Integration of the Market Response 2019

Task Force Implementation Strategic Reserve – Presentation

Brussels, April 1st 2019
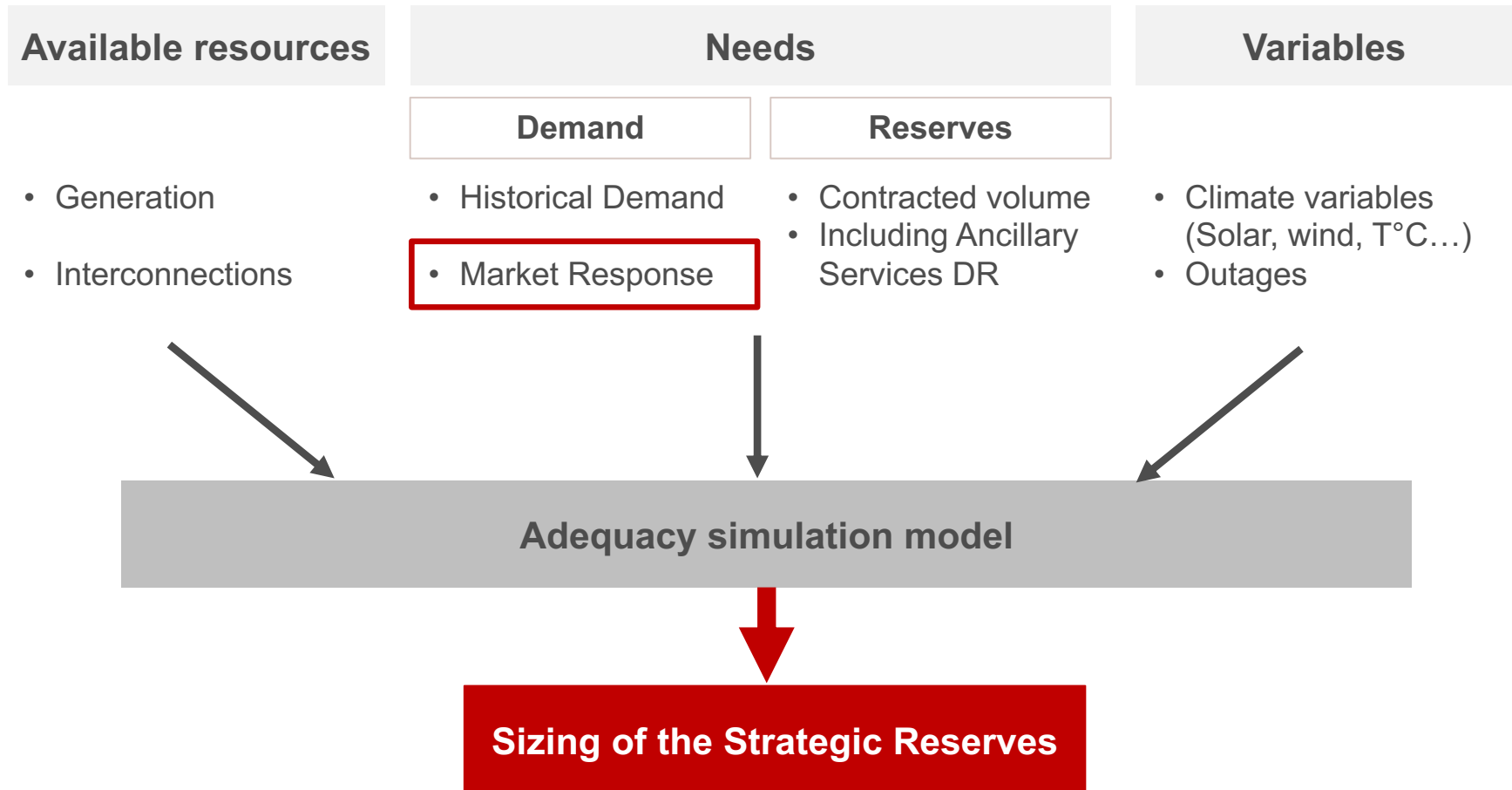
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Market Response volume determination is essential to size the volumes of Strategic Reserves

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Market Response corresponds to the response of electricity consumers in periods of tension and high prices in the electricity grid

Available resources	Needs		Variables
	Demand	**Reserves**	
• Generation	• Historical Demand	• Contracted volume	• Climate variables (Solar, wind, T°C…)
• Interconnections	• Market Response	• Including Ancillary Services DR	• Outages

Adequacy simulation model

Sizing of the Strategic Reserves

In the aggregated curves of EPEX DAM Belgium, Market Response volumes appear as a demand decrease or as an offer increase

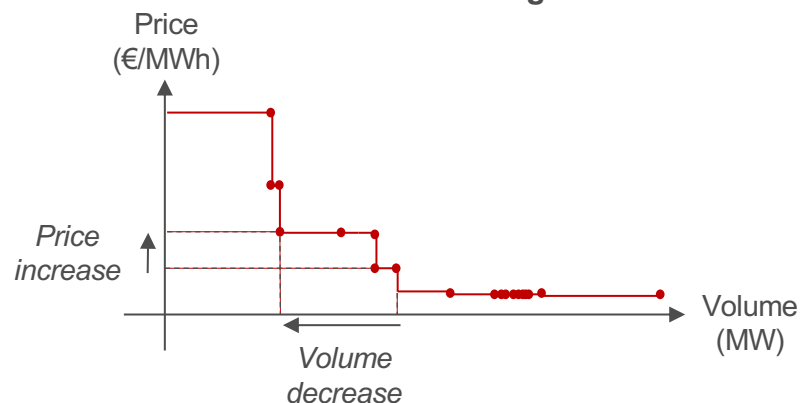## Market Response volumes valued in the DA market

Demand decrease

- This part can be analyzed directly in the aggregated demand curve, by studying the decrease of volume when price increases

Demand curve for a given hour

Price (€/MWh)

Price increase

Volume decrease

Volume (MW)

Offer increase

- Instead of a demand decrease, suppliers can value Market Response as new offer in the market: this part would appear in the supply curve

- Due to the possible presence of generation bids in the offer curve, two price thresholds have been set up:
  - Volumes above 150€/MWh, which correspond to the base case of Market Response volumes
  - Volumes above 500€/MWh, which enable to exclude all possible generation bids

Disclaimer:
The details on the activation cannot be estimated with the aggregated curve methodology, it is not possible to extract it from the curves. This has been validated with EPEX

Source: E-CUBE Strategy Consultants

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The update of the Market Response Study is based on the exact same methodology as the one performed in 2017 and 2018

The process followed four key steps to come to a pertinent volume of Market Response:
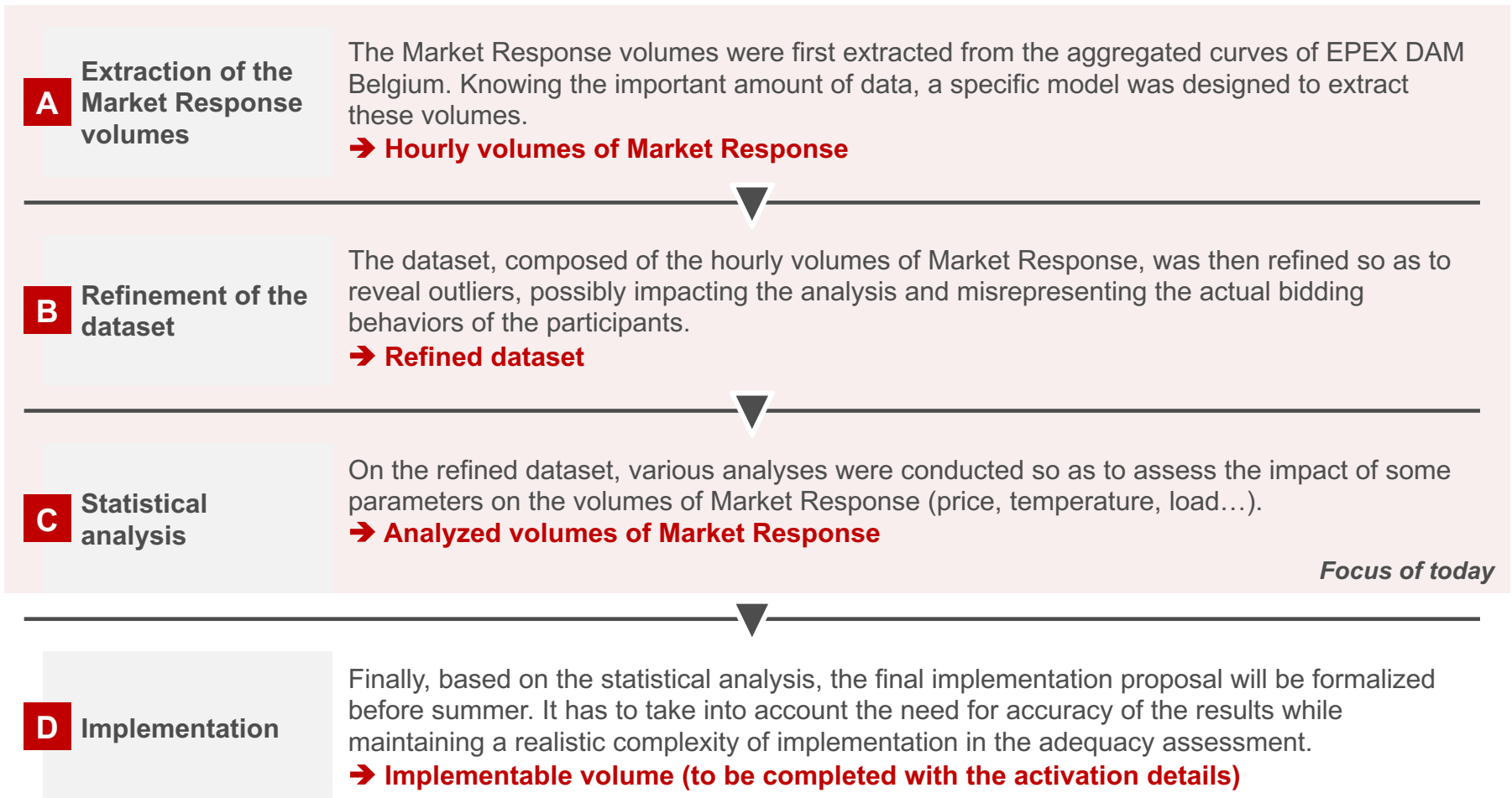
A **Extraction of the Market Response volumes**

The Market Response volumes were first extracted from the aggregated curves of EPEX DAM Belgium. Knowing the important amount of data, a specific model was designed to extract these volumes.
➔ **Hourly volumes of Market Response**

B **Refinement of the dataset**

The dataset, composed of the hourly volumes of Market Response, was then refined so as to reveal outliers, possibly impacting the analysis and misrepresenting the actual bidding behaviors of the participants.
➔ **Refined dataset**

C **Statistical analysis**

On the refined dataset, various analyses were conducted so as to assess the impact of some parameters on the volumes of Market Response (price, temperature, load…).
➔ **Analyzed volumes of Market Response**

Focus of today

D **Implementation**

Finally, based on the statistical analysis, the final implementation proposal will be formalized before summer. It has to take into account the need for accuracy of the results while maintaining a realistic complexity of implementation in the adequacy assessment.
➔ **Implementable volume (to be completed with the activation details)**

Source: E-CUBE Strategy Consultants

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2 Results of the methodology update 2019

EPEX DAM Belgium provides hourly aggregated curves of the purchase and sale orders

EPEX DAM Belgium aggregated curve
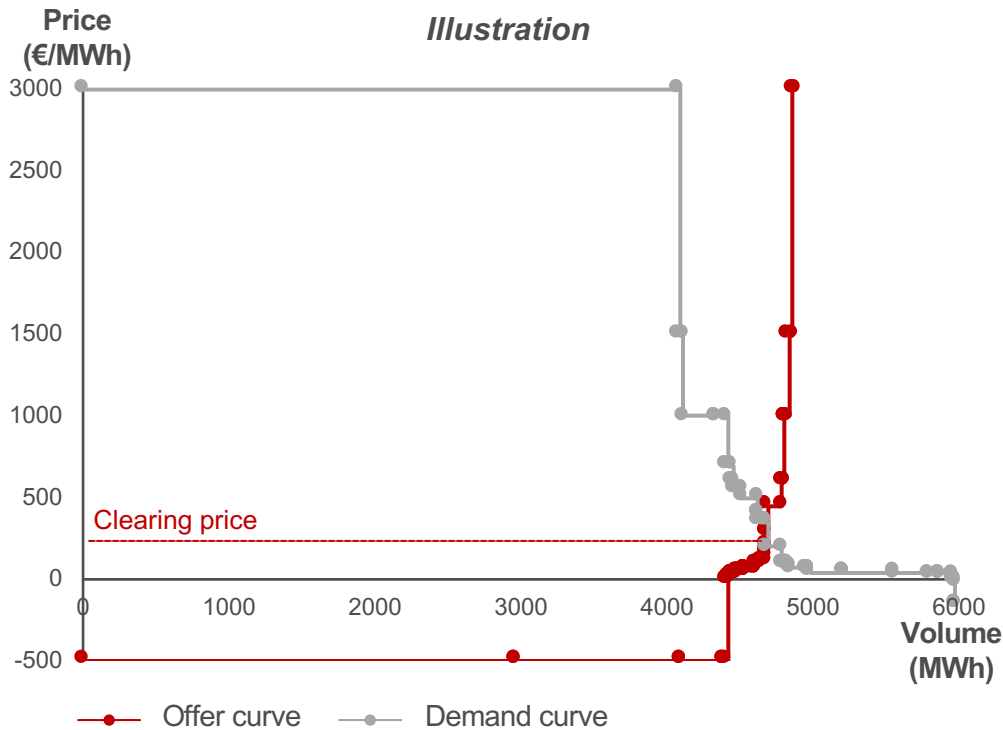
- **The curves determine the clearing price**: at the intersection of the demand and supply curve.

- From the curves, we can deduce the load variation corresponding to a given price increase

- This load variation **corresponds to the perimeter of Market Response** with contract based and price based MR but also voluntary DR. Indeed, if there are some volumes in the voluntary DR category, BRPs will anticipate voluntary DR events: it will impact their bidding behaviors and hence be reflected in the aggregated curves

Disclaimer:

The details on the activation cannot be estimated with the aggregated curve methodology, it is not possible to extract it from the curves

The Market Response volumes were extracted from the aggregated curves. The 2019 update added 7873 hours to the dataset
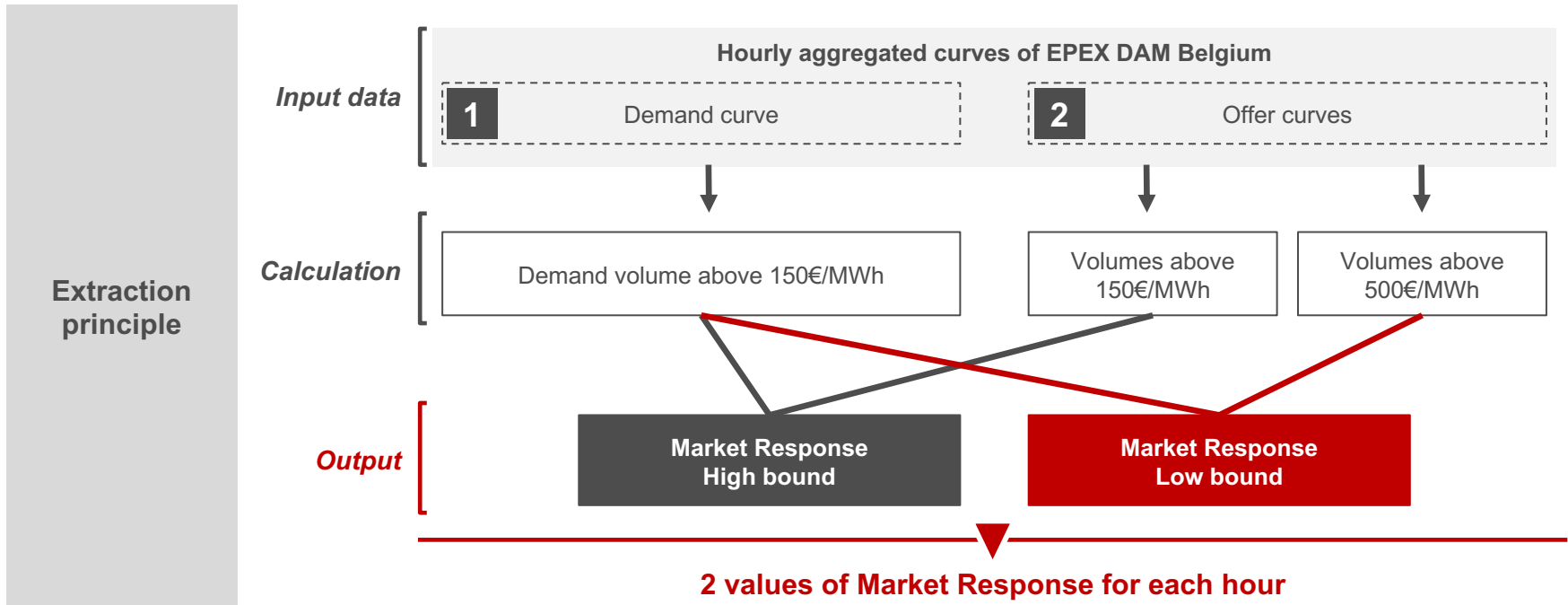
Timeframe of the dataset

Market Response study 2017				Update 2018	Update 2019
2014	**2015**	**2016**	**2017**	**2018**	**2019**

01/01/2014
00:00

01/05/2017
23:00

17/04/2018
23:00

11/03/2019
23:00

➔ **The first step of the analysis is to extract the Market Response volume from this dataset**

Extraction principle

Input data

Hourly aggregated curves of EPEX DAM Belgium

1 Demand curve

2 Offer curves

Calculation

Demand volume above 150€/MWh

Volumes above 150€/MWh

Volumes above 500€/MWh

Output

Market Response High bound

Market Response Low bound
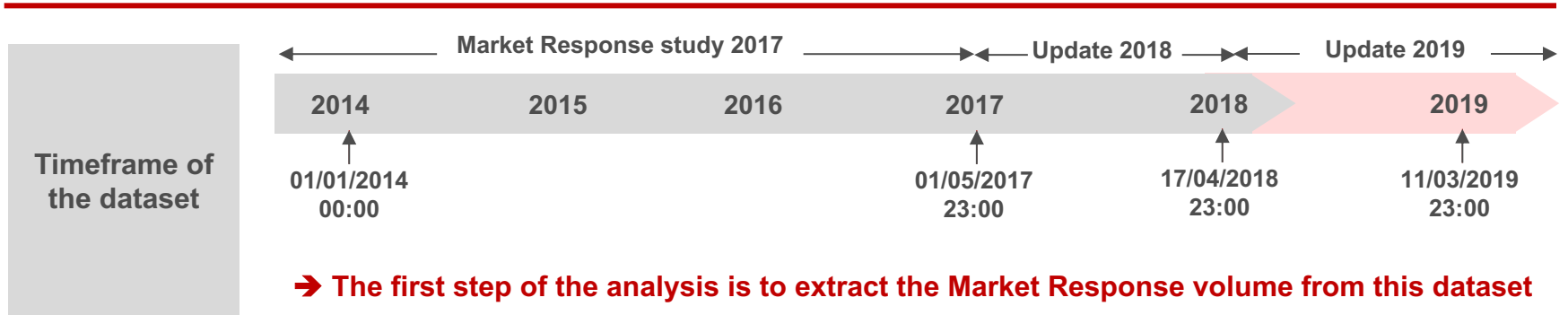
2 values of Market Response for each hour

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2 **Results of the methodology update 2019**

A Extraction of the Market Response volumes
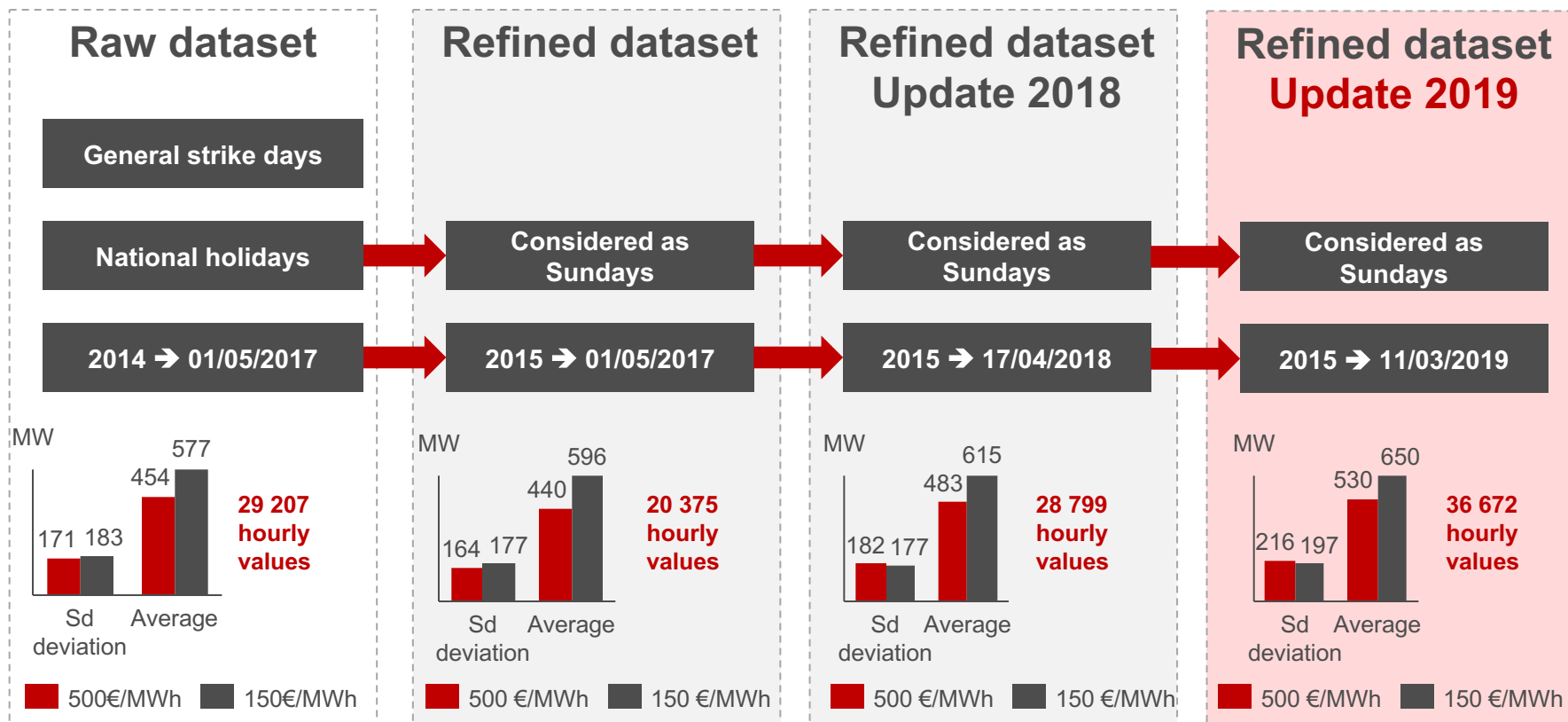
B **Refinement of the dataset**

C Statistical analysis

The cumulated dataset refinement follows the same approach as in the previous years and contains now 36.672 hours values

Market Response study 2017

Raw dataset

General strike days

National holidays

2014 ➔ 01/05/2017

MW

171 183 454 577

Sd deviation   Average

29 207 hourly values

■ 500€/MWh   ■ 150€/MWh

Refined dataset

Considered as Sundays

2015 ➔ 01/05/2017

MW

164 177 440 596

Sd deviation   Average

20 375 hourly values

■ 500 €/MWh   ■ 150 €/MWh

Update 2018

Refined dataset Update 2018

Considered as Sundays

2015 ➔ 17/04/2018

MW

182 177 483 615

Sd deviation   Average

28 799 hourly values

■ 500 €/MWh   ■ 150 €/MWh

Update 2019

Refined dataset Update 2019

Considered as Sundays

2015 ➔ 11/03/2019

MW

216 197 530 650

Sd deviation   Average

36 672 hourly values

■ 500 €/MWh   ■ 150 €/MWh

The refined dataset was used in the following analysis

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2 | **Results of the methodology update 2019**

A | Extraction of the Market Response volumes

B | Refinement of the dataset

C | **Statistical analysis**

The additional volumes of the 2019 update do not present a specific behaviour and are coherent with the dataset of the Market Response study 2017 and 2018

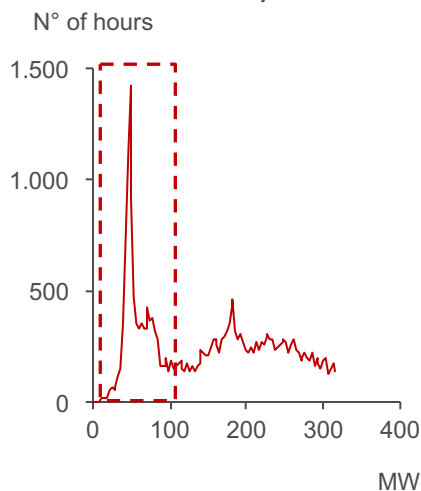**Distribution <u>for the offer side only</u>, cumulated dataset**

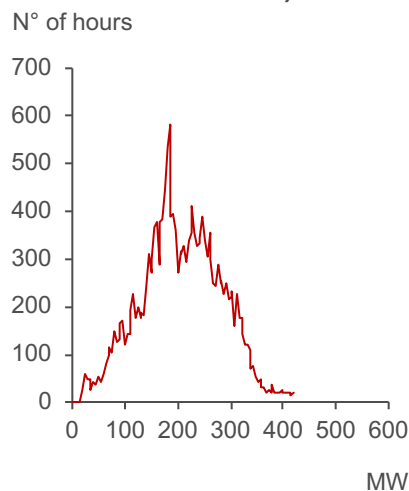| Raw dataset – 2017 Study	Dataset w.o. y. 2014 – 2017 study	Dataset w.o 2014 - 2018 update	Dataset w.o 2014 - 2019 update

Offer side volumes distribution (150€/MWh threshold)
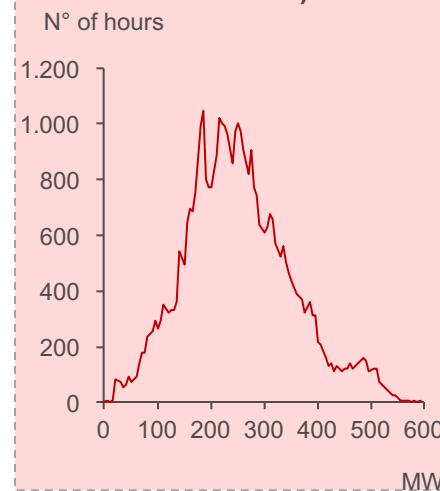
In the Market Response volumes of 2014, we noticed a specific behaviour of the customers not present in the volumes of 2015, 2016 and 2017 ➔ **The year 2014 was excluded of the dataset**
This type of behaviour doesn't appear in the 2015-2019 updated dataset ➔ **the volumes are coherent with the dataset of the Market Response study 2017**
The 2019 data is coherent with the 2015-2018 dataset

Numerous analyses were conducted to explain the volume patterns, yet without any strong correlations

Various analyses were conducted :

- Simple correlations and multivariate regressions:
  – Day-ahead prices
  – Temperatures
  – Normal temperatures
  – Daily maximum price
  – Load
  – Gas prices

- Analysis of the tail of the distribution

No satisfying results were found from these analyses (very low R^2), **so the impact of the three main parameters (load, price and temperature) was assessed differently: by restricting the dataset to periods of important load, price, temperature etc.**

All detailed documentation will be presented before summer and put thereafter on the Task Force ISR website

The impact of various parameters was assessed on the new dataset to verify the coherence with the analyses conducted in the last years

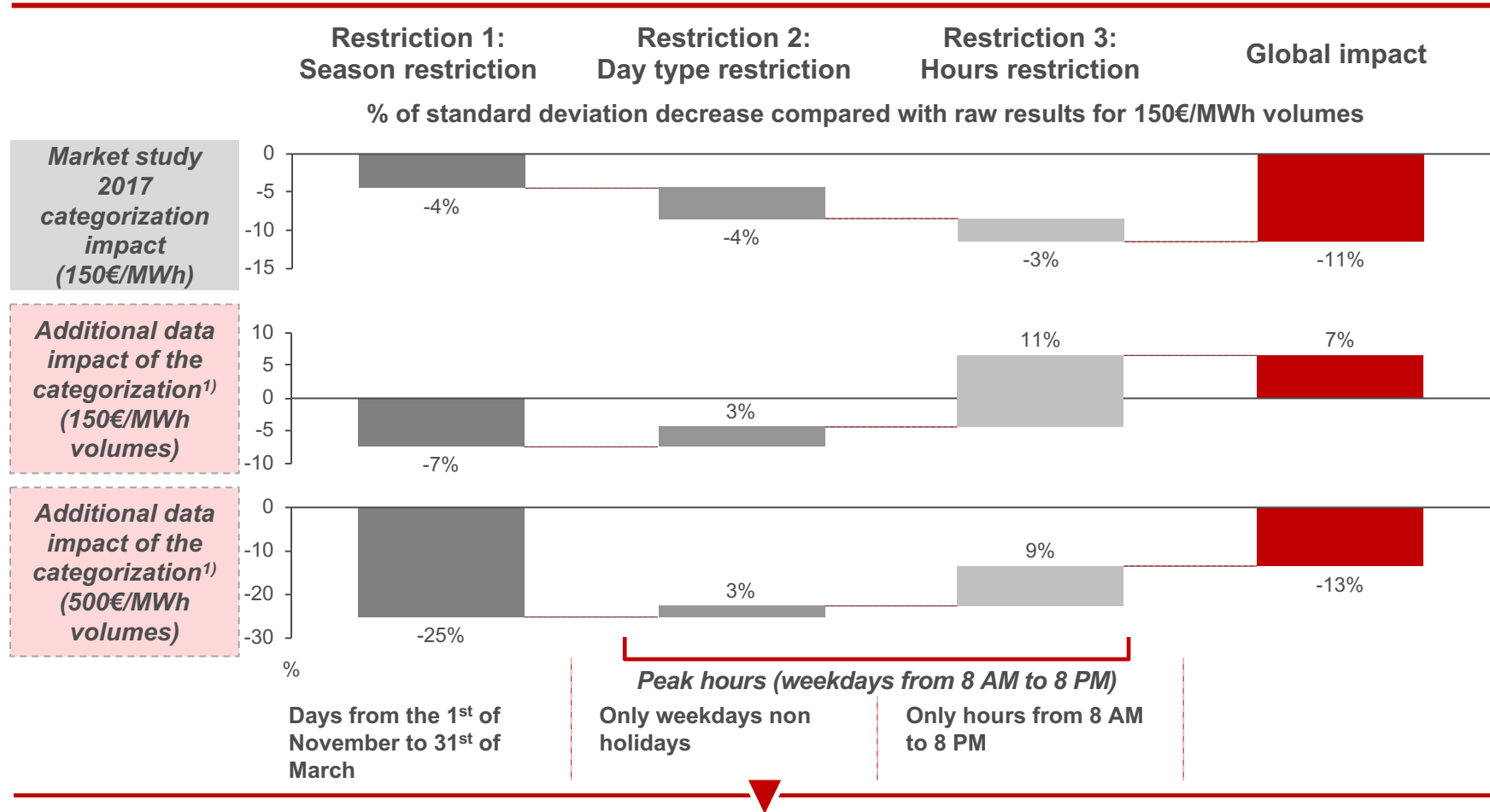|	Analyses conducted: impact of parameters	Focus on the load	Restriction of the dataset

2017 analysis	• 3 analyses were conducted to assess the impact of various parameters on our dataset:
	
	  • Load (Elia grid load)
	  • Price (Day-ahead prices)
	  • Temperature (Uccle[1])
	
	The principle of the analysis is to restrict the dataset to the hours when the parameter is above (or bellow) a threshold. Key statistics (standard deviation, number of values and average) are then calculated.
		Among the previous parameters, the load has the most important impact on the dataset:
		
		• **In periods of important load, the Market Response volumes is more pertinent** (there is a decrease of the standard deviation, along with a variation in the average)
			Though, the load varies strongly according to the period. **The restriction of the dataset to periods of important load should be studied:**
			
			• Season
			➜ **Restriction 1:** winter months
			
			• Day type
			➜ **Restriction 2:** weekdays
			
			• Hours:
			➜ **Restriction 3:** hours from 8 AM to 8 PM

2019 update	**The impact of the 3 parameters (load, price, temperature) will be assessed on the updated dataset**	**The restriction of the updated dataset was compared to the restriction conducted in the past years to assess the coherence**	

1) For the 2019 update Uccle temperature is unavailable, and the Zaventem temperatures have been used instead

Contrary to the 2017 study, only the restrictions of the dataset to the winter period decrease the volatility, while further restrictions to weekdays and peak hours increase it

	Restriction 1: Season restriction	Restriction 2: Day type restriction	Restriction 3: Hours restriction	Global impact

% of standard deviation decrease compared with raw results for 150€/MWh volumes

Market study 2017 categorization impact (150€/MWh)

-4% -4% -3% -11%

Additional data impact of the categorization[1] (150€/MWh volumes)

-7% 3% 11% 7%

Additional data impact of the categorization[1] (500€/MWh volumes)

-25% 3% 9% -13%

Peak hours (weekdays from 8 AM to 8 PM)

Days from the 1st of November to 31st of March

Only weekdays non holidays

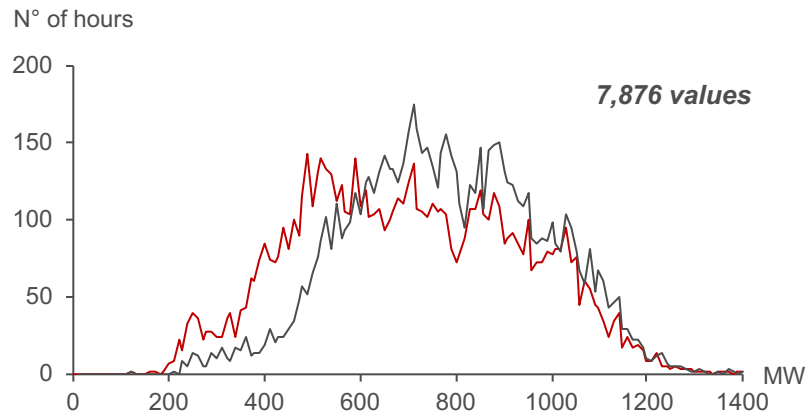**Only hours from 8 AM to 8 PM**

The focus on the most relevant hours in the context of the adequacy assessment (week days, peak hours of the winter period) is slightly less relevant in the updated dataset compared to the previous years

1) The additional data goes from April 18th, 2018 to March 11th, 2019
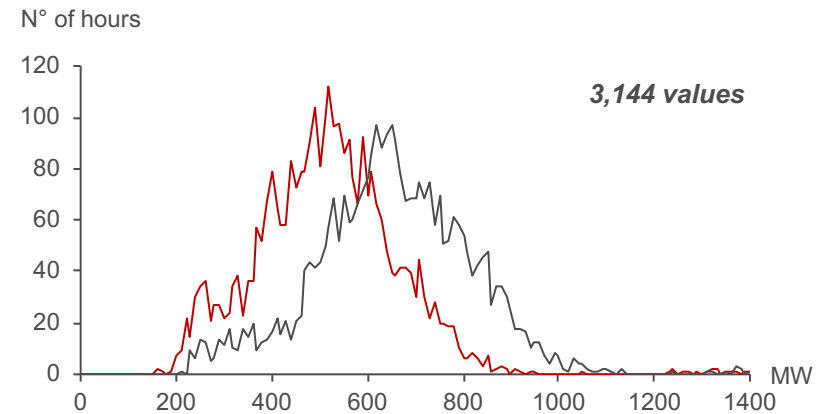
Source: E-CUBE Strategy Consultants

In the additional data received for the 2019 update, 1068 values remain after the data restriction

EVOLUTION OF THE DISTRIBUTION WITH THE RESTRICTIONS (upper & lower bounds) —— 500€/MWh —— 150€/MWh

Refined dataset distribution
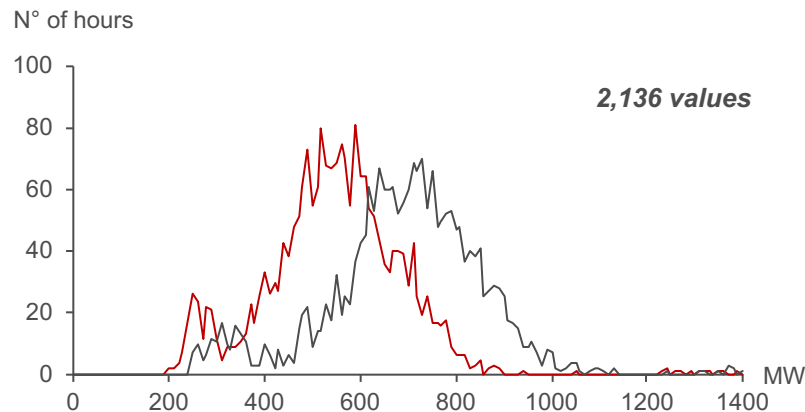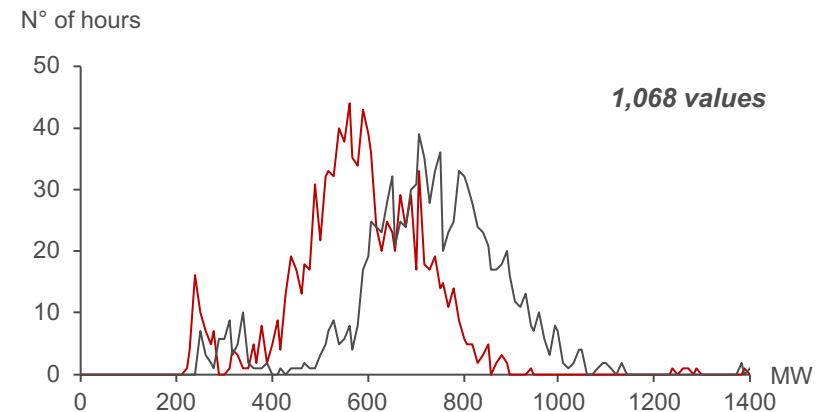
N° of hours

7,876 values

Restriction 1 : season

N° of hours

3,144 values

Restriction 2 : day type

N° of hours

2,136 values

Restriction 3 : hours

N° of hours

1,068 values

Source: E-CUBE Strategy Consultants
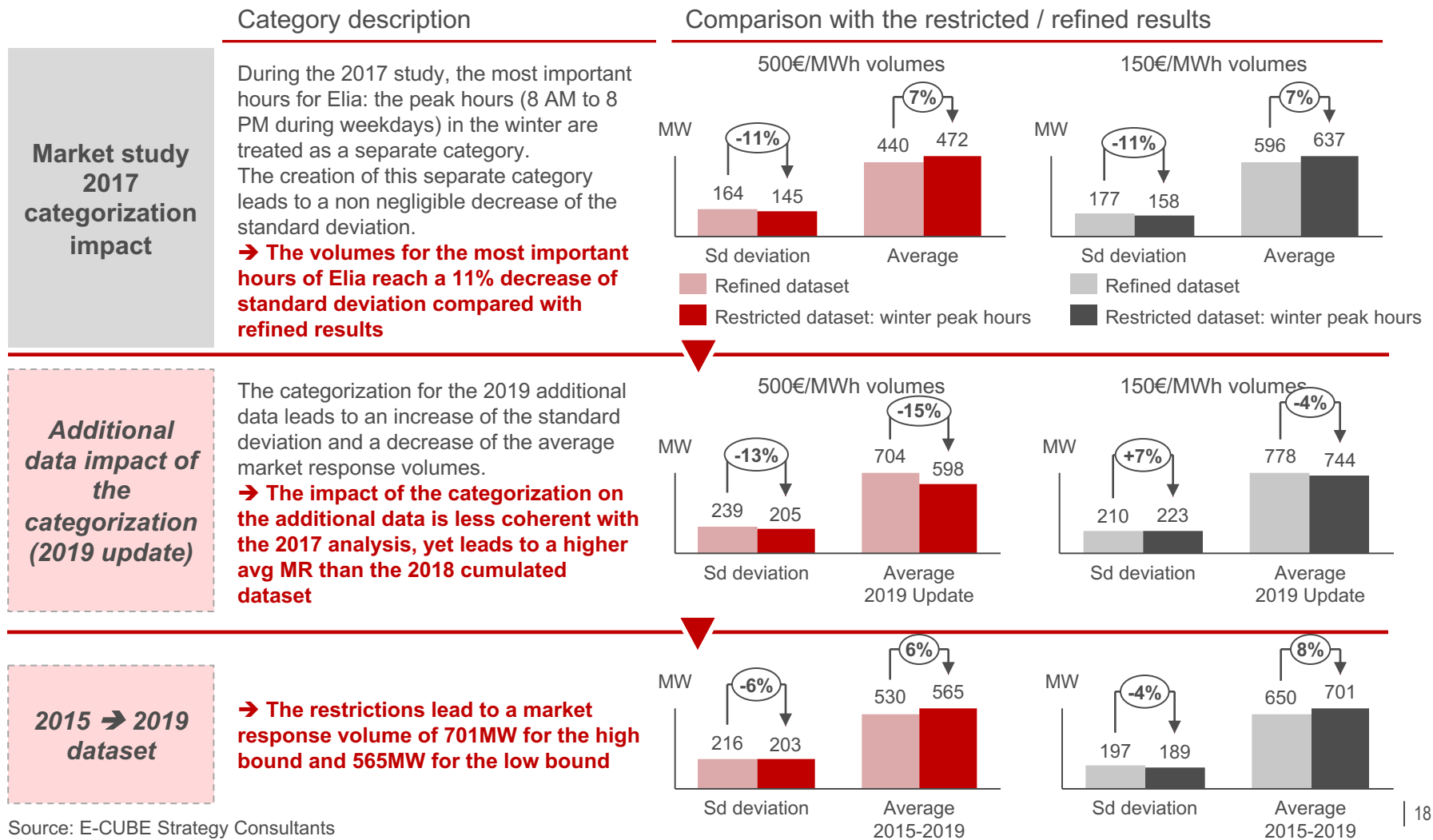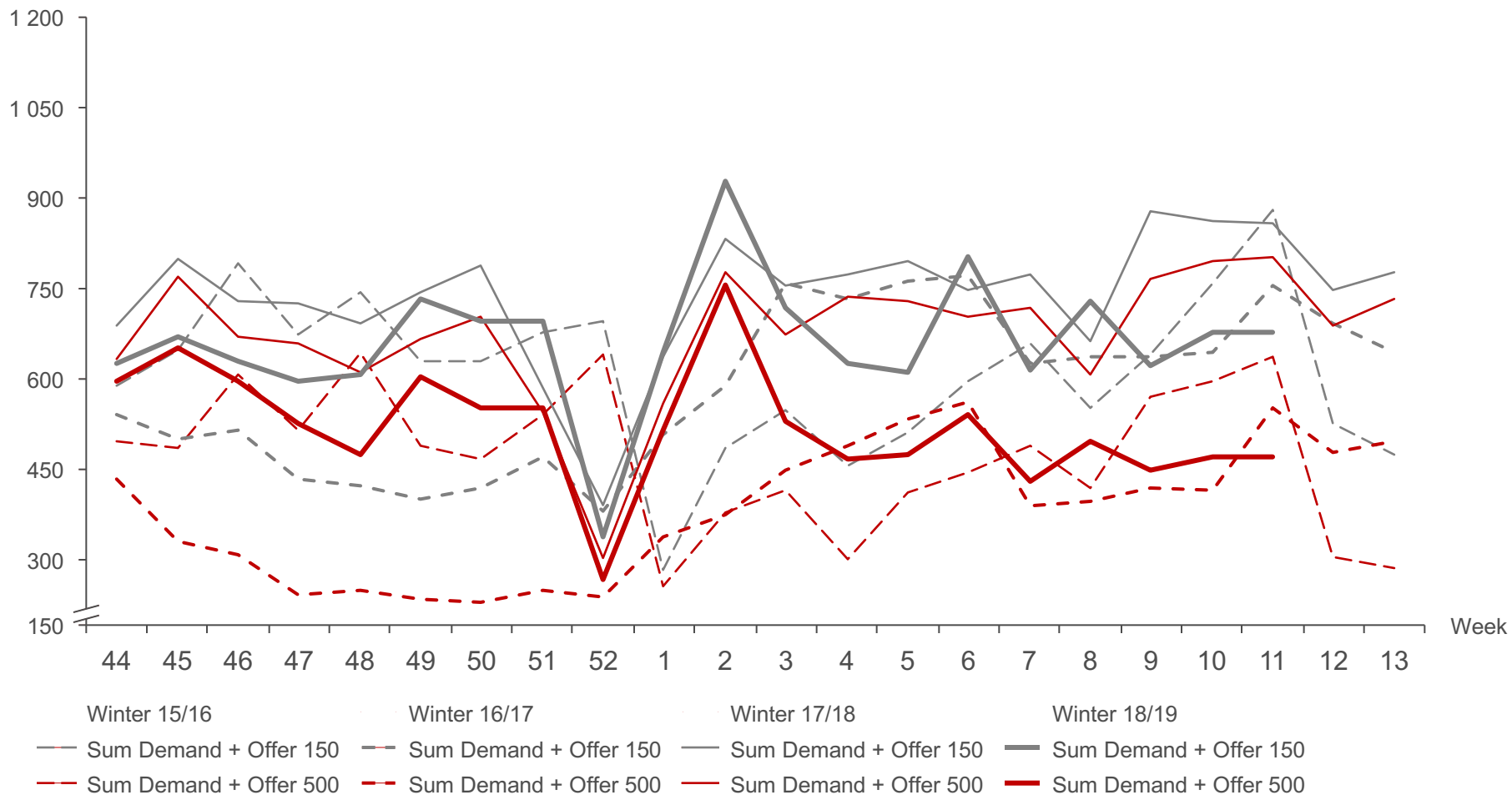
Contrary to the previous years, the categorization of the additional data is less coherent with the 2017 dataset: it leads to a standard deviation increase, and to a slightly lower market response volume

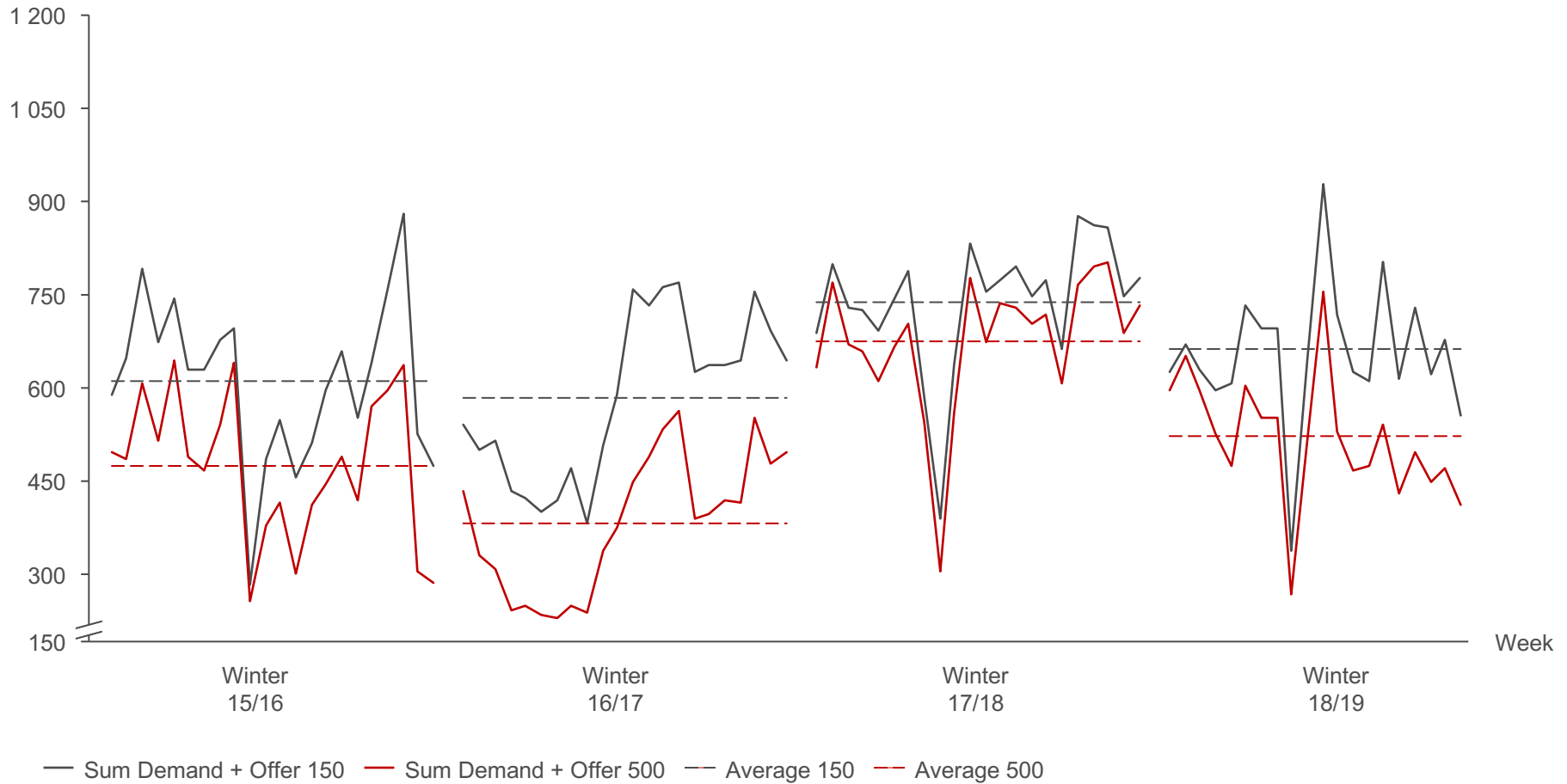**Summary of the two categories (refined and restricted dataset)**

Category description	Comparison with the restricted / refined results

Market study 2017 categorization impact

During the 2017 study, the most important hours for Elia: the peak hours (8 AM to 8 PM during weekdays) in the winter are treated as a separate category.
The creation of this separate category leads to a non negligible decrease of the standard deviation.
→ **The volumes for the most important hours of Elia reach a 11% decrease of standard deviation compared with refined results**

500€/MWh volumes

MW — Sd deviation: 164 → 145 (**-11%**); Average: 440 → 472 (**7%**)

150€/MWh volumes

MW — Sd deviation: 177 → 158 (**-11%**); Average: 596 → 637 (**7%**)

Legend:
- Refined dataset
- Restricted dataset: winter peak hours
- Refined dataset
- Restricted dataset: winter peak hours

Additional data impact of the categorization (2019 update)

The categorization for the 2019 additional data leads to an increase of the standard deviation and a decrease of the average market response volumes.
→ **The impact of the categorization on the additional data is less coherent with the 2017 analysis, yet leads to a higher avg MR than the 2018 cumulated dataset**

500€/MWh volumes

MW — Sd deviation: 239 → 205 (**-13%**); Average 2019 Update: 704 → 598 (**-15%**)

150€/MWh volumes

MW — Sd deviation: 210 → 223 (**+7%**); Average 2019 Update: 778 → 744 (**-4%**)

2015 → 2019 dataset

→ **The restrictions lead to a market response volume of 701MW for the high bound and 565MW for the low bound**

500€/MWh volumes

MW — Sd deviation: 216 → 203 (**-6%**); Average 2015-2019: 530 → 565 (**6%**)

150€/MWh volumes

MW — Sd deviation: 197 → 189 (**-4%**); Average 2015-2019: 650 → 701 (**8%**)

Source: E-CUBE Strategy Consultants

The market response in the 2018/2019 winter season is not higher than the previous years

Offer + demand (MW)

Week	Winter 15/16	Winter 16/17	Winter 17/18	Winter 18/19
	Sum Demand + Offer 150	Sum Demand + Offer 150	Sum Demand + Offer 150	Sum Demand + Offer 150
	Sum Demand + Offer 500	Sum Demand + Offer 500	Sum Demand + Offer 500	Sum Demand + Offer 500

Source: EPEX SPOT, E-CUBE Strategy Consultants

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The weekly averages for both the high and the low bounds are below those of last year (non-restricted hours), yet higher than winter periods 2015/2016 and 2016/2017

Offer + demand (MW)

Legend:
- Sum Demand + Offer 150
- Sum Demand + Offer 500
- Average 150
- Average 500

X-axis: Winter 15/16, Winter 16/17, Winter 17/18, Winter 18/19 (Week)

The 2018/2019 data update leads to a slightly higher cumulated MR value

- Winter 2018/2019 shows average MR volumes slightly lower than during Winter 2017/2018, yet higher than in previous winter periods analysed

- Nevertheless, on a cumulated basis, the MR volumes slightly increase with the addition of 2018/2019 data

- The restrictions applied on the winter 2018/2019 data lead to an increase of the standard deviation, contrary to the last years

- Additional analyses such as the evolution of the standard deviation following restrictions as in the last years show that the MR response values are most variable during the weekday peak hours.

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1 | Goal, scope and planning of the 2019 update – *Reminder*

2 | Results of the aggregated curves analysis – 2019 update

3 | **Next steps**

Based on today's discussions, the following steps will be performed

- Update of the market response values until the end of March (end of winter)

- Implementation proposal with extrapolation of the results (including ancillary services)

- Presentation in Task Force Implementation Strategic Reserve before the summer