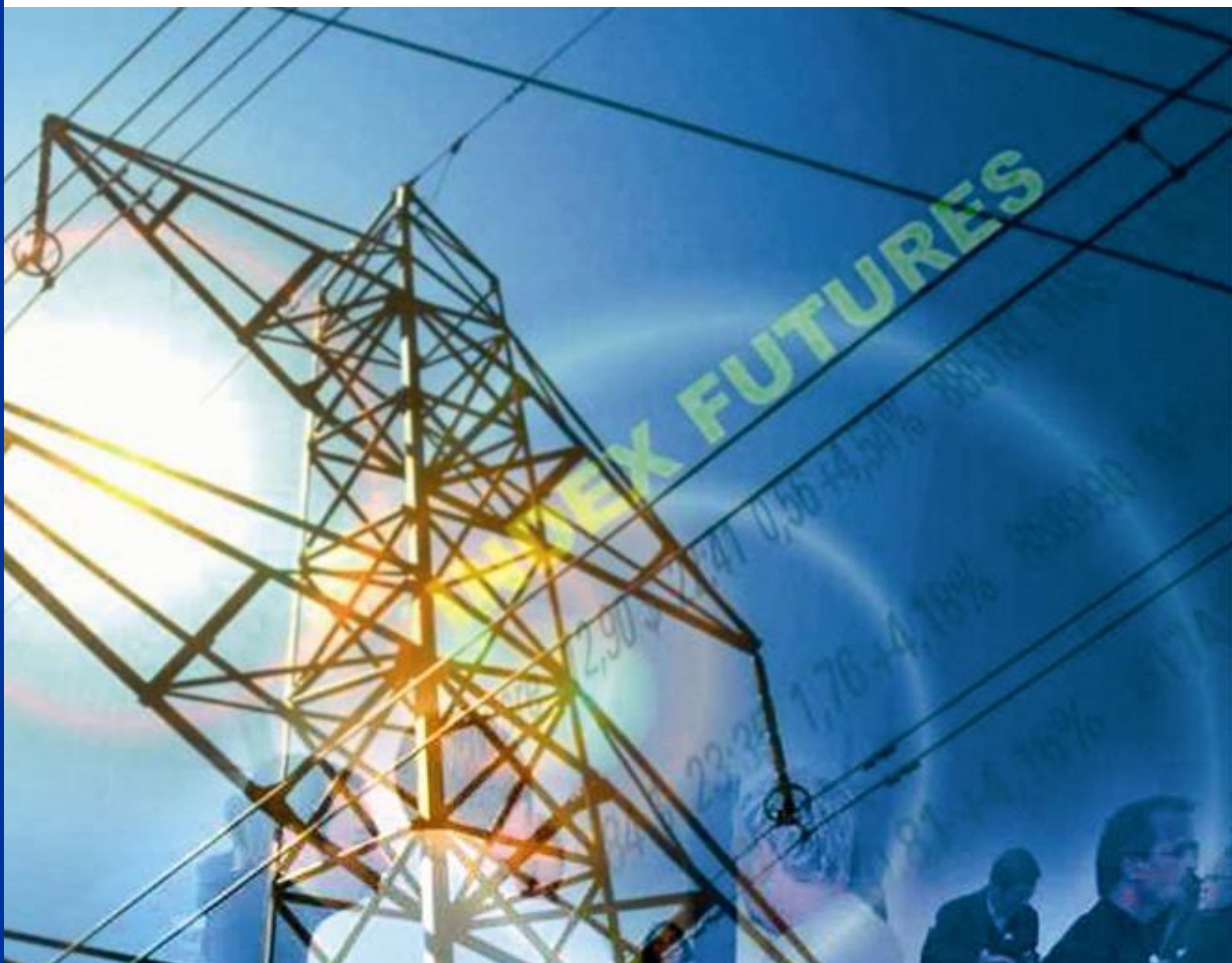
Baltic's balance management model study and harmonisation plan towards EU energy markets model (including Nordic-Baltic balancing cooperation)

Baltic's balance management model study and harmonisation plan towards EU energy markets model (including Nordic-Baltic balancing cooperation)

A report to Elering

March 2016

52X290613 - DEVELOPMENT OF COMMON BALTIC IMBALANCE SETTLEMENT ARRANGEMENTS



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1. INTRODUCTION

In June 2015, the Baltic electricity transmission system operators (TSOs): Augstsprieguma tīkls (AST) (Latvia), Elering (Estonia), Litgrid (Lithuania) and Finnish TSO Fingrid, representing the Nordic TSOs, signed the Terms of Reference regarding Baltic-Nordic balancing market development. Following the ToR a common Baltic electricity balancing market shall be created as an important step towards the Baltic-Nordic balancing market integration targeted by 2020.

As part of the creation of a Baltic balancing market, a set of common imbalance settlement arrangements need to be introduced.

The objective of this study is to define proposals for the common imbalance settlement arrangements in the Baltic markets.

The new imbalance settlement model should align with:

- the Network Code on Electricity Balancing; and
- the Nordic balancing arrangements.

There are several complicating issues:

- each Baltic TSO has different imbalance settlement arrangements;
- the Baltic TSOs are currently in the process of harmonising the balancing markets;
- the Nordic balancing model is under review; and
- the Baltic markets are part of the integrated UES (Russian) network.

The above circumstances make the Baltic situation more complex and consideration of the existing arrangements needs to be taken into account when suggesting harmonised model for imbalance settlement.

1.1 Objectives of the study

The objective and the scope of this study shall be the TSO-BRP (Balance Responsible Party) settlement issues and TSO-BRP balance management model conception.

In order to achieve this, the following scope definition was provided by the TSOs:

1. *Baltic's balance model for BRPs*
2. *Identification of the costs, which shall be incurred in the imbalance service*
3. *Proposals for the common imbalance pricing methodology and imbalance service fee structure*
4. *The proposal for harmonisation of balance settlement*
5. *Changes to be implemented in each Baltic power system for each proposal, including the regulations (consultations with National Regulatory Authorities)*
6. *A financial and socio economic analysis for common balance management target (consultations with stakeholders)*
7. *The proposals for further developments regarding balance management*

2. CURRENT IMBALANCE SETTLEMENT ARRANGEMENTS AND DRIVERS FOR CHANGE

This section gives an overview of current imbalance settlement arrangements in the Baltic markets followed by the Nordic markets. A brief overview of the drivers for harmonisation, including the current draft of the European balancing code, is then presented. The information sets the background for the discussions around a harmonised Baltic balancing model.

2.1 Current imbalance settlement arrangements in the Baltics

The imbalance settlement arrangements differ between the Baltic markets. This section summarises the main imbalance settlement parameters and provides an overall comparison. Table 1 provides a summary of the current situation.

Table 1 – Current imbalance arrangements in the Baltic markets

	Estonia	Latvia	Lithuania	Similar?
Number of imbalance portfolios	Single	Single	Triple (consumption, production, trade)	✗
Imbalance price determination	Average cost-based (pay-as-bid)	Average cost-based (pay-as-bid)	Partly (average) cost-based (pay-as-bid), partly reference price	✗
Imbalance pricing model	Dual-price	Dual-price	Dual-price	✓
Imbalance price methodology: main component for price	Aggravating: Weighted average price + marginal Reducing: Weighted average price – marginal	Aggravating: Weighted average control energy price x coefficient; Reducing: Weighted average control energy price x coefficient	Aggravating: Weighted average control energy price x coefficient; Reducing: Day-ahead market price x coefficient	✗
Price methodology for system open supply price (ACE)	Netted imbalance is priced at the average EE, LV and LT NPS Elspot price Not netted imbalance tariffs provided by INTER RAO Lietuva			✓
Open Balance Provider for System imbalance (ACE)	INTER RAO Lietuva			✓
Balance obligation for RES	BRP	BRP	TSO	✗

Imbalance settlement arrangements in the Baltic region show strong similarities between Estonia and Latvia and a different structure in Lithuania.

In Estonia and Latvia, settlement of imbalances is based on a single portfolio: in other words, all injections and all offtakes of energy in the transmission grid of each market participant is accounted algebraically into a single account, which finally reports a net position for each market participant. The sum of all net positions of all market participants shall result in its turn to zero, i.e. the system is planned to be balanced for the next energy delivery term. The prices used to value the balancing energy rely on a two-price model for imbalance surpluses and shortfalls. Normally the price to penalise deviations aggravating the system balance are priced, in absolute value, more than the actions to support then system balance. In Estonia and Latvia, the two prices are derived from a price and a coefficient. The methodology of imbalance pricing is cost-based: this means that the price is based on the volume-weighted average of the pay-as-bid balancing cost in a national merit order and system ACE cost.

Lithuania's imbalance settlement utilises three portfolios (consumption, production, and cross-border trade). A two-price model with a multiplicative factor (± 2%) is used as in the other two countries.

For aggravating imbalance:-

- balancing price = weighted average of [pay as bid paid activated balancing bids in a national merit order and national ACE cost] X ± 2% (sales /purchase tariff).

For reducing imbalance:-

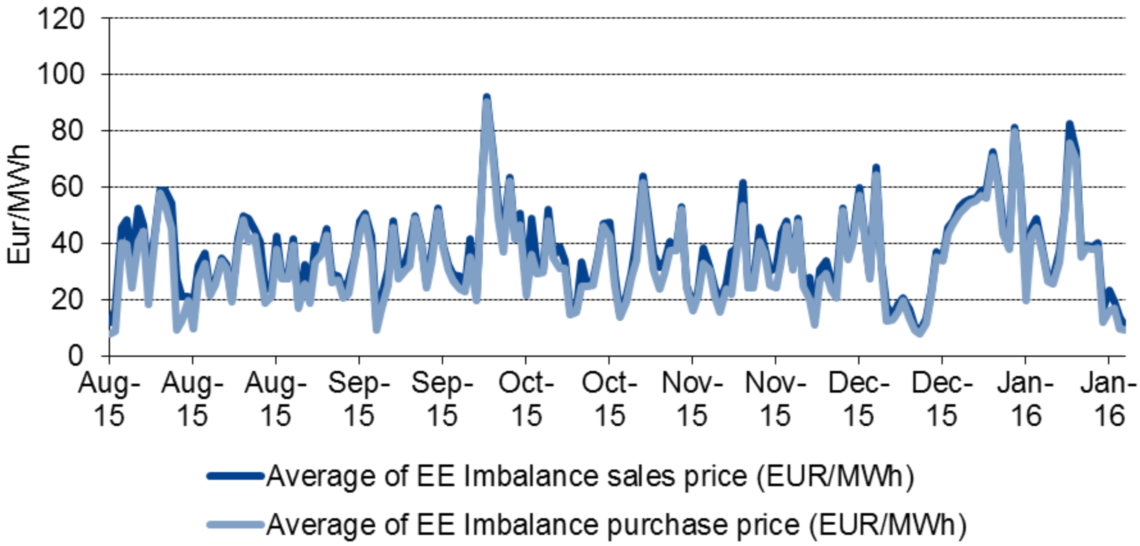
- balancing price = PX price X +/-2% (sales or purchase tariff),

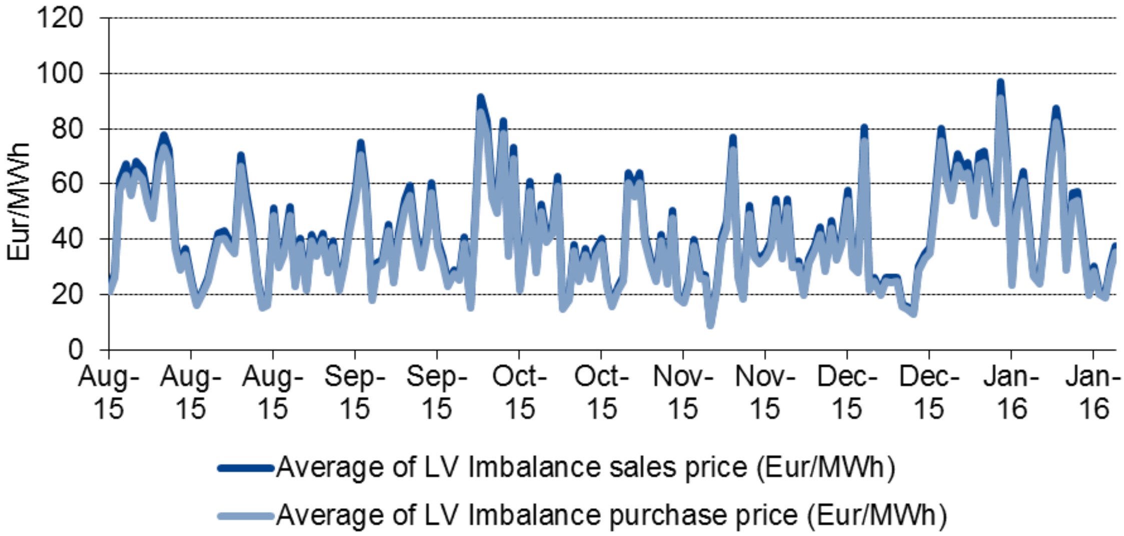
  where PX relates to the Elspot price.

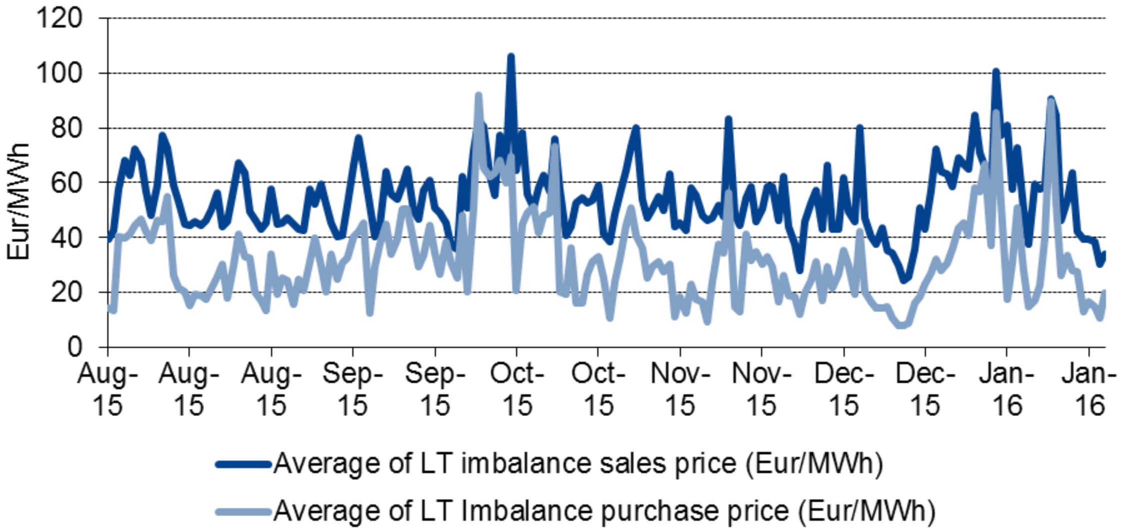
Figure 1 shows the average daily TSO imbalance sales and purchase price for each of the Baltic markets (EE refers to Estonia, LV for Latvia and LT for Lithuania). There are some issues to note:

- the spread between sales and purchase price is rather small in Estonia and Latvia; whereas
- the spread between sales and purchase price is much wider in Lithuania.

Figure 1 – TSO imbalance sales and purchase prices, daily average (€/MWh)







2.1.1 *Cost coverage*

The Baltic model for coverage of balancing costs is outlined in Table 2. There is a clear split between costs related to the balance service, which will be attributed to the imbalance fees, and the costs related to the grid service.

In the Baltics the balance service fees cover the ACE cost, cost of manual frequency restoration reserves (mFRR) for balancing purposes, and cost of balancing energy traded with BRPs. The grid service fees cover the reserve holding costs (also emergency reserve) and mFRR cost for congestion and system services purposes. AST and Elering deal with congestion costs through congestion income.

Table 2 – EE and LV model for cost coverage

Balance service (included in imbalance fees)	Grid service (included in grid fees)	Other
Area control error costs, ACE, netted and not netted (100%)	Emergency reserve holding costs (100%)	Congestion costs dealt with through congestion income
Frequency restoration reserves with manual activation (mFRR), energy and capacity for balancing purposes (100%)	Frequency restoration reserves with manual activation (mFRR), energy and capacity for congestion purposes and system services (100%)	
Emergency reserve activation costs		
Balancing energy traded with BRPs (100%)		
Settlement and administrative costs related to balance management, including IT systems costs (100%)	Settlement and administrative costs related to grid service management (100%)	

The content in the table above is not valid for Lithuania, where the surplus income form balancing income is also used to reduce costs related to grid services (Table 3).

Table 3 - Lithuanian model for cost coverage

Balance service (included in imbalance fees)	Grid service (included in grid fees)
Area control error costs, ACE, netted and not-netted (100%)	Emergency reserve holding costs (100%)
Frequency restoration reserves with manual activation (mFRR), (100%)	Other costs
Emergency reserve activation costs	
Settlement and administrative costs related to balance management, including IT systems costs (100%)	
Some revenue excess used to support cost coverage for grid service	

2.1.2 *Open balance supply and price setting*

Russia provides the frequency control in the Baltics. Therefore instead of frequency control the Baltic TSOs perform area balance control. The allowed Area Control Error (ACE) is +/- 30 MWh/h for Estonia and Latvia, and +/- 50 MWh/h for Lithuania.

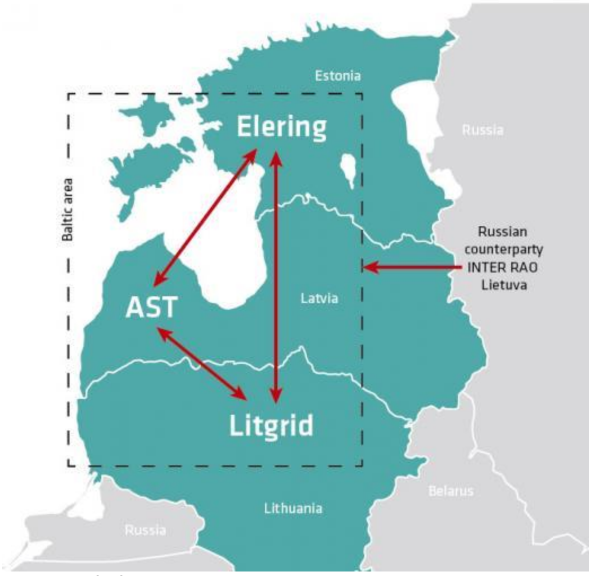
The cost of Russian frequency control service is covered through the Open Balance Agreement by payment for the Baltic ACE. The Open Balance Agreement sets the ACE cost in a stepwise, increasing schedule with each element settled at its own price[1] (not a marginal price). As per the agreement between the Baltic TSOs, the Open Balance Cost is shared between the countries in a two-price system.

The Open Balance Agreement

As of 1 January 2015 the Baltic TSOs have a joint Open Balance Agreement with INTER RAO Lietuva (IRL) for the purchase and sale of imbalance energy. Figure 2 shows the setup of this agreement. Under this agreement the Baltic countries, as a Coordinated Balancing Area (CoBA), operate as a single party in terms of the purchase and supply of imbalance energy for ACE. Elering is the settlement coordinator, and is responsible for compiling the Baltic CoBA settlement reports and for submitting the Baltic CoBA data to the Open Balance Provider on a monthly basis. Each TSO is responsible for the accuracy of the data concerning their own Balance Area.

[1] The INTER RAO Lietuva imbalance sale and purchase prices are provided for a month at a time, at the latest by the 25th for the following month. Prices are provided for day-night, business day-weekend, and for three volume steps, where the price increases when the volume passes a threshold. The prices are reflective of the Russian market price, fees and other costs incurred by the Open Balance Provider.

Figure 2 – Imbalance netting under the Open Balance Agreement



Source: Elering

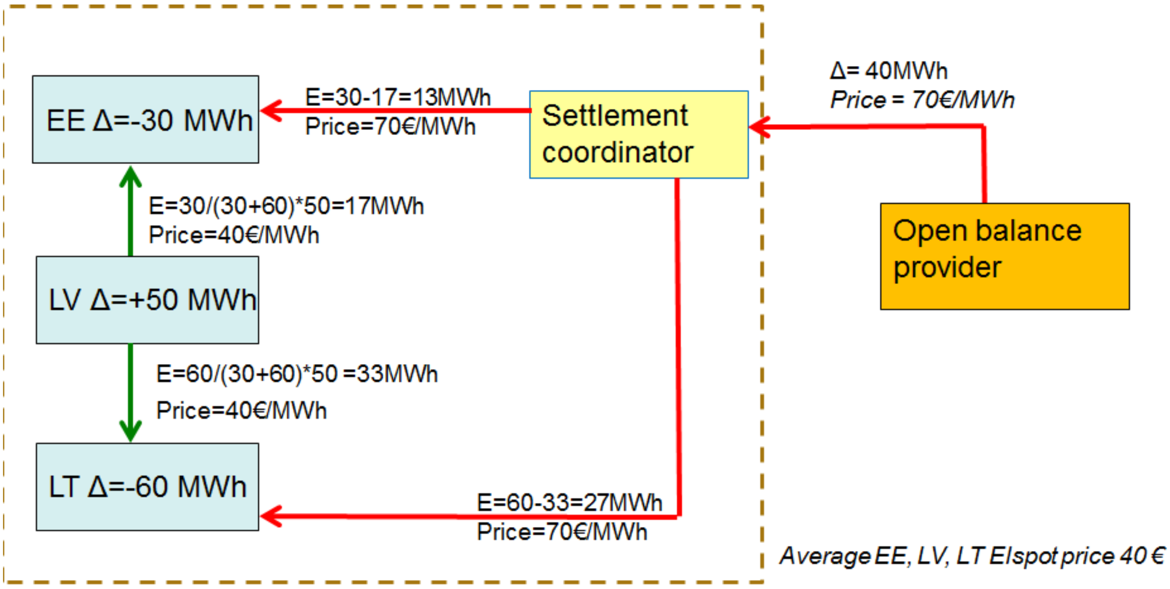
Allocation and settlement of the open balance cost

The Baltic TSOs have agreed on a settlement procedure for calculating the Open Balance. Every TSO submits daily reports which include fixed AC cross-border deliveries (Nord Pool Elspot and Elbas), activated AC cross-border balancing deliveries and emergency reserves, measured AC cross-border deliveries by metering points, and the AC system imbalance. Based on this information, Elering as the Settlement Coordinator calculates the net imbalance of the Baltic CoBA and the imbalance costs for AST and Litgrid. An example of the settlement process is shown in Figure 3.

The imbalance cost is allocated between TSOs on the basis of their share of the imbalance and the direction of imbalance. Any imbalance counteracting the overall imbalance is settled at the arithmetic average of the Estonian, Latvian and Lithuanian Elspot price, and is divided, as shown for Latvia in Figure 3, among the other Balance Areas according to their share of the aggravating imbalance. The residual, not netted imbalance is settled through the Settlement Coordinator at the Open Balance price.

The final open balance price is set for each Balance Area based on the weighted average cost of not netted imbalance energy and the netted imbalance energy.

Figure 3 – Allocating the cost of the Open Balance

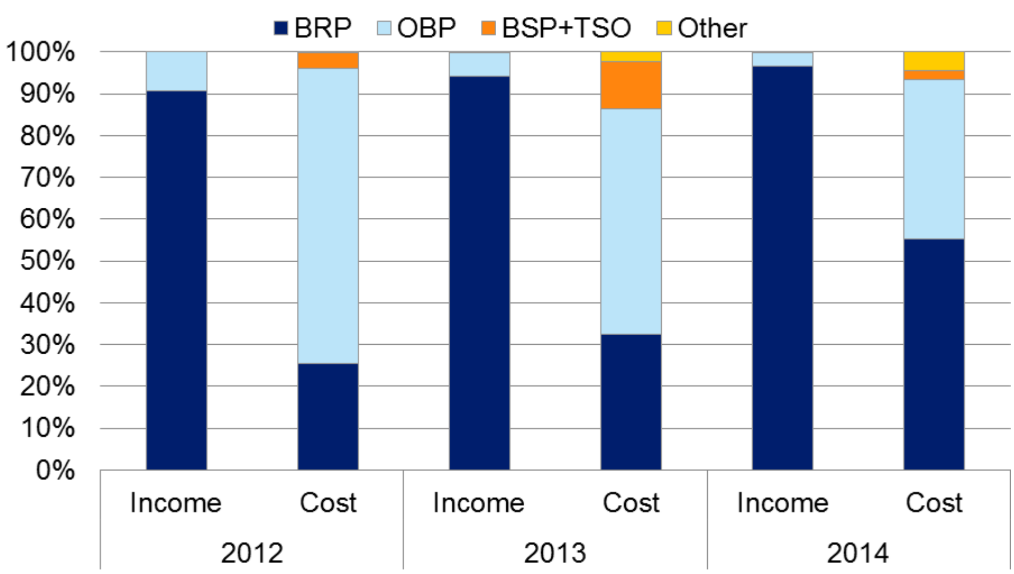


Source: Baltic-Nordic balancing market feasibility study

Distribution of income and costs to TSOs related to balancing – Open Balance costs are significant

Data has been provided from AST to illustrate the distribution of income and costs for the TSOs regarding balancing for the years 2012 to 2014. As would be expected, most income is from BRPs (>90%) with the remainder from the Open Balance Provider (OBP). Meanwhile the share of BRPs in relation to costs has been steadily increasing, from 26% in 2012 to 55% in 2014. The chart also shows the importance of OBP in terms of cost: the cost level in 2012 was remarkable at around 70% and by 2014 decreased to 40%, still a significant level.

Figure 4 – Share of income and costs for balancing in Latvia



2.1.3 *Balance obligation for RES*

BRPs are balance responsible for RES in Estonia and Latvia. In Lithuania this task is managed by the TSO.

2.1.4 *Balance plans*

Balance plans are dealt with in Chapter 5.

2.2 Imbalance settlement in the Nordics

2.2.1 *Nordic harmonisation process*

In 2002 a common Nordic regulation market started operating with a common price list in the Nordic Operational Information System (NOIS). However, imbalance settlement was not harmonised between the countries. The Nordic settlement models were very different (Figure 5) – Norway had a single portfolio and single price system, Finland had a single portfolio and dual price system, whereas Sweden and Denmark employed a triple portfolio and dual price system.

The reasoning behind the historical models related to the differences in generation mix. According to the Nordel report *Nordic model for balance pricing and settlement* (2003), the high percentage of hydropower facilitated the Norwegian model, while the more diverse generation mix in the other Nordic countries made it "necessary to include more steering signals to balance providers".

The Nordic Energy Regulators (NordREG) defined in its 2005 Work Programme an objective of a "truly common Nordic retail market with free choice of supplier" – with a sub-task of developing a common balancing management and settlement system. This objective was further supported by Nordic energy ministers in the Greenland meeting in August 2005 when they tasked NordREG with developing the prerequisites for an integrated Nordic retail market.

The NordREG Balancing Working Group was tasked with finding a model that the countries could agree on. According to NordREG (2006)[2], the first phase discussed a common definition and purpose of imbalance settlement, the cost-base, the concept of imbalance and how to allocate costs, the pricing model and the portfolio model. A roadmap for harmonisation of data systems and the processing of metering values was also discussed.

In 2007 the Nordel board agreed[3] on harmonisation of the following harmonised arrangements:

- **Two balance portfolios**. Two portfolios were chosen as this reduced the advantage that vertically integrated companies (or BRPs with production and consumption customers) had compared to a one balance model. The advantage was the ability of

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2 NordREG (2006): Development of a common Nordic balance settlement. http://www.energitilsynet.dk/fileadmin/Filer/publikationer/Common_Nordic_Balance_Settlement.pdf

3 NordREG (2008): Towards harmonised balancing services. http://www.nordicenergyregulators.org/wp-content/uploads/2013/02/NordREG-Towards-Harmonised-Balancing-Services.pdf

market participants with production and consumption to internally net imbalances compared to suppliers without production capacity.

- **Two price settlement for the production balance, single price for the consumption balance**. A common pricing model was deemed to give the same incentives to all players in the whole Nordic market. More specifically, single pricing for consumption was expected to increase interest from consumers to become BRPs and lead to more flexibility on the demand side. The two price system for generation was deemed suitable as it would incentivise generators to keep to their production plans and maximise the amount of regulation power given to the market.
- **Common fee structure**. A common fee structure was introduced to help TSOs cover balancing costs. The chosen fee structure was judged to make the system more compatible and transparent. Furthermore, the fee structure was designed so as not to advantage companies that were vertically integrated over suppliers, traders or customers without production resources.
- **Common principles for cost allocation.** A decision on which costs were included in the balance service fee and which were not.

The outcome was viewed as a political compromise to accommodate all the Nordic countries. The adopted solution balanced the pros and cons between the single price and one portfolio model in Norway and the dual price and multiple portfolios used elsewhere in the Nordics. A summary of the starting point and target imbalance settlement is presented in Figure 5.

Figure 5 – Imbalance fee structure in the Nordic markets before and after harmonisation

	Starting point				Target
	Denmark	Finland	Norway	Sweden	Harmonised model
Starting fee (€)	Yes	No	No	No	No
Fixed periodical fee (€/time)	Yes	Yes (monthly fee)	No	No	Yes (monthly fixed fee)
Fee per counterpart	No	No	Yes	Yes	No
Fee for measured production (€/MWh)	No	No	No	Yes	Yes (approx. 1/3 of cost)
Fee for measured consumption (€/MWh)	No	No	No	Yes	Yes (approx. 2/3 of cost)
Volume fee on imbalances on consumption	No	Yes (on total balance)	Yes (on total balance)	Yes	Yes
Volume fee on imbalances on production	No	Yes (on total balance)	Yes (on total balance)	Yes	No
Fee for peak load reserves	No	No	No	Yes	No (should be financed separately)
Imbalance pricing model	Dual	Dual	Single	Dual	Yes (production); No (consumption)
Number of imbalances (portfolios)	Three	One	One	Three	Two

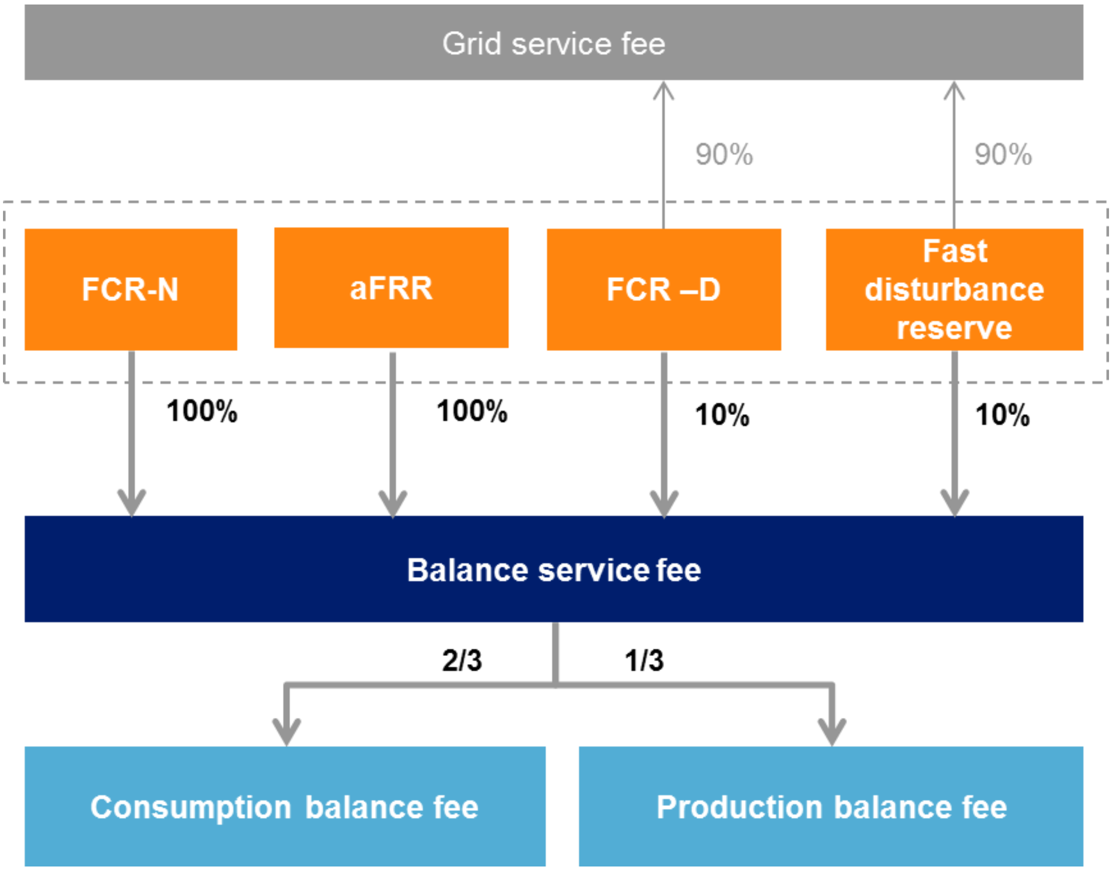
2.2.2 *Current Nordic arrangements*

The common Nordic model is thus based on a dual portfolio system with separate portfolios for production and consumption, where the production portfolio has dual pricing and the consumption portfolio has single pricing. The dual pricing uses the day-ahead price for supporting imbalances and the merit order balancing price for aggravating imbalances. The imbalance settlement period is 60 minutes. This choice stems from the need to increase TSO control in system balancing once the four Nordic systems had to be aligned with each other.

The Nordic synchronous power systems are balanced as one single area, or Load Frequency Control (LFC) block, and activations are done according to frequency of the whole synchronous area. The Area Control Error (ACE) of a single TSO is not used as a control criterion in real-time except in Western Denmark. A "free cross-border flow" of balancing/imbalance energy is allowed between TSOs. Balancing energy is activated from the Common Merit Order List (CMOL) in price order. Marginal pricing is used and the highest (up-regulation) or lowest (down-regulation) priced bid activated defines the price also for imbalance energy. Imbalance netting is used between the Nordic TSOs. Western Denmark is not included in imbalance netting but uses Area Control Error (ACE) as a control criterion in real time. Imbalance netting is not applied at the external borders of the Nordic system.

In the harmonised model, using the matching principle, the costs of various types of reserves are allocated both to balance service and to other TSO services – primarily grid service – so that the costs of frequency-controlled normal operation reserve belong to balance service, and the disturbance reserves (frequency-controlled disturbance reserve and fast disturbance reserve) belong primarily to the grid service. The principle of dividing the costs of disturbance reserves is the same for both reserves. Furthermore, the costs of the balancing power market are covered by the fees on imbalance power.

Figure 6 – Nordic model for cost coverage



Balance service fees cover a certain amount of the system cost for Nordic TSOs. Table 4 illustrates fee levels as of December 2015. Norwegian fees are about 25% of the level set in the rest of the Nordic markets. This is primarily due to the high level of flexibility in the Norwegian system. All Nordic markets have full balance responsibility for RES. The additional fee component in Sweden is a seasonal fee to cover the power reserve and is levied on consumption.

Table 4 – Nordic Balance service fees (December 2015), converted to €/MWh[4]

	Denmark	Finland	Norway	Sweden
Production fee	0.08	0.16	0.01	0.22
Consumption fee	0.18	0.24	0.01	0.44
Volume fee for consumption	0.13	0.50	0.15	0.49
Monthly fee	201	200	52	210
Other				0.60[5]

2.2.3 *Ongoing developments of the Nordic common imbalance settlement model*

The Finnish, Norwegian and Swedish TSOs have decided to implement a common imbalance settlement model in Finland, Norway and Sweden. The target is to contribute to a competitive common Nordic end user market, lower the threshold to enter the market, and enable market participants to expand into neighbouring countries. In the long run, the model is also expected to lower the operational costs and make balancing related costs more transparent.

The Nordic Balance Settlement model aims to design and provide similar operational preconditions for all balance responsible parties regardless of the country. Imbalance settlement all over the three countries will be performed with as similar principles as possible through one system. Rules and standards for information exchange are harmonised as well. The Nordic Balance Settlement will start operating during the year 2016 with the official go-live date set to Oct 3rd.

The most significant change in the Nordic Balance Settlement model is the establishment of a new Imbalance Settlement Responsible (ISR). The imbalance settlement will be organized through it, and therefore a new operational company – eSett – has been established. The company is owned by Fingrid, Svenska Kraftnät and Statnett. Currently the company is building up a new IT-infrastructure. eSett will be the single interface for all balance responsible parties and eSett will be responsible for the following:

- provide balancing related customer service to its customers;
- manage imbalance settlement contracts;
- perform imbalance settlement;
- invoice/credited the balance responsible party for the balancing power and invoice other, balancing related fees (e.g. balance management and settlement costs, and operational costs) on the behalf of TSOs;

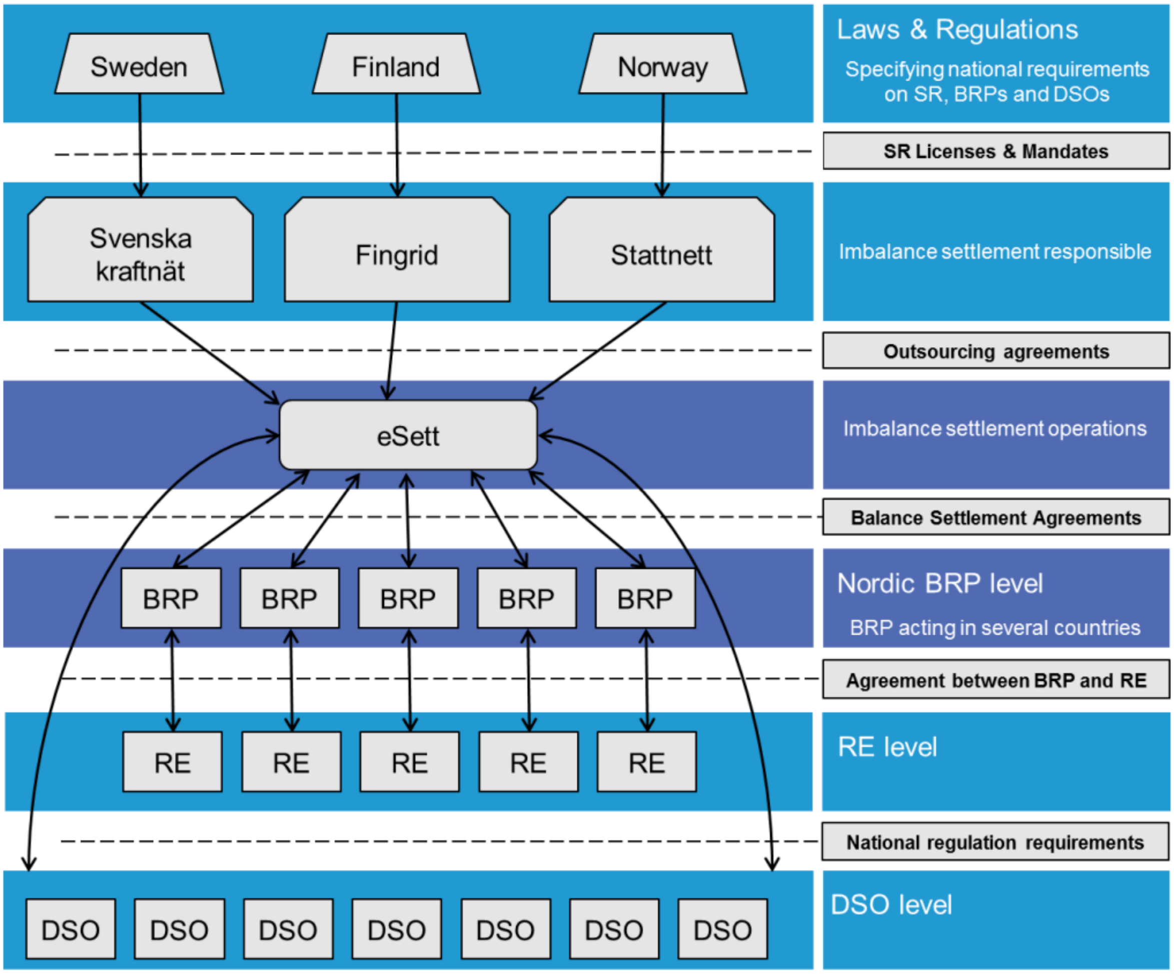
4 Exchange rates as of 31/12/2015: 1€ = 7.4627 DKK; 1€ = 9.6246 NOK; 1€ = 9.1827 SEK

5 Additional fee for the power reserve for consumption, excluding network losses in concessionary networks SEK 5.50/MWh during weekdays 06-22, 16 November to 15 March

- manage collaterals; and
- operate and provide an imbalance settlement IT system that market participants can use.

Figure 7 summarizes the relations between eSett and the market participants. Further details can be found in section 5.5 of this report.

Figure 7 – Relations between eSett and market participants



Source: eSett

2.2.4 *Future developments*

There is pressure on the Nordic market model to evolve from its current market design arrangements. This is partly driven by requirements set out in the European network codes but also a result of further integration between the Nordics and the Continent and the introduction of new technologies (RES and also the integration of demand side response). In particular, Nordic markets that do not have the benefit of large hydro volumes are beginning to question whether the current design is fit for purpose and propose steps to ensure a cost-effective, market-based Nordic system capable of meeting the future market challenges such as RES integration and security of supply.

To this end, the Danish TSO, Energinet.dk, has recently published its blueprint for a Market Model 2.0, which focuses on addressing three key issues:

- Capacity: How can security of supply be maintained in the future system?
- Flexibility: How can the electricity market facilitate flexibility in the demand side to meet the variable RES challenge?
- Critical properties: Who supplies critical properties to the system when power plants are not operating?

In response to the key issues, five main work areas were identified: (1) safeguarding critical properties, (2) ensuring market flexibility, (3) ensuring demand side flexibility, (4) raising of price caps, and (5) ensuring sufficient capacity. The areas identified by Energinet.dk are further broken down into 24 activities that will be carried out between 2015 and 2017. The areas will also likely have an impact on imbalance settlement arrangements.

2.3 Drivers for harmonisation of imbalance settlement arrangements

2.3.1 *Baltic electricity market development and integration*

The Baltic Energy Market Interconnection Plan (BEMIP) is a result of the 2nd Strategic energy review in 2009 by the Commission. The objective of the programme is to fully integrate the Baltics into the internal European energy market (gas and electricity). The purpose is to contribute to stability and economic growth. BEMIP Action Plans, detailing steps to this integration were signed in 2009 and a second version in 2015.

From the perspective of electricity markets, and also balancing the BEMIP defines stronger interconnections between Baltic markets, the Nordics and Continental Europe:

- Estlink I and II. 1000MW capacity between Estonia and Finland (operational);
- NordBalt. 700MW cable between Lithuania and Sweden (operational since Feb 2016); and
- LitPol. 1000MW cable between Lithuania and Poland (500MW operational since Feb 2016 and 500MW scheduled for 2020).

In the BEMIP the electricity market design has been agreed to be implemented based on the Nordic electricity market model. Progressing on these market design aspects represents a crucial element for the integration of the electricity systems of the three Baltic States into the Nordic electricity market system.

The updated BEMIP action plan lists two targets specifically related to balancing

The BEMIP action plan clearly states the requirement for a common Baltic Nordic Balancing market with a Baltic – Nordic Coordinated Balancing Area by 2018. The parties tasked with implementing this are the TSOs and NRAs of the respective countries.

The BEMIP action plan also clearly provides a target of 2025 for the Baltic synchronous operation to the UCTE network. At the moment the Baltic countries are physically integrated to the Russian and Belarussian (UES) network. This will clearly impact the provision of frequency response and hence the ACE costs.

2.3.2 *Baltic – Nordic TSO co-operation in electricity balancing*

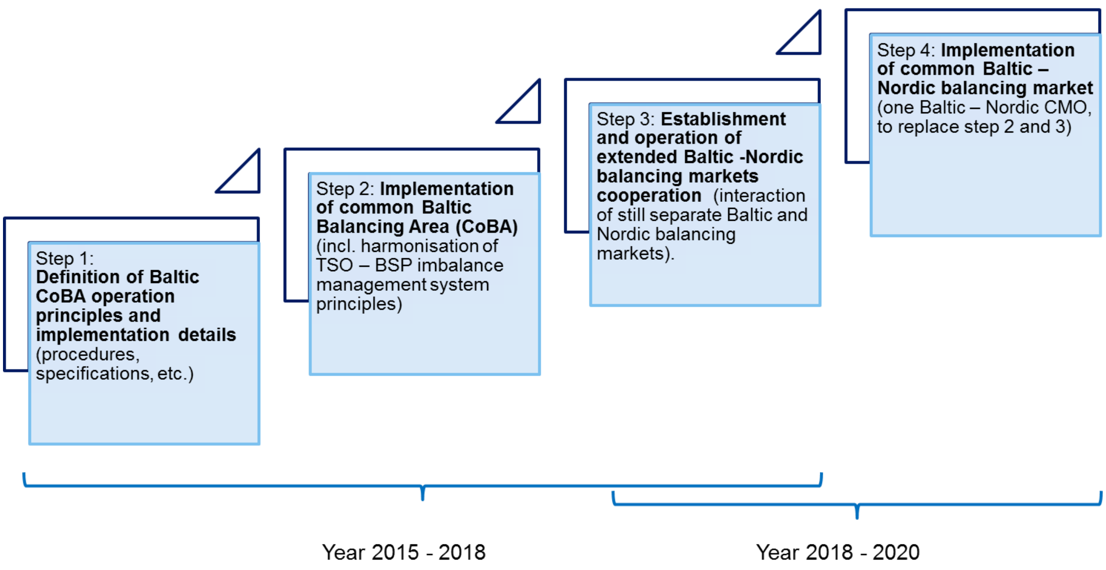
Progress towards a common Baltic and Nordic balancing market has proceeded according to the following milestones:

- May – November 2014: Feasibility study defined development principles for Baltic CoBA operation and Baltic – Nordic balancing market cooperation:
  - The study and its findings were approved by leaders of Baltic and Finnish (Nordic SPOC) TSOs on November 11
  - The final study report was shared with Baltic NRAs and ministries
- 1st December 2014: Leaders of Baltic TSOs agreed on:
  - Creation of the common Baltic-Nordic balancing market - the target. The common Baltic balancing market as an interim step according to BEMIP
- 2nd December 2014: Baltic-Nordic TSOs leaders' agreed on:
  - Common Baltic and Nordic balancing market is a common vision among Baltic and Nordic TSOs
- 29th May 2015: Baltic TSOs and Finnish TSO (Nordic SPOC) approved:
  - ToR for the Working Group (WG) of development of cooperation between Baltic and Nordic TSOs in electricity balancing for the period of 2015 – 2016

The implementation of the Baltic-Nordic CoBA has been designed on a stepwise basis, as shown in Figure 8.

The current timeline for the Baltic harmonisation project envisions that the development of a common Baltic CoBA, including common mFRR market and harmonised imbalance settlement will complete and enter into operation by January 2018. The development of common Nordic-Baltic mFRR market with a common merit order list is expected to be in operation by end of 2020.

Figure 8 – Stepwise approach to Baltic-Nordic CoBA



Source: Baltic TSOs

The target model for Baltic CoBA (step 2) in Figure 8 is outlined in Table 5.

Table 5 – Target model for Baltic CoBA

	Day Ahead Market	Intraday Market	Balancing Market	Settlement of balance area's ACE	Settlement of balancing deliveries	Imbalance settlement
Deadline	D-1	H-1	Intra-hour	D+1	D+1	M+15
Chain	NPS and BRP > TSO	NPS and BRP > TSO	TSO-TSO-BSP	TSO-TSO	TSO-TSO-BSP	TSO-BRP
The goal	Physical trading	Extra-trading with purpose to avoid imbalance energy	System balancing: CoBa shall be based on total Baltic's ACE.	Imbalance netting inside the Baltic's CoBA. Not-netted imbalance energy traded with open balance provider. (IMPLEMENTED)	Each TSO shall settle the activated volume of balancing energy with the BSP in its balance area and between other areas	Each TSO shall calculate the Imbalance for each BRP
The pricing principles	Marginal pricing		The pricing methods shall be based on marginal pricing.	The price of netted imbalance is based on average Elspot prices of Baltic's bidding area. The price of not-netted imbalance is based on Open Supply price. (IMPLEMENTED)	Marginal pricing	Input shall be based on balancing market prices. Incentives to reduce imbalance.
Pre-conditions	OK	OK	Common ACE agreement; New IT solutions or common platform and bid activation algorithms should be developed.			TSO – BRP imbalance pricing should be harmonised (parallel process)

Source: Baltic TSOs

2.3.3 *Network Code on Electricity Balancing*[6]

As fully integrated members of the European market, the Baltic markets will also need to implement measures to comply with the EU network codes.

With stronger interconnection in the European internal energy market, the national rules governing power markets need to be harmonised. This integration is particularly important with an increasing share of renewables generation, increasing the volatility of the energy supply and shifting some traded volumes to very short-term (intraday and balancing) markets. This evolution implies that balancing resources must be shared and coordinated at regional level in order to assure security of supply in a more cost effective way.

European-wide rules are under development by ENTSO-E and ACER to ensure effective and efficient management of electricity markets from forward to balancing timescales. The Network Codes were originally designed to guide the harmonisation of trading between national markets. They are written to support a stepwise harmonisation based on market-based principles. The target is to bring the multiple regional markets into a single European market by coordinating the market coupling, intraday trading and cross border balancing and imbalance principles. The experience resulting from initiatives such as the Baltic process will therefore be vital in the further development of the Network Codes.

The Network Code on Electricity Balancing (NC EB) defines a set of overarching principles, terms, and guidelines for European balancing markets. On the more detailed level it is purposely not specific, so as to accommodate the many differences in European markets today. The code provides details on the roles and structure in regional cooperation and a vision of market based balancing based on marginal cost principles, but does not give any detailed guidance on how to integrate the Baltic and the Nordic balancing arrangements.

Presently, the code has been reviewed and recommended by ACER, and the Comitology process for its approval into EU Law starts in 2016. This process is likely to result in changes to the code, which could be supported and justified by the experience cumulated in the regional pilots. This restates the importance of the findings of this project.

It should be noted that the codes do not cover relations with countries outside the EEA. The NC EB shall still be implemented in the Baltics, but (for example) there will be an exemption for frequency control in the related Network Code on Load Frequency Control and Reserves (NC LFCR). Other details are yet to be resolved.

The following subsections list the main points on the NC EB.

General objectives for the balancing market

The Network Code states that it shall facilitate the achievement of a number of objectives (NCEB, Article 10). These are listed below.

6 The information in this section refers to version 3.0 of the Network Code on Electricity Balancing, as well as its Supporting Document, which were resubmitted to ACER 6 August 2014. It also includes any relevant changes recommended by ACER for the Comitology process.

In the development of a common Baltic imbalance model, the design should in principle be checked against all objectives, and in particular those that are related to the economic efficiency of the overall system. Some of the objectives are however only weakly related to the scope of this project. The list includes examples of how most the objectives given in the Network Code are influenced, however weakly, by the design of the imbalance arrangements in the Baltic area:

- Enhancing pan-European Social Welfare:
  - This issue has to be tackled at European level, mainly through the way in which socio-economic surplus is analysed. The costs and benefits in other countries should be taken into account, reflecting the overall benefit of sharing resources.
- Ensuring Operational Security:
  - Operational security is mainly related to frequency control, which not in focus in the Baltic area. The operational security of the Nordic area will be beneficially influenced by increased access to balancing resources from the Baltic area.
- Contributing to the efficient long-term operation and development of the European electricity sector (including the Transmission System):
  - Decisions related to grid development will be influenced by the way imbalance costs are shared between TSOs.
- Fostering effective competition, non-discrimination and transparency in Balancing markets:
  - The degree of participation in balancing markets as Balancing Service Providers (BSPs) and/or Balance Responsible parties (BRPs) by market participants and thus market efficiency, is clearly influenced by the design of pricing mechanisms, imbalance settlement procedures etc.
- Facilitating the efficient functioning and preventing undue distortion of other electricity markets in timeframes different from the Balancing Markets:
  - The balancing market may influence the development of efficiency in other markets, for example through features that are introduced to increase competition in retail markets.
- Ensuring that the procurement of Balancing Services is fair, objective, transparent and market-based, avoids undue barriers to entry for new entrants, fosters the liquidity of Balancing Markets while preventing undue distortions from within the internal market in electricity:
  - Its importance is for example related to the role of the Activation Optimisation Function, making sure that no BSP is unduly favoured in the balancing process.
- Promoting the Exchange of Balancing Services:
  - Promoting exchange of Balancing Services in an optimal way, taking relative costs into account, is clearly one of the main objectives of the project.
- Facilitating the participation of Demand Side Response including aggregation facilities and energy storage:
  - Specific promotion of DSR is required; avoiding discriminatory access to the balancing markets from the demand side is not enough.
- Facilitating the participation of Renewable Energy Sources and support the achievement of the European Union target for the penetration of renewable generation:

– In the future, all RES generators should be BRPs. Dual pricing regimes may discriminate RES generation and should be reconsidered.

Marginal and average pricing allowed

The Network Code prefers pricing of balancing energy based on marginal pricing, but allows for average pricing where there is a relation "at least (…) to the average price of balancing energy activated within the area" (NC EB Supporting document, p. 75). The code states that "the imbalance price for shortage shall not be less than the weighted average price for activated positive balancing energy for frequency restoration reserves and replacement reserves", and conversely "the imbalance price for surplus shall not be greater than the weighted average price for activated negative balancing energy for frequency restoration reserves and replacement reserves" (NCEB, Article 61).

It is also possible to add penalties for BRPs that are aggravating system imbalances (NC EB Supporting document, p. 78).

Balancing prices will however have to be marginal (NC EB, Article 39), which gives firm steering towards marginal pricing also for imbalance pricing.

Single and dual pricing allowed

The NC EB Supporting Document describes two concepts for imbalance pricing: single and dual pricing. The TSO will establish the reference price in either direction. It can be set as the same for all situations, it can be derived from an existing market price, such as the day-ahead market price, or it can be derived from a merit order list. The reference price for no activation can be the average price for the first bid on each side.

Costs can be covered by imbalance and grid fees

The NC EB is clear that no TSO shall be able to gain any profit from the balancing energy settlement process (NCEB, Article 52). However, there is no mentioning that balancing should be a separate economic entity within the TSO. It means that any deficit should be covered from market participants and any surplus should be returned to them. This may however be done through general grid tariffs (on consumption, generation, generation capacity, etc.) or through fees directly related to balancing.

It is noted that ACER in its recommendation[7] states that the imbalance settlement price should not include any other costs of balancing, such as reserve procurement costs, administrative costs and other costs related to balancing. However, ACER does recognise the right of TSOs and NRAs to develop separate settlement mechanisms to balancing-related costs to ensure cost reflectivity.

The code also notes that regulation of tariffs will be in place in the future. The development of a Network Code on Tariff Regulation is currently being scoped.

Settlement period less than 30 minutes

In European power markets there is a trend towards shorter settlement timeframes. The settlement period indicated by the Network Code is 30 minutes or less (NC EB, Article 21). ACER has suggested moving to 15 minutes – this issue is yet to be resolved.

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7 ACER (2015): Recommendation of the Agency for the Cooperation of Energy Regulators No 03/2015, of 20 July 2015, on the Network Code on Electricity Balancing

A target date for implementation will be proposed by the NRAs based on a cost-benefit analysis carried out by ENTSO-E. A TSO can apply for a longer settlement period; this will require submitting a detailed cost-benefit analysis to the NRA and subsequent NRA approval.

Coordinated Balancing Area mandated

Under the NC EB, every TSO is obliged to cooperate with two TSOs or more in a Coordinated Balancing Area (CoBA; NC EB, Article 11). This is a vehicle introduced to speed up change in the national systems, so as to reach the targeted model in the timeframe of the Framework Guidelines. By mandating this organisation of the TSOs, the process will be to stimulate increased cooperation between CoBAs, mergers of CoBAs, and finally a single pan-European market.

The activation of Balancing Energy cross-border but within a CoBA, will be coordinated by a single function, an Activation Optimisation Function (AOF; NC EB, Article 26, 40). It will use the TSO-approved algorithm to decide the most efficient activation of resources given the restrictions in the system. Actual activation will be done by the TSOs – the process therefore requires robust communication between the AOF and the TSOs.

Cross-zonal capacity can be reserved for balancing

The NC EB states that “each TSO shall have the right to reserve cross zonal capacity for the exchange of balancing capacity and sharing of reserves when socio-economic efficiency is proved”. This capacity shall be calculated in line with the methodologies developed in the Network Code on Capacity Allocation and Congestion Management (NC CACM) and the Network Code on Forward Capacity Allocation (NC FCA).

Balance responsibility for all generators

Incentives to trade into balance are weak for variable renewable generators in some markets. There is not always full exposure to imbalance volumes and/or prices for these market participants – this generation relies to a greater extent on the TSO to handle their imbalances. The NC EB Supporting Document states that “all withdrawals and injections shall be covered by a BRP in accordance with the NC EB requirement to have no exemptions. For clarity, this includes injections from renewable and intermittent resources” (p. 75). Thus, under the NC EB there shall be complete balance responsibility, also for variable renewables generators such as wind and solar.

Imbalance price and volume publication

Under the EU Commission regulation no 543 (2013), Article 17, imbalance prices shall be published per balancing time unit “as soon as possible”.

The total imbalance volume per time unit shall be published as soon as possible and no later than 30 minutes after the operating period. If published data is preliminary, figures shall be updated when the data becomes available.

Other developments

The European balancing systems are exposed to tightening conditions with a tendency towards larger imbalances and reduced portfolio flexibility. Firstly, an increasing share of generation is unpredictable and inflexible. Secondly, conventional thermal plants, the main source of flexibility in traditional markets are closed down. This has led to a drive towards shorter time between gate closure and the operational hour as well as shorter settlement periods. This issue has also led to a renewed discussion of market design: the role of different markets (including capacity markets), allocation of network capacity across different timescales, etc. These issues are not taken into account in this project.

Timeline for NC implementation

The timing of the developments in the Baltics and in the European Network Codes is of importance when considering the alternatives for a common Baltic model. The NC EB is scheduled for the Comitology process in 2016 after which it enters into EU law. The period of implementation is defined for specific parts of the code. Under Article 21 it is stated that the main features of imbalance calculation and pricing shall be harmonised "no later than three years after the entry into force of this Network Code". Thus the deadline for imbalance settlement harmonisation is expected to be end of 2019.

It should also be noted that no later than two years after the Code becomes EU law – likely end of 2018 – the TSOs shall submit to the NRAs a proposal on the harmonisation of the imbalance settlement period within and between synchronous areas. With the current timelines the current plans for Baltic harmonisation are in line with the requirements of the EC NB.

2.4 Observations on the differences between imbalance settlement arrangements in the Baltics, Nordics and NC EB

2.4.1 *The need for certain market arrangements is different in the Baltics*

The Baltic balancing arrangements for maintaining the system frequency within a predefined stability range differ from the other European arrangements. The Baltic States are synchronously connected with the IPS/UPS power systems, where frequency control is handled by the Russian SO in a centralized way, and the responsibility of Baltic TSOs is to participate in the manual frequency restoration process by keeping their area control error (ACE) inside allowed limits for every operational hour. Therefore, Baltic TSOs have no need to procure or activate frequency containment reserves (FCR) or automatic frequency restoration reserves (aFRR), but rather manually activated frequency restoration reserves (mFRR). Procurement of replacement reserves (RR) is decided by the individual TSO.

The Russian frequency control service is paid through the ACE vis-à-vis Russia. The price of imbalance energy is determined by the Russian SO but the formation of the price is not transparent. As the ACE of Baltic systems towards Russian system must also be in certain limits, Baltic TSOs must introduce a common process that addresses these issues by having coordinated activation of mFRR together with imbalance netting in real-time operation phase. This is discussed further in section 3.

2.4.2 *Imbalance pricing not fully marginal and not reflective of full cost balancing*

European power markets typically employ variations on either marginal or average pricing for imbalance prices. Marginal pricing entails that the pricing reflects the marginal cost of balancing the system, whereas average pricing reflects the average cost of balancing the system. The NC EB allows for both pricing variations, although balancing prices will have to be marginal. In any case, the Nordic TSOs have set marginal pricing as a prerequisite for harmonisation with the Nordics. Therefore, marginal pricing is the imbalance pricing methodology considered in the following analysis.

Currently there is not marginal pricing in the Baltics. A transition methodology may be needed for a smooth implementation of marginal pricing. Such a methodology could be based on the average of a certain amount of the most extreme offers or bids accepted (excluding those flagged as being for non-energy). For the reverse price one could also consider a blending between the PX price and/or intraday price and the marginal balancing market price, and change the blending over time to arrive at a fully marginal price.

It should also be noted that reserve procurement programs may reduce the imbalance price level, thus increasing the need for further capacity support much the same way as capacity support programs for the spot market. Such procurement is often used as a volume or price risk hedge for TSOs. The activation fee of pre-contracted capacity is used in the calculation of the balancing and imbalance prices, but typically only reflects short-run costs of balancing energy. A reserve fee comprises the remaining costs, and is normally not recovered through balancing or imbalance prices but through general TSO charges. In the Nordic market, specific short-term option procurement programs (RKOM in Norway and balancing capacity market in Finland) are used to secure availability of balancing resources in specific situations.

Other ways to cover the long-run marginal costs could be a reserve scarcity function for pricing reserve, an ‘adder’ to the balancing price based on expected use, or a non-fixed activation fee for pre-contracted reserve (used in GB, Texas, North-Eastern United States).

2.4.3 *Longer imbalance settlement period than NC EB limit*

The Open Balance Agreement is currently based on a 60-minute settlement period, with no restriction on the point flows for shorter time periods. As a consequence, there is effectively a cost-free storage available between shorter settlement periods within any hour. Furthermore, reducing this to 15 minutes is not likely to provide any operational advantages, since the Russian System Operator provides frequency control.

Also, the same 60-minute settlement period is used in the Nordic model. There is therefore no incentive for the Baltic TSOs to go for a shorter period. Other settlement periods should be discussed for future implementation if and when such proposal comes from the Nordic TSOs or the Russian SO.

2.4.4 *Summary of differences between Baltic, Nordic and NC EB*

Table 6 presents a summarised version of the main differences between the imbalance settlement arrangements in the Nordics, Baltics and the requirements laid down in the NC EB as relates to imbalance settlement. Readers are also referred to Chapter 5 for imbalance settlement harmonisation requirements related to process and systems.

Table 6 – Summary of main differences between the Baltics, Nordics and NC EB

	Baltics	Nordics	NC EB
Imbalance settlement period	60mins	60mins	<30mins
Common balancing area	Between Baltic markets	Between Nordic markets	Required between 2 or more TSOs
Main price determination	Average (PAB)	Marginal	Either with a preference for marginal
Balance responsibility for RES	Yes, but not in Lithuania	Yes	Yes
Settlement portfolio model	Single in EE and LV, three balances in LT	Dual portfolio	Either
Settlement price model	Dual price	Dual price for generation, single price for consumption	Either
Cost coverage	Common - Area control error costs, ACE, (100%) mFRR, for balancing purposes (100%) Emergency reserve activation costs Balancing energy traded with BRPs (100%) Settlement and administrative costs related to balance management, including IT systems costs (100%) Differences - In Lithuania fees are used to cover grid service	Common - aFRR (100%); FCR-D and FCR-N (10-30%) ; Fast disturbance reserve (10%) Emergency reserve activation costs Balancing energy traded with BRPs (100%) Settlement and administrative costs related to balance management, including IT systems costs (100%) Settlement and admin costs related to balance management Differences - In Sweden there are specific fees to cover the power reserve and is levied on consumption.	Only costs associated with balancing actions

3. BUILDING BLOCKS FOR IMBALANCE SETTLEMENT

3.1 Objectives of the imbalance arrangement harmonisation

The benefits of harmonisation of electricity markets have often been repeated. The Baltic harmonisation project aims at, initially, aligning balancing and imbalance arrangements in the Baltics with the Nordics and, subsequently, with other EU markets (NC EB). Further to harmonising with neighbouring markets, the Baltic imbalance arrangements should also meet other policy objectives, primarily relating to delivering efficient short-term and long-term outcomes.

The imbalance arrangements should meet the following objectives:

- compatibility with the Nordic imbalance arrangements and the NC EB;
  - cross border sharing of resources and harmonisation can deliver additional benefits both in terms of using the 'global' cheapest solutions, but also for minimising upfront implementation costs;
- efficiency;
  - support the most efficient use of resources and provide for efficient price signals in the short-term and promote investment in the right type of balancing energy providers in the long term;
- security of supply;
  - the right type of capacity is on the system to help the TSO ensure security of supply and actions by market participants do not act as a barrier or increase the need for actions taken by the TSO;
- affordability;
  - the arrangements should not unduly burden consumers and risks should be allocated appropriately to the market participants that can best manage those.

3.2 Building blocks of imbalance arrangements

The framework for imbalance arrangements can be 'broken down' into a set of building blocks. The choices under each building block will then define the resulting design. It is therefore important to set out these fundamental building blocks and the potential options under each one:

- balance responsibility;
  - full balance responsibility for all BRPs;
  - exemptions for certain types of market participants;
- number of portfolios;
  - single;
    - each BRP submits and is settled based on single portfolio that includes generation, consumption and trade (cross-border and bilateral);
  - dual/multiple;
    - with a dual portfolio system each BRP has to keep separate account for generation and consumption and at the most disaggregate there can even be separate imbalance portfolios per unit (for generation);
- number of prices;
  - single;

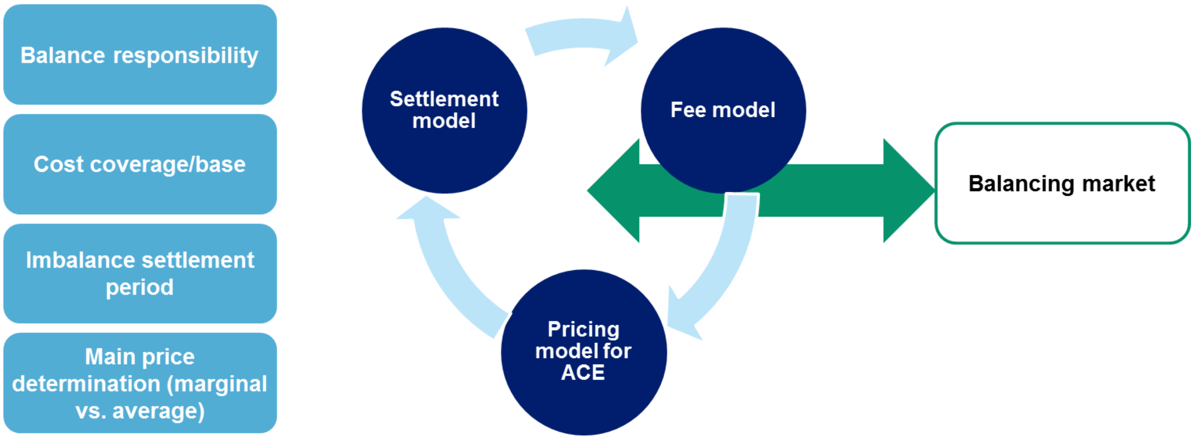
    - all BRPs face the same price irrespective of the deviation direction;
  - dual;
    - price faced by aggravating and supporting imbalances is different;
- main price determination (including the potential of reflecting the full long run costs of balancing energy provision);
  - marginal;
    - price reflects the marginal action for balancing supply and demand;
  - average;
    - the price reflects the average cost for balancing the system and an average imbalance price would typically be used alongside pay-as-bid for balancing energy;
  - other;
    - for example this could be a ‘pseudo-marginal’ price with the imbalance price being equal to the average of the top x% of the balancing energy bid ladder;
- additional cost recovery;
  - through an adjustment (fee) applied to all imbalances;
  - entirely through separate fees;
    - with single pricing, no surplus is created for the TSO from the balancing and imbalance settlement and there is a need for a separate way of recovering other costs (such as administration costs) relating to balancing the system;
  - partially recovered through an imbalance ‘fund’;
    - with dual pricing a surplus is created that can be used towards covering such costs;
- imbalance settlement period duration:
  - 60 minutes;
  - 30 minutes;
  - 15 minutes; or
  - other.

The Baltics are physically connected to Russia and there is an additional cost relating to the corresponding energy exchange. The cost of ACE is therefore both unique to the Baltics and its treatment is of particular importance. Even though this is covered under additional cost recovery ‘building block’, treatment of ACE costs merits a specific mention. The options for **ACE cost recovery** are:

- allowing ACE to set the price (be the marginal offer);
- including a targeted fee to the (interim) imbalance price, which would then be partially marginal and partially average; and
- socialising the cost of ACE and excluding it entirely from the imbalance price and settlement.

Even though it is convenient to describe the imbalance arrangements through a set of separate building blocks, there are strong dependencies between those. Choices under one building block have an impact on another, and a more holistic approach should be taken when considering the imbalance settlement framework as a whole. In particular, there is a strong link between the number of prices, price determination and additional cost recovery. These choices should also be informed by the applicable balancing market arrangements. This is shown in Figure 9.

Figure 9 – Relationship between different building blocks



The following sections define the major design choices to be made in the construction of a Baltic imbalance settlement model. The alternatives for each building block are briefly described for the purpose of clarity. In Chapter 4 the building blocks are put together in a coherent way and evaluated as a package.

3.2.1 *Balance responsibility*

With regards to balance responsibility the choices are not binary. Exemptions may be granted depending on the type of generation technology or size of market participant. However, the choices under this building block can be described through two main alternatives:

- full balance responsibility for all BRPs; or
- exemptions for certain types of market participants.

Balance responsibility is a central concept of the NC EB. Responsibility for resolving forecast errors (when it comes to intermittent generation or demand) and/or risks of generation failure are to be borne by market participants (BRPs) and exemptions should be limited to the greatest extent possible. The greater the degree of exemptions, the greater the role of the TSO becomes in balancing the system.

3.2.2 *Number of portfolios*

Single portfolio

With a single portfolio model production and consumption are aggregated in a single imbalance account. BRPs with both production and consumption in their portfolio can 'net off' imbalances.

Description of the single portfolio model

The algebra for a single balance portfolio is:-

Planned balance = Production + Purchase – Consumption - Sale

Measured balance = $\sum(P_{in} - P_{out})$ metered data in a BRP's portfolio

Imbalance = Measured – planned –/+ portfolio's imbalance adjustment (balancing)

Dual/multiple portfolios

With a dual portfolio model, production and consumption are reported and settled separately. More disaggregate splits according to type of generation (or even down to a unit level) are possible. Imbalances are aggregated for each defined portfolio, but imbalances in one portfolio cannot mitigate imbalances in another.

Description of the Nordic model

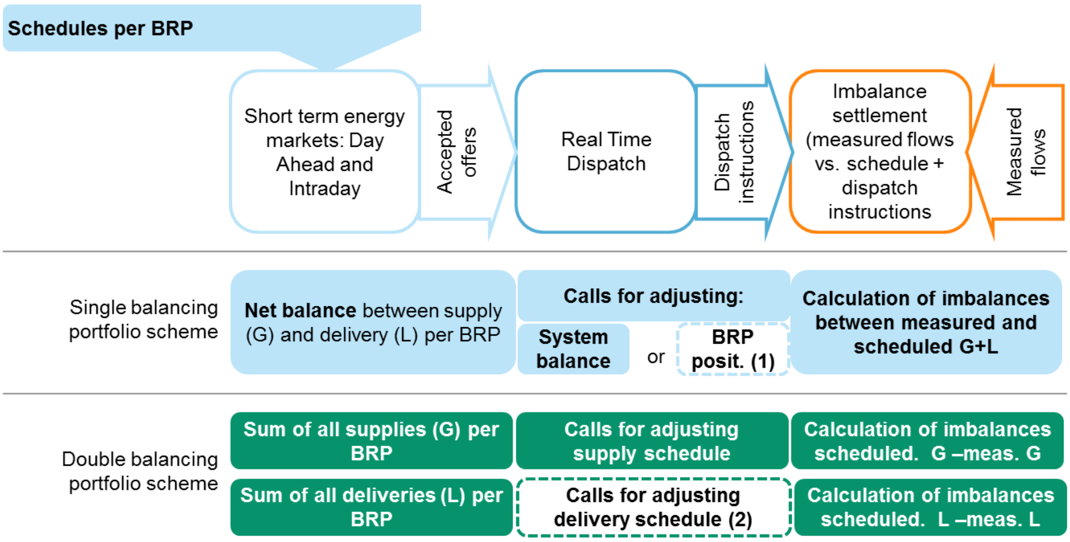
The algebra for the Nordic model is as follows:

Production imbalance = actual production – planned production -/+ production imbalance adjustment

Consumption imbalance = actual consumption + planned production –/+ trade –/+ consumption imbalance adjustment

Figure 10 presents a schematic representation of the two main (and more widespread) models.

Figure 10 – Portfolio splitting overview



(1) Dotted to indicate that in general the option for support to the system balance is preferred
(2) Dotted because calls for delivery schedule only if demand side equipped to react to such instructions

Table 7 provides a high-level assessment of the different options for the number of imbalance portfolios.

Table 7 – Pros and cons of single and dual (multiple) portfolios in the Baltics

Option	Pros	Cons
Single portfolio	▪ Simplicity ▪ Lower cost for BRPs on aggregate in the long-term ▪ Lower administrative costs	▪ Better suited to 'large', vertically integrated market participants ▪ Difficult to transition to a dual portfolio at a later stage
Dual portfolio	▪ Harmonised with Nordic model ▪ Easier to transition to a single (when compared to the reverse)	▪ More complex ▪ Higher cost for BRPs on aggregate in the long-term ▪ Requires changes to the current IT systems

3.2.3 *Number of prices*

Single pricing model

The single pricing model is based on a single price for both aggravating and supporting imbalances. Table 8 shows the price faced by BRPs depending on their and the system imbalance position. When the system is short, the imbalance price is typically set at the level of the marginal upward regulation offer for balancing the system. When the system is long, the imbalance price is typically set at the level of the marginal downward regulation activated offer for balancing the system. BRPs pay the imbalance price when their position is short and receive the price when their position is long. The imbalance price may differ from one period to another (and will depend on the system net imbalance position), but in any given period all imbalances face the same price, irrespective of direction (long or short).

Table 8 – Single pricing model

		System imbalance	
		Short	**Long**
BRP imbalance	**Short**	(-) Main price	(-) Main price
	Long	(+) Main price	(+) Main price

(-) denotes cash flows from the BRP to the TSO and (+) denotes cash flows from the TSO to the BRP

With single pricing 'passive' imbalances and active balancing market offers (typically) face the same price. This assumes that the balancing price is the same as the imbalance price[8]. By revealing 'passive' imbalances, additional available resources, which are not participating in the balancing market, effectively become available. Supporting imbalances from BRPs reduces the need for actions by the TSO. In some cases this can

8 It can be that there is a single imbalance price, but that is not consistent with the balancing price.

been seen as a disadvantage, as system balancing becomes more decentralised and carried out by market participants that do not have access to the same information (or the same objectives) as the TSO. In other markets (e.g. Netherlands) this decentralisation has been positively welcomed, with the TSO taking a strong role in information provision and a less active role in issuing balancing instructions, while market participants perform most of the energy balancing directly.

Single price gives appropriate self-balancing incentives. Depending on the expected price level, market participants have an incentive to deviate from a 'balanced' position, taking away some of the control from the TSO. The ultimate application of the single price model would be in circumstances where participants can continue to self-dispatch even after gate closure. Usually, this is possible for demand-side resources (which have no binding limits on their decisions up to real time), but most markets place limits on generation self-dispatch after Gate Closure[9]. For this to be effective, participants must have access to information regarding the direction of the system imbalance and access to (at least indicative) prices. Without such information or with poor quality data, actions taken by market participants may be inefficient.

Single pricing provides no net income generation for the TSO from the trading of balancing power due to the lack of spread between the prices. There is thus no cash surplus to cover balancing costs outside the market (i.e. balancing costs caused by intermittent generation or by any other source of imbalances, e.g. the Open Balance, not handled directly by the balance responsibility contract). Such costs have to be covered through a separate mechanism or included as an additional uniform fee (as part of the imbalance price), which then may mean that there is inconsistency with the balancing price.

Dual pricing model

In a dual pricing system, different prices are used for market participants that aggravate the system imbalance and for those that 'help' the system. The philosophy is that supporting imbalances are unintentional and should not receive the same price as energy activated in the balancing market. This price spread is usually created by either:

- adding a cost element to the price faced by aggravating imbalances and/or deducting a cost element from the price faced by supporting imbalances; or
- replacing the price used for supporting balances by a 'neutral' reference price (for example the day-ahead market price) with this price typically being lower when the system is short and higher when the system is long.

Table 9 shows the prices used in a dual pricing system with the prices being different for different imbalances depending on the relative position when compared to the system net position.

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9 The Dutch market is an exception, in which Tennet publishes real-time information on the state of system balance and encourages the market participants to make adjustments (not under TSO instruction) to correct system imbalance.

Table 9 – Dual pricing model

		System imbalance	
		Short	**Long**
BRP imbalance	**Short**	(-) Main price	(-) Reverse price
	Long	(+) Reverse price	(+) Main price

(-) denotes cash flows from the BRP to the TSO and (+) denotes cash flows from the TSO to the BRP

Dual pricing provides little incentive for participants to help the TSO balance the system, as supporting imbalances are not compensated based on the 'true' value of the energy to the system. For this reason, this model is, in some cases, favoured by TSOs that wish to assume (or retain) greater control. Effectively, the model pays a premium for TSO control over balancing actions.

Inconsistent remuneration for supporting deviations can result in a potential efficiency loss. Resources with a cost between the balancing market price and the reference price or resources that do not participate in the balancing market may be excluded from balancing the system. More importantly, it may reduce demand-side participation if applied to consumption portfolios.

Table 10 summarises the assessment of the different pricing models.

Table 10 – Pros and cons of single and dual pricing in the Baltics

Option	Pros	Cons
Single pricing	▪ Incentive to focus on system imbalance ▪ Enables participation of resources outside standard balancing products ▪ Simplicity and transparency	▪ Generates no surplus to cover costs ▪ Different to Nordic arrangements ▪ [Less TSO control]
Dual pricing	▪ Generates a surplus to cover other costs ▪ More aligned with Nordic arrangements ▪ [More TSO control]	▪ Incentive to focus on portfolio imbalance ▪ Limits participation to standard products, potential efficiency loss ▪ Reduces incentives for DSR

3.2.4 *Main price determination (including the potential of reflecting the full long run costs of balancing energy provision);*

Imbalance prices can be determined on the basis of:

- marginal;
  - price reflects the marginal action for balancing supply and demand;
- average;

  - the price reflects the average cost for balancing the system and an average imbalance price - would typically be used alongside pay-as-bid for balancing energy;
- other;
  - for example this could be a 'pseudo-marginal' price with the imbalance price being equal to the average of the top x% of the balancing energy bid ladder;

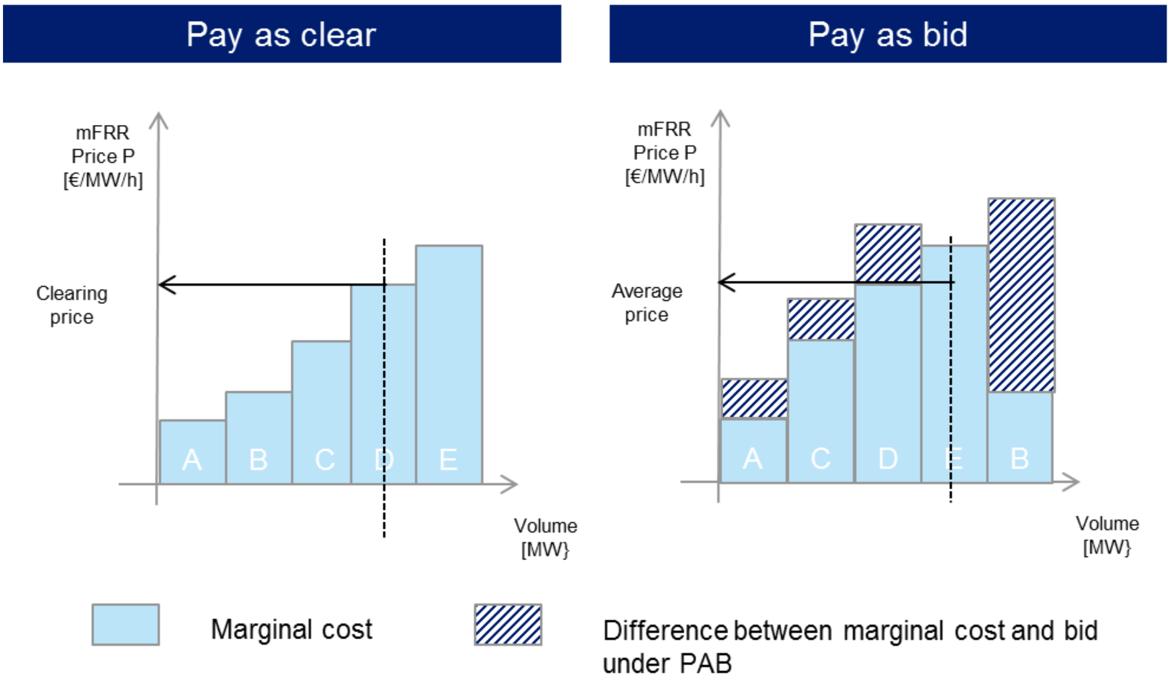
3.2.4.1 Marginal and average pricing

There is a strong link between the pricing and remuneration for balancing energy and imbalances. If pay as clear is used for pricing balancing energy, then the (main) imbalance price should ideally follow the same principle and reflect the marginal cost of balancing energy provision. If pay as bid is used for balancing energy, then average pricing for imbalances is a better 'fit'.

The widely used argument in favour of marginal pricing (pay-as-clear) instead of average pricing (with pay-as-bid) is as follows:

- Under a pay-as-bid scheme participants receive the revenue related to the offer they submitted. Hence participants have an incentive to bid at the expected price level of the most expensive offer (to maximise their revenue).
- Under a marginal price arrangement (pay-as-clear), all market participants receive the price of the most expensive offer that is accepted and the participants are incentivised to bid at their short run marginal cost which provides a clear reference price for the marginal cost. This should result in a more efficient use of resources.

Figure 11 – Difference between pay-as-clear (marginal) and pay-as-bid (average)



3.2.4.2 Determination of the price-quantity stack and imbalance volume

If the imbalance price is set on a marginal basis, then supply (balancing energy) and demand (imbalance volume) are key in determining the price. With average pricing, on the other hand, the imbalance price is simply defined as the cost for the purposes of balancing the system smeared across the net imbalance position.

A key consideration is the relationship between the balancing and imbalance prices. There are several challenges if balancing and imbalance prices differ:

- efficiency loss; and
- difficulties with hedging (as a result of the spread between the two prices) and potentially higher risk premiums in hedging contracts.

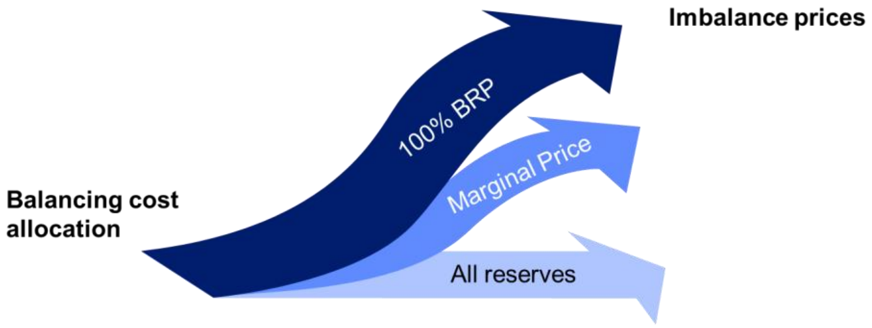
This means that the methodology for determining the marginal price for balancing should ideally be similar to the imbalance price determination. TSOs, when balancing the system, are typically incentivised to achieve this in a least cost manner, whilst ensuring secure operation. In an 'unconstrained' system this would mean choosing the 'cheapest' actions first. However, offers may be activated 'out-of-merit' to resolve other, non-energy issues and constraints. This could have a distortive impact on the balancing energy price, especially when such system actions are frequent. One potential mitigation measure is to define a framework for excluding such activated offers from the 'stack'.

3.2.4.3 Long-run costs and reservation fees

An upfront payment for reserve products can distort (dampen) the imbalance price and may lead to the 'missing money' problem. This in turn can create a disincentive for new entrants (such as demand-side response) as energy prices and price volatility are dampened.

Within the balancing (and other spot) markets, there should ideally be no price caps or regulatory controls on bidding, and any market power mitigation should be done in ways which does not distort short term energy price formation. So, in general, any effect that reserve contracting could have on balancing and imbalance prices should be removed. This step tackles the 'missing money' problem for (uncontracted) capacity used to balance the system whilst targeting reserve costs over periods where reserve is actually deployed. Figure 12 illustrates the concept.

Figure 12 – Balancing cost allocation



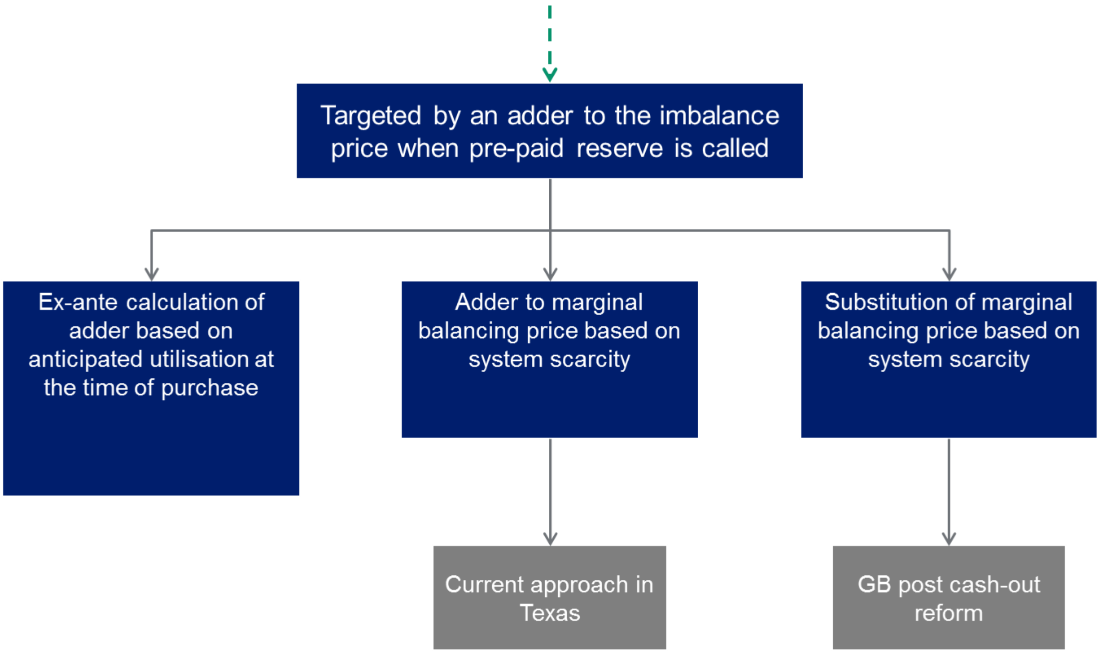
The full reflection of long-run marginal cost of system balancing tackles the 'missing money' problem for (uncontracted) capacity used to balance the system whilst targeting reserve costs over periods where reserve is actually deployed

Source: Pöyry

Reservation fees should be reflected in the imbalance (and balancing) prices fees (as shown in Figure 13). This is can be achieved through various ways:

- an appropriate 'adder' for distributing the actual reservation fees for contracted reserve capacity procured by the TSO, included in the balancing prices, and based on expected utilisation
- a Reserve Scarcity (VoLL/LOLP) Function for pricing reserve (when used to balance the system); and/or
- avoid fixing the activation price for pre-contracted reserve (which is a partial solution).

Figure 13 - Mechanisms of scarcity pricing



Source: Pöyry

There will be a re-examination of the functioning of the Nordic market by the Nordic TSOs in order to ensure clear price signals. This is driven by the changes in the Nordic power system (integration of RES, retirement of thermal power) and forthcoming European regulation. Therefore we may expect that existing reserve capacity procurement schemes such as those used by the Nordic TSOs will be assessed with a view towards improving price signals through full cost balancing.

Currently, emergency reserve holding costs are included in the grid fees and activation costs (for balancing purposes only) in the balance service fees in the Baltics. Hence, this is an area which should be kept under review based on further guidelines for the common EU balancing market model.

3.2.5 *Cost recovery of additional balancing costs*

Irrespective of the number of prices, there are additional costs incurred in the operation of the balancing market that are not always recovered through the imbalance settlement. This is more likely to occur in a single pricing system. The principle of financial neutrality requires for a TSO to collect income from the imbalance settlement that covers all costs incurred in performing balancing operations, but no more. Consequently, a mechanism is needed to facilitate the recovery of additional costs incurred during balancing that are not recovered from the main imbalance price.

The potential additional balancing cost in this context can be split into the following components:

- administrative costs;
- other applicable balancing costs;
- residual cost recovery/distribution; and
- ACE cost.

Administrative cost coverage is straightforward and refers to the costs incurred operating the market. Other applicable balancing costs relate to balancing costs that are not recovered through the main imbalance price and need to be recovered from BRPs.

Residual cost recovery/distribution arises due to the unpredictable nature of the cost of balancing and the requirement for the TSO to maintain financial neutrality. The unpredictable cost of balancing means that when imbalance settlement occurs, there will be a shortfall or surplus of revenues that accrue to the TSO through the main imbalance price. So, there needs to be a tool that can be used to settle the outstanding cost difference with the BRPs at the end of each period for:

- recovery of a shortfall in revenues from the imbalance price; or
- distribution of any surplus revenues from imbalance price.

A general principle (of fairness, not efficiency) is that ‘polluter pays’. Costs arising from a specific market participant should be attributed to this specific entity. The alternative solution is to cover the residual cost through levies on generation and/or consumption.

The imbalance fees can take the form of one or more of the following: fixed fee; actual production / consumption fee, or a volume fee for imbalance.

- A fixed fee is a fee that falls due over a certain time period and it is usually the same for each party; it is suitable for costs that are incurred by e.g. administration of a scheme that need to be shared between scheme members.
- A fee based on production/consumption is a volume fee but is levied across a wide base (total demand/generation); this is suitable for costs that all users should pay something towards, such as the holding fees for FCR and aFRR in the Nordics.
- Volume fees that are based on imbalance are more targeted and can be deemed to be means to disincentivise certain behaviour (in this case, imbalance).

Table 11 – Overview of different fee structures for cost recovery

Fee type	Comments and examples
Fixed fees per BRP	In the Nordic market there is a weekly fee (€/week). In GB, Elexon has an extensive structure of fixed fees per participant, per Unit registered, etc.
Fees proportionate to some sort of size or activity indicator	An example of this thinking is a fee per time series applied by Statnett, prior to harmonisation of Nordic arrangements In GB, National Grid recovers the total cost of system balancing from grid fees (levied per MWh of demand and generation) and Elexon returns the imbalance revenue through a residual cash flow (also levied per MWh of demand and generation); the net cost is effectively charged based on metered demand and generation
Fees proportionate to imbalance volume (€/MWh)	Gives incentive to reduce own imbalance and not system imbalance. Given the narrow charging base, may have serious distortive effects in incentives.
Contract notification fee	In GB, Elexon charges this fee in £/MWh of contracts at gate closure (net volume per pair of counterparties).

3.2.6 *Settlement period duration*

The NC EB specifies 30 minutes as the maximum settlement period duration. The Nordic and Baltic areas both have 60 minutes at present. Shortening the settlement period is mainly linked to frequency control. For the Baltic area, there is therefore no reason to change until Russia and/or the Nordic area changes. The settlement period duration does not have a material impact on the choice of settlement system, and we therefore propose to postpone further discussion until it is raised by one of the other parties.

4. INITIAL PROPOSALS FOR A BALTIC IMBALANCE SETTLEMENT MODEL

This Chapter introduces Pöyry's initial proposals for the imbalance settlement building blocks outlined in Chapter 3. Different options considered are shown in Table 12.

Table 12 – Options for imbalance settlement model building blocks

Building block	Options
Balance responsibility	Full or RES exempted
Portfolio	Single or dual
No. prices	Single or dual
Main price determination	Marginal or average
Cost recovery of additional balancing costs	Targeted, hybrid or socialised
Treatment of ACE	Option to either include, exclude or selectively exclude ACE from the main imbalance price
Imbalance settlement duration	15, 30 or 60 min

4.1 Common building blocks for imbalance settlement

4.1.1 *Balance responsibility*

As mentioned in the previous Chapter, responsibility for resolving forecast errors (when it comes to intermittent generation or demand) and/or risks of generation failure are to be borne by market participants (BRPs) and exemptions should be limited to the greatest extent possible. Therefore, all market participants, including RES generators, should have balance responsibility. At present RES operators are balance responsible in Estonia and Latvia but not Lithuania.

4.1.2 *Cost coverage/base*

A common cost base (fee structure) for balance settlement needs to be established to reflect a common concept towards imbalance. The principle of cost reflectiveness is also relevant here – costs for balancing are paid for by the BRPs while any cost for grid operation should be paid through the grid tariff.

In the Nordics, the fees for balance service and grid service differ between the countries, as the countries have different costs incurred by the operation of the balance services. However, the fee structure is the same (an overview is given in Figure 6 and Table 4). The items to be included in the Baltic imbalance fees are shown in Figure 14. Non-balancing costs should be excluded from the additional fees.

Figure 14 – Costs to be included in the Baltic imbalance price (ref Nordic model)

Baltic's CoBA Balance service (included in the imbalance price)	Nordic's CoBA Balance service (included in the imbalance price)
Area control error costs, ACE (100%)	aFRR (100%) Frequency Containment Reserves for Disturbances 10-30% Fast Disturbance Reserves 10-30%
mFRR for balancing purposes (100%)	mFRR for balancing purposes (100%)
Imbalance energy traded with BRPs (100%)	Imbalance energy traded with BRPs (100%)
Settlement and administrative costs related to balance management	Settlement and administrative costs related to balance management

At present, Estonia and Latvia have a similar cost base for imbalance pricing. The arrangements in Lithuania are different, with some support for grid fees through income from balance services.

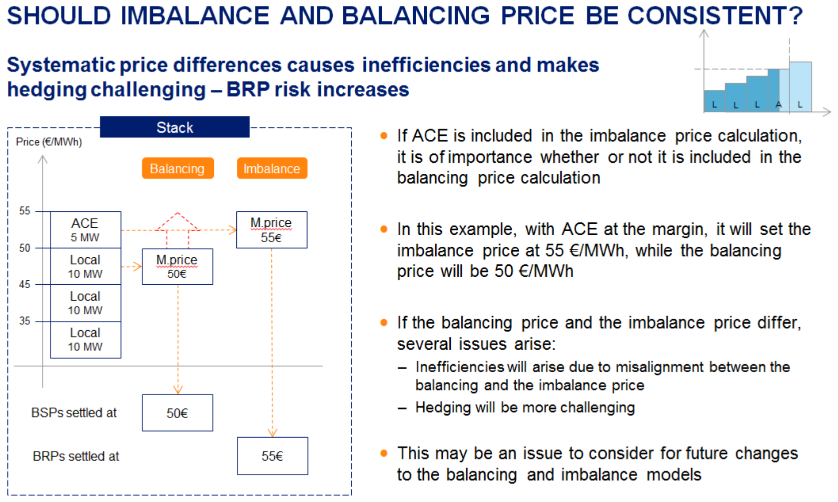
4.1.3 *Main imbalance price determination*

Balancing and imbalance prices should be the consistent

As noted in 3.2.4.2, issues can occur if balancing and imbalance prices differ – it is better to have the models aligned to avoid the risk that people take uneconomic self-balancing actions. Figure 15 shows the issue schematically: one implication is a loss of efficiency. Another is that hedging becomes more difficult due to the spread that emerges between the two prices. This can then result in higher risk premiums integrated into hedging contracts, which drives up system costs and promotes illiquid markets.

Hence, marginal pricing should be considered as the basis for imbalance pricing.

Figure 15 – The issue of inconsistent imbalance and balance prices



4.1.4 *Imbalance settlement period (ISP)*

The imbalance settlement period should begin as 60 minutes as a first step with a view to moving towards a shorter ISP in the future as per discussions under the NC EB. An ISP of 60 min is consistent with the current Nordic arrangements and the open balance agreement with the UES system operator. ACER asks for an ISP of 15 min, while the NC EB has a minimum requirement of 30 min.

The current arrangements in the Baltic and Nordic markets consist of ISP of 60 min. This issue must be kept under review as the Nordic arrangements review the implications of the NC EB.

4.2 Building blocks with alternatives

4.2.1 *Pricing model for ACE*

The issue of how to treat ACE is the issue of what to include in the marginal price calculation. In Pöyry's terminology, the marginal hourly imbalance price is determined from a 'stack' that consists of the activations made during hour (i.e. the supply of balancing energy). This stack is made up of the elements that the TSO includes in the imbalance price. The target volume (i.e. the demand for balance) is met by the activations in the stack, and the marginal price is set by the highest priced energy activation in an up-regulation hour, and the lowest priced energy activation in a down-regulation hour.

The stack may potentially consist of local activations, imports (e.g. through Estlink, Nordbalt, etc.), ACE energy, and other system activations for balancing purposes. The target volume may include or exclude any of these elements and specifically may include or exclude ACE energy. A key question is: should all these activations be treated equally in the imbalance price determination? The NC EB is explicit that all energy balancing actions should be included; it does however not treat the specific issue of ACE energy, which is very different from other energy balancing actions. This analysis has assumed that there will be a choice for the Baltics of whether to include ACE energy or not in the imbalance price determination.

ACE costs are a significant part of balancing costs in the Baltic markets (e.g. some 40% of total balancing costs in Latvia in 2014) and hence the treatment of ACE cost is an important consideration. The terms of the NC EB does not define the treatment of balancing energy costs from non EU markets.

There are three options to consider:

- ACE can be excluded from the main imbalance price;
- ACE can be included in the main imbalance price; or
- ACE can be selectively excluded in the main imbalance price.

Setting the price when ACE is excluded

If ACE is fully excluded from the main imbalance price, it means that the ACE price and the ACE volume are not considered in the calculation of the marginal imbalance price. ACE is in this option not included in the 'stack' of activations and can therefore not set the price, and the ACE volume that is used in balancing the system is not included in the target volume[10]. The theoretical consequences are three-fold:

- as ACE energy is not included in the 'stack', the marginal price will not reflect the price of ACE;
- the exclusion of ACE energy means that the volume of ACE energy is not included in the marginal price calculation (and the marginal imbalance price may even be set by the reverse direction) and
- as the volume does not include ACE, the cost of the ACE volume will not be recovered through the imbalance settlement and there will tend to be a cash under-recovery from imbalance of balancing costs (since ACE tends to have more extreme costs to the system than the other balancing actions).

In the option where ACE is excluded, the additional ACE cost will have to be recovered through supplementary fees.

Setting the price when ACE is included

At the opposite end of the spectrum, ACE may be fully *included* in the imbalance settlement. In this model, the ACE price is reflected in the main imbalance price, and the fee level required to cover ACE is lower (and there may even be a cash surplus generated; if balancing prices are set by the marginal local balancing actions). In the case of no activations, the average Elspot price is used.

Activated (delivered) ACE energy is included in the 'stack' and included in the target volume. This entails that delivered ACE energy is treated similarly to a local activation and will set the imbalance price if it is marginal. An estimate of the delivered ACE volume will be required to allow imbalance prices to be set quickly after the event; the TSOs have confirmed that this is feasible.

In the option where ACE is included fully in imbalance pricing, the ACE cost will for the most part be recovered through the imbalance price (except when netting of opposite direction imbalances removes ACE). If the balancing price is set excluding ACE (as is presently envisaged) then the 'ACE included' model for imbalance pricing will deliver a cash surplus in most instances (which must then be redistributed to participants).

Setting the price when ACE is 'selectively' excluded

We have considered a hybrid option in which ACE is selectively excluded. In this model, the ACE volume is included fully. The ACE price is included in the calculation of the main imbalance price only to the extent that there are unused offers/bids which are cheaper to the system with enough volume to replace the ACE energy. In this case, a replacement price, based on these unaccepted balancing offers is used. ACE will therefore be able to set the price only when it cannot be fully substituted by a local (unaccepted) balancing offer. This is essentially a compromise approach designed to limit the worst features of the other two models.

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10 In our modelling of case A, we first excluded ACE energy before calculating any further netting of opposite direction imbalances (instead of processing this in the opposite order). The consequence of this is minor, but it leads to a small number of hours in which (in our modelling) the net imbalance volume is set in the 'reverse' direction to the system imbalance.

As a result of this procedure there will generally be an under-recovery of costs, and this will need to be recovered through an additional fee as ACE does not set the price in all hours where it is the highest priced (or conversely, lowest priced downwards) regulation.

Pöyry has carried out analysis of the impact that different pricing models for ACE could have. The results are presented in Chapter 6.

4.2.2 *Elements of the settlement model*

The settlement model comprises two elements:

- Firstly, whether market participants are assessed with a single balancing position across their entire portfolio (as in Estonia and Latvia); or whether (as in Lithuania, the Nordics, and other markets, like GB) their imbalance positions are assessed separately on their ‘production’ (large generation) and ‘consumption’ (demand, and perhaps small generation) accounts. We consider ‘dual portfolio’ and ‘single portfolio’ options.
- Secondly, whether there is a single imbalance price for imbalances in both directions, or whether there are different prices applied to participants (or accounts) out of balance in different directions. ‘Aggravating’ imbalances (in the same direction as the overall system imbalance would face a marginal price, but ‘supporting’ imbalances (in the opposite direction to the overall system imbalance) would face a less-than-marginal price (in general, worse to the participant who offers offsetting imbalance positions). We consider ‘dual price’ and ‘single price’ options.

The choice of price and portfolio model should be made together. In all there are six combinations to consider (Figure 16).

Figure 16 – Possible alternatives for price/portfolio combination

	OPTION A	OPTION B	OPTION C	OPTION D	OPTION E	OPTION F
Portfolio	Single	Single	Dual	Dual	Dual	Dual
Pricing	Single	Dual	Single	Dual	Single for demand, dual for generation	Dual for demand, dual for generation

The following paragraphs highlight the main logic for selecting the alternatives that are suitable for the Baltics. The generic pros and cons were presented in 3.2.2 and 3.2.3.

The single-single model represents the most economically pure arrangement for imbalance settlement model

The concept of the single-single model is to give the right incentives for market participants to balance the system, based on transparency and sharing of information.

In addition the single-single model:

- is simple and enables participation from all available resources;
- gives incentive to focus on the system imbalance rather than portfolio imbalances (if adequate data is made available to BRPs);
- may be considered more suitable for the Baltic markets due to their size; and
- enables participation of resources outside standard balancing products, which are expected to become more prevalent as smart metering and demand side management evolves; and
- lowers long-term costs and has lower administrative costs than the alternatives.

Challenges with the single-single model include:

- for single pricing to be effective, participants must have access to accurate real-time information regarding the direction of the system imbalance and access to (at least indicative) prices;
  - in extremis there could even be instability in the system as participants all chase expected imbalances (although this may be mitigated by regulatory limits on the extent of voluntary imbalance);
- the single-single model may be better suited to larger vertically integrated players as imbalances can be internally netted between portfolios of consumption and production; and
- in the single pricing model there is no cash surplus to cover balancing costs outside the market; any such costs have to be covered through a separate mechanism or included as an additional fee (although we find any such cash surplus in the dual pricing model to be relatively small in any case).

In terms of cash flow, the number of portfolios does not matter for single pricing

The selection of the number of portfolios and number of prices should be considered together. A single imbalance price results in cash settlement which nets out at the highest corporate portfolio level, irrespective of the number of imbalance portfolios. Therefore, single pricing should be considered with single portfolio model. The logic is presented in the worked example in Figure 17. This is not the case for dual pricing, where the number of portfolios matters (due to the dual pricing effect). Hence Option C can be excluded.

Figure 17 – Worked example showing the difference between single and dual portfolio under single pricing

- Assumptions
  - Single imbalance price 100 €/MWh
  - Portfolio 1 -5 MWh
  - Portfolio 2 +10 MWh
- Option A – Single portfolio model
  - Total cash flow → (10 MWh – 5 MWh) * 100 €/MWh = 500 €
- Option C – Dual portfolio model
  - Total cash flow → (10 MWh * 100 €/MWh) + (-5 MWh * 100 €/MWh) = 500 €

The Baltic markets are each dominated by a few large vertically integrated players; a dual portfolio model would be good for competition

The benefits of a dual portfolio in terms of competition and the lack of advantage it provides to large incumbents with a supply and demand portfolio is a worthy reason to consider a dual portfolio model. In addition:

- a significant driver of the imbalance settlement arrangements is cost coverage (especially to recover the costs of ACE energy), and a dual portfolio with dual price generates a cash surplus (albeit a small one relative to ACE costs);
- single pricing for demand makes sense, given the lack of data regarding hourly demand consumption: an incentive could be provided, as in Nordics on imbalance volumes for consumption;
- the model is flexible (as it is easier to aggregate the model in the future to single portfolio/single pricing than to disaggregate; if that is later deemed necessary);
- it provides greater TSO control for generation (unless other limits on self-balancing are introduced) rather than incentivising self-balancing of the system (which in turn could give advantages to larger players with better data); and
- having a similar imbalance pricing model to the Nordics could promote trade opportunities.

Challenges with dual portfolio model include:

- the arrangements are more complex and could be more costly to implement (especially in Latvia and Estonia which currently have a single portfolio imbalance model);
- by definition the creation of a surplus from imbalance implies a higher cost for BRPs (in the effect of dual price), but this mitigates the level of the additional fee for cost recovery; in effect in a dual pricing model the cost is targeted more sharply at those participants which are out of balance in a direction which assists the system; and
- participants may take costly action to avoid imbalances which would support the overall system imbalance and the overall costs of balancing would be higher as a result.

If considering non-single pricing, the Nordic variant is the best choice

Single pricing for consumption is expected to increase interest from consumers to become BRPs and lead to more flexibility on the demand-side. The two price system for generation is expected to incentivise generators to keep to their production plans and maximise the amount of regulation power given to the market. In addition, adopting the Nordic model maximises trade opportunities with the Nordics.

Hence Options B, D and F are excluded. This leaves Options A and E:

- Single price – single portfolio model; and
- Dual portfolio with a single price for demand and a dual price for generation.

The models will be further investigated under the socio-economic analysis in Chapter 6.

Figure 18 – Chosen combinations for portfolio and price

	OPTION A	OPTION B	OPTION C	OPTION D	OPTION E	OPTION F
Portfolio	Single	Single	Dual	Dual	Dual	Dual
Pricing	Single	Dual	Single	Dual	Single for demand, dual for generation	Dual for demand, single for generation
Comment	Of interest	Excluded	Excluded	Excluded	Of interest	Excluded

4.2.3 *Fee model*

As the recovery pot is substantial and dominated by ACE costs, the targeting of cost recovery fees will be important in the Baltics

The level of the recovery that the fee must achieve will be defined by the pricing model that is adopted and how the ACE costs will be integrated into the main imbalance price. To a lesser extent it will be defined by the settlement model.

There is a decision to be made on how the cost recovery mechanism is levied. At a high level the choice is between the following fee models:

- socialised fee model;
- targeted fee model; and
- hybrid fee model.

Socialising the fee means that all users pay a contribution, typically based on total consumption or generation; or the (weighted) sum of both. The advantage of socialising the fee is that the base is large, i.e. the fee per MWh can be small. If the imbalance fee is volume based and levied on generation then (if predictable) it will be priced into wholesale prices and suppliers will pass the costs through to consumers. The simplest approach would be to levy this directly on demand volumes, perhaps as an annual or monthly fee.

Targeting the fee on the imbalance volumes gives a smaller fee base, a higher fee, and therefore also a higher incentive not to be in imbalance. The alternatives here are to target the fee on either gross imbalance volumes or net imbalance volumes.

A hybrid model is a combination of targeted and socialised fee structures where certain components or a certain level of the fee is socialised and the remainder (e.g. either a minimum or a maximum level) is targeted. Hybrid approaches could limit the highest targeted fees but still provide a volume incentive through the imbalance prices to avoid imbalance. The impact of such hybrid options would be that the results fall between the cases modelled.

Pöyry has carried out a high level assessment of the possible fee levels based on historical data provided by the Baltic TSOs under the socialised and targeted fee models. The results are presented in Chapter 6.

4.3 Summary of initial proposals for imbalance settlement models for consideration in the socio economic analysis

Table 13 shows a summary of the imbalance settlement models to be taken forward.

Table 13 – Summary of imbalance settlement models under consideration

Building block	Single-Single	Nordic
Balance responsibility	Full	Full
Portfolio	Single	Dual
No. prices	Single	Single (consumption) Dual (production)
Main price determination	Marginal	Marginal
Cost recovery of additional balancing costs	Targeted, hybrid or socialised	Targeted, hybrid or socialised
Treatment of ACE	Option to either include, exclude or selectively exclude ACE from the main imbalance price	Option to either include, exclude or selectively exclude ACE from the main imbalance price
Imbalance settlement duration	60 min	60 min

4.4 Regulatory gap analysis

Previous sections have laid out the changes that are proposed to the imbalance settlement arrangements. The purpose of this section is to present a regulatory gap analysis relating to these changes. This analysis was conducted with the help of the Baltic TSOs.

4.4.1 *Estonia*

In Estonia, the regulations concerning imbalance settlement are laid down in the following legal and non-legal agreements:

Electricity Market Act

The Electricity Market Act defines the general provisions regarding balance responsibility, balance settlement principles, guarantees and imbalance electricity. To implement changes, The Ministry of Economic Affairs and Communications initiates the process by compiling the Electricity Market Act amending draft with an explanatory memorandum justifying the need for the changes, and by presenting it to the Government of the Republic for co-ordination. Upon receiving approval, the draft amendment is taken into proceedings by the Parliament of Estonia, where it will then pass three readings. Changes in the Electricity Market Act need a simple majority vote cast in the Parliament.

The expected timeline for changes or amendments is 8 to 12 months.

Grid Code

The Grid Code states the activities of market participants in greater detail than what is laid out in the Electricity Market Act. According to the Electricity Market Act (paragraph 39 subsection 14), the TSO compiles amendment proposals and sends them to the Ministry of Economic Affairs and Communications, which in turn initiates the discussion in the Government of the Republic session.

The expected timeline for changes or amendments is 1 to 3 months.

Unified Method for Determining the Balancing Electricity Price and the Standard Terms and Conditions for Electricity Balance Agreements

The standard terms and conditions specify the requirements for providing balance service. They define (1) the procedures for balance planning, balance management and balance settlement between the TSO and the balance provider; (2) the rights and obligations of the TSO and the balance provider; and (3) guarantees.

The TSO is obliged to coordinate all changes to the Unified Method for Determining the Balancing Electricity Price and the Standard Terms and Conditions for Electricity Balance Agreements with the Estonian Competition Authority (NRA). Paragraph 53 subsection 6 of the Electricity Market Act states that the NRA will develop and publish the Unified Method for Determining the Balancing Electricity Price. According to the Electricity Market Act (paragraph 39 subsection 6), the TSO must develop standard terms and conditions and the imbalance price method taking into account the principles of transparency and equal treatment.

The TSO initiates the process by sending the NRA an application containing proposals of required amendments to the current documentation. The NRA assesses the proposals (taking also into account the feedback assembled from the relevant market participants) and compiles a statement of approval or objection drawing attention to deficiencies in the proposals with detailed reasoning. The NRA accepts and confirms the proposals when it deems that the amendments or explanations provided by the TSO with regard to the NRAs propositions are met and/or justified.

The expected timeline for changes or amendments is 3 to 6 months.

Legal and non-legal amendments required by the proposals

A compilation of legal and non-legal amendments required in Estonia by the proposals can be found in Table 14.

Table 14 – Current arrangements and future requirements of Estonian regulation

Source	Definition	Modifications required
Electricity Market Act, Paragraph 20, (3-6)	▪ Sets out conditions for the calculation of the variable guarantee	▪ Modifications to the Grid Code and Electricity Market Act would be needed as new harmonised BRP collateral management conditions will be introduced
Grid Code, Chapter 8, Paragraphs 61 (2) & 62	▪ States that each balance provider should put forward a permanent guarantee in the sum of 31 955 EUR ▪ Regulates how the collaterals are managed	
Balance Agreement (Also in the Standard Terms and Conditions).	▪ States that each balance provider should put forward a permanent guarantee in the sum of 31 955 EUR	
Unified Method for Determining the Balancing Electricity Price	▪ Sets out the formula on which basis the TSO defines imbalance prices (the TSO shall define the costs related to the purchase and sale of the balancing electricity as well as its costs and income using the formula developed by the Estonian Competition Authority)	▪ Changes due to the introduction of a new model for pricing of imbalances (such as additional cost coverage fees to cover ACE, marginal pricing)
Standard Terms and Conditions for Electricity Balance Agreements	▪ Sets out detailed requirements, timelines, rights and obligations of the parties	▪ Introduction of a new imbalance settlement model calls for changes in balance planning, intra-day corrections and balance settlement sections incl. imbalance pricing, fees and guarantees

Source: Elering

4.4.2 *Latvia*

In Latvia, the regulations concerning imbalance settlement are laid down in the following legal acts and agreements:

The Electricity Market Law

The Electricity Market Law (EML) defines general balancing responsibilities for the transmission system operator (TSO) in Latvia. Section 37 of the EML (*The Balancing and Calculations of Balancing)* states the overall principles that the TSO shall perform calculations of balancing openly and without discrimination in respect to all recipients of a balancing service. Recipients of the balancing services shall have the duty to pay for the balancing service the scope of which is determined on the basis of the data of the TSOs and DSOs. Calculations of balancing shall be performed on the basis of the accounting of electricity transactions performed in a definite period in order to determine the volume of the balancing electricity. The calculations of balancing shall be available to the market and system participants involved in the transaction, ensuring the protection of commercial secret. A system participant shall provide a system operator with information, which is justly necessary for the balancing and performing the calculations of balancing.

As the EML defines very general requirements regarding balancing, there could be no need for amendments in the existing wording.

The Network Code

Chapter 4 of the Network Code (NC) defines basic principles of the electricity system balancing and trading, particularly the following points:

- Point 76 of the NC states that imbalance prices shall be published on the TSO website not later than 15th date of the next month;
- Point 77 of the NC states which elements should be taken into account for the imbalance price calculation; and
- Point 80 and Point 82 of the NC defines the coefficients (1.03 and 0.97) that should be applied for the imbalance price calculations.

The Public Utilities Commission (NRA in Latvia) is in charge of any amendments in the NC. The main criteria for the regulatory decision is to ensure that the NC is in line with the aims and provisions of the EML as well as to ensure the effectivity of the procedures for the system management and usage, and the activities of the market participants. TSO shall ensure compliance with the procedures specified in the NC and shall ensure implementation of the approved amendments in the NC.

Adoption of the amendments in the NC by the NRA may require one or a few months.

The Imbalance Electricity Price Calculation Methodology and other agreements

The Imbalance Electricity Price Calculation Methodology was adopted in 2014 by Latvian TSO AS “Augstsprieguma tīkls”. This methodology was developed based on the provisions of the EML and the NC. At the moment this is the methodology in force that defines the imbalance electricity price calculation methodology.

Other relevant agreements include:

- agreement of ancillary service;
- agreements of system usage and balancing services with the market participants; and
- agreements with electricity TSOs in neighbouring countries.

Depending on the Baltic TSOs agreement and wording of the Baltic common imbalance market calculation methodology, it could be possible that there will be no more necessity for the separate Imbalance Electricity Price Calculation Methodology adopted by the Latvian TSO. Approval by the NRA is not required regarding to the changes in the balancing agreements.

Implementation of the changes in the agreements with the market participants could take a few months.

Legal acts and amendments required by the proposals

A compilation of legal and non-legal amendments required in Latvia by the proposals can be found in Table 15.

Table 15 – Current arrangements and future requirements of Latvian regulation

Source	Definition	Modifications required
NC	▪ Chapter 4 (Point 74 - Point 90) of the NC defines basic principles of electricity system balancing and trading.	▪ In case the imbalance price calculation methodology will be changed, Point 76, Point 77, Point 80 and Point 82 of the NC may require amendments
Imbalance price methodology	▪ Defines the imbalance electricity price calculation methodology	▪ With harmonised imbalance pricing, there could be no need for a separate price calculation methodology by the Latvian TSO
Balancing agreements	▪ Sets out detailed requirements, timelines, rights and obligations of the parties	▪ Introduction of a new imbalance settlement model calls for changes in the agreeemnts

Source: Augstsprieguma tīkls (AST)

4.4.3 *Lithuania*

In Lithuania, the regulations concerning imbalance settlement are laid down in the following legal and non-legal agreements:

The Law on Electricity

Electricity transmission system operator is responsible for balancing the Lithuanian power system. According to the law, the TSO is the only entity authorized for cross-border trading with operators from other countries with a purpose of balancing the national power system. The law provides for the definition of imbalance electricity and sets main responsibilities in relation to imbalance electricity trading.

Only the Parliament can amend the Law on Electricity. The Government or the Parliament members can initiate the law amendment procedure. Usually the Ministry of Energy is responsible for drafting the initial wording of the draft amendment. Afterwards, public discussion and coordinating of the draft amendment with other state authorities and stakeholders should take place.

The expected timeline for changes or amendments is 6 to 12 months.

Governmental Decree on Approval of Rules for Trading Electricity.

This decree sets the principles for calculation of imbalance electricity amount traded with other neighbouring countries. Governmental Decree can be amended by the decision of the Government. Usually the Ministry of Energy is responsible for drafting the initial wording of the draft amendment. Afterwards, public discussion and coordinating of the draft amendment with other state authorities and stakeholders should take place. In practice it takes at least 2-3 months until draft amendment reaches the Government. Sittings of the Government are scheduled each week, however in practice it might take a couple of months until amendment is approved by the Government.

The expected timeline for changes or amendments is 2 to 6 months.

Order of the National Commission for Energy Control and Prices on Approval of Rules for Balancing Electricity Price Calculation

The Lithuanian NRA sets the rules for imbalance electricity price calculation. The NRA adjusts electricity transmission tariffs following revenues collected by the TSO from imbalance electricity providers. Order of the National Commission for Energy Control and Prices can be amended after a public consultation procedure which usually lasts about one month.

The expected timeline for changes or amendments is 2 to 3 months.

Balancing agreements

Balancing agreements are signed between TSO and imbalance electricity providers. Amendments to the agreements with other counterparties should be discussed and negotiated. Time duration for introducing of these amendments may vary.

Legal acts and amendments required by the proposals

A compilation of legal and non-legal amendments required in Lithuania by the proposals can be found in Table 16.

Table 16 – Current arrangements and future requirements of Latvian regulation

Source	Definition	Modifications required
The Law On Electricity (article 30, paragraph 8)	▪ An imbalance electricity provider should provide a bank guarantee following request of TSO	▪ Introduction of harmonised collateral management conditions requires changes
Governmental Decree on Approval of Rules for Trading Electricity (article 33)	▪ Each imbalance electricity provider should separately balance the end users and power generators	▪ As it concerns certain imbalance electricity providers, a possibility of introducing common balancing of the end users and power generators should be discussed
Order of the National Commission for Energy Control and Prices on Approval of Rules for Balancing Electricity Price Calculation	▪ Imbalance electricity price for imbalance electricity providers may be different following situation in the power system	▪ Introduction of Harmonised imbalance electricity price calculation principles requires changes
Balancing agreements	▪ According to the agreements signed with imbalance electricity providers a bank guarantee should be provided (minimum amount of bank guarantee is 100 k€)	▪ Introduction of harmonised collateral management conditions requires changes

Source: Litgrid

4.4.4 *Summary of changes required*

Table 17 summarises the legal acts and amendments required by the proposals to imbalance arrangements presented in this report.

Table 17 – Summary of regulatory changes required

	Estonia	Latvia	Lithuania
Changes in laws	Electricity Market Act and Grid Code	No	Law on Electricity and Governmental Decree on Approval of Rules for Trading Electricity
Changes in regulations	Unified Method for Determining the Balancing Electricity Price	Network Code	Order of the National Commission for Energy Control and Prices on Approval of Rules for Balancing Electricity Price Calculation
Changes in balancing agreements	Yes	Yes	Yes
Approximate time for changes in laws	8-12 months	-	6-12 months
Approximate time for change in regulations	3-6 months	1-3 months	2-3 months
Approximate time for changes in balancing agreements	-	1-3 months	-

5. THE PROPOSAL FOR HARMONISATION OF IMBALANCE SETTLEMENT PROCESS

The Target model for Baltic CoBA[11] states the following goals for imbalance settlement:

- *Deadline for balance report: M + 10*
- *Chain: TSO-BRP*
- *Goal: Each TSO shall calculate the Imbalance for each BRP (same as ENTSO-E network code on Electricity Balancing)*
- *Pricing principles (discussed in previous sections of this report): Input shall be based on balancing market prices. Incentives should be designed to reduce imbalance.*

Target for the balance report deadline was originally set to M + 15, but the Baltic TSOs have agreed upon a harmonised DL of 10th day of next month.

In addition, the proposal for harmonisation in this chapter focuses on relevant data for the choice of the imbalance settlement model which is discussed in the previous chapter. This consists of:

- balance plans submitted by BRPs to TSO;
- balance settlement data by TSOs to BRP;
- data exchange formats; and
- financial guarantees.

Further harmonisation similar to the Nordic Balance Settlement model introduced in 2.2.3 should however be taken into consideration to promote:

- the possibility for a BRP to operate in the whole Baltic market as one legal entity and according to the rules set for a single system for balance management; and
- further integration between the Baltic and Nordic markets.

The following sections are structured around current setup in the Baltic markets and main differences, proposals for harmonisation and arguments for changes. In addition, the settlement principles in the Baltics are compared to the Nordic Balance Settlement. Wherever possible, we have been adding a summary table after the description of the situation in the Baltic.

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11 Source: http://elering.ee/public/Teenused/Bilanss/Feasibility_Study_Regarding_Cooperation_between_the_Nordic_and_the_Baltic_Power_Systems_within_the_Nordic_ENTSO-E_Pilot_Project_on_Electricity_Balancing.pdf

5.1 Balance plans submitted by BRPs to TSO

5.1.1 *Current situation*

Estonia

The balance plan includes production, consumption and consolidated data of supplies from the power exchange and bilateral trade. The BRP submits the balance plans to the TSO as follows:

- The daily balance plan for the next day (D-1) is submitted by 16:20 each day;
- Corrections to the balance plan are submitted as soon as the power exchange operator has confirmed the transactions regardless of the trading period, and no later than 50 minutes prior to the corresponding trading period; and
- The fixed supplies, i.e. bilateral trades, in the balance plan must always match those of the counter-parties.

Latvia

The balance plan includes production, consumption and consolidated data of suppliers from the power exchange (bilateral trades). The BRP submits the balance plans to the TSO as follows:

- The daily balance plan for the next day (D-1) is submitted by 16:00 each day; and
- Corrections to the balance plan are submitted no later than 45 minutes prior to the corresponding trading period.

Lithuania

The BRP submits the balance plans to the TSO as follows:

- The daily balance plan for the next day (D-1) is submitted by 15:00 each day; and
- Corrections to the balance plan are submitted no later than 45 minutes prior to the corresponding trading period.

5.1.2 *Comparison and proposals to harmonise*

Table 18 includes a comparison of balance plans submitted by BRPs to the TSO in each respective imbalance settlement area.

Table 18 – Comparison of balance plans submitted by BRPs to TSO

	Estonia	Latvia	Lithuania	Nordic Balance Settlement	Proposal
Daily balance plan (D-1) deadline	16:20	16:00	15:00	National approaches	No need to harmonize
Content of balance plans	Production, consumption, bilateral trades	Production, consumption, bilateral trades	Production, consumption, cross border trade, bilateral trades	Production, bilateral trades	Production, consumption, bilateral trades
MW limit for minor production	No limit	10 MW	No limit	National approaches	National approaches
Final balance plan deadline	50 min	45 min	45 min	45 min	45 min

The day-ahead daily balance plan deadline is not critical to the harmonisation of the balance portfolio model, but is more related to system operation needs of each TSO, and can thus be based on national approaches.

In Nordic Balance Settlement (NBS), consumption plans are reported only for industrial consumption (over 50 MW) in Sweden and not at all in Finland and Norway. Therefore it should be evaluated by the Baltic TSOs whether reporting of consumption plans is truly necessary. Due to Lithuania's three balance approach, Lithuanian BRPs also report cross border trade in their balance plans. When the Baltics move to a harmonised single or dual portfolio model, it should be evaluated whether cross border trade should be included in production/consumption plans, bilateral trades or if the information is available from Nord Pool[12]. As a conclusion, content of balance plans should be based on the model in Estonia and Latvia with regards to trades, i.e. consisting only of bilateral trades.

Currently BRPs in Estonia and Latvia report production plans separately for power plants of 10 MW and higher. For power plants below 10 MW, production plans are reported on an aggregated basis per BRP. In addition, plans for wind plants are submitted for each connection point regardless of capacity in Estonia. In Lithuania, there is no MW limit defined. In the Nordic Balance Settlement, there is no harmonized MW limit defined. The limit in Finland is 1 MW, 3 MW in Norway and in Sweden there is no limit defined. The limit for minor production is not critical for the harmonisation of the balance portfolio model, but more related to system operation needs of each TSO, and can thus be based on national approaches. If a specific MW level is defined, minor production can be netted with BRP's aggregated consumption. In addition, the TSO may retain the right to request separate production plans for specific plants, if deemed necessary for system operation

12 Such inclusion is indeed common practice in the rest of Europe. TSOs are accounting export schedules as consumption and import schedules as generation. So there is no need for a separate accounting of cross border flows.

purposes (e.g. for wind power plants), in the terms and conditions of the balance service agreement. This is the case for example in Finland.[13]

The goal of harmonising the gate closure times for intraday balance plans and bids in the regulating power market is to offer common rules to all market players in the Baltic area and at the same time ensure TSOs have reasonable time to plan the balancing of the power system. We recommend 45 min target to harmonise the Baltics with the Nordics. All Baltic systems are already within 5 minutes of this deadline. In the Nordics, the main argument for using a 45 min deadline was the intraday cross border trade with CWE (i.e. France, Germany, Belgium, Holland and Luxemburg).

5.2 Balance settlement data submitted by TSOs to BRP

5.2.1 *Current situation*

Estonia

The initial balance settlement is carried out each month as follows:

- Metering data from each metering point is made available to the parties in the Data Warehouse (datahub);
- Aggregated report of the total sum of measured suppliers in the BRPs' balance area is sent to the parties by the 10th day of each month;
- TSO submits the initial balance report to the BRP no later than the 15th day of the following month; and
- To settle the final balance, Elering submits the final balance report to the BRP as soon as possible after receiving the required information but no later than 3 months after the end of the month.

Elering publishes the purchase and sales prices of imbalance electricity on its website two working days after the trading period by 16:30.

The balance report is presented in an hourly format and consists of:

- Fixed net deliveries (incl. planned production, planned consumption, Elspot, Elbas and bilateral trade), MWh
- Measured net deliveries, MWh
- Imbalance adjustments in the BRP's area, MWh
- Net amount of imbalance energy, MWh
- Imbalance energy sales and purchases by TSO, MWh
- Purchase and sales price of imbalance energy, €/MWh
- Imbalance purchase and sales, €

Latvia

The initial balance settlement is carried out each month as follows:

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[13] Fingrid. Tasepalvelun sovellusohje. Valid from October 1st 2013.

- DSOs send monthly metered data for production and consumption for each BRP by the 2nd working day 17:00 of the following month
- AST submits the initial balance report to the BRP no later than the 10th day of the following month; and
- To settle the final balance, AST submits the final balance report no later than 2 months after the end of the month.

TSO publishes the purchase and selling prices of imbalance electricity by the 15th day of the next month.

The balance report consists of:

- Metered consumption and production data for each metering point directly connected to the transmission network, MWh
- Imbalance purchase and sales, €

Lithuania

The initial balance settlement is carried out each month as follows:

- DSOs send monthly metered data for production and consumption for each BRP by the 5th working day 17:00 of the following month
- Litgrid submits the balance report to the BRP no later than the 8th day of the following month. There is no correction period after this deadline.

Litgrid publishes the purchase and selling prices of imbalance electricity by the 8th working day of the next month.

The balance report is presented in an hourly format and consists of:

- Planned production, consumption and cross border balance, MWh
- Measured production, consumption and cross border balance, MWh
- Imbalance adjustments in the BRP's area, MWh
- Imbalance energy sales and purchases by TSO, MWh
- Purchase and sales price of imbalance energy, €/MWh
- Imbalance purchase and sales, €

5.2.2 *Comparison and proposals to harmonise*

Table 19 includes a comparison of balance settlement data submitted by the TSO to the BRPs in each respective imbalance settlement area.

Table 19 – Comparison of balance settlement data submitted by TSO to BRPs

	Estonia	Latvia	Lithuania	NBS	Proposal
Imbalance price publication	D + 2	15th day of next month	8th working day of next month	H + 1	As soon as possible
Balance report	Monthly based	Monthly based	Monthly based	Weekly based (daily calculation)	Monthly based
Initial balance report for BRP	M + 1 (by 15th)	10th working day of next month	8th working day of next month	D + 13 (first delivery D + 2)	10th day of next month
Correction period for final balance report for BRP	3 months	2 months	No correction period	Corrections are handled bilaterally	Corrections are handled bilaterally
Deadline of metering data	5th day of next month (as of Jan 2017)	2nd working day of next month	5th day of next month	D + 13 (first delivery D + 2)	5th day of next month
Number of metering points	0.7m	1.1m	1.6m	N/A	N/A
Deadline for smart meter roll-out	Jan 1st 2017	2023	No roll-out (negative CBA)	N/A	N/A
Content of balance report	Fixed and metered net deliveries*, imbalance adjustments, price and volume of imbalance energy	Metered consumption and production connected to the transmission grid, price and volume of imbalance energy	Fixed and metered deliveries (production, consumption, cross border), imbalance adjustments, price and volume of imbalance energy	Fixed and metered deliveries (production, consumption) imbalance adjustments, price and volume of imbalance energy	Balance settlement calculation inputs and outputs (volumes, prices)

*Including planned production, planned consumption as well as Elspot, Elbas and bilateral trade

The guiding principle for imbalance price publication is to publish the prices as soon as possible to provide information to the market participants. In addition, high imbalance prices can provide a signal to the BRPs to participate in balancing the system more actively. Therefore as a first step, the Estonian price publication cycle of D + 2 should be adopted in Latvia and Lithuania. Later on, aiming to move towards H + 1, similar to the Nordics is recommended as the goal to provide more timely price signals to market participants to balance their portfolio.

The frequency of balance reports, monthly, is the same in all Baltic markets. Deadlines for the initial reports differ somewhat, but are not substantially different. Target for the Baltic CoBA was set to M + 0.5 (i.e.15th day of next month) in a feasibility study by the Baltic

TSOs[14]. The Baltic TSOs have however agreed upon a harmonised DL of 10th day of next month.

The cycle of meter data delivery is monthly in all countries. Therefore the cycle of balance settlement should be the same so that actual metering data can be used. Later on, the Baltics could consider moving to a weekly based settlement cycle which is used in the NBS. With the roll-out of smart meters, also weekly based balance reports can be based on actual metering data while making faster correction of errors possible. Estonian smart meter roll-out is planned to be finished by 2016/17. In Latvia, the plan is to introduce smart meters by 2023. Currently, roughly 10% of customers have smart meters. Lithuania conducted negative CBAs (cost-benefit analysis) for a large-scale smart meter roll-out and does not currently have a target of installing smart meters to all customers.

Imbalance corrections, after the imbalance settlement reporting is closed, should be settled bilaterally between the DSO and retailer. This is aimed to provide an incentive for the DSOs to ensure the quality of metering data in the first delivery. In Estonia and Latvia, this will mean a change as they have currently a correction period after the initial balance report. In Lithuania, this would mean no changes to current arrangements. In a study conducted by NordREG in 2006 for developing a framework to harmonise Nordic balance settlement[15], the comments from market players (BRPs, retailers and big consumers) emphasized that the possibility for balance settlement corrections because of corrections from DSOs should be reduced. In other words, the balance settlement results should be considered ‘frozen’ after the delivery of the balance report. A firm deadline motivates market participants to provide correct data on time. The exact procedure for bilateral settlement of imbalance corrections should be developed by the energy industry in each country where current procedures can be used as is or as a starting point as this is not considered a part of the TSO-BRP harmonisation. In Estonia, this process between DSOs and suppliers is defined in the grid code. In Latvia and Lithuania, there is no defined process and corrections are handled case by case.

The balance report should contain the inputs and outputs of the balance settlement calculation. Inputs refer to planned and metered deliveries and imbalance adjustments (balancing actions). Netted deliveries are enough in the case of single portfolio (as in Estonia today), and for dual portfolio, consumption and production need to be separated (as in NBS). The balance report of the Latvian TSO contains currently metered consumption and production data of each metering point connected to the transmission network. To harmonise the content of the balance reports, this should be reported separately as this information is related to the TSO’s role as the transmission grid operator instead of imbalance settlement responsible.

5.2.3 *Imbalance settlement description for dual portfolio model*

Below is a description of the balance settlement calculations in a dual portfolio model. Imbalance volumes are calculated based on received settlement data and the calculation is performed at BRP level.

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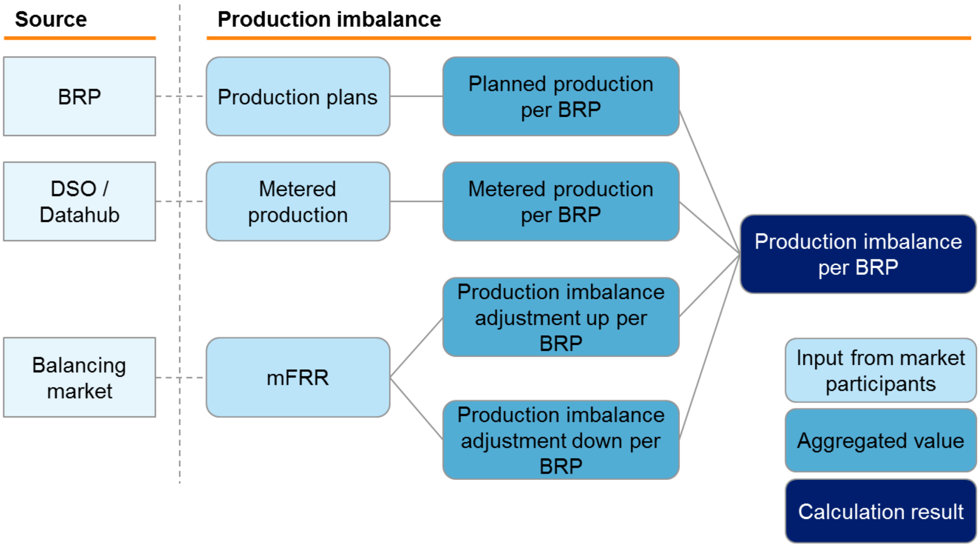
[14] Source: Feasibility study regarding cooperation between the Nordic and the Baltic power systems within the Nordic ENTSO-E pilot project on electricity balancing

[15] Nordic Energy Regulators (NordREG). Development of common Nordic balance settlement. Report 3/2006.

Production imbalance is calculated as the deviation between metered and planned production and imbalance adjustments (Figure 19). A balance deviation arises when there is a difference between the metered production and the production plan. If the BRP produces less electricity than it planned to produce, there is a deficit in the production imbalance, and the BRP purchases imbalance power in order to cover the deficit. Correspondingly, the BRP sells imbalance power if there is a surplus in the production imbalance.

As was mentioned in section 5.1.2, the MW limit for minor production is more related to system operation needs of each TSO, and can thus be based on national approaches. In case of implementation of the dual portfolio model, a MW limit should be defined for the production portfolio. Also if a specific MW level is defined, minor production can be included in the BRP's consumption imbalance. For example in Finland, there is a 1 MVA limit for minor production, but if the BRP so chooses, also production from under 1 MVA units can be included in the production imbalance.[16]

Figure 19 – Production imbalance settlement calculation

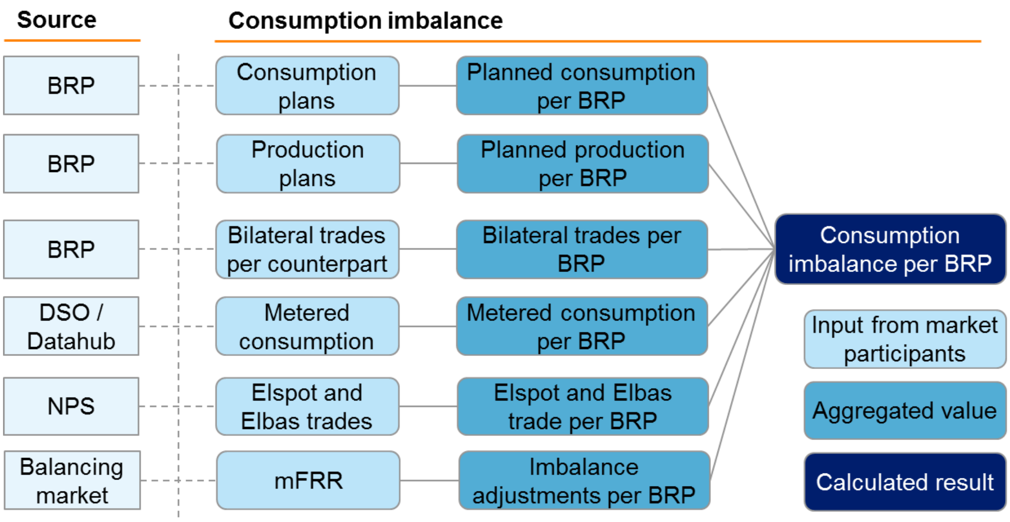


Consumption imbalance is calculated as the deviation between consumption, planned production, trades and imbalance adjustments (Figure 20). A balance deviation arises when there is a difference between the consumption and electricity purchases (included in the consumption plans). If the BRP consumes more electricity than it purchased, the BRP is required to purchase imbalance power to cover the deficit and vice versa.

Consumption plans are not used in the consumption imbalance settlement calculation as the same information is contained in production plans and trade data (in the Nordic case). If the Baltic TSOs decide that the reporting of consumption plans by BRPs is not necessary, these can be removed from the calculation.

16 Fingrid. Tasepalvelun sovellusohje. Valid from October 1st 2013.

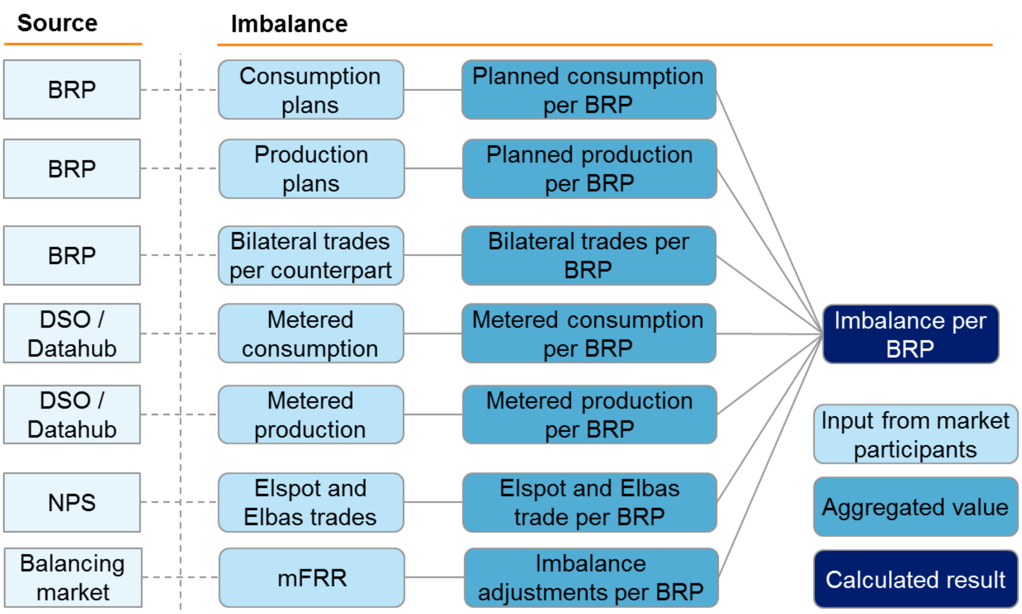
Figure 20 – Consumption imbalance settlement calculation



5.2.4 *Imbalance settlement description for single portfolio model*

Imbalance in a single portfolio model is calculated as the deviation between metered and planned production and consumption, trades and imbalance adjustments. Imbalance settlement calculation in a single portfolio model is illustrated in Figure 21.

Figure 21 – Imbalance settlement calculation in a single portfolio model



5.3 Data exchange formats

Table 20 includes a comparison of data exchange formats in each respective imbalance settlement area.

Table 20 – Comparison of data exchange formats

	Estonia	Latvia	Lithuania	NBS	Proposal
Data exchange format	ENTSO-E XML	Excel documents	Excel documents	ENTSO-E XML and ebIX* XML (metered production, aggregated consumption)	ENTSO-E XML (support for Excel as a transition measure)

*Ediel Nordic forum was renamed ebIX in 2002, to make it clear that the organisation had gone from a Nordic organisation to a European organisation

XML is currently considered as the long-term syntax choice for standardised market message exchange. ENTSO-E has had XML as the only choice of syntax from the beginning of the market message exchange working group in 2001. ebIX has migrated from EDIFACT to XML as the leading syntax during the last decade. ENTSO-E has the responsibility for the upstream market (communications towards and from the TSOs), while ebIX should have the responsibility for the downstream (retail) market. Hence as a first step, relevant harmonisation in the Baltics applies only to ENTSO-E XML syntax.

Implementing the recommended change in data exchange format will require an initial investment in IT systems by the TSOs and BRPs in Latvia and Lithuania. This is however seen necessary to ensure that balance settlement information (plans, trades, deliveries) is based on the same formats so that it can be sent between parties in different Baltic countries, and later between Baltic and Nordic market parties.

The introduction of standardised market messages means that verification of messages can be automated. For example, NBS will follow the ENTSO-E acknowledgment process. A document is controlled at two levels:

1. System level to detect syntax errors (XML parsing errors, file processing errors, etc.)
2. Application level to detect any semantic errors (invalid data, wrong process, etc.)

5.4 Guarantees

TSOs are the financial counterparty in the imbalance settlement towards all BRPs which poses a counterparty risk for the TSOs. Each BRP must therefore provide collateral to the TSO as security against the risk that the BRP is unable to fulfil its obligations. Collateral can be provided in the form of a cash deposit on pledged bank account or a bank guarantee.

Table 21 includes a comparison of guarantees in each respective imbalance settlement area and in the Nordic Balance Settlement.

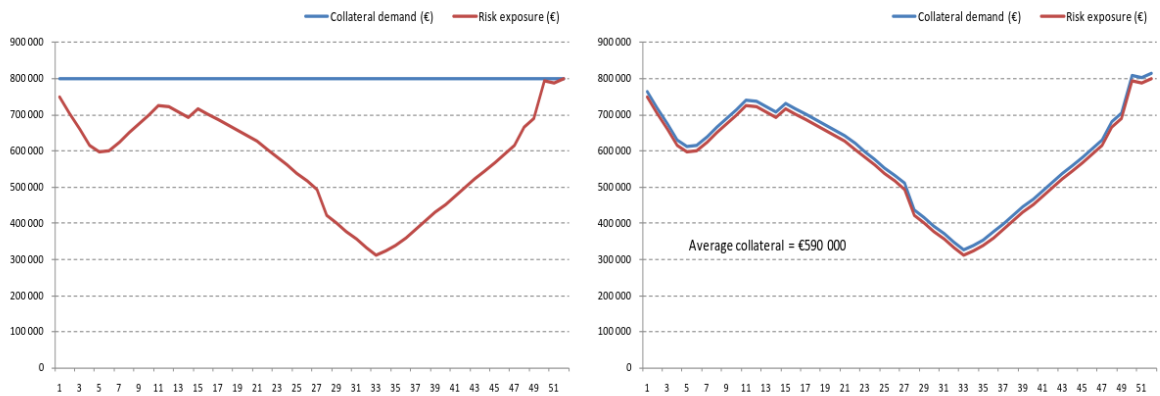
Table 21 – Comparison of guarantees

	Estonia	Latvia	Lithuania	NBS	Proposal
Guarantees for BRP	Permanent guarantee 32k€ + variable guarantee (not used by Elering)	Permanent guarantee 31k€ + variable guarantee (for facilities connected to the transmission grid)	Calculated on a daily basis: Not paid amount for imbalance of previous month plus preliminary payment for current month multiplied by 2. Minimum guarantee 100k€	Calculated on a weekly basis (formula presented below)	Dynamic guarantee, no minimum guarantee

5.4.1 *Financial guarantees in the NBS*

The Nordic Imbalance Settlement Model uses a dynamic collateral model. This means that the collateral requirements are recalculated every week based on the latest available settlement and price data. The advantage of the dynamic collateral model compared to a static one is that collateral levels of the dynamic model are closer to the actual counterparty risk (illustrated in Figure 22). As the collateral requirements are recalculated when conditions change, the collateral formula does not have to include as much safety margin over the prevailing risk level as would be needed with a static model.

Figure 22 – Illustration of the static (left) and dynamic (right) collateral model



Source: Nordic Balance Settlement (NBS) Design, 2011 (Svenska Kraftnät, Fingrid, Statnett).

The overall counterparty risk exposure consists of the following components:

- Delivery hours for which the settlement amounts have been invoiced but not yet paid;
- Delivery hours for which the settlement amounts are known but not yet invoiced;
- Delivery hours during which the BRP has been active but the imbalances are unknown (only trade, production plans and imbalance adjustments are known); and
- Delivery hours in the future which the BRP will be active, but for which there is no information yet about the BRP's activity. This component needs to be considered as well since there is the risk that a distressed BRP might cease to honour its

commitments in the electricity market and accumulate significantly higher imbalances than normally until the point when this is noticed and the accumulation of further imbalances can be prevented.

In NBS, under normal circumstances, the collateral requirement of a BRP is calculated according to the following standard formula:

$$Collateral\ requirement = 3 * (S_1 + S_2) + m * (V_1 + V_2) * P$$

Where:

S_1	=	Average of the sums of invoiced production fees, consumption fees and consumption imbalance fees per week for the last three invoiced weeks, including any VAT on these amounts that the BRP is liable to
S_2	=	Average of the absolute amounts of the sums of invoiced production and consumption imbalances in a week for the last three invoiced weeks, including any VAT on these amounts that the BRP is liable to. (First we sum up the bought and sold production and consumption imbalance in a week. Then we take the absolute amount of this sum. This is done for the last three invoiced weeks. Then we calculate the average of these absolute amounts.)
V_1	=	Consumption volume the last seven settled days (current day minus 20 days to current day minus 14 days)
V_2	=	Bilateral and spot sales volumes during the last seven days for which such volumes are available (current day minus 8 days to current day minus 2 days)
m	=	Multiplier: ▪ 3/7 for the share of $(V_1 + V_2)$ that does not exceed 80,000 MWh ▪ 1/7 for the share of $(V_1 + V_2)$ that exceeds 80,000 MWh but does not exceed 400,000 MWh ▪ 0 for the share of $(V_1 + V_2)$ that exceeds 400,000 MWh
P	=	Average of the consumption imbalance prices in the different MBAs during the last seven days for which such prices are available (current day minus 7 to current day minus 1), where the price of each MBA is weighted according to the share of the BRP's total turnover (consumption, spot sales and bilateral sales) during the last three invoiced weeks that took place in the respective MBA

The first term of the formula provides an estimate of all the outstanding settlement amounts that have accumulated until the current day but not been paid yet. The second term of the formula provides an estimate of the forward-looking component of the exposure, i.e., the imbalances that a misbehaving BRP may accumulate from this point onwards until the point when the irregular behaviour can be identified and the accumulation of further imbalances prevented. The calculation is based on the worst-case assumption that the whole turnover of the BRP may turn into imbalance.

5.4.2 *Financial guarantees in the Baltic – suggested approach*

A similar approach to the NBS is recommended for the Baltics as well. The current Lithuanian approach can be used as a starting point. As the guarantee is updated regularly and it includes a forward-looking component, the requirement for a minimal guarantee can be removed. A dynamic guarantee with no minimum requirement will reduce the amount of tied working capital for BRPs while reflecting a realistic risk exposure level to the TSO.

There are some situations where the standard formula is not applicable. These include:

- **New BRP** – With a new BRP the guarantee should be based on planned balance, expected volumes of trade and consumption, and credit rating. For a new BRP, a minimum amount of collateral should be set as default value.
- **BRP with changed portfolio** – If there are substantial changes in the BRP's portfolio due to, e.g., merger, acquisition or divestment, the BRP should provide the TSO necessary information of expected changes in traded volumes, based on which the TSO can calculated an adjusted guarantee requirement.
- **BRP in financial distress** – If there is evidence of an increased risk that the BRP might not be able to meet its obligations; the TSO can calculate a new specific guarantee requirement based on planned balance, conditions for continued operation, trading behaviour and credit rating.

5.5 Further harmonisation of the imbalance settlement model

This chapter has been focused so far on the harmonisation of the TSO-BRP balance model between the Baltic markets. For further harmonisation similar to the NBS to support the operation of BRPs in several market areas, other settlement principles need to be considered and further aligned.

To give a brief overview, different procedures and operations of an imbalance settlement model are divided into five core functions in the NBS handbook (see Figure 23): settlement structure management, metering and reporting data, settlement, invoicing and reporting.[17] In addition, the settlement model can contain own functions for collateral management and market behaviour monitoring. These concepts are explained briefly below:

- **Settlement structure** defines how the information about the imbalance settlement structure and hierarchy (relations) is collected and managed, e.g. information about a new Metering Grid Area (MGA) or the contact information of a market participant.
- **Metering and reporting data** handles the imbalance settlement data reception, validation, storing and reporting.
- **Settlement** is the execution of the process, dealing with the material handling of production and consumption imbalance settlement calculations, quality assurance and publishing of results.
- **Invoicing** handles invoicing of BRPs, based on realised imbalances resulting from settlement.
- **Reporting** includes the creation, distribution and publishing of various reports and files according to the same format, again resulting from settlement.
- **Collateral management** includes control of the BRPs' collateral demands as well as follow-up of the placed collateral deposits in comparison to demands. Proper linkages with the previous process shall be established to ensure the appropriateness of the collateral levels, especially if these are set dynamically as suggested more above.
- **Market behaviour monitoring** is based on the analysis of the BRPs' imbalances. These are analysed by calculating a set of KPIs, which show the BRPs market performance (e.g. quality of reported data, reporting frequency, relative imbalances, absolute imbalances and imbalance costs per unit). The quality of DSO reporting can

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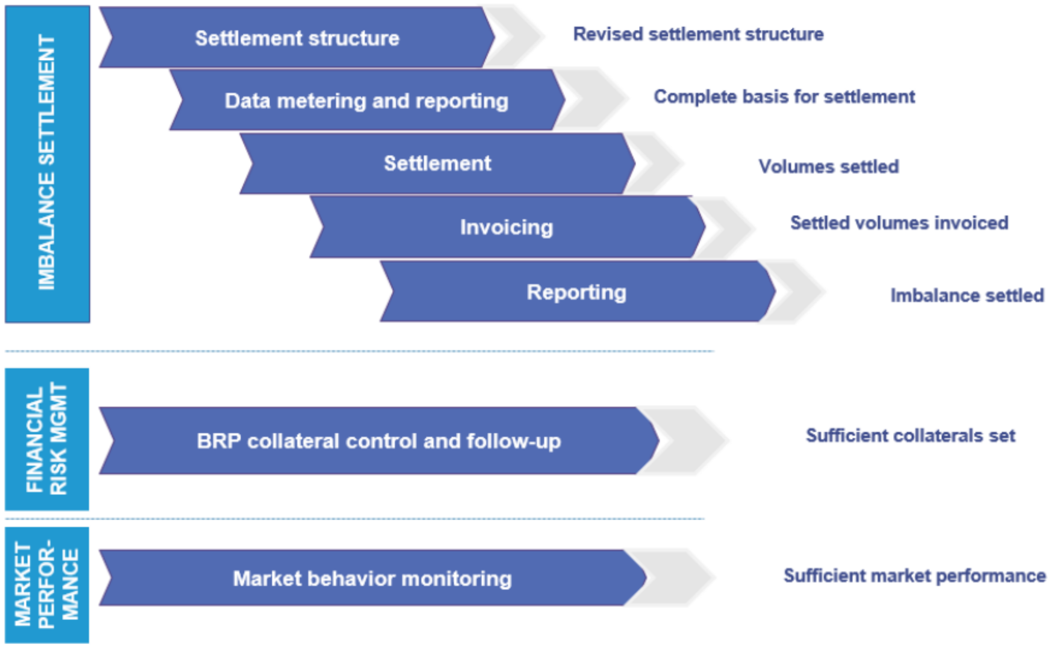
[17] Source: Nordic Imbalance Settlement Handbook. 7.10.2015.

also be monitored. It is suggested that the design of this specific process is designed in agreement with the Regulators, who have, in the very end, the executive power to issue fines and penalties to misbehaving parties.

Figure 23 – Imbalance settlement model functions



Source: Nordic Imbalance Settlement Handbook

6. FINANCIAL AND SOCIO-ECONOMIC ANALYSIS FOR A COMMON BALANCE MANAGEMENT TARGET

Chapter 4 presented two main proposals for the common Baltic imbalance settlement model. This Chapter explores these proposals further through modelling of the imbalance settlement using historical data, to illustrate the potential effects of implementing the different options.

6.1 Introduction

Socioeconomic analyses are often used to determine the size and direction of benefits accruing from implementation of one or more models compared to a baseline. In this case, we are using historical data and we are not covering the balancing market itself. Therefore, any changes modelled will simply be redistributions of cash, and no net costs of savings can be identified for the system as a whole. However, we do comment on areas where the outcomes would lead to better (or worse) incentives and/or to better or worse allocation of risks between BRPs and the TSO.

6.1.1 *Objectives*

In this report the analysis investigates the cash flows of the TSOs and BRPs under different imbalance models. The objective is to determine the high-level merits of the settlement models. Does the model generate a surplus or a shortfall? How are costs recovered, and how is any over-recovery returned? Key metrics will therefore be the cash surplus or shortfall in the different models, and the fee levels necessary in each model to return the TSO to financial neutrality.

Further, on a market participant level the analysis investigates the distribution of welfare on a market participant level. How are market participants affected in one model *compared to another*? A key metric here will be the relative change in cost to different classes of BRPs between the settlement models.

6.1.2 *Data and limitations*

The input for the analysis is actual imbalance data from 2015 for each of the three Baltic countries. This includes hourly overall system imbalance, aggregate short and long imbalances, balancing actions, netting of ACE between countries, etc. Only a single year of data was available for this analysis. System costs are therefore also assumed equal across the models analysed.

Data for individual BRPs at a BRP account level is only available for Lithuania. This is because Lithuania is the only Baltic country that today has more than one portfolio account, and therefore holds data on short and long imbalance positions per portfolio per BRP. Due to this data availability the impact on BRPs has therefore only been investigated for Lithuania.

Full-scale socioeconomic analysis including assessments of improvements in social welfare necessitates modelling of how market participants would adapt under different models. This is a highly demanding, complex, and costly modelling task. Modelling of behaviour change is not in scope for this analysis. As a consequence there is no exploration of improvements of total social welfare in the system. If there is no modelling of behaviour change the model with the highest social welfare may be the model which is cheapest to implement, which is not an interesting or valuable outcome.

A further assumption in the modelling of the Baltic system is that transmission capacity within balancing timeframes is not limited. The intent of the exercise is to look at the pricing patterns and the implications for different participants in order to demonstrate the pros and cons of the alternative arrangements, not to be a full scale modelling exercise (which would not be likely to shed light on the policy decisions at hand).

6.2 Description of the analysed models

The analysis considers three dimensions:

- pricing model (inclusion of ACE energy);
- settlement model (single/dual portfolio and single/dual price); and
- fee model (method for recovery of cash shortfall or surplus).

The analysis does not represent the total set of options under consideration (including all of the various hybrid options and the full detail for each of the options) but covers a wide range of possible outcomes.

6.2.1 *Pricing model for ACE*

This project has aimed not only to analyse a set of pre-defined models for imbalance settlement but to explore the details of the Baltic system and evaluate whether these details merit further consideration.

Over the course of the project a number of Worked Examples have been developed to illustrate differences between the options available for a common Baltic system. The examples looked at specific options for the determination of the marginal price, e.g.:

- whether to include only actual activations in the setting of the marginal price, or available bids/offers also should be considered to some extent in case of inefficiencies;
- whether to employ netting of opposite direction regulation, i.e. net off regulation in the opposite direction with the most expensive regulation in the main direction; and
- whether to include ACE in the marginal price determination.

The TSOs decided over the course of the project to base the marginal price for balancing and imbalance on actual activations, and to employ netting of opposite direction regulation activity[18]. These issues have not been explored further in this analysis. It was decided to analyse the final issue – how to treat the cost of ACE in the common Baltic imbalance settlement model – in the socioeconomic analysis.

The main findings are summarised in Figure 24.

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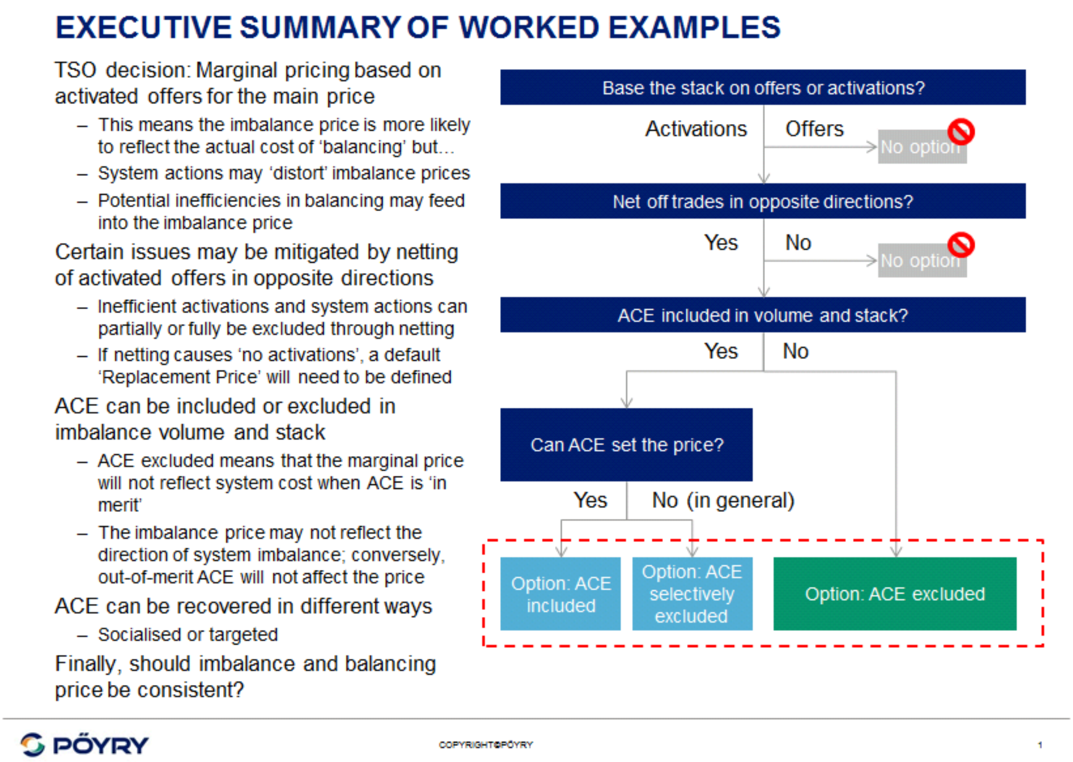
18 Netting of offsetting balancing actions has the effect that the price relates only to the net energy imbalance volume, and that any further balancing actions in the main and the reverse direction are treated as out-of-merit non-energy actions. Such activations could be due to transmission constraints or other system actions

Figure 24 – Determination of options through Worked Examples



Three pricing models for the inclusion of ACE in imbalance prices were identified in Chapter 4:

- Model A: ACE excluded (price and volume);
- Model B: ACE selectively excluded (total volume included, price selectively excluded by substitution); and
- Model C: ACE included (price and volume).

We have chosen to treat these options as a spectrum where ACE excluded and ACE included are at each end, and ACE 'selectively' excluded somewhere in between. However, for ease of explanation the two extremes – A and C – are described first. Results are reported in the order A-B-C.

In principle in each of the cases it would be desirable to net offsetting volumes (including ACE energy) before the further processing of ACE energy and the calculation of the marginal price.

6.2.2 *Settlement model*

Chapter 4 identified two settlement models to investigate in the socioeconomic analysis:

1. Single-single model: This model has a single imbalance portfolio and uses single pricing for all imbalances.

2. Nordic model: This model is similar to the model used in the Nordic countries. It has two portfolios, one for production and one for consumption. The production portfolio has dual pricing. The consumption portfolio has single pricing.

6.2.3 *Fee model*

Chapter 4 identified two fee models to investigate further:

a. Socialised fee: This fee (or return of any cash surplus) will be levied on all consumption in the system. As it is spread on a broad base, the fee will typically be a small number per MWh.

b. Targeted fee: This fee will be levied on the net imbalance in the system. As it is spread on a narrower base, the fee will typically be a higher number.

Other fee models have also been identified. One is a variation on the targeted fee, where the fee is targeted on the imbalance in the main direction. It is applicable in the Nordic model but not in the single-single model, as it will create a dual price when levied only on one direction. Other hybrids between a targeted and a socialised fee are also possible, e.g. either requiring a minimum or a maximum uplift to the marginal imbalance price through a targeted fee. These alternative fee models have not been analysed further, but their impact sits between the cases analysed.

6.2.4 *Summary of models*

The three dimensions to the analysis are summarised in Figure 25.

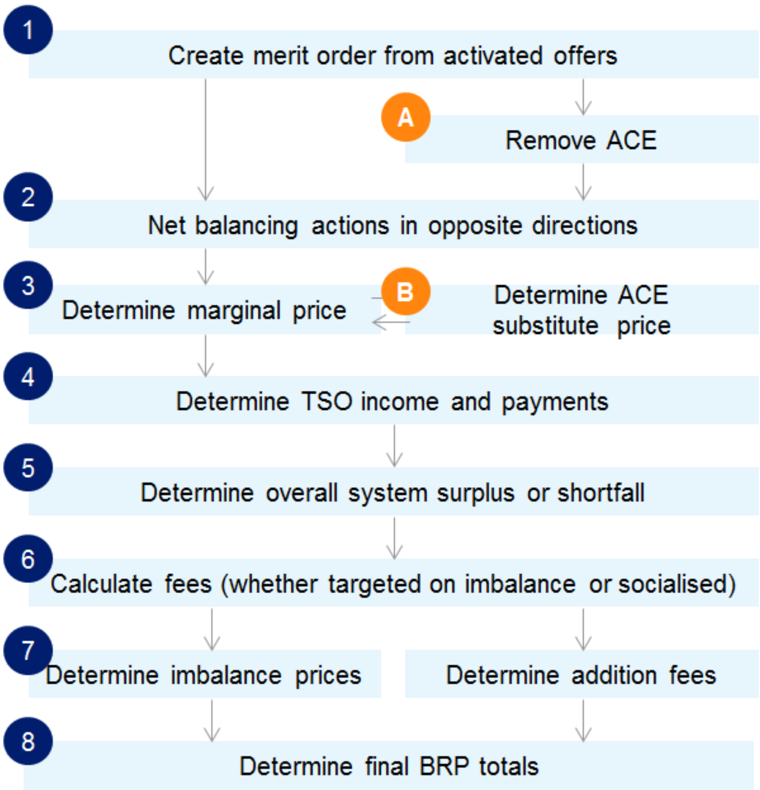
Figure 25 – Matrix of options explored for imbalance pricing

		1a	2a	1b
		Single, socialised fee	Nordic, socialised fee	Single, targeted fee
A	ACE excluded	✓	✓	✓
B	ACE selectively excluded	✓	✓	(✓)
C	ACE included	✓	✓	(✓)

6.3 Methodology

This section goes into detail on the two main elements of the analysis: marginal price determination and derivation of settlement results. The overall methodology is shown in Figure 26.

Figure 26 – Methodology of marginal price determination and derivation of settlement results



6.3.1 *Marginal price determination*

The marginal price is determined in three main steps:

1. A 'stack' (or merit order) is created from the activated offers.
2. Opposite direction regulations are netted against each other[19], where the MWh in the opposite direction are netted against the highest priced regulation, offsetting the most extreme priced orders (highest priced up regulation against lowest priced down regulation).
3. A marginal price is determined from the remaining activations in the stack.

If there are no remaining activations, either due to netting or exclusion of ACE, the price is set by a reference price. In this analysis the average of the three Baltic Elspot prices has been used as a reference.

In pricing model A, where ACE is excluded, the ACE is removed from the 'stack' and the target volume (before netting, in our modelling). This is shown in step 1-A in Figure 26.

19 In the case with ACE excluded, we performed the netting step after exclusion of ACE actions. The differences in results are considered to be small.

In pricing model C, where ACE is included, the ACE is not removed and is allowed to set the marginal price.

In pricing model B, where ACE is 'selectively' excluded, there is another set of steps to complete:

4. It is determined for which hours ACE sets the price and with what volume.
5. The remaining not activated offers are assessed, to determine whether there are enough cheaper offers in the hour that could 'substitute' for the ACE volume.
6. In the hours that ACE sets the price and there are enough substitute offers, then ACE is removed and substituted by other offers; if there are not enough substitute offers then ACE will still set the price.
7. The marginal price is recalculated based on a revised stack. When ACE can be substituted the revised stack includes the substitute offers instead of ACE.

The steps 4-6 are included in the step 3-B in Figure 26.

6.3.2 *Calculation of settlement results*

When the marginal price is set, the cash flows can be analysed. Figure 26 shows the main steps in the analysis. Note that in all cases we assume that the balancing prices are set after excluding ACE energy from the stack and the volume. This is under discussion by the TSOs under a separate exercise.

TSO income and payments come from a number of sources: imbalance settlement, balancing actions, ACE trading with Russia, netting of ACE between the Baltic countries, trade (Estlink), and other actions. Taken all together the income and payments give an overall surplus or shortfall.

If there is a shortfall, money will have to be recovered from the market participants. Conversely, if there is a surplus, money will have to be given back to market participants. The socialised fee is derived from the surplus/shortfall and divided by the total consumption in the system[20]. The targeted fee is derived from the surplus/shortfall and divided by the net imbalance in the system – this targeted component is then added on top of the imbalance price (in hours when the system is short) or deducted from the marginal imbalance price in hours when the system is long.

We assumed that even with the 'adder', the prices should be limited so that they are not more extreme than the ACE price. If any other additional fees are needed, these are calculated separately[21].

In the final step the results for the BRPs are calculated (and clustered), based on the imbalance prices and fee levels.

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20 In practice, the simplest approach would be to levy this as an annual or monthly fee rather than a price calculated in each settlement period as we have modelled.

21 In practice it may be desirable that if there is a surplus, this is socialised rather than being treated as a negative 'adder' to imbalance prices, making imbalance prices less than marginal. We did not model this hybrid.

6.4 Results

Results of the socioeconomic analysis are reported for the three categories of models described above: pricing model, settlement model, and fee model. This section presents results of these models in this order and summarises the conclusions at the end.

6.4.1 *Choice of pricing model for ACE*

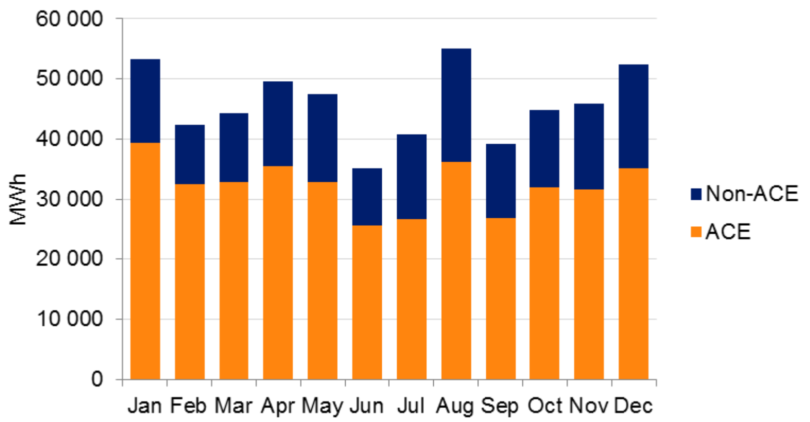
Impact of ACE energy

Interpreting the data received from the Baltic TSOs, it is clear that ACE energy is used to meet minor imbalances and local activations are used mainly to meet larger imbalances on relatively rare occasions. ACE is therefore a major part of the energy used to balance the Baltic system, at present.

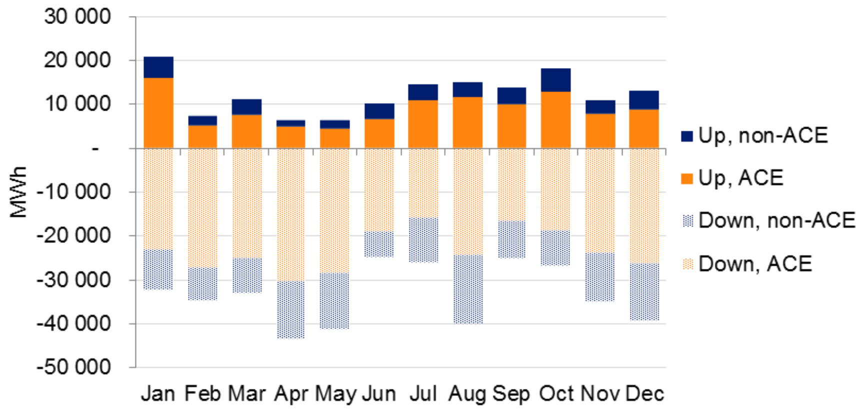
Figure 27 illustrates this point by showing the total use of ACE compared to other sources of balancing energy per month for 2015.

Figure 27 – Volume of ACE compared to non-ACE sources, monthly, 2015, MWh

Total



Per direction

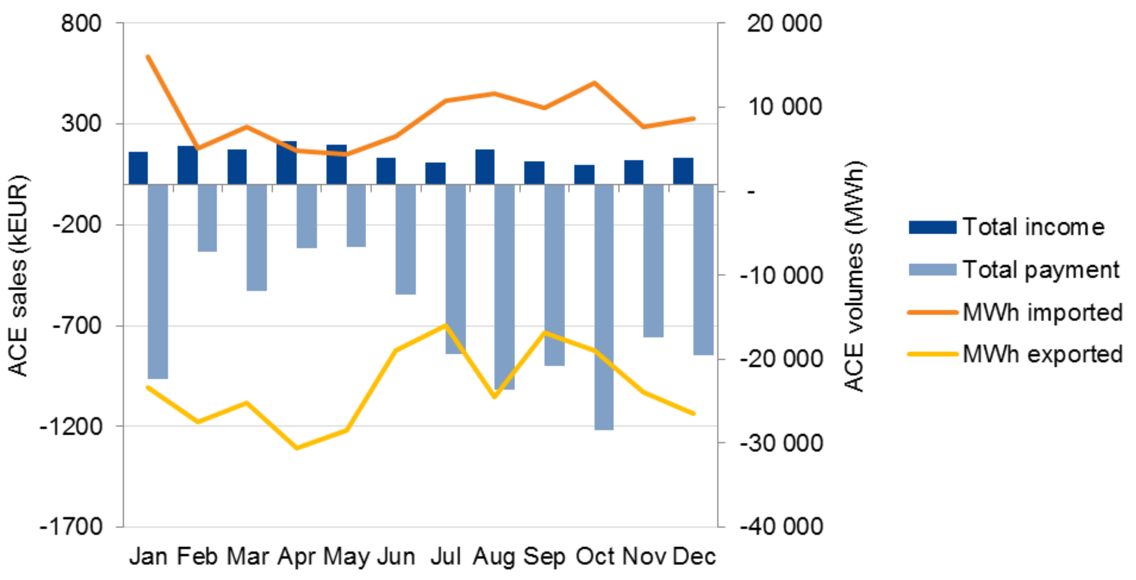


The lower chart in Figure 27 illustrates another point: the Baltic system is most often long. This is not uncommon; participants tend to be long rather than short as the potential is for 'short' prices to be more extreme than 'long' prices. This reflects the underlying system reality: that it is simpler for the TSO to deal with a surplus at short notice than a shortfall (which may involve starting up generation units).

Looking at ACE specifically the Baltic position is generally also long, i.e. the Baltic countries overall sell more MWh energy to Russia than they buy. Trading away imbalances through the Open Balance Agreement with Russia is however not a profitable exercise. The OBP sell price is fixed at 5 €/MWh (as of late 2015), which means that the TSOs recover only a small part of the production cost of these MWh. At the same time the OBP buy price is high, and may in daytime be more than 100 €/MWh. Using ACE energy is therefore costly, and selling ACE energy is not very profitable.

This becomes clear when looking at aggregated ACE volumes as well as sales for the three Baltic countries, shown in Figure 28.

Figure 28 – Monthly ACE sales (k€) and volumes (MWh), 2015



The figure shows that the ACE position in terms of energy is overall long, i.e. selling energy to Russia. However, the net result in cash is a payment, i.e. a cash flow from the Baltics to Russia.

These two figures make an important observation about the Baltic system: the treatment of ACE in imbalance settlement is a key issue for the Baltics. ACE energy is used extensively, and it is a costly endeavour. Therefore it would be recommended for a common Baltic imbalance settlement model to take into account these issues.

Price levels under different pricing models

The pricing model determines how ACE is treated in the calculation of the marginal price. Three models were considered in section 6.2.1, and the price set in each model is determined from the methodology in section 6.3.1.

In model A, where ACE is fully excluded, the marginal imbalance price is meant not to be influenced by ACE, but set only by local activations (or a reference price). However, although the imbalance price is not set by ACE, it is actually not set by local activations for most of the time either. The price curve will in practice be heavily influenced by a reference price, which in this analysis is assumed to be the average of the three Baltic Elspot prices.

The reference price is used in hours with no local activations either way, i.e. a net zero volume of balance activations (after excluding ACE). In this pricing model, 'no activations' happens in two cases:

- in many hours ACE is the only source of balancing energy, and when ACE is excluded there are no activations; and
- there are other activations but opposite direction activations net off to zero.

The marginal imbalance price in these hours is then the reference price. Overall, the reference price sets the marginal imbalance price in 58% of hours and for 53% of gross imbalance MWh in the model where ACE is excluded. If this is the preferred solution, then the definition of the reference price is of the utmost importance, as it may be setting the price more than half of all hours of the year.

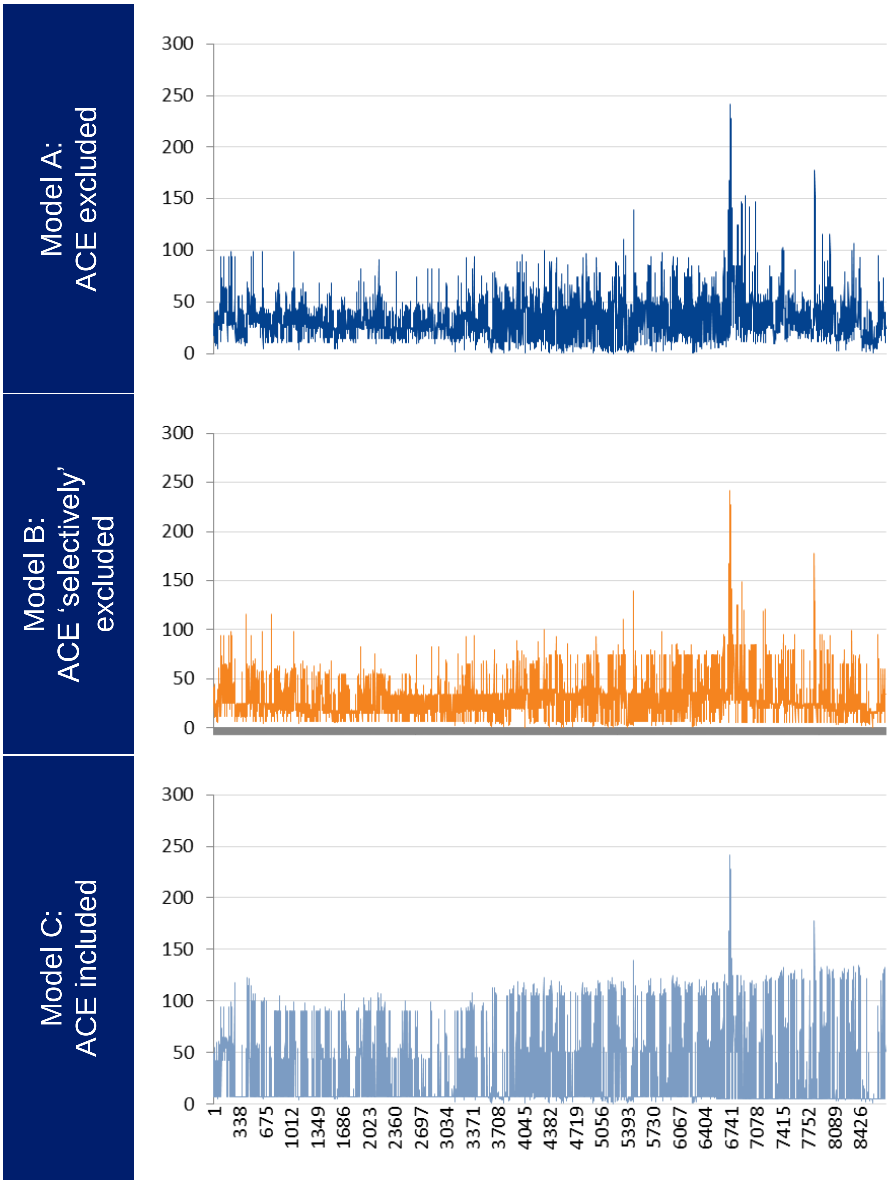
Another issue with model A is that – in the way we have modelled it, excluding ACE before netting opposite direction actions – the price may be set in the 'wrong' direction. For example, if 20 MWh ACE energy is bought from Russia but a local activation of -10MWh (down regulation) also has been called, then excluding ACE will cause the opposite direction regulation to set the price. In the analysis of 2015 data this would have happened in ca. 4% of the time and for 1% of gross imbalance MWh. If netting were performed before exclusion of any remaining ACE energy then these hours would also use a reference price.

In model C, where ACE is fully included, the pricing model allows the highest priced activation in an up-regulation hour (and conversely the lowest priced activation in a down-regulation hour) to set the price, to ensure that the marginal imbalance price is reflective of the actions taken to balance the system. In this model there will be very few hours with no activations, and the reference price is used less than 1% of the time and for less than 1% of gross imbalance MWh. The main issue in model C is that ACE sets the marginal imbalance price in most hours, ca. 90% of the time. This may not be an acceptable outcome. In terms of the MWh of imbalance actually settled at this price, ACE would define the price for 89% (in a single price model).

In model B, where ACE is 'selectively' excluded, ACE sets the price only when there are not adequate better priced offers available to substitute ACE in the stack of activations. Local activations will set the price in most instances in this model. Only for 5% of both hours and volume (gross imbalance MWh) are there insufficient better offers available than ACE, i.e. the ACE substitute price would be more extreme than the ACE price, and ACE ends up setting the price. And only in another 1% of both hours and volume will a reference price be used due to no activations.

The hourly marginal imbalance prices in the three pricing models are shown in Figure 29.

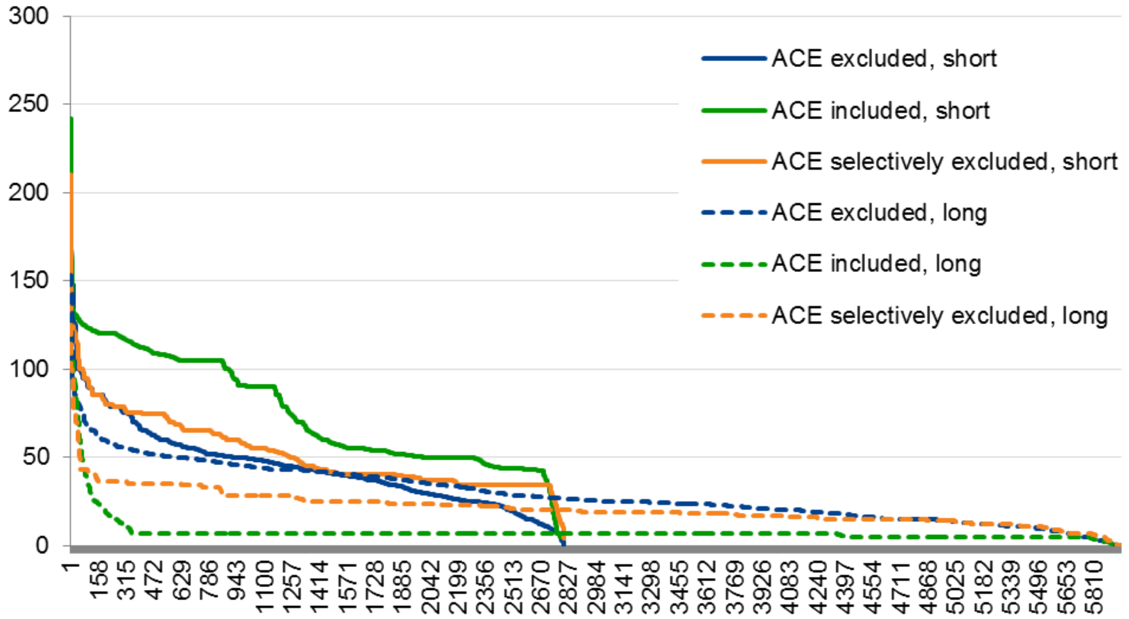
Figure 29 – Hourly imbalance price per model, €/MWh



It can be seen from these charts that model C sets the price at very high and very low levels more often than models A and B; in model C the price effectively oscillates between the ACE buy and sell prices. As mentioned previously, ACE sets the price in this model 90% of the time.

Figure 30 shows price duration curves for when the system is short and when the system is long for each of the pricing models.

Figure 30 – Price duration curve, for system short and long, €/MWh, 2015



In model C prices are generally very high or very low, and they are very low (5-7 €/MWh) for ca. 65% of hours (and of gross imbalance MWh). There are periods where the price remains at this very low level for many hours in a row, which leads to difficulty representing volatility by standard volatility measures. In Model A, the exclusion of ACE energy appears to mean that in all but the most extreme hours, prices are artificially low when the system is short and artificially high when the system is long.

Key metrics

In summary, there are drawbacks to each of the models A and C at each end of the spectrum: either a reference price or ACE sets the price for a large number of hours of the year, and a significant portion of the imbalance volume.

A middle option, with ACE selectively excluded, merits consideration. The marginal imbalance price is set mainly by local activations that are substituted for ACE, and the price duration curve shows more similarity to the model A (ACE excluded) than the high-low switching of model C (ACE included). It shows less of a step between hours in which the system is short and hours in which the system is long, compared to model C.

6.4.2 *Choice of settlement model*

The settlement models considered in the analysis are

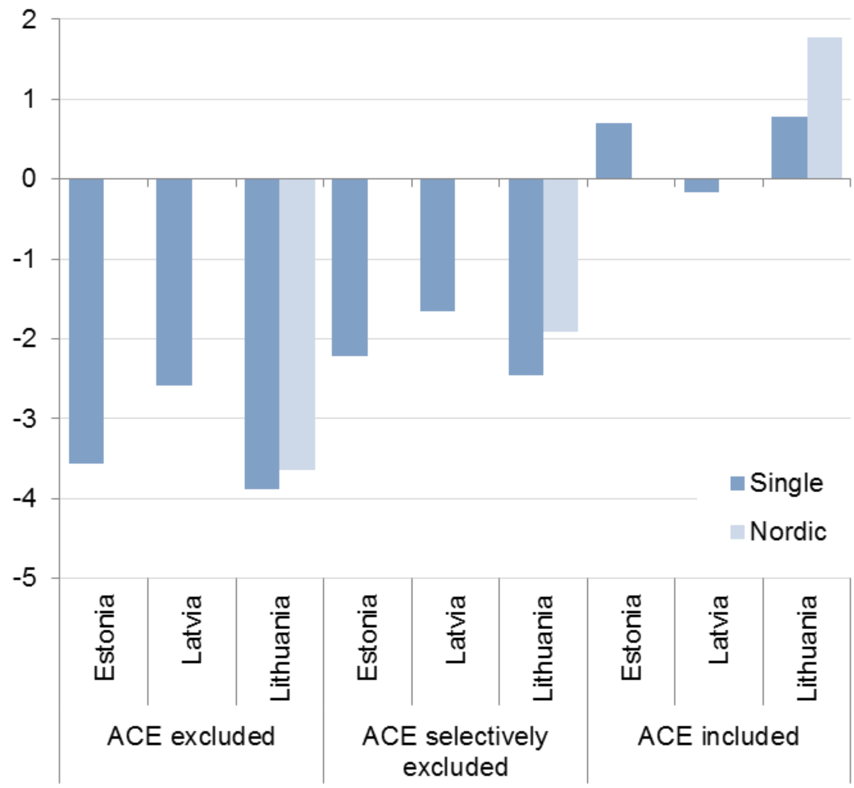
- the single-single model, with a single portfolio and single pricing; and
- the Nordic model, with a dual portfolio, dual pricing for production and single pricing for consumption.

The descriptions and merits of the settlement models have been covered in Chapters 3 and 4. The following analysis is based on application on actual 2015 data for the three Baltic countries.

A key consequence of the choice of pricing model is whether the model generates a surplus or a shortfall. The settlement model itself may contribute a net surplus in the case of two portfolios. The size of the overall surplus/shortfall will in turn affect the levels of the fees needed to be levied on market participants to recover costs (or pay back revenues).

Figure 31 shows the calculated surplus/shortfall in the pricing and settlement models analysed. Note that the results for the Nordic model are calculated only for Lithuania due to data availability (see section 6.1.2). Under the pricing model B, the total cash to be recovered would be smaller; and, under the pricing model C, there would be an overall cash surplus even before consideration of a dual settlement model.

Figure 31 – Surplus in the settlement models, M€



The figure shows that pricing models A and B (exclusion or selective exclusion of ACE) will generate a shortfall for the Baltic system, which is only partly offset by the use of a Nordic settlement model. This is true for all settlement constellations when ACE is excluded or selectively excluded. When ACE is included in the pricing of imbalance energy and not in the pricing of balancing energy, there is a substantial surplus generated in both the single and the Nordic model.

There are two key observations to make from Figure 31.

The first observation is that the shortfall is approximately halved between models A and B. Selectively excluding ACE has a major impact on the size of the shortfall by allowing substitution of ACE and, in 5% of hours, leaving ACE to set the price.

Model C generates a surplus or a slight shortfall (varying by country). The results do however depend on an assumed inconsistency between balancing pricing and imbalance pricing. Whereas the balancing price is assumed to be purely a marginal mFRR price (i.e. ACE excluded), the imbalance price in this model includes ACE. This causes a discrepancy between the calculated incomes and payments for balancing and imbalance. In turn, this causes the single model to generate a surplus.

The second observation to make is that the Nordic settlement model makes only a small contribution toward the total system shortfall. In model A the surplus recovered from the Nordic settlement model for Lithuania is approximately 0.25 M€ in the context of a shortfall of 3.9 M€. In model B the surplus generated is doubled to ca. 0.5 M€ – but this still only makes up 20% of the total cash shortfall in the single model. And in model C the Nordic model actually worsens the situation considerably; it delivers an increased surplus that must be returned to the market participants.

From these observations it is clear that the difference between the single-single and Nordic settlement models may not be as pronounced for the Baltic system as one might have thought. Instead the decision on pricing model will make a major difference in terms of the surplus/shortfall. The gains from the Nordic model are minor, and may also be offset by other factors, e.g. costs of implementation of dual portfolio settlement in Estonia and Latvia which currently operate under a single portfolio model.

6.4.3 *Choice of fee model*

All combinations of pricing and settlement models will to some extent deliver a cash shortfall or surplus which must be recovered from or returned to market participants.

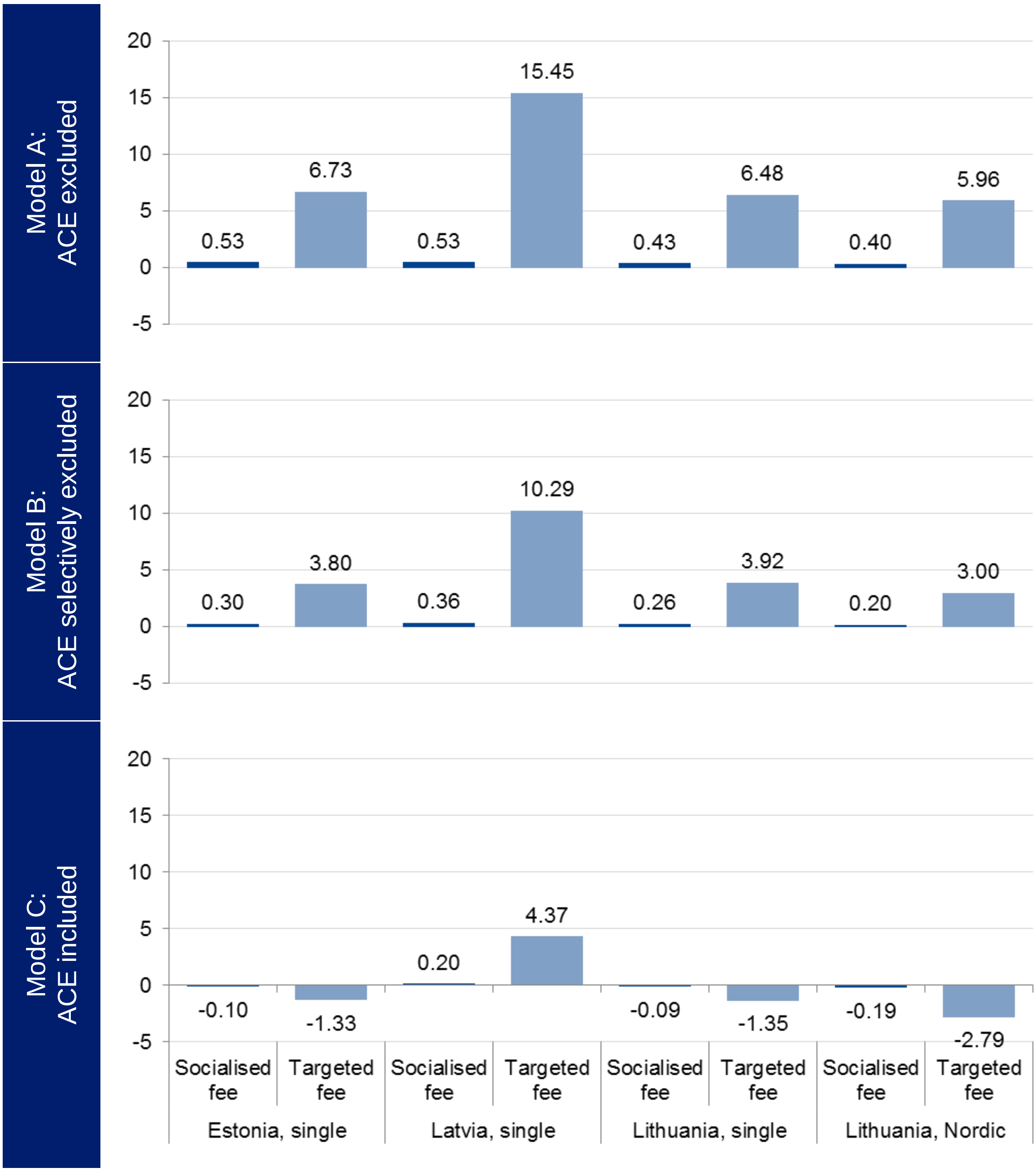
The fee models considered in this analysis are

- socialised fees, where the surplus or shortfall is divided by the total country demand and levied on suppliers; and
- targeted fees, where the surplus or shortfall is divided by the net imbalance volume and levied on imbalance fees.

We have chosen to model the fees as being recovered directly in each hour. It would be possible to smooth the settlement, perhaps by fixing the level of socialised fee at the end of each month and/or by fixing a tariff in advance with an annual reconciliation. These details are not covered in the socio-economic analysis.

Analysis of 2015 data for the Baltic countries results in the fee levels shown in Figure 32.

Figure 32 – Socialised and targeted fee levels (unconstrained), volume-weighted, €/MWh



Socialised fee levels are naturally very much lower than targeted fee levels. In all models they are within +/- 0.5 €/MWh (annual average) when the surplus/shortfall is divided between the entire demand. The fee differs little between pricing models and also little between settlement models. Thus, when considering the socialised fee the choices of other pricing or settlement models are not significant – the fee will be very low in any case.

Targeted fee levels may be very high. In model A the fee may exceed 15 €/MWh on average over the year. This fee is modelled as unconstrained; there has been no capping or flooring of the fee to a certain level (except that the final price must not exceed the bounds set by the ACE prices). However, it is likely that there will be some sort of cap (if shortfall, floor if surplus) on fee levels to limit the imbalance price from reaching unreasonably high or low levels. In the modelling, the application of the ACE price limit means that the actual targeted fee will cover most of a shortfall but not all of it.

Targeted fees in model B are somewhat lower, ca. 4 €/MWh in Estonia and Lithuania and higher in Latvia. In model C fees are modelled as negative in the cases where the models generate a surplus and money shall be returned to market participants (although in practice it may be better to avoid negative imbalance fees).

The effect of the pricing models on fee levels is to reduce the fee the more ACE is included in the marginal price. That is, when ACE is fully excluded the fees are the highest, while when ACE is included the fees are lower or negative. This is natural, as the marginal imbalance price will recover more of the cost when ACE can set the price.

The effect of the settlement model (Nordic or single) on the fee level is small. The socialised fee is reduced slightly in the Nordic model (only calculated for Lithuania) in models A and B, and slightly higher in model C, as there is a bigger surplus to return. In practice when considering the fee model, it may be better to return this as a socialised fee than a targeted negative levy on imbalance.

Resulting imbalance prices with targeted fees are shown in Figure 33 and Figure 34 using Estonia as an example.

Figure 33 – Time-weighted average monthly imbalance prices for hours when the system is short and long, without fees and Estonia with fees, €/MWh

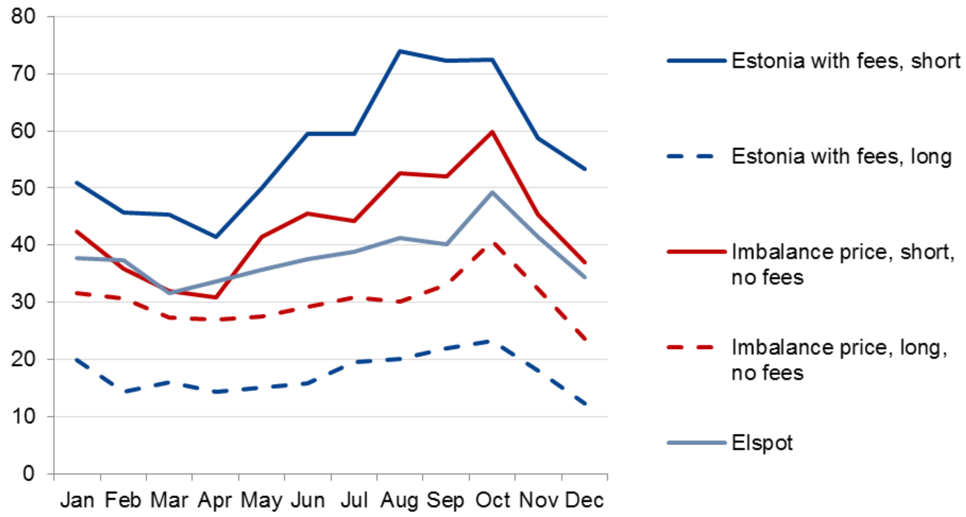


Figure 34 – Volume-weighted average monthly imbalance prices for parties who are short and long, without fees and Estonia with fees, €/MWh

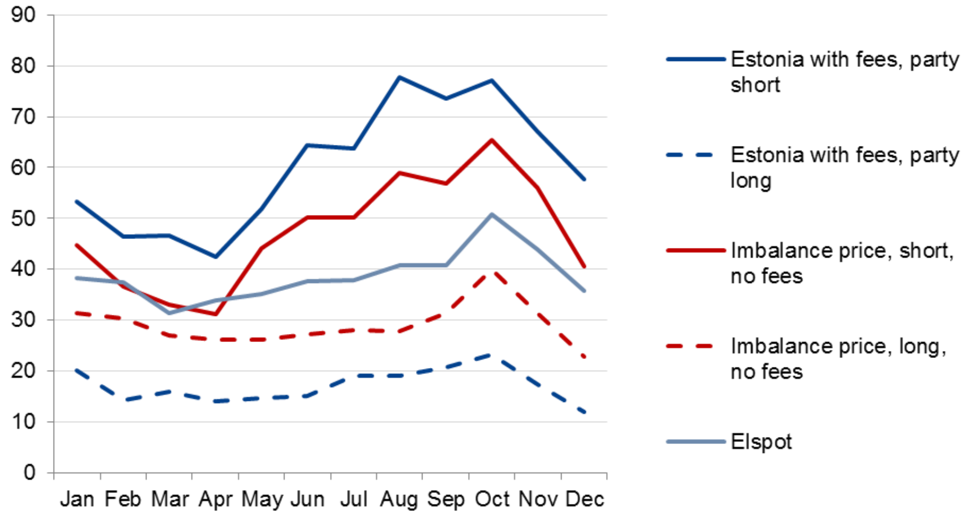


Figure 35 summarises the average imbalance prices for when the system is long and short. The table also includes actual 2015 data for the Baltic countries. A comparison between the modelled prices and the actual reveals that modelled prices in model A with a targeted fee and in model C with a socialised fee are broadly in line with the actual prices. Price levels for hours when the system is long and short are closest in model A with a socialised fee.

Figure 35 – Average imbalance prices, hours when system is long and short. Modelled and actual 2015, €/MWh

	Regulatory scenario		Imbalance price €/MWh Long	Short	Difference
Estonia	Model A	Socialised fee	30.4	42.6	12.2
		Targeted fee	17.7	56.1	38.4
	Model B	Socialised fee	25.4	44.3	18.9
	Model C	Socialised fee	19.0	53.4	34.4
		Actual 2015	19.5	52.9	33.4
Latvia	Model A	Socialised fee	32.6	36.1	3.5
		Targeted fee	15.7	51.2	35.6
	Model B	Socialised fee	26.6	37.3	10.7
	Model C	Socialised fee	20.2	41.9	21.7
		Actual 2015	17.3	53.3	36.0
Lithuania	Model A	Socialised fee	30.6	38.7	8.1
		Targeted fee	13.3	52.5	39.2
	Model B	Socialised fee	24.0	40.6	16.6
	Model C	Socialised fee	15.1	48.4	33.3
	Lithuania	Actual 2015	16.2	55.6	39.4

Note: Estonia and Latvia operate with a spread on sell and buy prices. Long and short prices are an average of the sell and buy prices for each system direction.

The table illustrates a similarity between the 2015 imbalance regime outcome, Model A (ACE excluded) with targeted fees and Model C (ACE included) with socialised fees. In each case, the imbalance prices in each hour broadly recover the total balancing cost including ACE costs.

With a socialised fee, model C (ACE included) gives extremely sharp imbalance price incentives (determined largely by ACE prices); Model A (ACE excluded) gives softer balancing incentives and model B represents a middle ground.

6.4.4 *Outcomes for BRPs*

To determine distribution of welfare between market participants it is necessary to analyse data for individual BRPs. To compare the single-single and the Nordic model it is then necessary to use data for production and consumption portfolios separately. As previously noted this analysis is conducted for Lithuania only, as the only country that currently accounts for these portfolios separately.

The data has been analysed for a total of 18 BRPs. To develop patterns between BRPs (as well as to preserve anonymity of individual BRPs) they have been grouped into several types. These are shown in the table in Figure 36. The groups are not mutually exclusive, and any BRP may be part of several groups. These are the groupings that have yielded the clearest results.

Figure 36 – Grouping of BRPs

	Generation as percentage of total volume (gen+demand)	Imbalance volume as percentage of total volume (gen+demand)	Market share
Consumer	0%		
Generator	90-100%		
RES generator	90-100%	High	Low
Small player, not well-balanced		High	Low
Major player			More than 10%

The data for the BRP groupings has been analysed both in absolute and relative terms. In absolute terms, differences are observed to be in the order of magnitude of several 100 k€ for the bigger market participants.

However, it may be more interesting to investigate a relative measure. Such a measure has been developed by creating an average result over the different models, and looking at how the models change relative to this average. The results of this relative measure are reported per pricing model in the tables in Figure 37. Note that that this is before any passing on of costs. A (predicted) socialised fee levied per MWh on suppliers would be passed directly to customers. Similarly, a volume-based socialised fee on generators would be passed on to suppliers in the wholesale price (and then to customers). Any costs arising from inflated imbalance risks in the case of targeted fees are also passed on but in a less straightforward way.

Figure 37 – Effect on BRP income/cost* between settlement/fee models

Model A: ACE excluded	Single-single model, socialised fee	Nordic model, socialised fee	Single-single model, targeted fee
Supplier	↓↓	↓	↑
Generator	↑	↑	↓
RES generator	↑↑	↑	↓
Small player, not well-balanced	↑	↑	↓
Major player (any type)	↓	↓	↑
Model B: ACE selectively excluded	Single-single model, socialised fee	Nordic model, socialised fee	Single-single model, targeted fee
Supplier	↓↓	↓	↑
Generator	↑	↑	↓
RES generator	↑↑	-	↓↓
Small player, not well-balanced	↑	-	↓
Major player (any type)	↓	-	↑
Model C: ACE included	Single-single model, socialised fee	Nordic model, socialised fee	Single-single model, targeted fee
Supplier	↓↓	-	↑
Generator	↑	↓	↑
RES generator	↑	↓	↑
Small player, not well-balanced	-	-	-
Major player (any type)	↓	↑	↓

* Green arrow (up) signifies that the model is better than average of the three models for the BRP group from an income/cost perspective, while the red arrow (down) signifies that the model is worse than average. However, this is only a first-order indicator because uniform unit costs, which are predictable, would be pass-through costs for the BRPs.

In general, consumption-only BRPs (generally suppliers) appear better off in a targeted model. This follows from the socialised fee being levied only on consumption. It is then better to pay the targeted fee on the smaller imbalances incurred than to pay a socialised fee on all consumption volumes. However, in practice any targeted fees would be passed on to customers.

Generators generally appear better off in a socialised model for the same reason. There will be no socialised fee to pay, as they only have production volumes. However, in model C generators are generally worse off in a Nordic model with a socialised fee. This comes from the implementation of the targeted fee in the analysis, where a surplus is returned as a targeted fee in the same way that a shortfall is recovered by a targeted fee. As previously noted, a surplus may also be returned as a socialised fee even in a targeted fee model.

There is a class of generators that can be identified as RES generators: active in production only, small players, with a relatively large imbalance. RES generators are better off in the single model with socialised fee under every pricing model, as there is no socialised fee levied on their production, and there is no additional targeted fee to pay on their imbalances. The picture changes slightly in model C, where the targeted fee model delivers a net payback to the market participants (through a negative targeted fee, although in practice this may not be how such a model is implemented).

In model A the impact on RES generators of moving from a single-single model to a Nordic model is negative, from a very positive outcome to a less positive one. For a supplier the same change is positive, from a very negative outcome to a less negative one. In this sense the Nordic model in model A becomes a compromise solution, where those who do very well in the single-single still do well while those who do not do well are at least better off. This picture is not as clear in models B and C, where results are more mixed.

In addition to type, size also matters. Smaller players that are not well-balanced, independent of type (supplier/generator), may be heavily penalised in a targeted fee model. This is most clearly the case in model A and to some extent in model B. In model C (as we modelled it) there is no clear picture for these BRPs.

For the major players in the market, again independent of type, the targeted fee model is the most advantageous when ACE is excluded; when ACE is included the Nordic model appears to be better.

In summary, suppliers are generally better off in a targeted fee model while generators (RES included) are better off in a socialised fee model. However, this effect would be mitigated because volume-based fees would be passed on to the next market in higher prices. Smaller players, which may incur imbalances that are large relative to their total volume, may generally be worse off in a targeted fee model, while major players are better off.

6.5 Conclusions and recommendations

This analysis has investigated the impacts on TSOs and BRPs resulting from the choice of pricing model, settlement model, and fee model.

Key metrics from the analysis are summarised in Figure 38.

Figure 38 – Key metrics of the analysis for the Baltics in total (unfavourable outcomes highlighted in orange)

	ACE excluded	ACE 'selectively' excluded	ACE included
ACE sets the price	0% of the time 0% of MWh gross imbalance	5% of the time 5% of MWh gross imbalance	90% of the time 89% of MWh gross imbalance
Reference price sets the price	58% of the time 53% of MWh gross imbalance	1% of the time 1% of MWh gross imbalance	<1% of the time <1% of MWh gross imbalance
Marginal price without fees – av[22]	34.3 €/MWh	31.4 €/MWh	30.0 €/MWh
Marginal price without fees - long	30.8 €/MWh	26.0 €/MWh	20.6 €/MWh
Marginal price without fees - short	39.2 €/MWh	38.6 €/MWh	43.1 €/MWh
Socialised fee level (average over single and Nordic model)	0.47 €/MWh	0.28 €/MWh	-0.05 €/MWh
Average Baltic targeted fee level under single-single model	9.6 €/MWh	6.0 €/MWh	-0.56 €/MWh
Impact on BRPs	▪ Suppliers appear to be better off with a single-single model with a targeted fee ▪ Generators appear to be better off with a single-single model with a socialised fee, and RES generators especially ▪ Small players may be heavily penalised in a targeted fee model		

The analysis of the three different pricing models – ACE excluded, ACE 'selectively' excluded, and ACE included – yielded a number of important insights:

- With ACE excluded from the marginal price determination means that ACE will not set the price, but also that a reference price will heavily influence the marginal price due

22 Volume weighted average basis

to lack of other activations – such a reference price will have a strong impact on the price level in the Baltics.

- With ACE included ACE will set the price 90% of the time. This may not be an acceptable outcome for the Baltics.
- With ACE 'selectively' excluded there is little influence from either ACE or a reference price. The marginal price will mainly be determined by local activations and substitute offers.

Pöyry's view on the pricing model is that the selective exclusion of ACE (model B) merits further consideration; potentially also for setting balancing prices.

The settlement model analysis revealed that the difference between the two settlement models considered – the single-single model and the Nordic model – may not be very big. In fact, the Nordic model creates less of a shortfall in models A and B, but this shortfall is small compared to the total. In model C the Nordic model actually worsens the situation by increasing the surplus compared to the single-single model. Again, the impact is not massive compared to the total.

It should be noted that although the models do not differ vastly in terms of cost recovery, they do differ in their effect on BRPs.

The fee model analysis showed that targeted fees may be very high in the Baltics. It is however likely that the fee levels would be capped and floored at a certain point[23]. Capping/flooring will result in lower average fees than what is showed in Figure 32.

A socialised fee gives cost coverage and does not introduce any unwanted consequences that may arise from high targeted fees. Although the fee itself does not incentivise the market participants to be in balance, the imbalance price still does give this incentive.

Finally, the analysis of BRP data revealed certain general conclusions:

- suppliers appear to be better off with a single-single model with a targeted fee;
- generators appear to be better off with a single-single model with a socialised fee, and RES generators especially; and
- small players may be heavily penalised in a targeted fee model.

The single-single model with a targeted fee appears to be unfavourable to generators when looking at the summary in Figure 37. Only in model C, where ACE is included, does the picture change. However, any costs arising from inflated imbalance risks in the case of targeted fees are passed on eventually to customers so the question of levying costs on suppliers or generators is less relevant when compared to the choice between socialised and targeted.

In model A the choice between the single-single and the Nordic model (both with socialised fees) may not be too different, although the single-single model appears to give stronger benefits to RES generators at the expense of suppliers.

[23] In the modelling, the fees were limited so that the prices were not more extreme than the ACE price

7. RECOMMENDATION FOR A COMMON BALTIC IMBALANCE SETTLEMENT MODEL

In June 2015, the Baltic electricity transmission system operators (TSOs) agreed to create a common Baltic electricity balancing market by 2018, as a step towards Baltic-Nordic balancing market integration. This Chapter presents recommendations for the set of common imbalance settlement arrangements that should be introduced initially, leading to the harmonisation of the rules regarding TSO-BRP balance settlement procedures.

All BRPs in the Baltics were invited to a consultation on the recommendations made in this report. Their responses were received after the report was finalised and will be taken into account in future deliberations on the matter. A summary of the responses is presented in Annex C.

7.1 Recommendations

As a conclusion of the qualitative and quantitative analysis provided in this report, it is recommended the Baltic countries adopt an imbalance settlement model with:

- ACE selectively excluded from the main imbalance price;
- single-single settlement model (single portfolio, single pricing);
- a socialised fee to recover any additional balancing costs (including any residual ACE costs); and
- changes to balance responsibility and cost coverage/base to support proper functioning of the balancing arrangements.

Table 22 summarises the recommendations.

With this proposed model, imbalance prices more closely reflect the true cost of balancing the system in the Baltics while protecting the market participants from large swings in imbalance price between hours in which the system is short and hours in which the system is long:

- ACE costs are selectively excluded, which allows the imbalance price to reflect ACE energy volumes, but does not lead to ACE dominating the price formation;
  - compared to fully excluding ACE, the imbalance prices in the proposed model should provide better incentives for participants to be in balance;
- the combination of socialised fee with ACE “selectively excluded” pricing model does not unfairly penalise market participants due to unreasonably high imbalance prices when the system is short and very low prices when the system is long; and
- the single-single settlement model is simple, effective, transparent and already in use in two of the three countries. The single-single settlement model better positions the Baltics to integrate new technologies, e.g. demand-side response.

The following sections expand on the reasoning of these recommendations.

Table 22 – Summary of recommendations

Building block	Recommendation
Balance responsibility	Full
Cost coverage/base	Costs for balancing are paid for by the BRPs while any cost for grid operation should be paid through the grid tariff
Main imbalance price determination	Marginal
Imbalance settlement duration	60 min
Pricing model for ACE	Selectively exclude ACE from the main imbalance price
Settlement model	Single portfolio, single pricing
Fee model – cost recovery of additional balancing costs	Socialised

7.2 Recommendations for the elements of the imbalance settlement model

7.2.1 *Balance responsibility*

All market participants, including RES generators, should have balance responsibility. At present RES operators are balance responsible in Estonia and Latvia but not Lithuania.

7.2.2 *Cost coverage/base*

Costs for balancing are paid for by the BRPs while any cost for grid operation should be paid through the grid tariff. The costs are recovered in the imbalance price complemented with a socialised fee to cover residual balancing costs, including ACE.

7.2.3 *Main imbalance price determination*

Balancing and imbalance prices should ideally be consistent to avoid loss of efficiency and making hedging more difficult due to the spread that emerges between the two prices. Hence, marginal pricing should be considered as the basis for imbalance pricing and ideally, imbalance pricing should reflect long-run costs (and any capacity reservation fees). This is not however seen critical in the first phase of harmonising the imbalance arrangements but rather as a consideration for future development.

7.2.4 *Imbalance settlement period*

The imbalance settlement period should be 60 minutes as a first step with a view to moving towards a shorter ISP in the future as per discussions under the NC EB. An ISP of 60 min is consistent with the current Nordic arrangements and the open balance agreement with the UES system operator. This should be kept under review as the Nordic arrangements adapt.

7.2.5 *Pricing model for ACE*

Treatment of ACE in imbalance pricing is a key issue for the Baltics. ACE energy is used extensively, and it is costly. The pricing model is critical as it influences the level of additional fees that are needed to recover ACE costs. The results of the socio-economic showed that fully including ACE in imbalance pricing generates a surplus while all other options generate a shortfall.

It is recommended that the Baltics change to a pricing model that selectively excludes ACE. This model has the following benefits:

- local activations will set the price in most instances instead of ACE or the reference price, and ACE energy will set the price when it is genuinely the marginal cost option;
- there is a lower spread between short and long prices compared to when ACE is included; and
- the shortfall to be recovered is reduced significantly compared to when ACE is excluded.

The main disadvantage of this model is that including ACE in the imbalance price causes a difference between the balancing and imbalance price. However, the downsides of the other models are more severe. Fully including ACE in the pricing model means that ACE sets the price in nearly 90% of hours in our historic analysis (the price levels are either very low or very high) and excluding ACE means that the reference price is used for nearly 60% of hours.

7.2.6 *Settlement model*

According to the results of the socio-economic analysis (with no modelling of behavioural change of market participants) the choice of the settlement model is second-order compared to the pricing model but it is still an important choice.

It is recommended that the Baltics adopt the single-single model with single portfolio and single pricing for imbalances. The reasoning for this is as follows:

- it enables participation of resources outside standard balancing products, which are expected to become more prevalent as demand-side develops;
- it gives incentive to focus on the system imbalance (if adequate data is available to BRPs);
- it is simple, resulting in lower long-term costs and lower administrative costs; and
- it is easier for the Baltic countries to switch to the single-single model as two of them already have it and it is easier to switch from a dual portfolio model to single portfolio than the other way around.

For single pricing to be effective, participants must be given access to accurate real-time information regarding the direction of the system imbalance and access to (at least indicative) prices. Hence, the Estonian imbalance price publication cycle of D + 2 should be adopted in Latvia and Lithuania as a first step. Later on, aiming to move towards H + 1, similar to the Nordics, is recommended as the goal to provide more timely price signals to market participants. It may be necessary to introduce (Grid Code) limits on self-balancing volumes, at least initially, to prevent instability.

The socio-economic analysis showed that the cash gains from the Nordic model in terms of cash surplus are minor compared to the selection of the pricing model. These may also be offset by other factors, e.g. costs of implementation of dual portfolio settlement in Estonia and Latvia which currently operate under a single portfolio model. Being compatible with current Nordic arrangements is a benefit as the Baltics seek to further integrate with the Nordics in the future. However, the potential benefits of the single-single model are more tangible and thus outweigh the benefits of the Nordic model.

7.2.7 *Fee model*

As mentioned in 7.2.5, the fee levels to recover residual balancing costs (including ACE) depend heavily on the pricing model: the more ACE is included in the imbalance price, the lower the residual fee. As the recovery pot is substantial and dominated by ACE costs, the targeting of cost recovery fees will be important in the Baltics.

A (predicted) socialised fee levied on suppliers would be passed directly to customers. Any costs arising from inflated imbalance risks in the case of targeted fees are also passed on but in a less straightforward way.

It is recommended that the Baltics choose the socialised fee approach in which any residual costs (or surplus) are charged to participants based on their physical volumes. The simplest approach would be to levy this directly on demand volumes, perhaps as an annual or monthly fee (rather than a price calculated in each settlement period as we have modelled). The socio-economic analysis showed that targeted fee levels are high in any pricing model where ACE is not fully included. The targeted model can be risky for smaller participants and RES generators pay a higher share of the imbalance with a targeted model, which is perhaps more than can be justified by marginal cost pricing. In addition, using targeted fees leads to effectively the same impact on imbalance prices than the ‘ACE included’ pricing model of which drawbacks were discussed in 7.2.5.

Hence, the reduced risk from the socialised fee spread across a large volume is more favourable even though targeting the fee on the imbalance volumes gives a higher incentive not to be in imbalance.

7.3 Impact on BRPs

Outcomes for BRPs are influenced by the choice of pricing, settlement and fee models. The analysis of BRP data in the socio-economic analysis revealed the following general conclusions:

- consumption-only BRPs (generally retailers) **appear** better off in a targeted fee model. This follows from the socialised fee being levied only on consumption within our model. It is then better to pay the targeted fee on the smaller imbalances incurred than to pay a socialised fee on all consumption volumes. However, in practice any (predicted) targeted fees would be passed on to customers and it is not the case that suppliers would end up better off under such a model.

- generators generally appear better off in a socialised model for the same reason (and for the same reason this is a slightly misleading result, as any predicted per-MWh costs would be passed on to wholesale prices). There will be no socialised fee to pay, as they only have production volumes. However, generators are generally worse off in a Nordic model with a socialised fee when ACE is fully included. This comes from the implementation of the targeted fee in the analysis, where a surplus is returned as a targeted fee in the same way that a shortfall is recovered by a targeted fee. As previously noted, a surplus may also be returned as a socialised fee even in a targeted fee model.

- RES generators are better off in the single model with socialised fee under every pricing model, in part as there is no socialised fee levied on their production, and there is no additional targeted fee to pay on their imbalances. The picture changes slightly when ACE is included, where the targeted fee model delivers a net payback to the market participants (through a negative targeted fee, although in practice this may not be how such a model is implemented).

- moving from a single-single to Nordic model impacts RES generators negatively, but from a very positive outcome to a less positive one. For a supplier the same change is positive, from a very negative outcome to a less negative one. In this sense the Nordic model becomes a compromise solution when ACE is excluded, where those who do very well in the single-single still do well while those who do not do well are at least better off. This picture is not as clear the other pricing models, where results are more mixed.

- in addition to type, size also matters. Smaller players that are not well-balanced, independent of type (supplier/generator), may be heavily penalised in a targeted fee model.

7.4 Harmonisation of imbalance settlement

The existing Baltic imbalance settlement processes are to a large extent similar; with some differences in deadlines and specific rules and conditions. The text below outlines recommendations which require notable changes in one or more countries. A full list of proposals can be found in Chapter 5.

The Baltic TSOs have agreed upon a harmonised DL of 10^{th} day of next month for the balance report. After this deadline, corrections should be settled bilaterally between the DSO and supplier. This is intended to provide an incentive for the DSOs to ensure the quality of metering data in the first delivery. This will mark a change to the current procedure in Estonia and Latvia, which have a correction period after the initial balance report deadline.

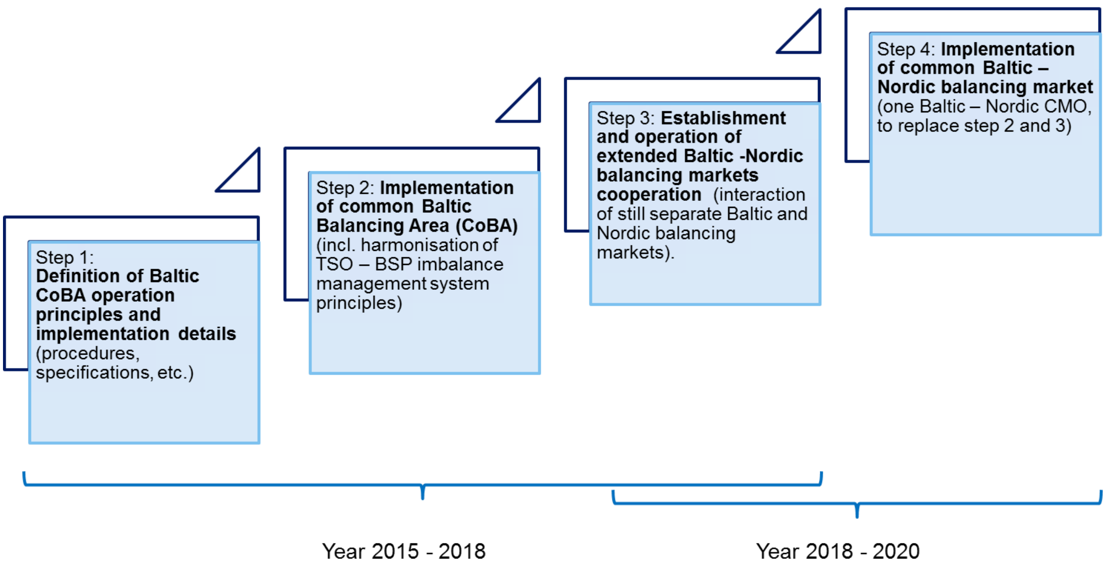
It is also recommended that the Baltics move to ENTSO-E XML as the data exchange format with support for Excel as a transitional measure. This will require an initial investment in IT systems by the TSOs and BRPs in Latvia and Lithuania. This is however seen necessary to ensure that balance settlement information (plans, trades, deliveries) is based on the same format so that it can be sent between parties in different Baltic countries, and later between Baltic and Nordic market parties.

Regarding guarantees, the adoption of dynamic guarantees, similar to what will be used in the Nordic Balance Settlement, is recommended. As the guarantee is updated regularly and it includes a forward-looking component, the requirement for a minimal guarantee can be removed. A dynamic guarantee with no minimum requirement will reduce the amount of tied working capital for BRPs while reflecting a realistic risk exposure level to the TSO.

7.5 Approach for harmonisation within the Baltics and with the Nordics

The current timeline for the Baltic harmonisation project envisions that the development of a common Baltic CoBA, including common mFRR market and harmonised imbalance settlement will complete and enter into operation by January 2018. The development of common Nordic-Baltic mFRR market with a common merit order list is expected to be in operation by end of 2020.

Figure 39 – Stepwise approach to Baltic-Nordic CoBA



Source: Baltic TSOs

Figure 40 summarises the proposed approach for Baltic TSO-BRP harmonisation, which was the focus of this report and is related to step 2 in Figure 39.

Phase 1 consists of harmonisation of the main elements of the imbalance settlement model presented in 7.2.

Phase 2 focuses on more specific terms and conditions of the imbalance settlement process. Some of these are described in 7.4 and also in 5.5. The target of further integration of the imbalance settlement is to support market participants to expand into neighbouring countries and lay the foundation for the possibility that supplier sells to the whole Baltic market from one legal entity. This can also include a consideration of establishing a common Baltic imbalance settlement similar to eSett in the Nordics.

Phase 3 then contains further development of the balancing and imbalance arrangements under changing market and regulatory requirements.

Co-operation between Baltic and Nordic TSOs is increasing due to the target to have a common Baltic-Nordic balancing area; and imbalance arrangements are one of the issues under consideration. This is related to steps 3 and 4 in Figure 39. At the same time, the Nordic balancing model is being developed and the TSOs are looking at issues such as full cost balancing and the introduction of 15-min imbalance settlement period. Therefore, a joint working group between the Baltic and Nordic TSOs is recommended to coordinate the future development of the balancing markets in the Baltic Sea region. It is also recommended to assess the feasibility of adopting a centralised body to take over the operational responsibility of the imbalance settlement for the region.

Figure 40 – Approach for Baltic TSO-BRP harmonisation

Phase 1

- Common purpose for imbalance settlement
- Common cost base for imbalance settlement
- Common pricing model for imbalance settlement
- Common portfolio model for imbalance settlement
- Common balance plan and calculation of imbalances

Phase 2

- Common rules for imbalance pricing in shortage situations
- Metering requirements and profiling
- Timing for balance calculation, settlement, what to do about errors
- Metering requirements, load profile systems and demands on data systems
- Management of measurement corrections from network operators
- Invoicing and terms of payment
- Collateral and guarantees
- Organisational requirements on balance responsible parties

Phase 3

- Full cost balancing
- Imbalance settlement period to less than 60 mins
- Harmonise imbalance and balance pricing

ANNEX A – DEFINITIONS

Activation Optimisation Function (AOF): The function that operates the algorithm applied for the optimisation of the activation of Balancing Energy bids within a Coordinated Balancing Area.

Area Control Error (ACE): The difference between measured physical flow and final external schedules of Baltic CoBA, where

- measured physical flow shall be based on total hourly measurements of the Baltic CoBA synchronous interconnections; and
- final external schedules shall be the cross-border trade on synchronous interconnections in day-ahead and intraday markets, balancing (regulating) purchases and trade from the emergency reserves activation between the Baltic CoBA and the power systems of Russia and Belarus.

Balancing Energy: Energy used by a TSO to perform balancing actions, i.e. up or down regulations for system balancing purposes

Balance Responsible Party (BRP): A market party that is responsible for the equilibrium of its Imbalance Portfolio under an agreement with connecting TSO.

Balancing Service Provider (BSP): A market party providing balancing services to its connecting TSO.

Baltic Coordinated Balance Area (CoBA): Cooperation of balance areas of Estonia, Latvia and Lithuania based on netted aggregation of all cross-border power flows between the three balance areas.

BRELL Agreement: The agreement on parallel operation of the power systems between Belarus, Russia, Estonia, Latvia and Lithuania. It stipulates certain conditions for the power systems, e.g. amount of reserve capacity to be made available for all BRELL participants.

Common Merit Order List (CMOL): A list of Balancing Energy Bids sorted in Order of their bid prices, used for the Activation of Balancing Energy bids within a Coordinated Balancing Area.

Connecting TSO: The TSO that operates the Responsibility Area in which Balancing Service Providers and Balance Responsible Parties shall be compliant with the terms and conditions related to Balancing.

Double Imbalance Portfolio: grid injection and offtake schedules are summed into two separate balance responsibility accounts.

Dual Pricing Model: Two imbalance prices for system shortage situations and two imbalance prices for system surplus situations. The price charged depends on whether the BRP is supporting the system balance or aggravating the system balance.

Imbalance: An energy volume calculated by TSO for a BRP, representing the difference between actual measured volume, final fixed trade and imbalance adjustment volumes within a given settlement period.

Imbalance Adjustment: An energy volume representing the Balancing Energy from a BSP and applied by the Connecting TSO for an Imbalance Settlement Period to the concerned BRP, for the calculation of the Imbalance of the BRP portfolio.

Imbalance Area: The Imbalance Price Area for the calculation of an Imbalance.

Imbalance Portfolio: Accounting mechanism to calculate Imbalances for Balance Responsible Parties. The number of Imbalance Portfolios defines the number of Imbalance volumes calculated, attributed and charged to Balance Responsible Parties.

Imbalance Settlement: a financial settlement mechanism aiming at charging or paying BRPs for their imbalances.

Imbalance Settlement Period (ISP): time unit used for computing BRPs' imbalances.

Main imbalance price: Imbalance price for imbalances aggravating the system balance.

Netted imbalance of ACE: Imbalance that is resolved by the purchase or sale of imbalance energy between the TSOs.

Not netted imbalance of ACE: Imbalance that is not resolved by the purchase or sale of imbalance energy between the TSOs, but settled by the trade of imbalance energy with the Open Balance Provider. The not netted imbalance for every settlement period is the ACE of the Baltic CoBA.

Open Balance: The purchase and/or sale of imbalance energy of the Baltic CoBA to stay within the ACE limits.

Open Balance Provider (OBP): The commercial Party that provides the Open Balance with the BRELL system, which currently is Inter RAO Lietuva.

Reverse imbalance price: Imbalance price for imbalances supporting the system balance.

Single Imbalance Portfolio: grid injection and offtake schedules are netted into a single balance responsibility account.

Single Pricing Model: A single imbalance price for system shortage and a single imbalance price for system surplus

ANNEX B – BRP CONSULTATION DOCUMENT

B.1 Introduction

In June 2015, the Baltic electricity transmission system operators (TSOs) agreed to create a common Baltic electricity balancing market by 2018, as a step towards Baltic-Nordic balancing market integration. This short note outlines the alternative imbalance settlement models for TSO-BRP (Balance Responsible Party) settlement, presents analysis on the implications of the alternatives, and sets out questions to market participants seeking their views. The scope of this note covers imbalance arrangements not (directly) balancing arrangements, although the two issues are closely linked.

Why are Baltic imbalance settlement arrangements being harmonised?

Harmonisation of imbalance settlement should drive two positive outcomes for the market:

- (in conjunction with harmonising the balancing arrangements) supporting lower balancing costs due to the more efficient use of resources across the entire Baltic market area; and
- Facilitate the functioning of the Baltic market by making it more attractive to new entrants and laying the foundation for the possibility that a supplier sells to the whole Baltic market from one legal entity.

Co-operation between Baltic and Nordic TSOs is increasing due to the target to have a common Baltic-Nordic balancing area; and imbalance arrangements are one of the issues under consideration.

The European Network Code on Electricity Balancing (EB NC[24]) states that the imbalance settlement model should support the achievement of a number of objectives (NCEB, Article 10 stipulates certain requirements from imbalance settlement design). As fully integrated members of the European market, the Baltics will also need to implement measures to comply with the EU network codes. The main points relevant to this context are:

- fostering effective competition, non-discrimination and transparency in balancing markets;
- ensuring that the procurement of Balancing Services is fair, objective, transparent and market-based;
- avoid undue barriers to entry for new entrants; and
- facilitate the integration of renewable resources and the participation of demand-side response.

Harmonisation of imbalance settlement is planned to proceed on a stepwise basis (Figure 8). The current timeline for the Baltic harmonisation project envisions that the development of a common Baltic CoBA, including common mFRR market and harmonised imbalance settlement will complete and enter into operation by January 2018.

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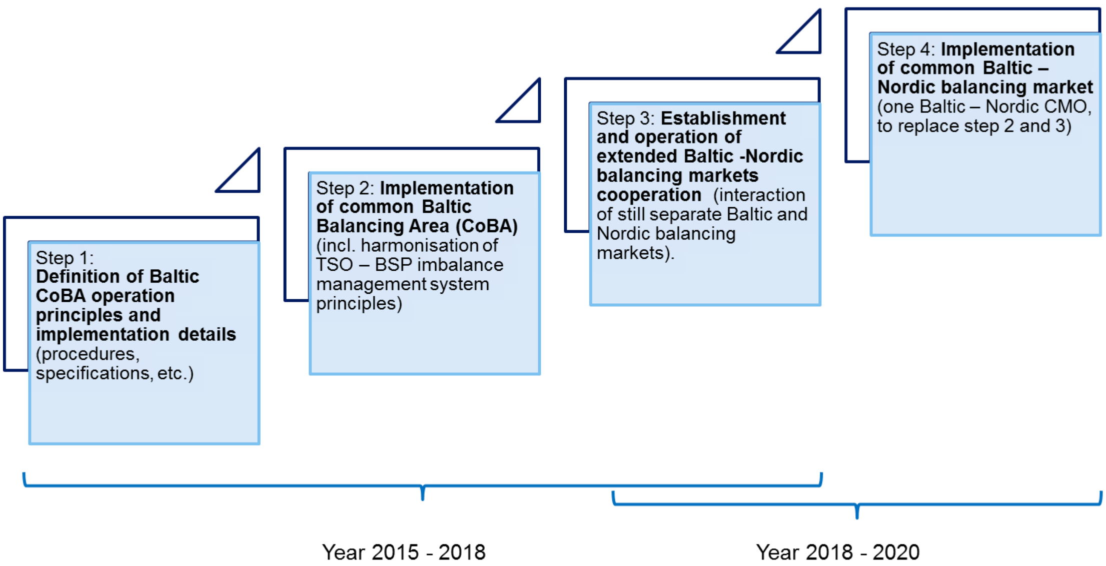
24 The information in this section refers to version 3.0 of the Network Code on Electricity Balancing, as well as its Supporting Document, which were resubmitted to ACER 6 August 2014. https://www.entsoe.eu/major-projects/network-code-development/electricity-balancing/Pages/default.aspx

The development of common Nordic-Baltic mFRR market with a common merit order list is expected to be in operation by end of 2020.

Figure 41 – Stepwise approach to Baltic-Nordic CoBA

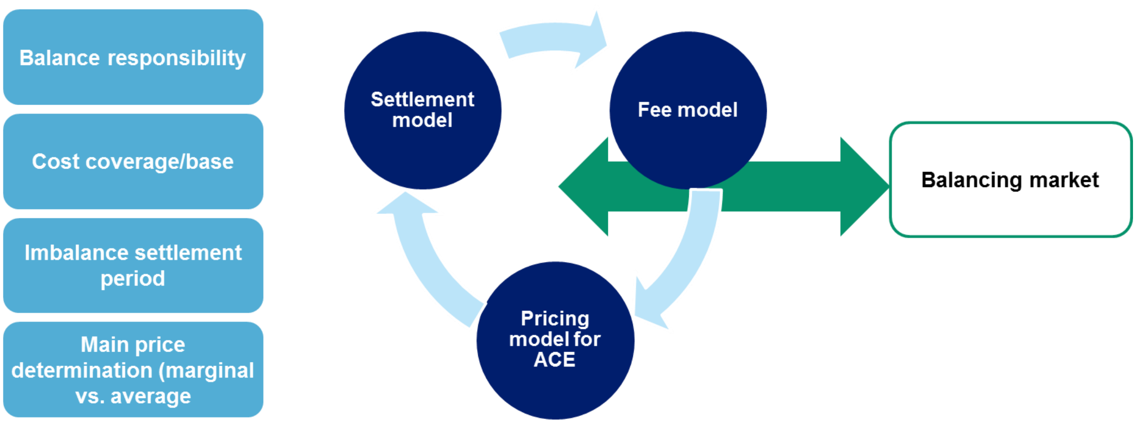


Source: Baltic TSOs

B.2 Building blocks for imbalance settlement

Although it is convenient to describe the imbalance arrangements through a set of separate building blocks, there are strong dependencies between those. Choices under one building block have an impact on another, and a more holistic approach should be taken when considering the imbalance settlement framework as a whole. In particular, there is a strong link between the number of prices, price determination and additional cost recovery. These choices should also be informed by the applicable balancing market arrangements e.g. imbalance settlement period. This is shown in Figure 9.

Figure 42 – Relationship between different building blocks



The following sections define the major design choices to be made in the creation of a harmonised set of rules for Baltic imbalance settlement arrangements:

- the proposal for balance responsibility;
- the proposal for cost coverage/base;
- the proposal for imbalance settlement period;
- the proposal for the main imbalance price determination;
- the alternatives for the pricing model;
- the alternatives for the settlement model; and
- the alternatives for the fee model.

B.3 Balance responsibility

Balance responsibility is a central concept of the EB NC. Responsibility for resolving forecast errors (when it comes to intermittent generation or demand) and/or risks of generation failure are to be borne by market participants (BRPs) and exemptions should be limited to the greatest extent possible. Therefore, all market participants, including RES generators, should have balance responsibility. At present RES operators are balance responsible in Estonia and Latvia but not Lithuania.

B.4 Cost coverage/base

A common cost base (fee structure) for balance settlement needs to be established to reflect a common concept towards imbalance. The principle of cost reflectiveness is also relevant here – costs for balancing are paid for by the BRPs while any cost for grid operation should be paid through the grid tariff. The elements to be included in the harmonised cost base reflect these costs and are as follows:

- mFRR for balancing purposes (100%);
- imbalance energy traded with BRPs for balancing purposes (100%);
- area control error costs (i.e. total power system(s) imbalance) for balancing purposes (ACE, 100%); and
- settlement and administrative costs related to balance management.

At present, the Estonia and Latvia have a similar cost base for imbalance pricing. The arrangements in Lithuania are different with some support for grid fees through income from balance services.

B.5 Imbalance settlement period

The imbalance settlement period (ISP) should be 60 minutes as a first step with a view to moving towards a shorter ISP in the future as per discussions under the EB NC. An ISP of 60 min is consistent with the current Nordic arrangements and the open balance agreement with the UES system operator. ACER asks for an ISP of 15 mins, while the EB NC has a minimum requirement of 30 mins.

The current arrangements in the Baltic markets consist of ISP of 60mins.

B.6 Main imbalance price determination

The main imbalance price determination should be calculated on a marginal basis based on activated balancing energy, excluding actions for non-balancing (system) purposes.

There is a strong link between the pricing and remuneration for balancing energy and for imbalances.

As the EB NC indicates that pay-as-clear (i.e. marginal pricing) should be used for pricing balancing energy, then the (main) imbalance price should ideally follow the same principle and reflect the marginal cost of balancing energy provision. If balancing and imbalance prices are not similar there are negative implications. One implication is a loss of efficiency. Another is that hedging becomes more difficult due to the spread that emerges between the two prices. This can then manifest as higher risk premiums integrated into hedging contracts which drives up system costs and promotes illiquid markets. At present all Baltic markets have imbalance pricing based on an average basis rather than a marginal basis.

The above determines how to treat the mFRR price but the further issues are how to treat ACE pricing in the marginal balancing stack, and separately how to treat actions in opposite direction. The decision regarding actions in opposite directions is to net off the most costly actions (from a system perspective) and then take a marginal price from what is left. The alternative ways of including ACE energy in the calculations are considered in B.6.1.

B.6.1 Pricing model for ACE

The issue of how to treat ACE is the issue of what to include in the marginal price calculation. In Pöyry terminology, the marginal hourly imbalance price is determined from a ‘stack’ that consists of the activations made during hour (i.e. the supply). This stack is made up of the elements that the TSO includes in the imbalance price. The target volume (i.e. the demand for balance) is met by the activations in the stack, and the marginal price is set by the highest priced energy activation in an up-regulation hour, and the lowest priced energy activation in a down regulation hour.

The stack may potentially consist of local activations, imports (e.g. through Estlink, Nordbalt, etc.), ACE energy, and other system activations for balancing purposes. The target volume may include or exclude any of these elements and specifically may include or exclude ACE energy. EB NC is explicit that all energy balancing actions should be included; it does however not treat the specific issue of ACE energy, which is very different from other energy balancing actions. This analysis has assumed that there will be a choice for the Baltics of whether to include ACE energy or not in the imbalance price determination.

ACE costs are a significant part of balancing costs in the Baltic markets (e.g. some 40% of total balancing costs in Latvia in 2014) and hence the treatment of ACE cost is an important consideration. The terms of the EB NC does not define the treatment of balancing energy costs from non EU markets.

There are three options to consider:-

- ACE can be excluded from the main imbalance price;
- ACE can be included in the main imbalance price; and
- ACE can be selectively excluded in the main imbalance price.

When ACE is fully excluded from the main imbalance price, it means that the ACE price and the ACE volume are not considered in the calculation of the marginal imbalance price. Instead the ACE cost will need to be fully recovered through a separate fee.

When ACE is fully included in the main imbalance price, the ACE price and volume is included in the calculation and can set the imbalance price when it is the most expensive offer that is activated. In this way the ACE price is reflected in the main imbalance price and the fee level required to cover ACE is lower (and there may even be a cash surplus generated). In the case of no activations, the average Elspot price is used.

When ACE is selectively excluded, the ACE volume is included, and the ACE price is included in the calculation of the main imbalance price unless there are unused offers/bids which are cheaper to the system with enough volume to replace the ACE energy. In this case, a replacement price, based on these offers is used. As a result of this procedure there will be an under-recovery of costs and this will need to be recovered through an additional fee. This is essentially a compromise approach designed to limit the worst features of the other two models.

Pöyry has carried out analysis of the impact that different pricing models could have. The results are presented in B.10.

B.7 Elements of the settlement model

The settlement model comprises two elements:

- Firstly, whether market participants are assessed with a single balancing position across their entire portfolio; or whether (as in Lithuania, the Nordics, and other markets, like GB) their imbalance positions are assessed separately on their 'production' (large generation) and 'consumption' (demand, and perhaps small generation) accounts. We consider 'dual portfolio' and 'single portfolio' options.
- Secondly, whether there is a single imbalance price for imbalances in both directions, or whether there are different prices applied to participants (or accounts) out of balance in different directions. 'Aggravating' imbalances (in the same direction as the overall system imbalance would face a marginal price, but 'supporting' imbalances (in the opposite direction to the overall system imbalance) would face a less-than-marginal price (in general, worse to the participant who offers offsetting imbalance positions). We consider 'dual price' and 'single price' options.

These two elements are later combined into a 'single-single settlement model' in which there is a single account per BRP, and single imbalance pricing; and a 'dual portfolio' model which includes dual portfolios, and a 'Nordic settlement model' which has dual pricing for the production account and single pricing for the consumption account. The 'dual portfolio' model is modelled on the Nordic imbalance arrangements.

B.7.1 Dual portfolio model

Below is a description of the imbalance settlement calculations in a dual portfolio model. Imbalance volumes are calculated based on received settlement data and the calculation is performed at BRP level. The dual portfolio model considered is the Nordic model.

Summary for dual portfolio

Production balance = actual production – planned production

Consumption balance = planned production + actual trade + actual consumption

Where:

Planned production = Approved production plan before the operating hour

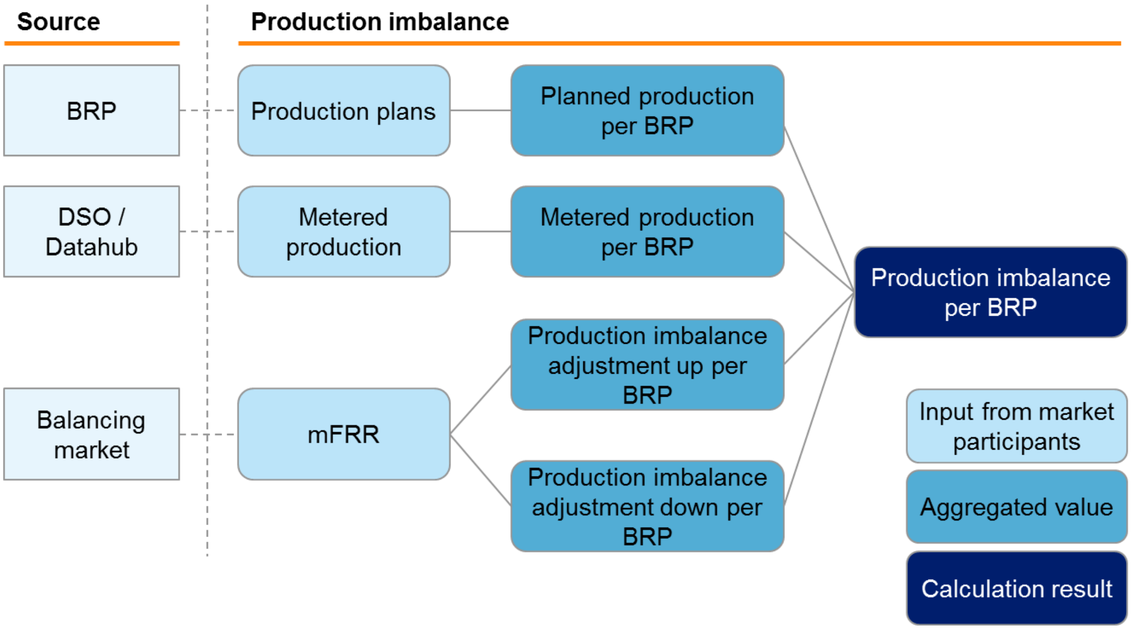
Planned consumption balance = Approved consumption plan

Production imbalance = Actual production – planned production -/+ production imbalance adjustment

Consumption imbalance = Consumption + planned production -/+ trade -/+ consumption imbalance adjustment + MGA imbalance

Production imbalance is calculated as the deviation between metered and planned production and imbalance adjustments (Figure 19). A balance deviation arises when there is a difference between the metered production and the production plan. If the BRP produces less electricity than it planned to produce, there is a deficit in the production imbalance, and the BRP purchases imbalance power in order to cover the deficit. Correspondingly, the BRP sells imbalance power if there is a surplus in the production imbalance.

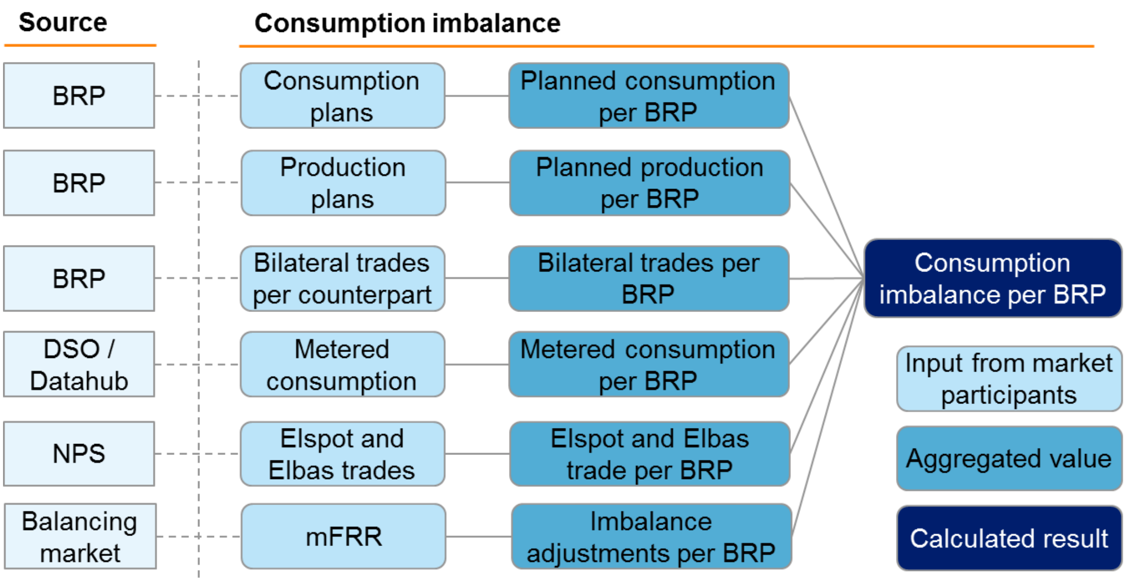
Figure 43 – Production imbalance settlement calculation



Consumption imbalance is calculated as the deviation between consumption, planned production and imbalance adjustments (Figure 20). A balance deviation arises when there is a difference between the consumption and electricity purchases (included in the consumption plans). If the BRP consumes more electricity than it purchased, the BRP is required to purchase imbalance power to cover the deficit and vice versa.

Consumption plans are not used in the consumption imbalance settlement calculation as the same information is contained in production plans and trade data (in the Nordic case). If the Baltic TSOs decide that the reporting of consumption plans by BRPs is not necessary, these can be removed from the calculation.

Figure 44 – Consumption imbalance settlement calculation



B.7.2 Single portfolio model

Below is a description of the balance settlement calculations in a single portfolio model. Imbalance volumes are calculated based on received settlement data and the calculation is performed at BRP level.

Summary

One Balance Portfolio:-

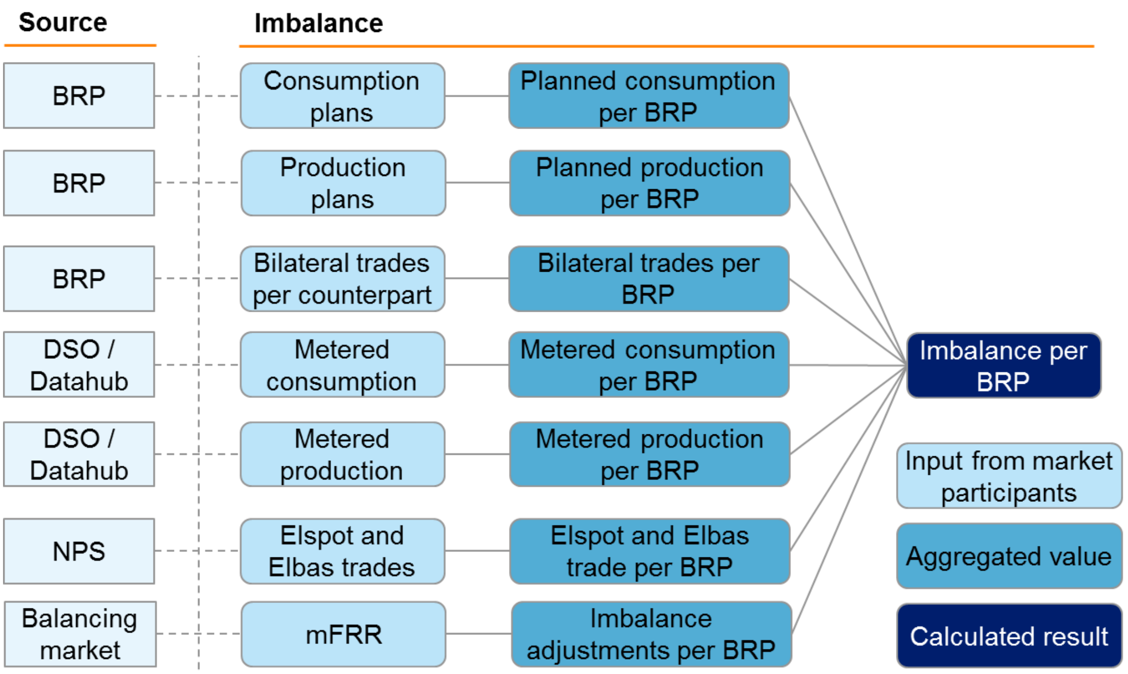
Planned balance = Production + Purchase – Consumption - Sale

Measured balance = ∑ (Pin-Pout) metered data in a BRP's portfolio

Imbalance = Measured – planned -/+ portfolio's imbalance adjustment (balancing)

Imbalance settlement calculation in a single portfolio model is illustrated in Figure 45.

Figure 45 – Imbalance settlement calculation in a single portfolio model



B.7.3 Dual price model

In a dual pricing system, different prices are used for market participants that aggravate the system imbalance and for those that support the system (with an imbalance in the opposite direction to the system imbalance). The philosophy of dual pricing is that supporting imbalances are unintentional (or even speculative) and should not receive the same price as energy activated in the balancing market. This price spread is usually created by either:

- adding a cost element to the price faced by aggravating imbalances and/or deducting a cost element from the price faced by supporting imbalances; or
- replacing the price used for supporting balances by a non-marginal reference price (for example the Day-Ahead market price) with this price typically being limited to be lower than the marginal price when the system is short and higher when the system is long.

Table 9 shows the prices used in a dual pricing system with the prices being different for different imbalances depending on the relative position when compared to the system net position.

Table 23 – Dual pricing model

		System imbalance	
		Short	**Long**
BRP imbalance	**Short**	(-) Main (marginal high) price	(-) Reverse price
	Long	(+) Reverse price	(+) Main (marginal low) price

(-) denotes cash flows from the BRP to the TSO and (+) denotes cash flows from the TSO to the BRP

B.7.4 Single price model

The single pricing model is based on a single price for both aggravating and supporting imbalances. Table 8 shows the price faced by BRPs depending on their and the system imbalance position. When the system is short, the imbalance price is typically set at the level of the marginal upward regulation offer for balancing the system. When the system is long, the imbalance price is typically set at the level of the marginal downward regulation activated offer for balancing the system. BRPs pay the imbalance price when their position is short and receive the price when their position is long. The imbalance price may differ from one period to another (and will depend on the system net imbalance position), but in any given period all imbalances face the same price, irrespective of direction (long or short).

Table 24 – Single pricing model

		System imbalance	
		Short	**Long**
BRP imbalance	**Short**	(-) Main (marginal high) price	(-) Main (marginal low) price
	Long	(+) Main (marginal high) price	(+) Main (marginal low) price

(-) denotes cash flows from the BRP to the TSO and (+) denotes cash flows from the TSO to the BRP

With single pricing, 'passive' (uninstructed) imbalances and active balancing market offers (typically) face the same price[25], assuming that the balancing price is the same as the

[25] Even with a single price model, participants which offer active balancing offers have an advantage over 'passive' uninstructed imbalance. If a participant deliberately chooses imbalance (e.g. a surplus), then if their imbalance assists (is in the opposite direction) to the overall system imbalance (in this example a system shortfall) then they will face a marginal (high) imbalance price for their energy surplus. However, if they misjudge the direction of the system imbalance and make the situation worse (e.g. if the system is long), they will face a marginal (low) price for their surplus. Conversely; a BSP instructed to deliver active downward regulation is guaranteed to receive the marginal price or their bid price, whichever is better for them; irrespective whether the system turns out to be long or short. Active balancing offers confer price certainty.

imbalance price[26]. By rewarding 'passive' imbalances on the same basis as active offers, additional available resources, which are not participating in the balancing market, effectively become available. Supporting imbalances from BRPs reduces the need for active balancing actions by the TSO, **if** participants have access to accurate real time data on the state of system balance[27].

B.8 Settlement models

B.8.1 Introduction

The combination of price and portfolio model leads to a discussion of the settlement model. A single price and single portfolio model (single-single model) is considered alongside a settlement model based on the current Nordic settlement arrangements i.e. a dual portfolio model with a single price for demand and a dual price for generation. The reasoning for excluding the other alternatives is:

- single price/dual portfolio makes no sense no as the imbalances are netted against the two portfolio; and
- dual price/dual portfolio is not consistent with the Nordic model; the long term goal (supported by the roll-out of smart meters) is to allow demand participation towards balancing, and the application of dual pricing to the dual portfolio does not support balancing actions which are not under instruction by the TSO.

Table 25 – Summary of imbalance settlement models under consideration

Building block	Single-Single model	Nordic model
Number of portfolios	Single	Dual
Number of prices	Single	Two for generation; one for consumption

B.8.2 Single-Single model

With a single portfolio model all imbalances (production, consumption, trade) are aggregated in a single imbalance account. In this model BRPs can 'net off' imbalances in production with imbalances in consumption.

The single pricing model is based on a single price for all imbalances. BRPs pay the imbalance price when their position is short and receive the same price when their position is long.

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26 It can be that there is a single imbalance price, which is not consistent with the balancing price. This might be a result of the different treatment of the ACE energy in the balancing and imbalance pricing arrangements.

27 In some cases this can been seen as a disadvantage, as system balancing becomes more decentralised and carried out by market participants that do not have access to the same information (or the same objectives) as the TSO. In other markets (e.g. Netherlands) this decentralisation has been positively welcomed, with the TSO taking a strong role in information provision and a less active role in issuing balancing instructions, while market participants perform most of the energy balancing directly

B.8.3 Nordic model

The Nordic model has a dual price for production and a single price for consumption. The dual price for generation reflects the concept that generation BRPs are capable of choosing their level of balance and should be incentivised accordingly. The single price for consumption assumes that that suppliers face challenges trying to balance themselves and hence a one price model is applied to consumption[28]. The single price model for consumption could also increase interest from the demand side to participate in the market, outside the framework of 'standard' balancing products.

The choice of two balance portfolios means that production and consumption accounts are reported and settled separately. Imbalances are aggregated for each defined portfolio, but imbalances in one portfolio cannot mitigate imbalances in another. This means that vertically integrated companies will not be able to net their imbalances and this can be argued to avoid discrimination against suppliers without production capacity. This is one of the reasons for proposing the Nordic model - a dual portfolio model would contribute to levelling the playing field for all BRPs within the Baltic and Nordic region, i.e. be beneficial in terms of competition. In addition, as the overall model is similar to the Nordic model it could promote trade.

B.8.4 Pros and cons for the stakeholders for the single model

The text below brings out the main practical arguments in favour and against the single model for imbalance pricing from the Baltic perspective.

The single-single model represents the most economically pure arrangement for imbalance settlement model.

The concept of the single-single model is to give the right incentives for market participants to balance the system, based on transparency and sharing of information.

In addition the single-single model:

- is simple and enables participation from all available resources;
- gives incentive to focus on the system imbalance (if adequate data is available to BRPs);
- enables participation of resources outside standard balancing products, which are expected to become more prevalent as smart metering and demand side management evolves;
- lowers long-term costs and has lower administrative costs than the alternatives.

Challenges with the single-single model include:

- for single pricing to be effective, participants must have access to accurate real-time information regarding the direction of the system imbalance and access to (at least indicative) prices
  - in extremis there might be instability in the system as participants all chase expected imbalances (although this may be mitigated by limits on the extent of voluntary imbalance);

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28 This assumption may be questioned with the advent of intermittent renewable generation, and the onset of smart metering and demand side management.

- the single-single model is better suited to large vertically integrated players as imbalances can be internally netted between portfolios of consumption and production; and
- in the single pricing model there is no cash surplus to cover balancing costs outside the market; any such costs have to be covered through a separate mechanism or included as an additional fee.

B.8.5 Pros and cons for the stakeholders of the Nordic model

The text below brings out the main practical arguments in favour and against the Nordic model for imbalance pricing from the Baltic perspective.

The Baltic markets are dominated by a few large vertically integrated players; the Nordic model would be good for competition and for trade with the Nordic markets.

The benefits of a dual portfolio in terms of competition and the lack of advantage it provides to large incumbents with a supply and demand portfolio is a worthy reason to consider a dual portfolio model.

In addition:

- a significant driver of the imbalance settlement arrangements is cost coverage (especially to recover the costs of ACE energy), and a dual portfolio with dual price generates a surplus;
- single pricing for demand is less penal for suppliers, given the lack of data regarding hourly demand consumption;
- the model is flexible (as it is easier to aggregate the model in the future than to disaggregate; if that is later deemed necessary);
- it provides TSO control for generation rather than incentivising self-balancing of the system (which in turn could give advantages to larger players with better data); and
- having a similar imbalance pricing model to the Nordics will promote trade opportunities.

Challenges with the Nordic model include:

- the arrangements are more complex and could be more costly to implement (especially in Latvia and Estonia which currently have a single portfolio imbalance model);
- by definition the creation of a surplus from imbalance implies a higher cost for BRPs (in the effect of dual price), but this mitigates the level of the additional fee for cost recovery; in effect the cost is targeted more sharply at those participants which are out of balance in a direction which assists the system; and
- participants may take costly action to avoid imbalances which would support the overall system imbalance and the overall costs of balancing would be higher as a result.

Pöyry has carried out a high level assessment of the impact that the different settlement models may have. The results are presented in B.10.

B.9 Fee model

According to the principle of financial neutrality, a TSO can collect income from the imbalance settlement that covers all costs incurred in performing balancing operations, but no more (the NC EB states that the imbalance price should not be less than the weighted average of the activated offers; this definition does not include ACE).

All combinations of pricing and settlement models will to some extent deliver a cash shortfall or surplus which must be returned to market participants. Consequently, a mechanism is needed to facilitate the recovery of additional costs incurred during balancing that are not recovered from the main imbalance price.

The potential additional balancing cost in this context can be split into the following components:

- administrative costs;
- other applicable balancing costs;
- residual cost recovery/distribution; and
- ACE cost.

The level of the recovery that the fee must achieve will be defined by the pricing model that is adopted and how the ACE costs will be integrated into the main imbalance price. To a lesser extent it will be defined by the settlement model.

There is a decision to be made on how the cost recovery mechanism is levied. At a high level the choice is between the following fee models:

- socialised fee model;
- targeted fee model; and
- hybrid fee model.

Socialising the fee means that all users pay a contribution, typically based on total consumption or generation; or the (weighted) sum of both. The advantage of socialising the fee is that the base is large, i.e. the fee per MWh can be small. If the imbalance fee is volume based and levied on generation then (if predictable) it will be priced into wholesale prices and suppliers will pass the costs through to consumers.

Targeting the fee on the imbalance volumes gives a smaller fee base, a higher fee, and therefore also a higher incentive not to be in imbalance. The alternatives here are to target the fee on either gross imbalance volumes or net imbalance volumes.

A hybrid model is a combination of the targeted and socialised fee structures where certain components or a certain level of the fee is socialised and the remainder (e.g. either a minimum or a maximum level) is targeted. Hybrid approaches could limit the highest targeted fees but still provide a volume incentive through the imbalance prices to avoid imbalance. The impact of such hybrid options would be that the results fall between the cases modelled.

Pöyry has carried out a high level assessment of the possible fee levels based on historical data provided by the Baltic TSOs under the socialised and targeted fee models. The results are presented in B.10.

B.10 Indicative socio-economic analysis of imbalance settlement arrangements

Pöyry have carried out analysis to investigate the impact of the different models concerning pricing, settlement and fees that were described in B.6.1, B.8 and B.9 respectively. The models investigated are represented in Figure 25.

Figure 46 – Matrix of options explored for imbalance pricing

		1a Single, socialised fee	2a Nordic, socialised fee	1b Single, targeted fee
A	ACE excluded	✓	✓	✓
B	ACE selectively excluded	✓	✓	(✓)
C	ACE included	✓	✓	(✓)

B.10.1 Objectives

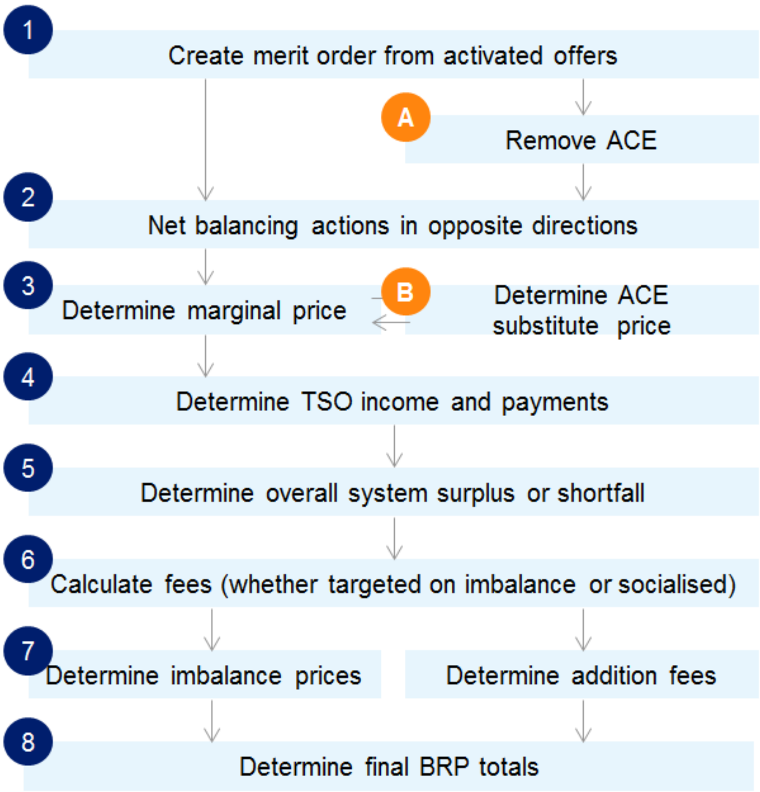
The analysis investigates the cash flows of the TSOs and BRPs under different imbalance models. The objective is to determine the high-level merits of the imbalance models. Key metrics are the cash surplus or shortfall in the different models, and the fee levels necessary in each model to return the TSO to financial neutrality. Further, the analysis investigates the distribution of welfare on a market participant level by assessing the results for market participants under the different arrangements.

B.10.2 Methodology

The analysis provides indicative distributional impact that the different arrangements could have. The purpose is to help stakeholders understand the potential implications of the different imbalance arrangements. The intent of the exercise is to look at the pricing patterns and the implications for different participants in order to demonstrate the pros and cons of the alternative arrangements, not to be a full scale modelling exercise

The high level methodology used is presented in Figure 26. The input for the analysis is actual imbalance data from 2015 for each of the three Baltic markets. This includes hourly overall system imbalance, aggregate short and long imbalances, balancing actions, netting of ACE between countries, etc. Only a single year of data was available for this analysis. System costs are therefore also assumed equal across the models analysed. Modelling of behaviour change is not in scope for this analysis. As a consequence there is no exploration of improvements of total social welfare in the system. A further assumption in the modelling of the Baltic system is that transmission capacity within balancing timeframes is not limited.

Figure 47 – Methodology for analysis of pricing, settlement and fee models



The key metrics from the analysis are summarised in Figure 38 which presents the high level results across the Baltic markets. More specific results are presented in the later sections.

The analysis of the three different pricing models – ACE excluded, ACE 'selectively' excluded, and ACE included – yields a number of important insights:

- Excluding ACE from the marginal price determination means that ACE will not set the price. However, as there are a significant number of hours when only ACE is activated, a reference price will heavily influence the marginal price due to lack of other activations. Hence a reference price will have a strong impact on the price level in the Baltics.
- With ACE fully included ACE will set the price 90% of the time. This may not be an acceptable outcome for the Baltics.
- With ACE 'selectively' excluded there is little influence from either ACE or a reference price. The marginal price will mainly be determined by local activations and substitute offers.

The decision regarding the treatment of ACE in the main imbalance price determination determines the scale of the cash surplus or shortfall that needs to be recovered through the settlement model and the fee model.

Table 26 – Key metrics of the analysis for the Baltic markets

	ACE excluded	ACE ‘selectively’ excluded	ACE included
ACE sets the price	0% of the time 0% of MWh gross imbalance	5% of the time 5% of MWh gross imbalance	90% of the time 89% of MWh gross imbalance
Reference price sets the price	58% of the time 53% of MWh gross imbalance	1% of the time 1% of MWh gross imbalance	<1% of the time <1% of MWh gross imbalance
Marginal price without fees – av[29]	34.3 €/MWh	31.4 €/MWh	30.0 €/MWh
Marginal price without fees - long	30.8 €/MWh	26.0 €/MWh	20.6 €/MWh
Marginal price without fees - short	39.2 €/MWh	38.6 €/MWh	43.1 €/MWh
Socialised fee level (average over single and Nordic model)	0.47 €/MWh	0.28 €/MWh	-0.05 €/MWh
Average Baltic targeted fee level under single-single model	9.6 €/MWh	6.0 €/MWh	-0.56 €/MWh
Impact on BRPs	▪ Suppliers appear to be better off with a single-single model with a targeted fee ▪ Generators appear to be better off with a single-single model with a socialised fee, and RES generators especially ▪ Small players may be heavily penalised in a targeted fee model		

The settlement model analysis reveals that the difference between the two settlement models considered – the single-single model and the Nordic model – is significant in its own right but is second order in comparison to the decision regarding the pricing model. Table 27 shows the impact of the settlement model under the different pricing model alternatives for Lithuania (due to data availability). The Nordic model creates a surplus and hence less of a shortfall in models A and B, but this shortfall is small compared to the total. This is partly due to the fact that the Nordic model only has a dual price for

29 Volume weighted average basis

production. In Model C (ACE included) the Nordic settlement model increases the surplus compared to the single-single model.

Table 27 – Indicative shortfall/surplus under the different settlement models for Lithuania, MEUR

	Single-Single, socialised fee	Nordic, socialised fee
ACE excluded	3.89	3.65
ACE selectively excluded	2.45	1.92
ACE included	-0.78	-1.78

All combinations of pricing and settlement models will to some extent deliver a cash shortfall or surplus which must be returned to market participants. This will be done via the fee model.

The fee model analysis shows that the choice of fee structure will have a significant impact on imbalance settlement outcomes.

Socialised fee levels are naturally very much lower than targeted fee levels. In all models they are within +/- 0.5 €/MWh (annual average) when the surplus/shortfall is divided between the entire demand. The fee differs little between pricing models and also little between settlement models. Thus, when considering the socialised fee the choices of other pricing or settlement models are not significant – the fee will be very low in any case.

Targeted fee levels may be very high. If ACE is excluded, the fee may exceed 9.6 €/MWh for the Baltic markets as an average over the year (the actual level then varies even more depending on the specific market). It should be noted that this fee is modelled as unconstrained; there has been no capping or flooring of the fee to a certain level - except that the final price must not exceed the bounds set by the ACE prices. However, it is likely that there will be some sort of cap (if shortfall, floor if surplus) on fee levels to limit the imbalance price from reaching unreasonably high or low levels. In the modelling, the application of the ACE price limit means that the actual targeted fee will cover most of a shortfall but not all of it.

Targeted fees when ACE is selectively excluded are somewhat lower, ca. 6.0 €/MWh for the Baltic markets on average with lower prices in Estonia and Lithuania and higher prices in Latvia. When ACE is fully included in the imbalance price, targeted fee levels shrink to around 0.5 €/MWh, on average across the Baltic markets. Fees can be negative in the cases where the models generate a surplus and money shall be returned to market participants (although in practice it may be better to avoid negative imbalance fees, which means that imbalance prices are less than marginal).

In general, the effect of the pricing models on fee levels is to reduce the fee the more ACE is included in the marginal price. That is, when ACE is fully excluded the fees are the highest, while when ACE is included the fees are lower or negative. This is natural, as the marginal imbalance price will recover more of the cost when ACE can set the price.

The analysis of BRP data for Lithuania also revealed certain general conclusions:

- consumption-only BRPs (generally retailers) appear better off in a targeted model. This follows from the socialised fee being levied only on consumption. It is then better to pay the targeted fee on the smaller imbalances incurred than to pay a socialised fee on all consumption volumes. However, in practice any targeted fees would be passed on to customers.

- generators generally appear better off in a socialised model for the same reason. There will be no socialised fee to pay, as they only have production volumes. However, in model C generators are generally worse off in a Nordic model with a socialised fee. This comes from the implementation of the targeted fee in the analysis, where a surplus is returned as a targeted fee in the same way that a shortfall is recovered by a targeted fee. As previously noted, a surplus may also be returned as a socialised fee even in a targeted fee model.

- RES generators are better off in the single model with socialised fee under every pricing model, as there is no socialised fee levied on their production, and there is no additional targeted fee to pay on their imbalances. The picture changes slightly in model C, where the targeted fee model delivers a net payback to the market participants (through a negative targeted fee, although in practice this may not be how such a model is implemented).

- moving from a single-single to Nordic model impacts RES generators negatively, but from a very positive outcome to a less positive one. For a supplier the same change is positive, from a very negative outcome to a less negative one. In this sense the Nordic model in model A becomes a compromise solution, where those who do very well in the single-single still do well while those who do not do well are at least better off. This picture is not as clear in models B and C, where results are more mixed.

- in addition to type, size also matters. Smaller players that are not well-balanced, independent of type (supplier/generator), may be heavily penalised in a targeted fee model. This is most clearly the case in model A and to some extent in model B. In model C (as we modelled it) there is no clear picture for these BRPs.

Figure 35 summarises the average imbalance prices for when the system is long and short under the different pricing and fee models for the single-single settlement model. As a reference, the table also includes actual 2015 data for each Baltic market.

A comparison between the modelled prices and the actual data reveals that modelled prices in Model A (ACE excluded) with targeted fee and in Model C (ACE included) with socialised fee are broadly in line with the actual prices observed in 2015. Price levels for long and short are closer in Model B (ACE selectively excluded), and in Model A (ACE excluded) with a socialised fee, the prices are even closer.

The table illustrates a similarity between the 2015 imbalance regime outcome, Model A (ACE excluded) with targeted fees and Model C (ACE included) with socialised fees. In each case, the imbalance prices in each hour broadly recover the total balancing cost including ACE costs.

With a socialised fee, Model C (ACE included) gives extremely sharp imbalance price incentives (determined largely by ACE prices); Model A (ACE excluded) gives softer balancing incentives and Model B represents a middle ground.

Table 28 – Average imbalance prices, hours when system is long and short. Modelled and actual 2015, €/MWh

	Regulatory scenario		Imbalance price €/MWh System Long	System Short	Difference
Estonia	Model A	Socialised fee	30.4	42.6	12.2
		Targeted fee	17.7	56.1	38.4
	Model B	Socialised fee	25.4	44.3	18.9
	Model C	Socialised fee	19.0	53.4	34.4
		Actual 2015	19.5	52.9	33.4
Latvia	Model A	Socialised fee	32.6	36.1	3.5
		Targeted fee	15.7	51.2	35.6
	Model B	Socialised fee	26.6	37.3	10.7
	Model C	Socialised fee	20.2	41.9	21.7
		Actual 2015	17.3	53.3	36.0
Lithuania	Model A	Socialised fee	30.6	38.7	8.1
		Targeted fee	13.3	52.5	39.2
	Model B	Socialised fee	24.0	40.6	16.6
	Model C	Socialised fee	15.1	48.4	33.3
	Lithuania	Actual 2015	16.2	55.6	39.4

Note: Estonia and Latvia operate with a spread on sell and buy prices. Long and short prices are an average of the sell and buy prices for each system direction.

ANNEX C – SUMMARY OF BRP CONSULTATION RESPONSES

This section sets out a summary, compiled by Elering, of feedback received from the market participants via the questionnaire in Annex B.

Feedback was invited on the general aspects related to balance management harmonization as well as on questions with regard to the proposed options provided in the study document. A total of five market participants submitted their views, two of which operate mainly as retailers while the other three also have generation in their portfolio.

C.1 Cost base

BRPs were asked to provide their views on the proposed cost base with separate regard to:

- mFRR for balancing purposes (100%);
- imbalance energy traded with BRPs for balancing purposes (100%);
- ACE costs for balancing purposes (100%); and
- settlement and administrative costs related to balance management.

Four respondents supported the proposed cost coverage structure. However, they stated that more detailed descriptions of the cost pillars should be given.

One market participant suggested that balancing prices should not be set by ACE since the option is not market based. The exclusion of settlement and administrative costs was also suggested by this player as otherwise it would distort the important principle that imbalance pricing should always reflect the marginal costs of balancing the system.

C.2 Pricing model

BRPs were asked to provide their views on the different imbalance pricing models:

- ACE fully excluded;
- ACE selectively excluded; and
- ACE fully included.

Three out of five respondents stated that model B would be the most reasonable out of the three alternatives. It was noted that on the one hand, imbalance prices would then reflect the outcome that would have been achieved if best priced balancing alternatives had been used, and on the other hand, ACE would be treated as any other market participant if enough liquidity for regulation appears in the market. It was also added that model B would require a very transparent pan Baltic (and Nordic) regulating bid database. A couple of respondents also shared opinions over model A indicating that the full exclusion of ACE shall lead to a situation where imbalance prices do not reflect the actual situation in the system. It could be argued that such a system would create opportunities for ACE related parties to incur intentional imbalances in order to profit from it. However, it was noted that the aforementioned effects could be mitigated to some extent in case the ACE cost is to be reimbursed in the form of targeted fees on imbalance volume.

One market participant strongly preferred model A and another had no strong preference between models A or B, reasoning that in both cases the imbalance price would be more in line with the reference price. Model C was disregarded by all the respondents.

C.3 Settlement model

BRPs were asked to provide their views on the different settlement portfolio and pricing models:

a) single or dual portfolio, and

b) single or dual imbalance price.

Three respondents preferred a single balance portfolio accompanied with a single imbalance pricing model (i.e. single-single model) and two opted for the dual portfolio model with a two price imbalance pricing system (i.e. the Nordic model).

Proponents of the single-single model pointed out that market participants would be able to adjust their balance to help the overall system. As an argument against the Nordic model, it was mentioned that the generation side is less incentivised to support the system imbalance when the spot prices are unfavourable.

Advocates of the Nordic model emphasized that the single portfolio model gives a competitive advantage to the incumbents. Therefore, efficiency improvements, for companies that control only a side of the supply chain, must be significant in order for them to outweigh the inherent advantages held by incumbent companies. Since the Baltic market is dominated by large retailers who also have substantial production capacity, then a dual portfolio model would level the playing field in the retail market by creating equal opportunities for all market players.

With regard to the number of imbalance prices, it was stated that the dual system provides market participants with stronger incentives to plan actual consumption and production. It was also mentioned that this system would then encourage the participation of consumption (DSR) in balancing the system. In addition, since the long-term goal is to integrate the markets, the Nordic market set-up should be taken into serious consideration. Therefore, the end result of the Baltic harmonization process should lead to a situation where both the Baltics and Nordics would, to the greatest extent possible, have a similar balance model.

In summary, two respondents preferred the single-single model, two respondents preferred the Nordic model, and a single respondent preferred the single model with two imbalance prices.

C.4 Fee model

BRPs were asked to indicate their preferences on the different fee models proposed:

- Socialized fee
  - Based on demand only
  - Based on demand and production
- Targeted fee
  - Gross imbalance volume

– Net imbalance volume

Two respondents expressed clear favourable views on a socialized fee model. A fee option for generation and consumption were deemed acceptable by both although one respondent suggested that a fee on demand only would be more appropriate, reasoning that imbalances are usually caused by consumption. The adoption of a targeted fee was said to create market entry barriers for smaller players. One respondent was more inclined towards the socialized fee model rather than the targeted fee model however further discussions and explanations were needed to assess the impacts of both alternatives.

A single market participant stated that a targeted fee model should be implemented. The supporting argument for the targeted fee option was that market participants who cause imbalances are faced with the costs (i.e. “causer pays” principle) and thus a well-balanced market participant is not penalized for the mistakes of others. This would provide a strong incentive for market participants to seek better efficiency. Levying a fee on gross imbalance volume was suggested as this model would reflect the actual results of a market participant’s planning and forecasting ability while applying the fee on netted imbalance volumes would benefit market participants that are diversified (having both production and consumption) rather than the ones who are most efficient.

One respondent stated that market participants should not pay any fees as ACE as a whole should be recovered through the grid tariff.

C.5 Other views

BRPs were asked to provide any other views that should be taken into consideration. Two participants added their comments:

- Retailers have already sold 2018+ contracts and will continue to sell until the imbalance principles for 2018+ will be finalized. So, for market participants it is important to understand as quickly as possible whether for example socialized fee based on consumption will be set from 2018 or if the cost base is going to increase sharply, which will increase imbalance costs for BRPs. Also, it deserves explanation why the calculated social fee is so much higher than today’s BRPs costs for imbalance. How much is the cost base going to change compared to present situation?

- One market participant suggested a fourth alternative for the pricing of imbalances whereby the ACE costs would be divided into the last regulating bid price. In their reasoning it would be better than using only ACE cost, because in cases where ACE usage is only very small, it would not set the price. And at the same time this would require less fixed costs division. For example if regulating price is 40 EUR, ACE price is 90 EUR, total imbalance is -25 MW during the hour and only -1 MW was purchased with ACE price, then the balancing price for that hour would be calculated as such: 40 EUR + (90/25)=43.6 EUR.

- It was proposed that ACE costs should instead be included in the grid tariff, which would give TSOs incentives to minimize ACE by using the balancing market. It was also said that TSOs should provide real-time data about system balance in order to hand market participants the opportunity to aid the system imbalance.

ANNEX D – DATA PUBLICATION

The EU regulation concerning transparency of information related to imbalances, regulation 543/213 on submission and publication of data in electricity markets, fixes a long list of information required for the balancing markets and notably:

(a) rules on balancing including:

  a. processes for the procurement of different types of balancing reserves and of balancing energy

  b. the methodology of remuneration for both the provision of reserves and activated energy for balancing,

  c. the methodology for calculating imbalance charges,

  d. if applicable, a description on how cross-border balancing between two or more control areas is carried out and the conditions for generators and load to participate;

(b) the amount of balancing reserves under contract (MW) by the TSO, specifying:

  a. the source of reserve (generation or load),

  b. the type of reserve (e.g. Frequency Containment Reserve, Frequency Restoration Reserve, Replacement Reserve),

  c. the time period for which the reserves are contracted (e.g. hour, day, week, month, year, etc.);

(c) prices paid by the TSO per type of procured balancing reserve and per procurement period (Currency/MW/period);

(d) accepted aggregated offers per balancing time unit, separately for each type of balancing reserve;

(e) the amount of activated balancing energy (MW) per balancing time unit and per type of reserve;

(f) prices paid by the TSO for activated balancing energy per balancing time unit and per type of reserve; price information shall be provided separately for up and down regulation;

(g) imbalance prices per balancing time unit;

(h) total imbalance volume per balancing time unit;

(i) monthly financial balance of the control area, specifying:

  a. the expenses incurred to the TSO for procuring reserves and activating balancing energy,

  b. the net income to the TSO after settling the imbalance accounts with balance responsible parties;

(j) if applicable, information regarding Cross Control Area Balancing per balancing time unit, specifying

a. the volumes of exchanged bids and offers per procurement time unit,

b. maximum and minimum prices of exchanged bids and offers per procurement time unit,

volume of balancing energy activated in the control areas concerned. Operators of balancing markets shall be considered as primary owners of the information they provide.

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