without fixed deadline: *TSOs* share bids and activate exchanges on a continuous basis. For instance, this flexible product may be designed to implement exchanges of manually activated *reserves* with a 15 minutes activation lead-time and duration.

Implications in terms of system operation

- Define standard products to be exchanged by *TSOs*;
- Develop a common platform and necessary IT tools to be used by participating *TSOs*;
- (Optionally) build the products based on local bids from providing *BSPs* (volumes & prices);
- Handle the cross-border exchanges in price formation and *imbalance settlement*;
- Manage transmission capacity close to real time (refreshment and nomination being more complex with shorter-term flexible products) and coordination with *intraday* timeframe.

8.4.4 TSO to TSO with Common Merit Order list

The *TSOs* share their *balancing* resources and optimise their activation in order to minimise the cost of *balancing* by gathering in a common list *balancing* bids and offers that are available in their *control areas*, and activate them according to a *merit order list* subject to operational security constraints including the availability of *cross-border transmission capacities*.

This exchange of standardised *balancing energy* products between *TSOs* is based on the activation of the cheapest available bids provided by the *BSPs* based on a common *program time unit*.

The *TSOs* may be allowed to deviate from the *merit order list* if congestion impedes cross-border exchange of *balancing energy* or other operational security limits that prevent the activation of the cheapest bids.

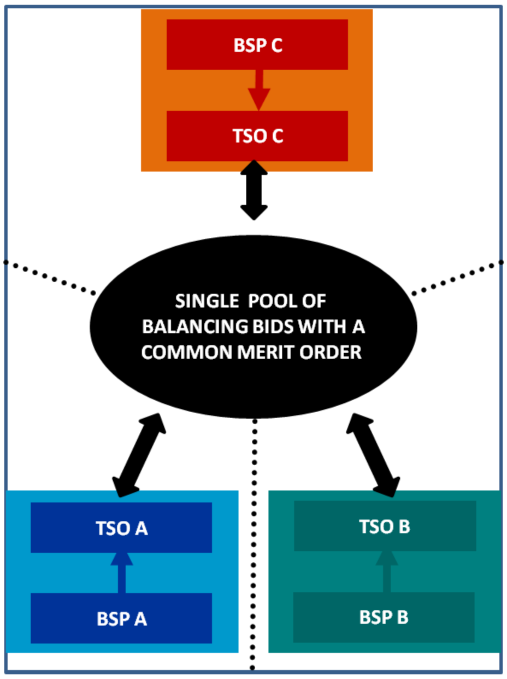

Figure 13: TSO-TSO model with common merit order list for exchanges of balancing services

The concept of unshared bids

TSOs are obliged to ensure there are always enough *reserves* within their *control area* to meet the security standards, which are to be defined in the Network Code on Load Frequency control and Reserves. These standards can be met by contracting enough *reserves*, which are then obliged to place always the bids for *balancing energy* to the *TSO*. However, if *TSOs* are obliged to share all the bids with other *TSOs*, there exists a possibility that all bids would be activated by other *TSOs*, without reciprocal availability of their bids to this *TSO*. To account for such possibility and to allow *TSOs* to gain experience with sharing the *balancing energy* bids, the concept of unshared bids allows the *TSOs* to keep for themselves sufficient amount of *balancing energy* bids to meet the security criteria.

However, since from security perspective it does not matter which bids are not shared, the concept of unshared bids allows *TSOs* not to share only the most expensive bids. This allows the cheapest bids to be shared and activated at a European level and that global social welfare is enhanced. Additionally the *TSOs* may have some specific bids, which cannot be easily activated by other *TSOs* (e.g. hydro plants with limited water storage). The concept of unshared bids also allows the bids from these specific products to be considered. This concept allows the *TSOs* to gain experience and trust in sharing the *balancing energy* bids and once the experience shows that reciprocal sharing and no free riding always ensure sufficient amount bids to the *TSOs*, the volume of unshared bids would diminish towards zero.

Implications in terms of system operation

- Define a limited set of standard products to be used by *TSOs*;
- Develop a common platform and necessary IT tools to be used by participating *TSOs* to exchange and activate *balancing energy*;
- Manage of transmission capacity close to / in real time and coordination with *intraday*;
- Set up a settlement mechanism between *TSOs*.
- Set up a harmonised approach to reserve sizing to prevent free-riding behaviour.

Implications in terms of harmonisation of balancing markets

A limited set of standard *balancing* products are identified and are used both locally and across the border. To enable participation of specific *balancing* resources and new technologies, specific *balancing energy* products may still be defined, and the *TSOs* make them available for exchanges together with the standard products.

Key elements of the national market design are likely to be harmonised such as the *program time unit* and the *gate closure time*, as well as the roles and responsibilities of *BSPs*. Some elements may remain outside the scope of harmonisation requirements, where it is considered that they do not impede the development of the cross-border exchanges.

This exchange of standardised *balancing energy* products between *TSOs* is based on the activation of the cheapest bids provided by the *BSPs* on a common *program time unit* basis.

The *TSOs* may be allowed to deviate from the *merit order list* if congestion impedes cross-border exchange of *balancing energy* or other operational security limits that prevent the activation of the cheapest bids.

8.5 Price signals

8.5.1 Settlement of balancing services

In existing European balancing markets, the procurement of *balancing* products is generally based on the following pricing methods:

- Pay-as-bid pricing: the participating *BSPs* receive a remuneration equivalent to the price they bid;
- Pay-as-cleared pricing: the participating *BSPs* receive the same remuneration, equivalent to the price of the highest activated *balancing energy* bid;
- Administrative (non market-based) pricing in some specific cases.

Pay-as-bid is currently the most used pricing mechanism for procurement of *balancing* products, however, for the development of liquid integrated balancing markets a pay-as-cleared pricing would probably be more appropriate.

Table 4: Pricing methods mainly applied in European balancing markets[30]

Balancing Service	Countries applying pay-as-bid pricing	Countries applying pay-as-cleared pricing
Primary Control Capacity	Austria, Belgium, Czech Republic, Germany, Hungary, Sweden, Switzerland, UK	Finland, Norway
Primary Control Energy	Ireland	Finland, Norway, Poland, Sweden
Secondary Control Capacity	Belgium, Czech Republic, Germany, Denmark, Hungary, Lithuania, Netherlands, Slovenia, Switzerland, UK	Croatia
Secondary Control Energy	Austria, Belgium, Germany, Hungary, Italy, Lithuania, Slovenia	Netherlands, Poland, Portugal, Spain
Tertiary Control Capacity	Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Hungary, Netherlands, Portugal, Slovenia, Switzerland, UK	Croatia, Denmark, Norway, Poland
Tertiary Control Energy	Austria, Estonia, France, Germany, Hungary, Ireland, Italy, Lithuania, Slovenia, Switzerland, UK	Czech Republic, Denmark, Finland, Netherlands, Norway, Portugal, Spain, Sweden

Pay-as-bid pricing, as the overall market price cannot be influenced by single bids, might create a lower incentive for *BSPs* to withhold capacity or deviate from their marginal costs. Bidding strategies in general might be different when pay-as-bid pricing is applied, as *BSPs* are in general trying to guess the market price and bid just below this expectation. A major drawback of this method is that it does not provide a clear signal on the price of the marginal unit of *balancing energy* and thus does not provide a clear signal and incentives to *BRPs* to be balanced, in particular in case of shortages. In highly concentrated markets, furthermore, the price of the last accepted bid could be estimated by *BSPs* with great market share and bidding prices could be set

[30] Source: "*Ancillary Services in Europe Contractual aspects*"; ENTSO-E, WG Ancillary Services, as of 6th July 2011.

close to this theoretical market clearing price with the effect that pay-as-bid and pay-as-cleared pricing lead to the same result.

Pay-as-cleared pricing depicts a transparent and plain pricing mechanism. The price obtained in this way represents a clear reference for all *BSPs* about the price of the marginal unit of *balancing energy* and would thus incentivise them to offer all the *balancing* resources at their disposal. As the market clearing price is determined by the last accepted bid, energy or capacity shortage can be indicated appropriately. This has also a positive effect on the incentives on *BRPs* to keep the system in balance in particular in case of shortages. The possibility to significantly influence the market price by withholding of capacity could be considered as a drawback of this method, however it has been shown that such behaviour is possible in case of market power exercise, which in turn cannot be prevented by any of the two pricing methods. Another drawback for pay-as-cleared method is also that it may at best lead to equal costs compared to pay-as-bid method, but very unlikely to lower costs. Another possible drawback of the pay-as-cleared pricing method is that it could lead to very complex estimation in systems with very frequent internal congestions and central dispatch systems. The full implications of this method on the *BRPs* incentives in different *control areas* are not yet fully understood.

Table 5: Comparing the main pros and cons of pay-as-bid vs. pay-as-cleared pricing methods

PAY-AS-BID PRICING		PAY-AS-CLEARED PRICING	
PROS	CONS	PROS	CONS
BSPs get the price they bid	Does not define a clear market reference price	Gives a transparent and plain price building and imbalance price calculation	May result in higher procurement costs and *imbalance settlement* prices
Withholding of capacity may not influence the whole market price	Shortage of *balancing services* may not be clearly revealed by the market	Provides more efficient dispatch and more responsive balancing market; More appropriate for standardized products	On European scale the incentives on *BRPs* in one *control area* might influence the incentives on *BRPs* in another *control area* and overreaction of *BRPs* to create *imbalances*
Deviations from marginal costs may be less profitable	*BSPs* try to guess the market price, which is more challenging for smaller *BSPs*	Creates a level playing field, and requires less effort for *BSPs* to prepare bids (smaller providers) and gives them accurate price signals	Possibly high complexity of price formation with continuous or sequential activation of bids, activation duration smaller than settlement period and in case of frequent congestions or in central dispatch market
Is more appropriate when products cannot be sufficiently standardised	Does not provide the correct incentives to *BRPs* to be balanced	Can lead to higher profits for *BSPs*, which incentivises participation and investments in *balancing* resources (including *demand response*)	Higher risk of strategic bidding and market power in smaller areas and in scarcity moments (e.g. conventional generation)
Consistent with the continuous trading model (long-term, *intraday*)	Consistent with the auction based model (*day ahead*)	Consistent with the auction based model (*day ahead*)	Unit with marginal or negative marginal costs capture some extra revenue

8.5.2 Imbalance settlement

In course of the imbalance settlement, two different kinds of pricing choices can be distinguished. The first is the choice for *imbalance settlement* pricing method, which can be based on the price of the marginal *balancing energy* bid or an average price of all activated *balancing energy* bids. The second choice is the direction-related pricing of the negative and positive *imbalances* of *BRPs*. Here a single pricing or dual pricing can be established.

Pay-as-cleared or marginal pricing in the *imbalance settlement* has the main advantage that it offers a higher incentive for *BRPs* to avoid *imbalances* compared to the *average pricing* method on top of pay-as-bid method for *balancing energy*. Furthermore, with marginal pricing, the shortages of *balancing* resources can be indicated appropriately. A major drawback depicts the fact that pay-as-cleared pricing in the *imbalance settlement* is often combined with pay-as-cleared pricing in the procurement process, and hence effects like market power might have a higher influence on the *imbalance settlement* price compared to an average pricing method.

For the direction-related pricing method, single and dual pricing concepts are mainly applied. A single pricing concept means that imbalance prices and penalties for positive (supply > demand) and negative (supply < demand) *imbalances* of BPRs are equal (see example below).

Table 6: Imbalance pricing with single price mechanism[31]

with: P…Price BE…*Balancing Energy*		**System Imbalance** Negative (short) supply < demand	**System Imbalance** Positive (long) supply > demand
BRP Imbalance	Negative (short) supply < demand	$+ P_{pos.\ BE}$	$+ P_{neg.\ BE}$
BRP Imbalance	Positive (long) supply > demand	$- P_{pos.\ BE}$	$- P_{neg.\ BE}$

In a dual pricing concept imbalance prices and penalties for positive and negative *imbalances* differ. Different combinations for example with *day ahead* or *intraday* prices for the support of the *control area* and penalties based on procurement prices for *balancing services* are possible (see example below).

Table 7: Imbalance pricing with dual price mechanism

with: P…Price BE…*Balancing Energy*		**System Imbalance** Negative (short) supply < demand	**System Imbalance** Positive (long) supply > demand
BRP Imbalance	Negative (short) supply < demand	$+ P_{pos.\ BE}$	$+ P_{Day\text{-}Ahead}$
BRP Imbalance	Positive (long) supply > demand	$- P_{Day\text{-}Ahead}$	$- P_{neg.\ BE}$

[31] Source: “Study on the interactions and dependencies of balancing markets, intraday trade and automatically activated reserves”; KH Leuven & Tractebel Engineering, February 2009

The direction-related pricing method can be combined with both, pay-as-cleared or average pricing. Because penalties and payments in cases of *single pricing* are equal, the mechanism depicts a transparent and plain pricing method.

Dual pricing concepts, on the other hand, can deliver higher incentives for BPRs to minimize the system imbalance. However, it has to be taken into account that asymmetric imbalance prices lead to asymmetric incentives, which can cause for example BPRs to be systematically long in order to avoid high imbalance prices in case of a short position. This would cause asymmetric needs for *balancing services* for *TSOs*.

Wrong incentives can also be given by the possibility to arbitrage between balancing markets and *day ahead* or respectively *intraday* markets. To avoid such incentives the imbalance pricing mechanism should be designed in a way that *balancing energy* price and *imbalance settlement* price reflects that the prices for positive or negative *imbalances* are settled around the real time value of energy. One way to achieve this is through efficient competition and by allowing *BSPs* to change their *balancing* bids close to real time.

Moreover, the imbalance pricing method should avoid that bigger *BRPs* with a higher synergistic effects for netting of internal *BRP*'s *imbalances* are privileged compared to smaller *BRPs* with lower synergistic effect. Thus, the *imbalance settlement* should create level playing fields for larger and smaller *BRPs*.

The general principles mentioned in this section do not indicate a clear preference for one method, but assuming that market integration is progressing, there may be more arguments in favour of marginal pricing. However, this analysis shall support ENTSO-E in the elaboration of the respective network code that ensures a level playing field for cross-border trade of *balancing services*, an efficient procurement of *balancing services* and right incentives for *BSPs* and *BRPs* to ascertain system security.

Table 8: Comparing the main pros and cons of different imbalance pricing methods

	AVERAGE PRICING	PAY-AS-CLEARED PRICING	SINGLE PRICING	DUAL PRICING
PROS	Applicable with pay-as-bid and marginal pricing in the procurement process Mitigates the effect of market power (in the procurement) on imbalance prices	Higher incentive to avoid *imbalances* Shortage of energy / capacity can be indicated appropriately	Penalties equal payments (no additional cost distribution needed) Transparent and plain price building mechanism	Higher incentive for *BRPs* to minimise the ACE (if applicable);
CONS	Gives lower incentive to avoid *imbalances* Shortage of energy / capacity can not be indicated appropriately	Requires marginal pricing in the procurement process Higher effect of market power (in the procurement process) on imbalance prices	Lower incentive for *BRPs* to minimise the ACE (if applicable)	*Imbalance settlement* is no zero-sum game for the *TSO* Gives an incentive to *BRPs* to minimize the ACE instead of being balanced; Can cause strategic behaviour of *BRPs*