

WG Adequacy #13

17 November 2022

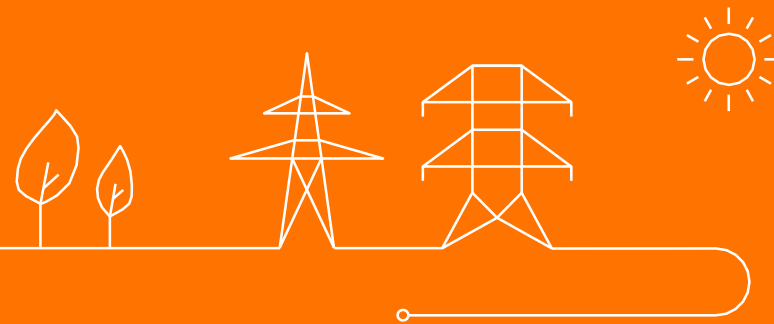


Agenda

- Welcome
- Minutes of Meeting WG Adequacy #11 (13.10.2022)
- CRM : Result Auction
- CRM : Timeline public consultation FR v0.3
- CRM : Retroactivity
- LCT : Feedback public consultation : Design Note
- Proposed trajectories for a progressive reduction of the CO2 emission limits to be respected under the Belgian CRM : Public consultation report
- Next meetings



Minutes of Meetings

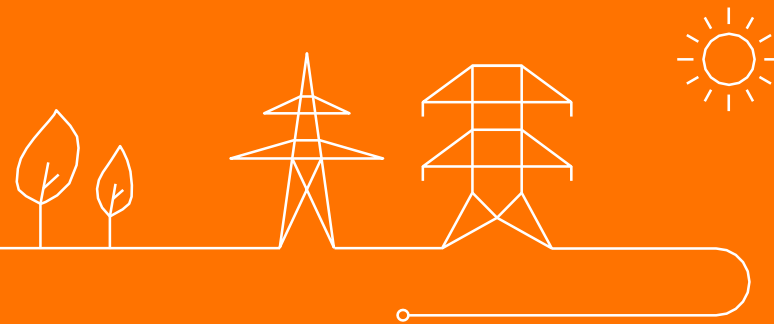


Minutes of Meeting

- **WG Adequacy #11 – 13.10.2022 : To be approved**
- *The MoM were sent on 14.11.2022. No comments were received.*



CRM results Auction



Setting the demand curve

Demand curve	Volumes 2022	Volumes 2021	Delta
Average consumption during simulated scarcity	14 089 MW	13 591 MW	498 MW
Balancing needs	1179 MW	985 MW	194 MW
Average unserved energy during simulated scarcity	-577 MW	-809 MW	232 MW
→ Non-eligible capacity (incl. nuclear prolongation of 1662MW)	-3948 MW	-3026 MW	-922 MW
Reservation for Y-1	-1249 MW	-1467 MW	218 MW
Reservation for foreign indirect contribution	-1428 MW	-1935 MW	507 MW
→ Already contracted capacity (Awirs, Vilvoorde & 47MW other)	-1649 MW	-0 MW	-1649 MW
Y-4 Auction volume (point B)	6417 MW	7339 MW	-922 MW

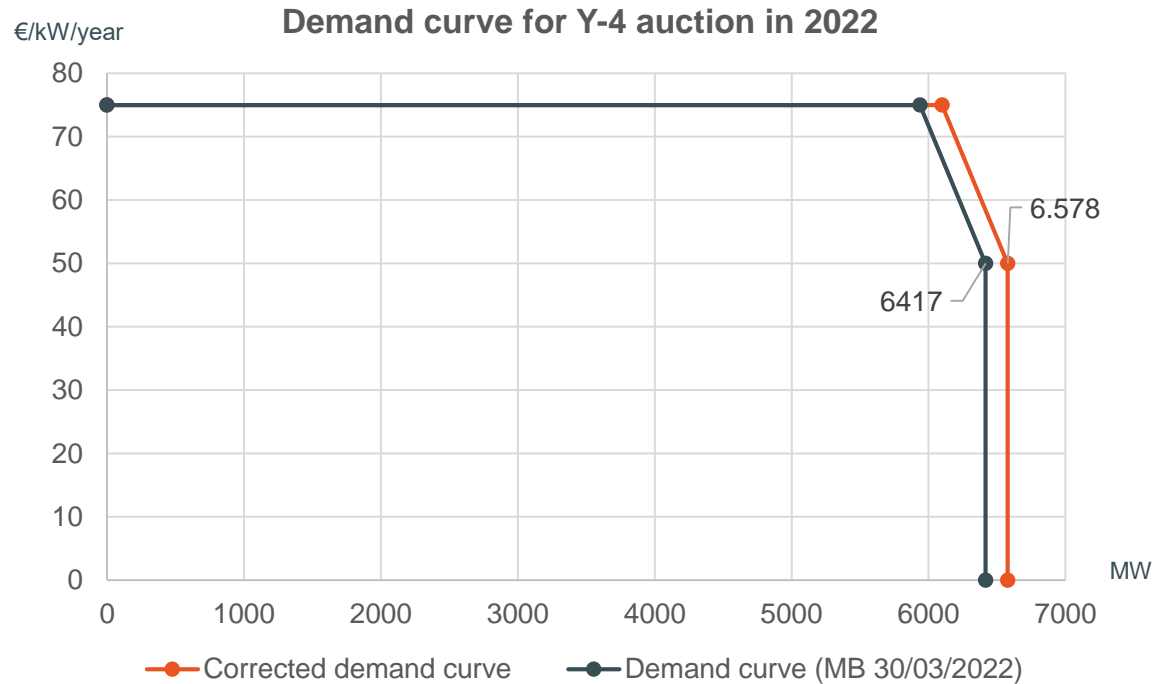
Calibration of the demand curve is similar to last year's Y-4 2025-26 auction, except that

- The nuclear prolongation is taken into account in the demand curve ('buy less in CRM'). The prolonged nuclear plants are not participating in the CRM.
- Capacity that was already contracted last year with a multi-year contract is also deducted from the demand curve.

Note that the Calibration of the demand curve follows the decisions from the Minister.

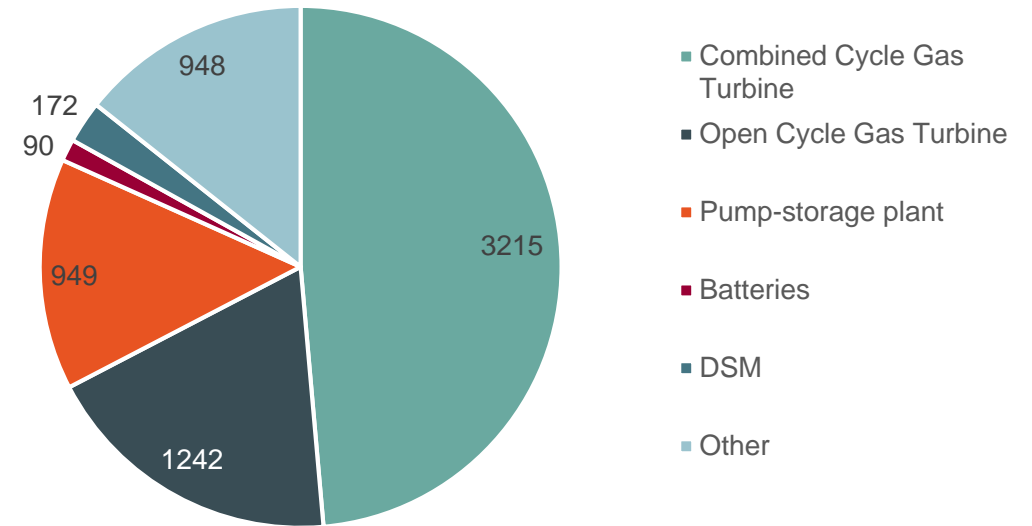
Demand curve correction volume

Corrected demand of 6578 MW ↔ 6617 MW of opt-out IN



Demand curve (MB 30/03/2022)	6417
Non-eligible capacity that participated	225,77
Eligible capacity that didn't participate	-56,21
Rerun correction	-9,05
Corrected demand curve	6578

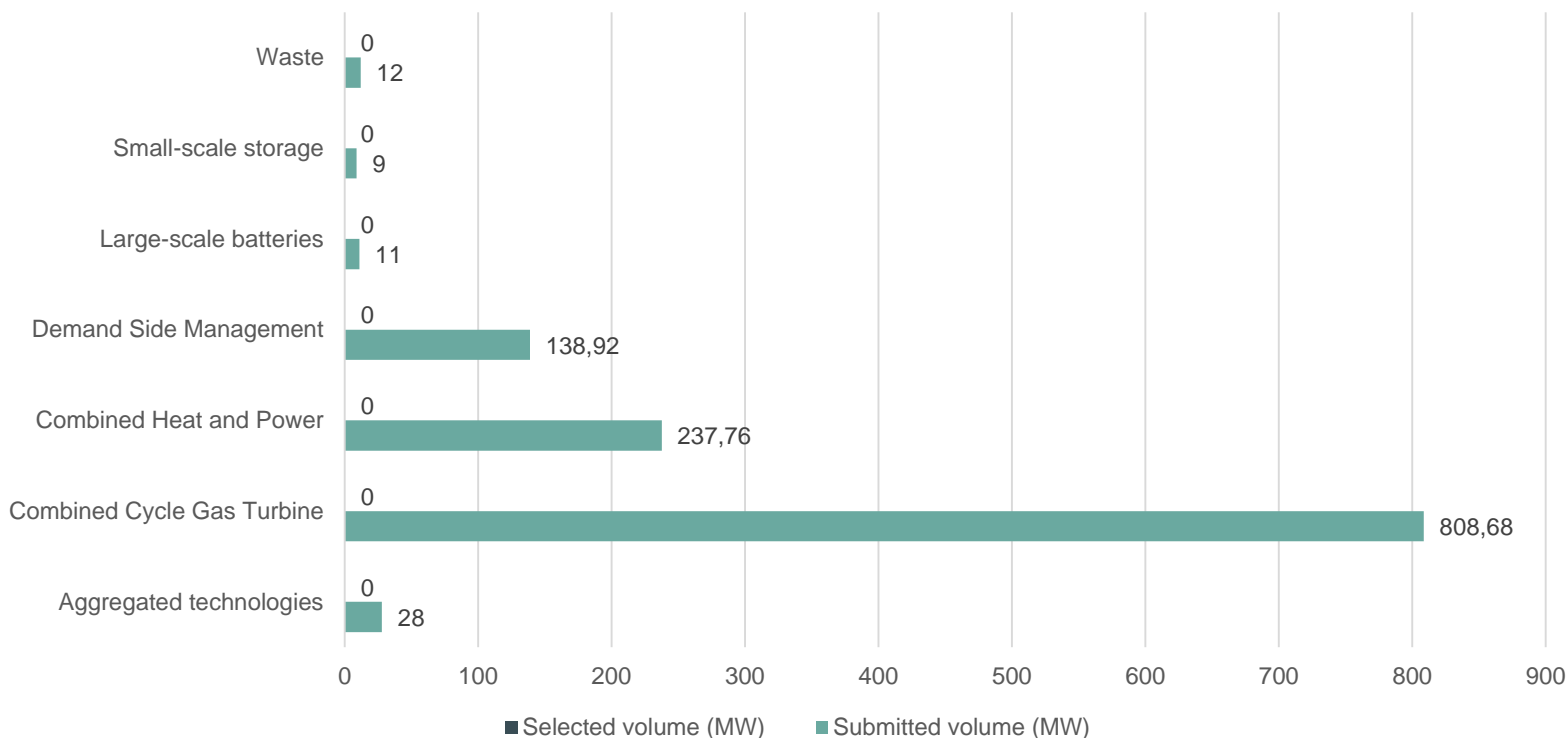
Opt-out IN per technology (MW)



- Existing capacity that decided not to participate, is however still considered to contribute to adequacy (opt-out IN)
 - The total opt-out IN volume (6617MW) exceeds the corrected demand (6578 MW) with 39 MW
- ➔ There is no remaining need for contracting any capacity in this Y-4 auction. However, the opt-out IN capacities can still participate in Y-1.**

Auction results

Offered Capacity volumes (derated) by Delivery Point Technology



Auction results (selected units):

- Total cost: €0
- No existing capacity contracted
- No New builds contracted
- No multi-year contracts awarded

- **No new capacity has to be contracted, since the required capacity (6578 MW) is fully covered by opt-out IN (6617 MW) and given the already earlier contracted volumes and nuclear prolongation.**
- **Offer > Demand: excess liquidity of about 1245 MW.**

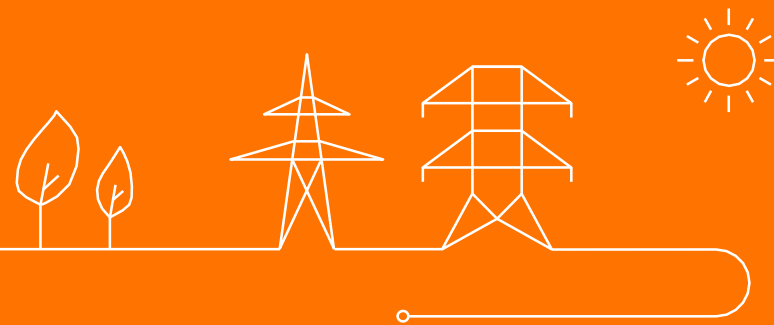
While the Y-4 Auction didn't require new contracts to be awarded, adequacy in delivery period 2026-2027 is nevertheless already partly covered, also thanks to the CRM.

	Delivery 2026-27	Delivery 2025-26
Volume awarded in the Y-4 auction	0 MW	4478 MW
Previously contracted multi-year contract volume	1658 MW	0 MW
Nuclear prolongation (outside CRM)	1662 MW	0 MW
Non-eligible capacity (after correction)	2060 MW	2000 MW
Subtotal	5380 MW	6478 MW

Opt-out IN (not contracted)	6617 MW	3806 MW
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- Note that "opt-out IN" capacities consists of (almost) existing capacity and it still has the option to participate in the Y-1 Auction.
- Note that none of the Opt-out IN capacities has announced a definitive (or even temporary) closure following Art. 4bis of the E-law meaning that today there is no reason to believe they won't contribute to adequacy.

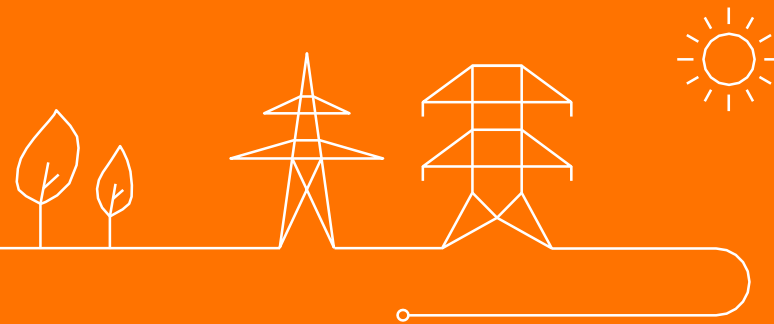
CRM : Timeline public consultation FR v0.3



Timeline for the public consultation CRM and LCT Functioning Rules



CRM : Retroactivity



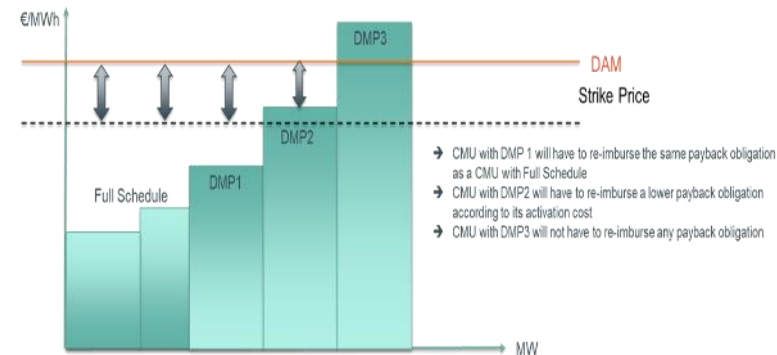
Payback Obligation: reminder of the design choices from the past

Reliability option has always been a compromise

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- The first CRM design proposals regarding the Payback Obligation aimed at keeping the CRM as a **technology neutral** mechanism with **limited overall costs** and **avoiding windfall profits** :
 - After lengthy discussions, the idea of a **single** strike price was retained :
 - It ensured a certain level playing field between CRM participants.
 - It avoided the complexity of multiple strike prices.
 - It was also decided not to consider any payback exemptions linked to e.g. hedging as such behavior eventually boiled down to an **individual** market actor's choice.
 - However, the concept of a single strike price was complemented with its possible substitution by a **Declared Market Price (DMP)** for units without a daily schedule :

- The underlying idea behind such DMP was to avoid that such units would not have to payback at the level of the calibrated strike price if it did not cover their high activation costs.



- An indexation mechanism looking at the evolution of DA prices between the auction and the second delivery period was also foreseen for multi-year contracts according to the Royal Decree Methodology.
- Following a **repeated feedback** from market parties on the Payback Obligation given the current market prices and following Haulogy's recommendations on the matter, Elia understands the need to reconsider some design aspects of the Payback Obligation.

Payback Obligation: reminder of the main design objectives

The design of the Payback Obligation should find a balance between capturing windfall profits and technology neutrality/openness



- The design of the Payback Obligation mechanism should respect certain principles highlighted in European Commission decision on the Belgian CRM (306) :

*“There should be a realistic chance of being exposed to the strike price in the event of peak prices to **avoid windfall profits**”*

*“Capacities should not be excluded from the CRM in case they only activate a market price higher than the strike price level” // **technology neutrality/openness***

- This is confirmed by the Royal Decree Methodology as well :

- *“27§ 1. De methodologie voor de kalibratie van de uitoefenprijs bestaat erin om een actualisering van het niveau van de uitoefenprijs te bepalen binnen een vooraf bepaald spectrum, waarbij ervoor wordt gezorgd dat in de eenvormige day-aheadkoppeling een **redelijk capaciteitsvolume wordt aangeboden en in de eenvormige day-aheadkoppeling wordt gekozen vooraleer de uitoefenprijs bereikt is.**”*

→ From the above and following unexpected recent events in the energy market, the current design of the Payback Obligation does not seem to fit anymore with the above-mentioned principles :

- The current strike price kept ‘as is’ would potentially lead to **persistent payback obligation events** for certain technologies (exceeding the realistic aspect of it) and could **prevent their participation** to the CRM.
- Moreover, Elia has been repeatedly informed by several market parties that the current Payback Obligation design is perceived as a **barrier of entry to the CRM**.

- Finally, taking into account feedback from market parties to improve and modify the payback obligation design was crucial for the European Commission to approve the payback obligation modalities:

“The Commission also notes that the mechanism of the payback obligation in the Belgian CRM has been significantly modified and improved following public consultations. (514) The Commission therefore considers that the mechanism of the payback obligation strikes the appropriate balance between the two competing goals referred to in recital (512).”

Current issue: given current prices and repeated feedback from several market parties, a redesign of the payback obligation might be needed
new design proposals seem inevitable

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- Current design

	Daily Schedule	Non-Daily Schedule
Energy Constrained	Single strike price	Declared Market Price
Non-Energy Constrained	Single strike price	Declared Market Price



- Possible design solution

	Daily Schedule	Non-Daily Schedule
Demand response	N/A	Payback obligation exemption
Other	Redesign of indexation of uniform strike price.	Declared Market Price (no change)

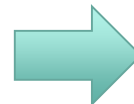
Retroactive application of the design changes has to be investigated

Evolution of the indexation mechanism for the payback obligation

Reminder of proposal Elia

- As presented in WG Adequacy on October 13th, Elia proposes to adapt dynamically the indexation mechanism of the strike price in order to capture recent market trends:
 - On a **monthly basis** and **ex-post** based on monthly **average DA prices** (i.e. strike price of September is set by DA prices of September) -> This indexation would apply from the **first delivery year**.
 - It consists in adding a **variable component** following the DA evolution to a fixed component on which the strike price was initially calibrated.
- The way to calculate the indexed ex-post strike price is the following :

Fixed component
 = calibrated strike price
 – average DA prices of the months used for the calibration period



Ex – post indexed Calibrated Strike Price =
(fixed component + Max(0; average DA price for month m))

- According to Elia, such proposal has the advantage of capturing a sufficiently high amount of Payback Obligation events while offering a stable framework for market stakeholders to participate to the CRM.
- Elia has included its proposal on the update of the indexation mechanism in the CRM Functioning Rules V3.
- However, the update of the indexation mechanism is not the only element to be considered for this next iteration on CRM Functioning Rules.



Payback Obligation : exemption for Demand Response

Status and Jurisprudence from Ireland

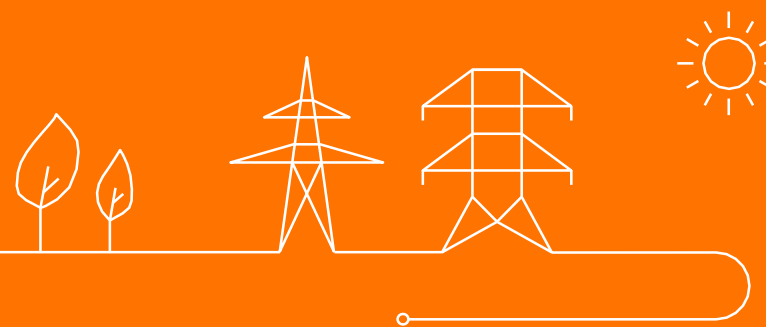
- Elia proposed an exemption of Payback Obligation for Demand Response and is still investigating whether the remaining open questions on that matter can be answered.
- Elia believes the regulatory framework will need amendment and understands that interaction with the EC might be needed.
 - A preliminary legal assessment shows that at least the Royal Decree Methodology will need amendment
 - A priori Elia does not believe a change in the E-Law is needed but acknowledges there might be different views.
- To this end, Elia refers to the Irish CRM for which Payback Obligation exemption for Demand Response has only been considered as '*acceptable*' by the European Commission as a '*temporary solution*' provided that authorities would commit to end it as of October 2020.
 - State Aid Case on Irish CRM : namely §§ 126 – 130
 - A public consultation was held during the summer 2022 to see how the Reliability Option Mechanism could be further considered in the future. No final decision was published yet.
- Elia would like to collect feedback from market parties on this aspect during the upcoming Public Consultation of the CRM functioning Rules.

Payback Obligation : retroactivity

- During the previous WG market parties have raised questions on the retroactive application of the proposed changes to the payback mechanism.
- In general, an internal legal analysis from Elia concluded that :
 - No modifications with respect to the E-Law are to be considered.
 - Retroactivity (not only for Payback) is already partially foreseen by Functioning Rules : cf. § 10.
- While Elia would not be against a retroactive application of the payback obligation design, in the evaluation several elements must be weighted:
 - Coherency of the CRM design and setting the right economic incentives for already contracted capacities
 - Legal certainty for already contracted capacity
 - Feasibility of amending the legal framework
- Elia would like to collect feedback from market parties on this aspect as well during the upcoming Public Consultation of the CRM functioning Rules.



LCT : Feedback public consultation : Design Note



The public consultation on the LCT design note ended 4th of November and 6 reactions were received.

- ✓ In total 5 parties (and 1 fully confidential) have provided feedback on the public consultation for the LCT design note:
 - Febeliec
 - FEBEG
 - Centrica Business Solutions
 - Nyrstar
 - Synergrid
- ✓ The remainder of this presentation will present a **high-level overview** of the main feedback received during the public consultation.
- ✓ It represents a **non-exhaustive overview** as all the **detailed comments will be covered in the public consultation report** and taken into account **in the LCT Functioning Rules**.
 - ✓ Most fundamental issues relate to the **general framework** and the **eligibility criteria**.
 - ✓ Several **detailed questions** on some design topics (e.g. PQ, financial securities, auction, availability monitoring, etc.) are received, which will be **covered in the public consultation report**.
 - ✓ The concerns raised by Synergrid are covered during the workshops between Elia and the DSOs.



Some of the received feedback relates to the general framework as set by the Belgian Authorities

- ✓ As part of the public consultation process, Elia has received several comments on the general LCT framework set by the Belgian Authorities.
- ✓ Elia takes note of these comments, but continues the design and implementation works within the current framework.

Comment	Who
Technology neutrality is questioned given that CO ₂ thresholds are not consistent with the CRM framework and given that some sections explicitly refer to the technologies demand response and batteries.	Febeliec/ FEBEG
Technology neutrality is questioned as existing capacities are not eligible to participate to the tender.	Febeliec/ FEBEG
The volume contracted with multi-year contracts should be reduced from the reserved volumes for the Y-1 Auctions .	FEBEG
Incorporation of the LCT Functioning Rules in those of the CRM creates additional complexity in case of retrospective changes of the latter.	Febeliec
It is not clear why XB participation will not be foreseen.	Febeliec
The decision to launch an additional LCT tender can negatively impact the business cases of existing capacities and capacities already contracted in the CRM. This adds to the perceived regulatory risks in Belgium.	FEBEG



Some concerns were raised on the interaction with the CRM processes

Febeliec does not fully understand **how capacities contracted in the CRM could be allowed to participate** in the LCT tender and how excessive remuneration would be avoided.

- ➔ *If already contracted capacities can commit to be ready by delivery period 2024-2025, these are eligible.*
- ➔ *However, an intermediate price cap will apply to avoid excessive remuneration.*

On multi-year contracts, Febeliec is concerned about the possible impact on the CRM, including e.g. impact on secondary market and issues with diverging derating factors and impact on Y-1 CRM auction.

- ➔ *Multi-year CRM contracts and Y-4 and Y-1 CRM auctions for the same delivery period also result in diverging derating factors.*
- ➔ *The evolution in derating factor will be taken into account in the same way as in the general CRM processes.*



Some clarifications were requested on the eligibility of battery projects

As stated in the design note, the **current eligibility rule for battery projects** is defined as follows:

“Additional – New Build” capacities are eligible to participate in the LCT. New build capacities are defined as not in service at the moment of the Auction.”

- *The exact definition of “in service” will be provided by the next WG Adequacy of 16/12.*
- *The exact cut-off time will be further defined in the functioning rules.*
- *Elia already clarifies that the “in service” definition will be important for the eligibility check, but that the remainder of the LCT processes (e.g. financial security and pre-delivery monitoring) will follow the CRM principles based on the definition of Existing and Additional CMUs.*

Moreover, market parties reacted to **the lead time of 1 year** between auction and start of the delivery period, whereas new battery projects can have a significantly longer lead time.

- *This feedback is in line with earlier comments in the context of the CRM Y-1 auctions.*
- *Elia takes note of this feedback, but due to timing constraints it is not feasible to advance the launch of the LCT tender.*
- *However, it will be investigated with all involved parties if the general framework can be improved to (partly) accommodate this concern.*



Some of feedback was related to the Eligibility of DSR

- 1) **Concerns regarding “double counting”** of MWs, regarding the misidentification of existing capacities as “new”.
- 2) The **eligibility criteria** are perceived as **too restrictive** and would exclude too many flexibility assets of increasing their flexibility/providing additional DSR.
- 3) Several requests for a **qualitative assessment** of the bids for new Demand Response capacity.
- 4) *Others*
 - Input for the quantitative assessment possible by capacities
 - ...



In response to this feedback, several aspects are being reworked and reviewed for Eligibility of DSR

1. Rework of the “full” exclusion principle to “partial” exclusion

- Exclude the capacity of “Existing DSR”, enabling additional flexibility under a DP
- Walking the line between “double counting” and being “too strict”
- Impact on several other processes to be assessed
- Quantitative/baselining assessment to be reworked

2. Improvement of the quantitative assessment to be more accurate/simple and in-line with other CRM processes

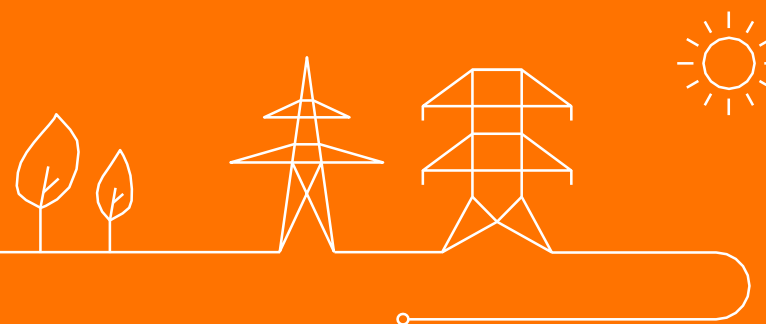
- Single step quantitative assessment to determine “Existing DSR”
- Based on baselining methodology of Availability Monitoring
- Allowing for input on “representative days” within strict pre-defined rules

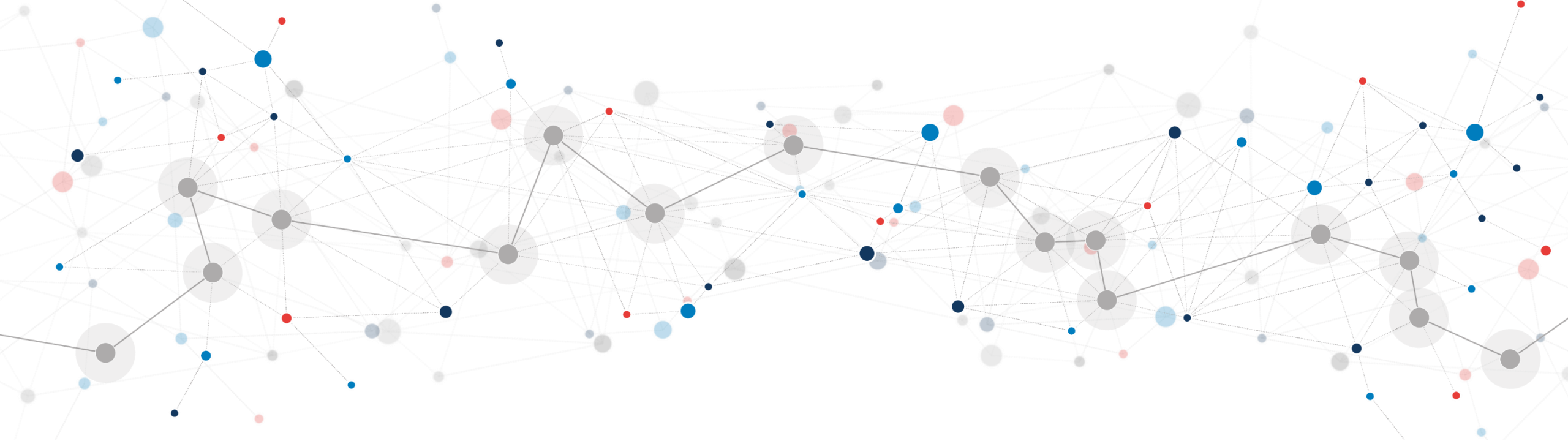
3. Qualitative case-by-case assessment

- If a framework can be developed in cooperation with the members of the cds, where a neutral third party performs the determination of the “Existing DSR”, to be used as input for Elia



Proposed trajectories for a progressive reduction of the CO₂ emission limits to be respected under the Belgian CRM : Public consultation report





Study of the proposed CO2 reduction trajectories in the Belgian CRM

Presentation Working Group Adequacy

Dmitri Perekhodtsev, Nicolas Hary

17 November 2022

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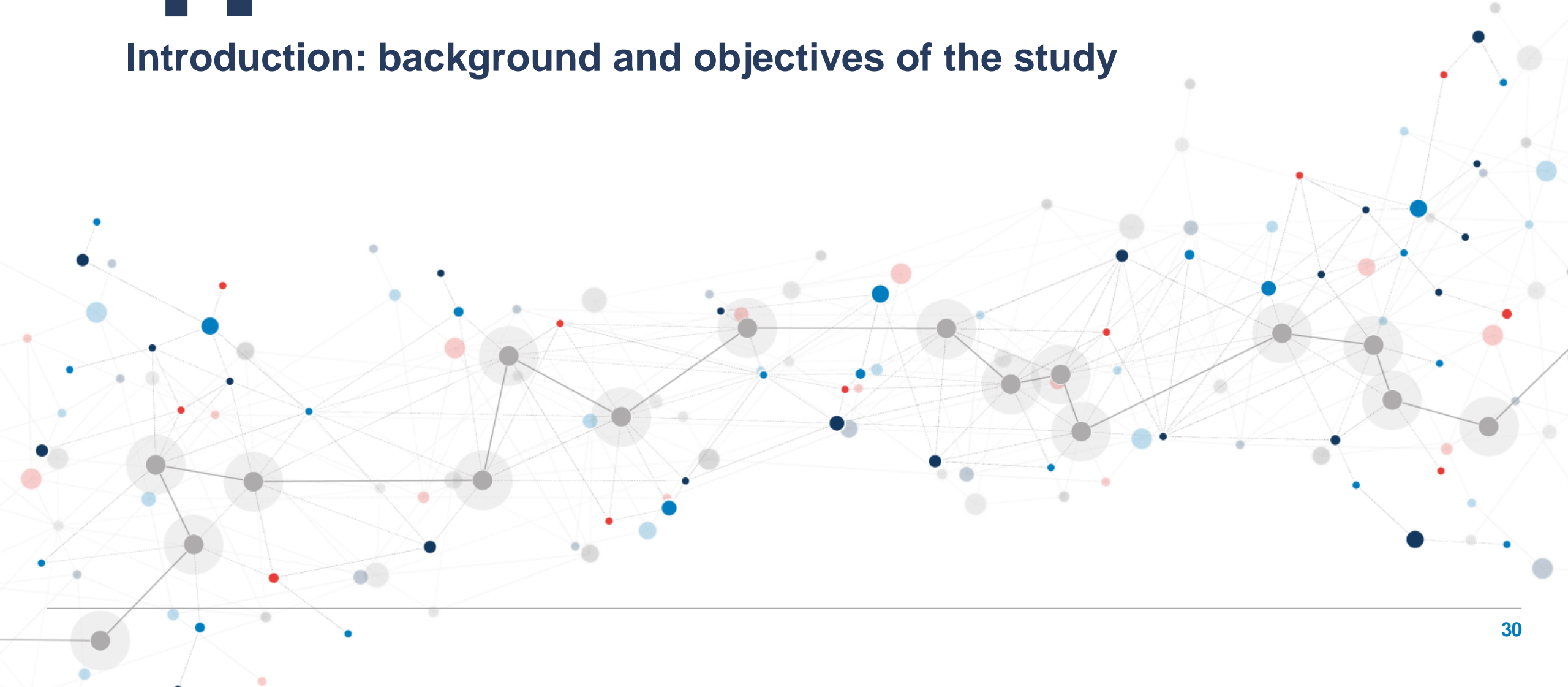
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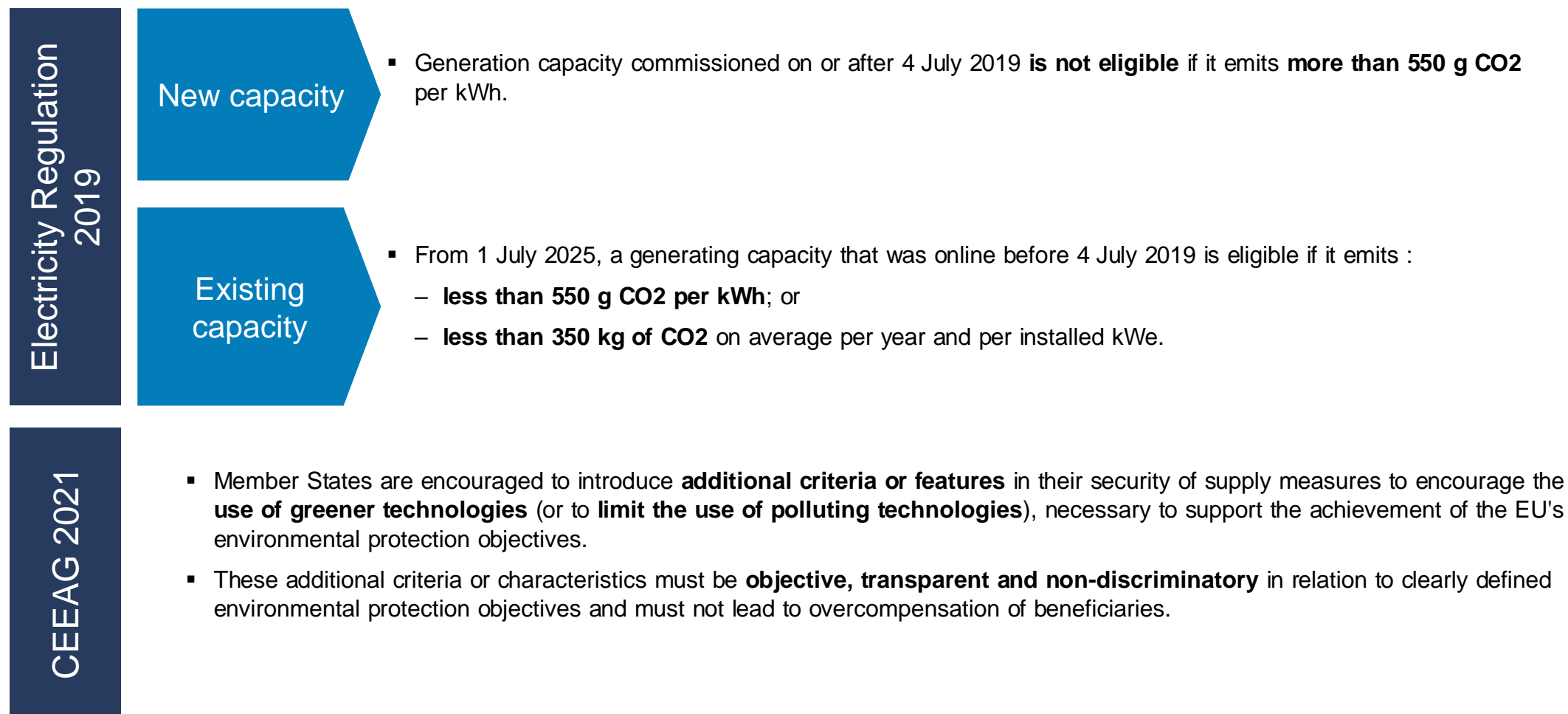
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1.

Introduction: background and objectives of the study



EU regulation introduces CO2 limits for capacity mechanisms



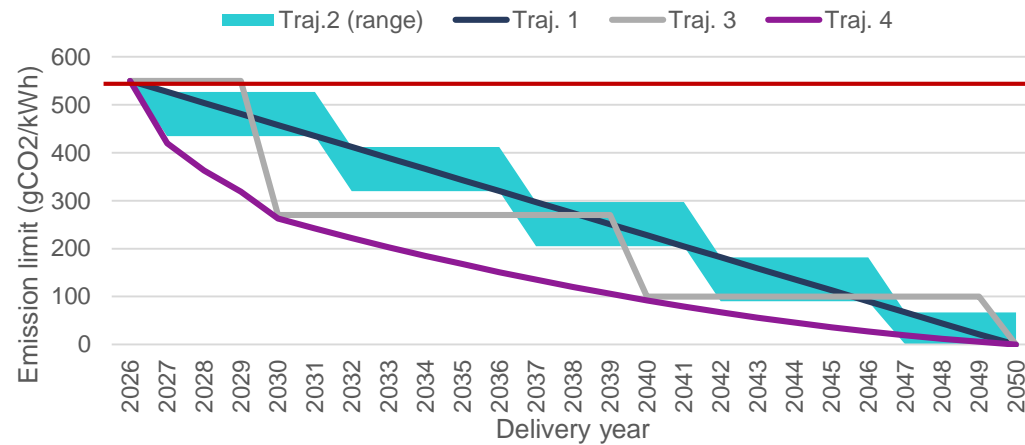
Countries with CRM implemented the CO2 thresholds required by EU regulation with some stricter conditions for new capacity

Country	Emission thresholds in the context of the CRM
France	Threshold of 200 gCO ₂ /kWh from the 2020 auction for new capacity with delivery in 2024.
Italy	Threshold of 550 gCO ₂ /kWh from the 2021 auction for delivery 24/25 (Y-4).
Belgium	A uniform limit on CO2 emissions from fossil fuels per kWh of electricity, applicable to generation capacities, is set at 550 g/kWh. No annual limit from 2022
United Kingdom	Limits CO2 emissions from any new power plant to 450g/kWh.
Ireland	Threshold of 550 gCO ₂ /kWh from the 2021 auction for delivery 24/25 (Y-4).
Poland	Compromise reached thanks to a special clause: securing capacity contracts awarded to coal-fired power plants before 31/12/2019, to support the construction of new units. Extension of long-term contracts by 2 years for capacity below 450g/kWh

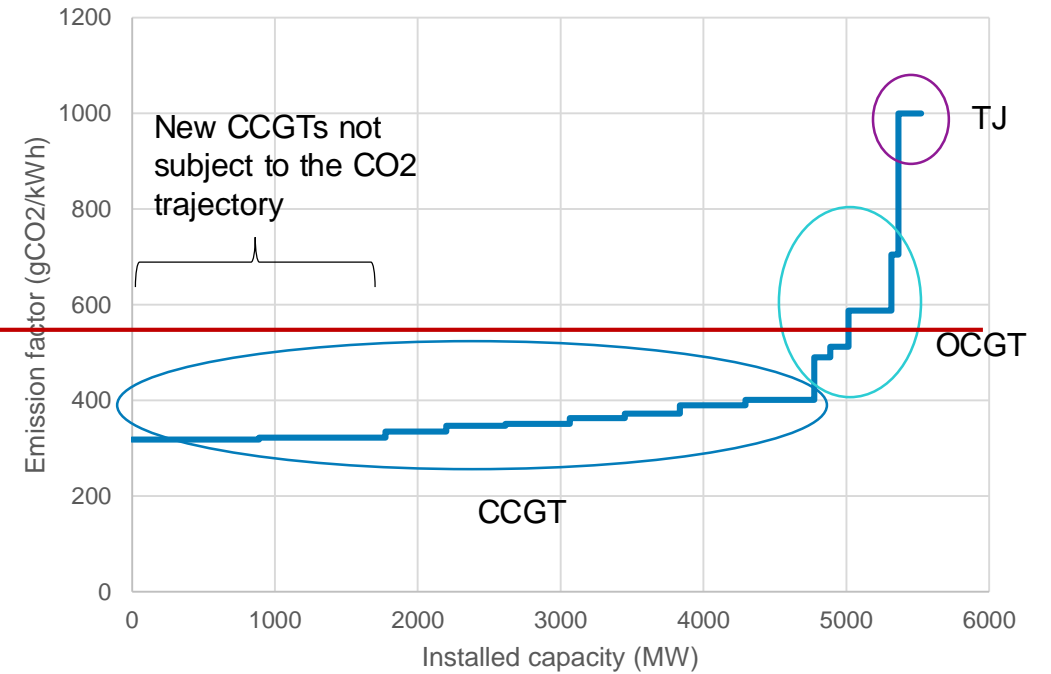
CO2 trajectories proposed by FPS Energy and comparison with the Belgian fleet

CO2 evolution trajectories proposed by FPS Energy

- Trajectory 2: threshold defined one year before the auction according to technological developments
- Trajectory 5: yet to be defined (see slide 24), combining a specific threshold and the reintroduction of an annual threshold



Emission factor of the thermal fleet in Belgium (excluding CHP)

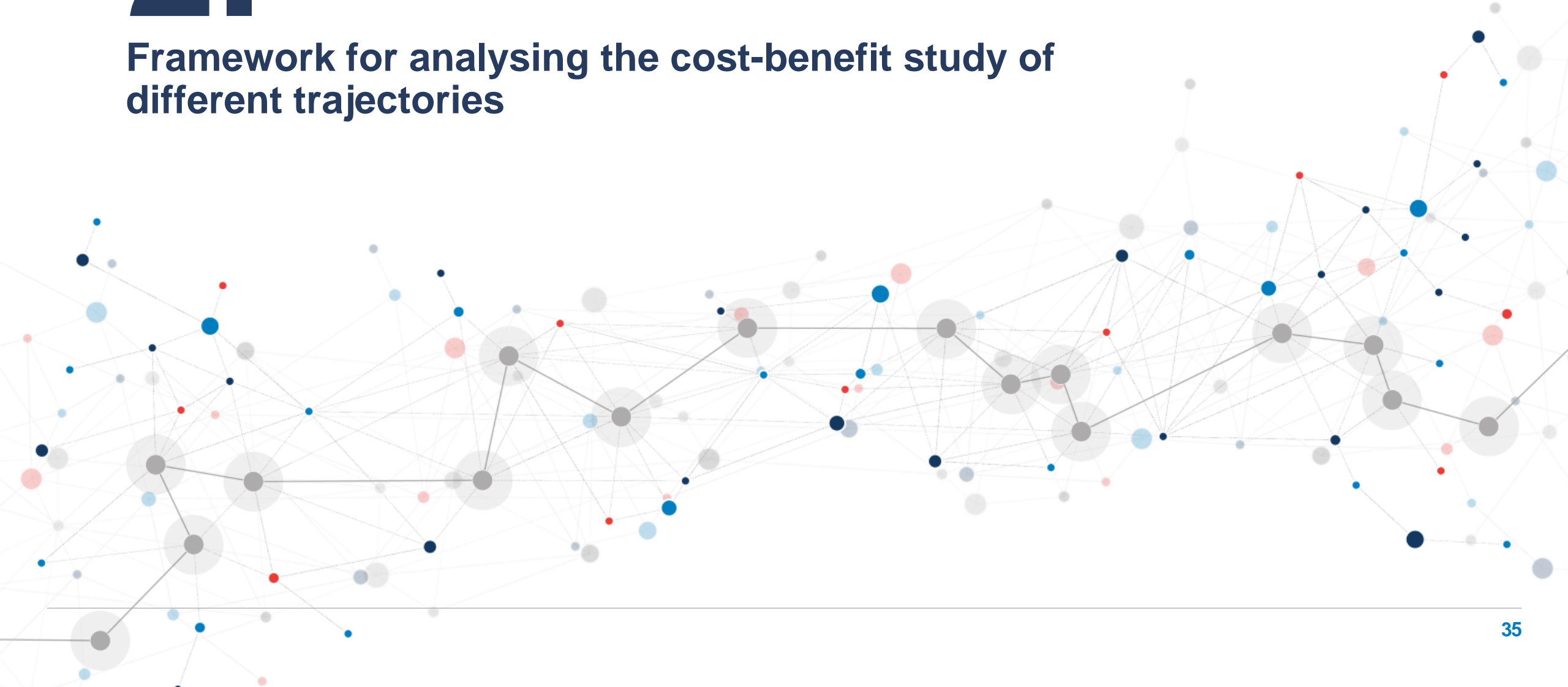


Objectives of the mission of Compass Lexecon

- Analyse the **technical feasibility of implementing** the trajectories given the different technologies to decarbonize thermal generation
- Carry out a **cost-benefit analysis (CBA)** in order to compare the impact of the trajectories on the power system
- Propose a **Trajectory n°5** including annual emission limits

2.

Framework for analysing the cost-benefit study of different trajectories



Methodology used in the CBA

Starting point - Reference situation, without CO2 reduction trajectory, based on the TYNDP 2022 Global Ambition scenario



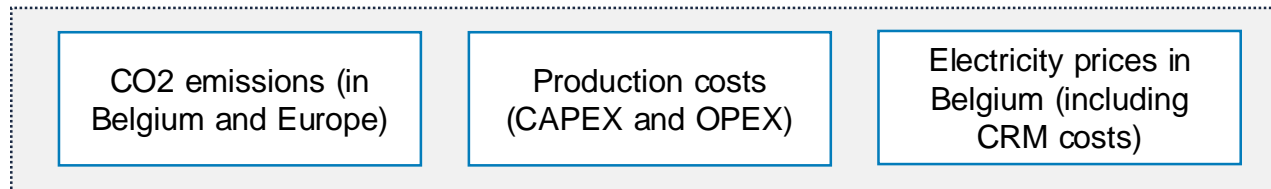
Step 1. **Exogenously** evolution of the capacity mix in Belgium (green fuel, decommissioning, development of other technologies...)



Step 2. **European Dispatch** according to the decisions taken in step 1



Output - Calculation of different indicators for each trajectory and comparison with the base case



CBA parameters

- Analysis over the **period 2027-2035** only
 - Stakeholders' concern about the impact of trajectories mainly in the short term (impact on existing plants)
 - Less differentiated trajectories in the long term
 - Reduction of CO2 emissions in all cases in the long term, even without an imposed reduction trajectory
 - Availability of green gas/hydrogen more certain in the long term, but very difficult to quantify
- Study for **two contrasting scenarios of the evolution of the energy landscape**
 - Many uncertainties in the short term (e.g. availability and cost of biomethane, decisions of stakeholders...) that will influence the results of the CBA
 - Study of two contrasting scenarios defined exogenously

Scenario 1

As soon as the CO2 constraint is reached, the thermal power plant does not/cannot make the necessary investments to decarbonize its production

Rationality - green solutions not available (technical constraint, limit of potential...), utilities do not want to invest because too uncertain...



CBA under scenario 1

Scenario 2

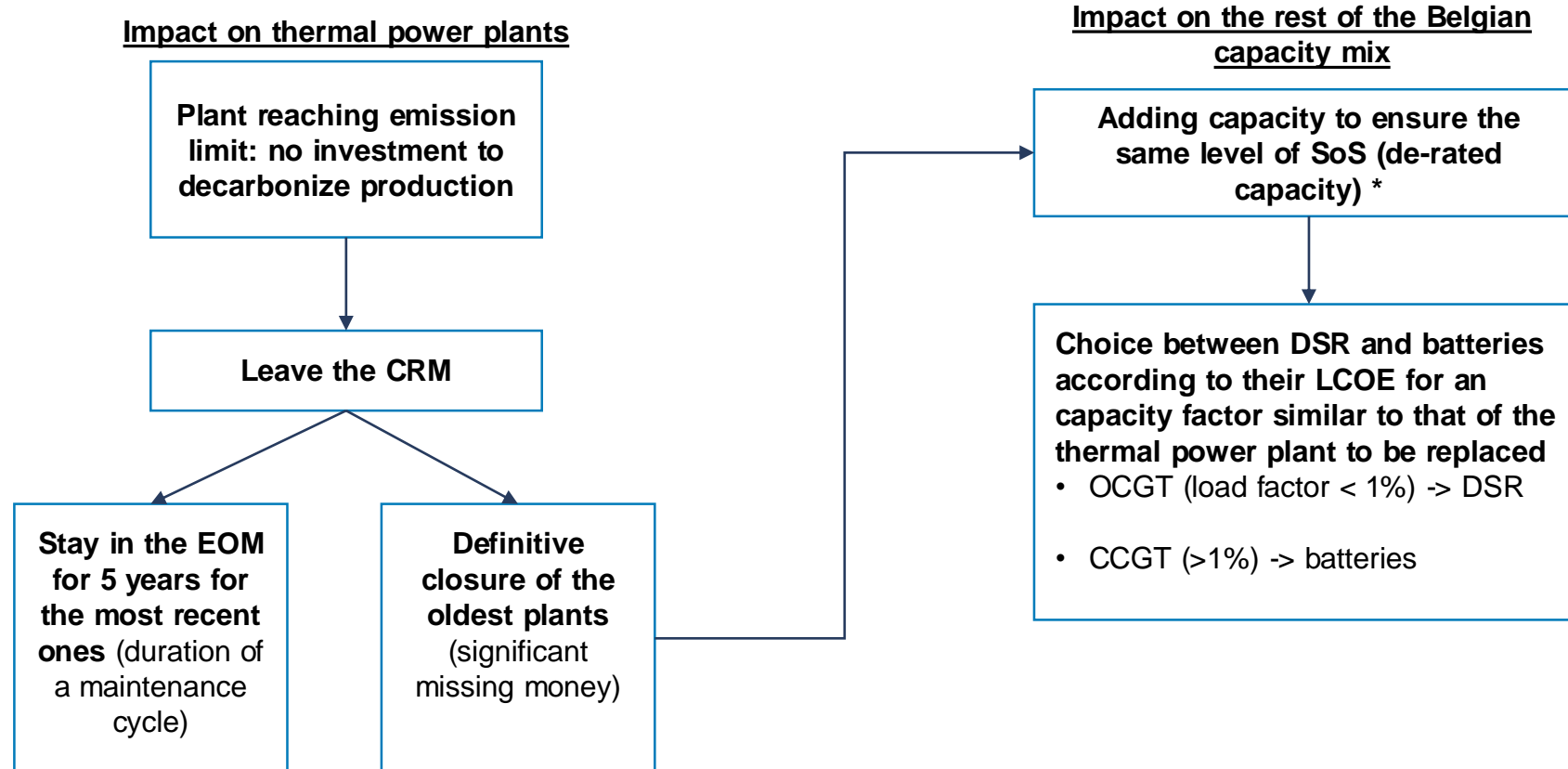
When the CO2 constraint is reached, the plant makes the necessary investments to continue generating (i) if technically possible, and (ii) if economically relevant

Rationality - biogas/H2 infrastructure available, investment cost can be covered by CRM...



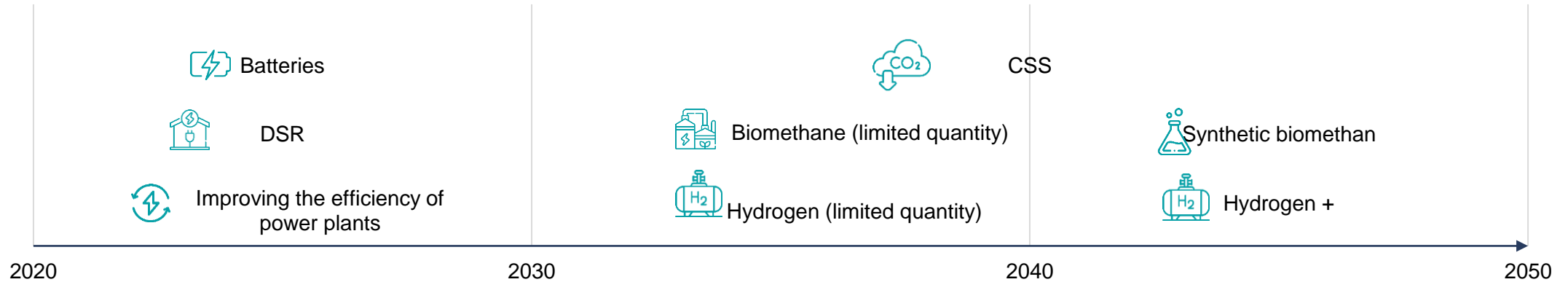
CBA under scenario 2

Scenario 1 - Evolution of the capacity mix



** In the current results, we do not assume any decrease of battery de-rating factor with increasing battery installed capacity*

Scenario 2 - Overview of low carbon flexible technologies



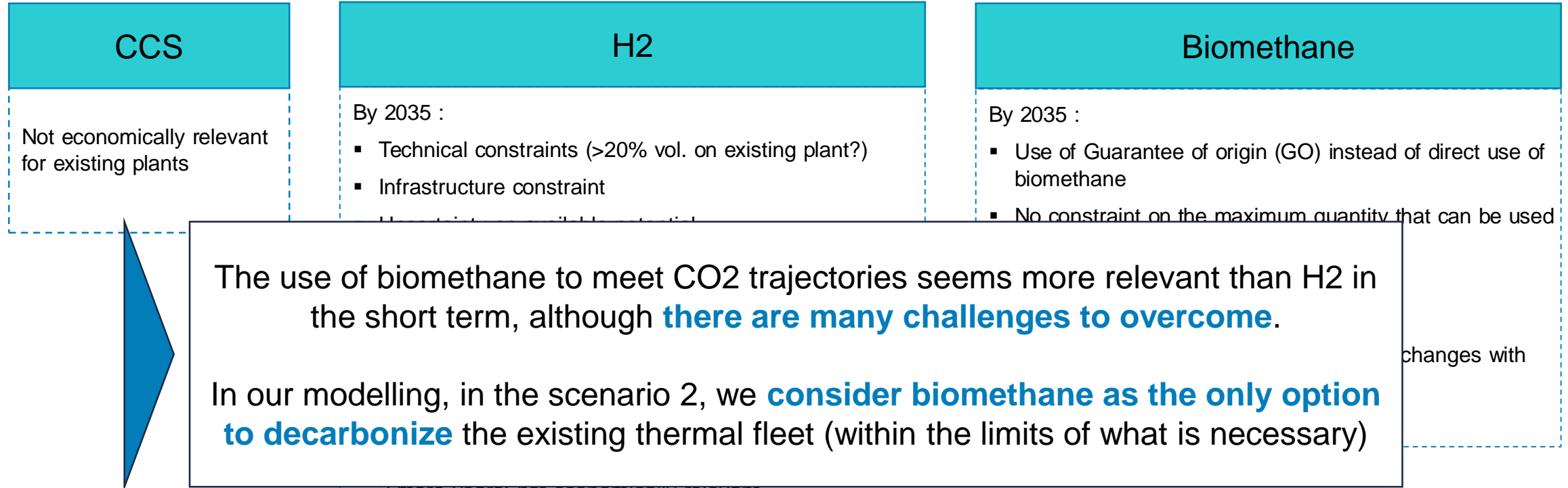
- The year 2035 seems to be a turning point in the development of low-carbon technologies.
 - Before that time, only technologies in advanced stages of maturity can be developed on a large scale. These technologies mainly include Li-ion batteries, DSR (industrial and domestic) and efficiency improvement of thermal power plants.
 - After this horizon, it will be possible to develop alternative solutions depending on the different political and industrial orientations in the time frame.
- In order to enable large-scale development of technologies that are not yet mature enough, strategic plans must be initiated now that will bring down the costs of technologies.

Scenario 2 - Comparison of H2 and biomethane

CCS	H2	Biomethane
<p>Not economically relevant for existing plants</p>	<p>By 2035 :</p> <ul style="list-style-type: none"> ▪ Technical constraints (>20% vol. on existing plant?) ▪ Infrastructure constraint ▪ Uncertainty on available potential ▪ Other priority sectors (hard-to-abate sectors) ▪ High cost ▪ Low energy intensity (50% H2 vol. -> 24% CO2 reduction) <p>→ More than 40-50% in volume by 2030 to meet trajectories 3 and 4</p> <p>→ Burning 30% H2 only allows to stay on the CRM for 1 or 2 more years: not economically relevant</p>	<p>By 2035 :</p> <ul style="list-style-type: none"> ▪ Use of Guarantee of origin (GO) instead of direct use of biomethane ▪ No constraint on the maximum quantity that can be used in a plant ▪ Less infrastructure constraint ▪ But other priority sectors ▪ Uncertainty on available potential GO exchanges with neighbouring countries ▪ High cost

	Traj. 1		Traj. 4	
	Without H2	With 30% H2	Without H2	With 30% H2
Year when a efficient CCGT must leave the CRM due to CO2 constraint	2034	2036	2028	2029

Scenario 2 - Comparison of H2 and biomethane



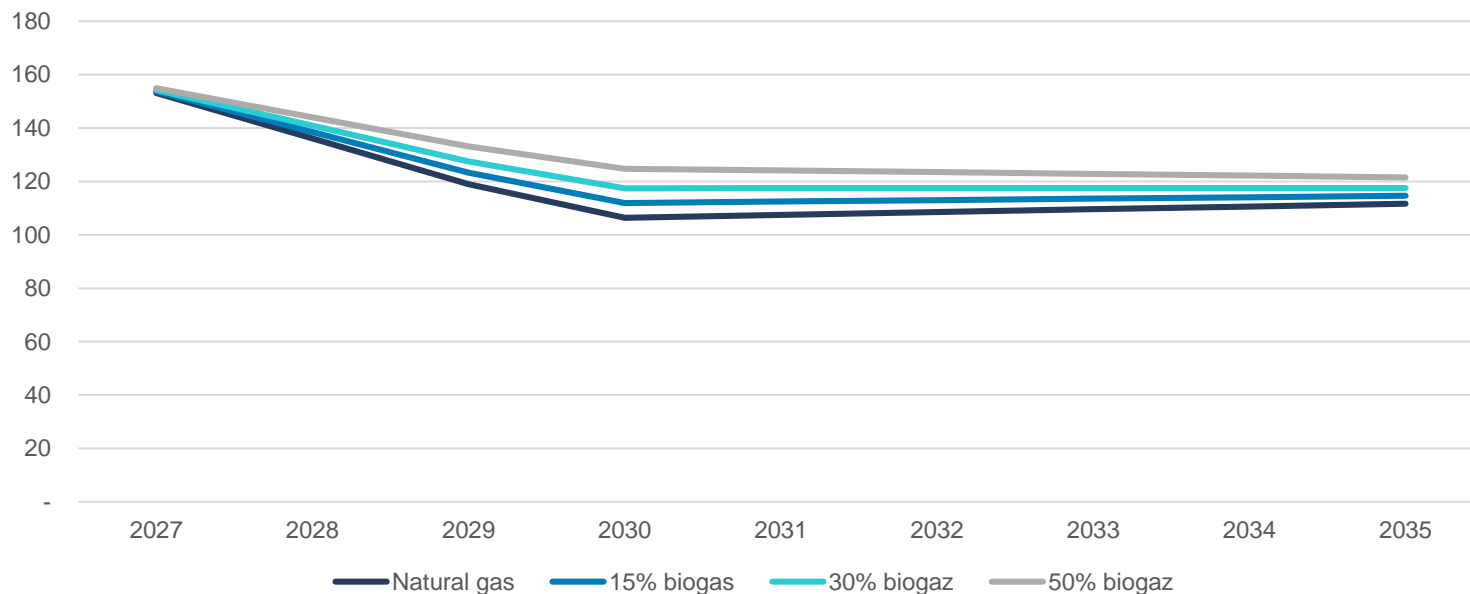
2 more years: not economically relevant

	Traj. 1		Traj. 4	
	Without H2	With 30% H2	Without H2	With 30% H2
Year when a efficient CCGT must leave the CRM due to CO2 constraint	2034	2036	2028	2029

Scenario 2 – SRMC comparison between NG + CO2 and biomethane

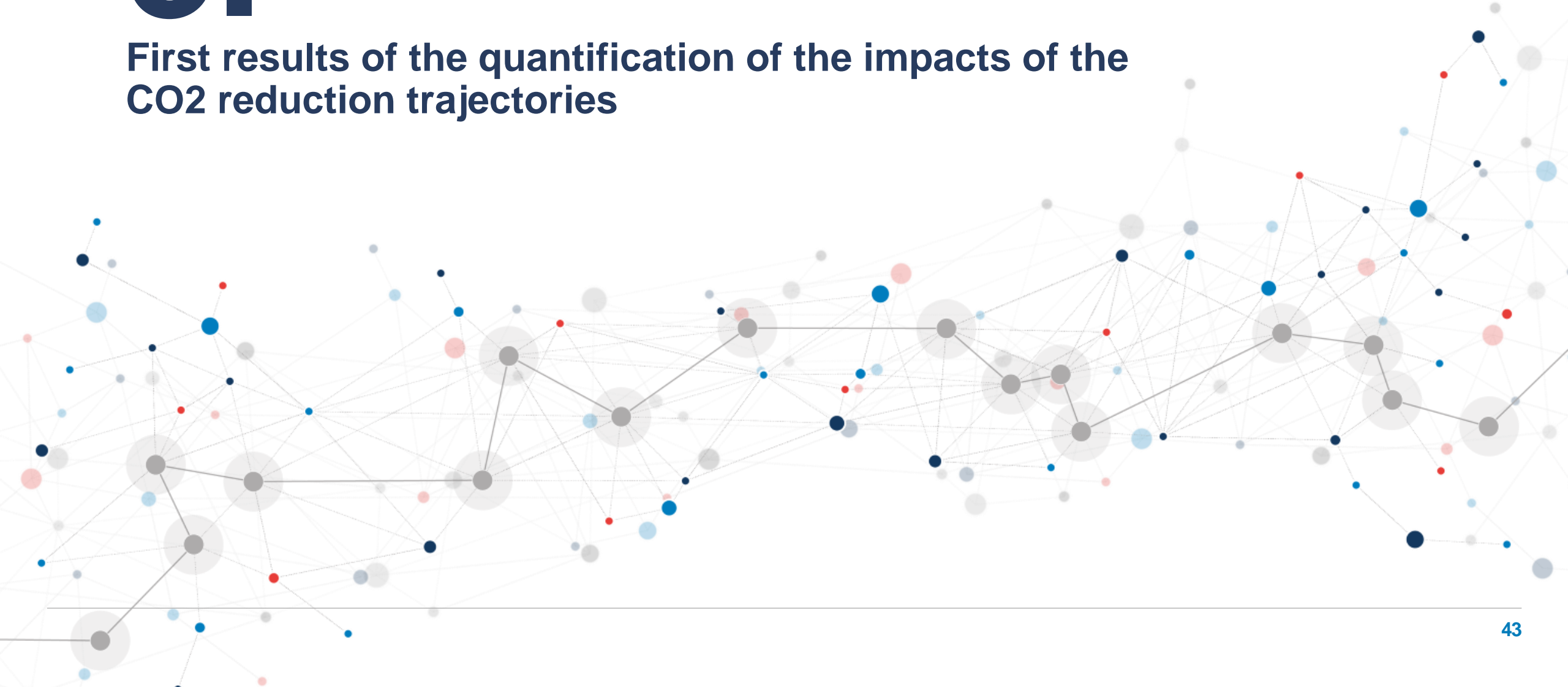
- CBA results highly depend on the lower competitiveness when burning biomethane instead of natural gas (+ CO2)
 - Biomethane costs based on TYNDP 22 (75€/MWh in 2030)
 - Natural gas and CO2 prices are based on Compass Lexecon scenarios (TYNDP prices were estimated before the Ukrainian war and are not longer consistent with current forward values): 35 €/MWh in 2030 for gas and 108 €/tCO2
- **Using biofuel tends to increase SRMC**

SRMC depending on biogas share (€/MWh)



3.

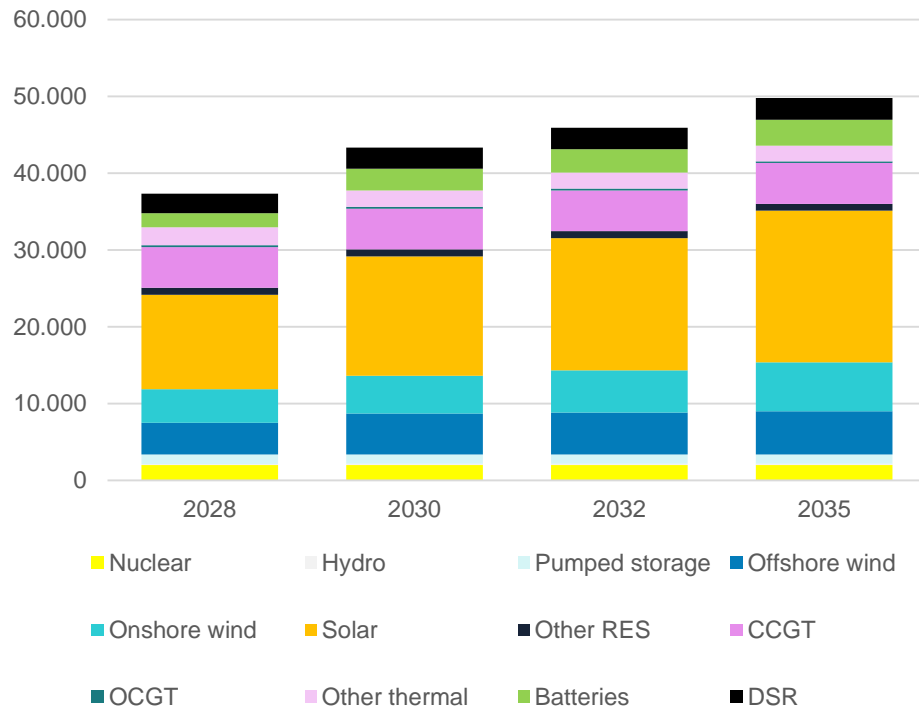
First results of the quantification of the impacts of the CO2 reduction trajectories



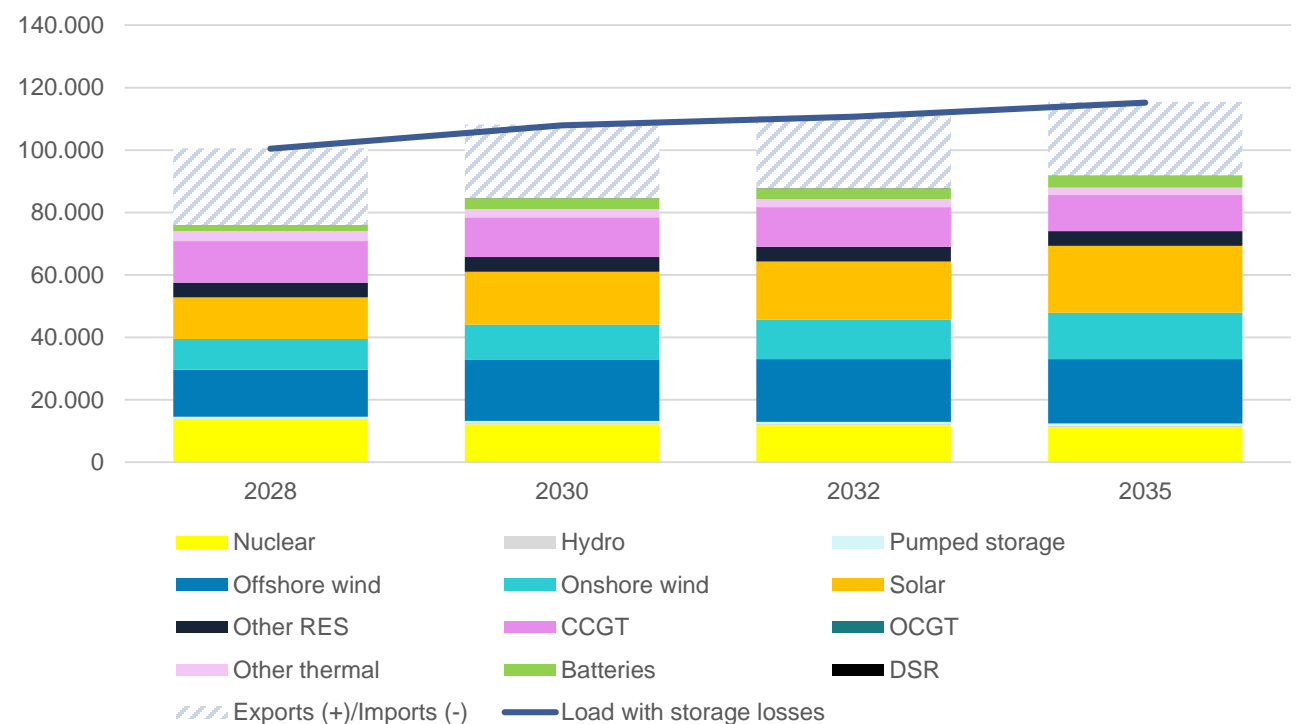
Presentation of the Base Case (without CO2 reduction Trajectory)

- Scenario based on **TYNDP 2022** (GA scenario), with correction of (i) Belgian nuclear (+ 2GW) and (ii) Belgian gas capacities (aligned with Elia)
- Taking into account the **removal of the annual emission threshold from 2026/27**: closure of TJs and older OCGTs (508 MW), replaced by DSR (712 MW to have the same de-rated capacity)

Installed capacity (MW)



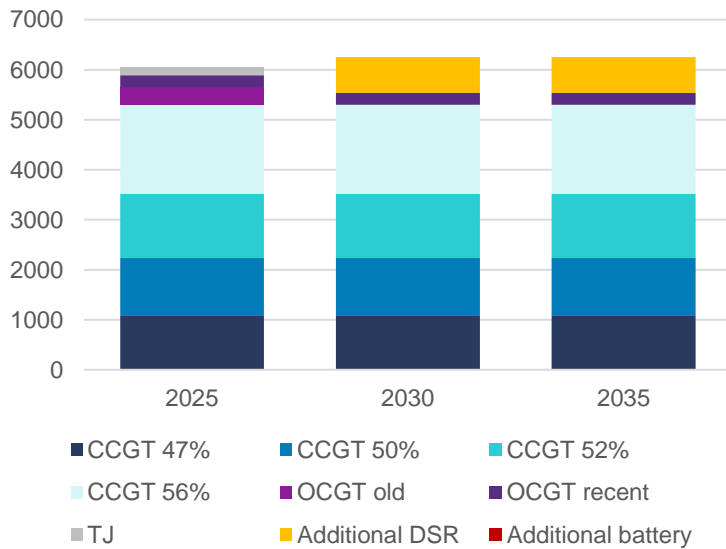
Generation (GWh)



Comparison of installed capacity in the 4 scenarios

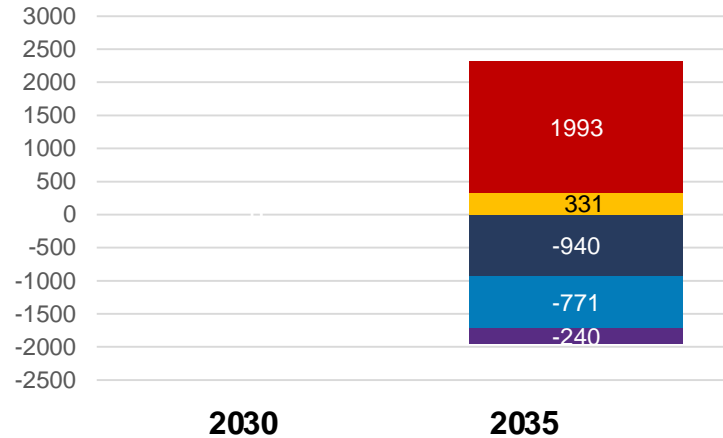
Preliminary results

Base Case, installed capacity (MW)

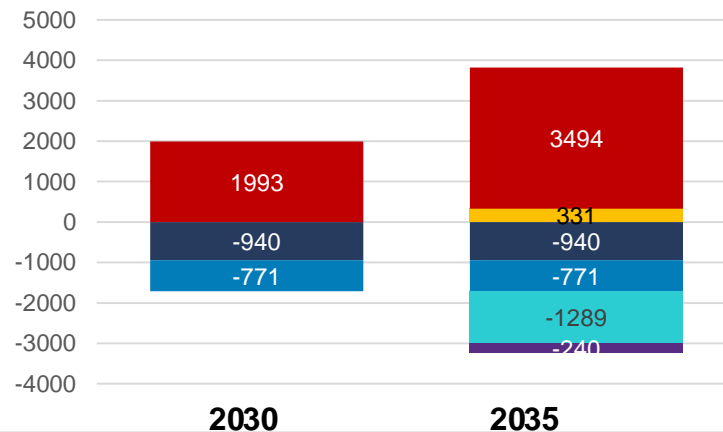


OCGT old and TJ to close in 2026, replaced by DSR

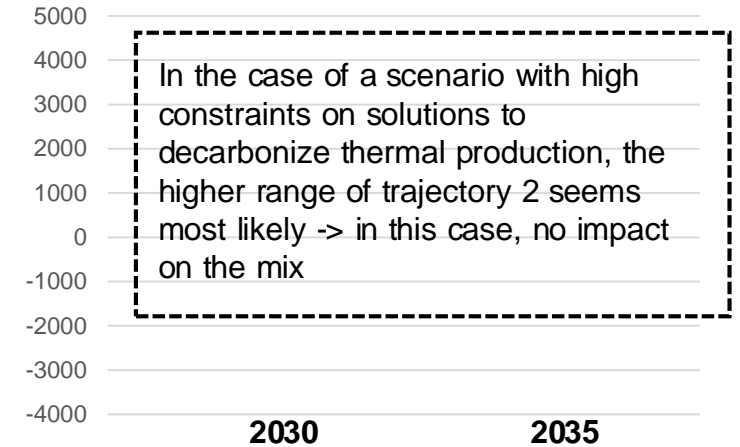
Traj. 1 (difference with Base Case), installed capacity (MW)



Traj. 3 & 4 (no difference in 2030 and 2035)



Traj. 2 Higher range

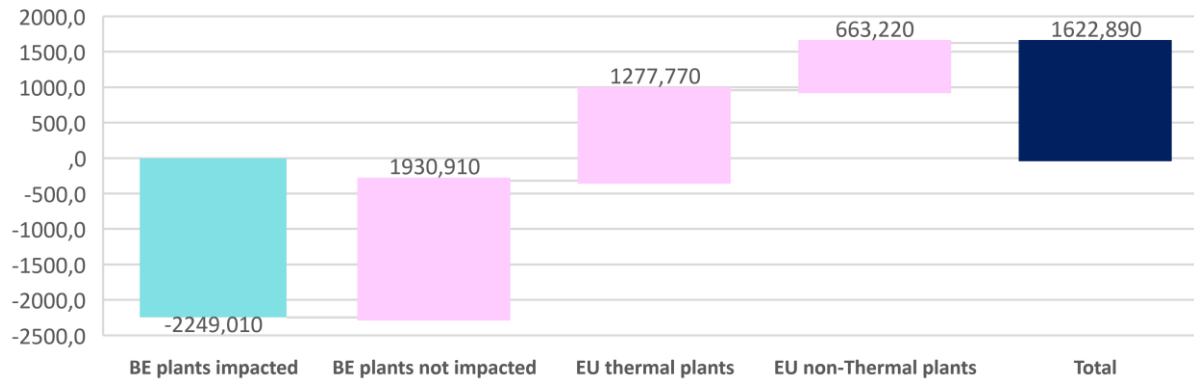


Caveat: No degradation of battery derating factor compared to current value
 → More batteries will be needed to ensure SoS but unclear to what level the derating factor can decrease with 3.5 GW of battery capacity

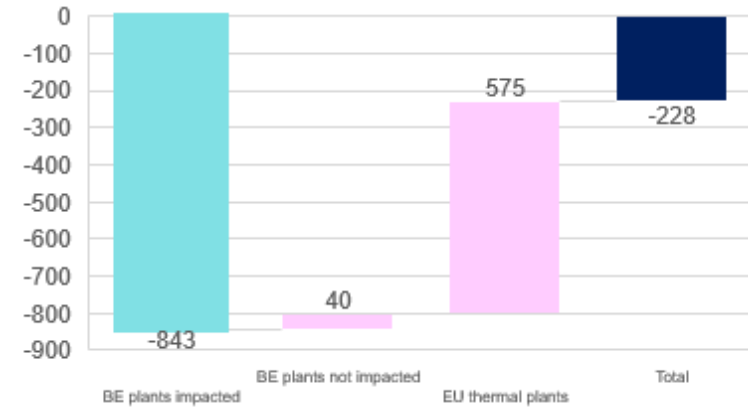
Impact of Trajectory 1 in 2035 - comparison with the Base Case

Preliminary results

Generation in Europe (GWh)



CO2 emissions in Europe (thousand tonnes)



In the end, only **27%** of the reduction in CO2 emissions is actually saved at European level

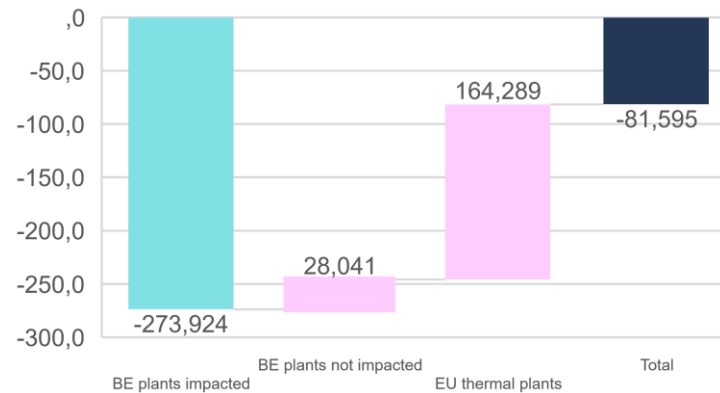
Electricity prices in Belgium (€/MWh)

+ 1.01 €/MWh (+1%)

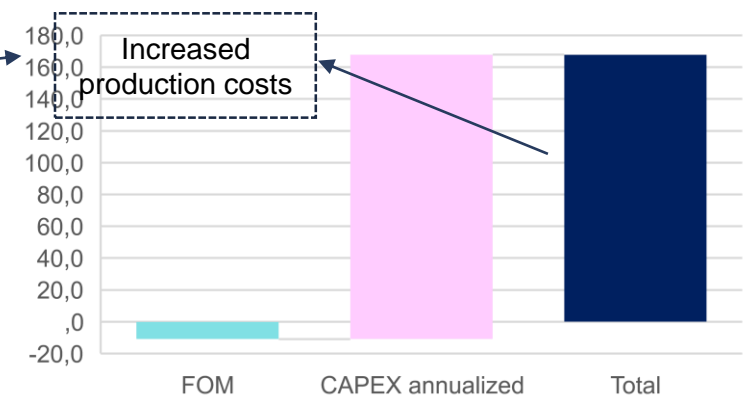
Capacity prices in Belgium (€/MW)

In the process of being calculated

OPEX in Europe (M€)



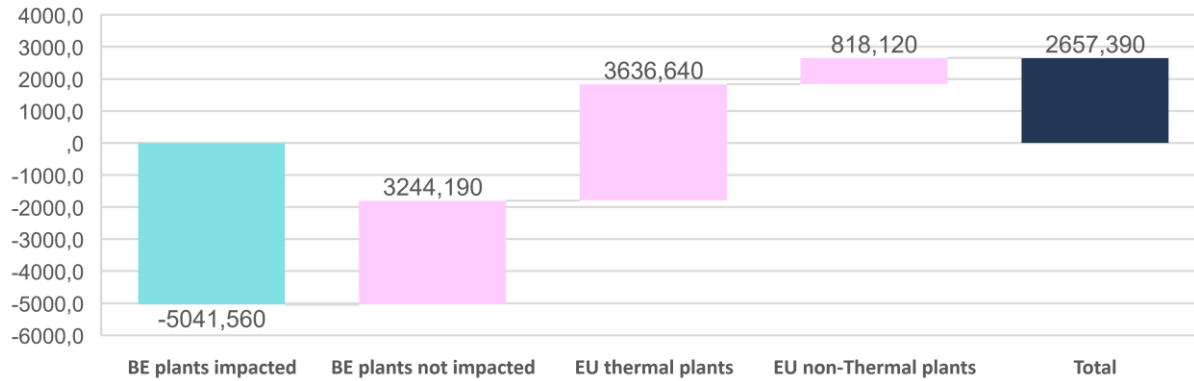
CAPEX in Belgium (M€)



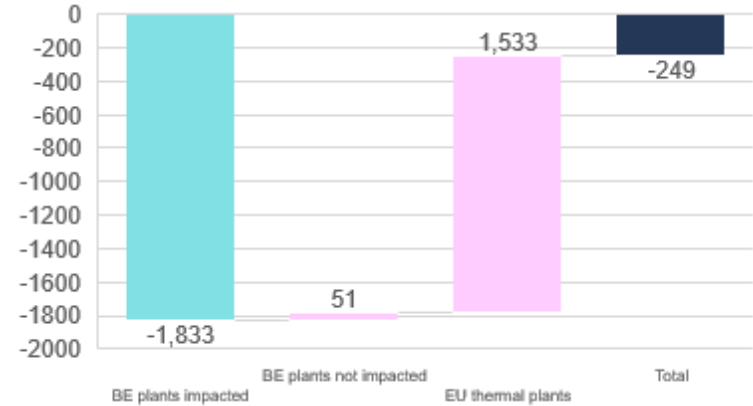
Impact of Trajectory 3 in 2035 - comparison with the Base Case

Preliminary results

Generation in Europe (GWh)



CO2 emissions in Europe (thousand tonnes)



Only 14% of the reduction in CO2 emissions is actually avoided (compared to 27% in trajectory 1)

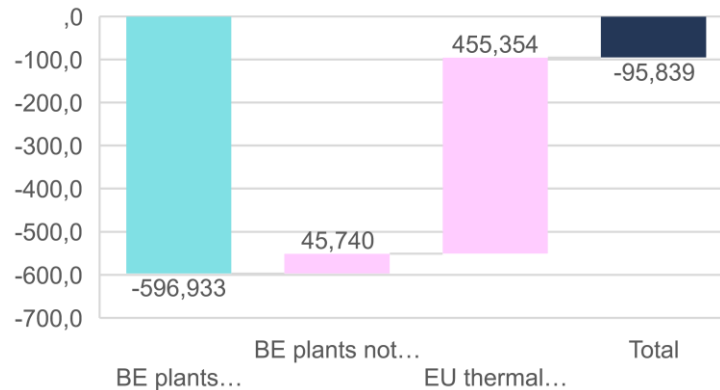
Electricity prices in Belgium (€/MWh)

+ 2.11 €/MWh (+3%)

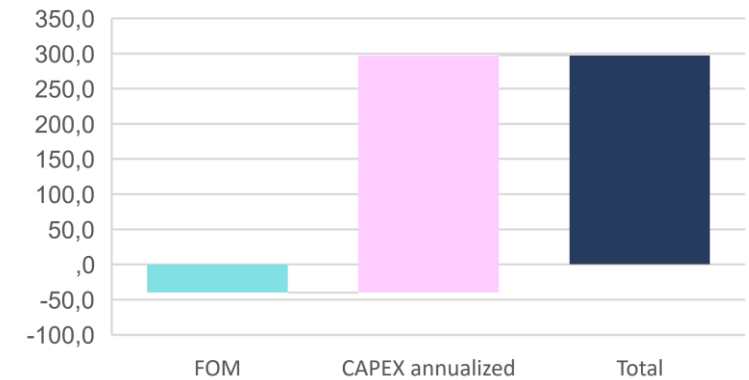
Capacity prices in Belgium (€/MW)

In the process of being calculated

OPEX in Europe (M€)



CAPEX in Belgium (M€)



Preliminary results on Trajectories 1 and 3/4 for 2030 and 2035

Preliminary results

2030

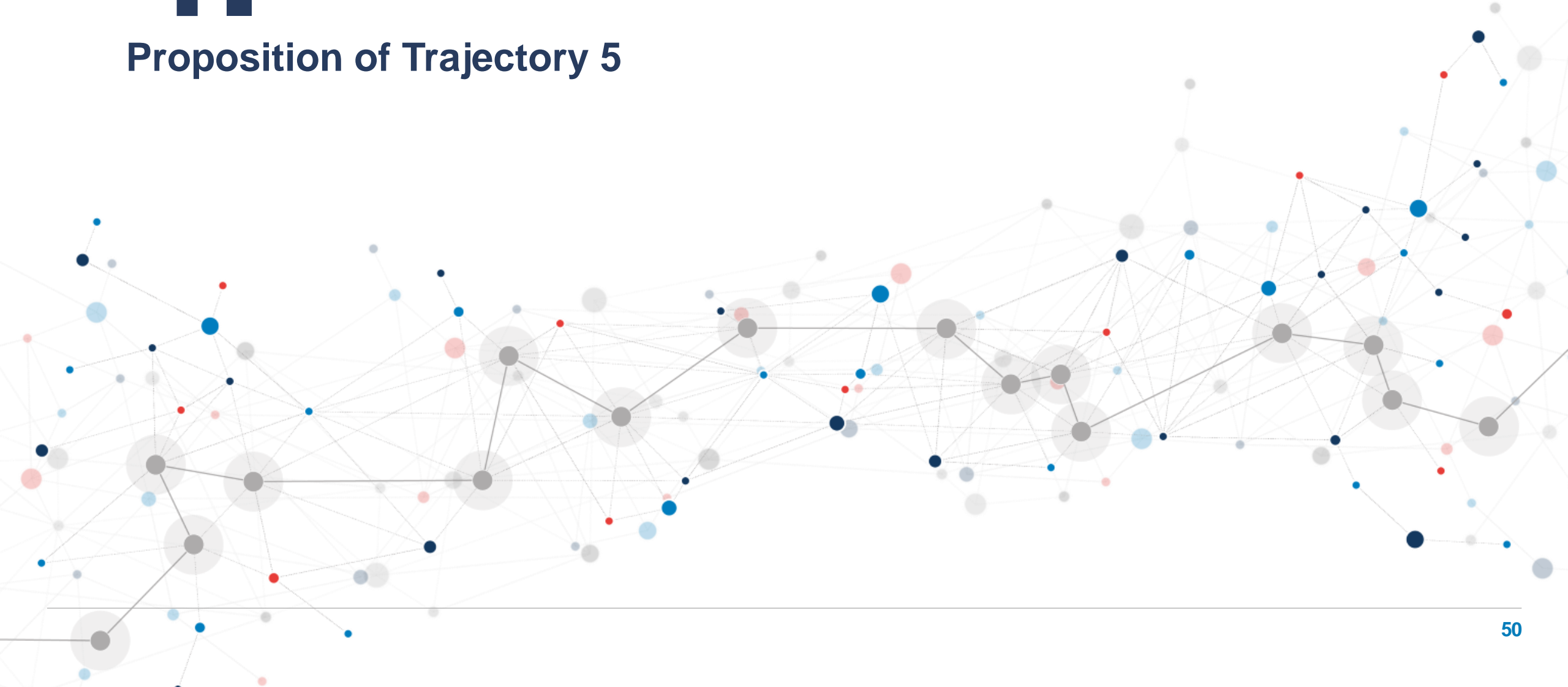
	Traj. 1	Traj. 3 and 4
OPEX + CAPEX (M€)	0	+ 127
CO2 reduction (thousand tCO2)	0	43
Abatement cost (€/tCO2)	/	905
BE electricity price increase (€/MWh)	0	3.24
CRM price	To be determined	To be determined

2035

	Traj. 1	Traj. 3 and 4
OPEX + CAPEX (M€)	+ 86	+ 202
CO2 emissions (thousand tCO2)	228	249
Abatement cost (€/tCO2)	378	809
BE electricity price (€/MWh)	1.01	2.11
CRM price	To be determined	To be determined

4.

Proposition of Trajectory 5



Criteria for the optimal Trajectory 5

Different approaches to existing and new capacity

- Conditions may be different for existing and new capacity
- This is already how the CO2 thresholds are defined in the European regulation and in the French case:

New Capacity

- Restrictive trajectories are possible (e.g. France) reflecting the policy.
- No impact on existing projects
- Beware of future adequacy issues in the absence of eligible technologies

Existing Capacity

- In case the trajectories put existing capacity out of business there is a risk of stranded assets, disputes and security of supply problems
- The objective is rather to induce them to emit less CO2 (in addition to the incentives already given by EU ETS)

Compatibility with European regulation

- The trajectory must be more restrictive than the specific threshold of 550gCO₂/kWh and the annual threshold of 350kg CO₂/kWe/year defined by the European regulation, according to CEEAG 2021.
- Trajectories cannot be set today for the whole period to 2050 due to technological and political uncertainties and the fact that the MRC is only defined for 10 years. One can envisage
 - A firm path(s) for the duration of the existing CRM
 - General guidelines for the future to be confirmed at the time of the renewal of the CRM

Proposition of the principles optimal Trajectory 5

New Capacity

- Steps of several years in order to respect the investment cycle (e.g. as in Trajectory 2)
- Consistent with specific emission of the best available new technology expected to be feasible over the period of the step
- E.g. to the extent H2 and biogas are not yet feasible, a 350-400 gCO2/kWh could be feasible for most efficient CCGTs
- Once H2/biogas mixing becomes feasible, further reduction to 270-300 gCO2/kWh could be envisaged.
- This is generally consistent with Trajectory 2 principle

Existing capacity

- Reintroduce annual thresholds in addition to specific thresholds 550gCO2/kWh and 350kgCO2/kW/year according to EU regulation
- Lower specific thresholds can be accompanied by higher annual thresholds as long as capacity meets the 550gCO2/MWh threshold.
- Possible approaches to set the annual thresholds:
 - **Economic:** ensure capacity not meeting specific threshold does not emit more than the capacity meeting specific threshold
 - **Policy:** further constraining the operation of capacity not meeting specific thresholds

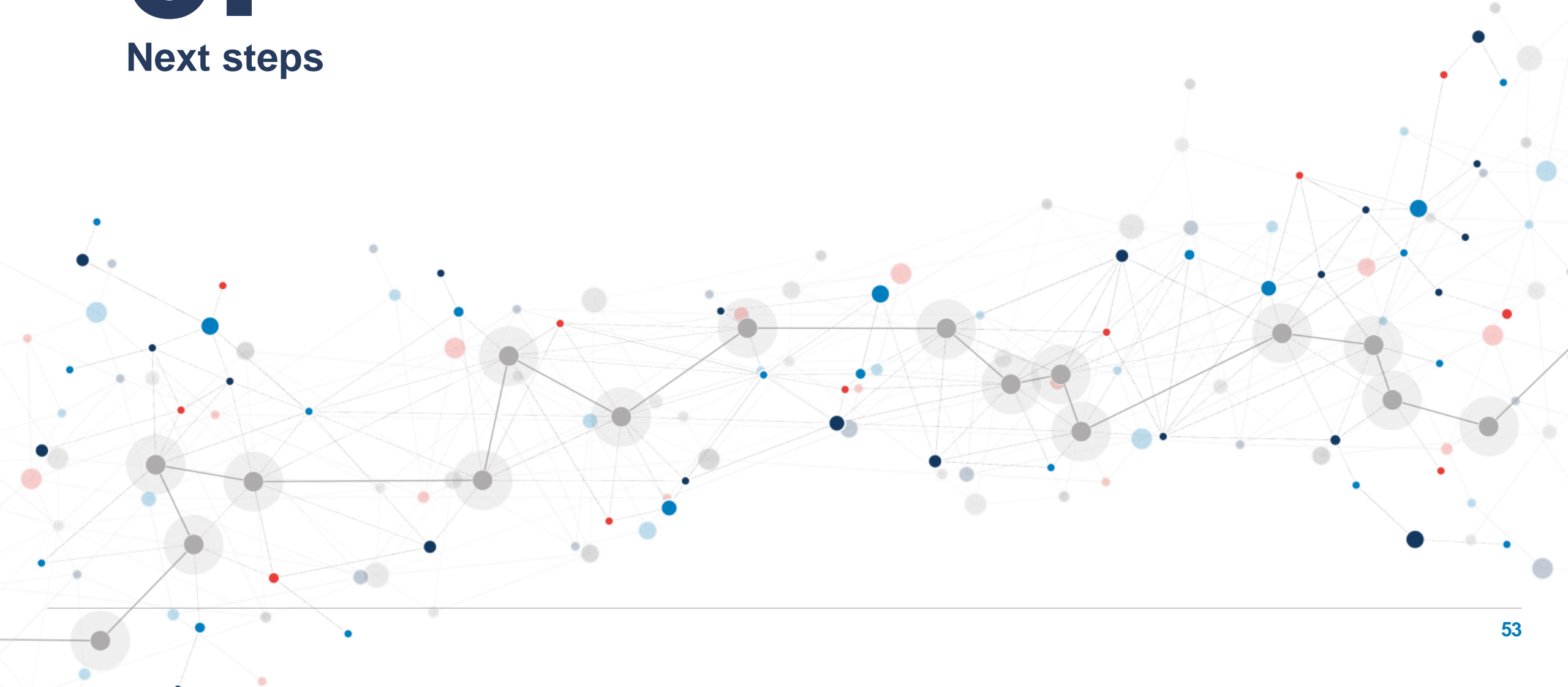
Example of the annual threshold calculation based on 2030 Base Case model

	Specific emissions (gCO2/kWh)	Installed capacity (MW)	Capacity factor (%)	Running hours	Annual emissions, kgCO2/kW/year
BE_CCGT 47%	394	598	10	910	359
BE_CCGT 50%	370	1,637	18	1,574	582
BE_CCGT 52%	356	1,289	28	2,424	863
BE_CCGT 56%	320	1,775	42	3,637	1,164

- Assuming the specific threshold is set at **350gCO2/kWh**, all existing CCGTs will be subject to the annual constraint, and only new CCGTs will be eligible based on the specific emissions
- An **economic** annual threshold can be defined at **1,164kgCO2/kW/year**. But such threshold level would not be binding as the existing CCGTs would not produce such volume anyway.
- A **policy** threshold can be set, e.g. at **500kgCO2/kW/year**. This would ensure that some existing CCGTs are constrained to produce less than they would otherwise

5.

Next steps

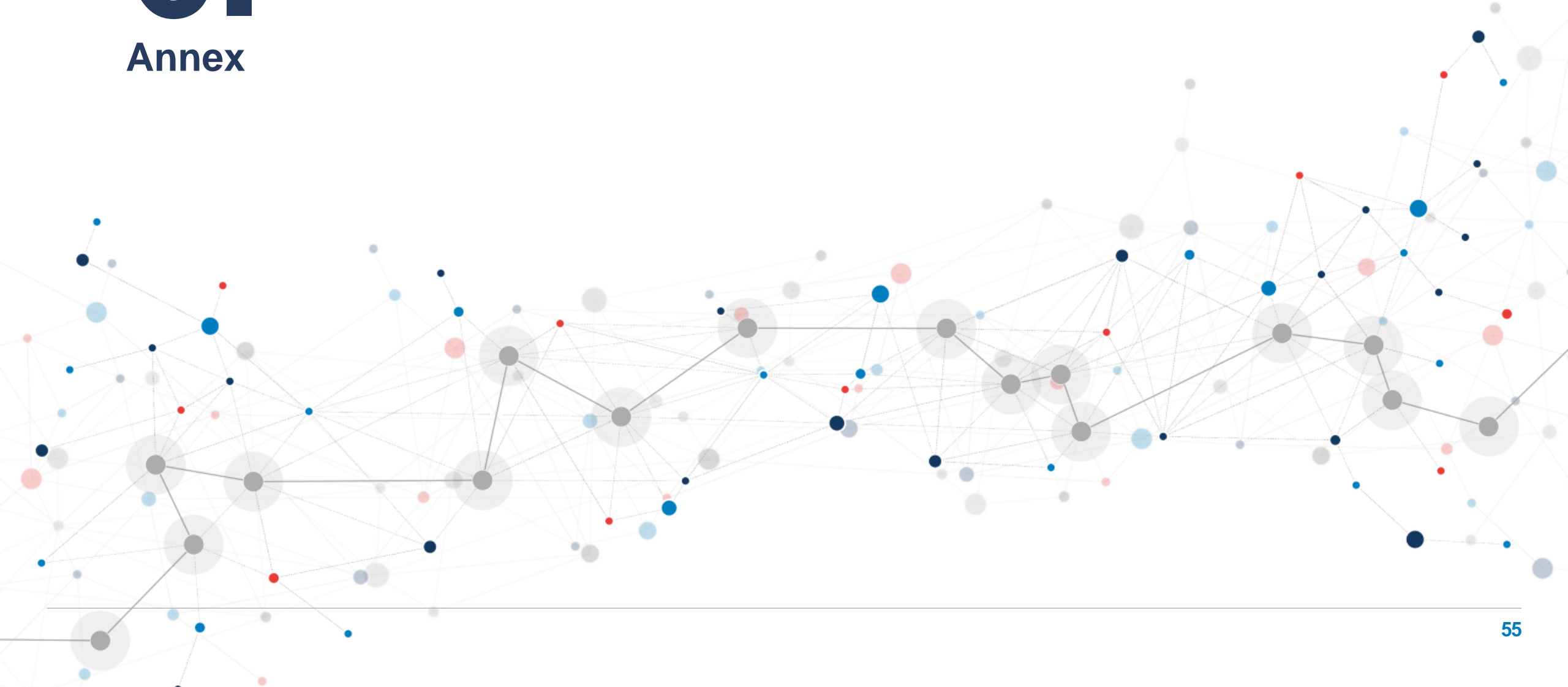


Next steps

- Consideration of stakeholders' comments
- Finalisation of the cost-benefit analysis
 - On scenario 2
 - For trajectory 5
 - Calculation of pending indicators (cost of CRM)
- Conclusion of the CBA

6.

Annex



CAPEX and FOM assumptions

- CAPEX and FOM assumptions are based on the values proposed by Elia in the public consultation for the Adequacy study 24-34

FOM assumptions

	Battery	OCGT recent	OCGT old	CCGT	DSR
FOM (€/kW/year)	15	25	50	40	0-300 MW – 25 300-600 MW – 50 600-900 MW – 75 > 900 MW – 100

Source: Elia

CAPEX assumptions

	4h-battery	DSR
CAPEX (€/kW)	2026-2030 : 850 2031-2045 : 750	Included in the FOM

Source: Elia

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Berlin, 10719

Brussels

23 Square de Meeûs
Brussels, 1000

Copenhagen

Bredgade 6
Copenhagen, 1260

Düsseldorf

Kö-Bogen
Königsallee 2B
Düsseldorf, 40212

Helsinki

Unioninkatu 30
Helsinki, 00100

London

5 Aldermanbury Square
London, EC2V 7HR

Madrid

Paseo de la Castellana 7
Madrid, 28046

Milan

Via San Raffaele 1
Milan, 20121

Paris

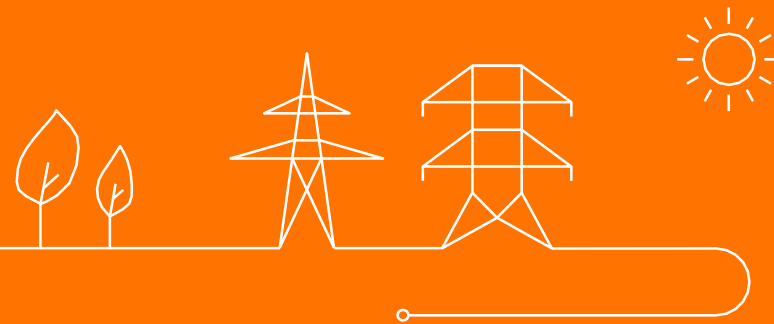
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Ce rapport a été préparé par les professionnels de Compass Lexecon. Les opinions exprimées dans ce rapport n'engagent que leurs auteurs et ne représentent pas nécessairement celles de Compass Lexecon, de sa direction, de ses filiales, de ses sociétés affiliées, de ses employés ou de ses clients.

Next meetings



Foreseen timeslots for next meetings

- Friday 16th December 2022 pm
- **NEW** Friday 27th January 2023 am
- **NEW** Friday 17th February 2023 am



Thank you !

