1. Market Response in Belgium

This document discusses how market response in Belgium can be estimated to be taken into account in adequacy studies, in the context of determination of strategic reserves.

As consumers may react when electricity is in limited supply by lowering their net consumption, it is important to take this market response into account to avoid overestimating the strategic reserve needed.

Section 1.1 provides a brief overview of how market response has been assessed using the aggregated curves in the past, and of the procedure resulting in the development of the new method which allows for market response from block orders to be integrated into the process of determining strategic reserve volume and for integrating additional NEMO's. Section 1.2 then gives a detailed description of the newly developed method.

1.1. Introduction

Market response is a crucial dynamic parameter when difficult situations arise on the electricity grid, especially under demanding conditions when adequacy problems arise. European policymakers (2009/72/EC and 2012/27/EC), national politicians and regulators are all pushing for the further development of market response (MR). Their urging is echoed by the market stakeholders' call (flexibility-requesting parties (FRPs), BRPs, producers, suppliers, third-party aggregators and customers) to fine-tune the methodology used to identify the volume of market response in Belgium when determining the strategic reserve volume.

In 2015, Elia sent a questionnaire to BRPs, Elia grid users and/or aggregators to estimate market response at times of system stress. The survey investigated three types of flexibility through load reduction in the market: based on contracts, on prices and on a voluntary mechanism. The results focused on the flexibility available to market participants, not on the volumes that Elia can contract and activate when balancing reserves or drawing on the strategic reserve.

In 2017, a broad range of market players expressed their willingness to participate in developing a new method for determining market response in Belgium as part of the process for determining the strategic reserve volume. In January 2017, in the context of the Task Force 'Implementation Strategic Reserve', a Demand Response Study subgroup was set up to design the most appropriate methodology for determining these market response volumes. Its work was conducted together with E-CUBE Strategy Consultants. The method they designed was based on interactions with stakeholders over four workshops and bilateral interviews.

During the Task Force meetings in 2019 (July and September[1]), it was discussed to adapt the methodology in view of stakeholder feedback on the fact that some volumes may not be fully captured. In particular:
- Look into multi-NEMO compatibility (since Nord Pool has entered in the Belgian market), with the possibility to integrate more NEMOs ;
- Re-assess the assumptions originally taken on block orders (simple and complex throughout this section), provided the data on block orders is made available.

The following methodology assumes that the aggregated curves and block orders (executed and non-executed) are made available by the NEMOs.

1.2. Development of a new method for determining market response volume

The market response used in the context of determining the strategic reserve volume, encompasses the full, energy-only market response when prices are exceptionally high. The market response under normal price conditions (i.e. prices < €150/MWh, threshold set in the 2017 methodology) is already taken into account in the normalised load profile constructed by Elia for its adequacy study. The newly developed methodology makes it possible to determine the market response volume available when prices are exceptionally high (> €150/MWh). The conclusion reached was that the method can estimate the market response across all different consumer segments.

Based on the workshops and input from consultants, it was concluded that the entire available market response can be taken into account by following the threefold approach set out below (see Figure 1).

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[1] https://www.elia.be/en/users-group/wg-balancing/taskforce-strategic-reserve/20190919-meeting

Global market response volumes can be estimated by analysing the aggregated demand and supply curve (section 1.2.1). Following the stakeholders' remarks, the newly proposed methodology integrates market response volumes from the block orders (section 1.2.2) and additional NEMOs. At this stage, NEMOs currently active in day-ahead markets in Belgium include EPEX Spot and Nord Pool Belgium. It is important to note that the methodology used can be applied to any number of NEMOs. The qualitative questionnaire to assess the activation details and lastly verified by performing a sanity check still applies. This questionnaire was delivered in 2017 and it is deemed unnecessary to repeat the operation every year. Moreover, yearly submissions to public consultation of the input data have not indicated a need for change.
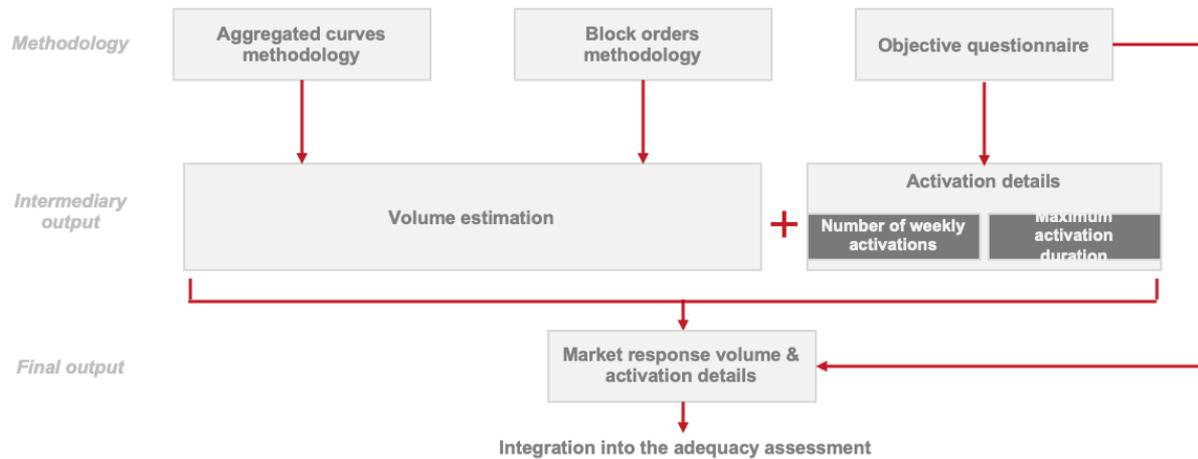

Figure 1

1.2.1. Aggregated curves- analysis: estimating global volume

As developed through the 2017 methodology, aggregated curves enable the market response volume to be estimated for contract-based, price-based and voluntary market responses. In these aggregated curves, market response volumes can take the form of a drop in demand or an increase in supply.

The **drop in demand** due to a price increase is directly incorporated in the aggregated curves by studying the decreasing volume associated with the price increase from €150/MWh (the lower limit for market response volumes) to €3,000/MWh (the maximum day-ahead price), as is evident in Figure 2. Since aggregated curves are provided every hour, this volume comparison is also computed hourly.
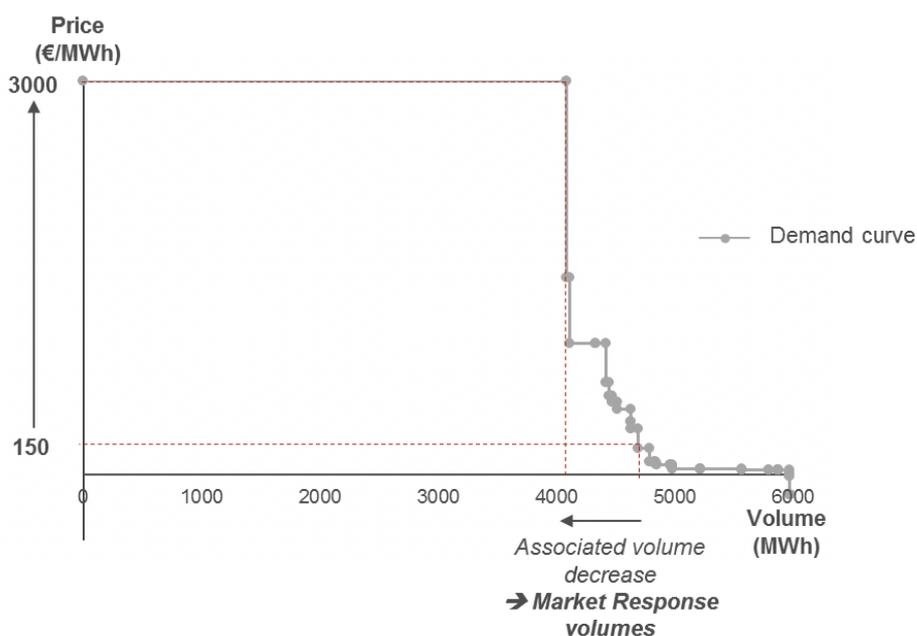

Figure 2

On the demand side, the output is the market response volume every hour. For example, if 400 MW are above the €150/MWh limit, the estimated market response volume for that particular hour is estimated to be 400 MW.

Instead of a drop in demand, suppliers can value market response in terms of **increased supply** to the market. The market response cannot be directly deducted from these curves as they aggregate this capacity with generation. Contrary to demand curves, where the presence of bids representing reduced generation is considered very limited above €150/MWh, supply curves can contain generation bids in this price range.

Generation bids higher than €150/MWh can be justified by extraordinary variable costs, such as foreign sourcing. To refine the analysis of the supply curve, two price thresholds are considered (see Figure 3):

- **€150/MWh**: generally regarded as the limit bid for generation assets, even if some generation assets can justify higher bids in specific cases;
- **€500/MWh:** above this value, it is deemed very difficult to justify the price, and it can be assumed that only demand response bids will appear in the curves.
  The analysis of supply-aggregated curves provides a range including:
- **a low estimate** for the supply side that does not take account of the potential value under €500/MWh, but definitely excludes generation;
- **a high estimate** that integrates the adequate scope of market response but may also take account of additional volumes of generation assets.
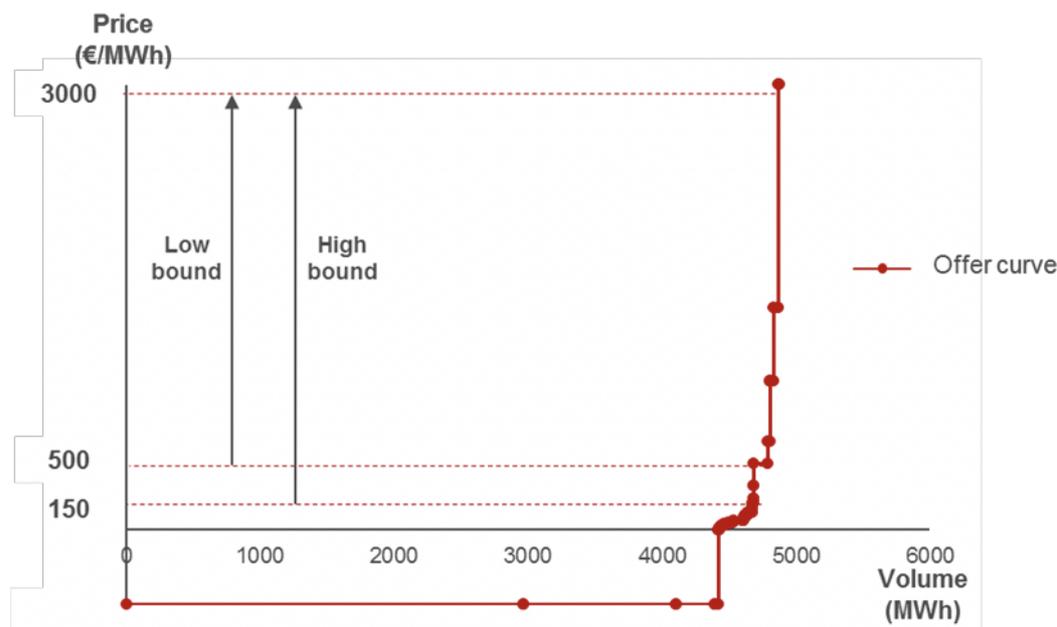
Figure 3

The curves do implicitly take account of over-the-counter (OTC) bids. If this volume would not be in the curves, it would correspond to irrational behaviour by the stakeholders, which was not taken into account in the study, as formalized in the 2017 methodology discussed with market stakeholders.

As an example, if the volume above €150/MWh is 150 MW and the volume above €500/MWh is 100 MW, the market response volumes presented as values in the supply curve can be considered to fall within the 100-150 MW range. The volume obtained by following this method corresponds to the adapted scope for contract-based and price-based market responses, as well as the voluntary market response forecast by market players. If some volumes are in the voluntary market response category, the market players will anticipate such events. Theoretically, their anticipation should be reflected in bidding behaviour, if the BRPs deem the changes to be definite, with the voluntary market response then implicitly taken into account in this methodology. In general, this approach makes the methodology robust with an eye to future changes (e.g. new technologies facilitating market response), since any change that the market players deem or will deem to be firm will appear in the aggregated curves and will therefore be considered in the analysis.

1.2.2. Block orders analysis

The block orders must be treated separately because the aggregated curves do not completely integrate them:
- Only executed blocks are integrated within the curves;
- They are not placed at their price but "at all price", i.e. 3000 € for the demand side and -500€ for the offer side

The block orders are not in the Market Response as calculated according to the 2017 methodology.

However, as the block order volumes are increasing (28% average yearly increase for 2017-2019), it was decided to re-assess the assumptions originally taken on block orders and adapt the methodology to include MR volume from block orders in the analysis. Indeed, it was deemed in 2017 that the volume of market response from block orders was very limited and would not significantly impact total market response volume[2].

1.2.2.1. Overview of block orders

There are several types of block orders requiring specific methodologies for assessing MR volume. Here we give an overview of the different block orders.
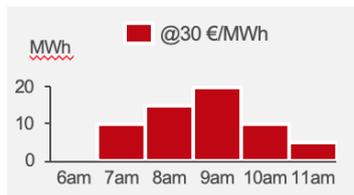
Simple blocks cover several hours and can be either entirely executed or entirely rejected. Whereas the volumes within a simple block can vary between hours, the price is the same for all hours.

Figure 4
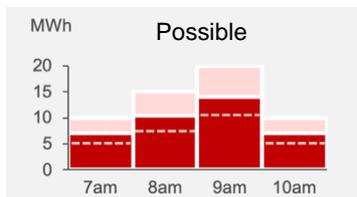
The notion of **curtailable blocks** adds an additional level of complexity but is crucial when dealing with block orders. Indeed, submitted blocks do not need to be executed at their maximum volume, they can be partially executed.

At the time of their submission, block orders will specify a Minimum Acceptance Ratio (MAR) defining the minimum volume that can be executed. Under this MAR, no volume will be executed for this block. The MAR is a number in [0:1].
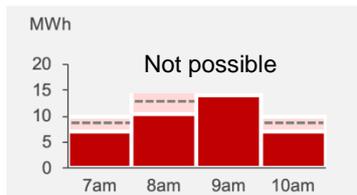
All types of blocks in block orders can be curtailable. The MAR of a group of blocks is the same for all blocks. For example, all the blocks from a group of exclusive blocks will have the same MAR. As for simple blocks, the MAR is the same over all hours, and in the case of block execution, the executed ratio is also the same over all hours. The figures on the left give an illustration of a possible situation (execution ratio above the MAR) and an impossible situation (execution ratio below the MAR).
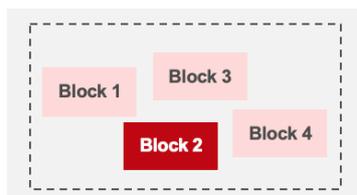
Figure 5

Figure 6

Exclusive blocks are a group of mutually exclusive blocks. Only one block within the group can be executed, all the others will automatically be rejected. The executed block is the one that maximizes the value of the market.

[2]https://www.elia.be/fr/users-group/groupe-de-travail-balancing/groupe-de-travail-reserve-strategique/2018-07-09-reunion
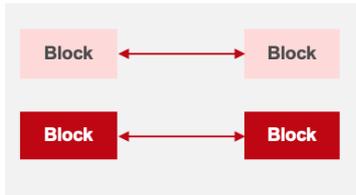
Loop blocks are groups of two blocks which are either executed as a couple or rejected as a couple. They allow for instance to bundle buy and sell blocks. Looped blocks are only offered at EPEX.
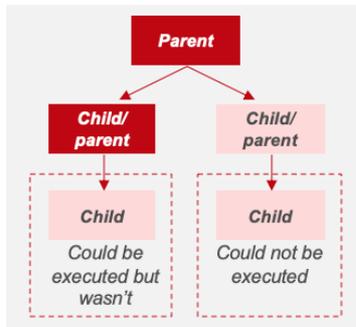
Figure 7

Linked blocks consist in sets of blocks with a linked execution constraint. Indeed, linked blocks are assembled in a hierarchical manner with the execution of a child block only possible if its father block was executed.

Figure 8

1.2.2.2. MR volume from block orders

As mentioned previously the different block order types require specific methodologies for assessing MR volumes. However, these methodologies all follow three principles to keep them in line with the methodology used for the aggregated curves (section 1.2.1).

Coherence with the market response definition	The market response volume is the total (net) volume that reacts when prices rise from 150/500 €/MWh (high/low thresholds) until 3000 €/MWh (not included), either by a generation increase (offer curve) or a consumption decrease (demand curve) → **Only bids above this 150/500 €/MWh Market Response Threshold (MRT) will be considered**
Multi-hour activation of block orders	*Observation: compared to simple bids, block orders actually span over multiple hours. This means that their activation in fact does not only depend on a price increase in one hour, but over multiple hours* Principle: high prices triggering market response activations (i.e. above 150/500 €/MWh) are considered to occur simultaneously over several hours of a day: this is a Market Response event. This avoids underestimating market response. → **We consider that hours around a Market Response event are correlated and that the prices rise equally**
Avoidance of double counting	→ **Only what is contractually possible in the bids is accepted – e.g.:** • **No double counting for blocks into MR**: *e.g.: only one exclusive block from a group of exclusive blocks can be counted, either in the market response, or excluded from it* • **All bids above the MRT are integrated into MR if they are deemed available (i.e. are contractually possible) during a MR event**

The data for the block orders analysis has to be provided by the NEMOs active in Belgium. This includes, for all types of block orders, information on date, execution, limit price, hourly volume information, acceptance ratio, etc. For example, for EPEX, the BBOF files include all the required details on the block orders.

These principles derive into a methodology of integration in the market response volume for each block order – overview:

ORDER BLOCKS	RULES OF INTEGRATION
1 Simple blocks[1)] NORD POOL >epexspot	If the block price is above the MR Threshold[1)], then it is considered as MR
2 Curtailable blocks NORD POOL >epexspot	If the curtailable block price is above the MR Threshold[1)], then it is considered as 100% MR, <u>whatever the minimum acceptance ratio</u>
3 Exclusive blocks[2)] NORD POOL >epexspot	1. The block that would contribute most to the loss of load avoidance – the one with the highest volume – is "selected" 2. If this block is above the MR Threshold, then it is considered as MR
4 Loop Blocks >epexspot	Only the <u>blocks</u> above the MR Threshold are considered as MR.
5 Linked blocks NORD POOL >epexspot	All the submitted linked blocks above the MR Threshold will be considered as MR

1) Excluding Block at -500€/MWh and blocks at 3000 €/MWh; 2) Called Exclusive group at Nord Pool

These principles will affect block order types differently:
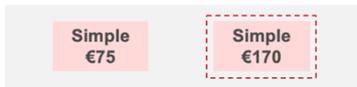
Simple blocks will be considered MR if the price limit is above the MR threshold.

Figure 9

Exclusive blocks are analysed in two steps.
1.   The block that would contribute most to loss of load avoidance – the one with the highest volume is "selected"
2.   If the block is above the MR Threshold, then it is considered as MR

Figure 10
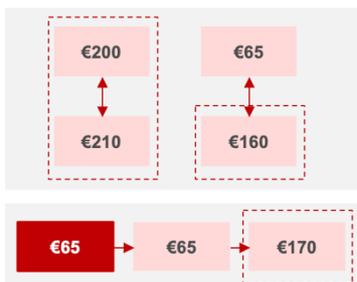
Linked blocks and **loop blocks** are assessed as MR as long as their price is above the MR Threshold.
For loop blocks: if both blocks are below the MR Threshold, then it is not MR.
For linked blocks: all the submitted linked blocks above the MR Threshold will be considered as MR

Figure 11

When calculating MR for block orders, the MAR is not taken into account. The block is either counted as MR for 100% of its volume, or it is not counted as MR, in order to grasp the full market response potential of that block order.

1.3. Consolidation of market response volumes

For each NEMO, the market response volume is assessed for simple bids from the aggregated curves (following the methodology set in 2017) and from the block orders (following the methodology described in the section above). These two values are summed to derive the market response volume for this NEMO.
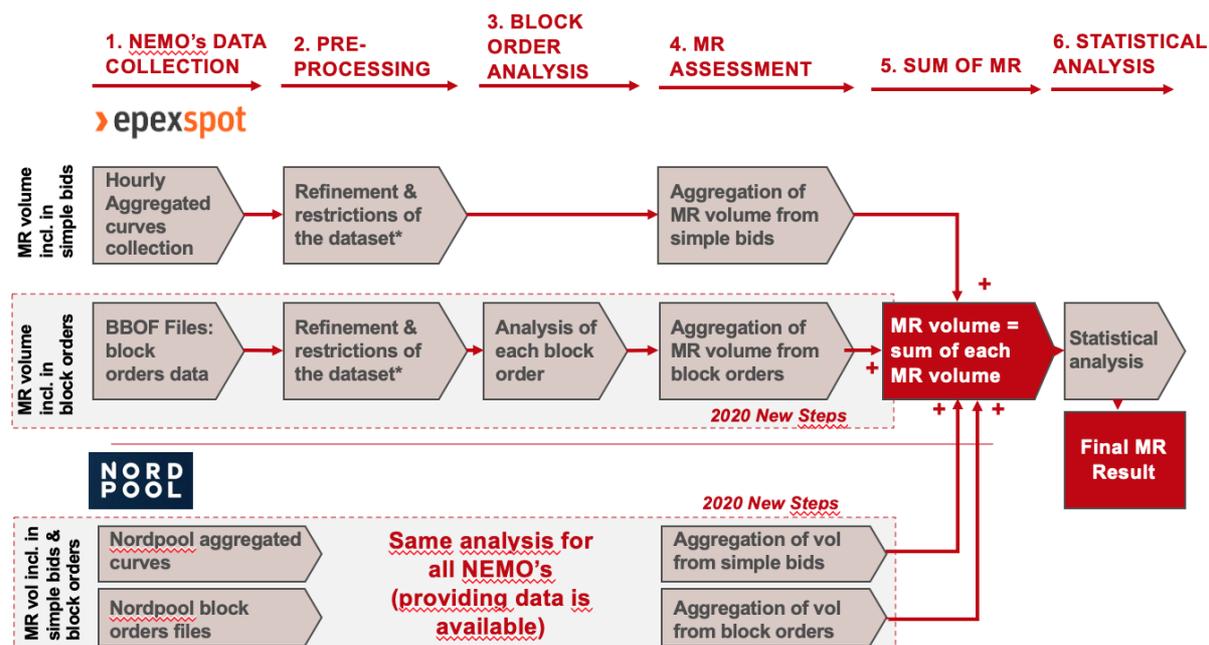

Figure 12

Following the methodology in this section, the final Market Response volume is obtained by summing the MR volume from each NEMO active in Belgium during the winter period analysed.

At the time of writing this document, the consultants have received the required data on bids (aggregated curves) and on block orders (BBOF files) from EPEX. Nord Pool Spot has agreed to provide the data, yet the consultants have not yet received it, despite numerous contacts.

A specific analysis will be performed on the last two weeks of March, to grasp the potential impact of the covid crisis on the MR volumes.