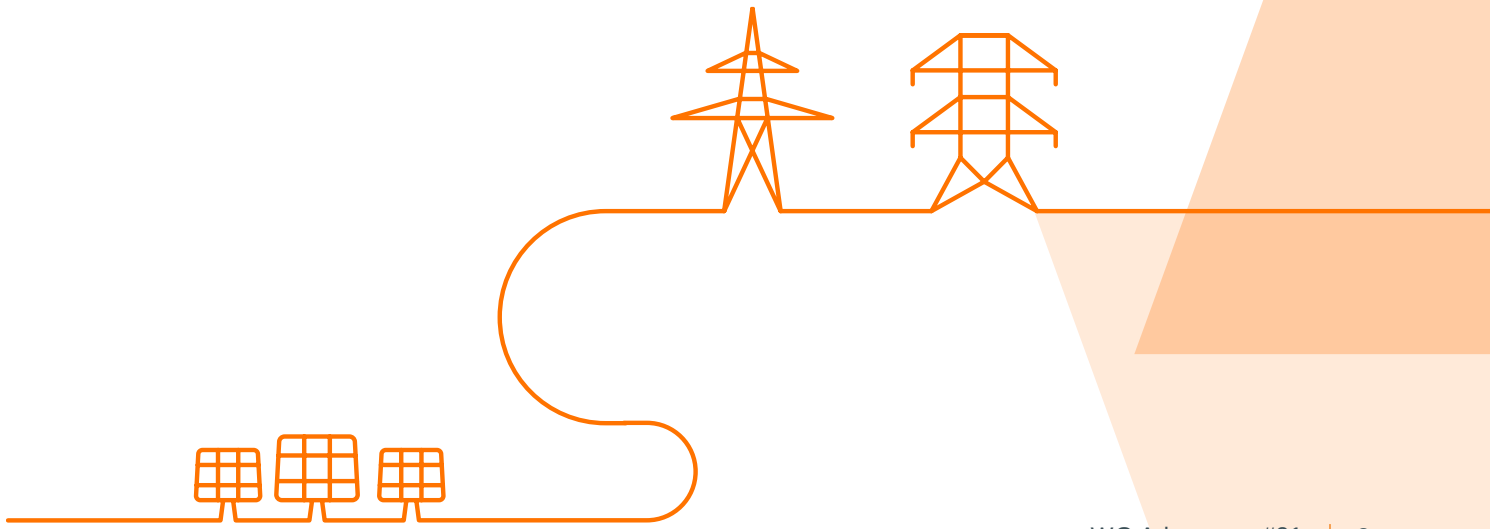
WG Adequacy #21

25/08/2023

Agenda

- Welcome
- Approval of the Minutes
- Cost of Capacity - Entras
- Update on Load - Climact
- Strike Price – E-Cube
- Market Response – E-Cube
- Update from Cabinet
- AOB
- Next meetings



Approval of the Minutes

Comments on the Minutes of the Meeting

WG Adequacy #17 & #18 + #19 & #20

WG Adequacy #17:

- Clarification question
  - Answered by Elia
- Clarification comment
  - Text adapted accordingly

WG Adequacy #18:

- Clarification comments
  - Text & participants adapted accordingly

WG Adequacy #19:

- No comments received

WG Adequacy #20:

- Clarification comments
  - Text & participants adapted accordingly

Adjustments in the MoM

– WG Adequacy #17

Engie wants to make sure that moving volume from Y-4 to Y-1 isn't unbalanced – it is a point to tackle in CRM design. Febeliec agrees that a balance is required. Elia answers that mandatory participation is when you have a production unit that will not disappear or when a unit has a connection contract in the grid of Elia and a production license. The production capacity can't be hidden. If it is a standard prequalification, without a bid, it's an opt-out out. If it's a fast track, Elia can't track if the assets will be delivered so it's opt-out in by default. It's up to the actor to choose the standard or the fast track. Febeliec says that going entirely from opt-out IN to opt-out OUT, no balance would exist – hence, increasing the volume in Y-4 and the cost of the CRM. Elia agrees that one of the goals of the opt-out is to find the balance with objective criteria. But edge cases will always exist and are difficult to forecast. Febeliec states that companies working on DSM can prequalify and decide for an opt-out without clarity on barriers from government. It doesn't mean that the capacity will not be built, it means that you will not participate to the auction. Elia agrees but reminds the goal is to find the balance. The changes made by Elia are regarding edge cases and how to treat them. Febeliec says that for projects with a lead time shorter than 4 years, one should pay attention to not exclude them. Elia answers that the proposal has been submitted to the CREG and that the comments can be made to the CREG during their public consultation.

– WG Adequacy #18

Regarding the preselected capacity types as additional parameter to consider, Engie asks if the gas engines are not considered anymore. Elia answers that they are not. Engie states the gas engines should also be removed for the computation of the CONE in the framework of the CRM. Elia answers that it's not ***per se*** the same list as in the CRM but that the comment will be considered.

Adjustments in the MoM

– WG Adequacy #20

Elia's recommendation

Febeliec asks what the Mixed 70% means. Elia answers that it's based on the recommendation of FEBEG to consider some countries case by case. Engie says that consideration case by case would be more realistic and wants to make sure that XB risks are captured. One should not be very optimistic on the various risks regarding XB. Elia takes the point.

Regarding the Y-1 auction with delivery period 2025-2026, Febeliec states that Elia is pessimistic. Febeliec points out that Elia only deviates from a central scenario only in the case of "*Minimum EDF forecast*". FEBEG adds that two different risks have been identified – UK & Norway – and have been denied. Elia answers that these forecasts are the fruit of intense work – it's now up to the Minister, CREG & FPS Economy to decide.

Concerning preselected capacity types, COGEN Vlaanderen discusses about the relevancy of considering gas engines as the use of gas is evolving. Engie states that if gas engines are the cheapest technology, entering the market wouldn't be problematic.

Regarding the IPC, Febeliec asks when the update of the list of technologies would be presented. Elia answers that it will be presented during the WG Adequacy in August. Furthermore, Engie states its desire to make the AMT price futureproof.

Cost of Capacity

Study by Entras

Consultancy project on “cost of capacity for calibration of the Belgian CRM”

Presentation for the WG Adequacy - August 25th of 2023

ENTRAS

Contact information: *Joost.Vandenberghe@entras.be*

Agenda

- Scope of the Entras CoC study
- Interaction with market players
- Longlist of technologies
- Criteria for Net-CONE shortlisting
- Criteria for IPC shortlisting
- Shortlisted technologies
- List of VOM & FOM
- List of initial CAPEX

Scope of the Entras CoC study (1/2)

A) Define a longlist of electricity generation technologies

- Shortlist this longlist for the use of Net CONE eligible technologies, based on relevant criteria
- Shortlist this longlist for the use of IPC eligible technologies, based on relevant criteria

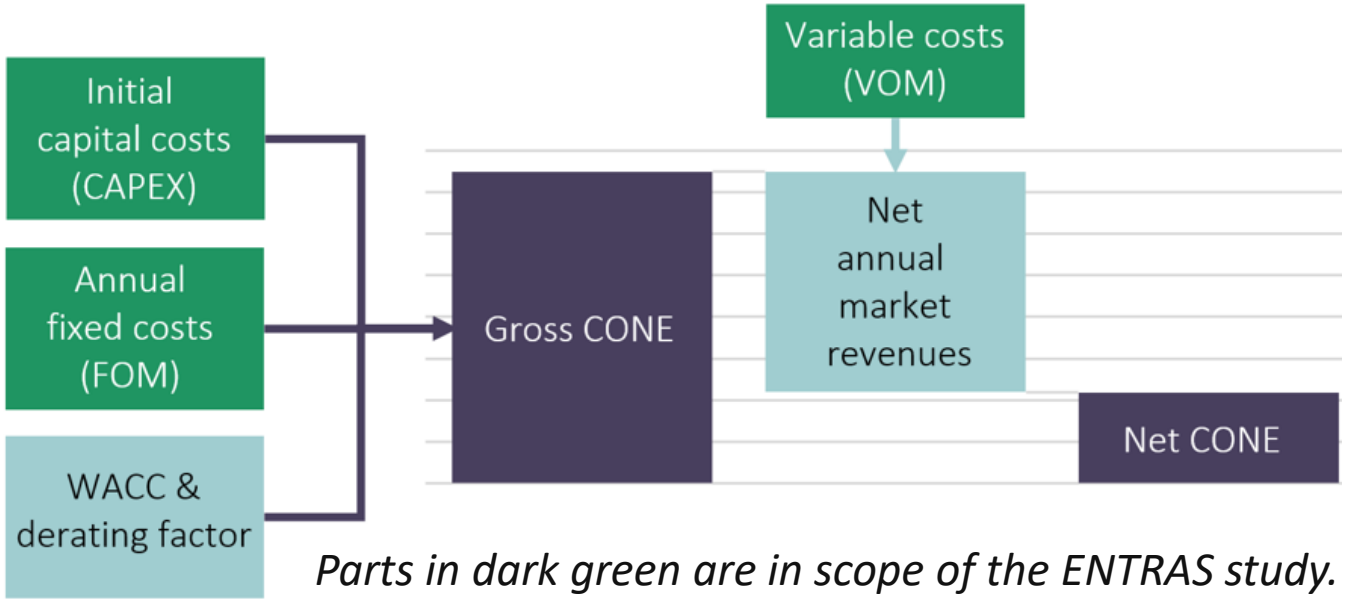
B) Define a clear overview of the FOM and VOM costs

- Create an overview of FOM and VOM cost components, to be expressed in €/MW/year or €/MWh respectively
- Provide a value for each of the relevant defined cost components for technologies expected to enter the Belgian energy market, i.e., the technologies as defined under A1
- Provide a low – mid – high value for each of the relevant defined cost components for existing technologies in the Belgian energy market, i.e., the technologies as defined under A2

C) Define a clear overview of the total initial CAPEX costs (for Net CONE)

- Create an overview of the total initial CAPEX cost components for each technology as defined under A1
- Provide a value for each of the CAPEX cost components, for each technology as defined under A1

Scope of the Entras CoC study (2/2)



Parts in dark green are in scope of the ENTRAS study.

	Auction 2021 (2025-2026)	Auction 2022 (2026-2027)	Auction 2023 (2027-2028)	Auction 2024 (2028-2029)
Technology shortlist VOM, FOM & CAPEX	Fichtner 2020 link + AFRY 2020 link		AFRY 2022 link	ENTRAS

Interaction with market players

05/23	• Invitation for interview by Elia to all members of the Adequacy working group
06/23	• Invitation for interview by Entras to representative sample in the Adequacy working group
06-07/23	• Interviews by Entras with invitation for data sharing (NDA-based)
08/23	• Data sharing

Longlist of technologies

	Primary fuel or energy	Capabilities		
		CHP	CCUS	2nd fuel type
1. Electricity generation technologies				
1.1 Thermal technologies				
Combined Cycle Gas Turbine (CCGT)	Natural gas	X	X	X
Open Cycle Gas Turbine (OCGT)	Natural gas	X	X	X
Combustion system & Steam Turbine (ST)				
Nuclear fission	Uranium			
Coal	Coal	X	X	
Waste	Waste	X	X	
Biomass	Biomass	X	X	
Internal Combustion Engines (IC engines)	Natural gas	X	X	X
Turbojets	Light fuel			X
1.2 Renewable technologies				
Onshore wind turbines	Wind			
Offshore wind turbines	Wind			
Hydropower (run-of-river)	Potential			
Photo Voltaic (PV)	Sun			
1.3 Electrochemical technologies				
Fuel cell (FC)	Hydrogen	X		
2. Storage technologies				
2.1 Pumped Hydro Storage	Electricity			
2.2 Battery Energy Storage Systems	Electricity	X		
2.3 Compressed Air Energy Storage	Electricity	X		
2.4 Flywheel	Electricity			
3. Demand Side Management (DSM) technology				

Criteria for IPC shortlisting

- Shortlisted technologies satisfy following criteria (Royal Decree – 28/04/2021, Art. 10)
  - Presence of existing operational installations of the technology in the market during the considered time frame
  - CO_2 emissions of the technology below the required threshold
    - European
      - specific emission below 550 g CO_2/kWh_e*
      - absolute emission limit of 350 kg CO_2 /kWe/year
    - National: stricter CO_2 emission limit trajectory under consideration
  - For technologies with a number of operating hours of the same order of magnitude, technologies with significantly higher cost parameters are excluded
- "Fit-for-purpose" check by taking into account the derating factor, i.e., its ability to contribute to the security of supply and adequacy.

*: For existing units, commissioned before 04/07/2019, a specific emissions limit is set at 600 g CO_2/kWh_e if the annual emission threshold of 306 kg CO_2/kWe/year is not exceeded.

Criteria for Net-CONE shortlisting

- Shortlisting for Net-CONE requires a specific approach to manage higher uncertainty
- ACER-methode* for calculation of CONE
  - Longlisted technologies are able to provide resource adequacy benefits, including but not limited to electricity generation capacity, storage facilities and DSR.
  - Shortlisted technologies satisfy two criteria
    - Standard technology:
      - *Reliable and generic cost information available*
      - *Costs are reproducible between projects*
      - *Development not bound by technical constraints*
    - Potential
      - *Has been developed in recent years, is in process of development or is planned for the considered timeframe*
      - *Development is not hampered by national/EU framework*
- "Fit-for-purpose" check by taking into account the derating factor, i.e., its ability to contribute to the security of supply and adequacy.

*: Methodology for calculating the value of lost load, the cost of new entry and the reliability standard

Shortlisted technologies

- **Resulting Net-CONE shortlist**
  - CCGT
  - OCGT
  - IC-engine
  - Battery Energy Storage Systems (BESS)
  - DSM

- **Resulting IPC shortlist**
  - CCGT
  - OCGT
  - Combustion systems and steam turbine technologies – waste incineration
  - Combustion systems and steam turbine technologies – biomass power plant
  - IC-engine
  - Pumped hydro storage
  - Battery Energy Storage Systems (BESS)
  - DSM

Shortlisting

	Net-CONE	IPC
1. Electricity generation technologies		
1.1 Thermal technologies		
Combined Cycle Gas Turbine (CCGT)	√	√
Open Cycle Gas Turbine (OCGT)	√	√
Combustion system & Steam Turbine (ST)		
Nuclear fission	nuclear exit	expected to be excluded from CRM support
Coal	not meeting the limit for CO_2	no existing operational installations
Waste	not fit-for-purpose / limited new capacity	√
Biomass	limited new capacity	√
Internal Combustion Engines (IC engines)	√	√
Turbojets	not meeting the limit for CO_2	not meeting the limit for CO_2
1.2 Renewable technologies		
Onshore wind turbines	not fit-for-purpose	not fit-for-purpose
Offshore wind turbines	not fit-for-purpose	not fit-for-purpose
Hydropower (run-of-river)	limited new capacity	not fit-for-purpose
Photo Voltaic (PV)	not fit-for-purpose	not fit-for-purpose
1.3 Electrochemical technologies		
Fuel cell (FC)	limited new capacity	no existing operational installations
2. Storage technologies		
2.1 Pumped Hydro Storage	limited new capacity	√
2.2 Battery Energy Storage Systems	√	√
2.3 Compressed Air Energy Storage	limited new capacity	no existing operational installations
2.4 Flywheel	limited new capacity	no existing operational installations
3. Demand Side Management (DSM) technology	√	√

List of VOM & FOM

Technical details & info size (MW) other info		CCGT			OCGT			IC engines			Biomass			Waste			Battery			DSR			PV			Wind Offshore			Wind Onshore			Pumped storag		
Cost elements (non-exhaustive)	**unit**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
General																																		
Insurance	euro/MW/yr																																	
Taxes	euro/MW/yr																																	
Land lease costs	euro/MW/yr																																	
Administrative costs	euro/MW/yr																																	
Compliance																																		
Health & Safety	euro/MW/yr																																	
Environment	euro/MW/yr																																	
Legal	euro/MW/yr																																	
Fuel																																		
Fees																																		
Starts	euro/MW/yr																																	
Electricity																																		
Fixed grid fee	euro/MW/yr																																	
Variable grid fee	euro/MWh																																	
Stand-by consumption	euro/MW/yr																																	
Maintenance																																		
Tools & equipment	euro/MW/yr																																	
IT infrastructure	euro/MW/yr																																	
Preventive maintenance - variable	euro/MWh																																	
Preventive maintenance - fixed	euro/MW/yr																																	
Unplanned maintenance contingency	euro/MW/yr																																	
Planned overhaul	euro/MWh																																	
Spare part storage	euro/MW/yr																																	
Site maintenance	euro/MW/yr																																	
Operations																																		
IT infrastructure & DCS	euro/MW/yr																																	
Chemicals & consumables	euro/MWh																																	
HVAC control	euro/MWh																																	
Sampling & analysis	euro/MWh																																	
Water treatment	euro/MWh																																	
Waste water treatment	euro/MWh																																	
By-products	euro/MWh																																	
Trading and Energy Management																																		
IT infrastructure	euro/MW/yr																																	
Trading and Energy Management Desk	euro/MW/yr																																	
3rd party service provider - variable	euro/MW/yr																																	
3rd party service provider - fixed	euro/MWh																																	
Ancillary services & CRM	euro/MW/yr																																	
Human Resources																																		
Personnel costs	euro/MW/yr																																	
Training	euro/MW/yr																																	

List of initial CAPEX

		CCGT			OCGT			IC engines			Biomass			Waste			Battery			DSR			PV			Wind Offshore			Wind Onshore		
Technical details & info size (MW) other info																															
cost elements (non-exhaustive)	**unit**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
EPC contractor costs (material + labor)																															
Civil works	eur/MW																														
Mechanical equipment	eur/MW																														
Additional systems (capabilities)	eur/MW																														
Electrical system	eur/MW																														
Instrumentation & control system, communication system	eur/MW																														
Indirect costs	eur/MW																														
Owner costs																															
Project development	eur/MW																														
Construction phase	eur/MW																														
Connection costs (outside-the-fence-line)	eur/MW																														
Site costs	eur/MW																														
Financing	eur/MW																														

Next steps

- Estimation of VOM, FOM and CAPEX ongoing
- Reporting:
  - VOM and FOM end of August 2023
  - CAPEX end of December 2023

Team

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Total Electricity Demand Projection

2023 exercise, presentation to the Adequacy Working Group

Elia

Climact

Brussels
August 25 , 2023

The future electricity load is decomposed in 7 components with associated assumptions on flexibility

Electricity load components	Associated flexibility assumed	Flexibility assumed in the Reference scenario
Historical usage of electricity		
Transport electrification		
Buildings heat electrification		
Electrolysers		
Data centres		
Industry new usage and electrification		
Losses		

Objective of Climact presentation

Agenda

- Methodology
- Update of the study
- Electricity consumption projections by sector and in total
- Conclusion

Agenda

Methodology
Update of the study
Electricity consumption projections by sector and in total
Conclusion

Visualization of the different steps and data sources to compute the total electricity demand

Step	Data source
Climact Pathways Explorer	• Extensive and continuous stakeholder consultation and literature review • Data sources can be found online
Impact of macro-economic evolutions	• FPB, June 2023, *Perspectives économiques 2023-2028*
New electrification	• ELIA, June 2023, *Adequacy and Flexibility study 2023* • Concerns: EV, HP, electrolysers, data centres, industry new usage and electrification
Impact of electricity prices	• Hindriks & Serse, 2022 ,*The incidence of VAT reforms in electricity markets: Evidence from Belgium* • FORBEG, 2023, *A European comparison of electricity and natural gas prices for residential, small professional and large industrial consumers* • Prices calculated based on forward market prices from July 2023(1)
NEW **Demand destruction**	• Based on Elia best estimate of the total load for 2023

(1) www.elexys.be

What has changed between Climact 23 and AF23 - General

- **Update of price trajectories (04/07/23)**
- **Different price impact methodology, using the same -0.12 elasticity:**
  - AF23: price sensitivity in buildings and industry with no delay (reaction of the 2023 load to 2023 prices)
  - Climact 2023 : price sensitivity with a 1Y delay in buildings (delayed reaction of the 2023 load to 2022 prices) and no delay in industry
- **Update of macro-economic projections with 2023 FPB projections**
- **Calibration updates:**
  - Assume constant consumption of 8.9 TWh(*) for resistive heating, over the whole period
  - New value used for calibration for 2021 total load (84.6 TWh in 2022 exercise vs 84.7 TWh in 2023 exercise)
  - Improvement in the refineries sector

(*) This corresponds to the value from 2021. No evidence could be found suggesting that resistive heating is either increasing or decreasing , hence it is kept at its current level. For the next exercise, we recommend a deeper analysis on this subject given the importance of this figure.

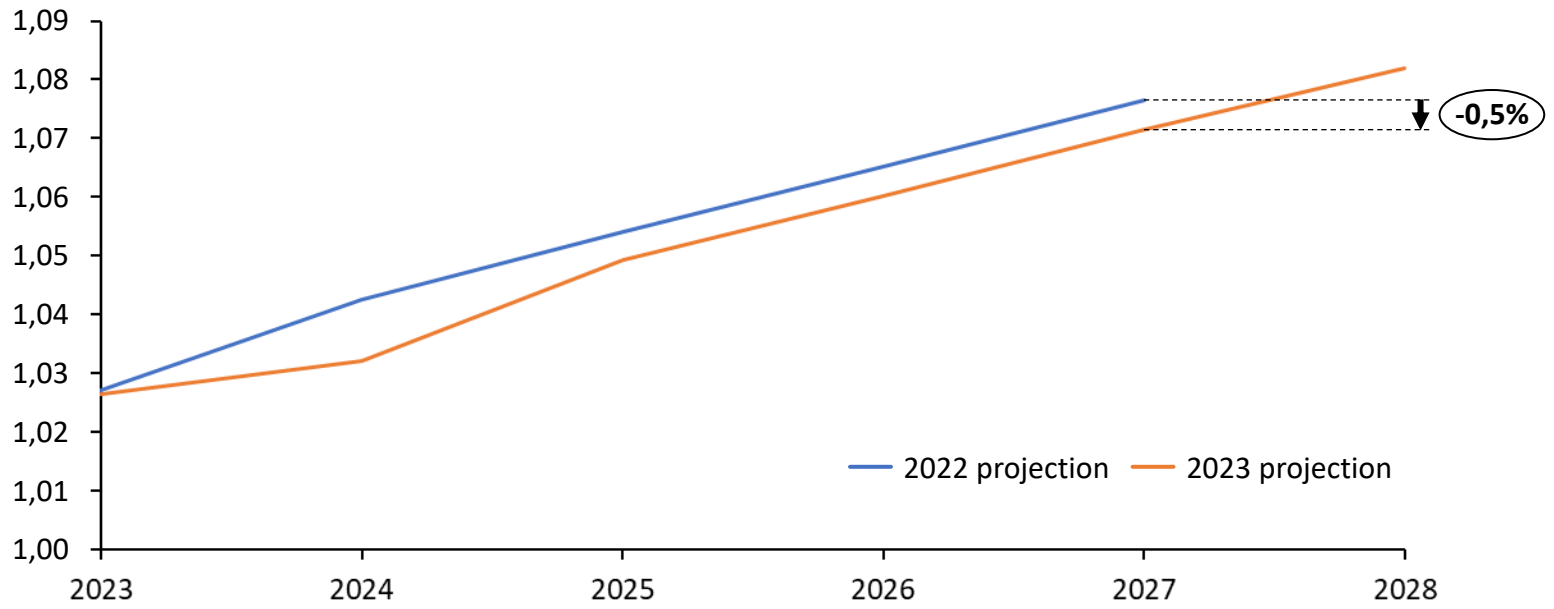
Agenda

- Methodology
- **Update of the study**
  - **Evolution of Federal Planning Bureau projections**
    - **Income**
      - Added Value
    - Projections for additional electrification
    - Electricity prices and impact on load consumption
    - Demand destruction
- Electricity consumption projections by sector and in total
- Conclusion

Comparison of 2022 and 2023 projections for the disposable income

UPDATE JULY 2023

Disposable income
[/, normalized w.r.t. 2020]



CHANGES BETWEEN 2022 AND 2023

- 2024: lower growth of the disposable income due to sustained inflation and lesser progression of the employment rate
- Longer-term trend similar to 2022 exercice

Quantity	Historical source	Projection source
Disposable income (normalized w.r.t. 2020)	1995-2021, NBB stat (1)	FPB (2), Perspectives économiques 2023-2028, June 2023

(1) National Bank of Belgium
(2) Bureau Fédéral du Plan

Agenda

- Methodology
- **Update of the study**
  - **Evolution of Federal Planning Bureau projections**
    - Income
    - **Added Value**
  - Projections for additional electrification
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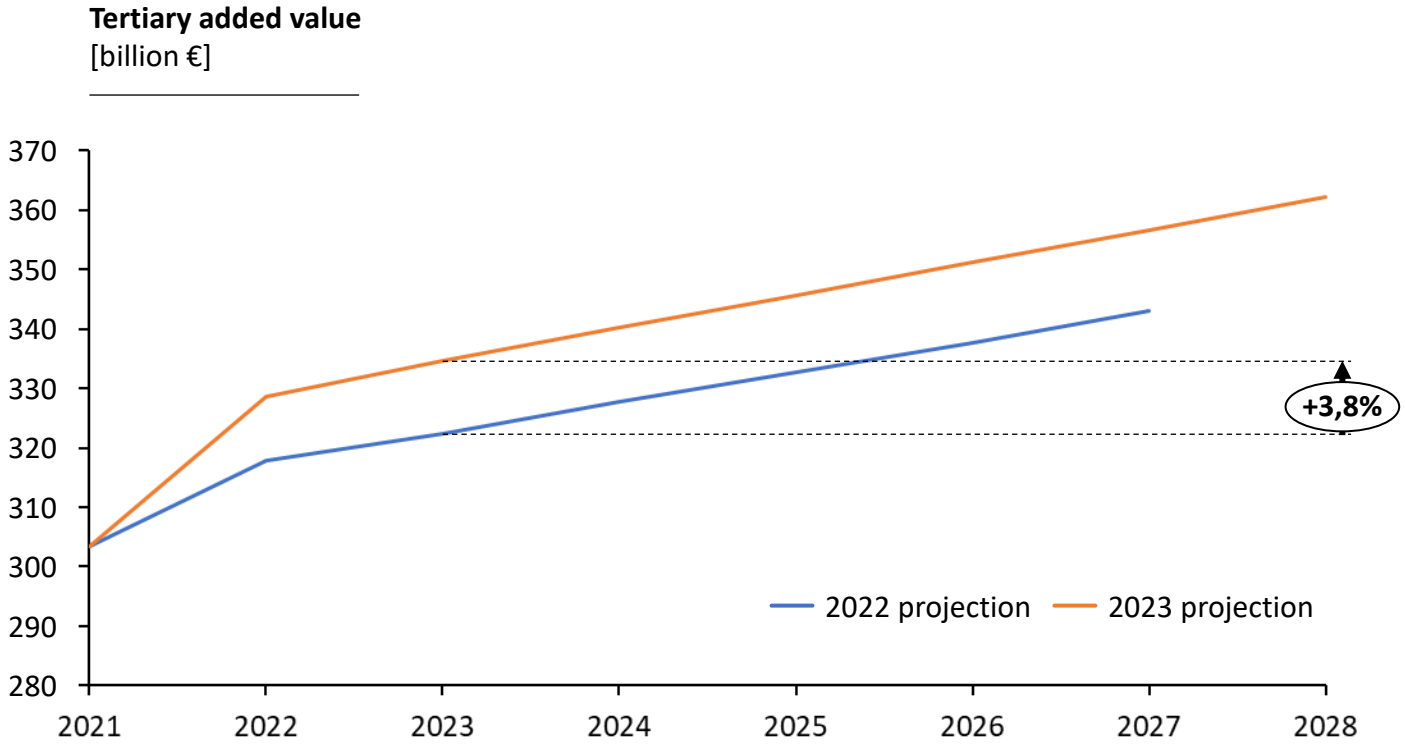
Comparison of 2022 and 2023 projections for the tertiary sector added value

UPDATE JULY 2023



CHANGES BETWEEN 2022 AND 2023

- Strong growth of the commercial services sector in 2022-2023, hence a higher added value than in the 2022 exercise for 2022 and 2023 (+3.8% compared to 2022 exercise)
- In the longer term the growth stabilizes to similar levels than in the 2022 exercise

Quantity	Unit	Historical Source	Projection source
Added value – tertiary sector	M€ (volume)	NBB stat (1)	FPB (2), Perspectives économiques 2023-2028, June 2023

(1) National Bank of Belgium
(2) Bureau Fédéral du Plan

The same methodology as in the 2022 exercise is chosen for industry in this exercise

- **Two main elements** affect the evolution of the industry electricity demand

1) Impact of electricity **prices**

2) New **electrification** in the industry(1) (new assets or retrofit of existing ones)

- These elements are accounted for in a separate way (explained in slides below)

➔ The same methodology as in 2022 is applied regarding the impact of FPB macro-economic projections on the industry electricity consumption, i.e.:

- The production of most industry subsectors (exc. wood, paper and other industries) is decorrelated from their added value
- Their output (in kt) is considered flat for the whole 2022-2028 period. Wood, paper and other industries see their production output vary proportionnaly to their sector added value growth

(1) Elia, June 2023, Adequacy and Flexibility study, https://www.elia.be/en/electricity-market-and-system/adequacy/adequacy-studies

Agenda

- Methodology
- **Update of the study**
  - Evolution of Federal Planning Bureau projections
  - **Projections for additional electrification**
  - Electricity prices and impact on load consumption
  - Demand destruction
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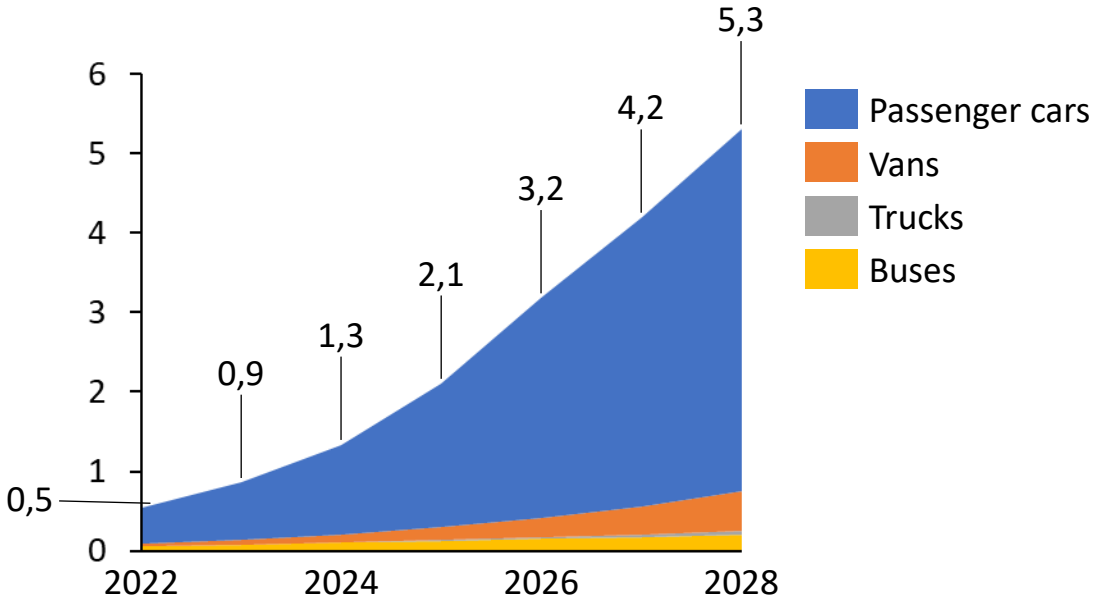
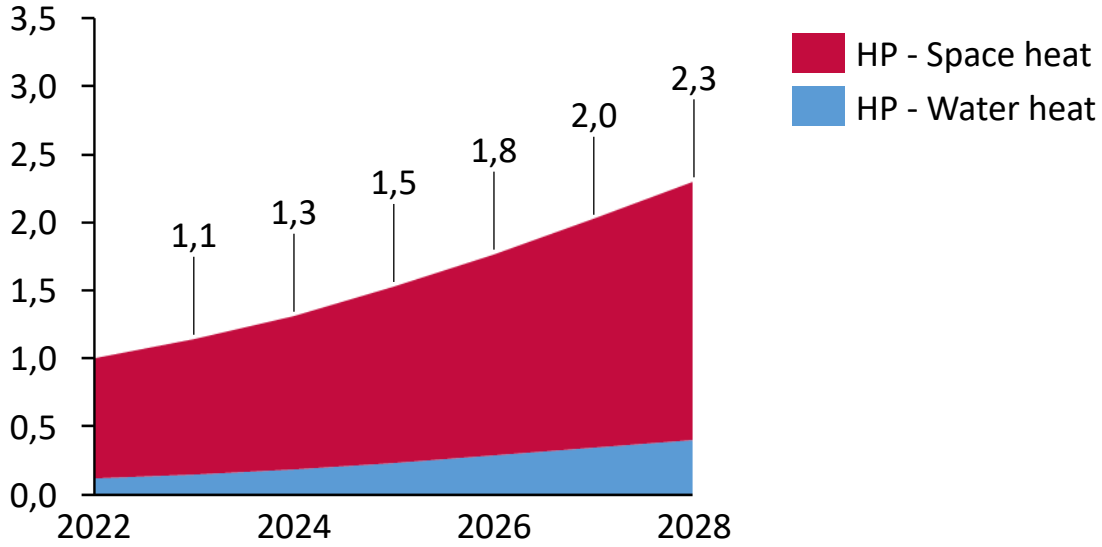
The uptake of electric vehicles and heat pumps is driven by market and policy insights

Electricity consumption for electromobility
[TWh]



Electricity consumption for heat pumps
[TWh]

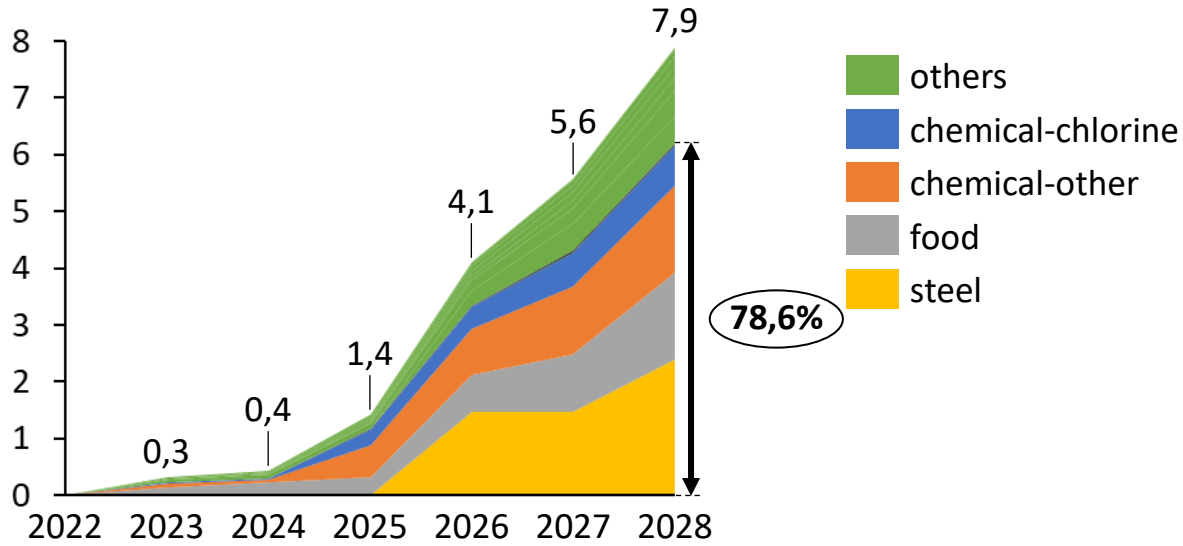


- Elia provides assumptions on the uptake of electric vehicles and heat pumps in its Adequacy & Flexibility study
- The corresponding electricity consumption is taken as an input for the current modelling exercise

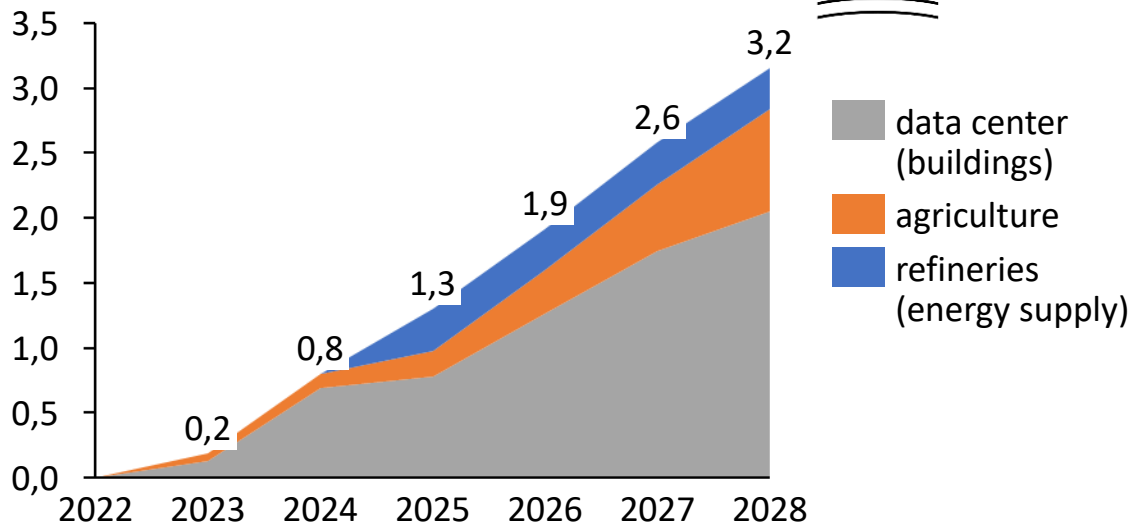
Source: Elia, June 2023, Adequacy and Flexibility study, https://www.elia.be/en/electricity-market-and-system/adequacy/adequacy-studies

The future electrification in industry is based on a bottom-up survey of large industrial consumers

Additional electrification in industry sector compared to 2022
[TWh]



Additional electrification in non-industry sectors compared to 2022
[TWh]



- Elia provides assumptions on new electrification in the industry, datacenter, refineries and agriculture based on a bottom-up study carried out with customers in 2022(1)
- The corresponding electricity consumption is taken as an input for the current modelling exercise
- These additional consumption figures were previously considered in post-processing by Elia but are directly considered in 2023 modelling exercise

(1) Elia, "Powering Industry towards Net Zero" , 2022, https://www.elia.be/en/news/press-releases/2022/11/20221118_visionpaper

Agenda

- Methodology
- **Update of the study**
  - Evolution of Federal Planning Bureau projections
  - Projections for additional electrification
  - **Electricity prices and impact on load consumption**
  - Demand destruction
- Electricity consumption projections by sector and in total
- Conclusion

The computed reaction of the total load to electricity prices variations can be seen as an upper limit of what would happen in real-life

- The elasticity coefficient considered to compute the impact of electricity price on the total load is ε = - 0.12[1]

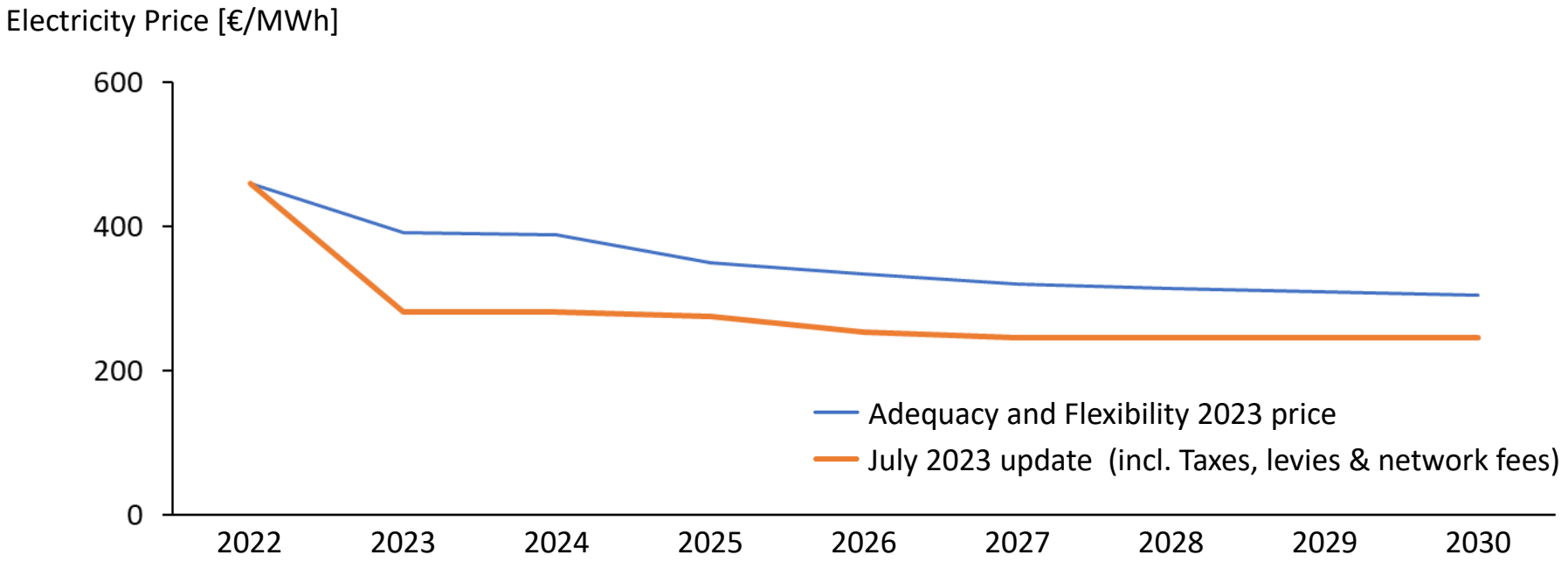
→ This means that a **1% increase in electricity price[2] causes a -0.12% decrease in the electricity consumption**

- Authors from the reference study [1] mention that
  1. The estimation of the elasticity has been carried out using consumption data from the 2014-2015 period when VAT was reduced from 21% to 6% and then increased back to 21%
  2. They observed that *"demand reacted quickly and symmetrically to the VAT cut and the subsequent VAT hike"*
  3. VAT changes are salient and comprehensible to end-users. Changes in market prices are more difficult for end-users to understand and follow, which **could lead to a lesser reaction to price changes, and therefore a lesser elasticity.**

- The same authors are currently updating their analysis of the elasticity of the electricity consumption for Synergrid (no results published yet). We recommend to integrate these results in the next iteration given the significant impact on total load projections.

(1) Hindriks & Serse, 2022 ,*The incidence of VAT reforms in electricity markets: Evidence from Belgium*
(2) The price variation is computed with respect to 2021 that is considered the base year, prior to the 2022 electricity price hike

Forward electricity prices have significantly decreased between both exercises



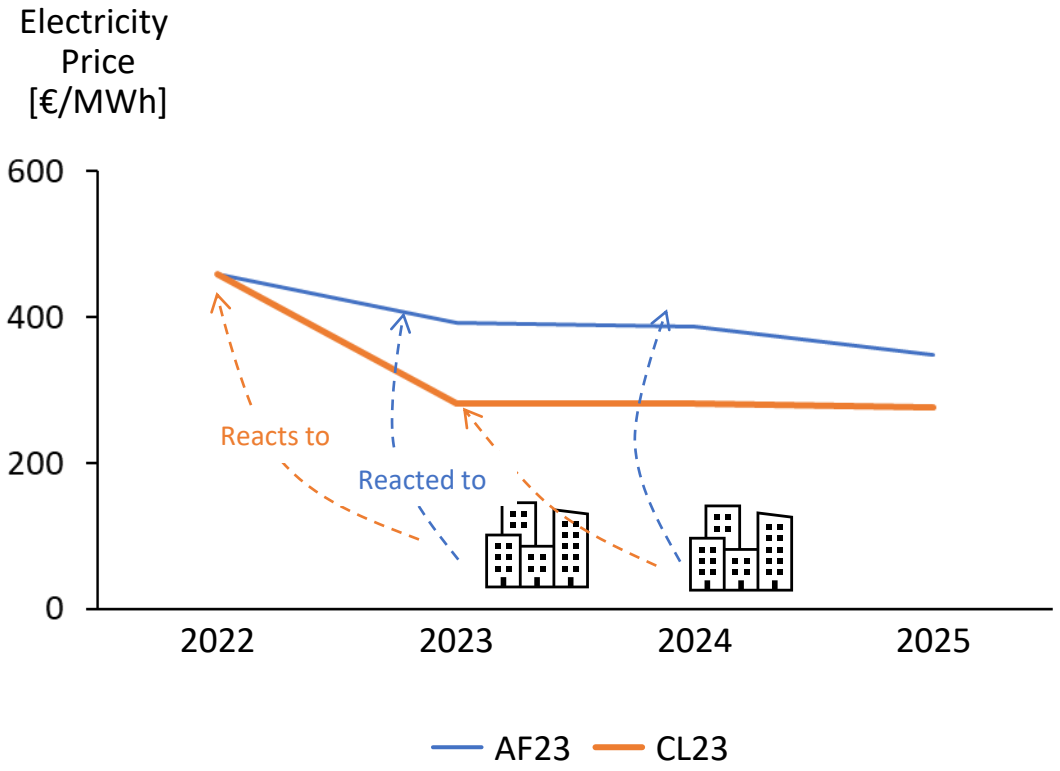
- Estimated wholesale electricity prices considered in this exercise are lower than the wholesale price for the Adequacy and Flexibility as the forward prices have significantly dropped between both exercises (February 2023 vs July 2023)

(1) Hindriks & Serse, 2022 ,*The incidence of VAT reforms in electricity markets: Evidence from Belgium*

The sensitivity to electricity prices in the buildings sector has been adapted following new insights from 2023

Elia observed that 2023 reduction is mainly due to the buildings sector, yet 2023 electricity prices are lower than in 2022

➔ It is considered that the electricity use from residential and tertiary buildings reacts with a 1-year delay to electricity prices

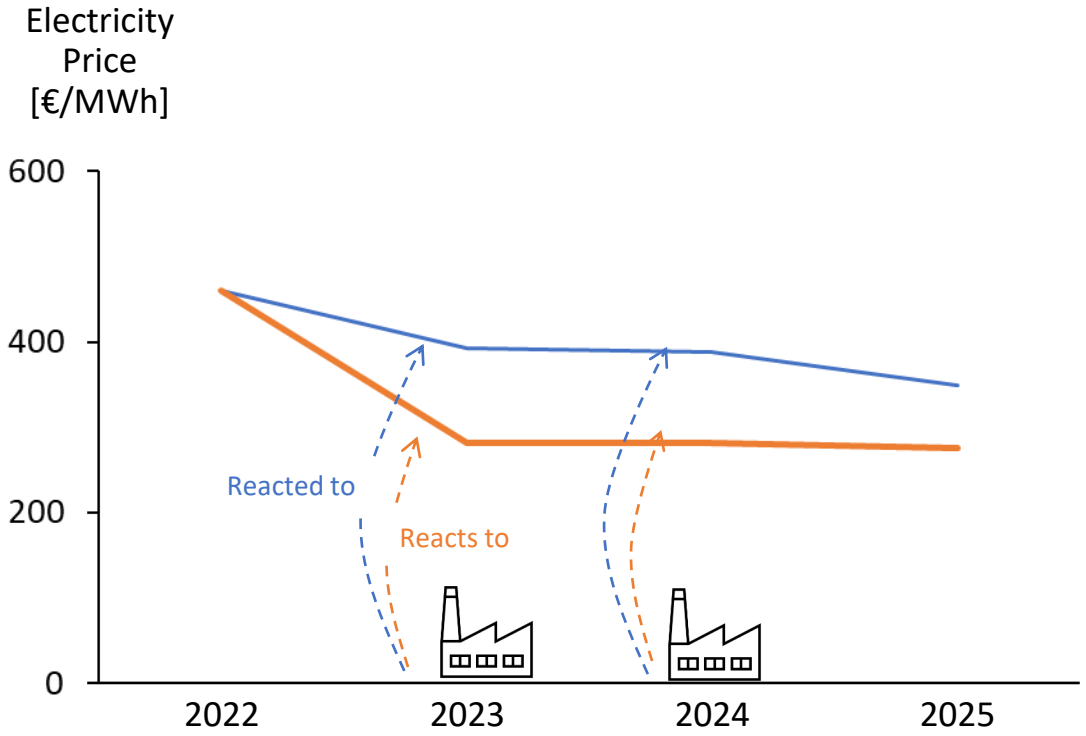


Source: Climact

Demand reduction due to price impact in the industry sector follows the same rationale as in 2022 but prices are lower in this exercise

Industry actors are considered to follow electricity price evolutions more closely

➔ There is no delay in the reaction to prices



Source: Climact

Agenda

- Methodology
- **Update of the study**
  - Evolution of Federal Planning Bureau projections
  - Projections for additional electrification
  - Electricity prices and impact on load consumption
  - **Demand destruction**
- Electricity consumption projections by sector and in total
- Conclusion

Demand destruction is added to fit Elia's best estimate of the 2023 total load

- The total load for the CL23 exercise, accounting for all aforementioned updates, amounts to **82.4 TWh**
- Elia's best estimate for the 2023 total load is equal to **80.3 TWh.** This is based on grid data from the 7 first months of 2023
- The difference between both figures is **2.1 TWh** which cannot be explained by other impacts already taken into account (macro-economic impacts, electricity price impact, electrification)

➔ A **permanent demand destruction of 2.1 TWh** is considered over the **2023-2028 period** to match Elia's best estimate for 2023

Agenda

Methodology

Update of the study

Electricity consumption projections by sector and in total

Conclusion

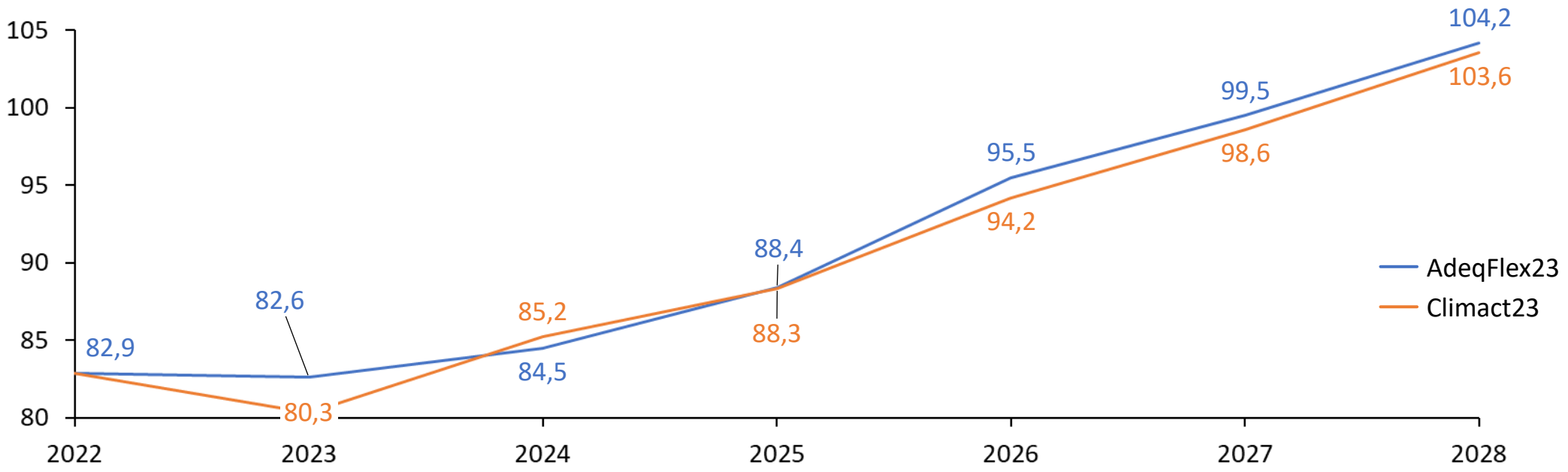
What has changed between Climact 23 and AF23 - General

- **Update of price trajectories (04/07/23)**
- **Different price impact methodology, using the same -0.12 elasticity:**
  - AF23: price sensitivity in buildings and industry with no delay (reaction of the 2023 load to 2023 prices)
  - Climact 2023 : price sensitivity with a 1Y delay in buildings (delayed reaction of the 2023 load to 2022 prices) and no delay in industry
- **Update of macro-economic projections with 2023 FPB projections**
- **Calibration updates:**
  - Assume constant consumption of 8.9 TWh(*) for resistive heating, over the whole period
  - New value used for calibration for 2021 total load (84.6 TWh in 2022 exercise vs 84.7 TWh in 2023 exercise)
  - Improvement in the refineries sector

(*) This corresponds to the value from 2021. No evidence could be found suggesting that resistive heating is either increasing or decreasing , hence it is kept at its current level. For the next exercise, we recommend a deeper analysis on this subject given the importance of this figure.

Comparison of Adequacy & Flexibility 2023 and Climact 2023 exercices

Final electricity consumption - total
[TWh]

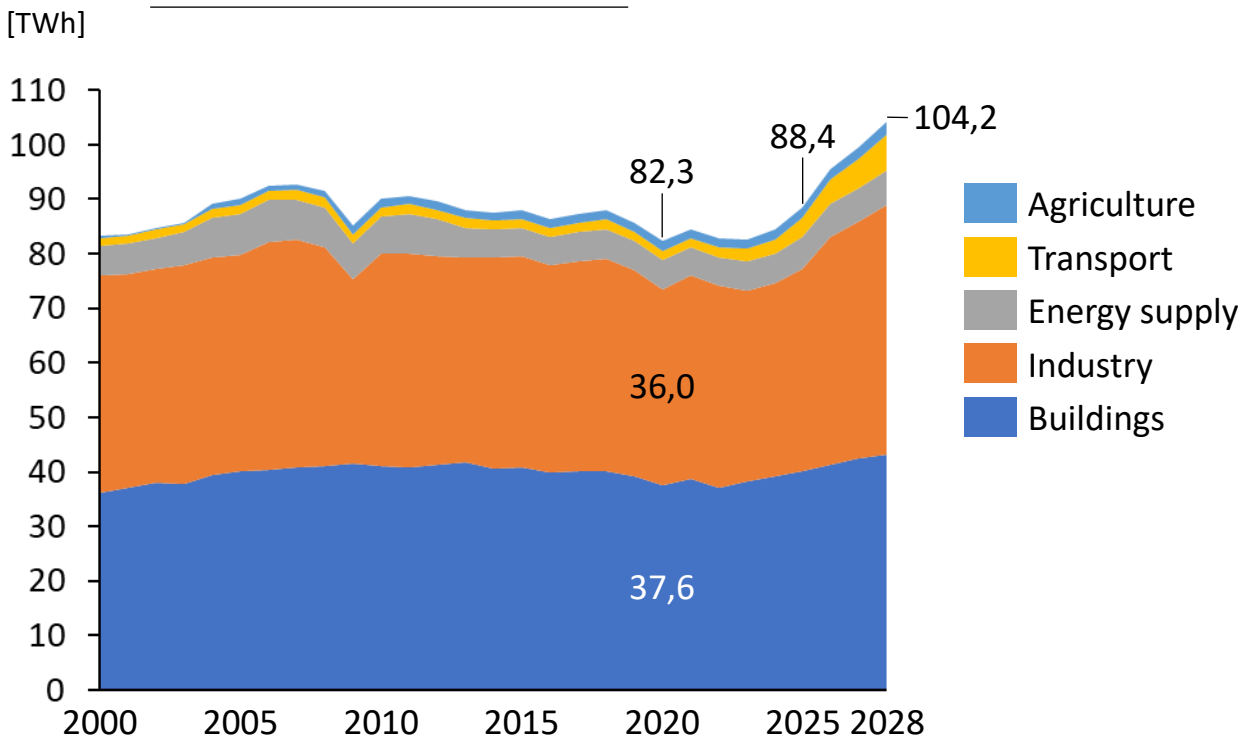


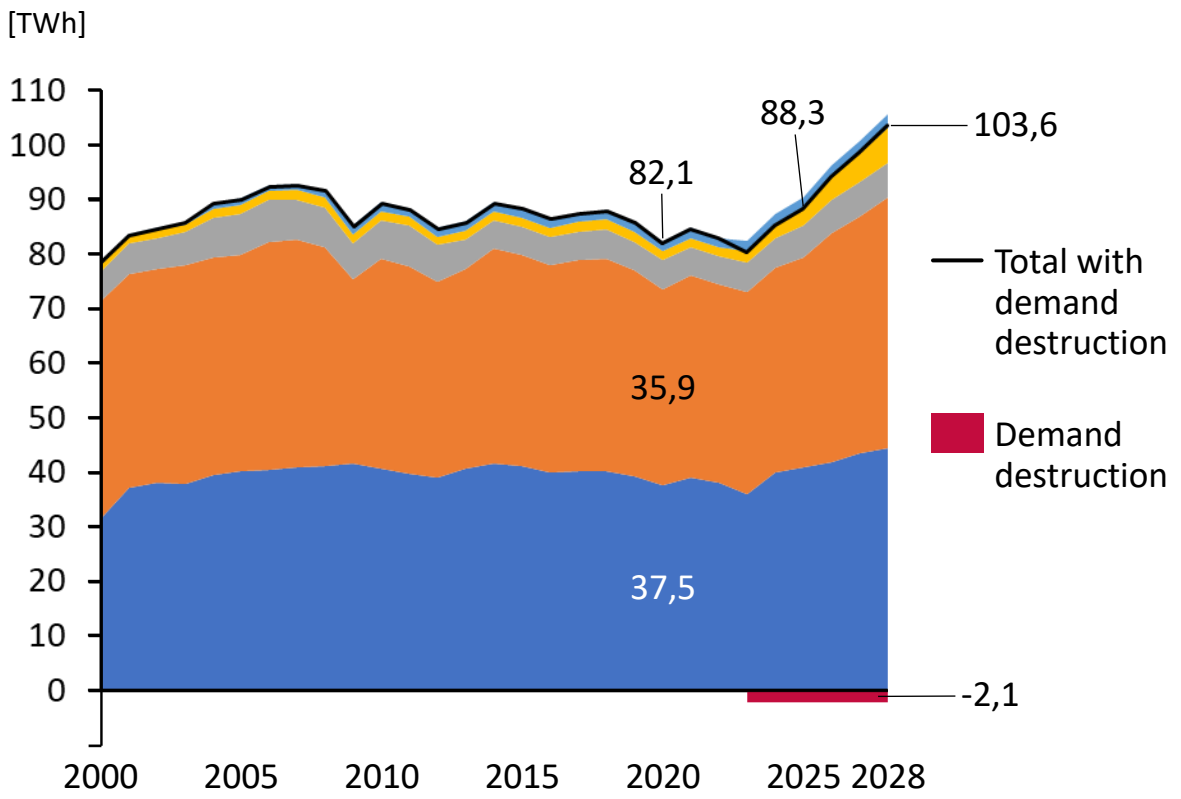
- Demand destruction has been considered to match Elia's best estimate of the total load (July 23)
- Demand destruction impacts considered constant during the entire trajectory from year 2023 onwards

Sources: Climact – Pathways Explorer

Updated 2023 projections are slightly under AF23 projections, from 2025 onwards

Final electricity consumption – total





AdeqFlex23 (AF23)

Climact 2023 exercise

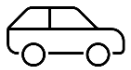
- Industry : lower price impact from 2023 onwards in CL23 than in AF23 due to lower electricity prices considered in CL23
- Buildings : lower price impact for 2023 in AF23 than in 2023 projections due to a 1-year delay (2023 reaction on 2022 prices) and lower organic growth due to change in methodology for resistive heater future load. From 2023 onwards, price impact in AF23 is greater than in Climact 2023 exercise due to higher prices considered in AF23

Sources: Climact – Pathways Explorer

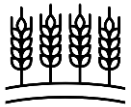
Year 2023-2028 : What has changed between Climact 23 and AF23 – Transport, Agriculture and Energy supply

Energy supply 

- No differences between AF23 and CL23 (Elia data)

Transport 

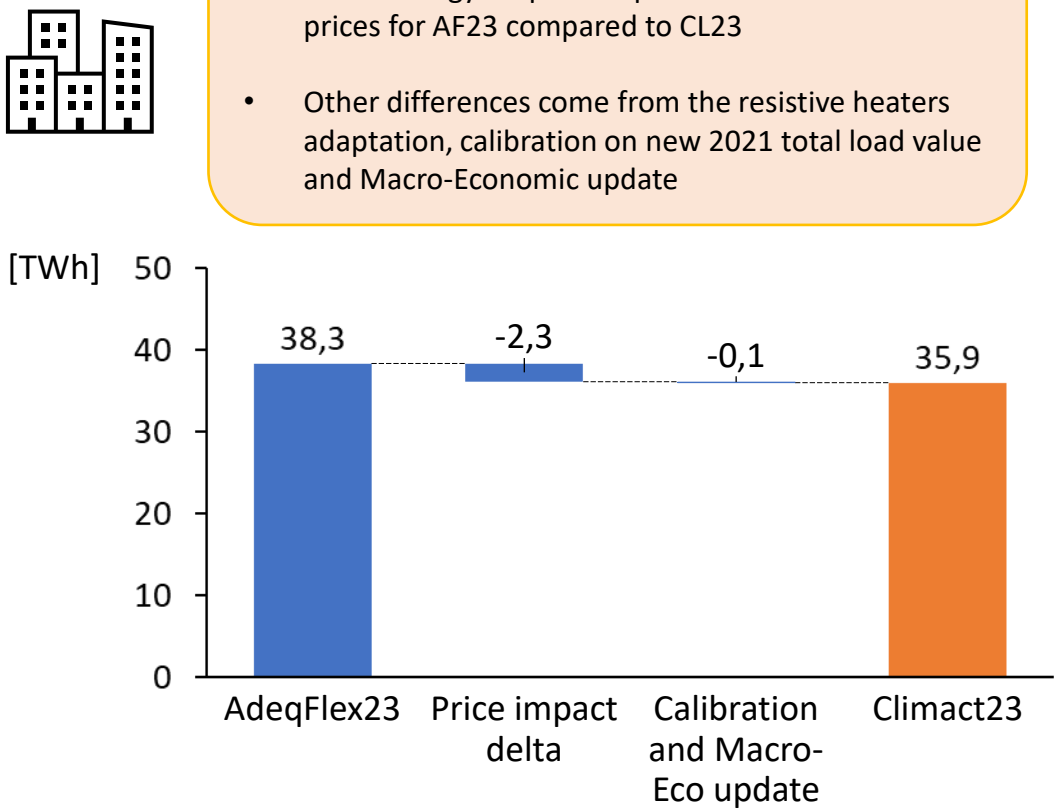
- Slight differences for the rail (train, metro & tram) consumption due to the update of the calibration
- Difference < 0.024TWh/year over 2023-2028 period

Agriculture 

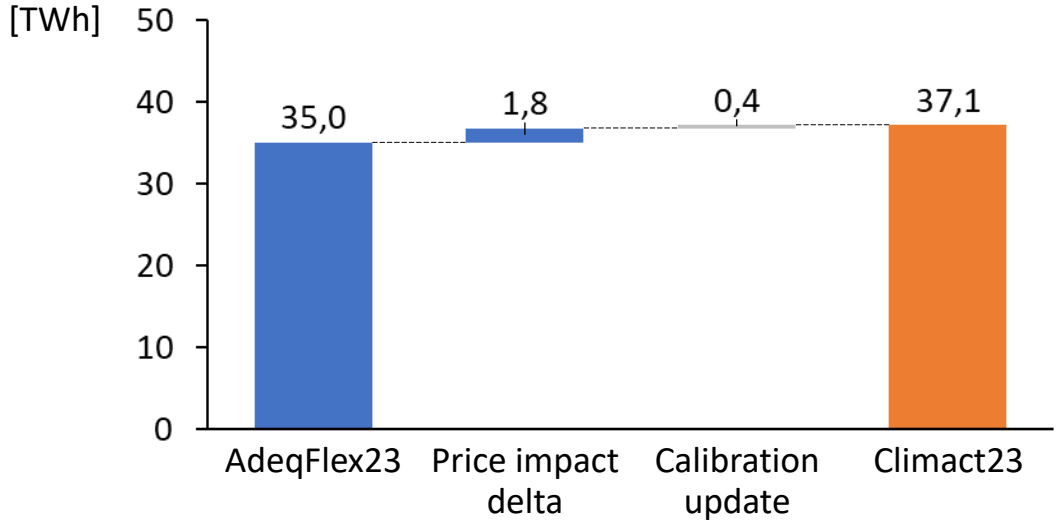
- Slight differences due to the update of the calibration
- Difference < 0.002TWh/year over 2023-2028 period

Year 2023 : What has changed between CL23 and AF23 – Buildings & Industry

- **Higher** price impact for CL23 due to the difference in methodology for price impact and the different prices for AF23 compared to CL23
- Other differences come from the resistive heaters adaptation, calibration on new 2021 total load value and Macro-Economic update



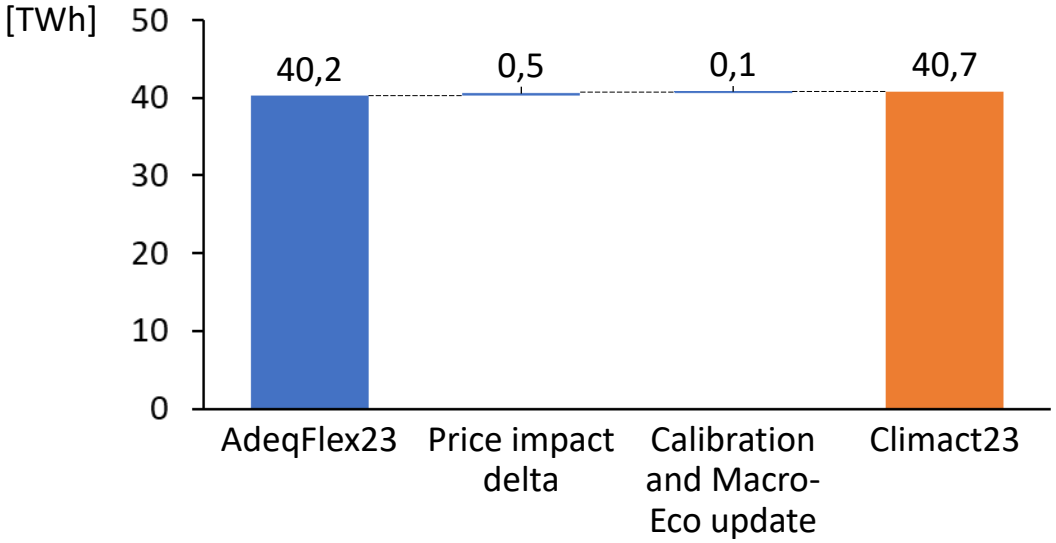
- Lower price impact for CL23 due to lower considered electricity prices compared to AF23
- The rest of the difference comes from the calibration on the new 2021 total load value



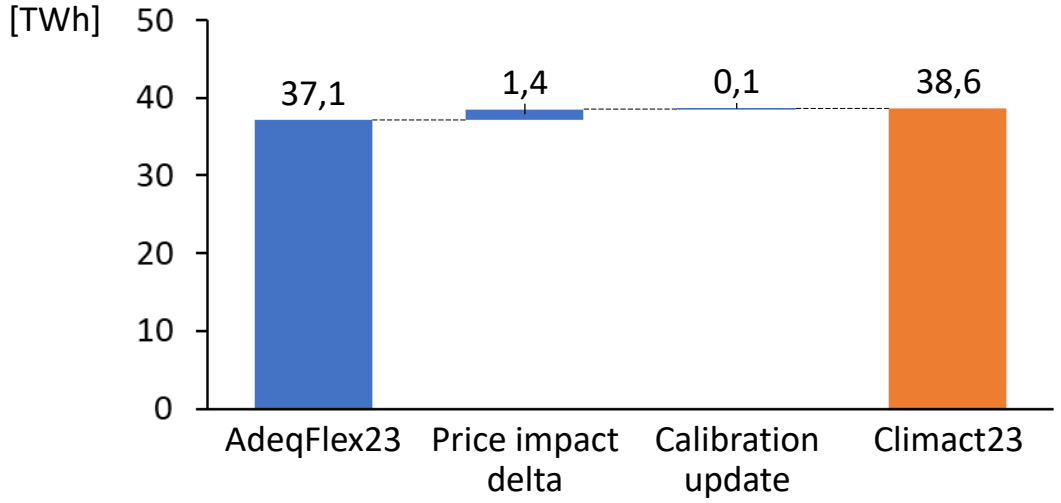
Disclaimer:
These figures do not include demand destruction, which is added to the total load

Year 2025 : What has changed between Climact 23 and AF23 – Buildings & Industry

- **Higher** price impact for CL23 due to the difference in methodology for price impact and the different prices for AF23 compared to CL23
- Other differences come from the resistive heaters adaptation, calibration on new 2021 total load value and Macro-Economic update



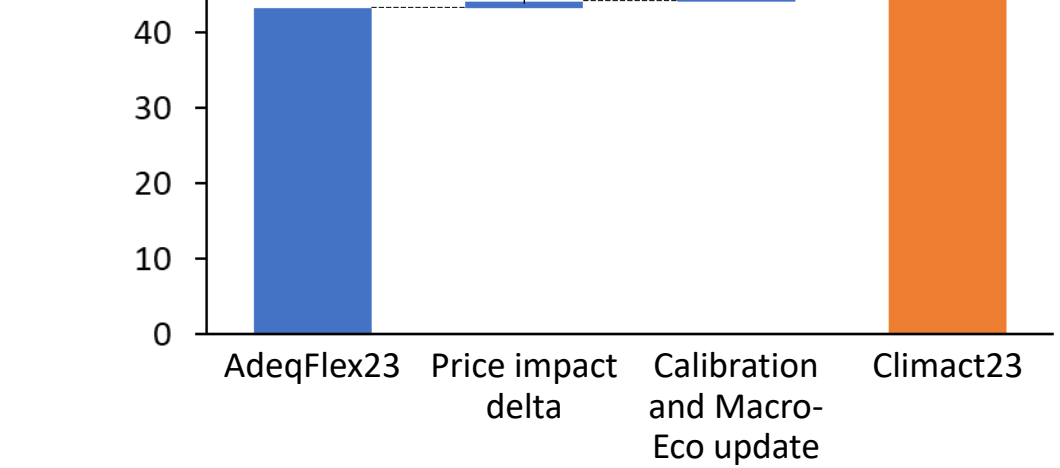
- Lower price impact for CL23 due to lower considered electricity prices compared to AF23
- The rest of the difference comes from the calibration on the new 2021 total load value



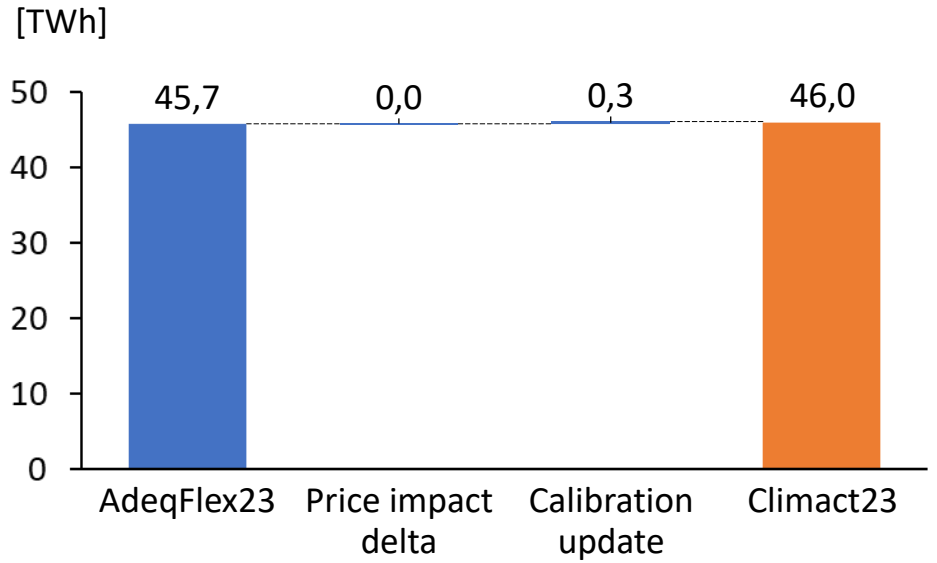
Disclaimer:
These figures do not include demand destruction, which is added to the total load

Year 2028 : What has changed between Climact 23 and AF23 – Buildings & Industry

- **Lower** price impact for CL23 due to the difference in methodology for price impact and the different prices for AF23 compared to CL23
- Other differences come from the resistive heaters adaptation, calibration on new 2021 total load value and Macro-Economic update



- Price impact not considered anymore in CL23 and AF23
- The rest of the difference comes from the calibration on the new 2021 total load value



Disclaimer:
These figures do not include demand destruction, which is added to the total load

Agenda

Methodology

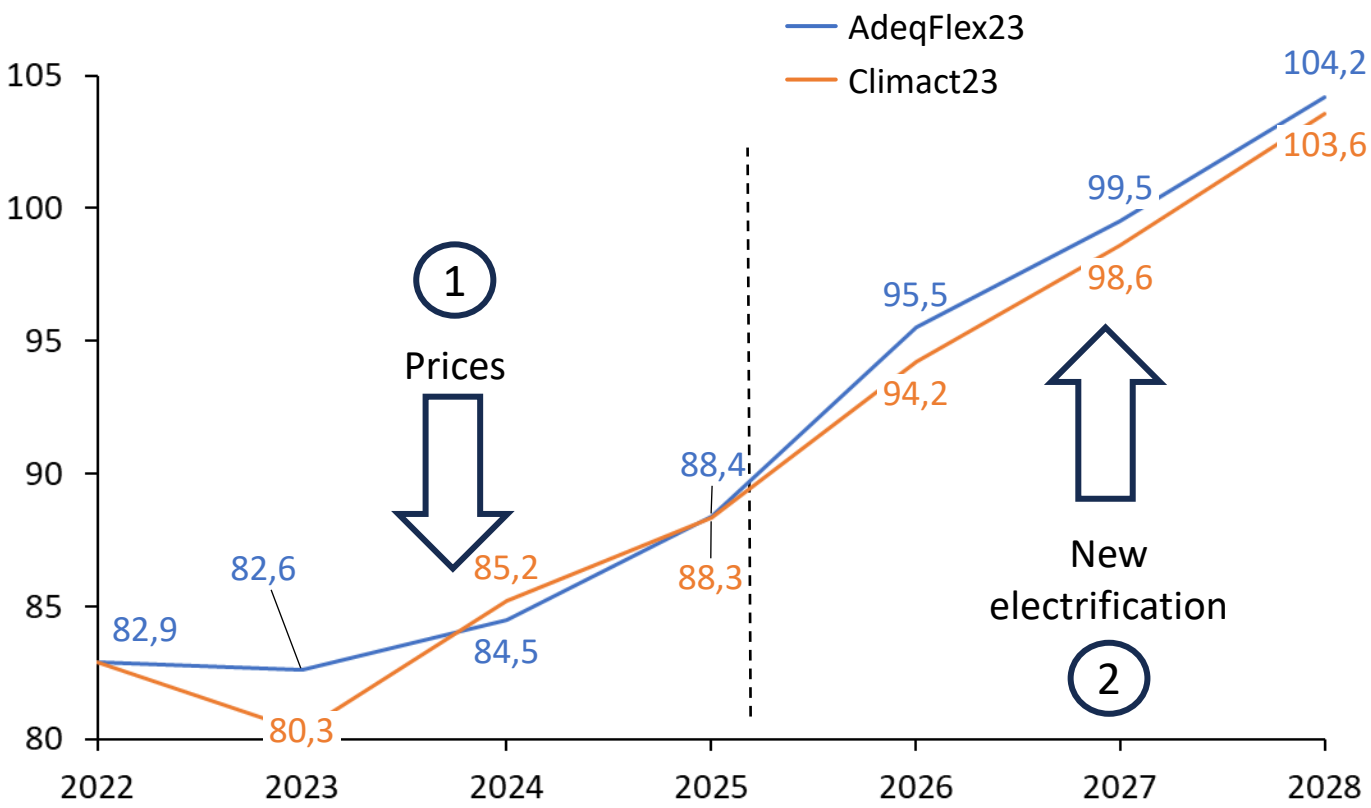
Update of the study

Electricity consumption projections by sector and in total

Conclusion

It is essential to monitor future developments in prices and new electrification as they both significantly impact future load projections

Total load projection
[TWh]



1

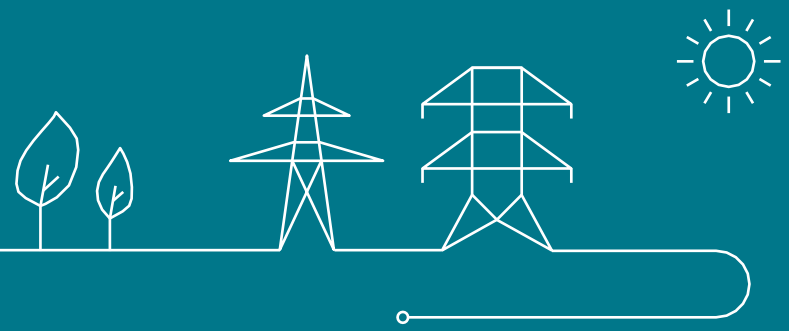
- High electricity prices have a downward impact on the total load on the short term (< 2025)
- It is important to keep tracking the evolutions of electricity prices and to assess as best as possible the impact on the total load

2

- New electrification has an upward impact on the total load on the medium term (> 2025)
- This additional electrification depends on major investments in the industry which should be monitored closely

Sources: Climact – Pathways Explorer

Thanks for your attention!
Any questions?



Strike Price

Study by E-Cube

Elia

Calculation of the initial Strike Price calibration for the CRM

Brussels, June 2023

Strictly confidential

The Strike Price is a key parameter for the Capacity Remuneration Mechanism. Its calibration is detailed in the Royal Decree Methodology from April 2021

STRIKE PRICE CONTEXTUAL DESCRIPTION

- In the context of Belgian future adequacy context, Belgium adopted in April 2019 an amendment to the Electricity Law to implement a **Capacity Remuneration Mechanism (CRM).** This mechanism offers, through auctions, a complementary revenue to market revenues for Capacity Providers. However, episodes of capacity scarcity in the energy market can result in events of very high prices. These very high price events could result in windfall profits for Capacity Providers already benefitting from the CRM complementary revenues.

- **As part of a Reliability Option, the Strike Price is set as the upper price limit until which Capacity Providers from the CRM can earn energy market revenues**. If the Reference Price (based on the price observed on a NEMO active in the day-ahead market in the Belgian bidding zone) exceeds the Strike Price, then all additional revenues made on the energy market from the Capacity Provider above the Strike Price are to be paid back by the Capacity Provider. The Strike Price is defined as "the predefined price that determines the threshold above which the Capacity Provider has to pay-back the difference with the Reference Price" [1)].

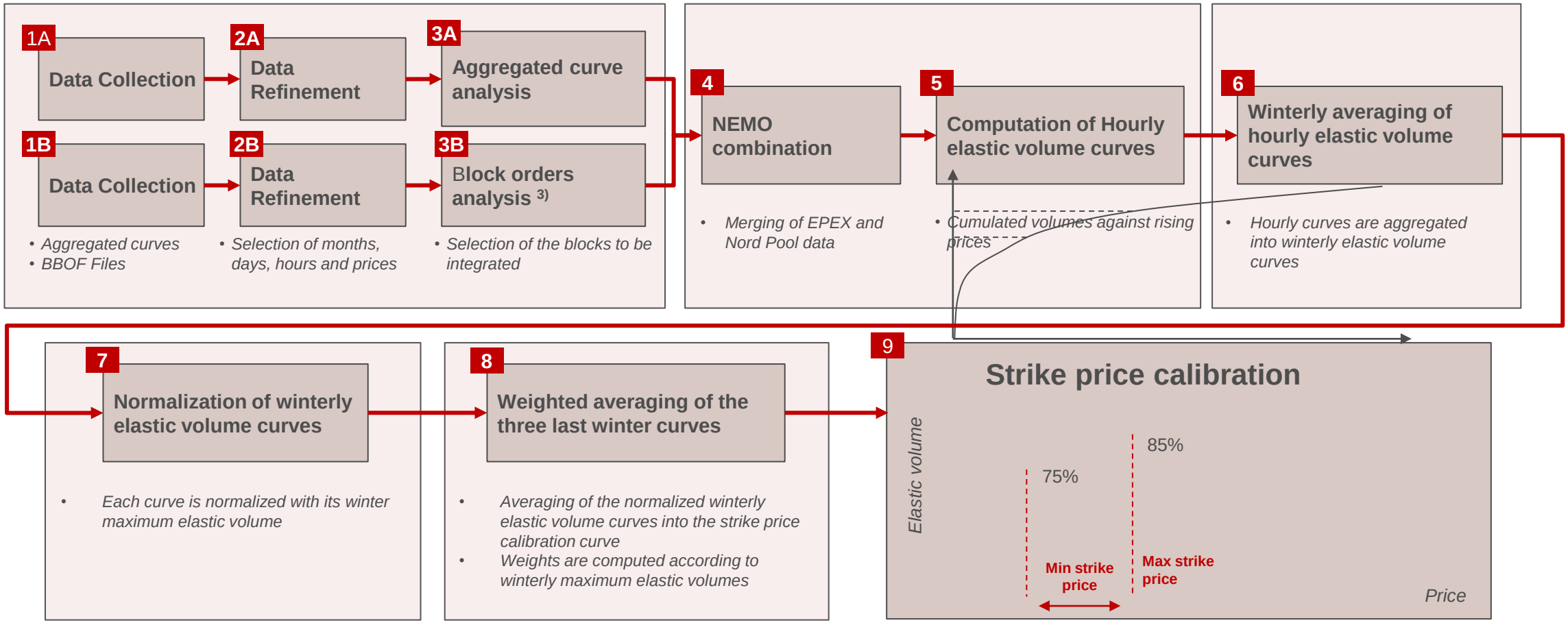
- The aim of this presentation **is to present the construction of the calibration curve used for the strike price calibration and to provide a short reminder about the methodology used to construct the calibration curve, as well as its corresponding strike price interval for the Y-4 auction related to the Delivery Period 2028-2029** (hereinafter referred to as "Y-4 auction**"), according to the Royal Decree Methodology presented in article 27 §1 from the Royal Decree published on April 30th 2021** (hereinafter referred to as "Royal Decree Methodology") [2)]

- The proposal of Strike Price from Elia must ultimately be calibrated in the strike price interval taking into account the criteria listed in article 27 §2 of the Royal Decree Methodology.

1) *Law on the Organisation of the Electricity Market (April 1999), art. 2, al. 1, 80° . Accessible on http://www.ejustice.just.fgov.be/cgi_loi/change_lg_2.pl?language=fr&nm=1999011160&la=F*
2) *Belgian Monitor (April 2021), p. 41179. Accessible on http://www.ejustice.just.fgov.be/eli/arrete/2021/04/28/2021041351/justel#LNK0008*

9 steps are required to construct the Strike Price calibration curve based on the elastic volumes collected from Day-Ahead markets datasets coming from both NEMOs active in the Belgian bidding zone

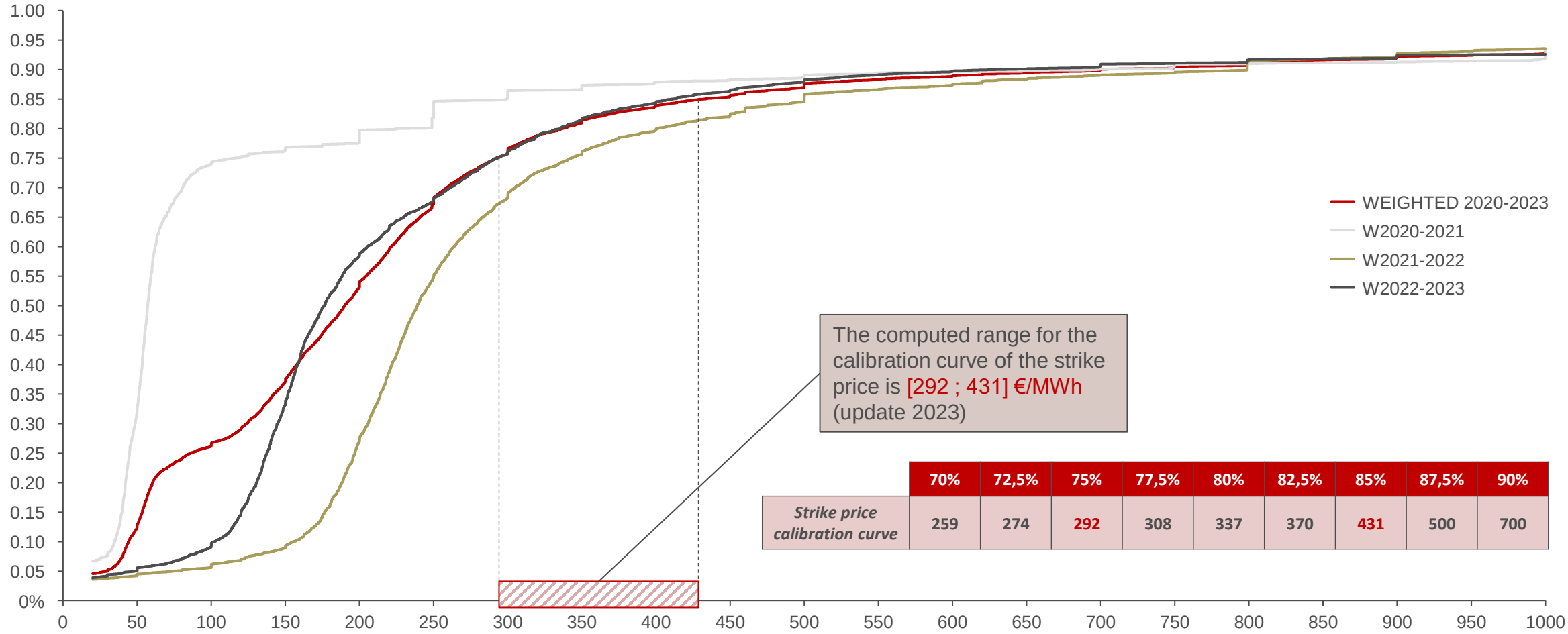
COMPARISON OF APPLIED METHODOLOGY AND STEPS OF THE ROYAL DECREE METHODOLOGY [1)]



1) No changes in the methodology compared to 2020
2) No additional block order categories were created in 2022/2023

For the Y-4 & Y-1 auction, the application of the methodology leads to a [292 ; 431] €/MWh range for the strike price calibration

COMPUTATION OF THE STRIKE PRICE CALIBRATION CURVE AND ITS RANGE FOR THE Y-4 AUCTION [€/MWH] (2020-2023)



	70%	72,5%	75%	77,5%	80%	82,5%	85%	87,5%	90%
Strike price calibration curve	259	274	292	308	337	370	431	500	700

Note : For 2022-2023 winter, it is assumed that NPS Aggregated Curves are included in EPEX Aggregated Curves

Source: E-CUBE Strategy Consultants, data from active NEMO's

A detailed analysis of the 70 – 90% interval does highlight a large increase in prices for the 2028-2029 delivery period due to W2021-2022 and to W2022-2023 which is still largely above winter periods before 2021

PRICES ASSOCIATED TO DIFFERENT % OF ELASTIC VOLUME IN THE Y-4 AUCTION CALIBRATION CURVES AND FOR THE LAST 7 WINTER PERIODS [€/MWH, 2016-2023]

	70%	72,5%	75%	77,5%	80%	82,5%	85%	87,5%	90%
Delivery period 2025-2026 & 2028-2029[1)]	**259**	**274**	**292**	**308**	**337**	**370**	**431**	**500**	**700**
Delivery period 2027-2028[2)]*	249	253	270	298	313	350	417	500	750
Delivery period 2026-2027[3)]	73	81	94	125	200	249	300	399	700
Delivery period (Y-4) 2025-2026[4)]	70	80	95	125	200	249	300	450	750
Winter 2022-2023	**261**	**276**	**293**	**310**	**335**	**363**	**410**	**480**	**630**
Winter 2021-2022[5)]*	300	313	335	355	391	343	494	591	799
Winter 2020-2021	80	89	116	198	230	250	299	385	699
Winter 2019-2020[6)]	55	64	90	148	200	249	300	399	648
Winter 2018-2019	72	78	85	97	125	215	280	379	750
Winter 2017-2018	80	96	115	158	200	300	450	750	799
Winter 2016-2017	54	61	72	90	180	250	300	300	600

1) Computed from winters 2020-2021, 2021-2022 and 2022-2023
2) Computed from winters 2019-2020, 2020-2021 and 2021-2022
3) Computed from winters 2018-2019, 2019-2020 and 2020-2021
4) Computed from winters 2017-2018, 2018-2019 and 2019-2020
5) First integration of Nord Pool Spot's Block Order
6) First integration of Nord Pool Spot's aggregated curves

* As communicated last year

Source: E-CUBE Strategy Consultants


E-CUBE
STRATEGY
CONSULTANTS

Market Response

Study by E-Cube

The future electricity load is decomposed in 7 components with associated assumptions on flexibility

Electricity load components	Associated flexibility assumed		Flexibility assumed in the reference scenario
Historical usage of electricity	Market response (DSR from existing usages)	Existing DSR (or market response) in the system with potential new additional volumes that can be invested in if economically viable	Existing DSR (Market Response) and additional if viable in the economic loop based on preselected capacity types.
Transport electrification	Vehicle-to-X Smart charging	Different modes of (dis-)charging EV considered depending on the EV usage, infrastructure and market incentives	Shares of EV, HP are optimised
Buildings heat electrification	Smart consumption	Assumed flexibility for heat pumps while ensuring comfort of consumers	
Electrolysers	Power-to-H_2	Turned on when electricity prices below a certain threshold	Foreseen evolution • E-boilers 100%; • Electrolysis 100%; • HP 80%; • DRI-EAF 75%; • Data centers 50%; • CCS 0%.
Data centres	Data centres	Activating back-ups when very high prices	
Industry new usage and electrification	CCS DRI-EAF	Flexibility from the process	
	Power-to-Heat	Turned on when electricity prices below a certain threshold	
Losses			

The future electricity load is decomposed in 7 components with associated assumptions on flexibility

Electricity load components	Associated flexibility assumed	Flexibility assumed in the reference scenario
Historical usage of electricity	Market response (DSR from existing usages): Existing DSR (or market response) in the system with potential new additional volumes that can be invested in if economically viable	**Existing DSR (Market Response)** and additional if viable in the economic loop based on preselected capacity types.
Transport electrification	Smart charging: considered depending on the EV usage, infrastructure and market incentives	Shares of EV, HP are optimised
Buildings heat electrification	Smart consumption: Assumed flexibility for heat pumps while ensuring comfort of consumers	
Electrolysers	Power-to-H_2: Turned on when electricity prices below a certain threshold	Foreseen evolution • E-boilers 100%; • Electrolysis 100%; • HP 80%; • DRI-EAF 75%; • Data centers 50%; • CCS 0%.
Data centres	Data centres: Activating back-ups when very high prices	
Industry new usage and electrification	CCS / DRI-EAF: Flexibility from the process Power-to-Heat: Turned on when electricity prices below a certain threshold	
Losses		

Objective of E-Cube presentation on Market Response

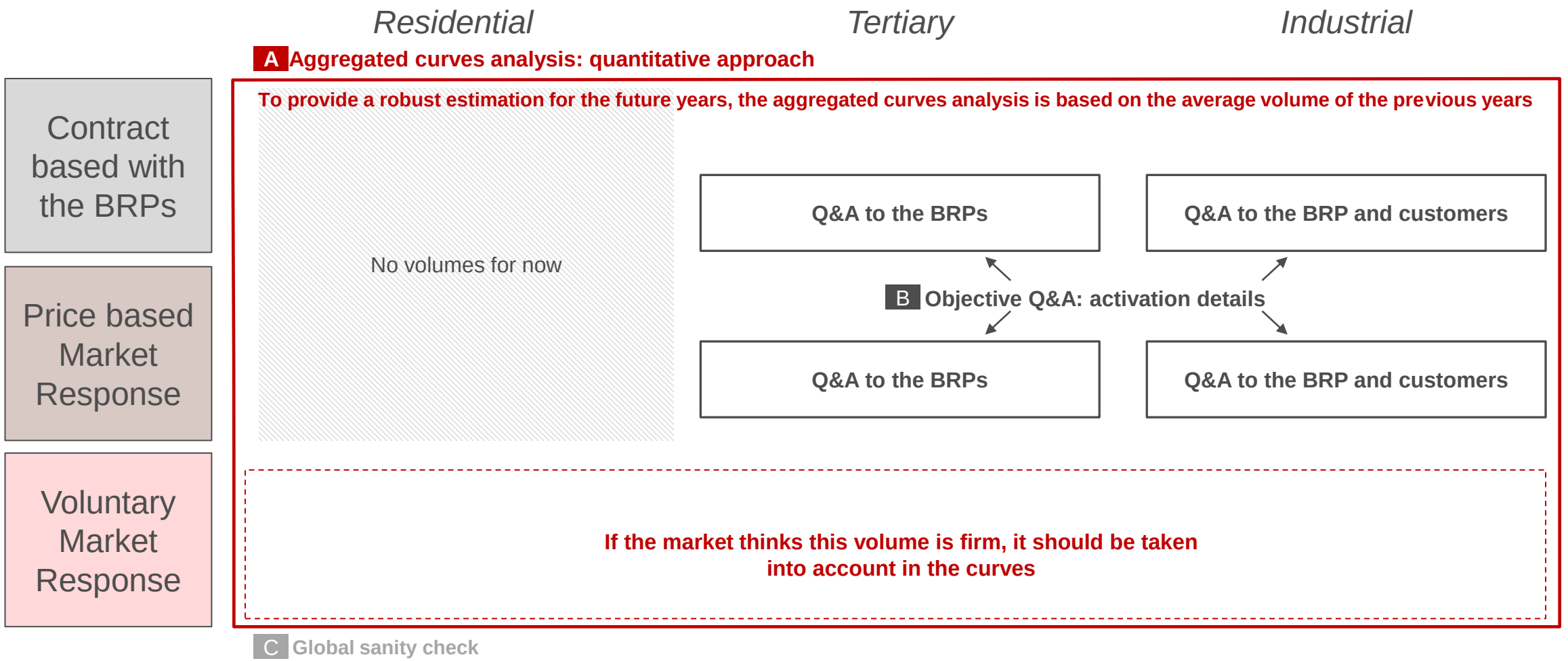
Elia

Market Response – Update 2023
Working Group Adequacy

Brussels, Summer 2023

Strictly confidential

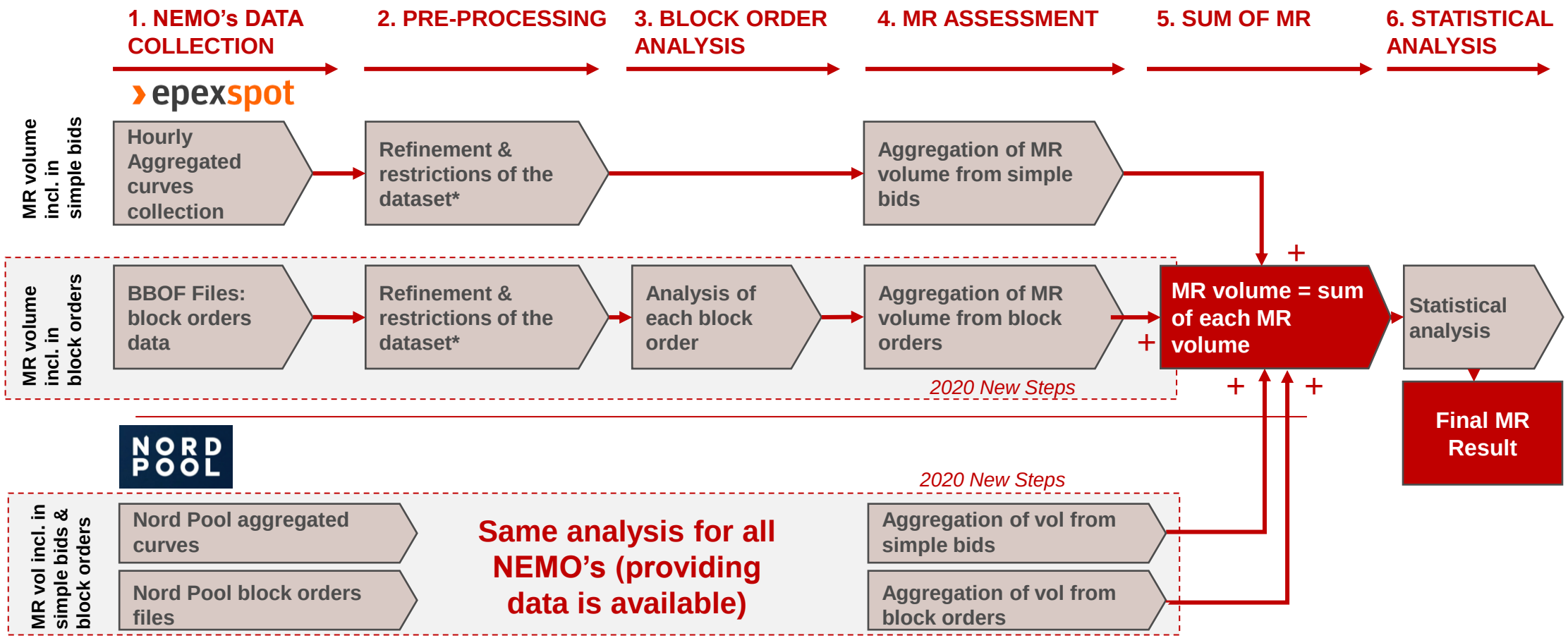
In 2017, a robust quantitative methodology was established based on the aggregated curves, and complemented with a qualitative Q&A to define the details of the activation



Source: E-CUBE Strategy Consultants

The 2020 updated methodology enables MR from block orders to be accounted for and allows the use of data from multiple NEMOs

GENERAL METHODOLOGY FOR THE CURVE ANALYSIS



MR = Market Response ** refinement: national holidays considered as Sundays; restrictions: 1.11 –> 31.3, weekdays, 8 AM to 8 PM)*

Note : Since October 2021, NPS and EPEX data are merged (new info as of 2023 update)

Source: E-CUBE Strategy Consultants

The methodology is based on three restrictions

GENERAL METHODOLOGY

Initial analysis

Analyses conducted: impact of parameters

- 3 analyses were conducted to assess the impact of various parameters on the dataset:
  - Load (Elia grid load)
  - Price (Day-ahead prices)
  - Temperature

The principle of the analysis is to restrict the dataset to the hours when the parameter are above (or below) a threshold. Key statistics (standard deviation, number of values and average) are then calculated.

Focus on the DA prices

Among the previous parameters, the DA prices has the most important impact on the dataset:

- **In periods of important DA prices, the Market Response volumes are more pertinent**
  (there is a decrease of the standard deviation, along with a variation in the average)

Restriction of the dataset

Though, the DA prices vary strongly according to the period. The restriction of the dataset to periods of important DA prices should be studied:

- Season
➔ **Restriction 1:** winter months

- Day type
➔ **Restriction 2:** weekdays

- Hours:
➔ **Restriction 3:** the 12 hours from 8 AM to 8 PM

Update

The impact of CO2 and Gas prices are assessed on the updated dataset

The restriction of the updated dataset is compared to the restriction conducted in the past years.
A new computation method is tested with the implementation of the dynamic threshold.

Source: E-CUBE Strategy Consultants

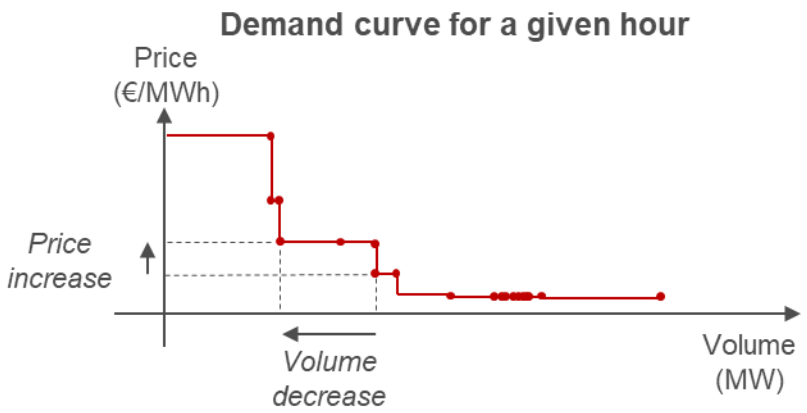
Historically MR was calculated on a threshold of 150€/MWh & 500€/MWh, but in the current context of high energy prices only the 500€/MWh has been analysed for the winter 21/22

GENERAL METHODOLOGY

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



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

- Historically, 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

In the **2021-2022** context of soaring energy prices, it seemed more reasonable to carry out the quantitative analysis **only with the 500€/MWh mark**. The 150€/MWh mark was proposed at a time where electricity prices were significantly lower (around 40-50€/MWh).

For **2022-2023**, additional analyses have been added on the thresholds, to introduce a dynamic element given the context of high volatility

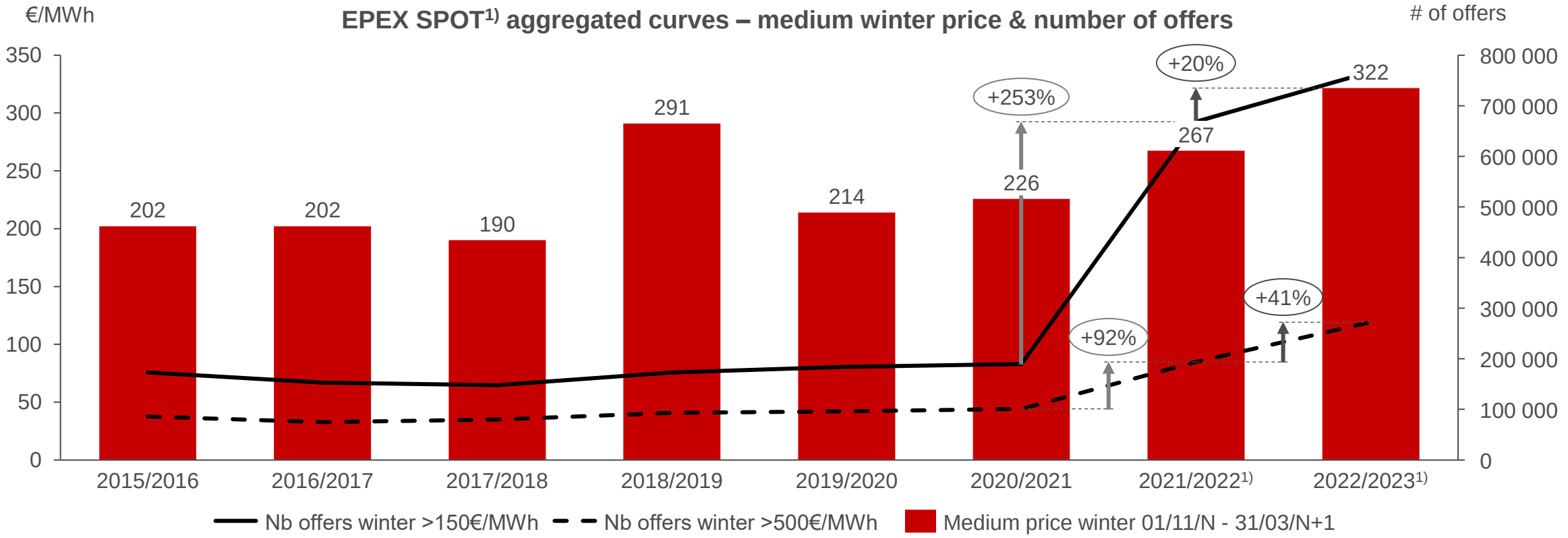
Disclaimer:

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 SPOT

Source: E-CUBE Strategy Consultants

The number of offers >150€/MWh (and >500€/MWh) and the average price are still significatively increasing, but at lower rate than for the last winter

EVOLUTION OF THE NUMBER OF OFFERS AND THEIR AVERAGE PRICE FOR ALL WINTERS SINCE 2015

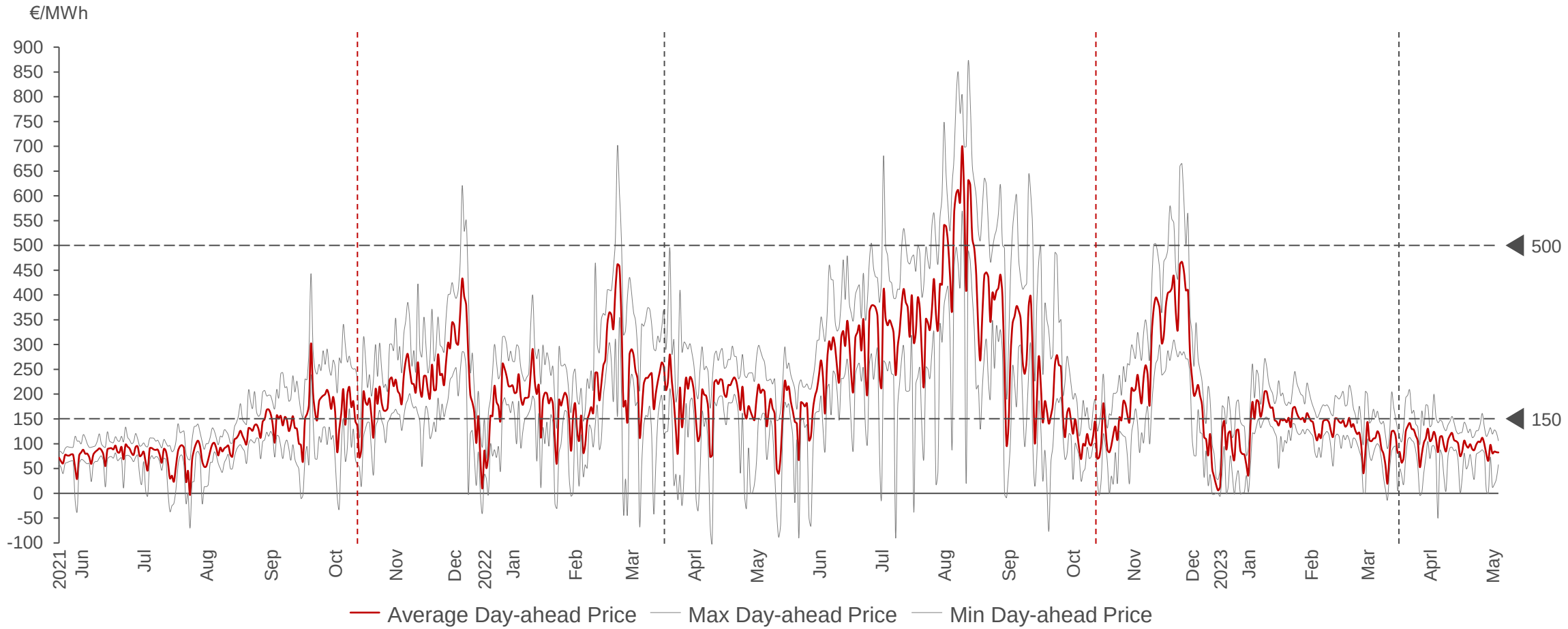


1) Nord Pool Spot's aggregated curves are included as EPEX and NPS data are merged after October 2021

Source: E-CUBE Strategy Consultants, EPEX SPOT, NPS

As day ahead prices were frequently above the 150€/MWh mark, the 500€/MWh threshold has been selected for the winter 2021/2022

BELGIAN DAY-AHEAD PRICE EVOLUTION FROM 04/06/2021 TO 19/05/2023 (ONLY WINTER MONTHS ARE SHOWN IN THE GRAPH)



Source: E-CUBE Strategy Consultants, Entsoe

The WG discussed possibilities to calculate the market response volumes dynamically, in the context of high volatility

- **The historical thresholds used in the market response calculation are fixed. In times of high volatility, the WG decided to investigate the possibility to calculate the market response volumes on a dynamic basis**

- **Calibration on the expected DSR marginal cost**
  - A correlation between the marginal cost of DSR and fuel and CO2 prices could be estimated based on historical data from before the price increase. If the correlation is strong enough, it could then be applied on to determine new price thresholds in a dynamic manner.

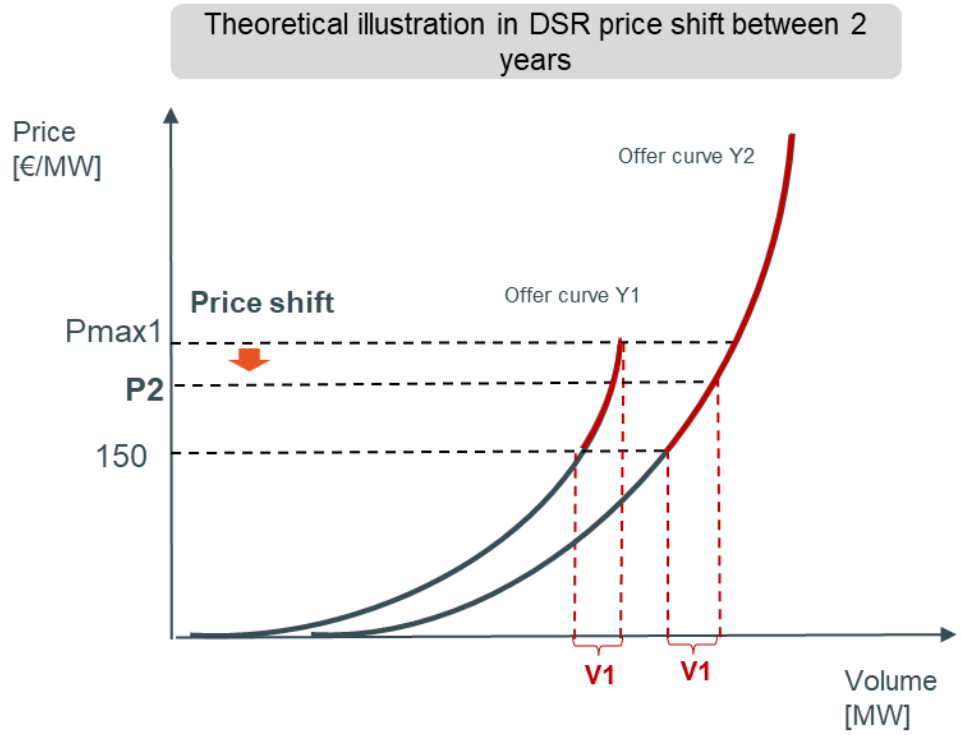
- **Correlation of the market response volumes with proxy of DSR opportunity cost**
  - A combination of CO2 and fuel prices with production price indices is used as a proxy for DSR opportunity cost, and is used to determine a potential correlation with market response volumes

Sourcre: WG Adequacy, Elia

As discussed in the WG, another approach was assessed to deduct the MR volume from the offer curve and computes a “marginal cost of DSR”, than looks for correlation of this with fuel and CO2 prices

Calibration on the expected DSR marginal cost

- A correlation between the marginal cost of DSR and fuel and CO2 prices could be estimated based on historical data from before the price increase. If the correlation is strong enough, it could then be applied on to determine new price thresholds in a dynamic manner.
- The figure on the right of this slide provides a graphic illustration of how the changes in DSR price could be determined based on historic data from before the price and volatility increase.
  - V1 is the DSR volume that was found in a certain year Y1 using either the 150 or the 500 €/MWh threshold. Pmax1 is the maximum price found for DSR in that same year.
  - For each day of the period, D1 is the offer curve (which can be shifted to the right or left). Starting from the maximum of the curve, we then subtract the previously computed volume V1. This allows us to find a corresponding price P.
  - From one day to another, this price should oscillate around the 150 (or 500) €/MW threshold.
  - In both years it is assumed that the base assumptions of the DSR estimation method are valid and that the DSR volume is determined correctly.



Source: WG Adequacy, Elia

There is no visible correlation between the “marginal cost of DSR” (computed with a 150 and 500 €/MWh thresholds) and the Gas/CO2 prices

EPEX AGG. CURVES ONLY, OFFER SIDE ONLY, JANUARY 2020 TO MAY 2021

R^2 (%) between the prices and the marginal cost of DSR (with initial threshold at 150 and 500)

R^2 [MR]	Gas		CO2	
	DSR MC – MR 150	DSR MC – MR 500	DSR MC – MR 150	DSR MC – MR 500
No restriction	0.00 *[711]*	0.00 *[307]*	0.00 *[711]*	0.00 *[307]*
Winter (20-21)	0.04 *[704]*	0.00 *[309]*	0.12 *[704]*	0.02 *[309]*
Winter + weekdays	0.11 *[698]*	0.01 *[319]*	0.18 *[698]*	0.03 *[319]*
All restrictions	0.15 *[698]*	0.02 *[334]*	0.17 *[698]*	0.03 *[334]*

As the R^2 values are always far below 0.85, **there are no correlation between the different quantities.**

Note: correlation calculated on a daily basis, on a linear basis
Source: E-CUBE Strategy Consultants

Even when looking at opportunity cost (industrial sales index) less production (fuel and CO2), the correlation of market response volumes is very low

2020-21 WINTER (1/11/2020 TO 31/3/2021)

R^2 (%) between the market response volumes and the opportunity costs

Approach

- Normalisation of fuel and CO2 vs average
- Normalisation of indices vs average (mining and quarrying, rubber and plastics products, chemicals and chem products)
- Normalised opportunity cost proxy (normalized fuel x CO2 combined with normalized index)
- Comparison to « cost of marginal DSR » to compute correlation (using the 150 threshold, no restrictions)

→ Correlation is **0,30**

As the R^2 values are always far below 0.85, **there are no correlation between the different quantities.**

Note: any correlation between fuel and CO2 in combination with the indices would lead to the same results of no correlation

Source: Statbel, Elia, E-CUBE Strategy Consultants

In this context, the possibility to compute market response volumes based on a dynamic threshold based on marginal production costs was assessed

- **Explanation of what a dynamic threshold based on marginal production cost is**
  - A dynamic threshold based on marginal CO2 and gas prices could lead to exclude generation bids more efficiently (on a daily basis)
  - The dynamic threshold based on marginal production cost leads a different threshold every day for the market response calculation
- **Based on OCGT, calculation of a dynamic threshold**
  - Marginal production cost calculated on a daily basis, based on CO2 and gas prices
  - Note: turbo jet have a much higher marginal costs and are not activated frequently
- **Calculation of market response based on historical thresholds (150 and 500, on the offer side)**
- **Analysis of the different results**
- **Proposition to the working group**

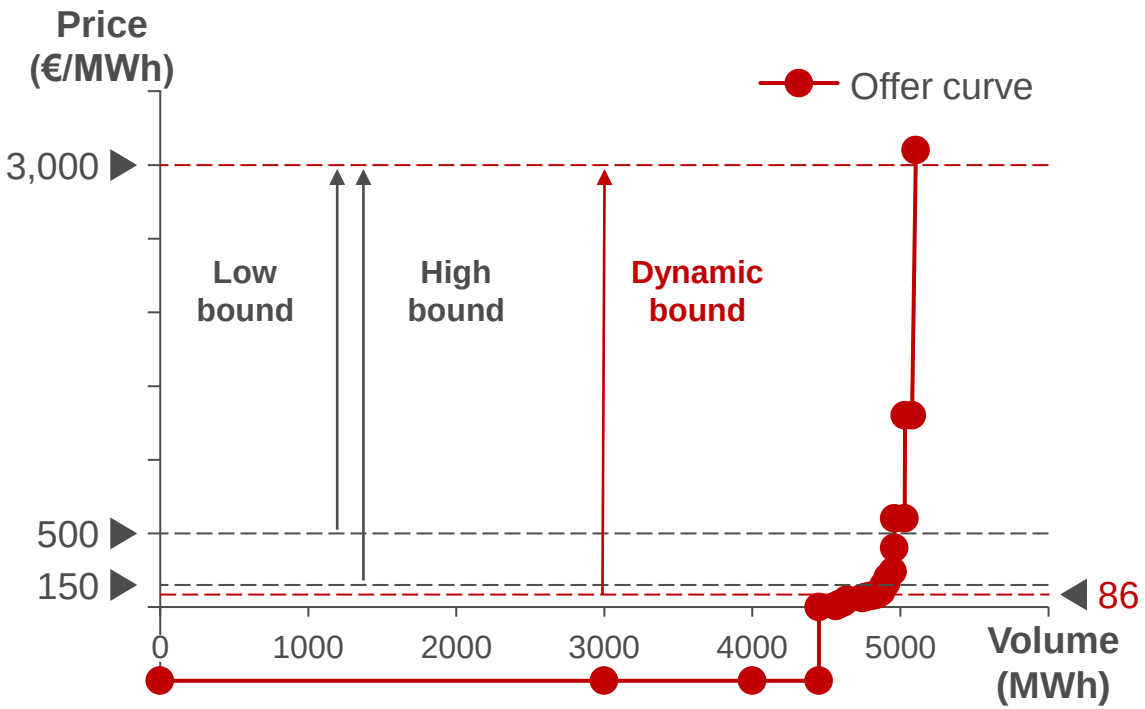
Sourcre: WG Adequacy, Elia

The 150 (or 500) €/MWh threshold is the same for each day (and therefore is independent from the electricity price) whereas a dynamic threshold based on marginal production costs varies from day to day

MARKET RESPONSE COMPUTATION METHODS – THRESHOLDS FIXED (150 AND 500 AT OFFER SIDE) AND DYNAMICALLY DEFINED

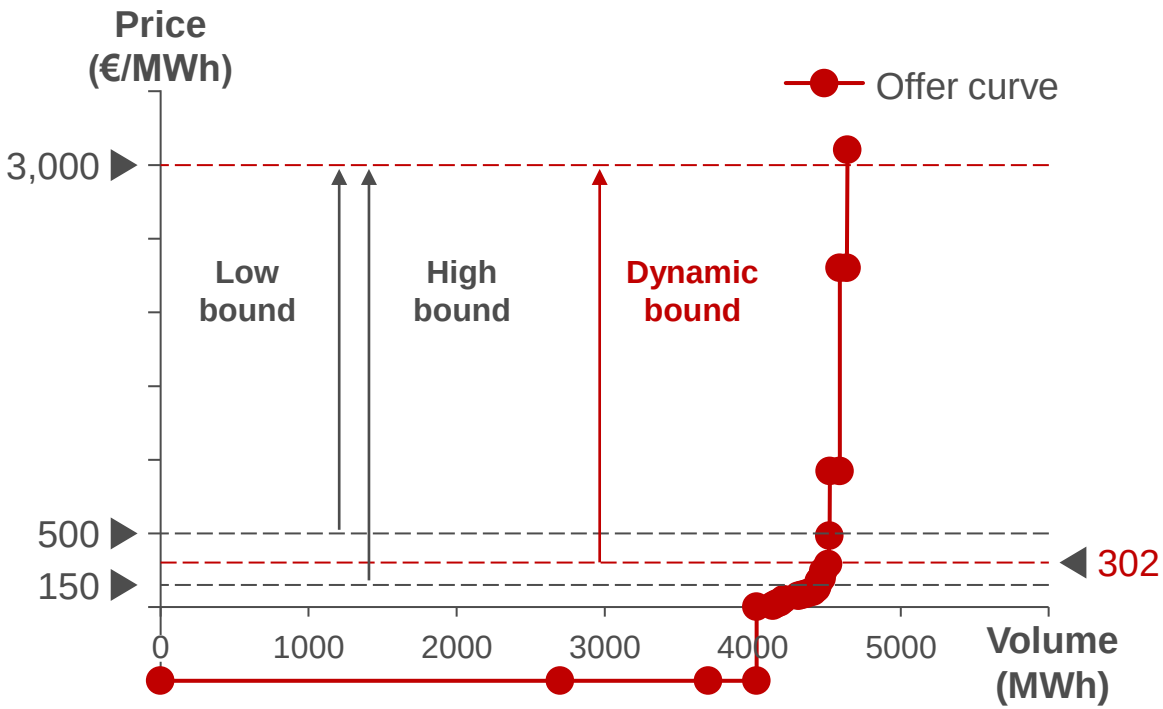
Day 1

*Dynamic threshold = **86 €/MWh***



Day 2

*Dynamic threshold = **302 €/MWh***



Source: E-CUBE Strategy Consultants

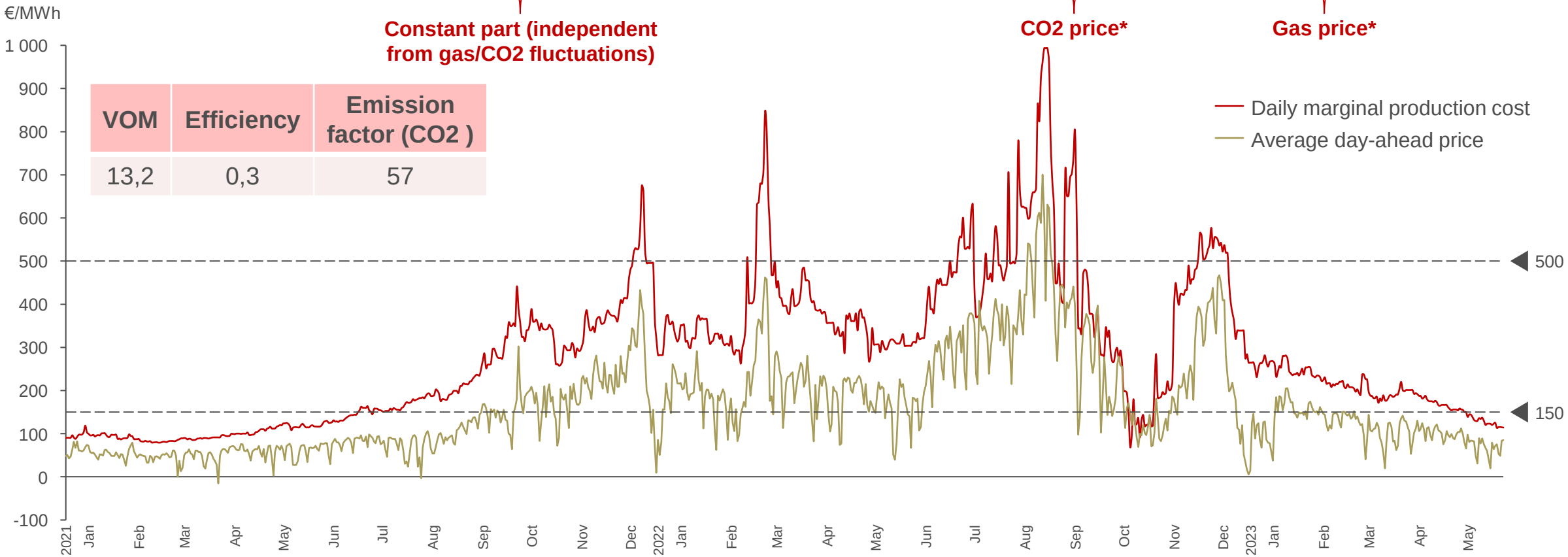
Marginal production cost estimation (used as dynamic threshold) vs day-ahead price, based on OCGT leads to exclusion of generation bids below this (dynamic) threshold

BELGIAN ELECTRICITY MARGINAL PRODUCTION COST (OCGT) SINCE 2021

Note: $$Variable\ cost\ (€/MWh) = Variable\ O\&M\ costs(€/MWh) + CO_2\ emission\ factor\ (tons/MWh) \times CO_2\ price\ (€/tons) + \frac{Fuel\ price\ (€/GJ) \times 3.6\ (GJ/MW)}{efficiency}$$

Constant part (independent from gas/CO2 fluctuations) — **CO2 price*** — **Gas price***

VOM	Efficiency	Emission factor (CO2)
13,2	0,3	57

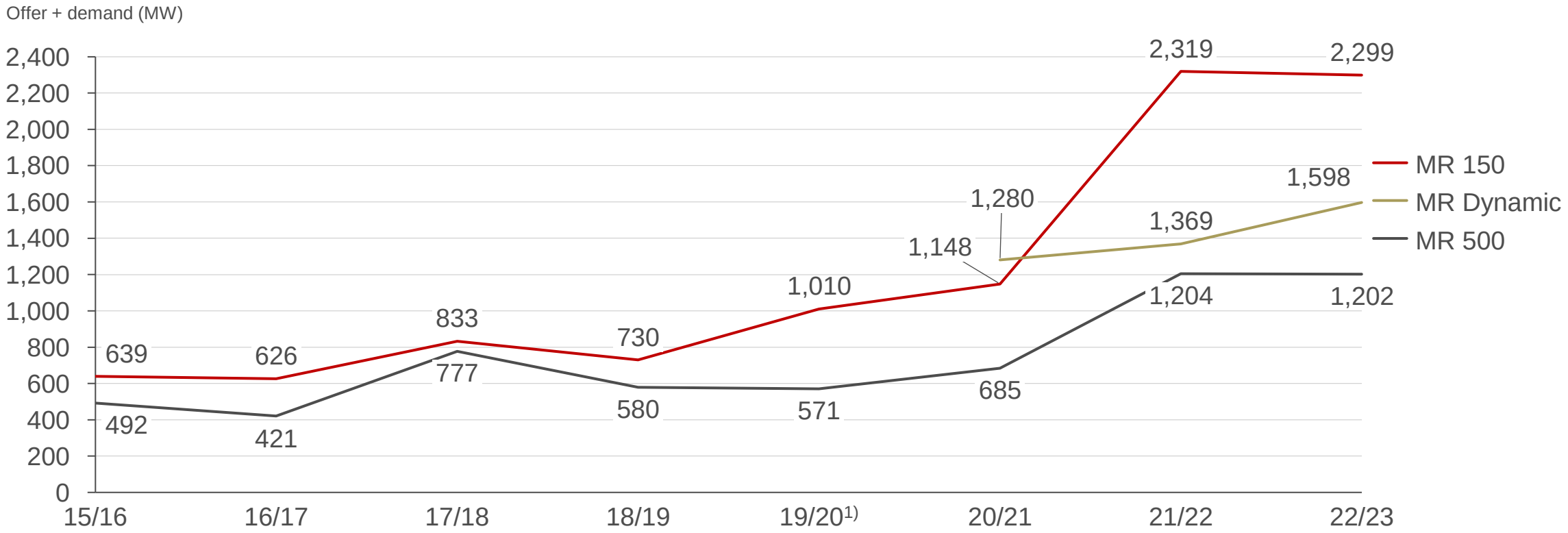


*: CO2 Emission Allowance Price EUR/ton; Gas Price [ZTP] EUR/MWh

Source: E-CUBE Strategy Consultants, ICIS, Entsoe

The MR volumes did not vary much between the 2 last winters, still higher than previous years – the MR volumes based on the new OCGT dynamic threshold lie between the 150 and 500 thresholds in 21/22 and 22/23

EPEX + NORD POOL SPOT AGGREGATED CURVES, RESTRICTED DATASET (WINTER, WEEKDAYS, PEAK HOURS)



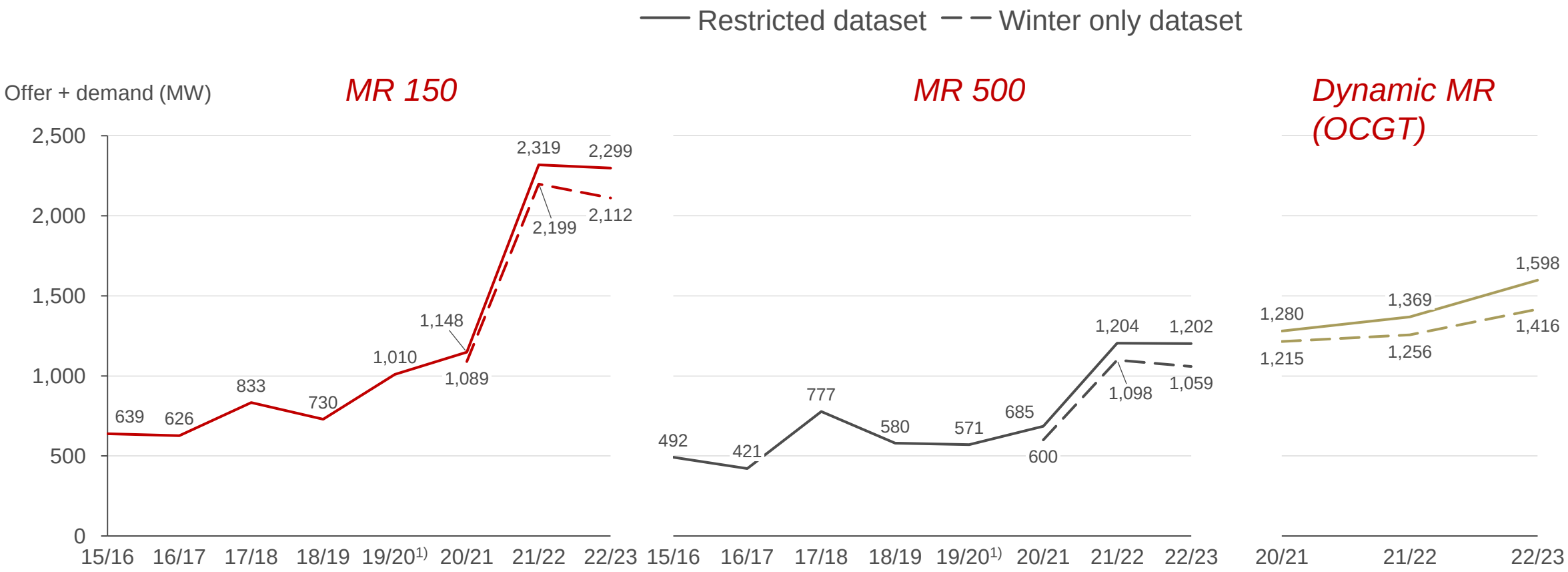
Note: As EPEX and NPS data are now merged in the aggregate curves, the standard deviation is not relevant anymore, hence there are small corrections on historical values
Please note that turbo jets may have higher marginal production costs than the thresholds. Elia estimates the volumes produced by turbo jets at 158 MW. The turbo jets bids cannot be extracted from the aggregated curves

1) First integration of Nord Pool Spot's aggregated curves in 2019-2020

Source: E-CUBE Strategy Consultants

Keeping only the winter restriction (i.e. taking all the hours of all the winter days) shows a similar pattern for the market response

EPEX + NORD POOL SPOT AGGREGATED CURVES



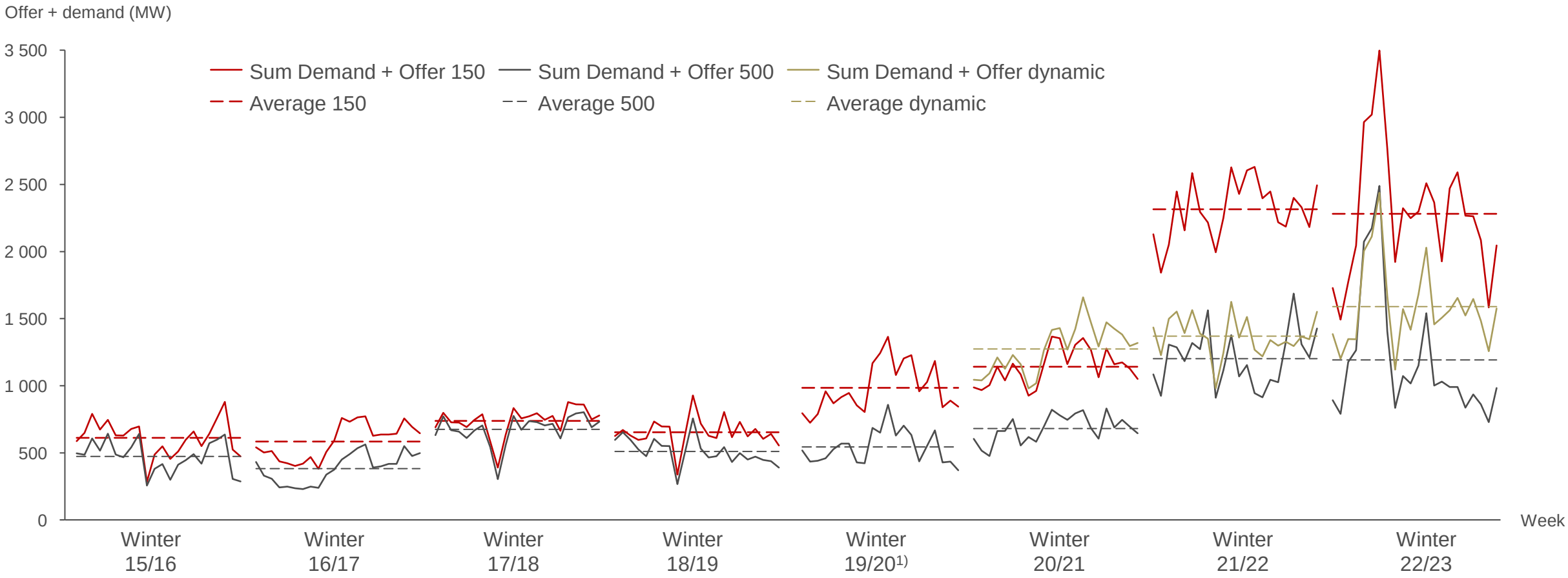
Note: As EPEX and NPS data are now merged in the aggregate curves, the standard deviation is not relevant anymore

1) First integration of Nord Pool Spot's aggregated curves in 2019-2020

Source: E-CUBE Strategy Consultants

The 22/23 winter market response volumes are still at a high level, but with much more variation than winter 21/23

MR PER WEEK FOR THE THREE THRESHOLDS AND PER YEAR FOR EPEX + NORD POOL SPOT AGG CURVES, RESTRICTED DATASET

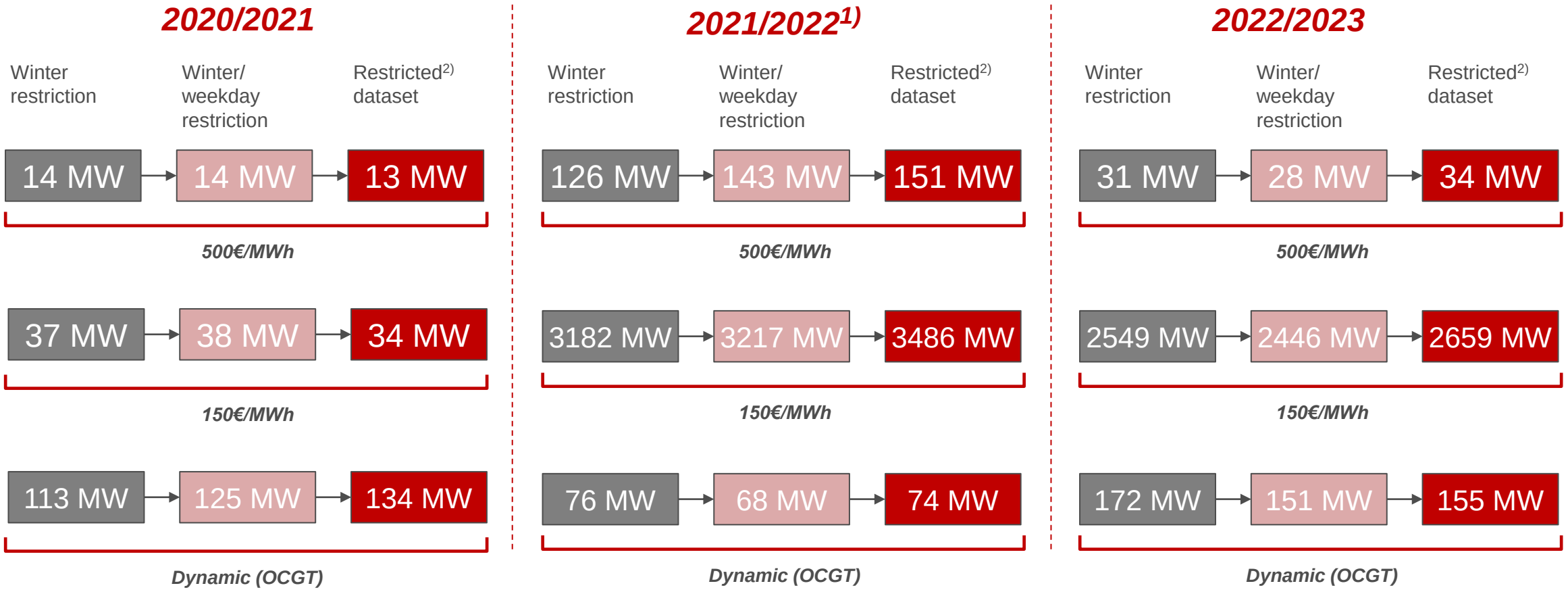


1) First integration of Nord Pool Spot's aggregated curves in 2019-2020

Source: E-CUBE Strategy Consultants, EPEX SPOT

The average of NPS and EPEX Block Orders has increased significantly since 20/21 due to higher prices and traded volumes

AVERAGE MR FOR NORD POOL [1)] + EPEX SPOT BLOCK ORDERS FOLLOWING THE DIFFERENT DATA RESTRICTIONS



Note : The nature of Block orders makes it that there are no Std deviation data

Source: E-CUBE Strategy Consultants, EPEX SPOT

1) First integration of Nord Pool Spot's block orders in 2021-2022
2) Restricted data = winter, weekdays, peak hours

Even if the market response has increased with Gas and CO2 prices over the past winters, these prices are not directly correlated with the market response volumes

DAILY CORRELATION COEFFICIENT BETWEEN THE CO2/GAS PRICES AND THE DIFFERENT MARKET RESPONSES, WINTER RESTRICTION ONLY

R^2[1]	150 MR	500 MR	Dynamic[3] MR
CO2 Price	0,76	0,33	0,45
Gas Price	0,71	0,74	0,55
Positive combination CO2 & Gas Price[2]	0,88	0,74	0,61
CO2 Price	0,13	0,13	0,24
Gas Price	0,13	0,17	0,11
Positive combination CO2 & Gas Price[2]	0,18	0,21	0,25

3 last winters

20/21 winter as example of winter period

The values of the correlation coefficients collapse when looking at to one winter instead of three.

From a winter to another**, the basic trend of the MR seems to be slightly linked with the prices** (high prices go with high market responses).

But within a winter, **we clearly miss other factors to follow the day-to-day market response fluctuations.**

When looking on several past winters, the strong overall growth eclipsed the daily fluctuations.

The correlation with the 150 threshold is higher. However, when CO2 and gas prices are high, generation prices are high. This leads to generation volume included in the market response volume.

1) R^2 is the square of the linear correlation coefficient. The closer an R-squared is to 1, the more correlated the data are
2) Making a linear combination of CO2 and Gas price, and keeping the coefficient that maximizes the final correlation
3) Based on OCGT

Source: E-CUBE Strategy Consultants, EPEX and NPS (daily market response calculated as average over the day)

Backup – Even if the global correlation between the prices and the MR seems to be present, the R-squared values drop significantly when scaled down to a single winter

R^2

Global	150 MR	500 MR	Dynamic MR
Threshold	0,72	0,74	0,56
CO2 Price	0,76	0,33	0,45
Gas Price	0,71	0,74	0,55
Positive combination CO2 & Gas Price [Gas/CO2]	0,88 [0,434]	0,74 [20,42]	0,61 [0,829]

2021-2022	150 MR	500 MR	Dynamic MR
Threshold	0,02	0,53	0,33
CO2 Price	0,19	0,08*	0,08*
Gas Price	0,02	0,54	0,33
Positive combination CO2 & Gas Price [Global Gas/CO2]	0,16 [0,434]	0,53 [20,42]	0,23 [0,829]
Positive combination CO2 & Gas Price [21-22 Gas/CO2]	0,25 [0,149]	0,54 [+inf]	0,33 [+inf]

2020-2021	150 MR	500 MR	Dynamic MR
Threshold	0,14	0,18	0,13
CO2 Price	0,13	0,13	0,24
Gas Price	0,13	0,17	0,11
Positive combination CO2 & Gas Price [Global Gas/CO2]	0,16 [0,434]	0,18 [20,42]	0,25 [0,829]
Positive combination CO2 & Gas Price [20-21 Gas/CO2]	0,18 [1,82]	0,21 [2,77]	0,25 [0,514]

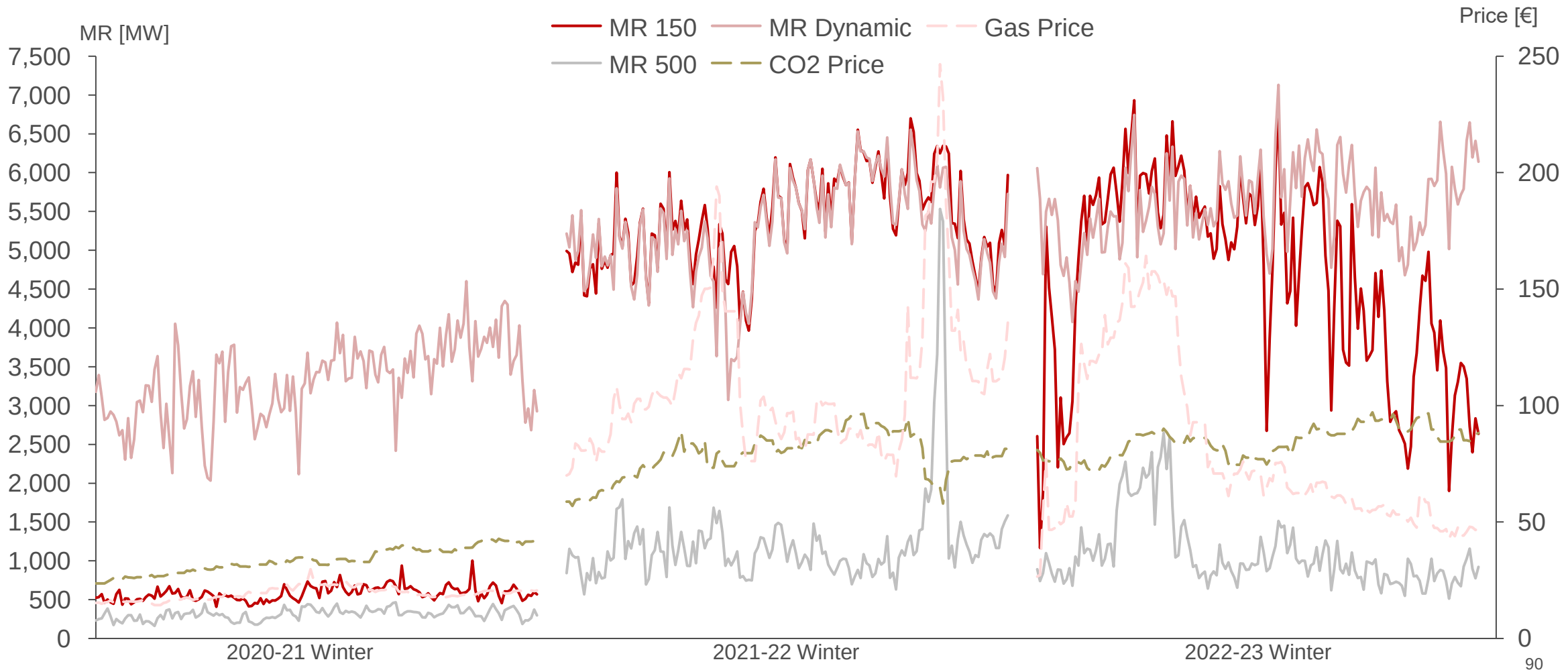
2022-2023	150 MR	500 MR	Dynamic MR
Threshold	0,48	0,65	0,19
CO2 Price	0,02	0,00	0,03
Gas Price	0,48	0,65	0,19
Positive combination CO2 & Gas Price [Global Gas/CO2]	0,39 [0,434]	0,65 [20,42]	0,23 [0,829]
Positive combination CO2 & Gas Price [22-23 Gas/CO2]	0,48 [+inf]	0,66 [1,44]	0,25 [0,346]

- R^2 is the square of the linear correlation coefficient. The closer an R-squared is to 1, the more correlated the data are
- Positive combination: making a linear combination of CO2 and Gas price, and keeping the coefficient that maximizes the final correlation
- Dynamic MR: based on OCGT

Source: E-CUBE Strategy Consultants

Backup – Even if the global correlation between the prices and the MR seems to be present, the R-squared values drop significantly when scaled down to a single winter

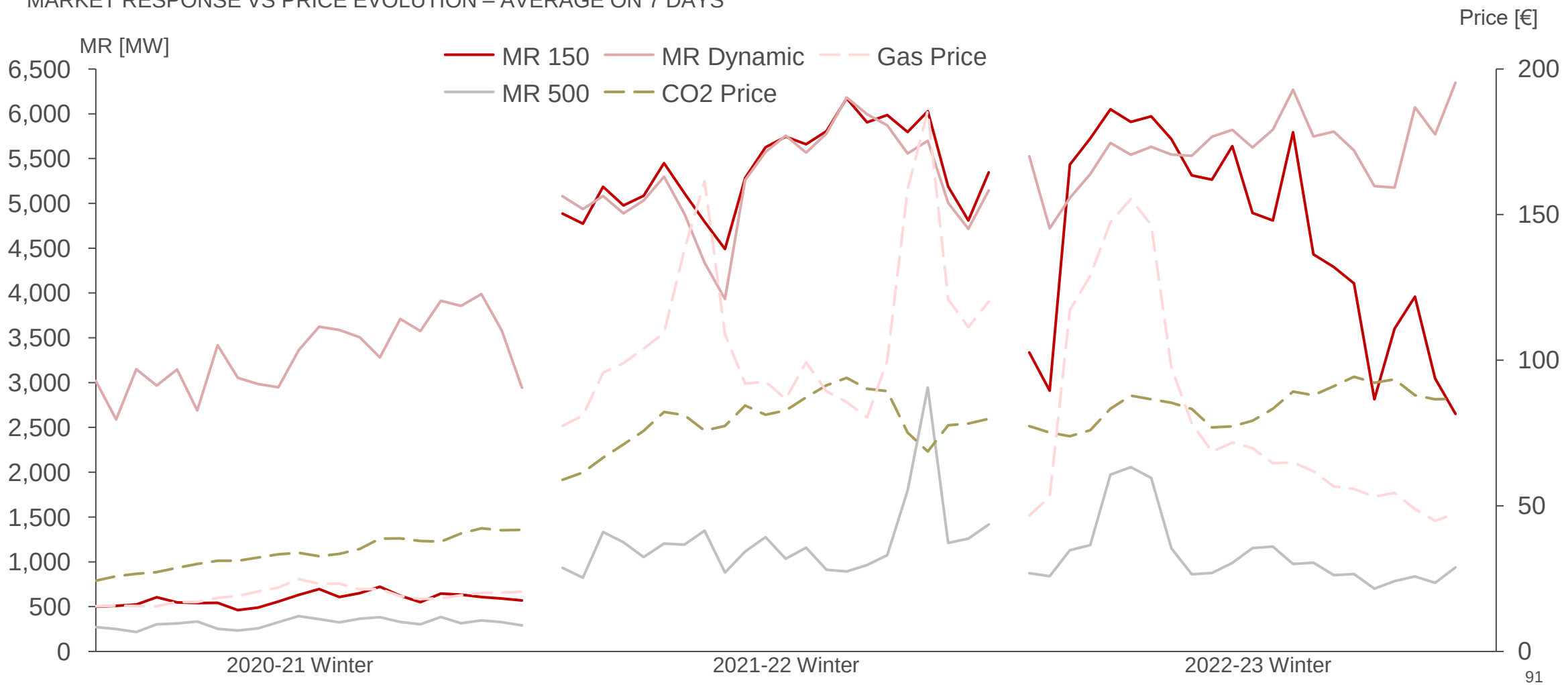
MARKET RESPONSE VS PRICE EVOLUTION



Source: E-CUBE Strategy Consultants

Backup – Even if the global correlation between the prices and the MR seems to be present, the R-squared values drop significantly when scaled down to a single winter (average on 7 days)

MARKET RESPONSE VS PRICE EVOLUTION – AVERAGE ON 7 DAYS



Source: E-CUBE Strategy Consultants

Ancillary services volumes are added to the winter only market response volumes

WINTER RESTRICTION ONLY

Data: AS MR (MW)

	FCR	aFRR	mFFR
2020	23	0	340
2021	26	10	340
2022	35	20	349
2023	35	20	365

Ratio

Y-1	Y
0,4	0,6

AS MR Result (MW)

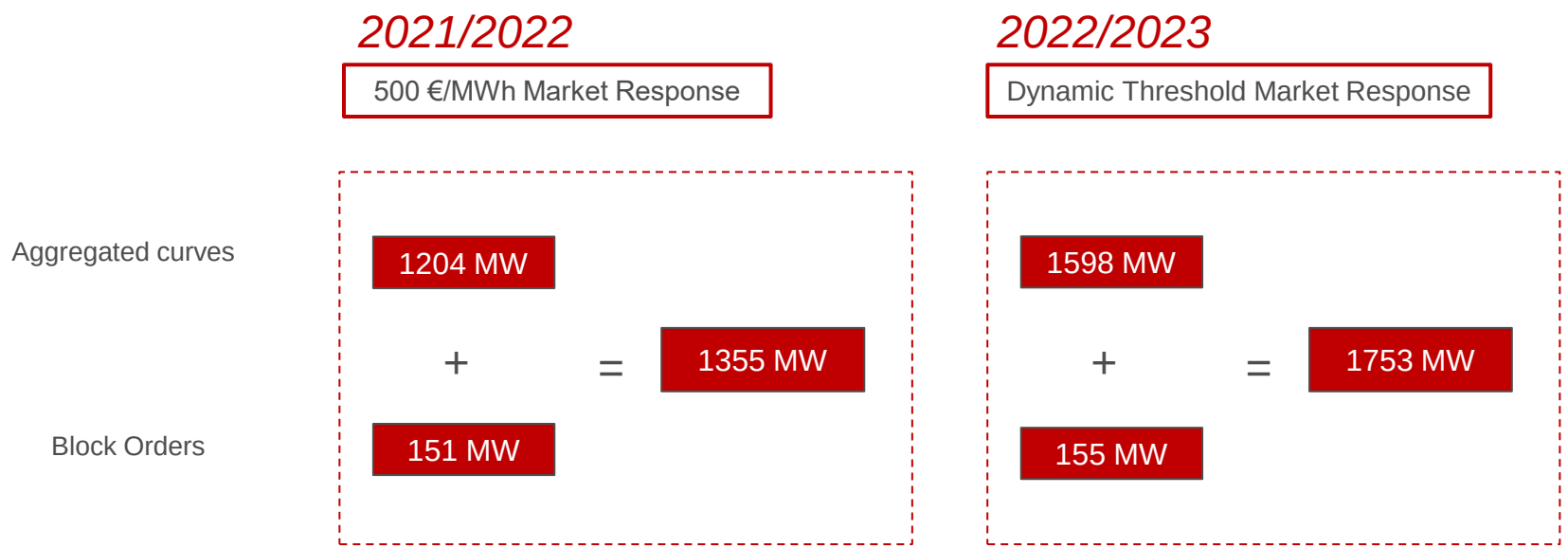
	FCR	aFRR	mFRR	Sum
20/21	24,8	6	340	370,8
21/22	31,3	16	345,4	392,8
22/23	35	20	358,6	413,6

Note: the 21/22 volumes differ slightly as AS volumes have been updated from preliminary to definitive. Values for 22/23 are still preliminary

Source: E-CUBE Strategy Consultants, Elia

The 2022/2023 market response increases significantly with the OCGT dynamic threshold computation method

TOTAL MR IS THE SUM OF MR FROM AGGREGATED CURVES AND BLOCK ORDERS, RESTRICTED DATASET



Note: the market response volumes may include some generation bids, e.g. turbo jets, as they have a higher marginal cost than the dynamic threshold based on OCGT

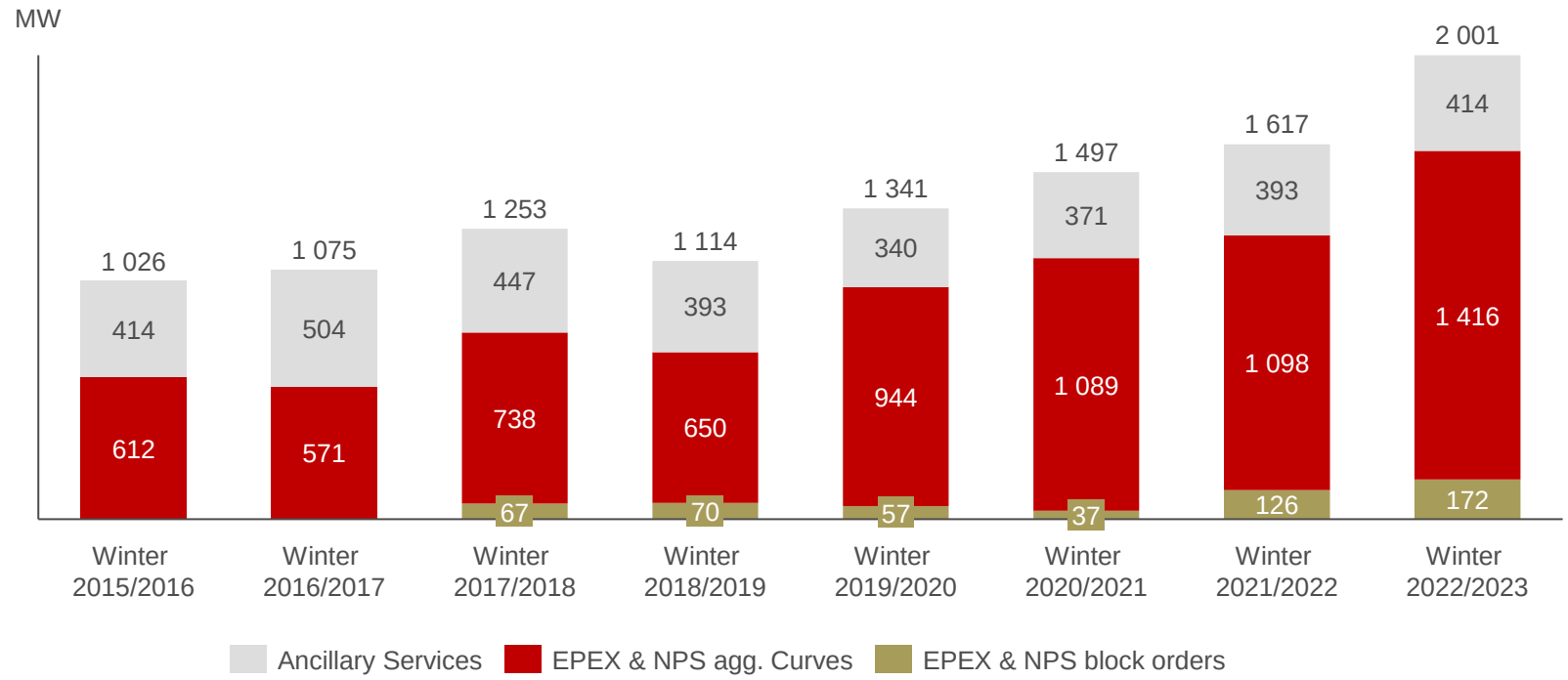
Note: the slight difference (1355 MW vs 1384 MW) with last year's figures are justified by the deletion of the NPS volumes (29 MW double counted as integrated into the aggregated curves)

Source: E-CUBE Strategy Consultants

The total market response for the winter 2022/2023 is calculated at 2001 MW (winter restriction only)

EVOLUTION OF THE VOLUMES OF MARKET RESPONSE - WINTER MONTHS RESTRICTION ONLY[1)]

Evolution of the volumes of MR



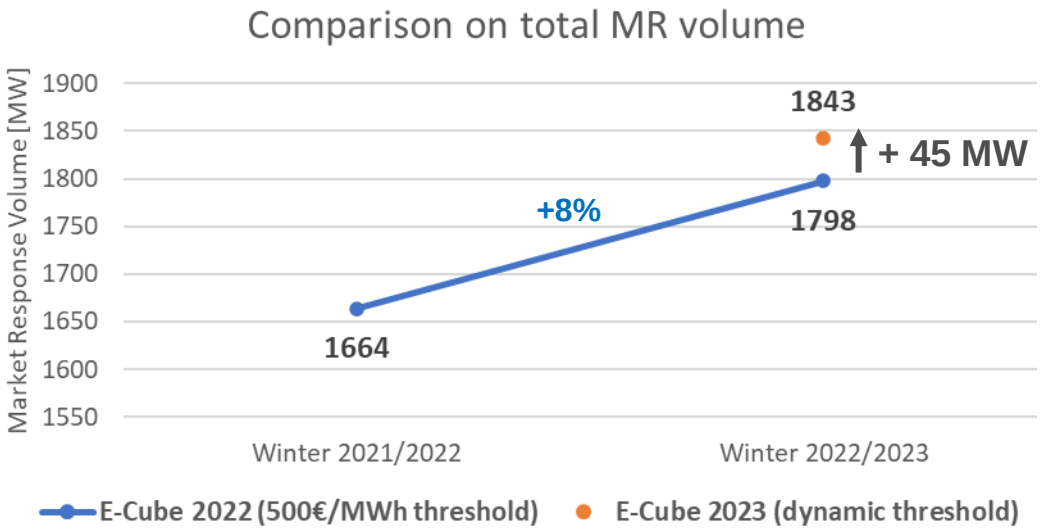
Note :

1) To stay coherent with AS volumes, the MR volumes studied here are obtained with the seasonal restriction only: all hours from winter months. Winter months: from the 1st of November to the 31st of March, Volumes for lower bound (150€/MWh) 15/16 to 20/21. 500€/MWh for the Winter 2021/2022 and with a dynamic threshold for 2022/2023 (OCGT)
2) Historical values corrected given EPEX and NPS data integrated in the same data sets
3) The market response 22/23 volumes may include some generation bids, e.g. turbo jets, as they have a higher marginal cost than the dynamic threshold based on OCGT

Source: E-CUBE Strategy Consultants, Elia

E-CUBE STRATEGY CONSULTANTS

Conclusion: Demand Response from existing industry to consider in the Y-1 2025-26 and Y-4 2028-29 scenarios



- New volume of **1843 MW** of MR (after exclusion of TJ)
- Increase of **45 MW** of DSR from existing industry compared to public consultation on the scenarios
- **8%** increase assumed in AdeqFlex
- Proposal to not apply growth rates as from winter 2022, in line with AdeqFlex

Update from Cabinet

Y-2 Auction & 200 hours rule

Retroplanning: RD Methodology, investment thresholds and pay-back exemption and RD Functioning Rules v3

RD Methodology and RD investment thresholds	Dates
Consultation report/Elia proposal/CREG opinion	Week of 27/03
File preparation	Week of 03/04
IKW (1)	20/04
CMR (1)	28/04
Council of State (30d)	Review received on 02/06
Adjustment of texts	Week of 05/06
IKW (2)	22/06
CMR (2)	23/06
Publication in the Belgian Official Journal	**07/08 and 10/08**

RD Payback exemption	Dates
Consultation report/Elia proposal/CREG opinion	Week of 27/03
File preparation	Week of 03/04
IKW (1)	20/04
CMR (1)	28/04
Council of State (30d)	Review received on 12/07
Adjustment of texts	Week of 12-19/07
IKW (2)	20/07
CMR (2)	21/07
Publication in the Belgian Official Journal	**25/08**

RD Functioning Rules v3	Dates
Consultation report/Elia proposal/CREG opinion	Week of 27/03
File preparation	Week of 03/04
IKW (1)	20/04
CMR (1)	28/04
Council of State (30d)	Review received on 26/05
Publication in the Belgian Official Journal	**Coming**

AOB

Next meetings

Foreseen timeslots for next meetings

- Thursday 14th of September 2023 – AM
- Friday 13th of October 2023 – PM
- **Wednesday 8th of November 2023 – AM** NEW
- Friday 1st of December 2023 – AM

Users Group Calendar: https://www.elia.be/en/users-group

Thank you.