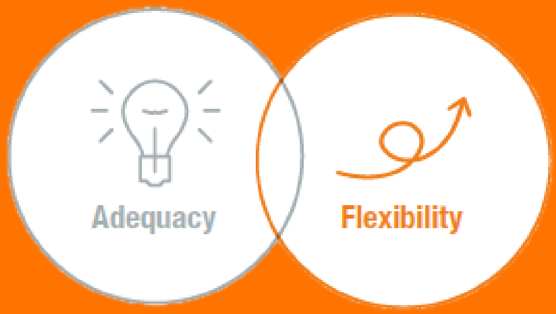
Adequacy & Flexibility study 2022-32

Ad-hoc Task Force



30 October 2020

Generalities

Presented by Kristof Sleurs

For a smooth teleconference with 30+ people …
Some rules apply

- Please put yourself on mute at any time that you are not speaking to avoid background noise.
- If you receive a call, please ensure that you do not put this meeting **on hold.**
    - You can quit and reconnect later on.
    - You will be muted or kicked out of the session, if necessary.
- You will be requested to hold your questions for the end of each presentation/topic.
    - Should you have a question, please notify via Skype or speak out if you are only via phone.
    - Share your question (with slide number) in advance so all participants may follow
    - Before you share your question, please announce yourself (name – company/organisation).
- If you have a poor internet connection, please dial-in.
- Finally, please be courteous and let people finish their sentences.
    - It is practically impossible to follow when 2 people are speaking at the same time in a teleconference.

Agenda

- Timeline, process, regulatory framework
- Methodology description
    - General description
    - Flexibility
    - Economic viability
    - Climate years
- Detailed scenario assumptions
- Public consultation details

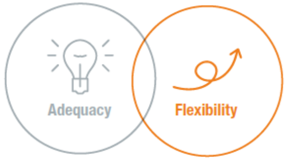
Timeline, process, regulatory framework

Presented by Rafael Feito Kiczak

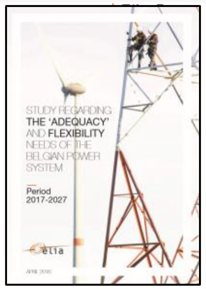
Belgian legal & regulatory framework related to this study

APR 2016

Adequacy & Flexibility
2017 - 2027



At the request of the Minister for Energy, an ad-hoc study covering the adequacy and flexibility of Belgium was published in April 2016. An Addendum (September 2016) requested by the authorities was also performed based on a large stakeholder consultation following the initial study.



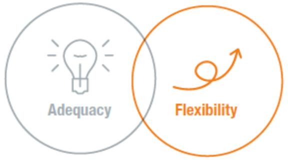
JUL 2018

Legal requirement in the federal electricity law:

Art. 7bis, §4bis: "*Uiterlijk op 30 juni van iedere tweejaarlijkse periode voert de netbeheerder* ***een analyse uit met betrekking tot de noden van het Belgische elektriciteitssysteem inzake de toereikendheid en de flexibiliteit van het land voor de komende tien jaar****. De basishypotheses en -scenario's alsook de methodologie die gebruikt worden voor deze analyse worden bepaald door de netbeheerder in samenwerking met de Algemene Directie Energie en het Federaal Planbureau en in overleg met de commissie.*"

JUN 2019

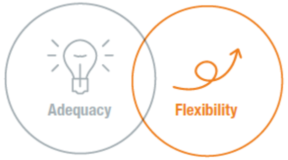
Adequacy & Flexibility
2020 - 2030



The first study published in 2019 after the modified law.

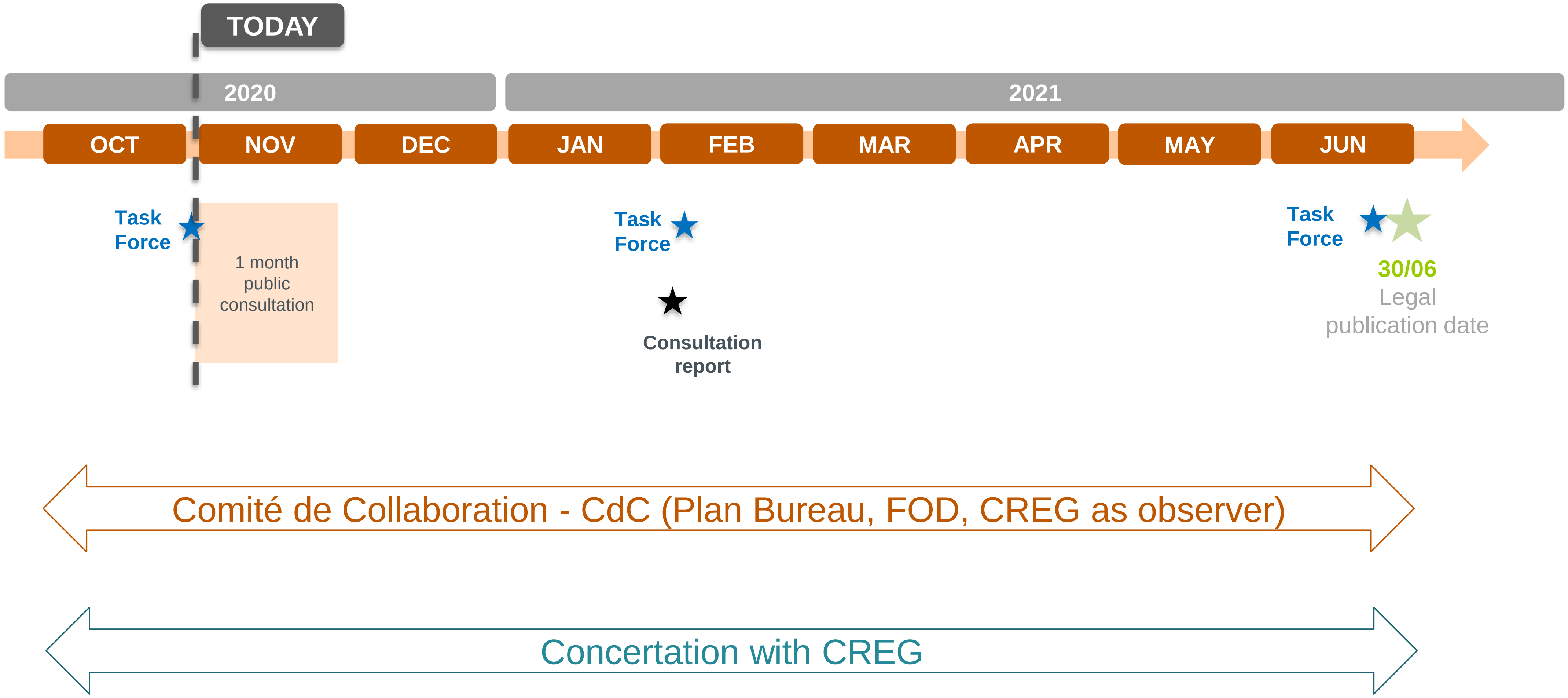
JUN 2021

Adequacy & Flexibility
2022 - 2032



The current study where the process starts now.

High level timeline for the study delivery



Link with the recently approved ERAA methodology

- The ERAA methodology was approved by ACER and published on 5th of October 2020

- The **ERAA methodology applies to the ERAA assessment, conducted by ENTSO-E**. **No ERAA assessment will be published before the next national adequacy & flexibility study.**

  ⇒ The first ERAA on the basis of this methodology will be published by the end of 2021

- An implementation plan is foreseen in the ERAA. The methodology **has to be fully applied for the ERAA by the end of 2023**. Therefore, it is impossible to implement all the requirements already for this adequacy & flexibility study as:

  - Some key elements won't be known by the legal deadline of publication (cfr. implementation plan, options left open in the ERAA method, detailed methodology to be elaborated...) ;
  - Some improvements require more time and resources which are not possible in the given timing.

Note that our goal is however **to pro-actively comply as much as possible with the elements of the ERAA methodology**. The proposed improvements in the methodology are made in such direction.

The scenario, methodology and request for sensitivities are submitted for a public consultation of 1 month starting today.

- The methodology from the previous study will be used as basis (any comments on it are also welcomed);
- A document describes the methodological changes we propose for the next study (the main ones are detailed in this presentation). Several annexes on economic viability are also added;
- An Excel file is also provided with the data for the proposed central scenario for Belgium including the sources;
- As the previous study, we are open for quantified suggestions for sensitivities from stakeholders. Those will be further analyzed within the CdC;
- As for any public consultation, feel free to ask for clarifications during the consultation period (if something is unclear to you).

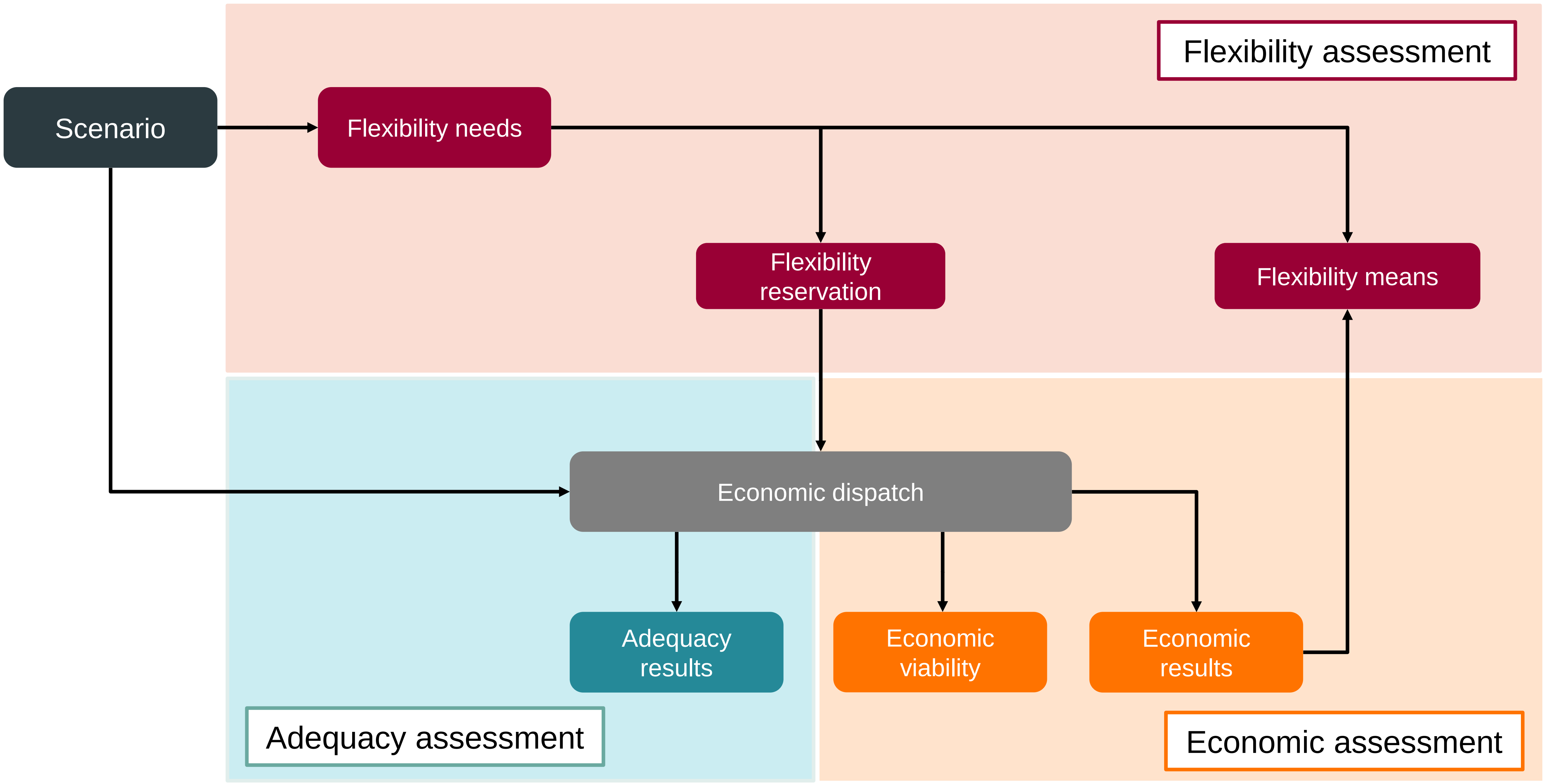
More practical details on the public consultation will be provided at the end of this presentation

Methodology description

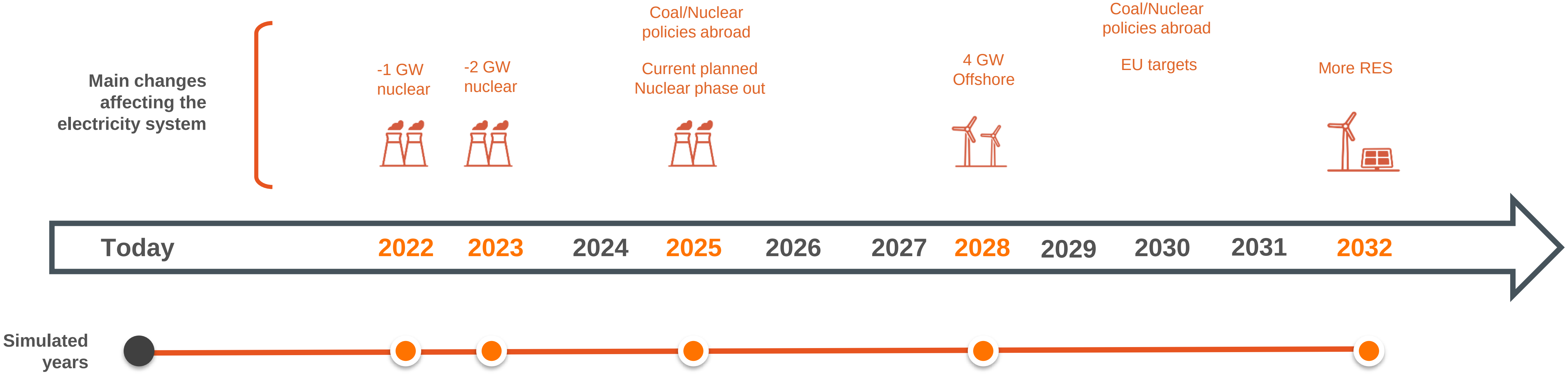
General methodology description

Presented by Bilal Hahati

The study will consist of several parts which are interlinked



Within the 10 years timeframe, <u>5 time horizons</u> are proposed to be quantified following a central scenario with additional possible sensitivities based on the ouputs from public consultation



Each year corresponds to a period starting from September: "year 2025" = 2025-26

Construction of the scenario

1 CENTRAL scenario will be constructed for all proposed time horizons

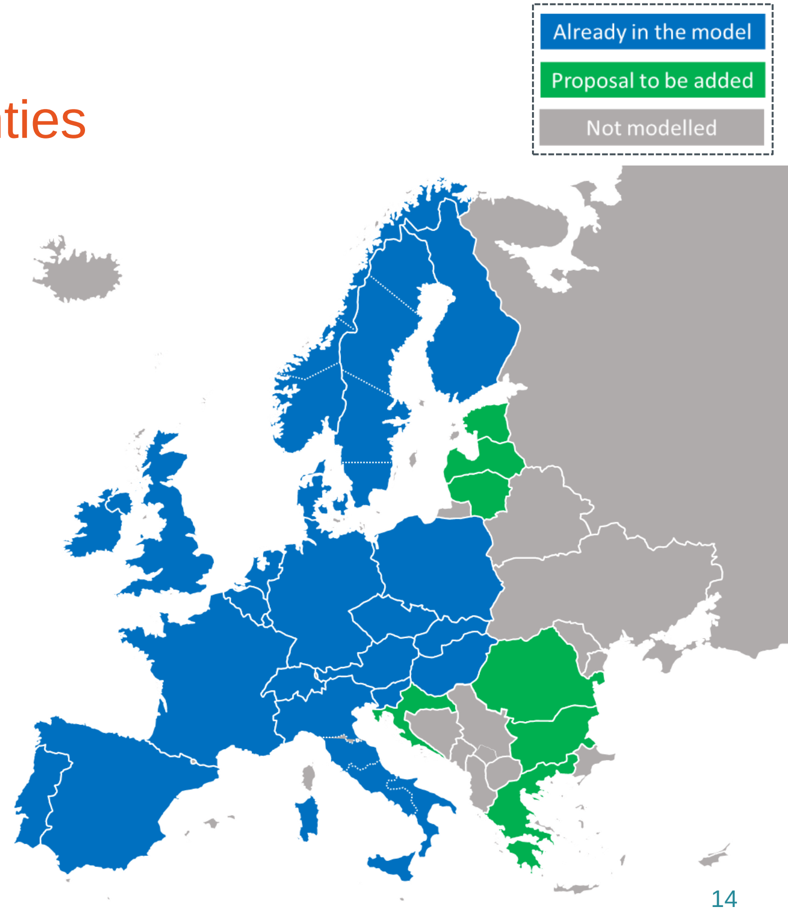
- The CENTRAL scenario will be aligned with the latest Belgian NECP and other countries' NECPs/MAF study
- The CENTRAL can be seen as a 'current/stated policies' based on Belgian/European ambitions

Additional sensivities will be defined to cover key uncertainties

- Sensitivities will be performed in order to capture the range of uncertainties on key assumptions. Open for any quantified suggestion from stakeholders.

More than 25 countries will be modelled in details

- Hypotheses of neighbouring countries will be based on the latest published MAF study, complemented with new information (if publically available) for the different countries.
- New countries/zones are added to cover the CORE region (or the whole EU).



ANTARES will be used to perform the market simulations in order to derive adequacy and economic indicators

INPUT DATA

- Consumption
- Centralised thermal production facilities
- Decentralised thermal production facilities
- Renewable production
- Interconnection capacity between countries
- Storage
- Demand flexibility

For all simulated countries

SIMULATIONS
Hourly dispatch optimisation to minimise costs

MODEL OUTPUT

- **Hourly dispatch** for all units in each country
- **Commercial exchanges** between countries
- **Hourly marginal prices**

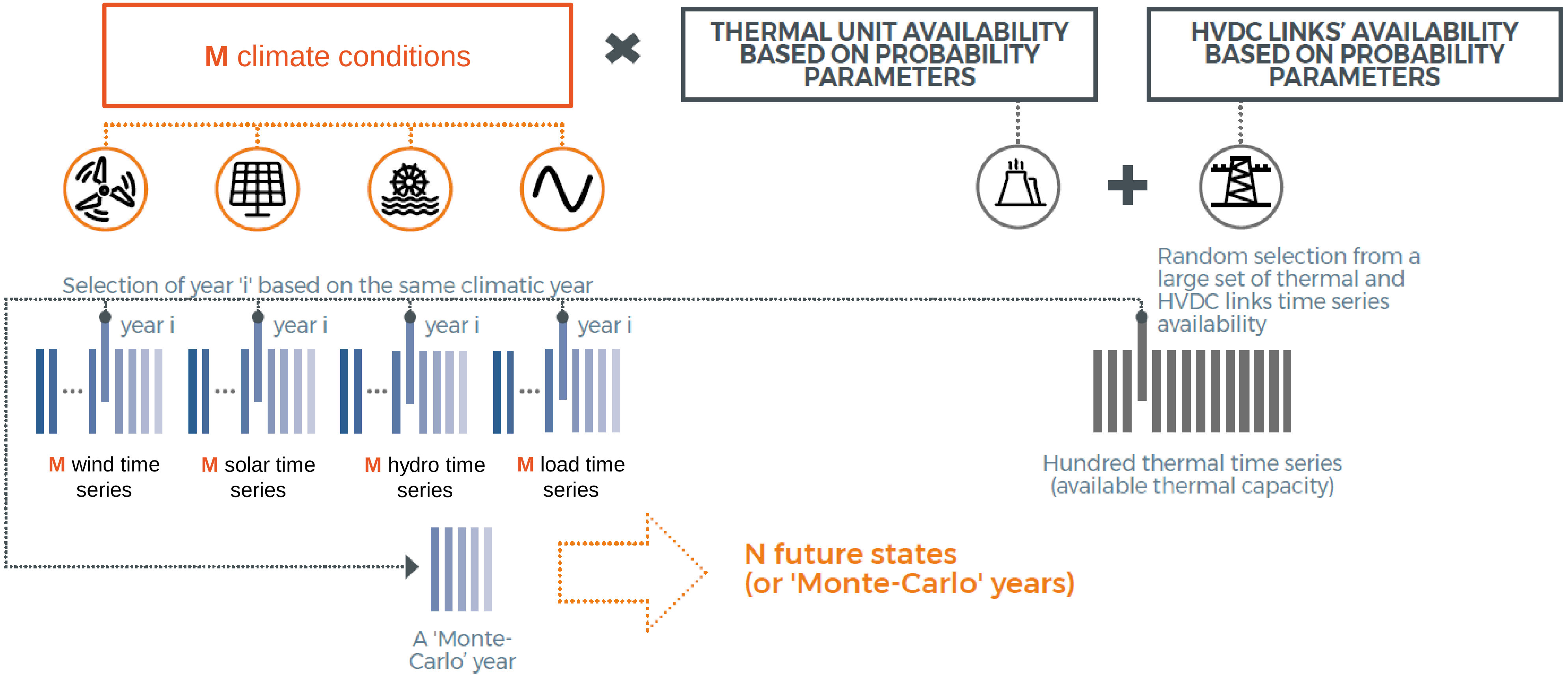
- **Adequacy** indicators
  - LOLE, ENS
- **Economic** indicators
  - Market welfare, total costs, unit revenues, running hours
- **Sustainability** indicators
  - Emissions, RES share
- **Dispatch** indicators
  - Imports/exports, generation per type

ANTARES is a perfect foresight economic dispatch model, also used by RTE and ENTSO-E for adequacy and electricity market simulations.

The tool is used as basis for adequacy and economic results.

Economic dispatch

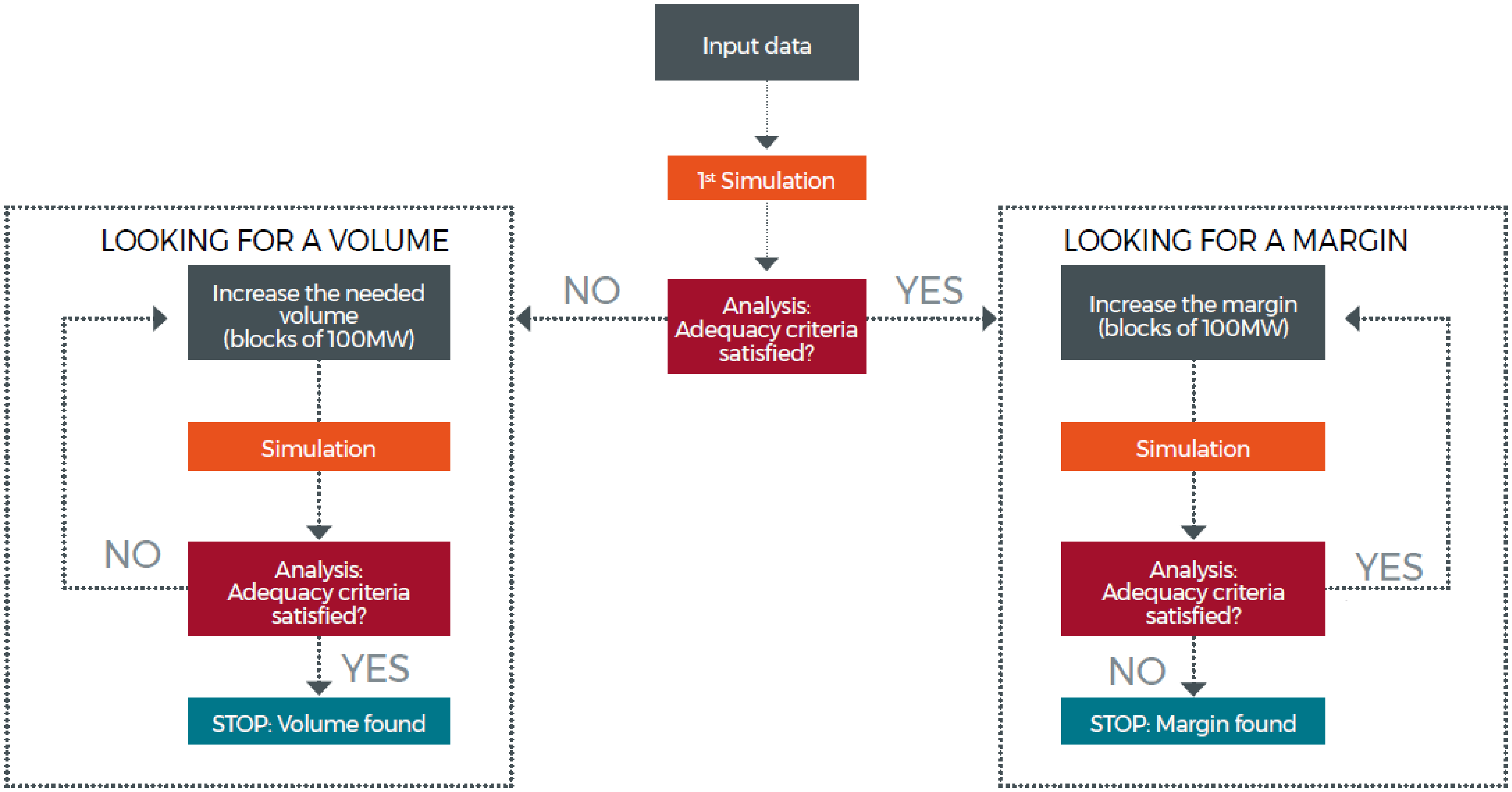
A large amount of Monte-Carlo years will be simulated at each iteration



In addition to the previous study, a convergence criteria as suggested in the ERAA methodology will be used for adequacy simulations

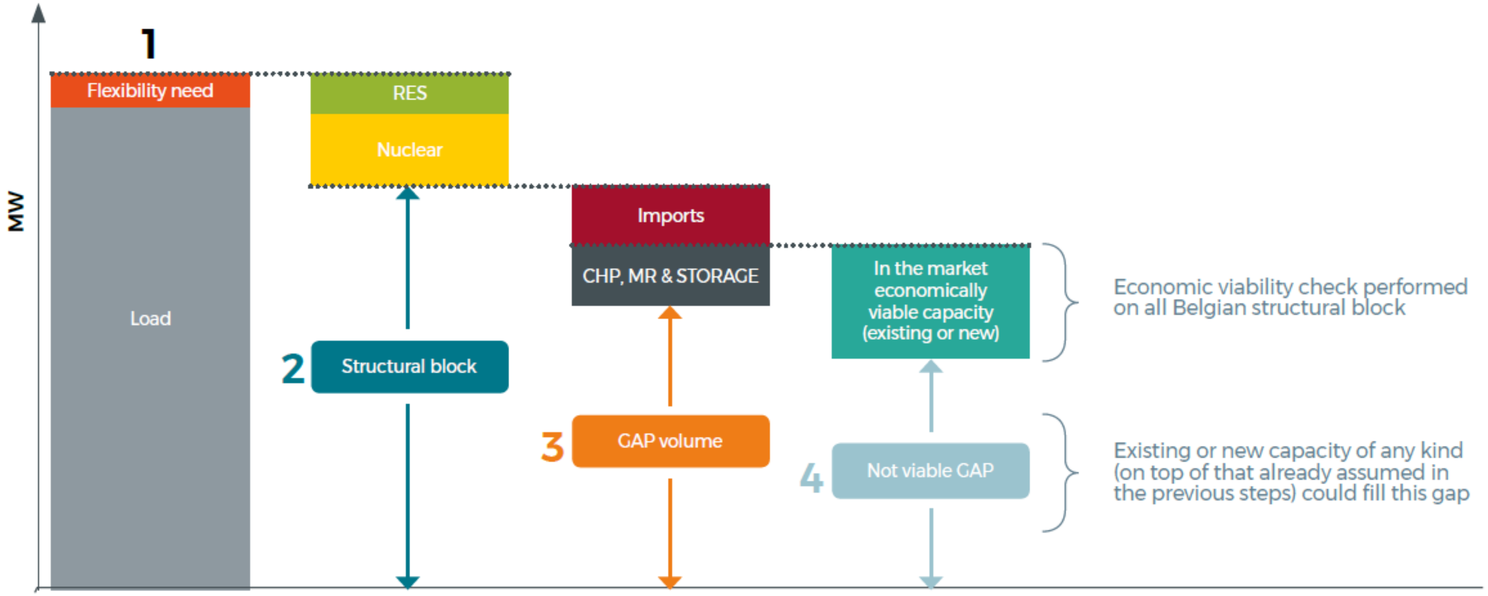
Adequacy results

An iterative process per steps of 100 MW to determine the needed volume to be adequate is performed



Adequacy results

The study consists in identifying the structural block, the GAP volume and the not Viable GAP capacity and characteristics to satisfy the adequacy criteria

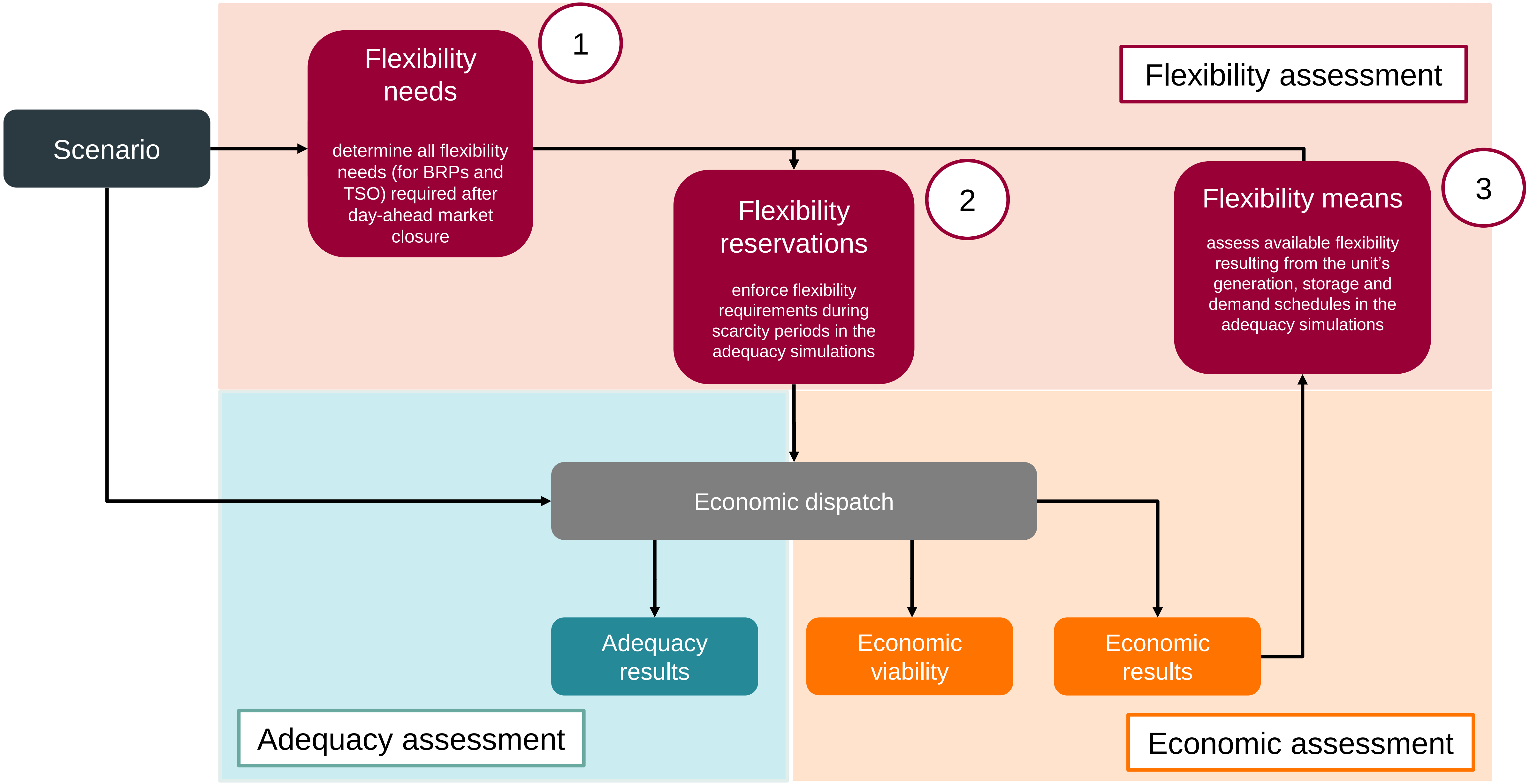


1. **The assessment starts** from the evaluation of the consumption for Belgium increased by the flexibility needs during scarcity risk periods identified in the flexibility assessment.
2. The **structural block** is the capacity needed **(100% available/flexible)** to ensure an adequate system when adding the flexibility needs to the consumption during scarcity risk periods and deducting the renewable generation and nuclear.
3. The **GAP** is the capacity needed **(100% available/flexible)** in Belgium to ensure an adequate system when deducting the contribution of CHP, market response, storage (without viability assessment) and imports from the structural block.
4. The **not viable GAP** **(100% available/flexible)** is the shortage in capacity that would prevail in market in **Belgium** resulting from an economic viability assessment on existing and new capacity.

Flexibility

Presented by Kristof De Vos

The flexibility assessment consists of 3 parts



Proposed methodology modification

EERA Methodology Article 4(6)g - Reserve requirements shall be set separately for FCR, FRR and RR.

i. For each target year, the dimensioning of FCR and FRR, and the contribution of each TSO, shall reflect reserve needs to cover imbalances in line with Articles 153 and 157 of SO GL.

ii. Unless the modelling framework described in paragraph 1(g) is able to model the use of balancing reserves in relation to unforeseen imbalances, FCR and/or FRR (or a part of these balancing reserves) may be deducted from the available capacity resources in the ED […]

AS IS (2019 study)

- The upward 'fast' flexibility during scarcity periods only are modelled in ANTARES (on top of FCR)
- This objective of this methodology was to cover both the flexibility needed by the BRPs to balance their portfolio, as the flexibility needed by the TSO to balance the system

TO BE (2021 study)

- To align with the EERA-guidelines, flexibility reservations will be replaced by an approach modelling upward FRR (aFRR + mFRR) in ANTARES (on top of FCR) :
  - ➢Reserved on generation units, storage and demand-side
  - ➢No downward reserves as not relevant for adequacy
- This requires long-term projections based on the FCR and FRR reserve dimensioning methodologies

THIS MODIFICATION DOES NOT IMPACT THE STUDY OF THE FLEXIBILITY NEEDS AND FLEXIBILITY MEANS

Public consultation on the methodology

•As it concerned a new methodology, it was extensively described in the report of the adequacy and flexibility study 2019, and also presented in specific TF iSR workshops.

•A mail to request feedback was launched by Elia on March 17, 2020 to request inputs before summer allowing sufficient time to prepare fundamental methodological improvements (if any)

- ➢No responses were received from the market parties. A reply was received from the FPB and treated within the CdC - it focussed mainly on clarifications

•Besides the implementation of some minor incremental improvements, Elia has no new information which justifies conducting methodological changes

Methodology

- The modification of the Flexibility to FRR/FCR reservations is specified in Section 6 the public consultation document
- Elia also welcomes any further remarks on the general methodology as specified in Section 3.4 of the adequacy and flexibility study 2019

Public consultation on the data

In the adequacy and flexibility study of 2019, Elia made assumptions on technical flexibility characteristics of generation, storage, demand-side and interconnection technologies . This was based on literature studies, Elia's expert view and information received from market players in the framework of a public consultation.

As Elia does not have information requiring a modifications of the consulted technical characteristics of generation, demand response and storage technologies, this data will re-consulted as such.

The limits for the calculations of the cross-border flexibility (currently set at 0 MW for ramping flexibility and 50 MW / 350 MW for fast flexibility) will be removed as more flexibility is likely to be available during particular periods via the new balancing exchange platforms. This will be investigated in the study.

Data

- The flexibility characteristics are consulted in a specific “tab 3.4” of the excel input file
- Besides the characteristics for cross-border flexibility, this “tab 3.4” remains unchanged compared to the previous version

Economic viability

Presented by Julie Van Steen

Economic viability in the ERAA

elia
Elia Group

- As long as **forward prices** are available, these may be assumed to reflect expected prices and hence used to consider hedging against risk.
- **Additional approaches** (such as “value at risk”) may be used to account for the price risk, when & due to lack of such forward products. See next slides for the ongoing work on the EVA metric (with Professor Kris Boudt).
- Exogenous assumptions according to national baselines **may be excluded from the EVA.**
- Regarding **“additional revenues”** (e.g. balancing, heat, etc) these are to be taken into account for the EVA. If possible to correctly quantify them, those will be taken into account for the EVA.
- An **implementation stepwise approach** is suggested which goes beyond 2021.

5. Based on the economic viability of each capacity resource, the EVA shall

    (a) keep existing economically viable capacity resources in the market;

    (b) consider re-entry of previously mothballed capacity if the mothballed capacity is viable;

    (c) consider removing or mothballing non-viable capacity resources from the model;

    (d) consider renewing or prolonging viable existing capacity resources (if applicable); and

    (e) consider adding new viable capacity resources.

18. Until 2023, ENTSO-E may simplify the EVA by manually assessing market entry and exit. In this case, the manual EVA shall reflect the main requirements set out in paragraphs (1) to (17).

19. ENTSO-E shall experiment with the EVA described in paragraphs (1) to (17) through a proof-of-concept stage, and shall publish a report (no later than the end of 2021) describing at least:

Our proposal :

- Implement an EVA metric based on academic/industry best practices that respect the ERAA requirements (see next slides).
- Check the EVA outcome with the forward prices when available
- Perform the EVA on Belgium on “non-policy units”. Try to extend it to neighboring countries if feasible

Update of the Economic Viability methodology in AdeqFlex

- ✓ Main questions to be answered:
  - ➢ Which metric would replicate as closely as possible the **actual decision making of investors/market players,** also taking into account **the ERAA methodology** and allowing a feasible integration in the overall modelling setup?
  - ➢ **Which role does investor's risk aversion play** in these investment decisions?

- ✓ In this context, Elia has requested **external input** to assist Elia in its reflections on an updated methodology for the economic viability check and to account for investor's risk aversion in modelling economic decisions:
  1. External consultant FTI: This note provides a theoretical overview and a summary of the importance of risks and uncertainties for investor's economic decisions.

     "TSOs need to consider the risk perception and risk aversion among market operators and investors when modelling market functioning, revenue outlook, risk profile of investments and their economic viability."

  2. Preliminary academic study from Professor in Finance: This study provides a theoretical and academic framework for investor's behavior and the impact of risk aversion, translated into a pragmatic approach (i.e. based on a WACC + hurdle premium approach) to apply this in practice.

Who:

- Professor in Finance and Econometrics **Kris Boudt** at Ghent University, Vrije Universiteit Brussel and Universiteit Amsterdam.

General conclusion of the preliminary study: A theoretical framework illustrates the impact of risk aversion and is translated into a pragmatic approach

Scope of the study

THEORETICAL FRAMEWORK ON RISK AVERSION HYPOTHESIS

Utility theory | Prospect theory

PRAGMATIC METHODOLOGY TO TAKE INTO ACCOUNT RISK AVERSION

Industry-wide WACC
(ERAA & CAPM-based)

~~Underlying assumption : NORMAL DISTRIBUTION~~ *

\+

Hurdle Premium
(in line with ERAA)

To cover for non-normality & project-specific adjustments/risks

Calibration of the WACC & hurdle premium is key (cf. ERAA)

* **Limitations of a "pure" CAPM approach :**

- CAPM starts from the assumption of a normal distribution: Skewness, kurtosis and large tails are disregarded

  FTI-CL: "The assumption of normal distribution hardly holds for returns earned in the power market, where prices and inframarginal rent can be very volatile and result in highly skewed return distribution with outliers"

- Additionally, model risk and policy risk are not taken into account, as well as deviations from the reference WACC.

Based on academic literature and finance views, risk-aversion is a key aspect to be accounted for in the model. While theoretical models exist to demonstrate the importance of risk-aversion, a practical model is needed to apply this in reality.

While utility functions and prospect theory confirm the need for a risk framework, practical methodologies are more often based on the cost of capital model (CAPM)

Proposed practical methodology takes WACC (CAPM-oriented) as a starting point (cf. ERAA)

Where the expected utility theory and the prospect theory provide an academic framework, they are more difficult to apply in practice

➔ Practical methodologies (incl. ERAA principles) are often based on the **CAPM model** (normal distribution as starting point)

➔ The academic study proposes a practical method based on a **WACC hurdle rate.**

➔ **Industry-wide reference WACC** (CAPM-oriented) as starting point, with a hurdle premium to cover for project adjustments and risk differentiation (also covering additional risks such as model risk and policy risk).

Economic Viability if (expected project return) > (Hurdle rate)

➔ Hurdle rate = model-based cost of capital (WACC) + hurdle premium

Cost of Capital (WACC)

- ✓ Based on the classic **Capital Asset Pricing Model (CAPM);**
- ✓ An industry-wide **reference WACC** will be calculated.

Hurdle Premium

The hurdle premium accounts for the following risks (the higher perceived risks, the higher the hurdle premium) :

	Reference WACC deviation	Risk/return relationship (incl. downside risk	Model risk	Policy risk impacting capacity mix and market design
Technology 1	Low/medium/high	Low/medium/high	Low/medium/high	Low/medium/high
Technology 2	Low/medium/high	Low/medium/high	Low/medium/high	Low/medium/high
Technology 3 (…)	Low/medium/high	Low/medium/high	Low/medium/high	Low/medium/high

- ✓ Project adjustment and risk differentiation per technology.
- ✓ Standard risk premium in academic literature around 5% or more
- ✓ The higher the identified risk, the higher the applied risk premium.

Calibration of the hurdle rate (reference WACC + hurdle premium) is key

1. Calibration of an industry-wide reference WACC (CAPM based), in line with the ERAA methodology

- ✓ For the calibration of the industry-wide **reference WACC (real & pre-tax),** the Fichtner study "Cost of Capacity for Calibration of the Belgian Capacity Remuneration Mechanism") is used as starting point.
- ✓ However, the WACC figure is **updated** based on (i) recent market evolutions and (ii) taking into account the ERAA principles.

2. Calibration of the hurdle premium to account for project-specific adjustments and risks

- ✓ As shown on previous slide, the hurdle premium is set based on a **combination of quantitative and qualitative assessment.**
- ✓ The **possible risks and projects adjustments** that are covered by the hurdle premium are described in the methodology description of the public consultation.
- ✓ As part of the public consultation, Elia would like to receive feedback from market parties on the risk appreciation allowing to calibrate **appropriate levels of the hurdle premium** in function of level of risk in the different categories.
- ✓ Obviously, the different risks can be appreciated differently **per technology.**

Scope of the public consultation

- ✓ In the methodology description of the public consultation, a **summary of the proposed EVA methodology** can be found.
- ✓ The following two documents are added to the public consultation document :
  - ✓ **Note from economic consultant FTI-Compass Lexecon:** “Memo on risk modelling in adequacy assessments”.
  - ✓ **Preliminary academic study** from Professor Boudt “Economic viability of investments in electricity capacity: design of a simulation-based decision rule”.
- ✓ The **value for the WACC parameter** is included in the excel file including the input parameters for the study.

Climate years

Presented by Rafael Feito Kiczak

Climate years and requirements from the ERAA

(f) The expected frequency and magnitude of future climate conditions shall be taken into account in the PECD, also reflecting the foreseen evolution of the climate conditions under climate change. To this effect, the central reference scenarios shall either

i. rely on a best forecast of future climate projection;

ii. weight climate years to reflect their likelihood of occurrence (taking future climate projection into account); or

iii. rely at most on the 30 most recent historical climatic years included in the PECD.

Other scenarios and sensitivities may rely on climate data beyond the one used for the central reference scenarios, e.g. pursuant to Article 3.6(e).

Source: ERAA methodology: Article 4, paragraph 1 (f)

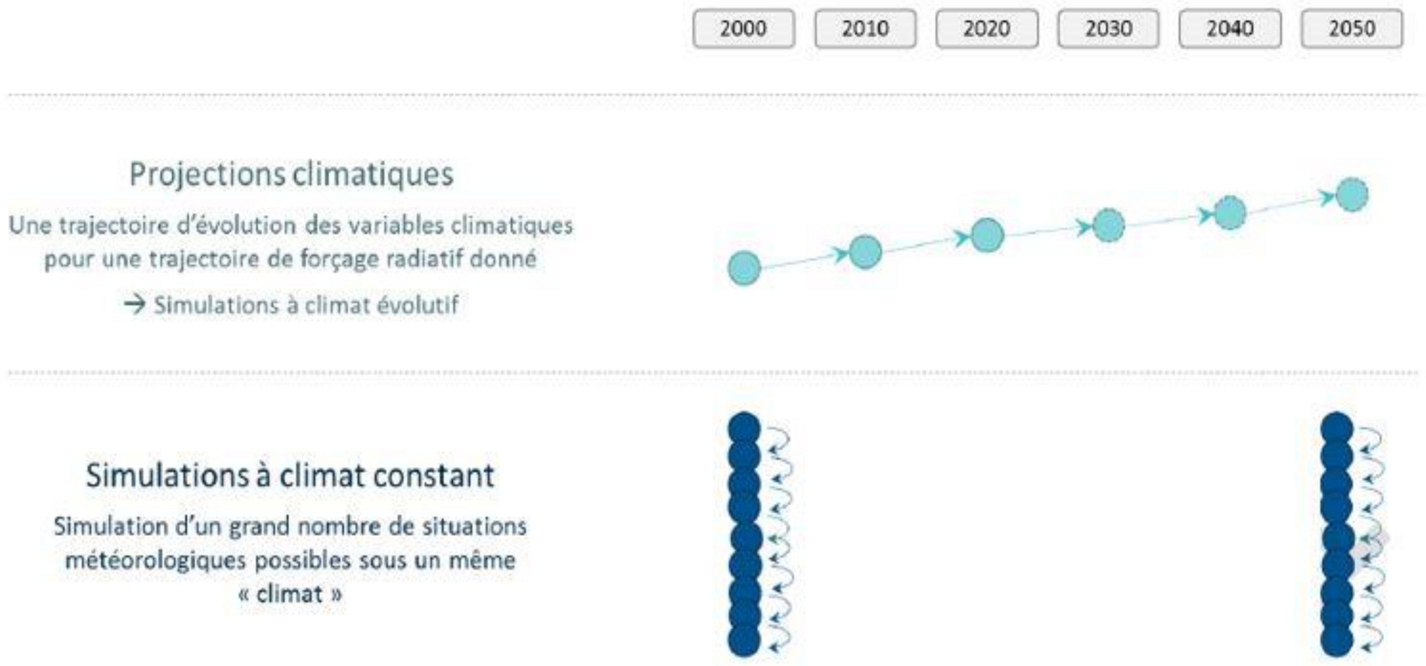
Our proposal

- Elia aims to comply with **option 1** as it seems the most preferred and statistically sound alternative;
- Elia is currently **investigating** the implementation of the '**200 synthetic climate years**' used by the French TSO (RTE) and described further in this presentation;
- Several steps are required before simulations can be performed and there is **no guarantee** that this can be **implemented in time** before the publication of the study;
- In case the intended implementation shows not to be feasible, alternative approaches will be investigated and proposed.

Elia has taken the initiative to see how the RTE/MéteoFrance database of 200 climate years could be used for the next AdFlex study

200 synthetic climate years ≠ historical climate years

For one given target time horizon, ‘200 climate years’ are generated by the climate model. These 200 climate years are equally likely to happen (“équiprobable”) under a climate of that given horizon



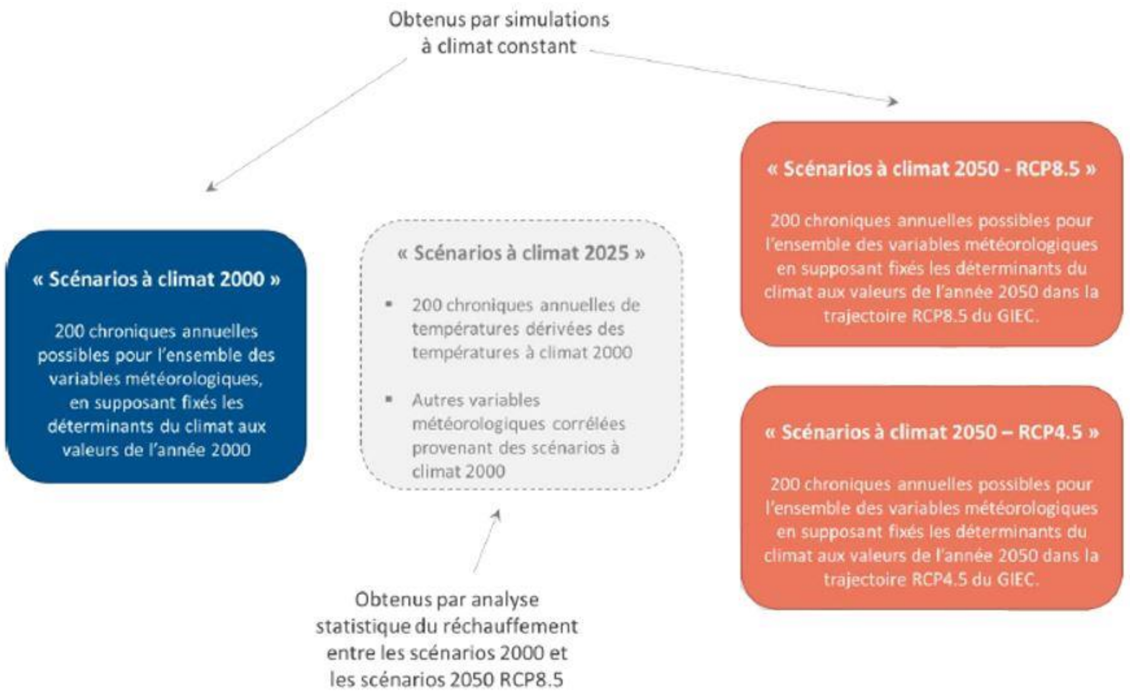
Source: RTE

Three time horizons generated by MeteoFrance exist

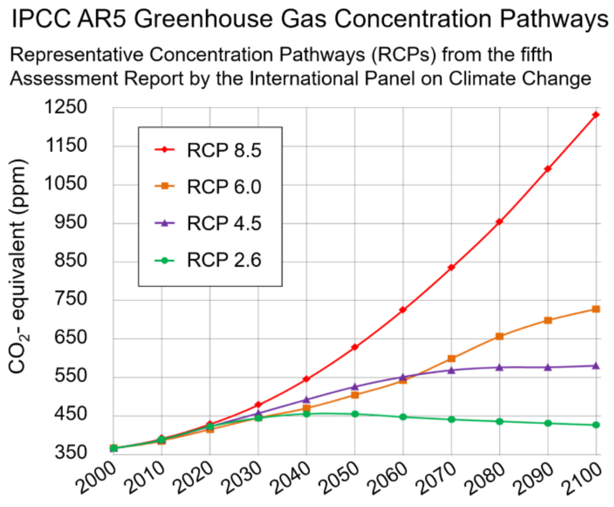
Different sets of climate years were generated by MeteoFrance for RTE: two sets for the time horizon 2050 (based on two Representative Concentration Pathway) and one for the time horizon 2000.

A scenario for 2025 was also deducted based on the results from 2000 and 2050 scenario 8.5, given that the greenhouse gases emissions today tend to an evolution most in line with the 8.5 scenario.

For this study, which covers the **time period 2022-2032**, and in order to be representative for this horizon, we propose to focus on the **scenario with constant climate of 2025 which is the most representative of the horizon assessed in this study.**



Source: RTE



Source: IPCC/Wikipedia

From weather variables to generation variables

- The climatic database contains data such as temperatures, precipitation, wind, solar radiation, etc. for thousands of points in Europe. This is therefore suitable for the analysis conducted in this study;

- In order to construct time series of electricity consumption and electrical generation (PV generation, wind onshore/offshore generation and hydro generation) to be used in the models, an **aggregation** (from thousands of points in Europe to country level) and a **translation** (e.g. from wind speed to wind turbine generation) of the weather variables has to be performed;

- Such **process is very complex** and **computationally intensive**. Elia is currently investigating what is possible to re-use from the work performed by RTE for their studies;

- In addition, the possibility to re-use the tools used by ENTSO-E will be investigated if the required data or tools would not be available (or are not suitable) from RTE.

Additional information on this database can be found online (public working document from RTE)

More information regarding this RTE/MeteoFrance database can be found in the following document created by RTE: « *Groupe de travail "Référentiel climatique" – Représentation des effets du climat sur le système électrique – Document de cadrage n°1 : les données climatiques utilisées pour la construction des scénarios de mix électrique à horizon 2050* »

https://www.concerte.fr/system/files/document_travail/GT%20Base%20climatique%20-%20cadrage%20donnees%20climatiques%20-%20vdiff2.pdf

Alternatively, a more high level document from Meteo France is available as well:

http://www.meteofrance.fr/documents/10192/22603710/DP_servicesclim.pdf

Detailed reference scenario assumptions

Presented by Bilal Hahati

Scenario definition elements

Electricity demand and demand side response

Available generation

Reference grid and XB capacities

Economics

Total electricity demand based on last input from FPB June 2020

Main macro-trends assumptions

Tertiary Added Value
Based on publication from **Federal Plan Bureau** in **June 2020** (COVID impact included)

Industry Added Value
Based on publication from **Federal Plan Bureau** in **June 2020** (COVID impact included)

Disposal income
Based on publication **NBB** in **June 2020** (COVID impact included)

Environmental/Energy policies
Transport share in new sales based on **NECP**
Renovation for tertiary based on **regional renovation strategies**

*The National Energy Climate Plan **(NECP)** includes two scenarios:*
- ***WEM:** With Expected Measures from NECP*
- ***WAM:** With Additional Measures from NECP*

Federal Planning Bureau (FPB) published each year in June a report with trends of national macro-economic indicators. Those are used as input in the 'Climact tool'.

Climact tool

The tool is a model developed by Climact** used to estimate the evolution of the **total electricity consumption** for Belgium in short and medium term. This tool is/was used in Strategic reserve volume evaluation studies and CRM.

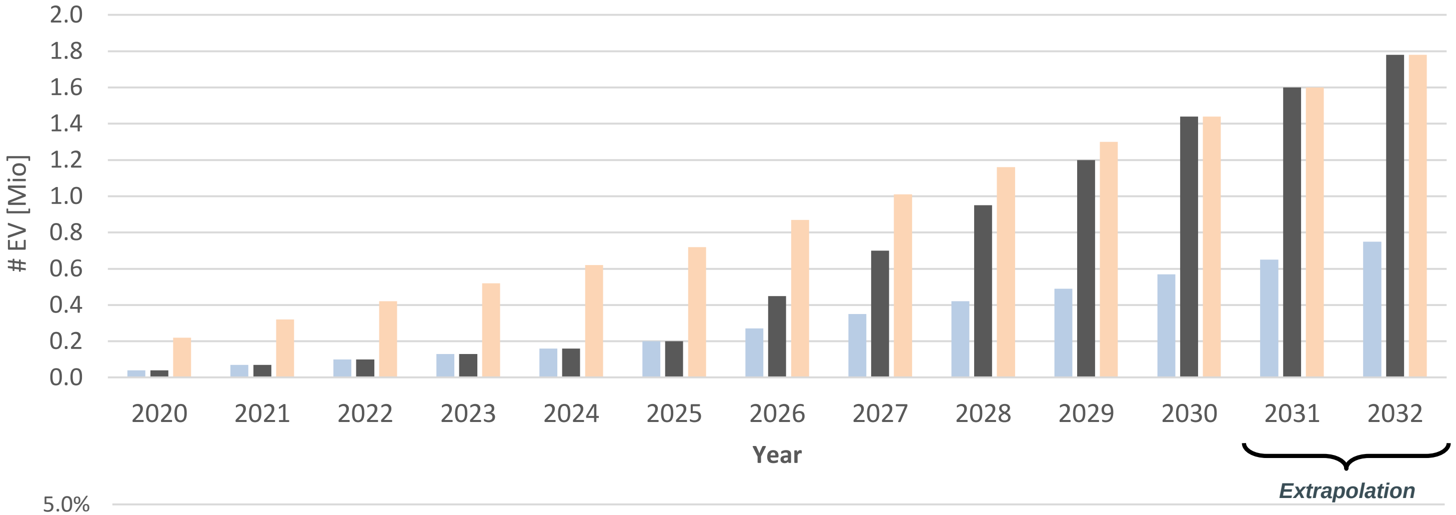
The methodology used to estimate the total electricity demand was developed in the **framework of the strategic reserve volume** study and was submitted for **public consultation** as well (links to those documents can be found in the consultation documents).

** A.o. New sales of company cars only zero-emission from 2026*
*** Climact is a company providing consultancy services on energy matters*

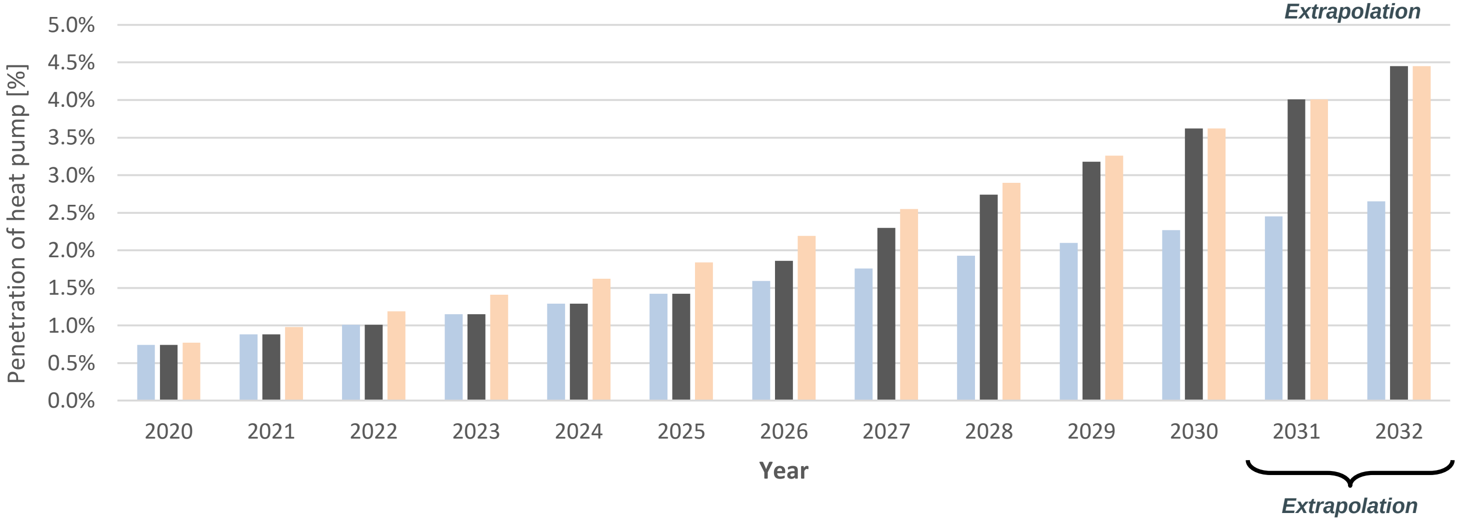
Additional electrification of transport and heating

All assumptions are expressed at the end of the mentioned year

Electric vehicles*



Heat pumps



Legend

- Proposed central scenario
- NECP - WEM scenario
- NECP - WAM scenario

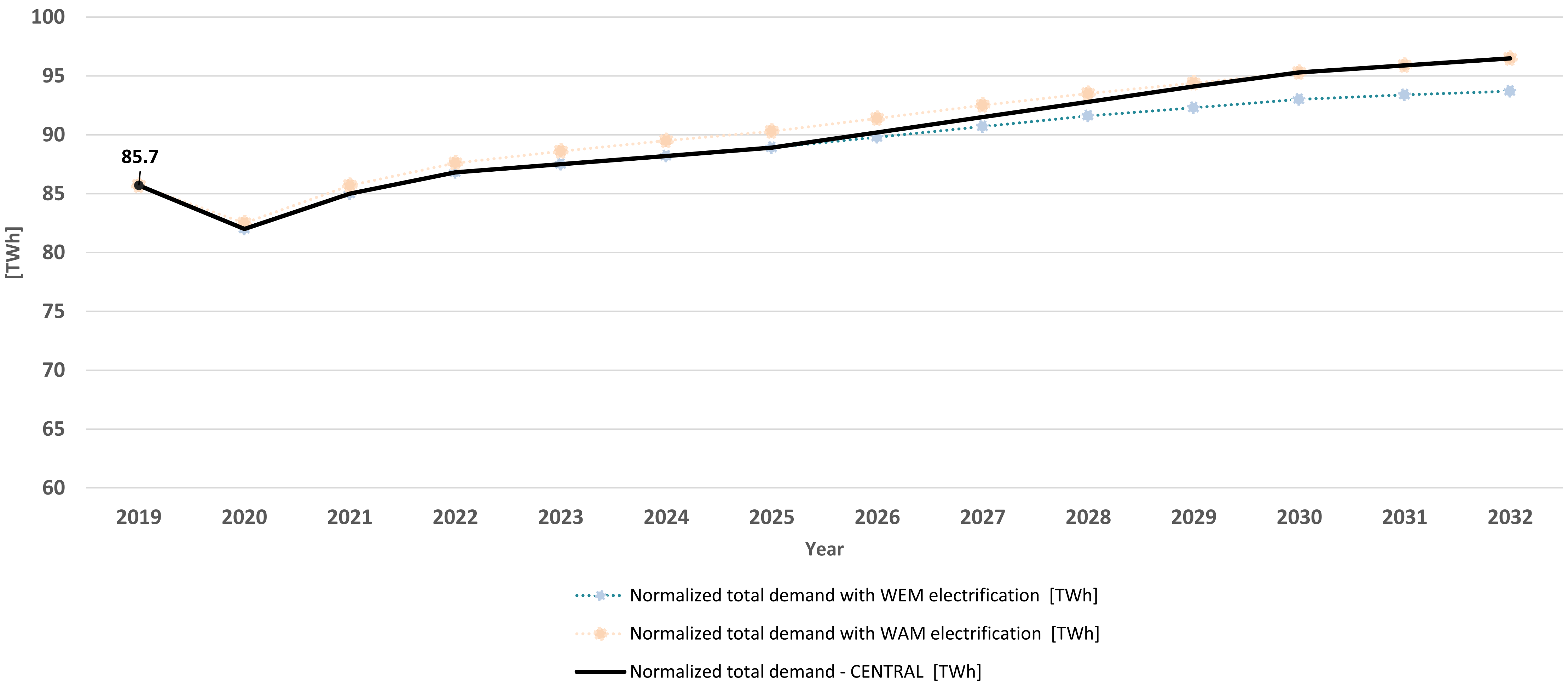
For **2020-2025**, the electrification from **NECP – WEM scenario (least ambitious)** was used given the most recent **evolution of EV sales** in BE. Given the ERAA methodology and the ambition of the new government*, it is suggested to use an **hybrid scenario** between WEM (short-term) and WAM (after 2025) regarding the EV/HP penetration scenario for the total electricity demand.

***Assumptions to derive equivalent # of EV consumption from NECP:** *17KWh/100 km and 15.000 km/year*

Total electricity demand based on latest input from BfP June 2020

All assumptions are expressed at the end of the mentioned year

Total electricity demand for Belgium based on BfP data from June 2020 and with WEM and WAM scenarios as electrification ambitions

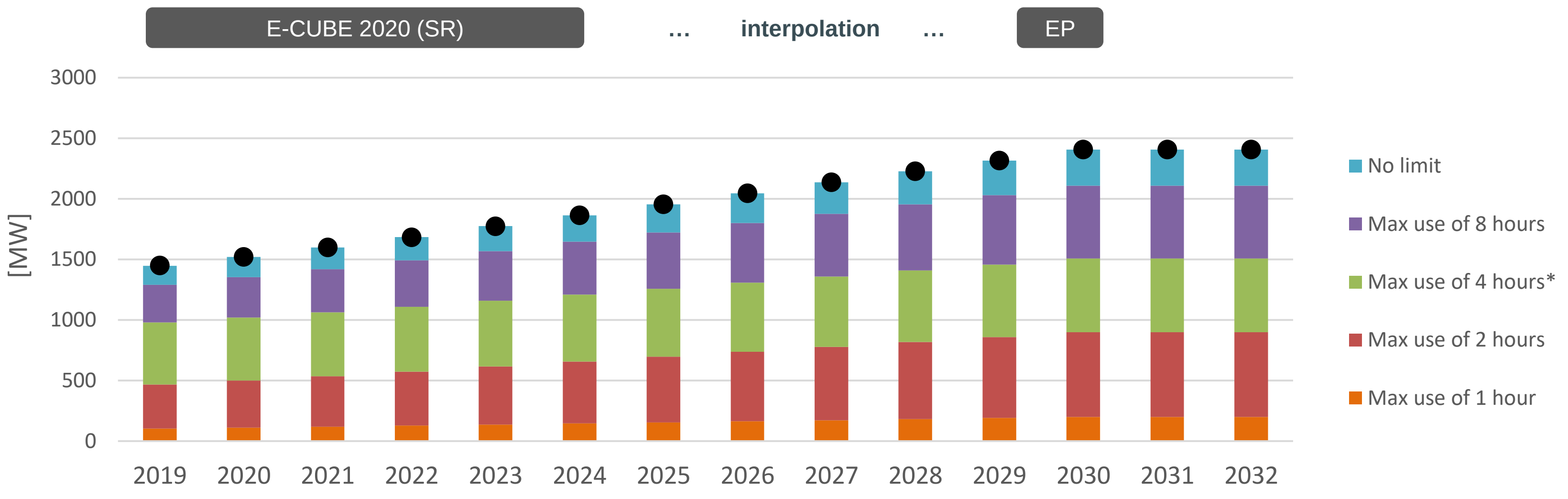


** The historical total demand is based on the current estimation of Elia for the total load (without Twinerg/Sotel and including losses) on which normalisation was applied*

Demand Side Response

All assumptions are expressed at the end of the mentioned year

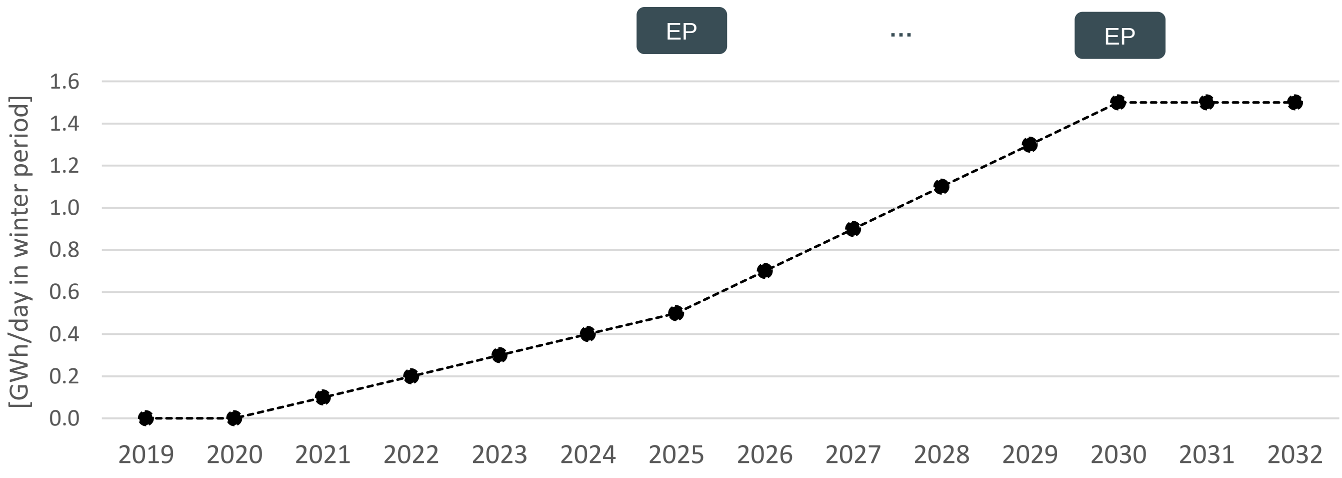
Shedding capacity (including the ones participating to the ancillary services today)



*Ancillary services volume included in "Max use of 4 hours"

- **For 2020-2023:** volume is based on **E-CUBE 2020** market response quantification in the framework of the evaluation of the strategic reserve volume
- **For 2030,** volume is based on **Energy Pact** (EP) figures

Shifting capacity



EP: Energy Pact

- **Demand shifting** based on **Energy Pact** (EP) figures **for 2025** and **2030**

Note: the aim is to consider DSR volumes as part of the EVA, for existing and new capacities

Scenario definition elements

Electricity demand and demand side response

Available generation

Reference grid and XB capacities

Economics

Pumped-storage and batteries

All assumptions are expressed at the end of the mentioned year

Pumped-storage

- Turbining capacity of **1224 MW** is assumed for **all time horizons**
- **Available storage** of **5300 MWh** for economical dispatch

Evolution of installed capacity of "other storage facilities" - split per category

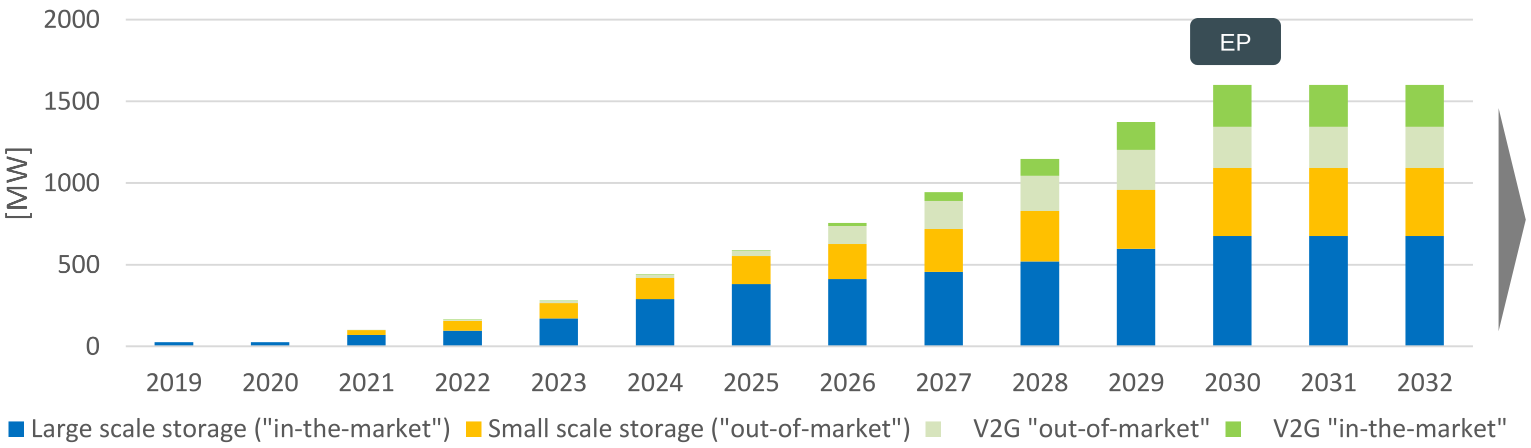
ERAA definition

in-the-market batteries, *which are large-scale battery capacities that are traded in day-ahead and intraday markets. In-the-market batteries shall be modelled similarly to pumped-hydro storage and shall be subject to the following constraints: maximum power, maximum energy storage, state of charge, charging/discharging efficiency;*

out-of-market batteries, *which represent small-scale batteries typically managed behind the meter. Out-of-market batteries shall be modelled as peak-shaving units based on predefined peak-reduction ratios, which are a direct input to the demand prediction process*

In-the-market	***out-of-market***
Large scale	
	Small scale
V2G	**V2G**

Projections



Total installed capacity based on **Energy Pact** (EP) figures **2030**

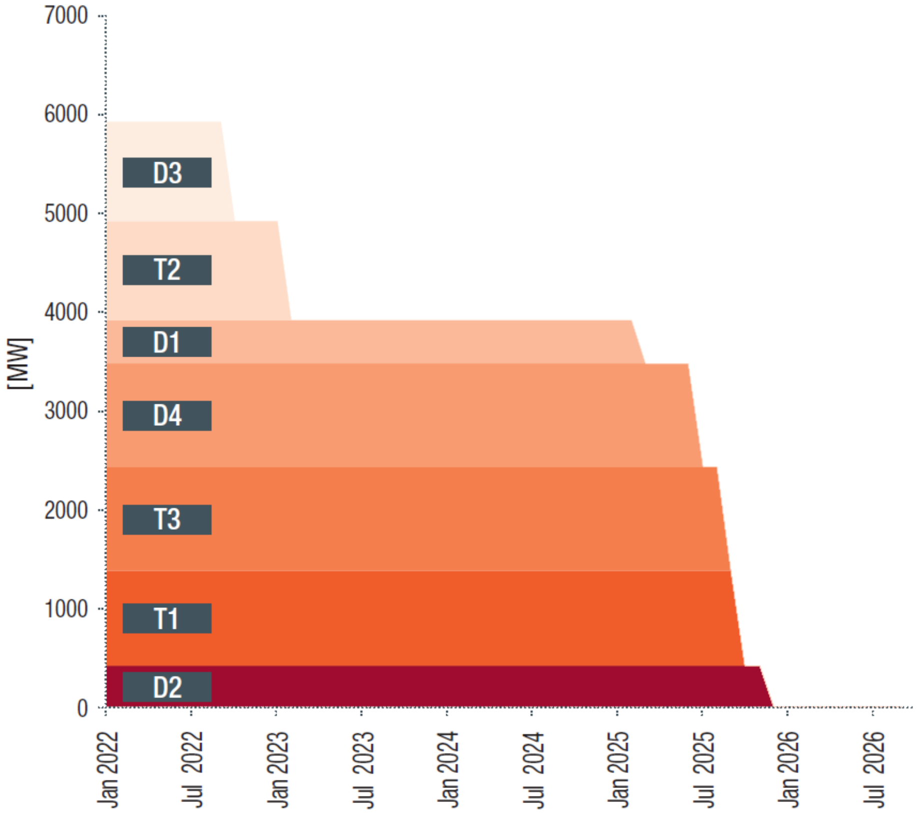
Note that pumped-storage, "in-the-market" batteries will be considered in the EVA while "out-of-market" batteries will not be considered in the EVA

ERAA: European Resource Adequacy Assessment

EP: Energy Pact

The evolution of nuclear generation fleet in Belgium is based on the current Belgian law for nuclear phase-out

Assumption for nuclear capacity from 2022 to 2032



- **Doel 3:** 1st October 2022;
- **Tihange 2:** 1st February 2023;
- **Doel 1:** 15 February 2025;
- **Doel 4:** 1st July 2025;
- **Tihange 3:** 1st September 2025;
- **Tihange 1:** 1st October 2025;
- **Doel 2:** 1st December 2025.

Renewable energy sources

Evolution of wind and PV installed capacity

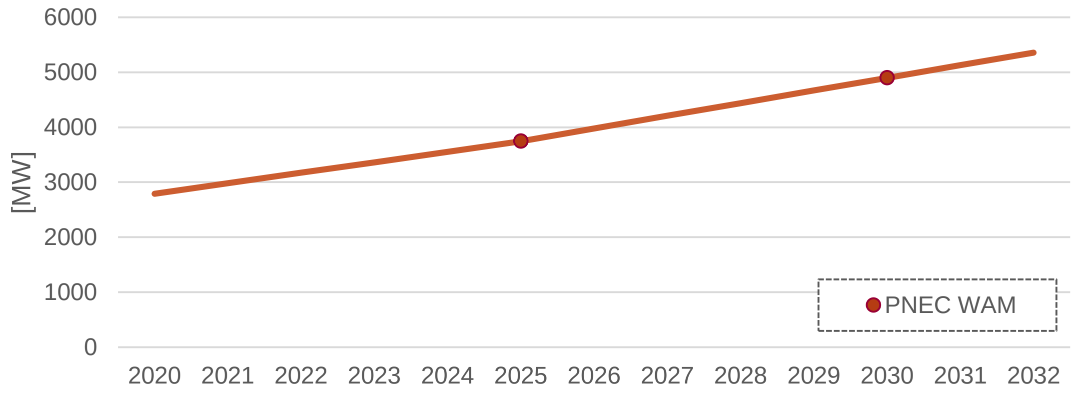
- **The scenarios are based on the NECP (WAM),** which foresees **8.9 GW wind and 11 GW PV by 2030**
- **The latest national government** agreement is **confirming 4GW** of installed wind offshore capacity by 2030.

Extract from national government agreement

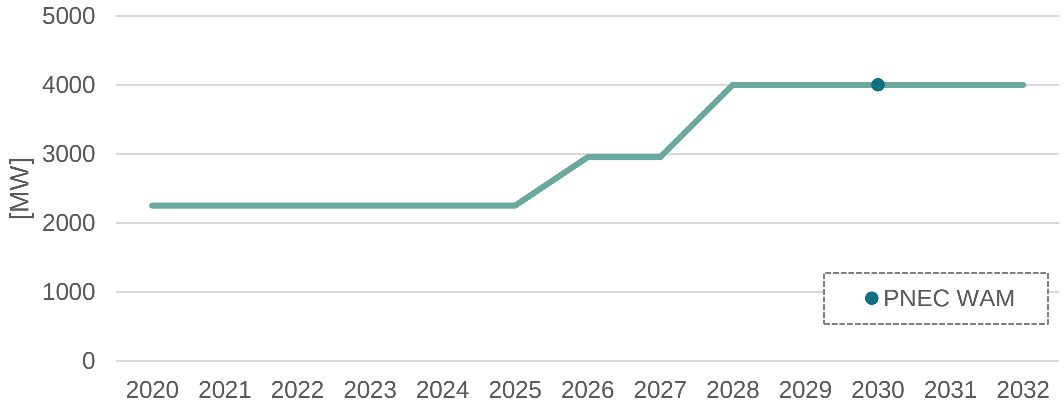
Engagement en faveur des énergies renouvelables

Un doublement des capacités d'éolien *offshore* sera prévu dans le plan national énergie et climat, pour atteindre 4GW d'ici à 2030. La production éolienne en Mer du Nord est d'ailleurs toujours en cours de déploiement : la deuxième zone de 2,2 GW, déjà décidée, sera réalisée le plus rapidement possible, conformément aux dispositions légales. En complémentaire au renforcement du réseau actuel prévu sur terre et sur mer, une connexion sera étudiée et, si possible, réalisée , au plus tard en 2025-2026.

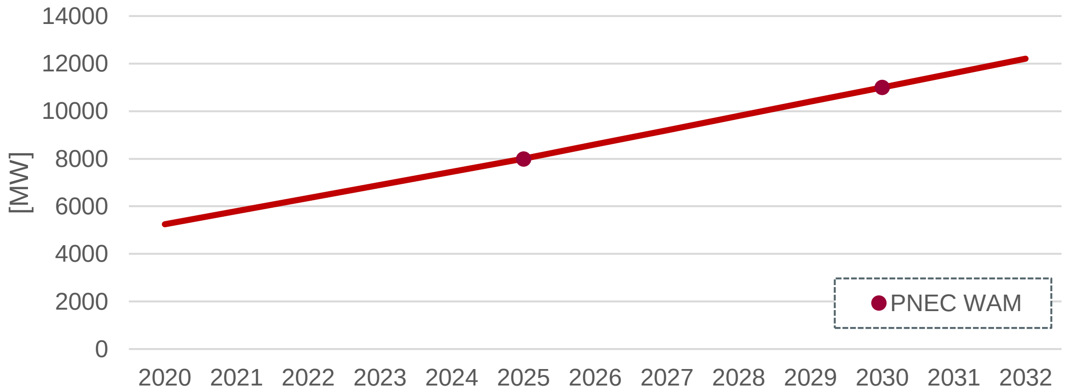
Evolution of installed onshore wind capacity for CENTRAL scenario



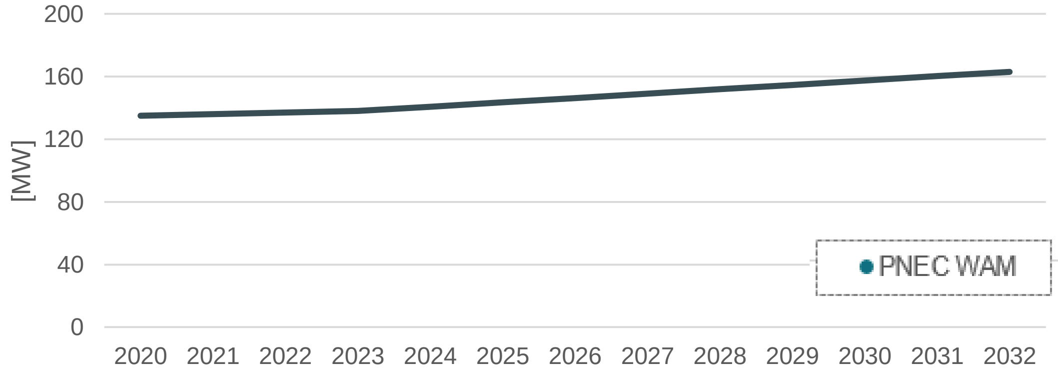
Evolution of hydro offshore wind capacity for CENTRAL scenario



Evolution of installed solar capacity for CENTRAL scenario



Evolution of hydro run-of-river capacity for CENTRAL scenario



Thermal generation

- **All existing generation units** will be considered **available** unless closure officially known. Those will be subject to an economic viability assessment.
- All thermal generations units were clustered in **4 categories**:

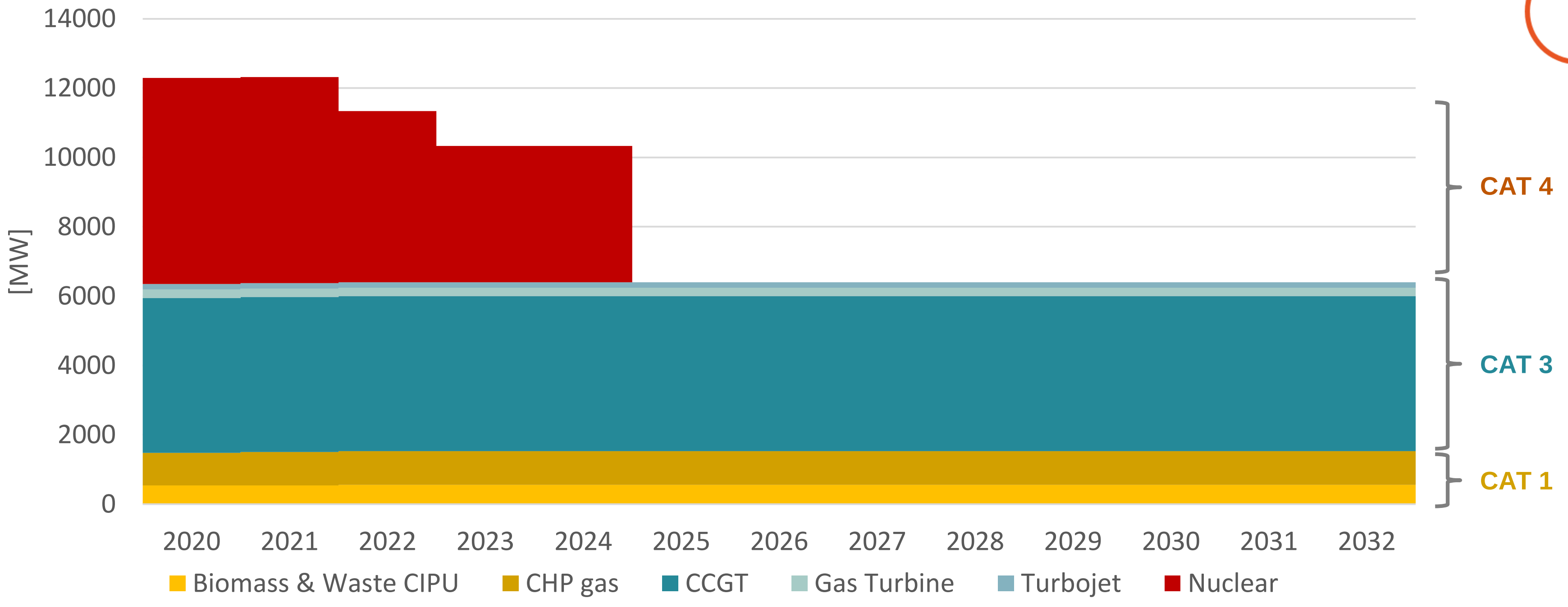
CAT 1: Units that will not be part of the EVA unless are indicated by market parties to be at risk or that the support mechanism is to be stopped in the future

CAT 2: Units that are not available for the market or closed

CAT 3: Units will be part of the Economic Viability Assessment (EVA)

CAT 4: Available units and no EVA will be performed (nuclear and non-CIPU)

Installed thermal capacity in Belgium at **end of the mentioned year**



Call to external parties to **communicate if any unit(s)** are to be considered as **not available** for future time horizons or if any of those units **are at risk** of not being available and for which reasons.

In addition, the economic viability assessment can also invest in new capacity of different types (not only thermal)

Outage parameters

Forced outages

- **10 last years (2010-2019)** will be used for the determination of the forced outage rates
- The **public data** from **ENTSO-E Transparency Data** is used for historical data when available (i.e. only 2015-2019)
- **Proposal:** 2011-2020 (to be update in Jan 2020 with the latest data)

Category	Number of FO per year	Average forced outage rate over 2010-2019	Average duration of forced outage rate over 2010-2019 [days (hours)]
Nuclear	1.7	3.7%	7 days (176 hours)
Classical	6.5	8.0%	3 days (80 hours)
CCGT	5.5	9.0%	3 days (62 hours)
GT	4.2	9.6%	3 days (62 hours)
TJ	2.1	3.6%	4 days (82 hours)
Waste	1.6	1.0%	2 days (49 hours)
CHP	3.9	6.8%	5 days (107 hours)
Pumped storage	2.4	4.4%	5 days (124 hours)
DC links	2	6.0%	7 days (168 hours)

** Note that 6% as used by ENTSO-E for HVDC FO rate and confirmed by the SPF in the scenario decision for the CRM auction.*
https://economie.fgov.be/sites/default/files/Files/Energy/avis-dg-energie-projet-proposition-2105-signed.pdf

Au vu des éléments susmentionnés, la DG Energie du SPF Economie se joint au § 41 de la proposition de la CREG mais avise d'intégrer les corrections de capacités de production de certaines unités, tel que renseigné par l'exploitant dans leur réaction à la consultation publique et recommande l'utilisation d'un taux de *forced outages* de 6% pour les lignes HVDC.

Planned outages

- The latest public information (REMIT) regarding the planned outages will be used
- For years or capacities were no data are available in REMIT, the data from ENTSO-E will be used : https://www.entsoe.eu/outlooks/midterm/

Scenario definition elements

Electricity demand and demand side response

Available generation

Reference grid and XB capacities

Economics

Flow-based perimeter and bidding zone definition

- The bidding zones are assumed to be the same ones that we have today for all future time horizons.
- Major improvements were done to extend the flow-based domains from CWE to CORE region and to include the possibility of 'Advanced Hybrid Coupling' (AHC). Those will increase the complexity of the simulations but will better reflect the expected evolution of the capacity calculation rules.
- The flow-based perimeter considered will be CORE for all time horizons (BE, FR, DE+LU, NL, AT, CZ, PL, HR, HU, RO, SI, SK)

	2023	2025	2028	2030	2032
FB CCR	CORE				
minRAM	DE 50.5 FR 70 NL 53 BE (derogation)	70 %			
CNEC	Up to 2023 Either XB or >5%	Only XB CNECs			
PST	• All get a setpoint based on the nodal flow estimation (FE) • In capacity calculation only the currently known PST's are selected (BC) • In capacity allocation none participate (MC)				

Scenario definition elements

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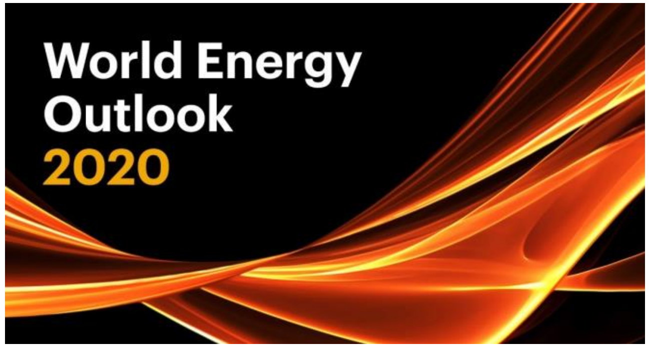
The assumptions for the fuel and CO_2 prices are based on the **“Stated Policies” scenario** from WEO published in October 2020



Stated Policies scenario

Price in €2019	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Gas TTF [€/GJ]	5.7	5.7	5.7	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.5
Coal ARA [€/GJ]	1.9	2	2	2	2	2.1	2.1	2.1	2.2	2.2	2.1
Oil [€/GJ]	9.7	9.9	10.1	10.3	10.5	10.6	10.8	10.9	11.1	11.2	11.3
CO2 EUA [€/tCO2]	24.5	26.4	28.4	30.3	31.3	32.4	33.5	34.5	35.6	36.7	37.7

Proposal for fixed costs (CAPEX/FOM) are based on several sources

- We are requesting stakeholders to provide any relevant source/input for those values.
- Note that for a better granularity and to better reflect reality, CCGT and OCGT were split into several sizes and demand response into a merit order depending on the amount of new capacity (to reflect what is also observed in France for instance).
- Those data and the sources on which the proposed values are based are further detailed in the Excel file submitted to consultation.

Technologies part of the structural block		Applies to	CAPEX [€/kW]	FOM (including major overhauls) [€/kW/y]	Investment economic lifetime [years]
Existing (assumed no extension costs)	**CCGT**	Existing units <25 years	-	30	-
	OCGT		-	20	-
	CHP	All existing capacity	-	60	-
	Turbojets	All existing capacity	-	30	-
	Demand Response	All existing capacity in 2020	-	10	-
	Pumped Storage	All existing capacity	-	30	-
Existing (assuming extension costs needed)	**CCGT**	Existing units >25 years	100	30	15
	OCGT		80	40	15
New	**Diesels**	New capacity	300	15	15
	Gas engines	New capacity	400	15	15
	CCGT	>800 MW	600	25	20
		400 < 800 MW	750	30	20
		< 400 MW	850	30	20
	OCGT	>100 MW	400	20	20
		<100 MW	500	20	20
	CHP	New capacity	800	60	20
	Demand response	New capacity 0 < 500 MW	*All costs included in the FOM*	20	-
		New capacity 500 < 1000 MW		40	-
		New capacity 1000 < 1500 MW		60	-
		New capacity 1500 < 2000 MW		80	-
	Batteries/Storage	Large scale batteries (1h)	100	10	10
		Enabling new V2G	130	10	10
	Pumped Storage - new unit	New unit in Coo	900	30	25

Public consultation details

Presented by Rafael Feito Kiczak

Public consultation on data & methodology: How ?

From 30/10 until 30/11/2020 6 PM

WHAT ?

- Data:
  - Excel file with the central scenario data for the different parameters.
  - The current slideset with visualization of the data.
- Sensitivities:
  - As for the previous study, we are open for quantified suggestions for sensitivities from stakeholders. Those will be further analyzed within the CdC to be taken into account in the study.
- Methodology:
  - The methodology from the previous study will be used as basis;
  - A document describes the main methodological changes we propose for the next study;
  - Several annexes on economic viability studies are also added.

In case of questions during the public consultation (e.g. clarifications), you can contact: Rafael.Feitokiczak@Elia.be

Any comments on the 3 above topics are more than welcome. This will help us make a valuable study for the stakeholders.

Thank you for your attention and have a nice week-end !