The Nordic Balancing Concept

Version 1

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This document has been prepared for explanatory reasons and is not a legally binding document

Preface

The prerequisites for efficient balancing of the Nordic power system are currently changing as we gradually move towards a green and harmonized European power market. On one hand, large-scale integration of non-dispatchable electricity sources requires a developed and adapted balancing scheme. On the other hand, an integrated European power system allowing effective cross border exchange of energy in all timeframes can only be enabled by an updated balancing scheme where all three main processes are unambiguously outlined: the dimensioning, the activation and the settlement processes. In a European context, this balancing framework is mainly constituted via the operational and balancing guidelines.

This document outlines a new and **future-proof concept** for balancing in order to fully benefit from the European harmonization process as well as facilitating a continued integration of renewable energy and HVDC interconnectors. This new Nordic balancing concept should ensure clear roles and responsibilities, adequate FRR dimensioning rules as well as activation and settlement principles integrating advantageous European procedures. Adapting to – and taking full advantage of – the continental and balancing market principles, will at the same time provide a platform from where the Nordics can use our market oriented and cross border way of thinking to trustworthy influence the European market design and methodology development yet to come.

Content

1 Introduction

In the report “Challenges and opportunities for the Nordic Power System” it is highlighted that the Nordic power system will go through significant changes in the period towards 2025. Closure of thermal power plants, rising share of wind power in the system, decommissioning of nuclear power plants and increased capacity due to new interconnectors, are all examples of the structural system changes that are going to take place. These changes will cause the power system to become more complex and integrated and lead to more challenging balancing of the power system over the coming years.

We are also observing a need to improve existing market solutions as the current solutions are not providing sufficiently clear and precise pricing signals, and we need to improve the financial incentives to ensure all TSOs always keeps sufficient balancing reserves at hand. The market and system challenges are intertwined, as we need well-functioning market solutions in order to solve the system challenges described above.

These challenges will require new measures from TSOs, regulators and market stakeholders. Small incremental improvements in solutions and processes will not be sufficient to tackle these challenges. Instead, the new demands and characteristics of the system will require us to strengthen our competences and deepen our insights to develop new optimal solutions, and be decisive and agile in order to realize them.

To achieve this we therefore need to rethink the fundamental design of how we operate and balance the system in order to ensure security of supply as well as economic efficiency for the future, here formulated as the Nordic Balancing Concept of the future.

Technical development
As the power system grows more complex, with higher reliance on renewable energy sources, increased demand from the population and more capacity from new interconnectors to the Nordics, the question of how well the Nordic partnership can leverage new technologies is becoming increasingly important. Digital innovations can be the key enablers of our needed restructuring of how we balance the Nordic power system. Examples of such innovations include:

- Real-time information that will allow system operations and control centers to make faster and better decisions and to take preventive and corrective control actions
- Big data analytics that will enable control centers and operating systems to process higher volumes of increasingly complex data
- Advanced algorithms and automation that will allow us to optimize bid selection, electronic activation of bids, and congestion management

Such innovations may contribute to increased efficiency and security for the development and operation of the Nordic power system. However, our ability to extract the true value of these technological possibilities depend on our ability to cooperate efficiently as TSOs and to work together for the development of a future-proof and modern balancing concept. The Nordic Balancing Concept have taken the technical requirements and possibilities of the continuous technical development into account.

The European integration
In parallel to handling the system related challenges, a common European framework for markets, operation and planning shall be implemented throughout Europe. According to the EU network codes, the control structure of the Nordics shall be organized on LFC area, LFC block and synchronous area level. This requires that codes, common Nordic functions and integrated Nordic and European market and system solutions shall be implemented in a coordinated way on the Nordic level. This has been kept in mind during the development of the Nordic Balancing Concept.

1.1 Definitions

The below definitions is considered as central in order to fully comprehend this document. Section 1.1.1 below contains definitions specifically for the purpose of the Nordic balancing concept. Section 1.1.2 contains definitions from the Guideline on electricity transmission system operation (SO GL) and in Guideline on electricity balancing (EB GL).

1.1.1 Definitions in the Nordic balancing concept

*'**balancing principal**' refers to Statnett and Svenska kraftnät and related responsibilities and mandates listed in section 11.*

*'**balancing participant**' refers to Energinet and Fingrid and responsibilities and mandates equal to balancing party.*

*'**balancing party**' refers to Energinet, Fingrid, Statnett and Svenska kraftnät and related responsibilities and mandates listed in section 11.*

1.1.2 Definitions in European guidelines

*'**balancing**' means all actions and processes, on all timelines, through which TSOs ensure, in a continuous way, the maintenance of system frequency within a predefined stability range as set out in Article 127 of Commission Regulation (EU) 2017/000 [SO], and compliance with the amount of reserves needed with respect to the required quality, as set out in Part IV Title V, Title VI and Title VII of Commission Regulation (EU) 2017/000 [SO];*

*'**balancing market**' means the entirety of institutional, commercial and operational arrangements that establish market-based management of balancing;*

*'**balancing services**' means balancing energy or balancing capacity, or both;*

*'**balancing energy**' means energy used by TSOs to perform balancing and provided by a balancing service provider;*

*'**balancing capacity**' means a volume of reserve capacity that a balancing service provider has agreed to hold and in respect to which the balancing service provider has agreed to submit bids for a corresponding volume of balancing energy to the TSO for the duration of the contract;*

*'**load-frequency control structure**' means the basic structure considering all relevant aspects of load-frequency control in particular concerning respective responsibilities and obligations as well as types and purposes of active power reserves;*

*'**load-frequency control block**' or 'LFC block' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC blocks, consisting of one or more LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control;*

*'**load-frequency control area**' or 'LFC area' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control*

*'**FRR dimensioning rules**' means the specifications of the FRR dimensioning process of a LFC block;*

*'**reserve capacity**' means the amount of FCR, FRR or RR that needs to be available to the TSO;*

*'**exchange of reserves**' means the possibility of a TSO to access reserve capacity connected to another LFC area, LFC block, or synchronous area to fulfil its reserve requirements resulting from its own reserve dimensioning process of either FCR, FRR or RR and where that reserve capacity is exclusively for that TSO, and is not taken into account by any other TSO to fulfil its reserve requirements resulting from their respective reserve dimensioning processes;*

*'**sharing of reserves**' means a mechanism in which more than one TSO takes the same reserve capacity, being FCR, FRR or RR, into account to fulfil their respective reserve requirements resulting from their reserve dimensioning processes;*

*'**area control error**' or 'ACE' means the sum of the power control error ('ΔP'), that is the real-time difference between the measured actual real time power interchange value ('P') and the control program ('P0') of a specific LFC area or LFC block and the frequency control error ('K*Δf'), that is the product of the K-factor and the frequency deviation of that specific LFC area or LFC block, where the area control error equals ΔP+K*Δf;*

*'**imbalance settlement period or ISP**' means the time unit for which balance responsible parties' imbalance is calculated;*

*'**bidding zone**' bidding zone' means the largest geographical area within which market participants are able to exchange energy without capacity allocation;*

1.2 Conceptual organization

Guideline on electricity transmission system operation (SO GL) determines a conceptual hierarchy of functional area definitions from the top level; Synchronous area, LFC block, LFC area and Scheduling area. In addition Control area is defined as a coherent part of the interconnected system, operated by a single TSO and the generic term monitoring area for an area which can be monitored. Guideline on Electricity Balancing (EB GL) adds market oriented definitions like bidding zone, imbalance area and imbalance price area (ref. regulation number 543/2013).

SO GL defines that there shall be synchronous area operational agreements (art.118) and LFC block operational agreements (art.119). In addition, the guideline defines several other agreements to specify obligations and processes within system operation.

In this document it is assumed that the control structure for the Nordic synchronous system is one LFC block (LFC block=Nordic Synchronous area) and a number of LFC areas with the same extension as the bidding zones (LFC areas=Bidding Zones=Scheduling areas). The total balancing concept is based on bidding zones as the building blocks while national obligations (e.g. reserve procurement) within the synchronous system are linked to the control area for each TSO (SO GL).

The real time control will be organized as balancing control for each bidding zone with an optimization function on top to achieve efficiency, the MACE control.

1.2.1 Relations to other synchronous systems

SO GL requires that rules including possible limitations for exchange and sharing of reserves with other synchronous systems are defined. These rules will be based on evaluation of implications for operational security and the design of the Nordic balancing process at the time. This design will develop in the direction of more active national actions to balance each country and then there will be room for more national specific arrangements as long as the remaining Nordic rules specified in NSOA, other agreements pursuant to SO GL and general requirements in the guidelines are followed.

A Nordic function will be established to contribute to maintain system security in the synchronous system, respecting the basic national responsibility for system security. The interface between this function and the European balancing platforms will have to be developed further.

1.3 Main design features

The Nordic Balancing rests on twelve main design features:

1. The synchronous area is divided into bidding zones corresponding to the main bottlenecks in the grid. Each bidding zone shall also correspond to an LFC area. The bidding zone constitutes the main building block in the Nordic LFC block balancing concept.

2. The balancing concept is based on a 15 minute balancing market, Market Time Unit, and a corresponding 15 minute Imbalance Settlement Period is applied for the Imbalance Settlement process.

3. Each Balancing Party shall ensure access to sufficient reserve capacity (according to Nordic FRR dimensioning rules to be described in the New SOA (as defined in art. 5.3) in all Market time units and in all bidding zones within its control area. If necessary, market based procurement of reserve capacity and reservation of transmission capacity shall be used to ensure this.

4. The FRR dimensioning rules shall be based on historical imbalances and the dimensioning incident in each bidding zone. In addition each Balancing Party shall secure necessary reserves to handle congestions within the bidding zones of its control area. The FRR dimensioning rules shall accommodate proactive balancing of mFRR and reactive balancing done mainly with aFRR.

5. FRR dimensioning shall follow the below stepwise process:

   (i) Dimensioning per bidding zone, based on above principles;

   (ii) Sharing of reserves within each control area in the LFC block;

   (iii) Sharing of reserves between control areas, while respecting the responsibility of each control area for operational security.

6. The Balancing Principals shall develop a methodology to exchange balancing capacity. The exchange of balancing capacity shall be used as a tool to ensure sufficient balancing reserves in each bidding zone and to increase economic efficiency. The methodology shall respect capacity exchange limitations that stems from the control area responsibility to maintain operational security.

7. Exchange of balancing capacity shall be secured by reservation of transmission capacity. Countertrade is a supplementary tool and shall not be used as an alternative to reservation of transmission capacity.

8. The manual FRR product shall under normal operation be used to proactively balance the system and for congestion management purposes. Proactive balancing implies forecasted imbalances and to release expected automatic FRR activation. mFRR control requests from each bidding zone shall be coordinated by a central European or Nordic activation optimization function. The activation process shall be supervised by a Nordic security function.

9. Each Balancing Party is economically responsible for balancing of the imbalances within its own control area

10. The automatic FRR product shall be used for reactive balancing and is activated based on aFRR control of each bidding zone, coordinated by a central activation optimization function which ensures a cross bidding zone border optimized aFRR activation in the LFC block. Available transmission capacity, including potentially reserved transmission capacity between the bidding zones is utilized by the central activation optimization function to exchange aFRR balancing energy.

11. The Balancing Parties in the Nordic LFC block shall establish joint balancing market underpinned by joint platforms for procurement and activation of balancing services. The balancing market design shall provide adequate price signals for balancing services

and imbalance settlement for Balancing Parties, BSPs and BRPs, per 15 minute time period and per bidding zone. Scarcity pricing shall be applied. Scarcity situations shall be defined based on the FRR dimensioning rules.

12. The balancing process shall strive to be non-discriminatory and transparent in all activities established under the balancing process. This implies to publish relevant market information not later than 30 minutes after real-time as long as publication does not create system operational inefficiencies or any competitive advantages or disadvantages to any market participants.

2 Introduction to the modern ACE control

In the Nordic power system today, we maintain the power balance by supervising and controlling the frequency. This allows for netting and exchange of balancing power, but the control structure has proven to be challenging in a number of ways: The frequency quality has been weakened in the last years, bottleneck control is a challenge for the operators and new developments in market integration, automation and decision support are hard to implement with the current practices.
By also looking at the imbalances in each bidding zone – the ACE – and combing this with modern IT systems, a better balancing model for the Nordic power system will be obtained.

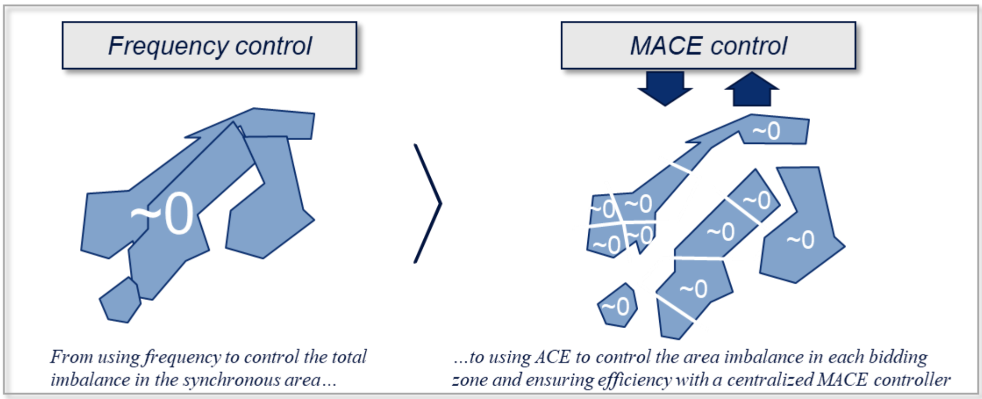

Figure 1: Illustration of the transition from frequency to (M)ACE control

2.1 ACE

Area Control Error (ACE) is a measure of the instantaneous power imbalance in an area of the power system. ACE is calculated by comparing the flow on all borders of an area with the planned flows, correcting for flows due to the activated primary reserves and agreed balancing contracts. The ACE can be calculated per country or per bidding zone. The sum of all ACEs in a synchronous area corresponds to the frequency deviation. Control the ACE implies that the operator of an area seeks to keep the ACE small or zero.

2.2 From ACE control to MACE control

Traditional ACE control as we know it from the Nordic power system before 2002 has some disadvantages. If each area shall be controlled by activating resources within that area, netting and trade gains are lost.

The idea of MACE is to use modern IT technology to combine the balancing needs, available transmission capacity and available balancing resources in a coordinated and optimal way.
The Nordic synchronous area is divided into bidding zones that follows the main bottlenecks in the grid. The existing bidding zones are a good starting point for MACE control.

Coordinated aFRR and mFRR control in all bidding zones will be a central component of balancing the Nordic system with MACE control. MACE for aFRR and mFRR means to calculate or decide on the desired reserve activation per bidding zone in each of the 11 bidding zones and a central optimization function that combines the needs for activation in all regions, applies netting and finds the cheapest bids to activate; all within the constraints given by the grid conditions.

Each TSO is responsible for their own ACE by requesting reserve activations from the Nordic and/or European platforms. The optimization of all requests must be done in central functions that need to be developed. The coordinated reserve activation based on bidding zone ACE can be based on Nordic and/or European activation platforms that the EB GL requires the TSOs to implement.

2.3 Better control with exchanged reserves

All reserve activation (and netting operations) in the aFRR and mFRR markets will be supplied from one bidding zone, the source; to another, the sink. As a result, it will be possible to settle all reserve activations more precisely than today. It will be possible to settle activations in opposite directions within the same ISP, and it will be possible to separate activations of different products with different prices. The exchange schedules between the bidding zones will be updated according to the activations, and the remaining volumes of imbalance flow should be magnitudes smaller than today.

2.4 Implications for other areas of the balancing function

When reserve activation shall be based on the activation needs in each area it will be important to secure access to available reserves in all areas. This can be done by having reserves in each bidding zones; or by making sure that resources are available for import. Capacity procurement methods with exchange of reserves and reservation of grid capacity between the bidding zones will be a part of The Nordic MACE balancing concept. Historic ACE values will also impact the reserve dimensioning in the bidding zones and control areas of the power system.

3 Balancing targets

Balancing has two main objectives. The first objective is to keep production, consumption and exchange balanced to maintain operational security and the second is that the available resources should be used in a cost optimal order for socio economic reasons. These two objectives should be integrated in the balancing processes. Balancing in a wide understanding means handling of imbalances in normal state, sudden imbalances e.g. due to faults and congestions in the grid.

To maintain a defined level of system security, the TSOs have to agree on a set of quality standards by specifying target, max, min and average values for different parameters as well as margins between expected performance and realized values. For some parameters a limitation of gradients for variations are also appropriate. While a number of these quality standards are currently described in the Guideline on System Operation (SO GL), others will be described in the Nordic System Operation Agreement (NSOA).

To use balancing resources in a cost optimal way, the TSOs organize different market arrangements. As these resources are necessary to facilitate the energy market, a theoretical target should be a total optimization of all markets. In practice this has so far been unrealistic. For the balancing market, it should be possible to use better coordination between market segments to achieve 1) Optimized procurement of different products, and 2) Optimized use of grid capacity. The optimization must be based on the quality standards in the paragraph above.

The Guideline on Electricity Balancing (EB GL) define framework for the market arrangements while NSOA and specific market agreements will describe the details.

A non-exhaustive list of specific parameters determining the balancing targets are:

- Dimensioning incident(s) / N-1 principle
- Saturation of aFRR less than X% of time
- Sufficient mFRR capacity to handle regular imbalances in YY% of time
- Minimum frequency, steady state frequency and max accumulated frequency deviations minutes/year)
- Time to restore frequency (TTRF)
- Max ACE per BZ
- Max accumulated ACE per ISP
- Time deviation (allowed)
- Additional targets as GL OS, annex III and VII

4 Ensure capability

A key objective for the balancing market is to ensure adequate and long term incentives to the market participants in order to support maintenance of existing flexibility and to ensure the development of new flexibility. Flexibility, the possibility to increase or decrease production or consumption of energy when required, is a necessity for the operative balancing of the system. Absence of flexibility will inevitable endanger operational security as well as impede a secure expansion of vRES (variable renewable energy sources).

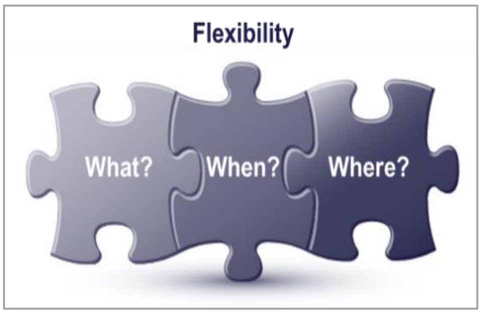

Figure 2: The three dimensions of flexibility

The Nordic balancing concept provides adequate incentives to the market participants by addressing the three dimensions that constitutes the type of flexibility needed to underpin a market oriented balancing scheme:

- **What** type and amount of balancing services
- **When** in time
- **Where** should the balancing services be located

These three dimensions should be expressed as adequate signals to market participants via the balancing market. More specifically the market signal can be conveyed either via the Balancing capacity market price signal, the Balancing energy market price signal, the Imbalance settlement, or the associated reporting or prequalification processes.

What type and volume (e.g. in relation to specification and dimensioning) of flexibility is initially communicated via balancing market product specification. The TSO responsibility is to decide on a product portfolio that answers to the demands of the power system, but at the same time takes the current and future market's ability to deliver into account. The system control response is a result of the combined product portfolio control response. The dimensioning rules decide the amount of each product that is needed to ensure efficient operation in line with the balancing concept. The TSOs must also consider the non-discriminatory aspect by requesting a technical capability, not specific type of units. Procurement shall be done with low thresholds in terms of administrative rules, but never compromise the quality of the product delivered. Scarcity of a product must inevitably be reflected in the price signals to the market.

When in time balancing energy can be delivered is growing in importance as we successively move towards a system where we may have an abundance of available energy during most hours, but face scarcity in balancing energy in periods with low consumption, high contribution from variable Renewable production (vRES) and high import from surrounding systems. The Nordic balancing concept utilizes a 15 minute market resolution as a baseline for pricing of capacity, energy and imbalances. Energy and imbalance prices are not capped nor floored which accommodates for both high and low prices which ensure that market players face an adequate price.

In scarcity, situations where system imbalances cannot be sufficiently covered by available balancing recourses, the operational security is jeopardized which could be expressed as a risk for disconnection of demand. This constitutes an additional cost for society[1], which should be correctly mirrored in the pricing scheme. If not, the market participants will meet a price that is lower than the actual value for society and will therefore not be incentivized to strive towards the economic optimum. The additional cost could be added as a scarcity markup. In theory, if the risk for disconnection of loads equals one, the imbalance price should equal the value of lost load. The

1 The cost for society is probabilistic - one can say that it is the probability for Loss of Load (LOLP) multiplied by the value of lost load (VOLL).

dimensioning rules and the procurement scheme stipulating the amount of the balancing products needed, could also be used to support correct and time dependent evaluation of balancing capacity.

Where the balancing services are located in the grid topology is a pivotal aspect that must be fully priced in order to ensure adequate price signals. Energy is not only defined by its abundance or scarcity, but also by its location. The Nordic balancing concept relies on a bidding zone structure that corresponds to the main bottlenecks in the grid – an important market design feature that should be fully exploited in the balancing markets. In practice, this means that on one hand the balancing service providers will receive a price for their services that fully reflects local availability and value, while on the other hand balance responsible parties will meet a cost reflective imbalance price. At the same time, a bidding zone focus on prices will accommodate a more socioeconomically efficient and transparent use of cross border transmission capacity since the value of both is a result of the pricing in the interconnected bidding zones.

Apart from the price signals, the balancing concept shall provide a fast feedback loop of all other market information that could help the market participants take informed decisions on how to act – in both the short and long run (ref. section 9). This includes publishing comprehensive market information (e.g. offered volumes and prices) as well as being transparent in the long term about expected upcoming system needs (e.g. balancing services).

The balancing concept is furthermore clearly designed in two layers: 1) Security of supply and 2) Economic efficiency.

The main and first layer in the Balancing concept is to guarantee a safe operation of the power system and by doing so providing a stable platform for the energy exchange facilitated by the energy markets. This means that the first objective of the Balancing function is to continuously ensure balance between production and consumption and when doing that allow energy traded in Day ahead and Intraday flow according to the trade schedules.

The second layer focus on economic efficiency, which can be interpreted as a market design providing market participants with adequate incentives as well as platforms facilitating trade and regional/pan-European market coupling. This will result in a cost efficient balancing function, which simultaneously safeguards that the short and long term power system perspective is duly imbedded in the decision making of the market participants. The second layer is of vital importance, but should be implemented within the frame of the first.

5 Balancing products

The European framework for integration of the balancing markets implies and promotes harmonization of the Balancing services provided by the Balancing Service Providers (BSPs). As a consequence, all European TSOs are jointly obliged to develop a set of common Standard FRR and RR products (article 25, EB GL). In addition, each TSO may develop Specific products if it can be demonstrated that the standard products are not sufficient to ensure operational security, to efficiently maintain system balance or if some balancing resources cannot participate in the balancing market through standard products (ref. article 26, EB GL).

Currently, the required Full Activation Time (FAT) for mFRR in the Nordics is 15 min. The delivered FAT is however 3-15 min and the BSPs are settled according to agreed or reported FAT between the TSO and each BSP. The Nordic mFRR product is directly activated, which means that the activation is not bound to a specific market time unit. The relatively small Nordic system requires products faster than the standard product FAT to comply with the frequency quality standards and to handle grid constraints within and between bidding zones. Currently, the aFRR process is not scaled to efficiently cover the anticipated system requirements.

The set of standard manual FRR products is not yet finally decided, but a reasonable assumption is to expect a FAT of 12.5 - 15 min and scheduled activation[2] procedures. The standard product for automatic FRR is not yet detailed.

The Nordic balancing concepts sets out the use of two manual FRR products:

a) The European standard product as defined in the joint European market coupling initiative.

b) A complementary specific product, direct and fast (e.g. 5 min FAT) activated product primarily used to maintain operation security (e.g. congestion management) and as a complement to the aFRR product.

In addition, the restoration reserve (RR) product may be considered if deemed economically efficient.

The Nordic balancing concept is based on an extensive use of automatic FRR. The aFRR product specification is yet to be detailed and is dependent on an activation process fit for the Nordic system demands as well as the European standard product definition.

Finally, it should be underlined that the standard product in its essence defines a cross border exchange of a balancing service between TSOs (defined as the TSO-TSO model in EB GL). The product definition between the connecting TSO (defined in SO GL) and the BSP may deviate and include additional requirements.

[2] Note that the definition currently is open for both direct and scheduled activation.

6 Reserve dimensioning

FRR resources are used for balancing of imbalances and restoring frequency, but also to remedy congestions in the grid between or within bidding zones. In the Nordics, these are currently integrated processes, while other countries have separate processes, separated in time and, for some also with separate bidding lists. Redispatch or counter trade is also used to avoid reductions in transmission capacity in markets. The European integration of activation of FRR will probably lead to a clearer distinction between balancing of imbalances and grid related activities. The Nordic Balancing Concept suggests to handle grid related issues first, and use remaining resources for balancing of imbalances.

Another perspective that will affect the FRR processes is that the resources are used in normal, alert, emergency and blackout state. Operational security aspects and requirements from SO GL means that FRR shall be supervised by the Nordic principal.

The FRR dimensioning rules shall be based on historical imbalances and the dimensioning incident in each bidding zone. If the need for reserves changes, this will affect the dimensioning.

6.1 Principles for FRR activations

The European platforms for aFRR and mFRR activations, which are under development, are meant to increase efficiency in balancing of imbalances in normal state. At the same time, SO GL requires allocation of regional responsibilities related to use of FRR within each synchronous system, each LFC block and each LFC area. Svenska kraftnät and Statnett propose to organize these responsibilities as outlined in chapter 0. There will be a Nordic function handling other FRR activations than balancing of imbalances in normal state. The Nordic function will also make security checks for potential limitation of bids sent to the European platforms, decide the available transmission capacity for FRR and serve as a Nordic backup for the platforms if the European system should fail.

Details on the FRR activation are found in Section 7.

6.2 Dimensioning of FRR

There are currently large variations in use of aFRR and mFRR in Europe, and this has affected the description of dimensioning in SO GL. In the Nordics the current assumption is that aFRR and mFRR will be dimensioned separately, because we use the two processes in different time frames and for different purposes. In Continental Europe, FCR is used to handle disturbances while aFRR and mFRR are two alternatives for restoring the frequency and the area imbalances.

In the Nordics, both FCR and aFRR are used in a different way than in Continental Europe. This is partly due to the smaller size of our system. The FCR process is not a pure "disturbance" process and the aFRR process is not a pure balancing process. In the Nordics there are close relations between FCR-N and aFRR, and there are also considerations to link aFRR dimensioning and inertia in order to keep frequency close to 50Hz in low-inertia situations. The role of aFRR in handling of low-inertia situation will be a result of the current redesign of the FCR process and future solutions for handling of low inertia situations. The volumes of aFRR are so far limited and the process is not available in all hours.

6.2.1 Expected Nordic changes

It is difficult to say today how and when the Nordic use of FCR-N, aFRR and mFRR will change in the future, but the elements of the resulting balancing model can still be described;
The balancing of imbalances can be divided in proactive and reactive balancing actions; The proactive balancing of Nordic imbalances is in the future expected to be handled by a Nordic or European platform for mFRR with one standard product and with a 15 minute balancing period. The reactive balancing will largely be handled using aFRR, and to some degree by a potential specific product for mFRR with shorter activation time. aFRR will be activated in a Nordic or European platform for aFRR.

A clearer distinction between FCR and aFRR, in line with the continental approach, must be expected as well as an increase in the aFRR volumes. The specific issues related to HVDC operation are vital for the future design of FRR exchange between the Nordics and Continental Europe.

Substantial changes in any of the issues mentioned here, may lead us to reconsider the assumption of dimensioning aFRR and mFRR separately for the Nordics.

6.2.2 Dimensioning of Manual FRR

mFRR will be dimensioned based on calculations of historic imbalances per bidding zones. The SOA project has proposed a simple probabilistic method saying that for each bidding zone, access to a percentage of current assumption (currently assumed to be 99%) of historic imbalances must be secured for balancing of imbalances. In addition to the reserves for balancing, enough reserves has to be secured for controlling a dimensioning incident and to handle internal bottlenecks in the grid.

The next step in the dimensioning process is to utilize sharing options between bidding zones within each country. This is based on the national responsibility for balancing capability, to remedy effects of different national strategies for number of bidding zones, and to get a foundation for cost sharing between TSOs in case of sharing of capacity between TSOs. The requirements per control area for mFRR volumes for balancing of imbalances may be reduced by applying sharing options in multi-TSO markets or by firm contracts between TSOs.
Each TSO will have to evaluate the need for grid-related volumes of mFRR and the security aspects related to location of mFRR volumes for disturbances.

Proper IT solutions will have to be in place for the calculation of historic imbalances.

6.2.3 Dimensioning of automatic FRR

aFRR will be dimensioned to enable the balancing philosophy where mFRR activation is used mostly proactively and most of the reactive balancing is done using aFRR. In addition to calculations of historical short term imbalances, historical aFRR activation volumes will be monitored and form a basis for the dimensioning. The saturation in the LFC controller shall be less than a percentage of time to be stipulated in the NSOA. In addition, we must consider the desired frequency quality and the link to inertia. A minimum volume of Nordic aFRR must be secured in all hours. The distribution of aFRR shall be based on calculations of historical imbalances in each bidding zone. The dimensioning principles for aFRR will have to be discussed in detail in the NSOA process.

6.3 Ensure reserve capacity and allocate transmission capacity

The TSOs are responsible for ensuring that the reserve capacity meets the dimensioning rules that are outlined above. This can be done in two ways:

- Reservation of FRR capacity
  - Within the bidding zone, or
  - In another zone with reserved grid capacity
- A probabilistic approach where the TSO relies on available energy bids from the BSPs

The Nordic Balancing Concept requires FRR capacity for N-1 to be reserved. FRR capacity for balancing must be reserved in capacity markets only if voluntary bids are not expected to cover the dimensioning. This probabilistic approach method for deciding if capacity must be procured or if voluntary energy bids will suffice, will be detailed in NSOA.

Reservation of aFRR and mFRR capacity will be done in common Nordic market(s) for reserve capacity. The contracted BSP is obliged to submit balancing energy bids to the contracting TSO of a volume corresponding to the reserved capacity. These markets will be daily markets, performed D-2. Exchange of balancing capacity requires reservation of transmission capacity before clearing of the day-ahead market. The reservation method shall be market based, i.e. transmission capacity can only be reserved if the value of using transmission capacity for balancing capacity is higher than the expected value of using transmission capacity in the day-ahead market on the margin.

To ensure that flexibility and transmission capacity is used in an optimal way, aFRR and mFRR capacity should be procured in a coordinated, ideally co-optimized manner.

7 FRR reserve activation

7.1 mFRR activation

The mFRR-process has two purposes which may in fact be considered as two more or less coupled processes - one mFRR Balancing Process and one mFRR Congestion Management Process.

The purpose of the **mFRR Balancing Process** is to:

- Proactively compensate for future forecasted imbalances and thereby limit aFRR activations in those cases were imbalances may be foreseen.
- Reactively release the activated aFRR and reset remaining ACE or frequency deviation (in case of saturated aFRR) in normal operation
- Reactively handle disturbances

Hence, from a balancing perspective, the mFRR product is closely related to the aFRR process and a vital part of the MACE control strategy.

The purpose of the **mFRR Congestion Management Process** is to:

- Prevent overloading of transmission lines by redispatch or counter trade
- Change flow in the grid by e.g. loops to increase ATC on some interconnections at the sacrifice of other connections

7.1.1 Activation within the mFRR Congestion Management Process

There are several reasons why the Congestion Management Process (CMP) should be separated from the Balancing Process (BP) in the future:

- The Nordic mFRR BP will change in the direction of a more proactive balancing
- The CMP will make bids necessary for this process unavailable for the BP and by that increase security in the Nordic system
- In certain cases the CMP can increase ATC for the BP on several important interconnections
- The available time for proactive balancing before real time is limited and the TSOs will have better control if the processes are separated in time
- If the CMP is before the BP, slower and potentially cheaper products may be used for the CMP
- Many European countries have already made this separation, facilitating Nordic integration with Europe

Bids for the Congestion Management Process shall be sent in due time for the TSOs to make evaluations of which bids to activate and to complete the process before the Balancing Process starts. The bid list can be a separate list for congestion management or an early version of the bid list for balancing.

While the mFRR CMP will primarily be a proactive process, there will still be a need for reactive congestion management.

7.1.2 Activation within the proactive mFRR Balancing Process

In the mFRR Balancing process in MACE control, mFRR will be activated proactively through the European mFRR platform and the mFRR will be activated during the whole ISP (15 min.) for the standard scheduled product. In this case the TSO send an mFRR activation request to the platform consisting of four parameters:

- Bidding zone
- Activation direction (Up or Down)
- Volume to be activated (MW)

In addition, the TSO shall send:

- Available bids within each bidding zone
- ATC between the bidding zone and adjacent areas

mFRR requests, mFRR bids and ATCs for a certain ISP must be sent to the platform within the time period of T-30 to T-15, where T is the starting time of the requested ISP.
The mFRR platform considers all the mFRR requests for each ISP and calculates an optimal activation (cost minimizing), taking into account the current transmission situation. The platform sends the optimal proactive activation solution to the TSOs and the TSOs communicates to the BSPs which mFRR activations shall be executed for the coming ISP. Exchange of mFRR will lead to an updated exchange schedule between the two areas, and for connections between synchronous areas; ramping of HVDC interconnectors.

The European platform might also offer a direct activation product. This product is currently not considered to be beneficial for exchange between the Nordics and Continental Europe due to the specific operational conditions related to HVDC exchange and the less efficiency in such activations (no netting effects). A scheduled activation each 5 minutes is an alternative, which is investigated.

7.1.3 Activation within the reactive mFRR Process

There will always be a need to use mFRR reactively in case of unforeseen events like faults in production, consumption or grid. It may be appropriate to have a specific fast product dedicated for this in the Nordics. These activations must be controlled from a Nordic function.

7.2 aFRR activation

The aFRR process is a fully automatic balancing process aiming at keeping the ACE in each bidding zone close to zero. The process relies on reserve activation from BSPs that are able to deliver fast and automatic regulating power. aFRR activations will be the main reactive tool for normal balancing in the Nordics.

When all bidding zones in a synchronous area are regulated with a well-functioning aFRR controller, this will have two main implications for the total system:

- The frequency quality will be improved. The sum of all ACE in the synchronous area corresponds to the frequency deviation, and if all areas are well regulated, so will the total system
- The flows between the areas will be under control. Undesired deviations from the planned flow will be efficiently controlled by controlling the ACE on both sides of all interconnectors

Each bidding zone will have their own aFRR controller[3] calculating the desired aFRR activation for their area. The calculation will run often, at least every 10s. The controller takes the area ACE as input and will through a PI regulator calculate the required aFRR MW to correct the ACE. All controllers in the synchronous system should be designed to work well together.

A central platform will receive the required aFRR activation of all bidding zones and calculate the most optimal activations. To be able to calculate this, the platform needs at least the following information:

- Required aFRR activation per bidding zone
- All available bids in the area. The TSOs should before giving the platform access to a bid decide if this bid can be activated, or if it will create congestion or another grid problem
- An updated grid model. A grid model describing the connection between the bidding zones. A PTDF matrix similar to the one used in the "flow-based" market clearing could be an alternative.
- Available transmission capacity (ATC) on all borders. This could be the remaining market capacity after all other markets or the difference between the measured flow and maximum flow on the interconnector; or a combination of the two.

When the platform decides that aFRR should be exchanged between two areas, this will result in an exchange between these two areas and an adjustment to the exchange schedule between the two areas. This adjusted exchange schedule will be used as input to the ACE calculation in those two areas. The changes in exchange must follow an agreed pattern for delays, ramping etc.

In a longer perspective, aFRR may also be developed to relieve congestions actively if clearly motivated by technical efficiency.

[3] Logically each area/TSO needs to have their own controller. Physically the controller might be placed in the IT-systems of another TSO

8 Settlement

The settlement principles shall be designed to provide adequate economic signals to all market participants (i.e. TSOs, BRPs, BSPs) based on the three dimensions *What*, *When* and *Where* elaborated in section 4. The settlement processes should be transparent and non-discriminatory and be designed to avoid any market distortions.

It should be noted that the activation and settlement processes for balancing energy as well as imbalance settlement are highly influenced by the European framework stipulated directly by the EB GL or methodologies jointly developed by the European TSOs to fulfill EB GL requirements. This means that the Nordic TSOs have a set of parent key design principles to take into account when designing the settlement processes for the Nordic LFC block and synchronous area. All joint European settlement principles are not yet agreed, but the harmonization process and scope is defined in EB GL. The settlement of balancing capacity is to less extent regulated by a European framework.

The settlement can generally be divided into six interdependent processes. Since the main principle of cross border exchange utilizes the TSO-TSO model for cross border exchange of balancing services, the settlement processes can also be divided in TSO-BRP, TSO-BSP and TSO-TSO settlement.

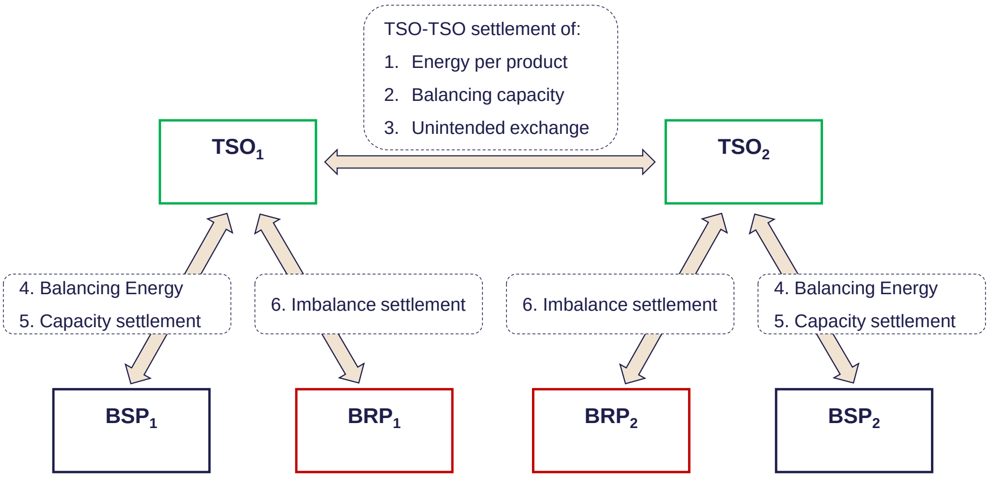

Figure 3: General overview of the settlement processes

8.1 Settlement of Balancing energy

The settlement process for balancing energy is the TSO – BSP settlement in which the reserve connecting TSO reimburse the BSP for activated balancing energy. Balancing energy is priced per *Product* and direction (upwards, downwards), *Balancing market time unit* (i.e. 15 min) and *Bidding zone* according to the principles outlined in section 4. Balancing energy bids are submitted by the BSP to the Balancing market before the relevant Gate closure time stipulated for the Product the bid belongs to, refer to 5. Activation is generally based on merit order and settlement is based on Cross Bidding zone border marginal pricing. Bidding zones with non-congested interconnectors shall have the same marginal price.

European pricing and activation principles are currently under development, and hence subject to change. Cross Bidding zone border marginal pricing principles imply a change of the current Nordic pricing regime as balancing bids activated as a result of imbalances outside the Nordic LFC block (e.g. an activation request from the European platforms) can potentially set the marginal price of Nordic bidding zones. There are however good reasons for the Nordics to support this principle in the future development. Balancing products should be efficiently priced in a market, and when there are no grid constraints different pricing regimes dependent on the location of balancing requests should be avoided. For the same reasons, there are also arguments for not having different pricing regimes dependent on the purpose of activation. The EB GL indicate, however, that activations for other purposes than balancing (e.g. congestion management) should deviate from merit order and marginal pricing principles and this will have to be taken into consideration in the development of future pricing and activation principles.

The Nordic balancing concept foresees the use of scarcity pricing in imbalance settlement, refer to section 4 and 8.4. The rationale behind is that the market design should correctly reflect the risk of load shedding due to scarcity of balancing reserves. At the same time the marginal real time value of balancing energy increases, which suggests that the general principle of symmetry between imbalance price and balancing energy price should be pursued also in scarcity situations, the exact design will however be further investigated and detailed.

8.2 Procurement and Settlement of Balancing capacity

The settlement process for balancing capacity is where the reserve connecting TSO procure balancing capacity from the BSPs in order to ensure sufficient balancing reserves in a specific bidding zone and time period in accordance with reserve dimensioning process. The contracted BSP is obliged to submit balancing energy bids to the contracting TSO of a volume corresponding to the reserved capacity.

The procurement of balancing capacity shall be considered as a tool to ensure a sufficient volume of balancing energy bids but the energy market shall be open for both pre-contracted and voluntary energy bids. In periods where historical energy bid volumes are considered to warrant volumes beyond what’s required according to the dimensioning rules, the capacity procurement may be adjusted.

In the Nordic LFC block, reservation of balancing capacity in each bidding zone shall be complemented with a market based allocation process for cross bidding zone border transmission capacity, described in section 6.3. This allows for the TSOs to efficiently exchange balancing capacity cross border.

8.3 Settlement of energy exchange between TSOs

Settlement of energy exchange between TSOs can be divided in intended and unintended exchange. Intended exchange is defined in EB GL as exchange of balancing energy bundled as balancing products, typically the European wide FRR and RR standard products (and netting process) and any additional regional specific products. See section 5 for details.

Pricing and settlement schemes for intended exchange of balancing energy between TSOs shall be jointly elaborated at European level and the European platforms for exchange of balancing energy will operate the settlement function for the standard products.

However, in the Nordic Balancing concept it is proposed that the balancing energy exchanged between TSOs is settled at cross bidding zone border marginal price as described in 8.1. The congestion rent that arises whenever a price difference is created (due to congestion between two bidding zones) shall be shared between the concerned bidding zones at the mid-price of the marginal prices in the importing and exporting area. This method shall consequently be pursued in the European harmonization.

Unintended exchange is indirectly defined in EB GL as energy that is not a result of intended exchange. This typically includes ACE, but also the intended exchange of KΔf and Ramping. In EB GL it is stipulated that all TSOs in a synchronous area shall develop a proposal for common settlement rules applicable to all unintended exchanges of energy. Currently, the continental TSOs are first out to propose a methodology[4]. The Nordic TSOs have not yet started up any corresponding work, but are obliged to develop a proposal at latest 18 months after Entry Into Force of EB GL (app. Q2 2019). In addition, all European TSOs shall develop a methodology for settlement of unintended exchange between synchronous areas which is an undertaking that the Nordic TSOs have an interest in.

The first step in the Nordic methodology development is to scrutinize the already detailed continental approach. There are obvious advantages if the same framework can be applied in the Nordics. However, there could be alternative design choices that could be preferred in the Nordics. One example could be the settlement period that could be shorter than the Imbalance settlement period.

8.4 Imbalance settlement

The imbalance settlement process refers to the TSO – BRP settlement in which;

- The TSO calculates an imbalance energy volume based on the BRP final position(s) and related imbalance adjustments. The Nordic Balancing concept foresees a single position per BRP, Bidding zone and ISP.

- The TSO determines an *imbalance price* per Imbalance Settlement Period (which shall be set to 15 min), Bidding zone and imbalance direction (i.e. upwards or downwards). The application of single and dual pricing is subject for European harmonization, but the Nordic balancing concept foresees a single pricing model where dual pricing only can be used under certain conditions

The imbalance settlement process is operated by eSett (except for Denmark). The imbalance price shall have a strong link to the price of balancing energy since symmetry between the imbalance price and the balancing energy price is pursued. However, due to the fact that the system will be balanced with a set of different products it is reasonable to assume that the imbalance price is not based on a single marginal price. A volume weighted average marginal balancing energy price is a possibility, but is yet to be decided. Such a price uses a volume weighted average of the product marginal prices activated during the ISP.

As previously discussed in section 4, scarcity pricing shall be applied, but the detailed methodology is yet to be detailed. As suggested in section 8.1, symmetry between imbalance price and balancing energy price could be pursued also in scarcity situations.

The reference price implies that the imbalance price in ISPs where no balancing energy has been activated. Currently, the reference price in the Nordics equals the day-ahead price of energy. The Nordic balancing concept refers to article 55.4 and 55.5 in EB GL which stipulates that the value of avoided activation of balancing energy from FRR and RR shall be applied as a minimum reference.

[4] Proposal for settlement periods and pricing methods for unintended exchange, Ramping Period and kΔf, Entso-e, 2016

9 Transparency and reporting

As set out in the Balancing concept main features (section 1.3.), market transparency is essential. The TSOs shall strive to be non-discriminatory and transparent in all activities established under the Balancing process. First layer of transparency is established under regulation No 543/2013 where the TSO Balancing market reporting responsibilities is addressed in article 17. The regulation is concretized in the "ENTSO-E Transparency" platform" which publishes electricity market data. Publication of balancing market data is further strengthened in EB GL (article 12) which stipulates rules for publication of balancing energy bid data (e.g. product type, volumes, prices) as well as balancing state soon after real-time. EB GL also establishes a framework for general transparency in balancing energy procurement and to which extent a TSO can choose to restrict its usage (on a common platform of European TSOs).

The European framework for the balancing market transparency will most certainly improve the functioning of the market, but will be challenging at the same time. From a market perspective, it is important that publication of data does not create competitive advantages or disadvantages for any market participant. From an operational perspective, close to real-time publication of information can create adverse incentives for the market participants. For instance, real-time publication of the balancing state may create counterproductive signals for self-regulation (especially in bidding zones with internal congestions) and hence operational inefficiencies or ultimately endanger a safe operation. The continuous work of developing the balancing concept will consider the realization of article 12 in EB GL, and furthermore involve detailing of a (possible and voluntary) Nordic transparency platform and assess which channels will be used for publication of European, Nordic and National publication of data.

Apart from publication of balancing market data described above – which overall can be considered as close to real time – the system challenges and the transformation of the power system calls for information with a broad and long-term perspective. The TSOs have an important role to play, especially when it comes to the balancing markets. In order to enable the transition to the new and future-proof Balancing concept outlined in this document, the Nordic TSOs need to be transparent and precise on upcoming modifications in the market design and the associated implementation plans. A cornerstone in the balancing concept will be an increased need for automatic FRR. This is an example that will be communicated in a trustworthy and correct way if BSPs shall have the possibility to meet the system demands. The Nordic TSOs shall use their established stakeholder forums, joint Nordic reports (e.g. the Challenge and Solution reports), as well as regularly published reports (e.g. System development plans) to inform the market players about the balancing concept and associated needs.

9.1 Internal reporting

Apart from the need of short and long-term balancing market information described above, the Nordic balancing concept requires an efficient and formalized TSO internal feedback loop from operations to the different balancing processes.

The reserve dimensioning process is based on high-resolution data on historical measured imbalances per Bidding zone and efficient sharing utilizing a statistical approach also based on historical data, for instance power flows. Future improvements of the dimensioning process where elements of the process may be moved closer to operation and ensured volumes are more dynamic will once again increase the need for well-developed and automatized data feedback and data processing.

A proactive balancing and congestion management process is also established as a central part of the new Nordic balancing concept (refer to section 6). Proactive balancing enables a more effective and extensive use of the European market coupling platform for manual FRR, but shall also be a central part of the congestion management and allow for socio-economic trade-offs when activating and/or releasing the different balancing products. The proactive balancing process will depend on reliable and detailed forecasts and will need a close to real-time feed-back loop of operational data, for instance imbalances, real availability of reserves, etc.

Finally, the Nordic balancing concept envisages an improved feedback loop from system operation to grid planning. This is obviously a different type of internal reporting process than described above, but of major importance, especially during the ongoing transformation of the power system. Planning and then operation of the grid is obviously closely linked, and operational concerns shall consequently feed into planning phase in order to maximize the socioeconomic value of any grid investment.

10 The Frequency Containment Process

The Frequency Containment Process (FCP) has in a European context the purpose of stabilization of frequency after incidents. The control target shall be to progressively replace the activated FCR by activation of FRR and frequency shall be restored within 15 minutes. Different from continental Europe, the Nordic FCP has two different products, one dimensioned and used for disturbances (FCR-D) and one dimensioned and used for normal operation (FCR-N) within the normal frequency band.

Currently the Nordic TSOs are redesigning the FCP within the Nordic Analysis Group (NAG). In this process new product specifications will be made. As several generators are affected by this, the implementation of the new design is expected to take many years before it is finished. To cope with the changes in the system characteristics in the next years, other measures like contracted tripping of consumption within the synchronous system or contracted use of Emergency Power on HVDCs are now discussed to avoid unwanted loss of load at low frequencies in strained situations, especially low inertia situations.

Activations of FCR have a significant impact on the flow in the grid and by that; there is a close relation between distribution of reserves in the synchronous system and the needed size of the Transmission Reliability Margin (TRM) in the grid. There is currently an investigation going on to find out how large this impact is on different corridors and the relations between FCR distribution and the size of the TRM. SO GL specifies dimensioning rules for FCR on control area level while the EB GL do not allow for reservation of grid capacity for exchange of FCR within the synchronous area. Consequently, flow changes due to redistribution of FCR between countries has to be allowed for within the determined TRMs between bidding zones. The impact of FCR activations on flows in the grid has a large impact on the design of the "congestion check" in the MACE controller.

The FCR-N product is closely related to the Nordic aFRR product. Both are currently designed to operate mainly within the normal frequency band and there may be some optimization benefits to earn if the two products are procured together. The role of FCR-N in the balancing concept must be further assessed.

Tests have shown that the current deliveries of FCR from different Nordic units are not as expected and wanted, and there is a large variety in delivery. There are also significant differences in the market design between the TSOs. An example is the varying risk of abuse of local market power. These issues need to be evaluated when common market arrangements are discussed.

In conclusion, there is a significant impact on balancing from the FCP, the FCP and FRP must be assessed as a whole.

11 Roles and responsibilities in balancing

In the table below, the main TSO roles are described for the balancing concept.

Roles	Responsibility for task	Comments	Type of change
Balancing Party (SN, Svk, EN & FG)	Develop appropriate capability for each bidding zone within the TSOs Control area	As is. The Nordic Balancing Concept strengthens incentives	Enforced incentives
	Continuously calculate ACE for each bidding zone within the TSOs Control area and send to Balancing principal	Not calculated correct today (may be delivered as a service from Balancing Principal)	New task
	Predict, secure reserves for and handle congestions within bidding zones included in the TSO:s control area	Current SOA is not specific on this issue. Clarifications will include specific dimensioning of FRR for this purpose, in line with the TSO responsibility in SOA and SO GL.	Clarified task
	Secure adequate FCR and FRR capacity for each bidding zone within the TSOs control area according the methodologies described in the Nordic Synchronous Operation Agreement (NSOA)	mFRR is currently not secured for forecast errors in all countries and the required distribution on bidding zones is new.	Developed task
	Continuously follow and predict future imbalances in each bidding zone within the TSO:s Control area	Responsibility for task put on all individual TSO.	New task
	Request FRR activations at relevant activation platforms in order to aim for ACE = 0 MW for all bidding zones within the TSO:s Control area	Responsibility for task put on all individual TSO. No platforms are used today	New task
	Act as interface between BSP/BRP within the TSOs Control area and relevant multinational capacity and activation platforms	No platforms are used today.	Developed task
	Keep Balancing Principal informed about requests and bids for FRR activation as well as ATCs for different products	Not done today, activations only show in NOIS.	New task

Roles	Responsibility for task	Comments	Type of change
Balancing Principal (SN & Svk)	Design the Frequency Restoration Process and potentially RR process including needed specification for the relevant products	A stronger leadership to improve efficiency in development.	Efficiency
	Design and facilitate common Nordic FCR markets	A stronger leadership to improve efficiency in development.	Efficiency
	Design and facilitate common Nordic FRR markets (capacity and energy)	A stronger leadership to improve efficiency in development.	Efficiency
	Design and facilitate potential common Nordic RR markets	No RR markets today. A stronger leadership to improve efficiency in development.	Efficiency
	Act as interface between Balancing Parties and European platforms when necessary to secure Nordic system security	Not done today, as there is no European platforms.	Developed task
	Act as back-up for European platforms	Not done today, as there is no European platforms.	Developed task
	Coordinate redispatch and countertrade within the Nordic synchronous area and with other synchronous areas if two or more Nordic Control areas are involved	More or less as today, but not clearly defined.	Developed task
	Supervise Nordic operational security (N-1) and coordinate measures in case of insufficient reserves on Nordic or Control area level	Today, no TSO has a defined overall responsibility. SO GL defines new regional requirements.	New task
	Activate FRR and potentially RR on Nordic level including responsibility for the MACE controller	Continuation of current responsibility.	Developed task
	Act as Frequency leader in alert/emergency state	Not clearly defined today.ER GL defines new regional requirements.	New task
Balancing Participant (EN & FG)	Responsibilities equal to Balancing Party	Balancing Principal has some additional responsibilities.	NA
European platforms	Design and facilitate European FRR and RR markets	Not done today, as there is no European platforms.	NA
	Activate FRR and RR on European level	Not done today, as there is no European platforms.	NA