EXPLANATORY DOCUMENT on the Proposal for RCC task of regional sizing of reserve capacity in accordance with article 37(5) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity

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INTRODUCTION

This explanatory note describes the TSOs' approach for the ENTSO-E proposal for the Regional Coordination Centres' (RCCs) task of according to Articles 37(1)(j) of the Regulation (EU) 2019/943 (hereinafter "Electricity Regulation"). Therefore, it gives background to the ENTSO-E proposal for the RCC task 'regional sizing of reserve capacity'.

For the tasks set out in Article 37(1) of the Electricity Regulation and not already covered by the relevant Network Codes or Guidelines, ENTSO-E shall develop a proposal according to Article 37(5) of the Electricity Regulation based on the procedure set out in Article 27 of the Electricity Regulation RCCs shall carry out those tasks on the basis of the proposal following its approval by ACER.

ENTSO-E identified that the RCC task according to Article 37(1)(j) of the Electricity Regulation – regional sizing of reserve capacity - is not yet fully covered by the relevant network codes or guidelines. Therefore, ENTSO-E decided to draft an ENTSO-E proposal defining this task to establish a coordinated understanding of the general aspects of the task. For the avoidance of doubt, regional in this context means the cross-border interaction of TSOs related to reserve capacity.

The facilitation by the RCC shall be in line with the existing and applicable European and National legal framework. Therefore, the RCC tasks defined in the ENTSO-E proposal must not go beyond facilitating the TSOs task 'dimensioning of reserve capacity' on regional level according to Article 6(7) of the Electricity Regulation. The allocation of such a facilitating task to the RCC shall focus on providing an added value to the relevant TSOs' task. TSOs shall have the final decision as they are obliged by regulation and liable accordingly to perform the dimensioning. Additionally, TSOs' legal obligations and local approaches, reflecting technical needs of the system, to define reserve capacity requirements and translating them into reserve capacity needs and finally into balancing capacity amounts shall be respected.

With regards to the TSOs' task of dimensioning of reserve capacity, it shall be facilitated at regional level according to Article 6(7) of the Electricity Regulation. ENTSO-E understands the proposed RCC task 'regional sizing of reserve capacity' as the facilitation of the dimensioning of reserve capacity according to Article 6(7) of the Regulation (EU) 118 2019/943.

This explanatory note gives more detailed information on the processes described in the proposal to define the RCCs' task of regional sizing of reserve capacity. Therefore, it depicts how the proposed short-term assessment of availability of sharing amounts and the determination of the minimum reserve capacity on the system operation region (SOR) level together meet the requirements of Point 7 of Annex I of the Regulation (EU) 2019/943, as ACER has agreed during alignment in the drafting phase to the TSOs.

RELEVANT LEGISLATION AND BACKGROUND

Article 40 of the Directive (EU) 2019/944[1] as well as requirements of Commission Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation (hereinafter "SO Regulation"[2]) establish the responsibilities of TSOs for local reserve dimensioning on Load Frequency Control (LFC) block level. In addition, Article 6(7) of the Regulation (EU) 2019/943 requires that the dimensioning of reserve capacity on LFC block level shall be performed by the TSOs and shall be facilitated at a regional level. This facilitation to be performed by an RCC as described in the proposal, shall provide added value to TSOs of the corresponding system operation region with a focus on the consideration of reserve sharing on a regional level and ensuring sufficient reserve capacity in the SOR. This task of an RCC facilitating the TSOs' task of dimensioning reserve capacity on a regional level shall be separate from and fully respect the local reserve dimensioning process performed and owned by TSOs forming a Load Frequency Control (LFC) block, to maintain sufficient reserves in the region covering those LFC blocks and be based on the dimensioning results.

Article 32(1) of EB Regulation requires among others that all TSOs of an LFC block shall regularly and at least once a year review and define the reserve capacity requirements for the LFC block or scheduling areas of the LFC block pursuant to dimensioning rules as referred to in Articles 157 and 160 SO Regulation respecting the requirements of Article 127 SO Regulation. The SO Regulation obliges TSOs to perform the dimensioning of frequency restoration reserves (FRR) and, when implemented, RR on the level of LFC blocks. The proposed determination of minimum reserve capacity on SOR level by the RCC will ensure sufficient reserve capacity in the SOR and also indicate to TSOs that there might be a possibility to reduce the dimensioned reserve capacity by entering into a sharing agreement following the provisions of SO Regulation. By providing this information at least on a yearly basis, the RCC facilitates the TSOs' dimensioning process.

According to Article 152(1) SO Regulation the objective of dimensioning reserve capacity FRR with automatic activation (aFRR), FRR with manual activation (mFRR) and replacement reserves (RR) according to Articles 157 and Article 160 SO Regulation is to determine the reserve capacity need on an load frequency control (LFC) block level in order to comply with the frequency restoration control error (FRCE) target parameters and dimensioning rules and thus ensuring operational security. The focus is on compliance with technical requirements. Accordingly, each TSO shall operate its control area with sufficient upward and downward active power reserves, which may include shared or exchanged reserves, to face imbalances between demand and supply within its control area.

Article 157(2)(b) SO Regulation requires that the FRR dimensioning shall take into account the restrictions for the sharing of reserves defined in Article 157(2)(j), Article 157(2)(k), Article 160(4) and Article 160(5) SO Regulation due to possible violations of operational security and the FRR availability requirements when applying the probabilistic dimensioning methodology. Additionally, all TSOs forming an LFC block shall take into account any expected significant changes to the distribution of LFC block imbalances or take into account other relevant influencing factors relative to the time period considered. Furthermore, Article 157(2)(g) SO Regulation states that all TSOs of an LFC block shall determine the reserve capacity on FRR of an LFC block, any possible geographical limitations for its distribution within the LFC block and any possible geographical limitations for any exchange of reserves or sharing of reserves with other LFC blocks to comply with the operational security limits. Further, all TSOs of an LFC block may reduce the reserve capacity on FRR of the LFC block resulting from the FRR dimensioning process by concluding an FRR sharing agreement with other

[1] *Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU, available at:* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0944.

[2] *Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (hereinafter "SO Regulation"), available at:* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.220.01.0001.01.ENG&toc=OJ:L:2017:220:TOC

LFC blocks according to Article 157(2)(j) and Article 157(2)(k) SO Regulation. Therefore, TSOs are required to assess the operational security before any sharing or exchange of FRR.

Articles 160(4) and 160(5) SO Regulation allow that all TSOs of an LFC block implementing an RR process (RR TSOs) may reduce the reserve capacity on RR of the LFC block, resulting from the RR dimensioning process, by developing an RR sharing agreement for positive or negative reserve capacity on RR with other LFC blocks. TSOs are required to assess the operational security before any sharing or exchange of RR.

Articles 166, 168 and 170 of SO Regulation define general requirements for sharing FRR and RR within a synchronous area. Following the provisions of this Article, the parties participating in a sharing agreement are a control capability receiving TSO and a control capability providing TSO. Following this, a sharing agreement is in principle a unilateral agreement. If two TSOs have concluded a bilateral sharing agreement (consisting of two unilateral sharing agreements) providing for the mutual provision of reserves, at least two unilateral sharing agreements are established. As the sharing of reserves reduces the overall amount of available reserves in the SOR, the RCC task 'regional sizing of reserve capacity' ensures operational security in a scenario where the impact of an event involving at least two LFC blocks requiring those LFC blocks to activate reserves simultaneously, needs to be assessed beyond each individual LFC block to guarantee appropriate reserve capacity and thus system operational security in the region. Articles 177 and 179 of SO Regulation provide general requirements for sharing FRR and RR between synchronous areas. Limits have to be defined by TSOs to this sharing of reserves to ensure operational security.

The RCC task of regional sizing of reserve capacity facilitates the TSOs' consideration of reserve sharing amounts when determining the reserve capacity of the LFC block within their dimensioning process. The result of the collaboration between TSOs and the RCC under regional sizing of reserve capacity represents a lower bound for the required reserve capacity of each type of reserves in the system operation region (SOR) and thus aims to ensure operational security. This amount of reserves is at least required to fulfil the minimum requirements set out in Articles 157(2) and Article 160 SO Regulation resulting in a solution guaranteeing sufficient reserve capacity in a region.

SHORT-TERM ASSESSMENT OF AVAILABILITY OF SHARING AMOUNTS

The ‘short-term assessment of availability of sharing amounts’ by RCCs is understood by TSOs as a subtask of the RCCs’ task ‘regional sizing of reserve capacity’ as a process which takes place after TSO’s dimensioning in a day-ahead or intraday timeframe. Thereby, the ‘short-term assessment of availability of sharing amounts’ takes place in full respect of the existing methodologies and processes approved locally by National Regulatory Authorities (NRAs) and already implemented by TSOs on an LFC block level. The results of the regional sizing performed by RCCs may be used by TSOs for a short-term increase of their required reserve capacity on LFC block level.

The sharing of reserves allows TSOs to decrease the reserve capacity of the LFC block resulting from the dimensioning process (performed separately by each of the TSOs) by concluding a sharing agreement between themselves. In the event that simultaneously (correlated) activation of shared reserves is required or a system situation not allowing for the provision of the initially forecasted volumes of shared reserves, there is a risk of insufficient reserve capacity in the region. Where a reserve sharing agreement exist within the SOR, the RCC shall facilitate the involved TSOs in determining the necessary reserve capacity of the LFC block by notifying the involved TSOs where and when the risk of simultaneously (correlated) activation of reserves exists. If this event poses a threat to the operational security of the SOR, the RCC task results in recommending a possible reduction of the amount of shared reserves to the relevant TSOs. Thus, this RCC task contributes significantly to ensuring system security in the SOR.

Due to the pure operational and technical focus of the dimensioning process based on SO Regulation, the focus of the RCC task of ‘regional sizing of reserve capacity’ is not on reducing the tender quantities of reserve capacity considered necessary per LFC Block, but on increasing system operational security by guaranteeing appropriate reserve capacity on a regional level. In particular, the TSOs’ consideration of restrictions defined in the agreements for the sharing of reserves or exchange of reserves due to possible violations of operational security, the FRR availability requirements and possible limitations for any sharing of reserves or exchange of reserves with other LFC blocks to comply with the operational security limits (Article 157(2)(b) and (g) SO Regulation) shall be facilitated on a regional level by the RCC.

If based on the short-term assessment performed by the RCCs, the availability of shared reserve capacity cannot be guaranteed due to simultaneously expected demands for reserve capacity in the relevant LFC blocks or insufficient cross zonal capacity available between the LFC blocks, the RCC shall notify the involved LFC blocks accordingly. Thus, the RCC recommendation suggests to the relevant TSO to increase locally available reserve capacity, up to a maximum of the reserve capacity resulting from the dimensioning process, as the TSO can no longer reduce its dimensioned reserve capacity by the sharing amount without threatening the system operational security. If the recommendation includes an adjustment of sharing, the concerns of affected TSOs, according to applicable guidelines and agreements, shall also be taken into account.

If based on the short-term assessment performed by the RCCs, the availability of increased shared reserve capacity can be guaranteed in the relevant LFC blocks and sufficient cross zonal capacity is available between the LFC blocks, the RCC shall notify the involved LFC blocks accordingly. This notification from the RCC of the possibility to increase the sharing amount shall not be considered as a recommendation. The LFC block may increase the sharing amount subject to the limits and requirements in the sharing agreement.

By allocating the short-term assessment of availability of sharing amounts to the RCC, more confidence is given to TSOs that there would be no decrease in system operational security when concluding a sharing agreement between themselves. From an economic efficiency point of view, the proposed RCC task avoids high expenses for remedial actions to maintain operational security in case of insufficient balancing capacity available. Thus, the RCC task ‘regional sizing of reserve capacity’ allows TSOs to ensure operational security with regards to complying with their frequency quality defining/target parameters in a cost-effective manner by regional cooperation and coordination.

Example for short-term assessment of availability of sharing amounts

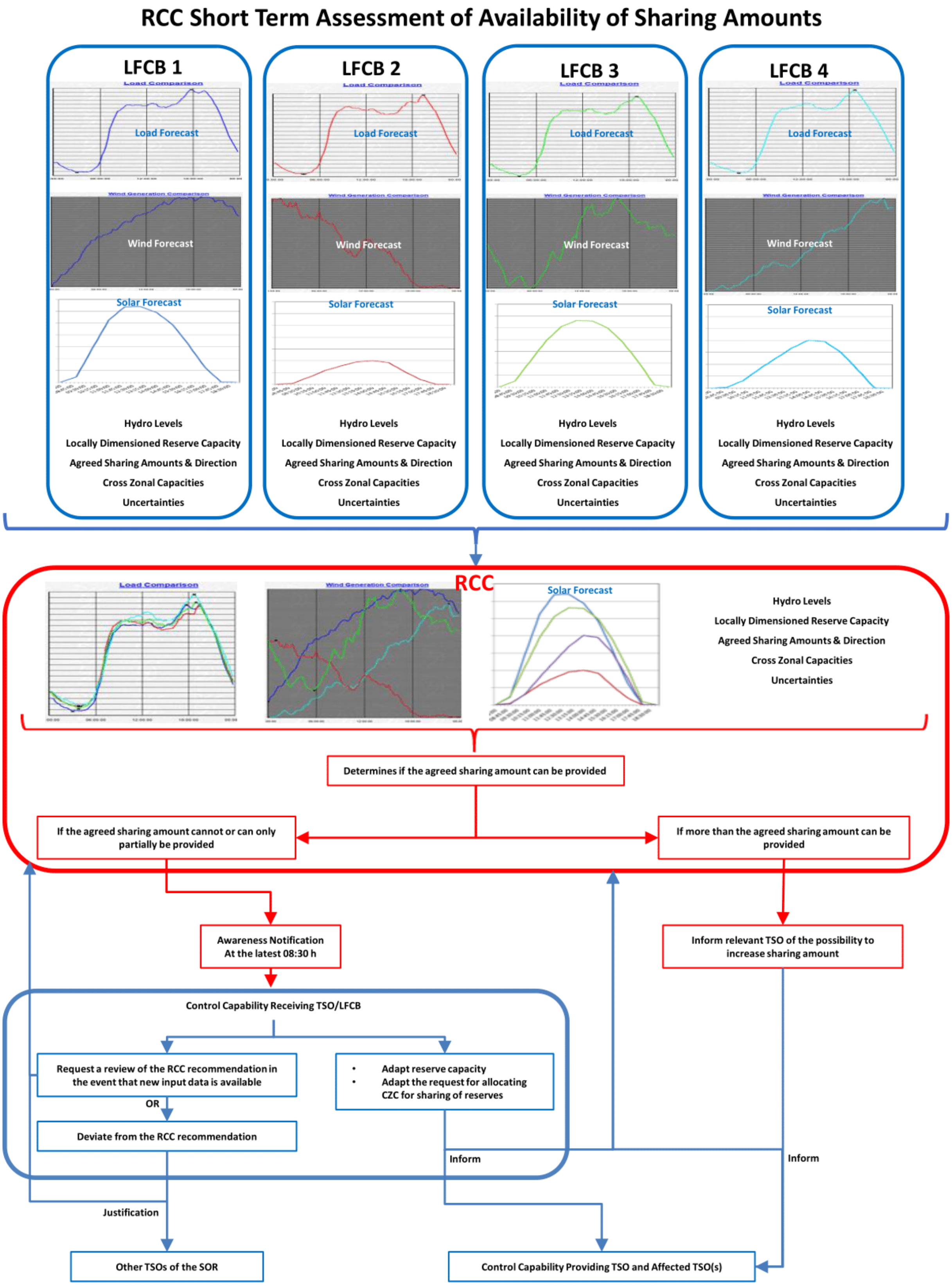
In this process, shown in the diagram on the following page, each LFCB making use of reserve sharing (as reserve receiving TSO) provides the RCC with its own load forecasts, wind forecasts, solar forecasts, expected hydro running, locally dimensioned reserve capacity, agreed reserve sharing amounts, cross zonal capacities and uncertainties related to current generation and load forecasts.
Based on the calculated regional sized reserve capacity and the uncertainties, the RCC may provide a recommendation on adjusting the amount of shared reserves used to decrease the final required reserve capacity for each type of reserves on LFCB level.

If based on comparison of the information provided the RCC determines that the agreed sharing amount cannot or can only partially be provided to the control capability receiving TSO in the relevant period, the RCC shall issue an awareness notification to these TSOs. The awareness notification should be issued 6 hours before gate closure and the control capability providing TSO and the relevant affected TSO(s) shall be informed.

On receiving the awareness notification, the control capability receiving TSO can:

- Adapt its reserve capacity;
- Adapt the request of allocating CZC for sharing of reserves;
- Request a review of the RCC recommendation in the case of new input data is available; or
- Deviate from the RCC recommendation, submitting a justification for its decision to RCC and to the other TSOs of the SOR

From SO Regulation article 157(2)(j)(i), for CE and Nordic synchronous areas, the amount of FRR that a LFC block can share is limited to the difference, if positive, between the size of the positive dimensioning incident and the reserve capacity on FRR required to cover the positive LFC block imbalances during 99% of the time. Additionally, the reduction in positive reserve capacity cannot exceed 30% of the dimensioning incident.


RCC Short Term Assessment of Availability of Sharing Amounts
LFCB 1
LFCB 2
LFCB 3
LFCB 4
Load Comparison
Load Forecast
Wind Generation Comparison
Wind Forecast
Solar Forecast
Hydro Levels
Locally Dimensioned Reserve Capacity
Agreed Sharing Amounts & Direction
Cross Zonal Capacities
Uncertainties
RCC
Determines if the agreed sharing amount can be provided
If the agreed sharing amount cannot or can only partially be provided
If more than the agreed sharing amount can be provided
Awareness Notification At the latest 08:30 h
Inform relevant TSO of the possibility to increase sharing amount
Control Capability Receiving TSO/LFCB
Request a review of the RCC recommendation in the event that new input data is available
OR
Deviate from the RCC recommendation
Adapt reserve capacity
Adapt the request for allocating CZC for sharing of reserves
Inform
Inform
Justification
Other TSOs of the SOR
Control Capability Providing TSO and Affected TSO(s)

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The following is a non-exhaustive list of parameters that RCC may consider for the short-term assessment of simultaneous risk of activation of reserves. TSOs have the responsibility to provide forecasts to RCCs, and TSOs can delegate this responsibility to RCCs.

- Weather Conditions:
    - High wind infeed, strong wind conditions
    - High sun infeed (risk of clouds)
    - Storms (Wind, snow)
    - Uncertainties of the RES forecasts.

RCCs evaluate the risk of simultaneous occurrence of reserve activation among LFC Blocks having a sharing agreement in place by comparing the time series of above listed and delivered parameters. More details about the process will be specified during the Implementation phase.

TSOs may provide additional information to be considered by RCCs. This may include:

- Special Grid conditions:
    - New systems, new processes, implemented in LFC Blocks having a Sharing Agreement
    - Fuel shortages (But this is probably more related to Adequacy issues, but the idea proposed is that such shortage could arrive suddenly)
- Specific Weather Conditions
    - Fast changes/ramp rates in RES, by identifying triggers of such fast changes in RES infeed
    - Other implications on demand or generation

Data exchange with RCC

In this paragraph are described some possible data exchange foreseen between TSOs and RCCs. During the implementation phase, more detailed data exchange and processes for performing the short-term assessment will be needed.

Data sent to RCCs by TSOs	Data sent by RCC to TSOs	
Forecasts to be collected at minimum at the LFC Block level *TSOs to investigate internally what parameters could be collected and transmitted to RCCs:*	Recommendation on increase of LFC Block balancing capacities due to short-term assessment Minimum balancing capacity needs	

• Wind speed • Light intensity • Load-forecast and influence factors such as temperature • RES infeed in MW, optionally with location of this infeed in the LFC Block • Risk of Wind decrease, unexpected level of RES infeed (to confirm that this risk is already taken into account) • Risk of RES forecasts uncertainties • Timing of the risk between LFC Blocks having a sharing agreement • Forecast for Wind/Sun curtailment • Negative prices (link with shutdown of RES infeed) • Uncertainty ratio of unplanned unavailability (whether conditions, negative prices,…)		

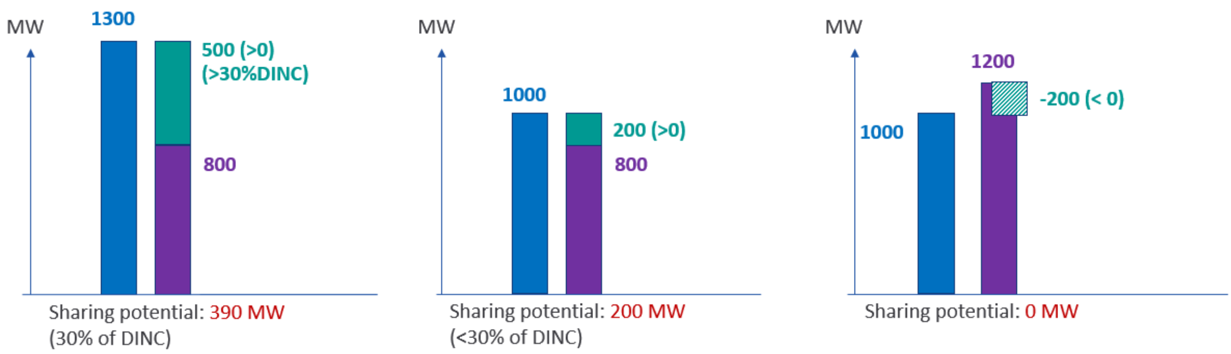
DETERMINATION OF MINIMUM RESERVE CAPACITY ON SOR LEVEL

To set up the methodology for determining the minimum reserve capacity which must be available on SOR level, TSOs took into account the provision of SO Regulation on the dimensioning of reserves. There are mainly two criteria underlying the dimensioning of reserves on LFC block level: the dimensioning incident or the probabilistic criterion (the reserve capacity must be able to cover the historical (positive and negative) imbalances at least 99% of the time).

SO Regulation allows TSOs of an LFC block to reduce the reserve capacity resulting from the dimensioning process by concluding a sharing of reserves agreement. Therefore, SO Regulation defines (for CE and Nordic SA) the possible sharing potential of an LFC block (for positive reserve capacity in general) as the *minimum of { 30% of LFC block's dimensioning incident and the maximum of [zero and the (LFC block's dimensioning incident minus the amount of reserve capacity required to cover at least 99% of the historical imbalances of the LFC block)*] }.

The LFC block imbalance corresponds to the ACE open loop following Article 3 (138) of SO Regulation).

The following gives three examples for the calculation of the sharing potential of a LFC block according to provisions of SO Regulation given the dimensioning incident in blue, the amount of reserve capacity required to cover at least 99% of the historical imbalances of the LFC block in purple and the resulting sharing potential in green.



If LFC blocks conclude a sharing of reserves agreement in line with SO Regulation, this may lead to decreased available reserves on LFC block level. Sharing of reserves is a useful option to comply with the locally determined reserve capacity requirements to ensure system operational security in a cost effective manner. On regional (SOR) level, sharing of reserves decreases the generally available reserves. Because of the assumed anti correlation of LFC block imbalances, this in a first approach is reasonable. With increasing shares of renewables and including other events with regional impact (e.g. system split), the assumption of anti-correlation can no longer be made steadily. Therefore, the RCC shall perform the proposed determination of the minimum reserve capacity to be available on SOR level, to ensure operational security in the most cost effective manner. If the summed up held reserve capacity (including the decrease by sharing of reserves) of all LFC blocks within the SOR should fall below the determined minimum reserve capacity necessary on SOR level, TSOs of the SOR would have to increase the available reserves to ensure operational security in the region.

To determine the minimum reserves required on SOR level the criteria underlying the dimensioning on LFC block level were converted to SOR level. Therefore, the sizing incident was introduced on SOR level as a reflection of the dimensioning incident. In addition, an approach to calculate the amount of reserve capacity required to cover at least 99% of the historical netted imbalances on SOR level was included in the proposal. The maximum between those two values (dimensioning incident and historical imbalances coverage higher than 99%).

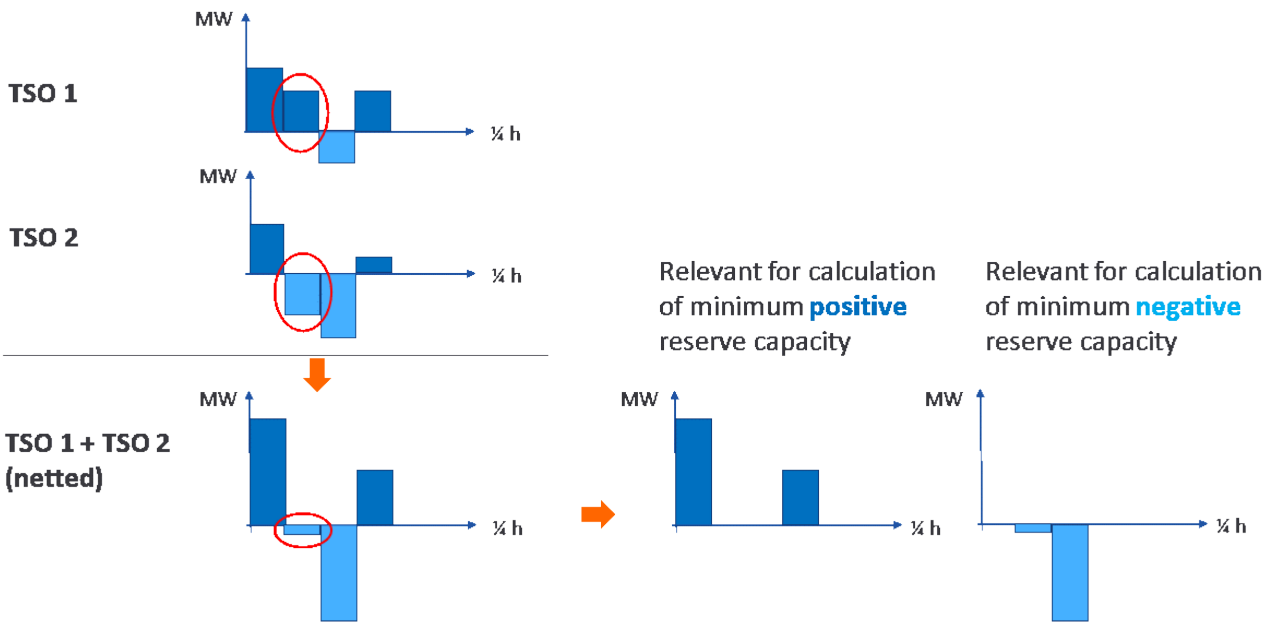
'Sizing incident' in this context means the maximum positive or negative power deviation occurring instantaneously between generation and demand in a system operation region, considered in the calculation of sharing potential. The sizing incident shall be the largest imbalance that may result from an instantaneous change of active power such as that of two power generating modules, two demand facilities, or two HVDC interconnectors or from a tripping of two AC lines, or it shall be the maximum instantaneous loss of active power consumption due to the tripping of one or two connection points. The sizing incident shall be determined separately for positive and negative direction.

In large systems such as CE, the amount of the generating capacity and demand leads to a larger probability of an additional loss of generation, consumption or in-feed before the system has recovered from a previous loss within the design window. Therefore, TSOs decided that an N-2 criterion shall be used to determine the sizing incident which is currently equivalent to 3000 MW - two biggest nuclear power units of 1500 MW each – for CE.

The minimum reserve capacity required on SOR level gives then two indications to the LFC Blocks within the SOR. First, it gives the minimum floor level to always be respected when multiple Sharing Agreement exist. On the contrary it gives an indication to the TSOs willing to set a Sharing Agreement, about the available amount of sharing that can still be implemented.

<u>Netting of LFC Block imbalances within a SOR in accordance with Article 4(1c)</u>

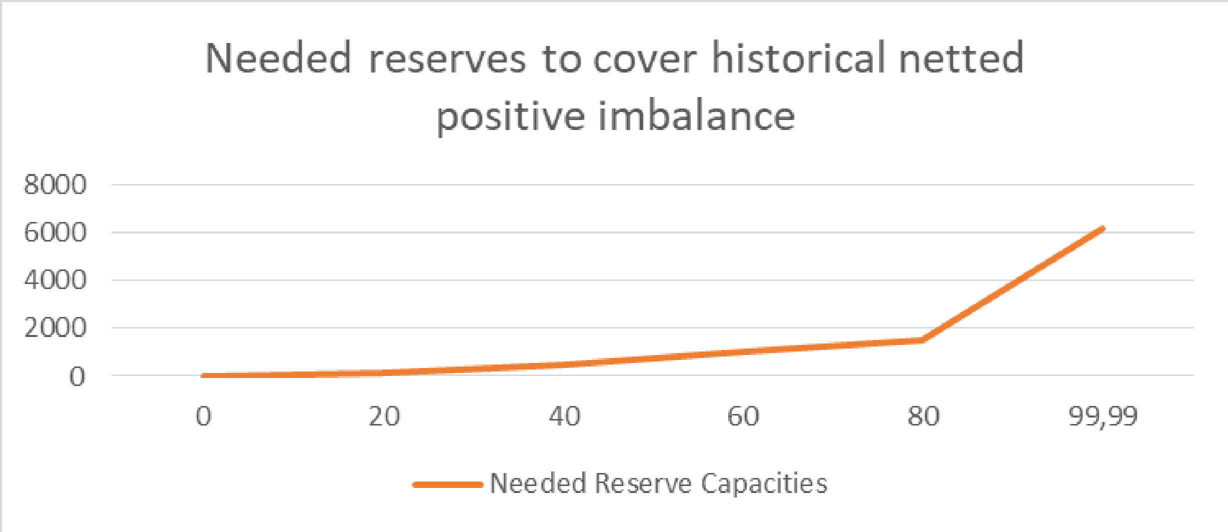
In order to sum up imbalances of LFC Blocks within a SOR, for a dedicated time serie, positive and negative values of the LFC Blocks imbalances would be summed up, as illustrated in the figure below. When considering all time series, then a chart with positive netted values can be drawn, and a chart with negative netted values can be drawn as well.



<u>Historical Coverage (at least 99,99%)</u>

For the following example a historical coverage rate of 99,99% was taken, as imbalance netting was included in the calculation of historic imbalances. Imbalance netting cannot be assumed to be available every time as a)

CZC must be available and b) there must be two opposed imbalances. Thus, a significantly higher historical coverage rate than 99% was applied. In the figure below you can see for positive netted imbalances, the process to compute the amount of needed Reserve capacity to cover at least 99,99% of the historical positive netted imbalances within the SOR. Similar chart for negative netted imbalances can be drawn. In the example below, in the considered SOR, the Needed Reserve Capacity to cover 99,99% of the time series with a Positive Netted Imbalance equals to 6187 MW .



Numerical example on determination of Minimum Reserve Capacity on the SOR Level

The following scenario is based on a System Operation Region (SOR) consisting of four Load Frequency Control Blocks (LFCB). Each LFCB has a positive and negative reserve requirement (Positive Reserves & Negative Reserves). This requirement is the result of each individual LFCB's dimensioning process on FRR or RR. In the scenario the LFCBs have concluded sharing of reserves agreements. One underlying assumption of the numerical example is that the demands for reserves of each LFCB are stochastically independent. Also shown are the maximum agreed sharing amounts which are specified in a sharing agreement. A sharing agreement is a bilateral contract where the obligation to provide reserves is unidirectional. If two TSOs have concluded a sharing agreement on mutual sharing of reserves, at least two unidirectional obligations to provide reserves are established independent of each other.

As LFCB 2 and LFCB 4 do not have a common border, their sharing agreement will include LFCB 3 as an affected LFCB. The example assumes that the agreed sharing amounts are the same in the positive and negative directions, in reality this may not be the case.

SOR X

LFCB 1	MW
Positive Dimensioning Incident	1300
Negative Dimensioning incident	-1000
Positive Reserves (99% criteria)	800
Negative Reserves (99% criteria)	-950
Maximum Agreed Sharing Amount	300

LFCB 2	MW
Positive Dimensioning Incident	1000
Negative Dimensioning incident	-1000
Positive Reserves (99% criteria)	800
Negative Reserves (99% criteria)	-800
Maximum Agreed Sharing Amount	300

LFCB 3	MW
Positive Dimensioning Incident	1500
Negative Dimensioning incident	-750
Positive Reserves (99% criteria)	1500
Negative Reserves (99% criteria)	-700

Maximum Agreed Sharing Amount	100
LFCB 4	MW
Positive Dimensioning Incident	500
Negative Dimensioning incident	-500
Positive Reserves (99% criteria)	450
Negative Reserves (99% criteria)	-500
Maximum Agreed Sharing Amount	100

To explain the arrangements on sharing of reserves in place:

- The sharing of reserves agreement between LFCB 1 and LFCB 2 is a bilateral sharing of reserves agreement with two unidirectional obligations. LFCB 1 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 2 and LFCB 2 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 1. This allows both LFCBs to reduce their locally dimensioned reserves by up to a maximum of 100 MW each, using this sharing agreement. The maximum agreed sharing amount between LFCB 1 and LFCB 2 is thus 100 MW in each direction. This results in a possible overall reduction of local dimensioned reserve capacity in the region of 200 MW resulting from this sharing of reserves agreement.

- The sharing of reserves agreement between LFCB 1 and LFCB 3 is a bilateral contract with one unidirectional obligation. In this agreement, LFCB 3 has agreed to share up to a maximum of 300 MW of its reserve with LFCB 1, but LFCB 1 does not share any of its reserve with LFCB 3. Thus, LFCB 1 can reduce its locally dimensioned reserves by up to a maximum of 300 MW, using this sharing agreement.

- LFCB 1 does not have a sharing agreement with LFCB 4.

- The sharing of reserves agreement between LFCB 2 and LFCB 3 is a bilateral contract with two unidirectional obligations. LFCB 2 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 3 and LFCB 3 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 2. This allows both LFCBs to reduce their locally dimensioned reserves by up to a maximum of 100 MW each, using this sharing agreement. The maximum agreed sharing amount between LFCB 2 and LFCB 3 is thus 100 MW in each direction. This results in a possible overall reduction of local reserve capacity needs in the region of 200 MW resulting from this sharing of reserves agreement.

- The sharing of reserves agreement between LFCB 2 and LFCB 4 is a bilateral contract with two unidirectional obligations. LFCB 2 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 4 and LFCB 4 has agreed to share up to a maximum of 100 MW of its reserve with LFCB 2. As they do not have a common border, LFCB 3 will have to be included as an affected LFCB. This allows both LFCBs to reduce their locally dimensioned reserves by up to a maximum of 100 MW each, using this sharing agreement. The maximum agreed sharing amount between LFCB 2 and LFCB 4 is thus 100 MW in each direction. This results in a possible overall reduction of local reserve capacity needs in the region of 200 MW resulting from this sharing of reserves agreement.

- LFCB 3 does not have a sharing agreement with LFCB 4.

Determination of the Minimum Reserve Capacity on the SOR Level

In this example, shown in the diagram on the next page, the RCC determines the SOR Positive Sizing Incident taking into account the change of active power of the two largest power generating modules (3000MW) and the Negative Sizing Incident taking into account the loss of power consumption due to the tripping of two HVDC interconnectors (-2000MW). In this example, LFCB 3 has two 1500MW generating modules.

Using the historical imbalance values of the LFCBs, the RCC sums up (netting) per time period the positive and negative imbalance of all four LFCBs. From the netted imbalance time series a chart with positive netted values and a chart with negative netted values can be produced. Using the netted positive imbalances and netted negative imbalances the required reserve capacity to cover the aggregated positive SOR imbalances for at least 99.99% of the time and the required reserve capacity to cover the aggregated negative SOR imbalances for at least 99.99% of the time can be calculated. In this example:

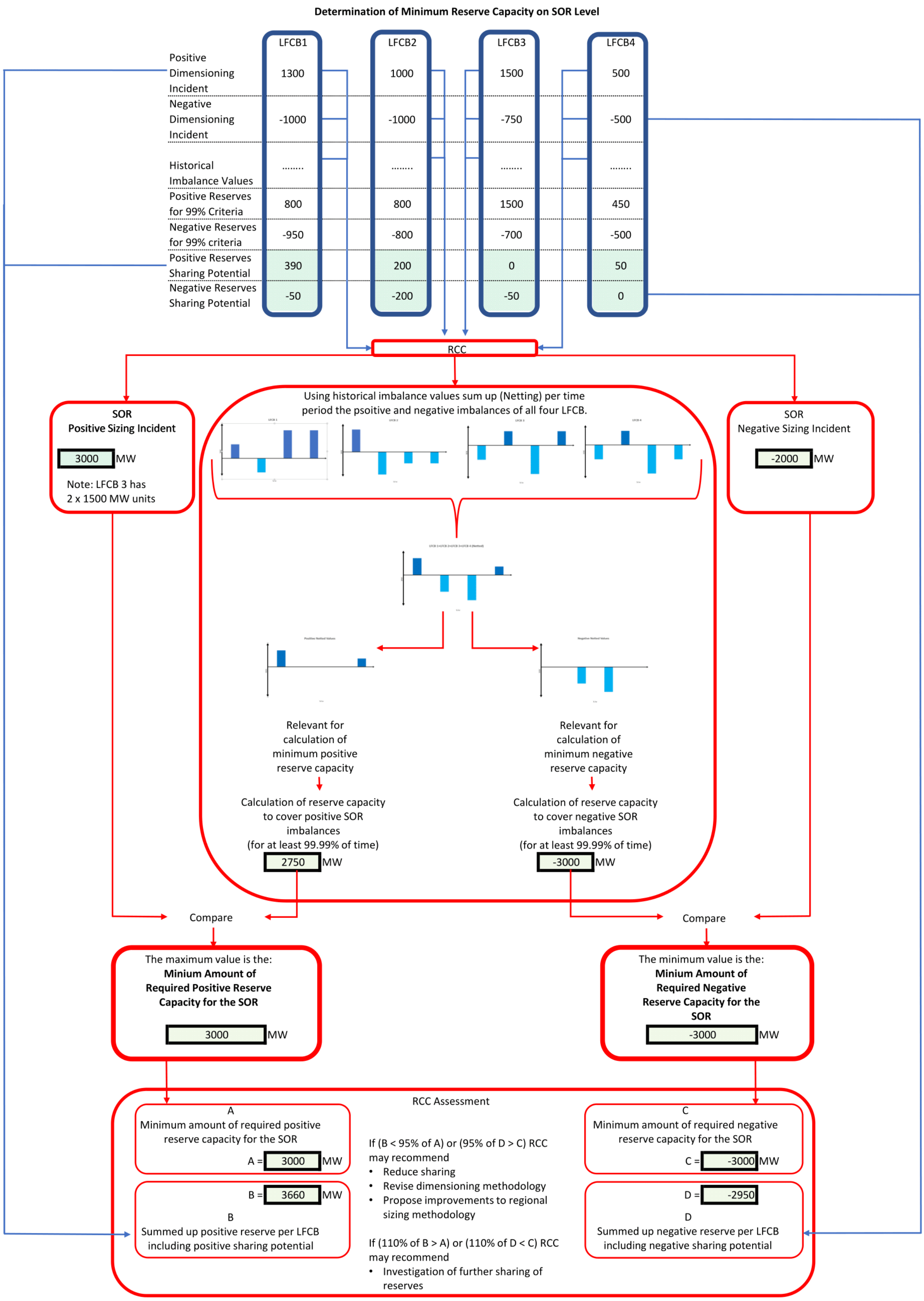
Reserve capacity to cover positive SOR imbalances (for at least 99.99% of time) = 2750MW
Reserve capacity to cover negative SOR imbalances (for at least 99.99% of time) = -3000MW

The Reserve capacity to cover positive SOR imbalances (for at least 99.99% of time), 2750MW, is compared to the Positive Sizing Incident, 3000MW. The maximum of these two values is the Minimum Amount of Required Positive Reserve Capacity for the SOR, 3000MW.

The reserve capacity to cover negative SOR imbalances (for at least 99.99% of time), -3000MW, is compared to the Negative Sizing Incident of -2000MW. The minimum of these two values is the Minimum Amount of Required Negative Reserve Capacity for the SOR, -3000MW.

As stated previously in this document, the SO Regulation allows TSOs of an LFC block to reduce the reserve capacity resulting from the dimensioning process by concluding a sharing of reserves agreement. The SO Regulation defines (for CE and Nordic SA) the possible sharing potential of an LFC block (for positive reserve capacity in general) as:

> *The minimum of {30% of LFC block's dimensioning incident and the maximum of [zero and the (LFC block's dimensioning incident minus the amount of reserve capacity required to cover at least 99% of the historical imbalances of the LFC block)] }.*


Determination of Minimum Reserve Capacity on SOR Level
LFCB1
LFCB2
LFCB3
LFCB4
Positive Dimensioning Incident
1300
1000
1500
500
Negative Dimensioning Incident
-1000
-1000
-750
-500
Historical Imbalance Values
....
....
....
....
Positive Reserves for 99% Criteria
800
800
1500
450
Negative Reserves for 99% criteria
-950
-800
-700
-500
Positive Reserves Sharing Potential
390
200
0
50
Negative Reserves Sharing Potential
-50
-200
-50
0
RCC
SOR
Positive Sizing Incident
3000 MW
Note: LFCB 3 has 2 x 1500 MW units
Using historical imbalance values sum up (Netting) per time period the psoitive and negative imbalances of all four LFCB.
SOR
Negative Sizing Incident
-2000 MW
Relevant for calculation of minimum positive reserve capacity
Calculation of reserve capacity to cover positive SOR imbalances (for at least 99.99% of time)
2750 MW
Relevant for calculation of minimum negative reserve capacity
Calculation of reserve capacity to cover negative SOR imbalances (for at least 99.99% of time)
-3000 MW
Compare
Compare
The maximum value is the: Minium Amount of Required Positive Reserve Capacity for the SOR
3000 MW
The minimum value is the: Minium Amount of Required Negative Reserve Capacity for the SOR
-3000 MW
RCC Assessment
A
Minimum amount of required positive reserve capacity for the SOR
A = 3000 MW
B = 3660 MW
B
Summed up positive reserve per LFCB including positive sharing potential
If (B < 95% of A) or (95% of D > C) RCC may recommend
• Reduce sharing
• Revise dimensioning methodology
• Propose improvements to regional sizing methodology
If (110% of B > A) or (110% of D < C) RCC may recommend
• Investigation of further sharing of reserves
C
Minimum amount of required negative reserve capacity for the SOR
C = -3000 MW
D = -2950
D
Summed up negative reserve per LFCB including negative sharing potential

In this example, LFCB 1 has a positive dimensioning incident of 1300MW and the amount of reserve capacity LFCB 1 requires to cover at least 99% of its historical imbalances is 800MW. Entering these values in the above equation results in:

Minimum of {[(0.3 x 1300)] and [maximum of (0 and (1300 – 800))]}
Minimum of {390 and [maximum of (0 and 500)]}
Minimum of {390 and 500}
For LFCB 1 the Positive Reserves Sharing Potential is 390MW.

In this example, LFCB 2 has a positive dimensioning incident of 1000MW and the amount of reserve capacity LFCB 2 requires to cover at least 99% of its historical imbalances is 800MW. Entering these values in the above equation results in:

Minimum of {[(0.3 x 1000)] and [maximum of (0 and (1000 – 800))]}
Minimum of {300 and [maximum of (0 and 200)]}
Minimum of {300 and 200}
For LFCB 2 the Positive Reserves Sharing Potential is 200MW.

In this example, LFCB 3 has a positive dimensioning incident of 1500MW and the amount of reserve capacity LFCB 3 requires to cover at least 99% of its historical imbalances is 1500MW. Entering these values in the above equation results in:

Minimum of {[(0.3 x 1500)] and [maximum of (0 and (1500 – 1500))]}
Minimum of {300 and [maximum of (0 and 0)]}
Minimum of {300 and 0}
For LFCB 3 the Positive Reserves Sharing Potential is 0MW.

In this example, LFCB 4 has a positive dimensioning incident of 500MW and the amount of reserve capacity LFCB 4 requires to cover at least 99% of its historical imbalances is 450MW. Entering these values in the above equation results in:

Minimum of {[(0.3 x 500)] and [maximum of (0 and (500 – 450))]}
Minimum of {150 and [maximum of (0 and 50)]}
Minimum of {150 and 50}
For LFCB 4 the Positive Reserves Sharing Potential is 50MW.

Similar calculations are performed to calculate the Negative Reserves Sharing Potential of each of the LFCBs.

By comparing the Minimum Amount of Required Positive Reserve Capacity for the SOR, 3000MW, to the summed up Positive Dimensioning Incidents per LFCB including the Positive Reserves Sharing Potential amounts, 3660MW, with a tolerance, the RCC can make a recommendation to the LFCBs. In this example, the RCC may recommend that the LFCBs investigate further sharing of reserves because the summed up positive reserve of the LFCBs of the SOR including positive sharing potential is greater than 110% of the Minimum Amount of Required Positive Reserve Capacity for the SOR. The threshold was set to 110 % as from operational perspective it is on the one hand giving a higher security level to have more than necessary reserves available and on the other hand to avoid too frequent investigations of small sharing amounts.

By comparing the Minimum Amount of Required Negative Reserve Capacity for the SOR, -3000MW, to the summed up Negative Dimensioning Incidents per LFCB including Negative Reserves Sharing Potential amounts, -2950MW, with a tolerance, the RCC can make a recommendation to the LFCBs. In this example the RCC may not recommend that the LFCBs reduce sharing, revise the provision of reserve capacity, and/or propose improvements to the regional sizing methodology because the summed up negative reserve of the LFCBs of the SOR including negative sharing potential is in absolute terms not greater than 95% of the Minimum Amount of Required Negative Reserve Capacity for the SOR. The threshold was set to 95 % as from operational perspective it is on the one hand giving a higher security level if reserves are increased as soon as possible to the required level but on the other hand the actions may need a lot of coordination and the efforts to do so should not start for a small gap of regional sized reserve capacity and reserve capacity dimensioned according SO Regulation.

TIMELINE

In order to take into account, the fact that the RCCs have not been active in the field of balancing until today and thus completely new tasks arise for them, an implementation period of at least 36 months seems appropriate.

The proposed implementation timeline considers the fact that RCCs involvement in this "Regional sizing of reserve capacity" is a new task specified by the CEP. This process is historically performed by TSOs. Thus, the implementation period of 36 months is supported by the following points:

- Sizing of reserve capacity is a completely new task and processes that needs to be at the RCCs. So RCCs will learn and develop the service from a black paper.

- The proposal is referring to a regional sizing of reserve capacity, however, it is not mentioned if the technical implementation (and it is not its goal) should be done on regional level or on pan-European level. So, RCCs will clarify within different SORs to align on the specific regional technical solutions. Even if having a common European tool shared by all RCCs needs to take into account the regional specificities.

- After this alignment all together either at regional or pan-European level, the timing also takes into account the potential duration related to specifications, tendering for IT solution, development of the IT solution. This is followed by the validation of the technical solution, its implementation including testing and parallel run and of course the stabilisation phase.

		goal	start	end	time interval
1.	**Regional alignment**		**1.1.2023**	**28.2.2024**	**423**
1.1.	Clarification of tasks to be requested by TSOs	Determining the tasks on the regional sizing of reserve capacity to be performed by the RCCs by the SOR TSOs	1.1.2023	1.9.2023	243
1.2.	Drafting of detailed	Detailed definition of the regional	1.9.2023	28.2.2024	180

	regional process	process of sizing of reserve capacity in cooperation with the SOR TSOs			
1.3	Clarification of IT needs	Definition of the needs for an IT tool in order to fulfil the RCC tasks in cooperation with the SOR TSOs	1.9.2023	28.2.2024	180
2.	**RCC process establishment**		**1.9.2023**	**15.12.2025**	**836**
2.1.	Internal definition of process	Determining the internal RCC process on the regional sizing of reserve capacity	1.9.2023	1.1.2024	122
2.2.	IT specification	Specifying the IT tool needed for the internal RCC process of regional sizing of reserve capacity	1.1.2024	15.6.2024	166

2.3.	IT developm ent	Realisatio n of the IT tool needed for the internal RCC process of regional sizing of reserve capacity	15.6.2024	15.6.2025	365
2.4.	IT testing	Testing of the IT tool needed for the internal RCC process of regional sizing of reserve capacity	15.6.2025	15.12.202 5	183
3.	**Go-live Phase**		**1.9.2024**	**15.6.2026**	**652**
3.1.	Operation al SLA finalisatio n	To finalise the Operation al SLA of the service including the KPIs	1.9.2024	28.2.2025	180
3.2.	Go-live. Check list completio n	Fill and sign the go-live checklist before starting the Parallel run	15.12.202 5	15.3.2026	90
3.3.	Training Operators	Train Operators to provide the service	15.12.202 5	15.3.2026	90

3.4.	Trial Run	Monitor the sizing and procurement process of TSOs according to the set process to identify possible risks	15.3.2026	15.6.2026	92
3.5.	Go-live		15.6.2026	15.6.2026	0

FREQUENTLY ASKED QUESTIONS (FAQ)

1) Is the proposal aiming for a common methodology for the whole EU Region or for different methodologies for each System Operation Region (SOR)?
    - The proposal aims for a common pan-EU methodology, but every SOR has dedicated implementation due to the specificities of regions.
2) Are different regional IT tools to be developed for the RCC service or a common pan-European tool (similar to what we have for STA and OPC)?
    - Different tools can be developed for the different SORs.
    - But the results of the calculations need to be comparable, so common input/output data contents and formats are to be defined
3) Which types of reserves are part of the scope of the proposal (FCR, aFRR, mFRR, RR)?
    - aFRR, mFRR and RR
4) What are the roles and responsibilities of RCCs in the regional procurement of balancing capacity?
    - Please refer to the business process description.
5) What are the interdependencies with other services/tools already assessed (e.g. STA, CCC)? Are there any possibilities to use data from other services for this service?
    - CCC: available amount of capacity
    - STA: ?
    - ROSC: impact of sharing on network flows
6) Is the usage of CGMES format to be assessed for the service?
    - The CIM format used for the network modelling can be applied for the purposes of this service, too.
    - This question is to be decided during the IT development phase, based on actual common requirements.

GLOSSARY OF TERMS

The glossary shall provide a short description of the term and a reference where further details can be found (e.g. to regulations, guidelines, descriptions)

Term	Definition
BSPs (Balancing Service Providers)	EB GL Art 2(6): 'balancing service provider' means a market participant with reserve-providing units or reserve-providing groups able to provide balancing services to TSOs;
CZCA (Cross Zonal Capacity Allocation)	methodologies for allocating cross-zonal capacity to the balancing timeframe pursuant to Chapter 2 of Title IV of EB GL.
CZCAOF (Cross Zonal Capacity Allocation Optimisation Function)	Harm. CZCA Method Art. 2(2)(b) 'Cross-zonal capacity allocation optimisation function' means the functionality that determines for each application and for each SPBC in each direction the allocation of cross-zonal capacity for the exchange of energy and for the exchange of balancing capacity or sharing of reserves. For the market timeframes of the co-optimised allocation process and the market-based allocation, the cross-zonal capacity allocation optimisation function shall determine the clearing prices and volumes of balancing capacity of each SPBC per bidding zone;
DAM (Day-Ahead Market)	CACM Art. 2(34) 'day-ahead market time-frame' means the time-frame of the electricity market until the day-ahead market gate closure time, where, for each market time unit, products are traded the day prior to delivery;
FCR (Frequency Containment Reserves)	SO GL Art. 3(6) 'frequency containment reserves' or 'FCR' means the active power reserves available to contain system frequency after the occurrence of an imbalance;
FRCE (Frequency Restoration Control Error)	SO GL Art. 3(43) 'frequency restoration control error' or 'FRCE' means the control error for the frequency restoration process (FRP) which is equal to the area control error (ACE) of a load frequency control (LFC) area or equal to the frequency deviation where the LFC area geographically corresponds to the synchronous area;
LFCB (Load Frequency Control Block)	SO GL Art. 3(18) '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;
FRR (Frequency Restoration Reserves), aFRR, mFRR (Automatic/Manual FRR)	SO GL Art. 3(7) 'frequency restoration reserves' or 'FRR' means the active power reserves available to restore system frequency to the nominal frequency and, for a synchronous area consisting of more than one LFC area, to restore power balance to the scheduled value; SO GL Art 3(99) 'automatic FRR' means FRR that can be activated by an automatic control device; Full activation time of standard products of balancing energy aFRR: 5min mFRR: 12.5min

MCO (Market Coupling Operator)	CACM GL Art. 2(30) 'market coupling operator (MCO) function' means the task of matching orders from the day-ahead and intraday markets for different bidding zones and simultaneously allocating cross-zonal capacities; CACM Whereas (5) The market coupling operator (hereinafter 'MCO') uses a specific algorithm to match bids and offers in an optimal manner. The results of the calculation should be made available to all power exchanges on a non-discriminatory basis. Based on the results of the calculation by the MCO, the power exchanges should inform their clients of the successful bids and offers. The energy should then be transferred across the network according to the results of the MCO's calculation. The process for single day-ahead and intraday coupling is similar, with the exception that the intraday coupling should use a continuous process throughout the day and not one single calculation as in day-ahead coupling.
Regional Sized Reserve Capacity	required reserve capacity for the system operation region
RR (Replacement Reserve)	SO GL Art. 3(8) 'replacement reserves' or 'RR' means the active power reserves available to restore or support the required level of FRR to be prepared for additional system imbalances, including generation reserves; Full activation time of standard products of balancing energy for RR 30 min.
Control Area	SO GL Art. 3(12) '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;
BSP-TSO gate closure time	EB GL Art. 2(27) 'balancing energy gate closure time' means the point in time when submission or update of a balancing energy bid for a standard product on a common merit order list is no longer permitted; EB GL Art. 24
required local reserve capacity / local reserve capacity needs / NRC (Needed Reserve Capacity)	SO GL Art 3(95) 'reserve capacity' means the amount of FCR, FRR or RR that needs to be available to the TSO; In RCC Procurement/Sizing Methodology FCR is out of scope.
available cross-zonal capacity	for CZCA: CZC calculated following CACM GL Art. 14 1(a)
non-contracted balancing energy bids	balancing energy bids, which are submitted without a prior contract for balancing capacity. Indirect Definition: EB GL Art 16(5)
balancing energy cooperation platforms, IGCC, PICASSO, MARI, TERRE	EB GL Art. 2(24) 'exchange of balancing energy' means the activation of balancing energy bids for the delivery of balancing energy to a TSO in a different

	scheduling area than the one in which the activated balancing service provider is connected; European platforms pursuant to Articles 19(1), 20(1), 21(1) and 22(1) EB GL IGCC: International Grid Control Cooperation Imbalance Netting (entsoe.eu) PICASSO: Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation PICASSO (entsoe.eu) MARI: Manually Activated Reserves Initiative Manually Activated Reserves Initiative (entsoe.eu) TERRE: Trans European Replacement Reserves Exchange TERRE (entsoe.eu)
TSO-TSO model	EB GL Art. 2(21) 'TSO-TSO model' means a model for the exchange of balancing services where the balancing service provider provides balancing services to its connecting TSO, which then provides these balancing services to the requesting TSO;
co-optimised allocation of cross-zonal capacity	EB GL Art. 42
market-based allocation	EB GL Art. 41
inverted market-based allocation	EB GL Art. 41 after DA Market + Harm. CZCA Method Art. 2(2)(d)
probabilistic methodology	EB GL Art. 33(6)
forecast of market value	EB GL Art. 39 Calculation of market value of cross-zonal capacity
order books / adjusted order books	collection of all DA orders submitted to the SDAC operator submitted by relevant NEMOs adjusted: shifted SDAC order book by CZCA forecast entity
CZC (cross-zonal capacity)	Transmission capacity on bidding zone border Regulation (EU) 2019/943 Art. 2 (70) 'Cross-zonal capacity' means as defined in Article 2(70) of Commission Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast).
SDAC	CACM Art. 2(26) 'single day-ahead coupling' means the auctioning process where collected orders are matched and cross-zonal capacity is allocated simultaneously for different bidding zones in the day-ahead market;

CPOF	EB GL Art. 2(42) ‘capacity procurement optimisation function’ means the function of operating the algorithm applied for the optimisation of the procurement of balancing capacity for TSOs exchanging balancing capacity.
ETP (European Transparency Platform)	Art. 3 of Regulation (EU) No 543/2013
exchange of reserves	SO GL Art. 3(96) ‘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; EB GL Art. 2(23) ‘exchange of balancing services’ means either or both exchange of balancing energy and exchange of balancing capacity; EB GL Art. 2(24) ‘exchange of balancing energy’ means the activation of balancing energy bids for the delivery of balancing energy to a TSO in a different scheduling area than the one in which the activated balancing service provider is connected; EB GL Art. 2(25) ‘exchange of balancing capacity’ means the provision of balancing capacity to a TSO in a different scheduling area than the one in which the procured balancing service provider is connected;
sharing of reserves	SO GL Art. 3(97) ‘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;
SPBC	EB GL Art. 25(2) standard products for balancing capacity for frequency restoration reserves and replacement reserves.
Providing TSO	SO GL Art. 3(103) ‘control capability providing TSO’ means the TSO that shall trigger the activation of its reserve capacity for a control capability receiving TSO under the conditions of an agreement for sharing reserves;
Receiving TSO	SO GL Art. 3(104) ‘control capability receiving TSO’ means the TSO calculating reserve capacity by taking into account reserve capacity which is accessible through a control capability providing TSO under the conditions of an agreement for sharing reserves;
Affected TSO	SO GL Art. 3(94): ‘affected TSO’ means a TSO for which information on the exchange of reserves and/or sharing of reserves and/or imbalance netting process and/or cross-border activation process is needed for the analysis and maintenance of operational security;
ACE open loop	SO GL Art 3(19) ‘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; SAFA B-6-2-2-1-5 ACE open loop (ACEol) means the remaining ACE open loop without contribution of mFRR and RR activations.
positive/negative sizing incident	SO GL Art. 3(58) 'reference incident' means the maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in the FCR dimensioning;

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