WG Adequacy #12

28 October 2022

Agenda

- Welcome
- Public consultation on the methodology, the basis data and scenarios used for the study regarding the adequacy and flexibility needs of the Belgian power system for the period 2024-2034 and including also the scenario parameters for the ‘Low Carbon Tender’ 2024-25
- Next meetings

elia
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Public consultation

28.10.2022

Adequacy and Flexibility Study for Belgium

The start of a new cycle...

Agenda

1. **Context of the Adequacy & Flexibility study (timeline, process, regulatory framework)**
2. **Methodology**
   - General description
   - Adequacy
   - Flexibility
   - Economic viability (incl. study by Prof. Boudt on the hurdle rates)
3. **Detailed scenario assumptions**
   - Study on residential and tertiary flexibility potential (DELTA-EE study): update and forecasts
   - Forced outages study (N-SIDE)
   - Generation, storage & demand for Belgium
   - Economic parameters (investments costs & fuel/CO2 prices)
   - Other countries
4. **LCT scenario parameters**

Context of the study

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 needs was published in April 2016. As requested by the authorities, an addendum was subsequently published in September 2016, based on a large skateholder consultation which was undertaken following the publication of the initial study.

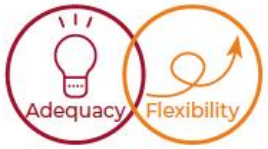
JUL 2018

Legal requirement in the Belgian Electricity Act

Art. 7bis, §4bis (Elia's translation into English): "*No later than 30 June of each biennial period, the system operator shall carry out an **analysis of the needs** of the Belgian electricity system in terms of the country's **adequacy** and **flexibility** for the next **ten years**.*
*The basic **assumptions** and **scenarios**, as well as the **methodology** used for this analysis, shall be determined by the system operator **in collaboration** with the **Directorate General for Energy** and the **Federal Planning Bureau** and in **concertation** with the **regulator**.*"

JUN 2019

Adequacy & Flexibility 2020-2030



The first study published in 2019 after the modified law.

JUN 2021

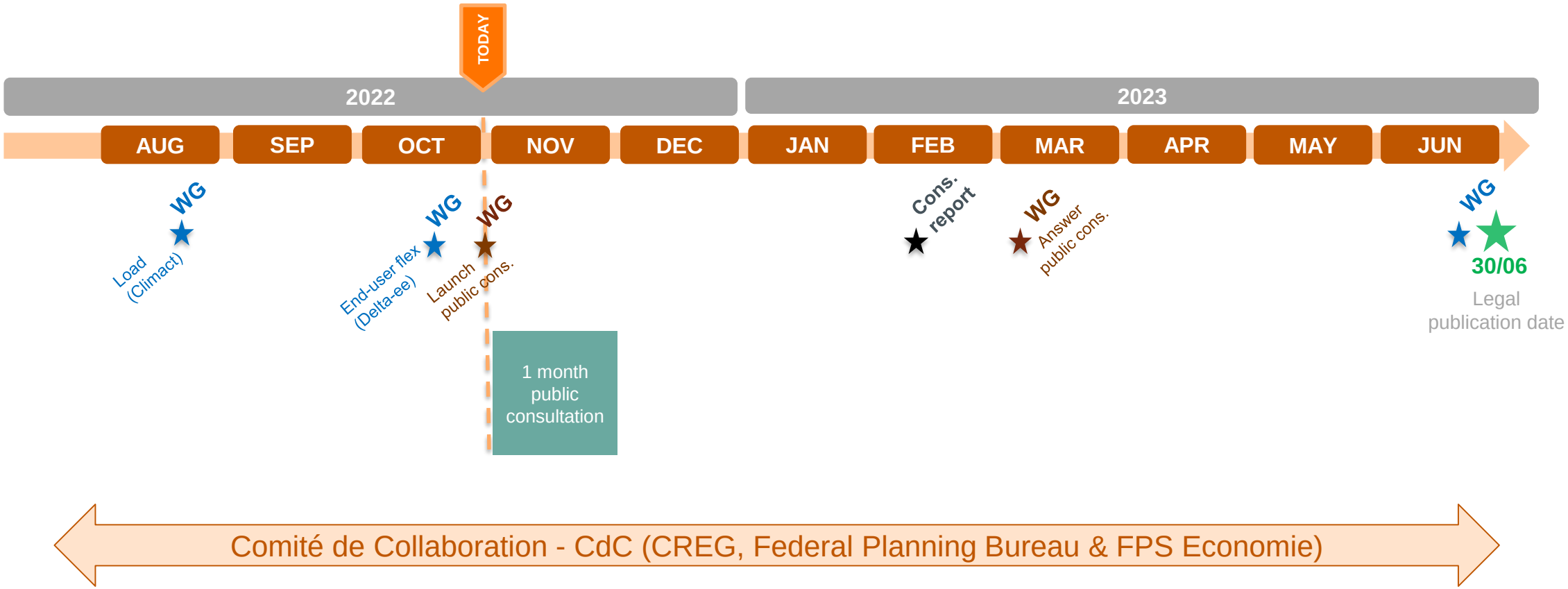
Adequacy & Flexibility 2022-2032

The present study.

JUN 2023

Adequacy & Flexibility
2024 – 2034

High level timeline of the study delivery



Note that although not mentioned on this slide, the scenario process for the 'Low Carbon Tender' (W24-25) is to be integrated in the study delivery.

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

Scenario assumptions

- A main document describing the different data submitted to the consultation including explanations and sources used to make the different forecasts;
- An Excel file is also provided with the data for the proposed central scenario for Belgium, economic assumptions and central scenario data assumptions for neighboring countries including the sources;

Study methodology

- Several methodological documents have been prepared (based on the previous study) but also integrating proposals for novelties;

External studies supporting methodology and assumptions elements:

- External studies on residential/tertiary end-user flexibility potential, forced outages, hurdle rates for economic viability, existing fixed operating and maintenance costs are also submitted as part of this consultation

Sensitivities

- As the previous study, we are open for quantified suggestions for sensitivities from stakeholders and methodological improvements (in-line with the ERAA methodology). 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

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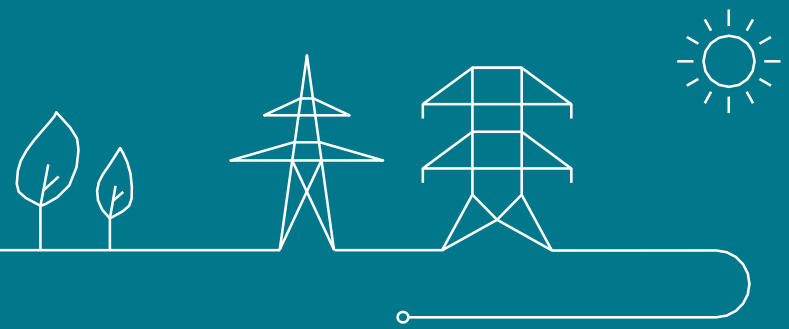
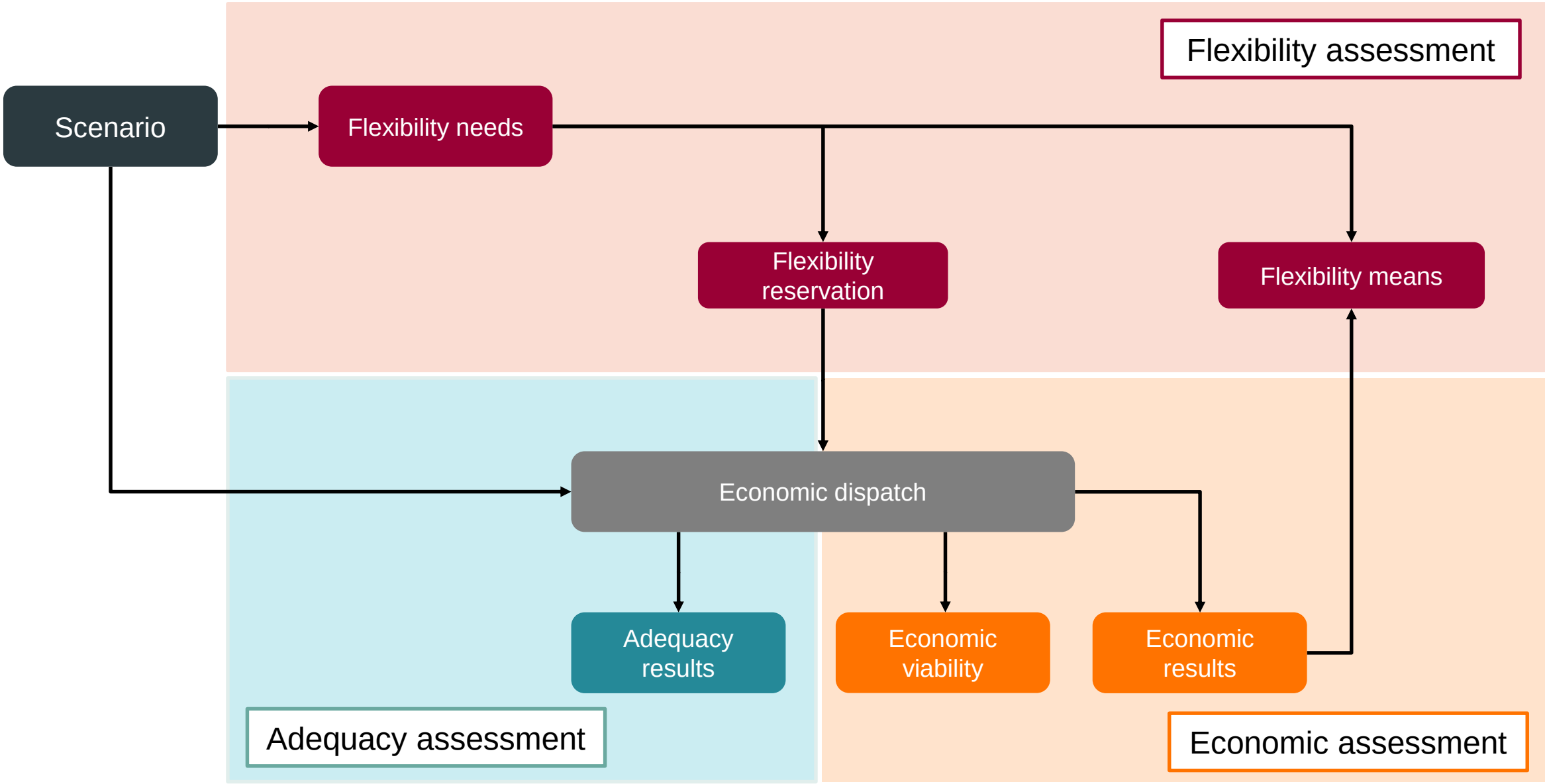
General methodology description



The study will consist of several parts which are interlinked



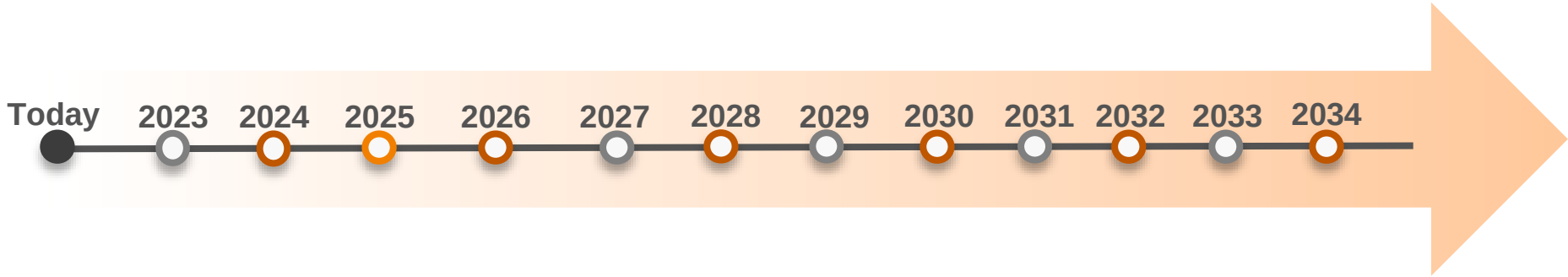
This study will meet the European requirements and will implement those faster than what is planned to be implemented by ENTSO-E in the coming years

Comparison of the methodology foreseen for the ERAA and Elia's Adequacy and Flexibility studies

	entsoe ERAA public implementation plan	elia ADEQUACY & FLEXIBILITY 2021	Adequacy & Flexibility study 2023
	Based on the implementation principle roadmap published by ENTSO-E on December 2020	*Based on the methodology used for the study published in June 2021*	**Based on the current proposal**
TARGET YEARS	ERAA 2021-22: Gradual increase of target years As from ERAA 2023: 1-10 year modelling	1-10 year modelling with sensitivities on 7 target years	**12 target years with different levels of details and analysis**
CLIMATE CHANGE	As from ERAA 21-22: Preparation of the forward looking database and temporary solution As from ERAA 2023: Forward looking climate database	Forward looking climate database from Météo-France (200 synthetic climate years)	**Forward looking climate database from Météo-France (200 synthetic climate years)**
ECONOMIC VIABILITY ASSESSMENT	ERAA 2021: Trials POCs As from ERAA 2024: Method ready to use	New methodology based on academic expertise in-line with the ERAA and with a European perimeter applied for 4 target years	**Integration of the multi-year approach** **Update of the hurdle rates**
FLOW-BASED MARKET COUPLING	ERAA 2021: Method ready to use ERAA 2022-23: Extension of the geographical scope and time horizons	Core perimeter for all the horizons and Advanced Hybrid Coupling as from 2025	**Core perimeter and AHC from 2025** **Update of the assumptions**
SECTORIAL INTEGRATION	ERAA 2021-22: Data collection ERAA 2023-24: Test of P2x integration	Modelling P2x as flexible demand and assessing the impact of further digitalisation of transport and heat electrification	**Modelling P2x as flexible demand** **Study on end-user flexibility potential and explicit modelling**

ERAA: European Resource Adequacy Assessment

The study will look 10 years ahead and 28 European countries will be simulated



- Main scenarios analysed for adequacy
- Detailed analysis and sensitivities for adequacy and economics
- Detailed analysis and sensitivities for adequacy, economics and flexibility

Years are simulated from 1 September Y to 31 August Y+1, hence 2025 corresponds to 1 September 2025 until 31 August 2026.

28 European countries simulated with an hourly resolution

covering the entire Core region (at least whole EU)

Adequacy assessment

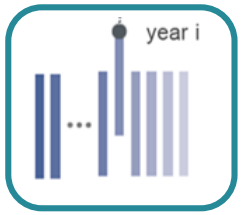
The adequacy methodology will be in line with the ERAA methodology.

- Consumption
- Centralised thermal production facilities
- Decentralised thermal production facilities
- Renewable production
- Hydro
- Storage
- Demand flexibility
- Interconnection capacity between countries (NTC/FB)

Forward looking climate database
(200 climate years)

METEO FRANCE

antaressimulator



Monte Carlo years

SIMULATIONS
Hourly dispatch optimisation to minimise total costs of the system

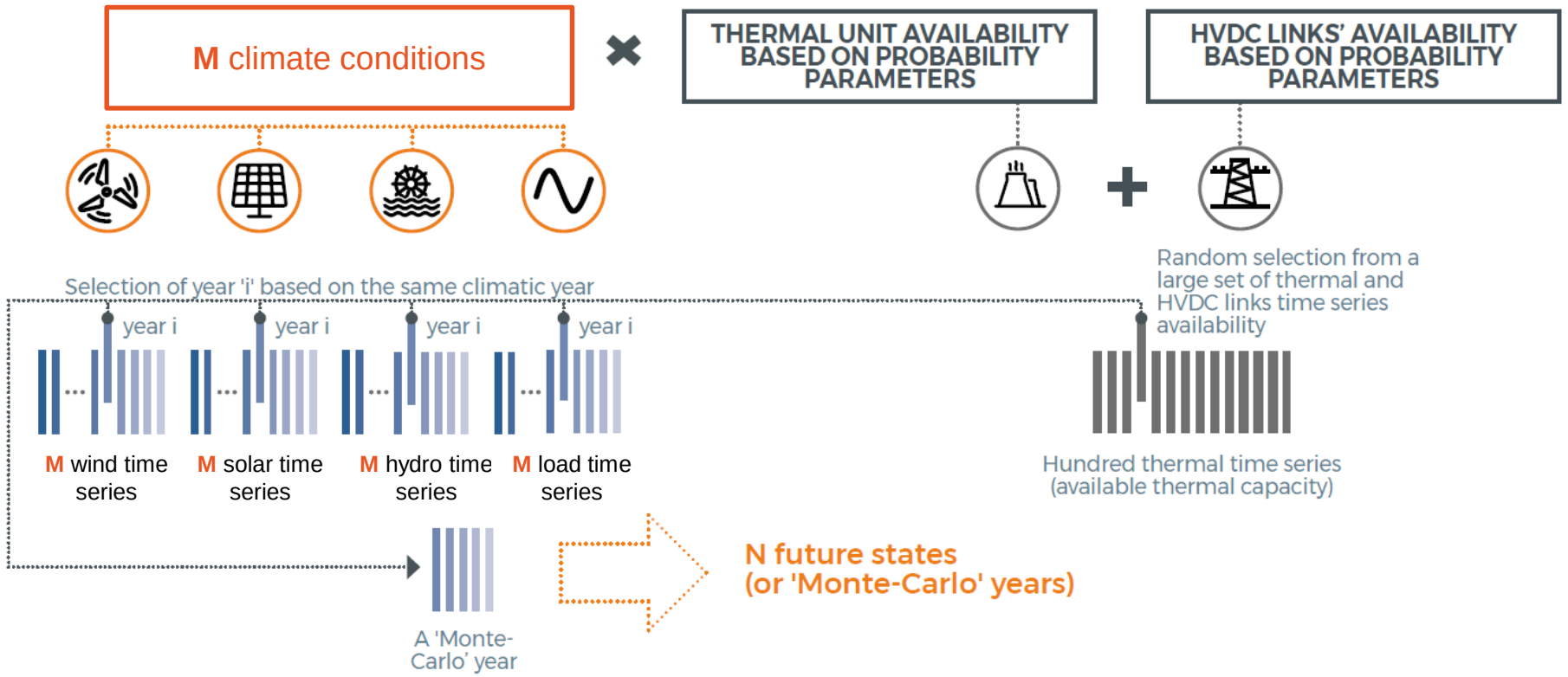
ANTARES is a perfect foresight economic dispatch model, also used by RTE and ENTSO-E for adequacy and electricity market simulations.

- **Hourly dispatch** for all units in each area
- **Commercial exchanges** between areas
- **Hourly marginal prices**

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

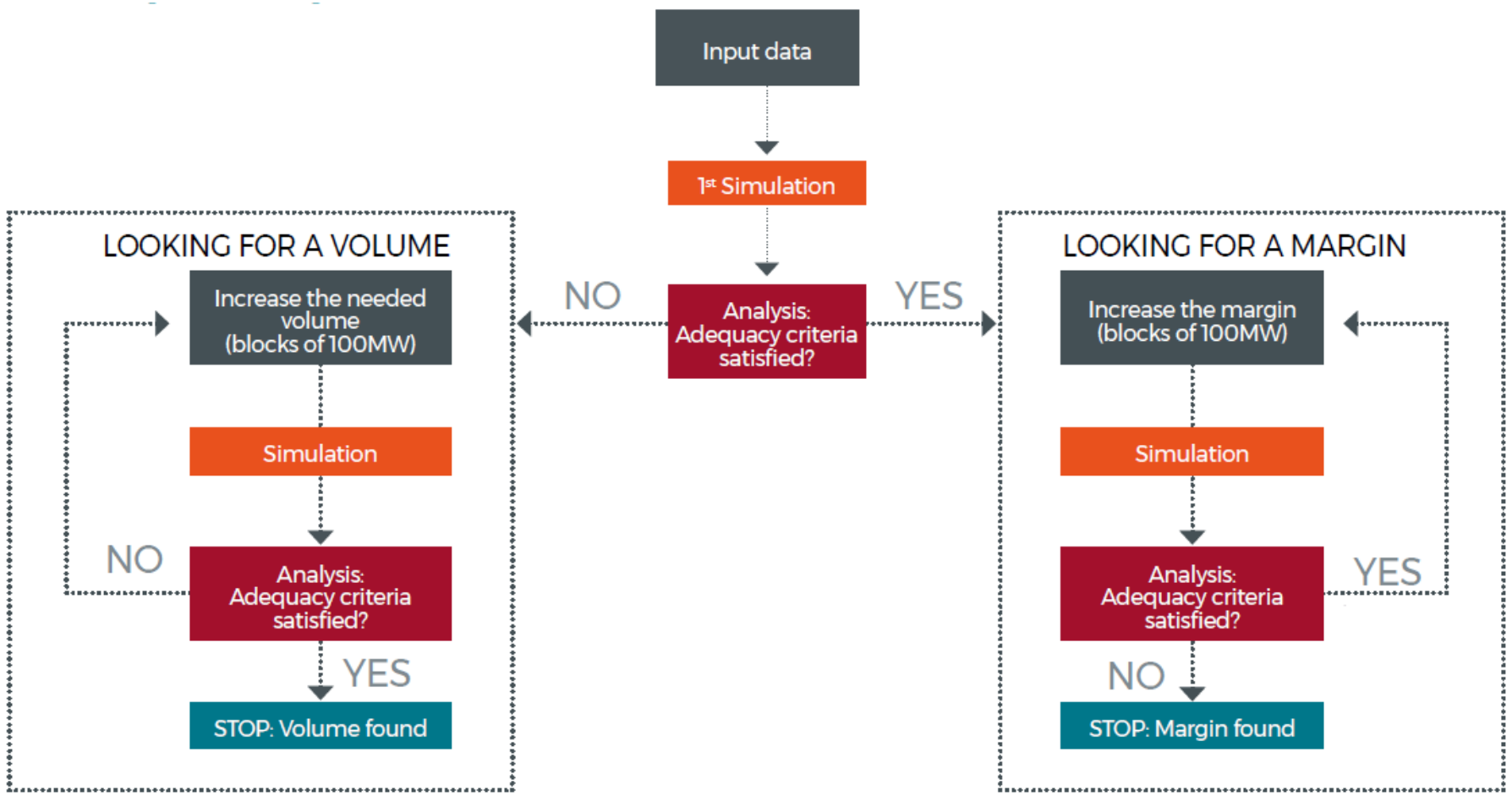
- The **forward looking climate database from MeteoFrance** will be used to translate installed RES capacity into generation data;
- The **ANTARES** simulator, a **perfect foresight unit commitment** open-source model also used by RTE and ENTSO-E, will be used.

Simulations will be performed on several hundreds of ‘Monte-Carlo’ years.



- The thermal availability will be reviewed (see later for the study from N-SIDE and the proposed values for outages)
- The **amount of Monte Carlo** years simulated will be based on a **convergence criterion.**
- The currently **set reliability standard** for Belgium will be used

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



Overview of methodology documents available and submitted to public consultation linked to the adequacy assessment

Unit commitment

- Details the unit commitment model used for the adequacy and economic simulations

Adequacy study

- Details the way that the adequacy simulations and Monte-Carlo approach are performed

Adequacy patch

- Details the way that curtailment sharing is dealt with

Climate years

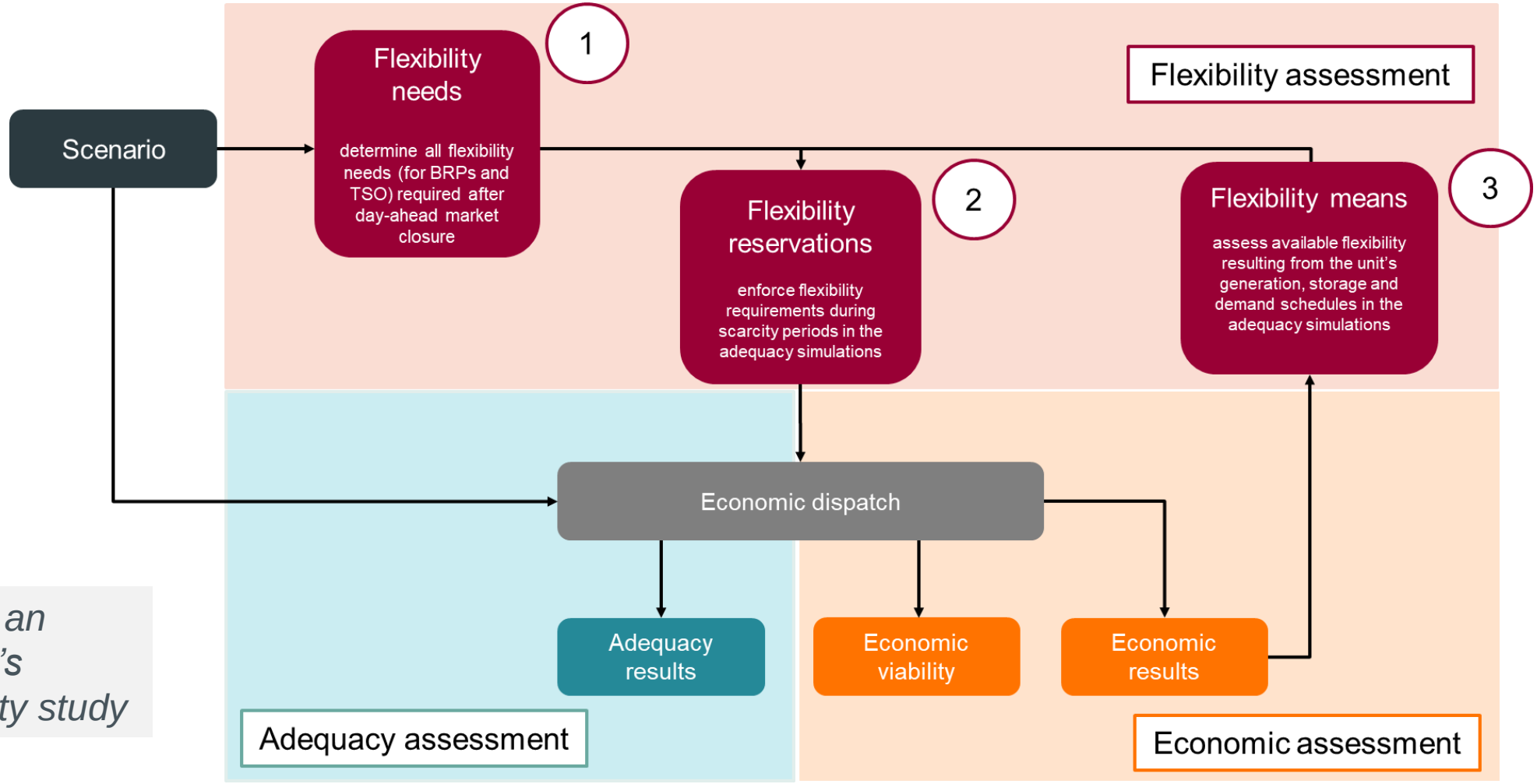
- Details on the content of the climate database to be used (“Météo France 200 forward-looking Climate years”)

Cross-border capacities

- Details the way that interconnections and flow based are modelled

Flexibility assessment

Methodology overview



The flexibility study is an integrated part of Elia's adequacy and flexibility study

Public consultation on the methodology

Methodology

- At this point, Elia has no information which should justify new modifications to the methodology. It welcomes any remarks based on the methodology.

- **The methodology was presented in specific TF iSR workshops towards the first AdFlex study 2019.**

- **A mail to request feedback was launched after publication of the first study to request inputs before summer allowing sufficient time to prepare fundamental methodological improvements** No responses on the method were received from the market parties.

- **In light of the ERAA methodology, the method was complemented by specifying the share of flexibility to be reserved as FRR/FCR in the adequacy simulations.** This was specified in the public consultation document

- **In context of AdFlex study 2021, Elia welcomed further remarks on the general methodology.** Besides general remarks on modelling FRR/FCR needs in the adequacy simulations (in line with ERAA-guidelines), no fundamental remarks were received from market parties.

Public consultation on the data and assumptions

Data

- Besides new technologies and characteristics based on the end-user flexibility study (electric vehicles, heat pumps and home batteries), no fundamental revisions are proposed to the flexibility characteristics of technologies.
- The forced outage characteristics will be updated based on the results of the forced outage study (cf. dealt with later in this presentation)
- Prediction data will be updated based on the latest available data

  - **In the AdFlex study of 2019, Elia made assumptions on technical flexibility characteristics of generation, storage, demand-side and cross-border flexibility. This was based on literature studies, Elia's expert view and information received from market players in the framework of a public consultation.**
  - **In the AdFlex study of 2021, this list was extended by electrolysers**
  - **For the study 2021, the contribution of cross-border flexibility via the EU balancing exchange platforms is studied via sensitivities.** This approach will be followed for the study 2023, but sensitivities might be further finetuned following return on experience with PICASSO and MARI

- **For the upcoming study, Elia complements / refines the assumptions on flexibility from end-users provided with electric vehicles, heat pumps and home batteries** (cf. dealt with later in this presentation)

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Attention points

- **In its study, Elia will give particular attention to the impact of expected system evolutions :**
  - The impact of the expected offshore wind power development on the flexibility needs
  - The impact of end-user flexibility on the available flexibility means
  - The impact of balancing market integration on the available flexibility means

Overview of methodology documents available and submitted to public consultation linked to the flexibility assessment

Flexibility assumptions

- Details the assumptions regarding flexibility characteristics of the different technologies

Flexibility methodology

- Details the methodology to be used for the needs and means assessment

Economic viability assessment (EVA)

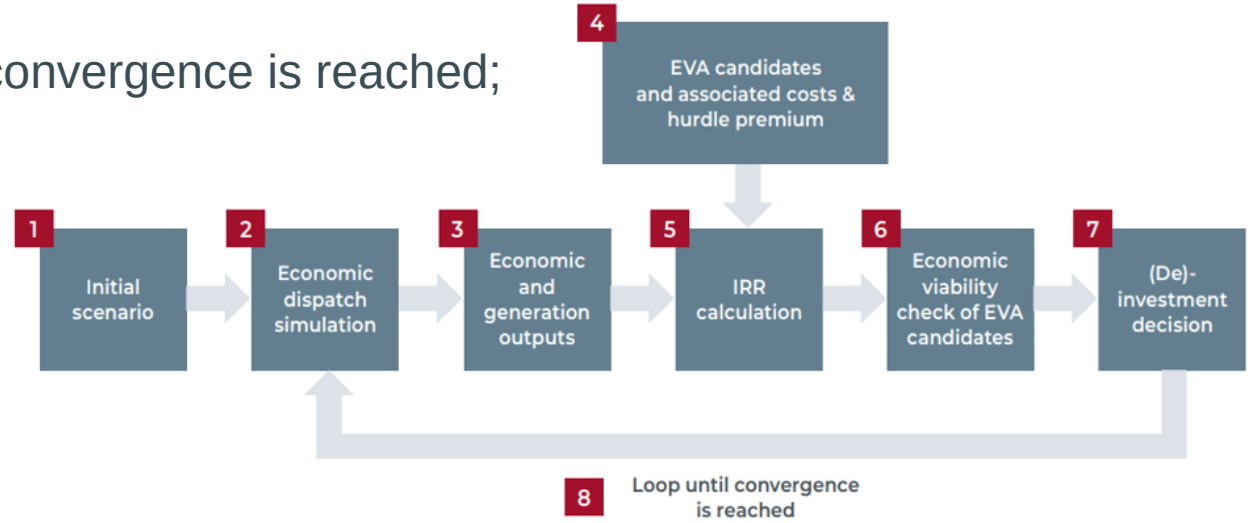
The Economic Viability Assessment methodology will be further improved in an ERAA-compliant way

- Taking into account **risk aversion** via the hurdle premium (methodology developed by Prof. Boudt)

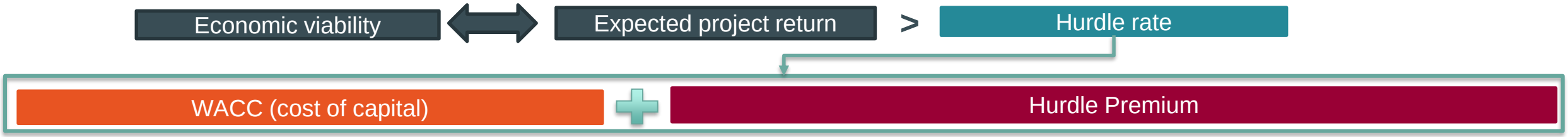
Economically viable if **Expected project return** (Based on average project rate of return (IRR)) > **Hurdle rate** = **WACC** + **Hurdle Premium**

- Considering that the **market price cap** can be increased over the lifetime of the investment, based on the observed prices in the simulation. Recent proposals (or future decisions) from ACER on the matter can also be taken into account;
- Considering **revenues outside the energy only market** (ancillary revenues, steam & heat revenues);
- Performing **loops** on **(de)investment** until convergence is reached;

A major improvement will be the implementation of a multi-year investment loop



Recap of the methodology which is not changed, only the level of the hurdle premium is updated in the new study



- ✓ Based on the classic **Capital Asset Pricing Model (CAPM).**
- ✓ The ACER-approved **ERAA methodology** provides for **(non-binding) guidelines** to calculate the WACC.
- ✓ A **reference WACC** is calculated taking into account publicly available data from energy market players in Europe.

➔ Based on the **(non-binding) guidelines of the ACER-approved methodology**, Prof. K. Boudt proposes a real **WACC of 4,89 % is proposed (value will be updated based on most recent market data in 1Q2023).**

The **hurdle premium accounts for the following risks** :

	Revenue distribution & downside risk	Model risk & policy risk
Technology 1	Low/medium/high	Low/medium/high
Technology 2	Low/medium/high	Low/medium/high

- ✓ Risk differentiation per technology based on a **qualitative assessment.**
- ✓ The higher the identified risk, the higher the applied risk premium.

A correction for gearing level, capex intensity & hedging opportunities per technology will be made as well.

Overview of the proposed hurdle premium

Technology	Reference WACC	Hurdle Premium	Hurdle Rate
New CCGT	4,9%	5,0%	9,9%
New OCGT	4,9%	6,5%	11,4%
Existing CCGT (no refurbishment)	4,9%	3,5%	8,4%
Existing CCGT (refurbishment)	4,9%	4,5%	9,4%
DSM 300	4,9%	4,0%	8,9%
DSM 1000 & 2000	4,9%	4,7%	9,6%
Wind & solar	4,9%	2,7%	7,6%
Existing OCGT (no refurbishment)	4,9%	3,5%	8,4%
Large scale batteries	4,9%	3,5%	8,4%
Existing OCGT (with refurbishment)	4,9%	5,5%	10,4%

- **Reference WACC has decreased from 5,53% to 4,89%**.
- The **upper range of the hurdle premium has also decreased** following the decrease in reference WACC.
- In the updated report, **more weight is given to policy risk** in view of recent events (cf. decision at EU and national level to potentially tax away excess revenues in the energy sector, etc.).

Net balancing revenues to be considered in the EVA revenues

Proposed approach

- For the yearly calibration of the CRM, Elia has to provide an estimation of **net balancing revenues** earned both for netCONE & IPC purposes :
    - To perform this estimation, Elia follows a methodology established in the Royal Decree Volume (respectively article 10 & 19 for netCONE/IPC).
    - This method was also followed in AdeqFlex for the study regarding the period 2022-2032 (cf. section 3.6.8.1)
- The idea would be to follow the same approach for this AdFlex study, with some modifications :
- **For capacity providing FCR & aFRR**, Elia believes that the current market circumstances merit a re-evaluation of the approach considered and proposes to consider the following principles when going from balancing revenues to **net** balancing revenues :
    - Going from balancing revenues to **net** balancing revenues should be done while looking at the foreseen trend regarding the **volume of capacity/ technology mix** able to provide such service.
    - Going from balancing revenues to **net** balancing revenues should be done by applying a limiting % for energy & maintenance costs.
    - Going from balancing revenues to **net** balancing revenues leads to applying a limiting % in order to account for the **arbitrage** being made by technologies when participating to balancing/energy markets.
- **For mFRR**, Elia proposes to follow the same approach than the one used for previous CRM Calibration.
- The Royal Decree foresees to **only** consider **reservation costs** and no activation costs from ancillary services --> Elia proposes to follow the foreseen methodology.

Overview of documents available and submitted to public consultation linked to the EVA

Economic Viability Assessment

- Details the methodology to perform the economic viability assessment of technologies

Study by Prof. Boudt: "Analysis of hurdle rates for Belgian electricity capacity adequacy and flexibility analysis over the period 2024-2034"

- Details the methodology and the calculations of the WACC and hurdle premiums for each technology

Scenario assumptions

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4. **LCT scenario parameters**

Study on residential and tertiary flexibility potential

presented by Elia & DELTA-EE

Why this study?

- In the past, Elia received several comments during public consultations on the lack of consideration of the residential & tertiary flexibility. It is the goal to improve it in the next AdFlex23 thanks to this study;
- A first presentation was already given in the last WG Adequacy
- This study will be submitted to public consultation (as part of the AdFlex23 consultation);

- The scope of the study is:
  - The Belgian perimeter
  - Residential & tertiary sector (industrial flexibility is out of scope)
  - Years up to 2035

Goal: Determine the amount of MW & MWh available for flexibility each hour

An illustrative example for EVs:

Asset Volume + **Asset Flexibility** + **Enablers** = **Forecast**

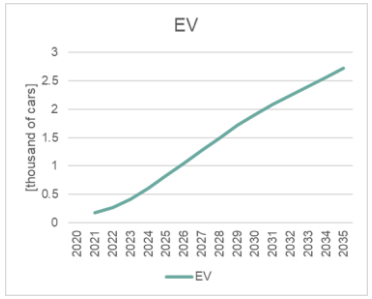
A fleet of EVs
for each scoped year

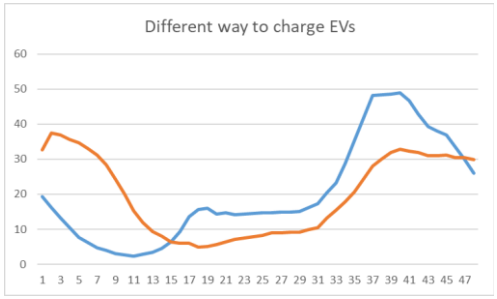
natural charging (V0)
Or
smart charging (V1)

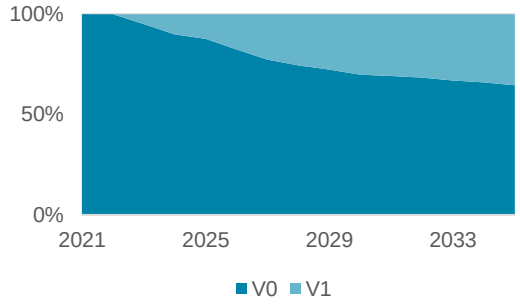
Control signal
Control capability
Relevant metering
Customer Engagement

Forecast of unlocked flexibility

Share of vehicle in natural or smart charging







DISCLAIMER: Not actual figures, presented for illustrative purposes

Reminder from last WG Adequacy on 13th October

Categories & profile of flex were presented

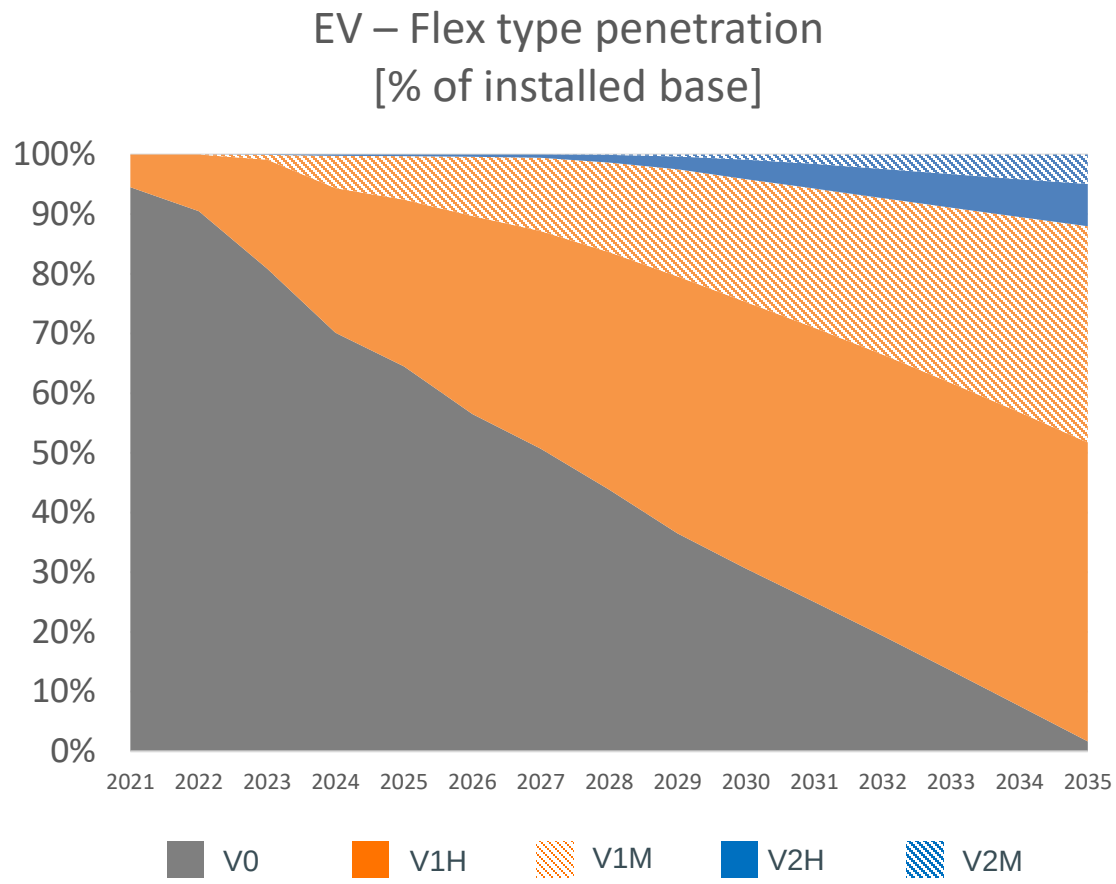
Technology	Profile name	Description	Enablers
Electric Vehicles (EV) 	V0	Natural Charging : charges as soon as plugged-in	/
	V1**H**	Smart charging based on local signal (**H**ome)	Smart meter, Smart charger & communication capability, Appropriate tariff
	V1**M**	Smart charging based on **M**arket signal	Smart meter, Smart charger & communication capability, Price signal (e.g.: dynamic tariff), Market reforms
	V2**H**	Smart management based on local signal (**H**ome)	All V1H enablers, plus: Bi-directional smart charger & EV
	V2**M**	Smart management based on **M**arket signal	All V1M enablers, plus: Bi-directional smart charger & EV, Market reforms
Electric heating loads (Heat pump) 	HP0	Natural load	/
	HP-1**H**	Load shifting based on local signal (**H**ome)	Smart meter, Communication capability, Appropriate tariff, (House insulation)
	HP-1**M**	Load shifting based on **M**arket signal	Smart meter, Communication capability, Price signal (e.g. : dynamic tariff), (House insulation), Market reforms
Residential Batteries 	B-2**H**	Load shifting based on local signal (**H**ome)	Smart meter, Communication capability, Appropriate tariff
	B-2**M**	Load shifting based on **M**arket signal	Smart meter, Communication capability, Price signal (e.g. : dynamic tariff), Market reforms

Market categories will be taken into account in the Flexibility study

Forecast of flex type for EV

Forecast made based on:

- BEV owners to **buy smart chargers and** with« dumb » chargers **replacement** every 4 years, infrastructure is planned to be available
- Maximum **V1H** uptake expected with appropriate tariff
- Market conditions is the only barrier to **V1M** & **V2M**
- **V2M** uptake in new sales (standard approved 2022 - ISO15118-20)
- EU pushing to lower market barriers.

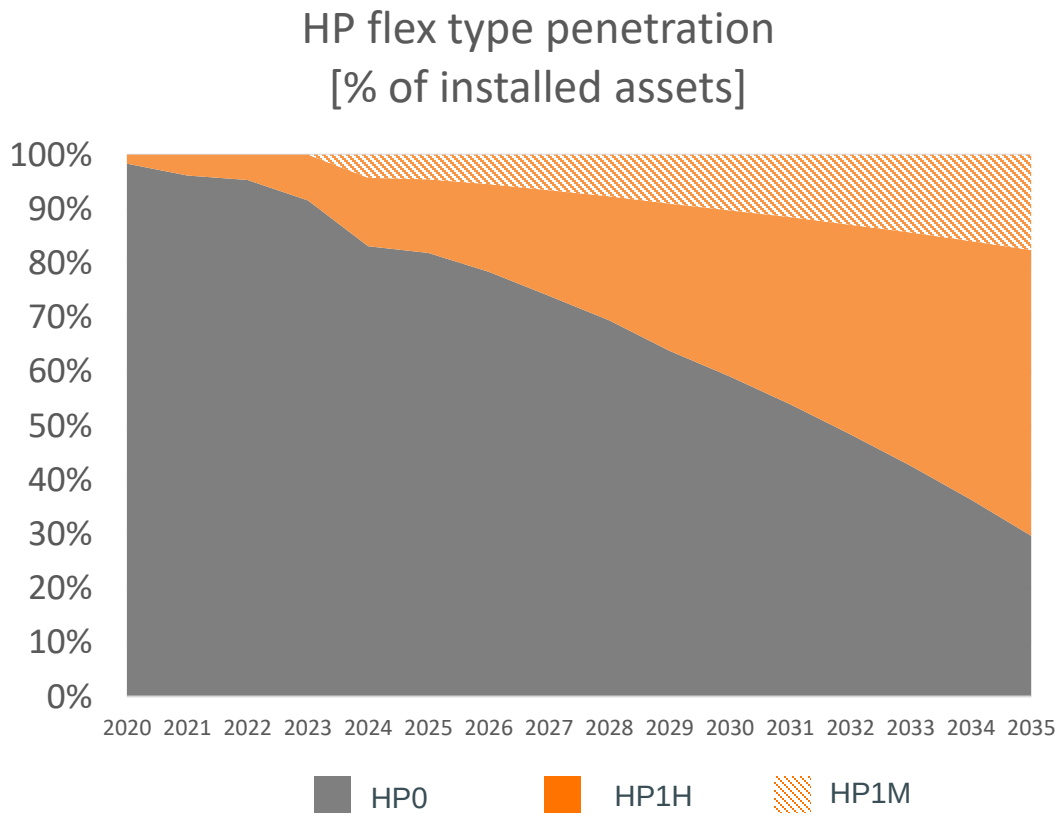


Penetration estimated with market reforms incentivising customer flexibility

Forecast of flex type for HP

Forecast assuming:

- **HP1H**: dynamic contract are already available.
  If Capacity and/or ToU tariffs come into place, profiles will change based on cost structure.
- **HP1M**: with smart meter rollout, key barriers for the market are coming ; expected uptake in the amount of players



Penetration estimated with market reforms incentivising customer flexibility

For public consultation (1/2)

Data in an excel file, full DELTA-EE report in Powerpoint

A tab in the Excel of the public consultation – 28/10

1. **Tab '3.3 DSR end-user'**
   a. Assumptions on smart metering technology penetration
   b. Flexibility options (V0, V1H, V1M, etc…) forecasts as % of installed base for each year.
   c. Flexibility profile for an average winter day
      [% of the demand, at each hour] for:
      i. EV (V0, V1H, V2H)
      ii. Heat pump – ASHP, GSHP (HP0, HP1H)
   d. Main assumptions on methodology

For public consultation (2/2)

Data in an excel file, full DELTA-EE report in Powerpoint

A tab in the Excel of the public consultation – 28/10

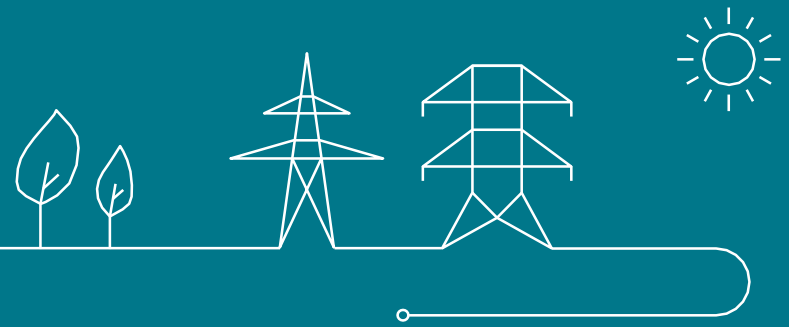
1. Tab ‘3.3. DSR end-user’
2. **Tab ‘4.4 Flexibility characteristics’**
   a. Ramp rate [%Pmax/min]
   b. Maximum upward & downward flexibility [%Pmax] (Ramping, Fast & Slow flex)
   c. Energy limit [hours]

Information submitted so far by DELTA-EE will be made available today.

The final report with all details of methodology – 4/11

Study on outage rates

presented by Elia & N-SIDE



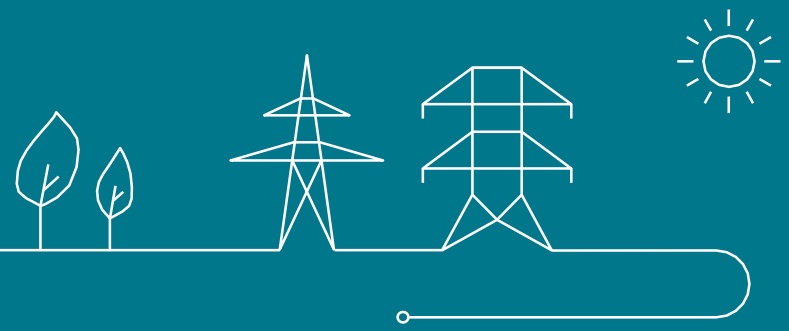
Forced outages and maintenance

Study performed in the framework of the Adequacy & Flexibility study to be published in June 2023

October 2022

Adequacy & Flexibility study (Elia, 2021)

Overview of the data from previous study



Where do we come from ?

In the previous Adequacy & Flexibility study, §3.3.9 described the forced outages and maintenance applied in the model. Those values were also updated on a yearly basis to take the latest data into account.

Belgian thermal generation units took into account:

- **planned unavailability** (usually maintenance)
- **unplanned unavailability** (usually caused by an unexpected malfunction)

Planned unavailability	Unplanned unavailability
• If the maintenance dates are known in the transparency platforms of the producers in the framework of REMIT (for the first years analysed), those are explicitly taken into account; • If the maintenance dates are not known yet or beyond the scope of REMIT, then a maintenance rate (in-line with the ENTSO-E common data) is used. The maintenance is then drawn by the model ex-ante the simulation. • No maintenance is considered on individually modelled units for Belgium during winter months (November to March) unless provided in the transparency platform of the producers (or bilaterally).	3 parameters are calculated : • Forced outage rate $\text{Average FO rate} = \frac{(\text{FO energy 2011→2020})}{\text{FO energy 2011→2020} + \text{Available energy 2011→2020}}$ • Average forced outage duration $\text{Average FO duration} = \frac{\text{Sum}(\text{FO duration}_{2011}+\ldots+\text{FO duration}_{2020})}{\#\text{FO over 2011→2020}}$ • Average amount of events $\text{Average \#FO} = \text{Average}(\#\text{FO}_{2011}+\ldots+\#\text{FO}_{2020})$

How were the indicators calculated in previous AdFlex study ?

Concerning forced outages, an analysis was carried out for each generation type.

For generation technologies, these indicators have been calculated using availability data of the last 10 years (from 2011 up to and including 2020).

The data is taken from the ENTSO-E transparency platform (ETP) where available (i.e. only for 2015-2020 period) and combined with Elia's internal database where needed.

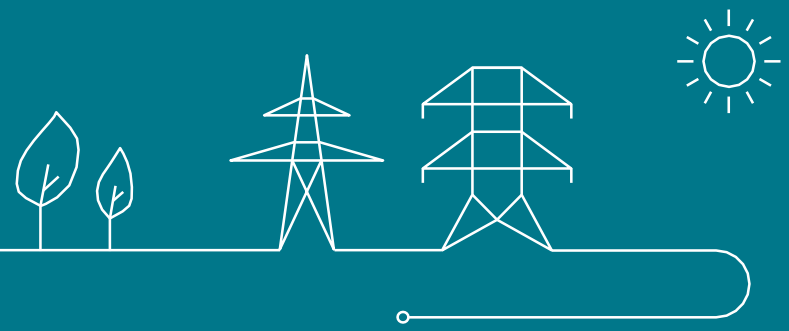
[FIGURE 3-33] — FORCED OUTAGE PARAMETERS (OVER 2011-2020) used in the latest Adequacy & Flexibility study published in June 2021

Category	Number of FO per year	Average FO rate [%]	Average duration of FO rate [hours]
Nuclear	1.6	3.7%	240 hours (around 10 days)
CCGT	7.0	8.4%	101 hours (around 4 days)
GT	3.1	9.2%	201 hours (around 8 days)
TJ	2.0	3.6%	98 hours (around 4 days)
Waste	1.5	1.0%	82 hours (around 3 days)
CHP	3.8	7.0%	124 hours (around 5 days)
Pumped storage	3.0	4.5%	181 hours (around 8 days)
DC links (in each direction)	2.0	6.0%	168 hours (around 7 days)

AdFlex 21 indicators calculation presented some imperfections

- No data available in ETP (ENTSO-E Transparency Platform) before 2015.
- ETP dataset is not available for units < 100 MW.
- Elia's internal database only provides a daily granularity.
- Some discrepancies were observed between the databases (ENTSO-E Transparency Platform and Elia's internal database).
- The amount of units is very limited for some individually-modelled technologies (this does not ensure statistically robust data):
  - Nuclear: 7 units
  - CCGT: 20 units
  - OCGT: 11 units
  - CHP: 27 units
  - TJ: 13 units
  - PSP: 2 units
  - Biomass: 5 units
  - Incineration Station: 13 units
- Due to the limited dataset, a specific year with high forced outage rates could strongly impact the results

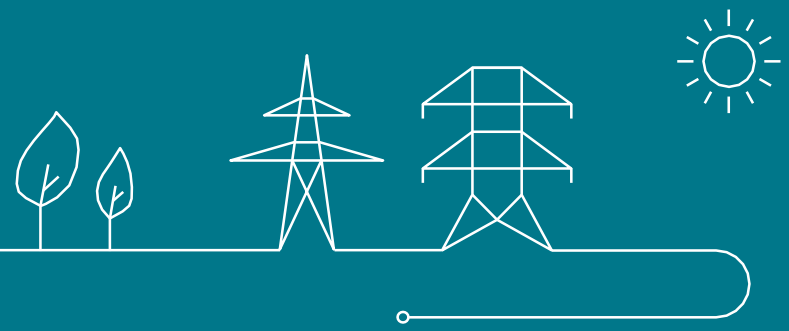
Objectives



Objectives

- ✓ Consolidate the dataset from ETP and Elia's internal database
- ✓ Data Quality of the dataset
- ✓ Validation of the indicators with other countries or other sources
- ✓ Calculate required indicators
- ✓ Perform additional analysis on the indicators
- ✓ Provide updated indicators to be used in the framework of AdFlex 23
- ✓ Ensure robust indicators to avoid doing updates every year

Methodology



Indicators to be assessed

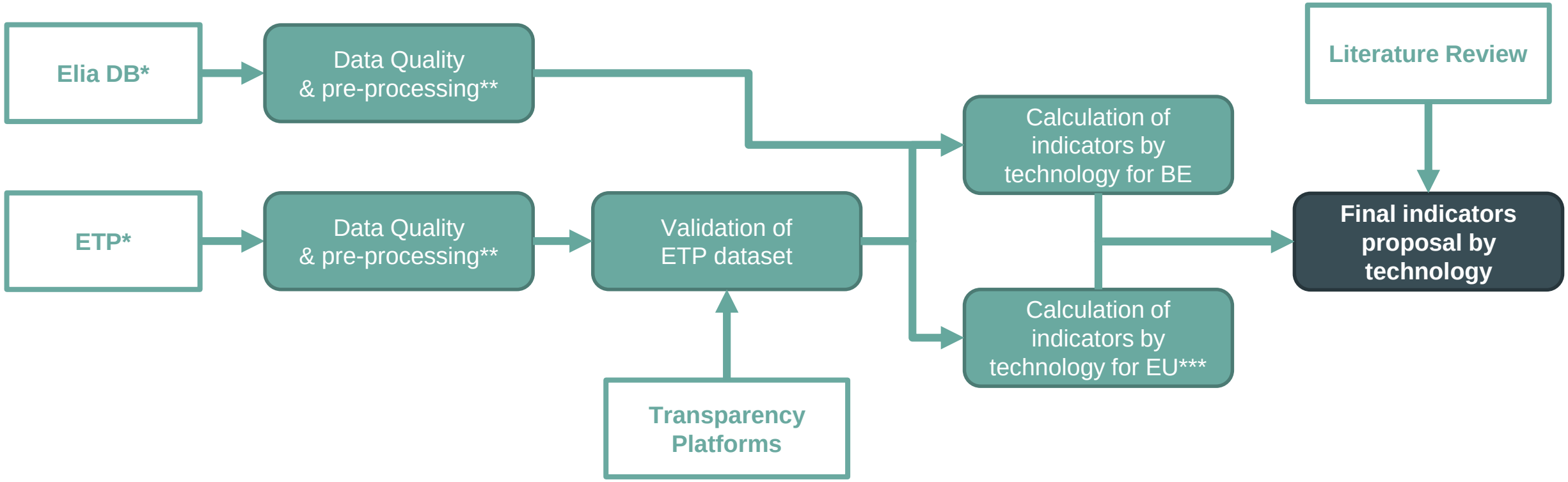
	Planned unavailability	Forced outage
Average rate	$\frac{1}{T}.\sum_{t=1}^{T}\left(\frac{PO\ energy_t}{Total\ energy_t}\right)$	$\frac{1}{T}.\sum_{t=1}^{T}\left(\frac{FO\ energy_t}{FO\ energy_t + Available\ energy_t}\right)$
Average duration	$\frac{1}{T}.\sum_{t=1}^{T}\left(\frac{1}{PO_t}\sum_{i=1}^{PO_t} PO\ duration_i\right)$	$\frac{1}{T}.\sum_{t=1}^{T}\left(\frac{1}{FO_t}\sum_{i=1}^{FO_t} FO\ duration_i\right)$
Average number of events	$\frac{1}{T}.\sum_{t=1}^{T} PO_t$	$\frac{1}{T}.\sum_{t=1}^{T} FO_t$

Where T is the number of years considered
Where PO_t, FO_t are the number of events for year t

Dataset assessed

	ETP	Elia DB	Transparency Platforms
Description	ENTSO-E Transparency Platform (ETP) [ENTSO-E Transparency Platform (entsoe.eu)]	Elia's internal database	Producer's transparency platforms such as NordPool, EDF database or TotalEnergies Transparency
	• Legal obligation for units >100 MW to report outages • Large sample size: outage data for all ENTSO-E bidding zones • Reporting of partial outages • 15 minutes time granularity • Public information	• Outage data on all unit sizes • Data available for more than 10 historical years	• Reporting of partial outages • 15 minutes time granularity • Public information
	• No data for units < 100 MW • Only data available as from 2015	• Only BE data • Only daily granularity • No legal obligation • Not public information	• Mainly data for units > 100 MW • Different platforms per producer • Limited amount of years

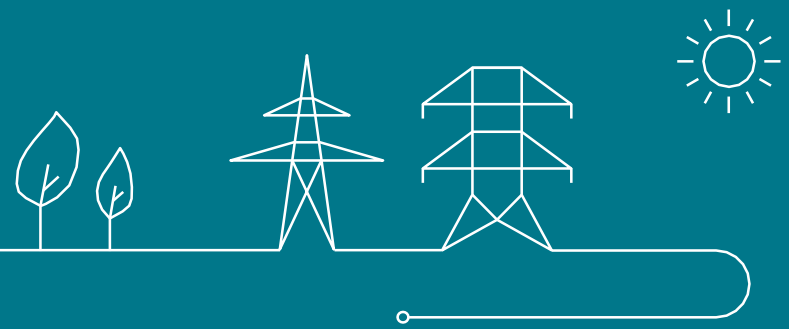
General Methodology



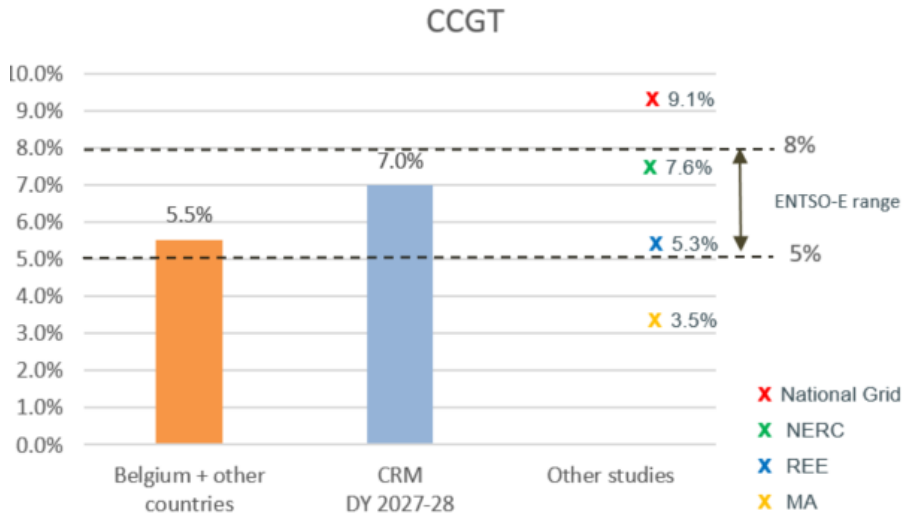
* Calculated for 2015-2021 period (period for which data is available in ETP) for all countries and technologies (for consistency)
**Cleaning of overlapping and duplicate outages (for all countries, technologies and sources)
** Planned outages that start on the date a forced outage ends, are converted to forced outage
***EU = GB, FR, NL, DE, IT

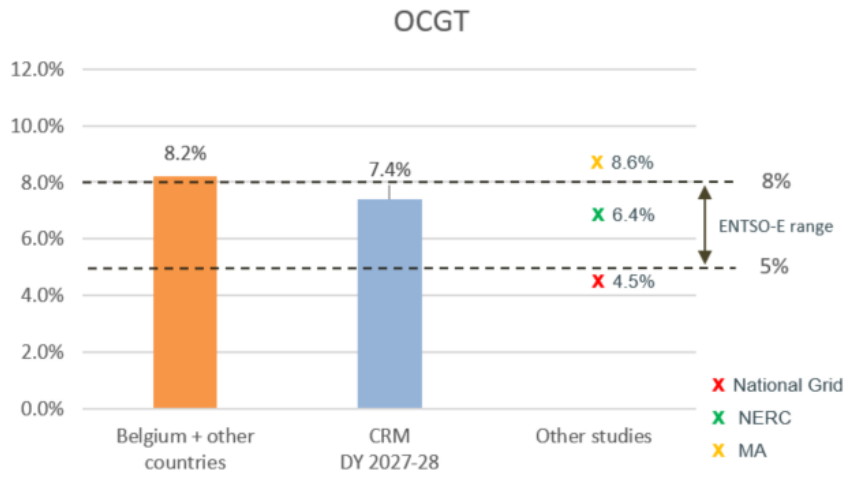
Adequacy & Flexibility study (Elia, 2023)

Overview of the indicators proposed for next study



Result of Forced Outage rates for CCGT & OCGT





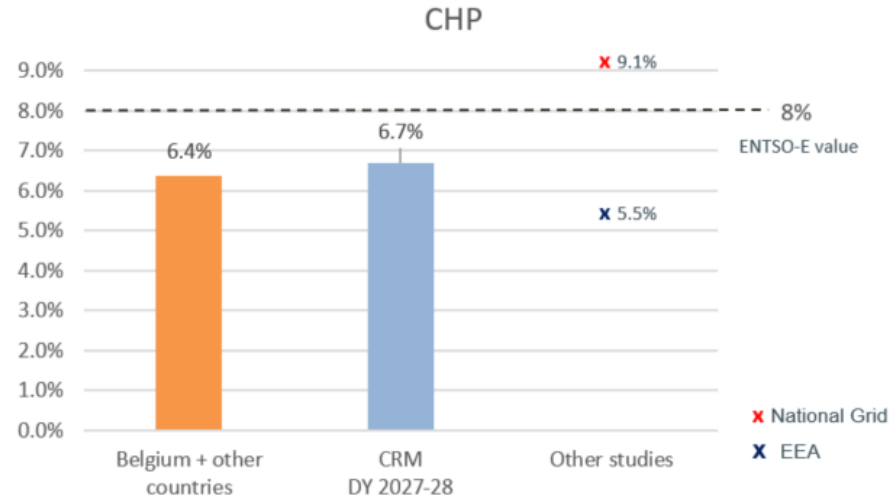
Result CCGT: 5.5%

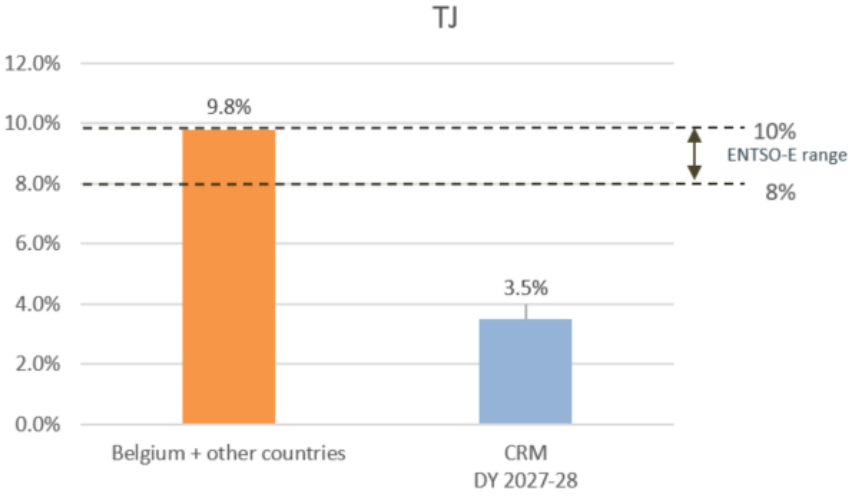
- Only ETP data, 20 units for Belgium, 175 for other countries
- Many units, stable value across years
- Drop from the FO rates used in the CRM calibration 2027-28 value explained by high outage rates observed in the 2012-2014 period

Result OCGT: 8.2%

- For Belgium: 10 units from Elia data, 1 from ETP
- 16 units for other countries
- Increase in FOR explained by the combination with values for other countries and high FOR in 2020 and 2021

Results of Forced Outage rates for CHP & TJ





Result CHP: 6.4%

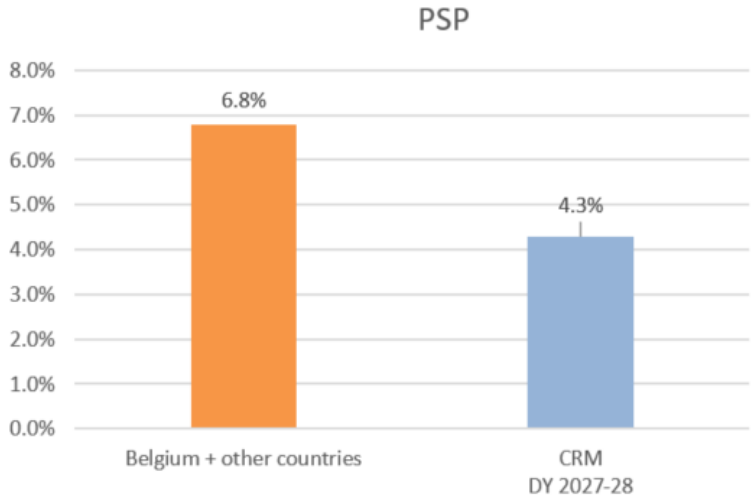
- For Belgium, 26 units from Elia data, 1 from ETP
- 3 units for other countries
- ENTSO-E value used is for “conventional gas” category
- Drop from the FO rates used in the CRM calibration 2027-28 value explained by high outage rates observed in the 2012-2014 period

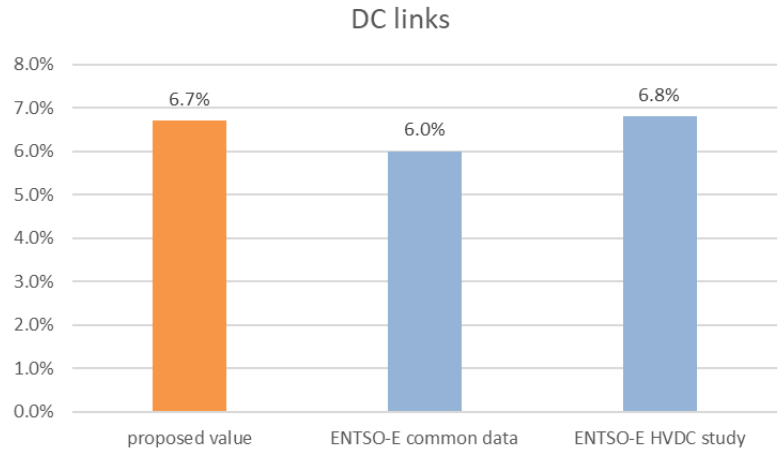
Result TJ: 9.8%

- Elia data for 13 Belgian TJ units
- 26 units for other countries
- Increase due to higher FOR in recent years and inclusion of other countries

No other sources found

Result of Forced Outage rates for PSP & DC links





Result PSP: 6.8%

- 1 from Elia data and 1 in ETP for Belgium
- 87 units for other countries
- Increase due to inclusion of other countries and a high forced outage rate in 2021

No ENTSO-E reference available

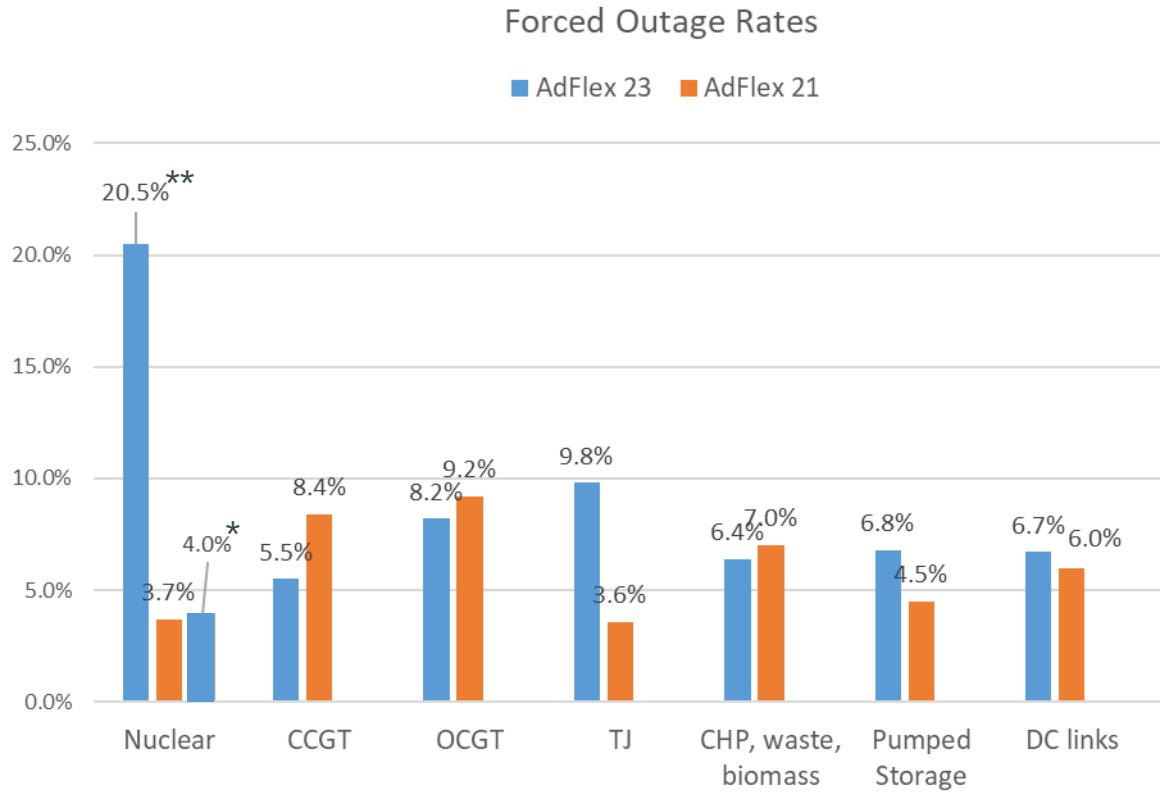
No other sources found

Result DC links: 6.7%

- Calculated on ETP data for 14 North-Sea and Baltic DC links
- Increase compared to ENTSO-E value used in previous studies
- In line with latest ENTSO-E study on the availability of DC links in the Nordics (disturbance outages + unplanned maintenance + limitations)

Proposed indicators – Forced outage Rates

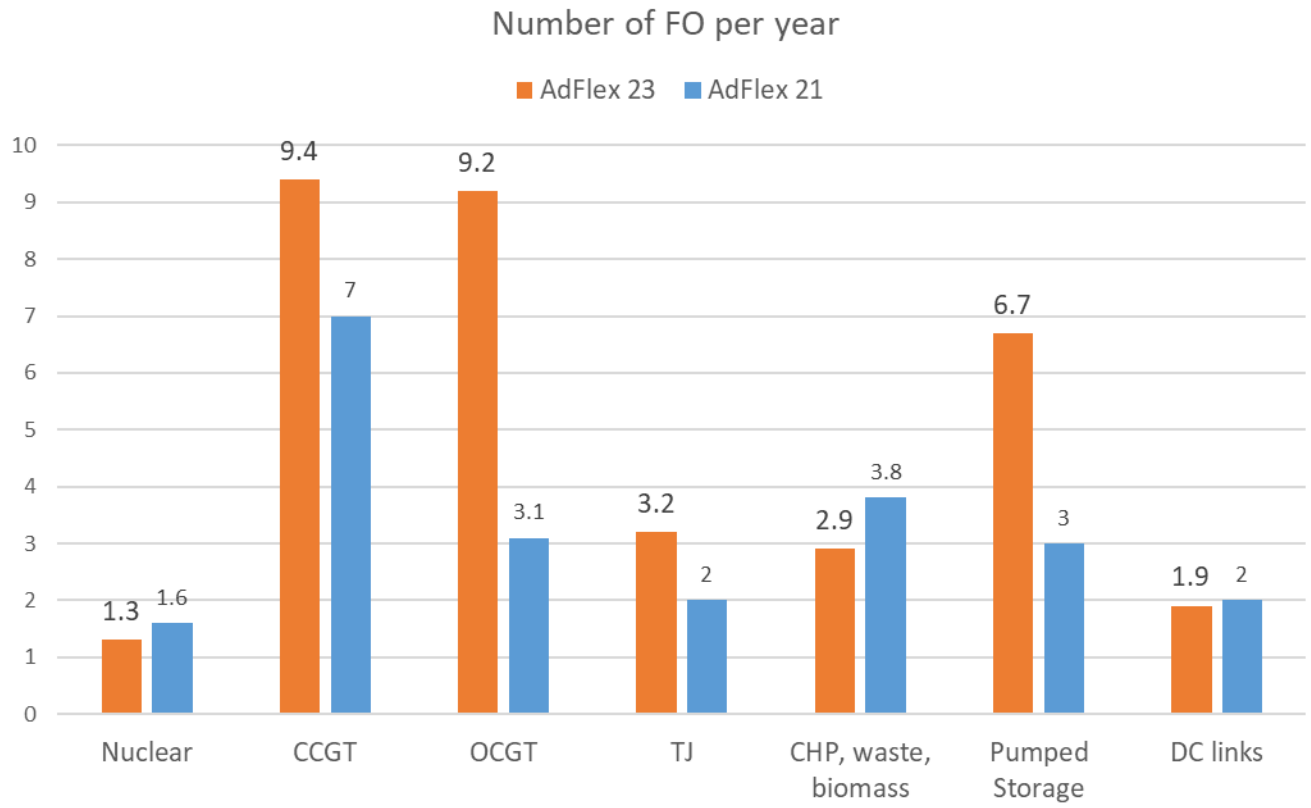
Category	Average FO rate [%]	
	AdFlex 23	AdFlex 21
Nuclear	4.0 %* - 20.5%**	3.7%*
CCGT	5.5%	8.4%
OCGT	8.2%	9.2%
TJ	9.8%	3.6%
CHP, waste,	6.4%	7.0%
Pumped Storage	6.8%	4.5%
DC links (in each direction)	6.7%	6.0%



** only technical FO rate considered*
*** considering technical FO and long-lasting FO*

Proposed indicators – Number of FO per year

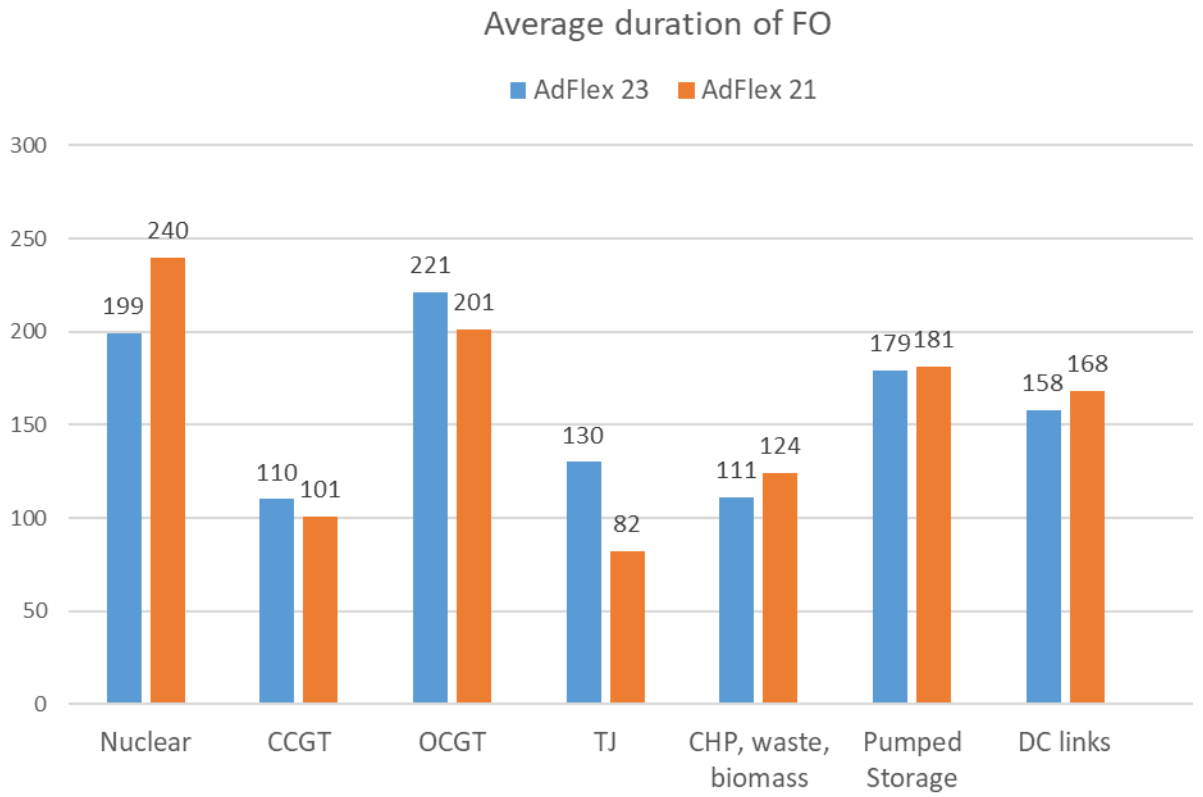
Category	Number of FO per year	
	AdFlex 23	AdFlex 21
Nuclear	1.3*	1.6*
CCGT	9.4	7.0
OCGT	9.2	3.1
TJ	3.2	2.0
CHP, waste,	2.9	3.8
Pumped Storage	6.7	3.0
DC links (in each direction)	1.9	2.0



** only technical FO rate considered*

Proposed indicators – Outage Rates

Category	Average duration of FO rate [hours]	
	AdFlex 23	AdFlex 21
Nuclear	199*	240*
CCGT	110	101
OCGT	221	201
TJ	130	82
CHP, waste, biomass	111	124
Pumped Storage	179	181
DC links (in each direction)	158	168



** only technical FO rate considered*

Summary of resulting forced outage indicators to be used

Category	Number of FO per year	Average FO rate [%]	Average duration of FO rate [hours]
Nuclear	1.3*	4.0%* - 20.5%**	199 hours*
CCGT	9.4	5.5%	110 hours
OCGT	9.2	8.2%	221 hours
TJ	3.2	9.8%	130 hours
CHP, waste, biomass	2.9	6.4%	111 hours
Pumped Storage	6.7	6.8%	179 hours
DC links	1.9	6.7%	158 hours

** only technical FO rate considered*
*** considering technical FO and long-lasting FO*

Overview of sources used for the literature review

- MA: Monitoring Analytics - 2021 State of the Market Report for PJM,
- National Grid: NGESO - Electricity Capacity Report,
- NERC - 2021 State of Reliability
- REE (ES): Spanish electricity system 2019 report
- ENTSO-E common data used in the ERAA & TYNDP studies

Many other sources were consulted as well but provided no clear distinction between forced and maintenance rates.

Belgian generation, storage and demand

General considerations

- The current context adds several uncertainties on the future assumptions one can make. Several assumptions (e.g. prices) are experiencing high volatility
- The goal of the presented values is to get feedback from market parties and ideally challenge the proposed figures with alternative quantified values
- The values that will be presented are proposed for the ‘CENTRAL’ scenario for Belgium
- In any case, a “reality check” will be performed beginning of 2023 in order to take into account developments that happened in 2022 but that are not yet known (e.g. the amount of PV installed in 2022 or the amount of EV sales)
- The following slides provide an overview of some key assumptions (the other assumptions are detailed in the consultation documents)
- As already mentioned, we are asking for (quantified) sensitivities to be considered in the study that you find relevant to be studied in the scope of the study

Scenario definition elements

Electricity demand and demand side response

Available generation & storage

Reference grid and XB capacities

Forecast of total electricity demand

25/08/2022

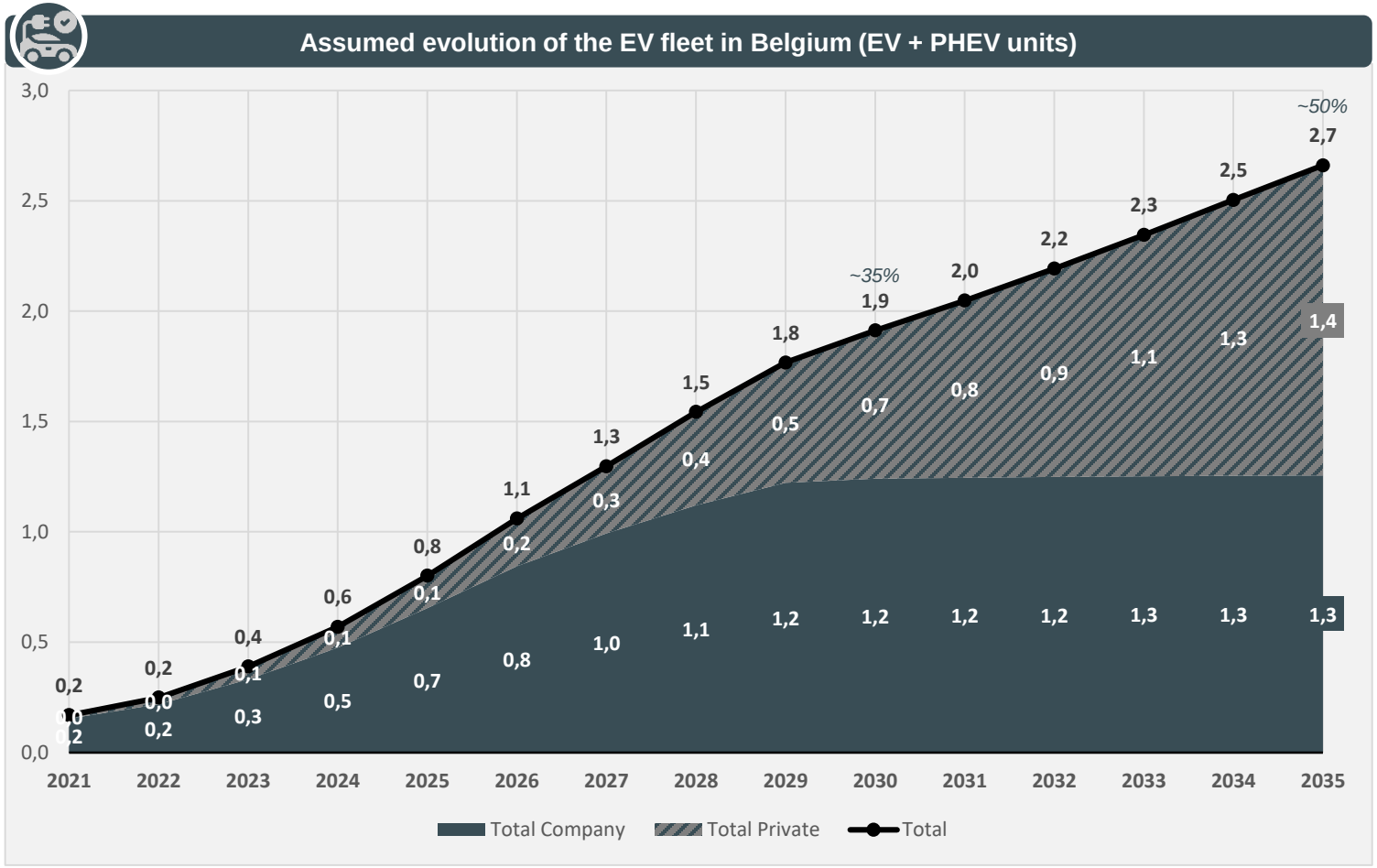
28/10/2022

- On the WG Adequacy of 25/08/2022 Climact presented the forecast of total electricity demand with focus on 2027/28 in the context of the CRM. This forecast included:
  - The impact of macro-economic forecasts based on the report published by the Federal Plan Bureau in June 2022[1]
  - Forecast of electrification in transport and heating of buildings
  - The impact of current high energy prices on the demand
- Since then the forecast has been adjusted to take into account:
  - Update of the energy price impact by taking into account the latest forward & IEA prices (cfr. “Fuel & CO2 prices”)
  - Update of the EV & HP trajectories (regionalization, refinement of sub-categories, peer-review and meetings with DSOs, regional authorities and sectoral organizations)
  - The forecast of Climact assumes only the organic impact of economical activity on electricity demand and assumes industrial processes remain structurally the same. Based on real-life observed requests from Elia-connected clients and in depth consultation with different industrial companies, sectoral organisations and researchers, an additional range is proposed to take into account additional electrification from industry and data centers. It is important to note that those are

[1] Bureau fédéral du Plan - Publication - Perspectives économiques 2022-2027 – Version de juin 2022

The latest trends and policies are reflected in the trajectory EV trajectory – passenger cars

Measure	CENTRAL
Company cars: +/- 1.3 M cars, new sales of +/- 260k/y	
New sales	235k/y *Avg covid years*
'Law Van Peteghem' company car fiscal deductibility favouring ZEV	80% company car EV in 2026, 15% PHEV 100% reached in 2029
Private cars: +/- 4.5 M cars, new sales of +/- 260k/y	
New sales	180k/y *Avg covid years*
EU: **no new ICE from 2035**	100% EV sales in 2035
Flanders: **no new ICE sales** from 2029	100% EV sales in 2029
BXL: **Low emission zone**: no more new diesel from 2030, gasoline from 2035	100% EV from 2035
WL: no targeted politics	40% EV sales in 2030, 100% in 2035



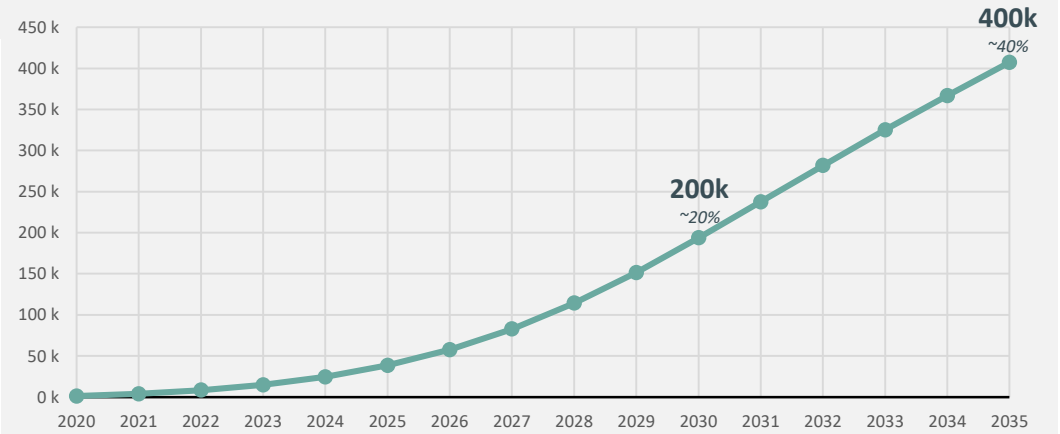
Sources

- EU: Fit for 55: MEPs back objective of zero emissions for cars and vans in 2035 | News | European Parliament (europa.eu)
- BE: Minister Van Peteghem maakt van bedrijfswagens en laadpalen de hefbomen naar een groener wagenpark | Vincent Van Peteghem (belgium.be)
- VL: VR 2021 0511 DOC.1237-1 Visienota VEKP Bijkomende maatregelen.pdf (energiesparen.be)
  - *"B.2* Uitfasering aankoop fossiele verbrandingsmotoren *"*
- BXL: Praktisch pagina | Low Emission Zone (lez.brussels)

Other transport segments assume a slower degree of electrification than in the passenger car segment

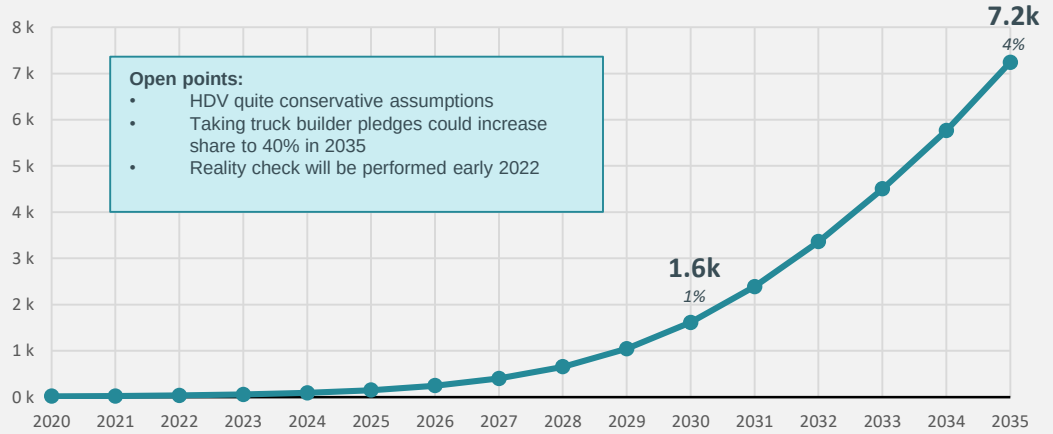
Assumed evolution of EV+PHEV in the LDV freight fleet (vans)

- Total market +/- 850k with +/- 60k sales/y (counted both private & company)
- EU ICE ban from 2035 also applicable for LDV



Assumed evolution of EV+PHEV in the HDV freight fleet (trucks)

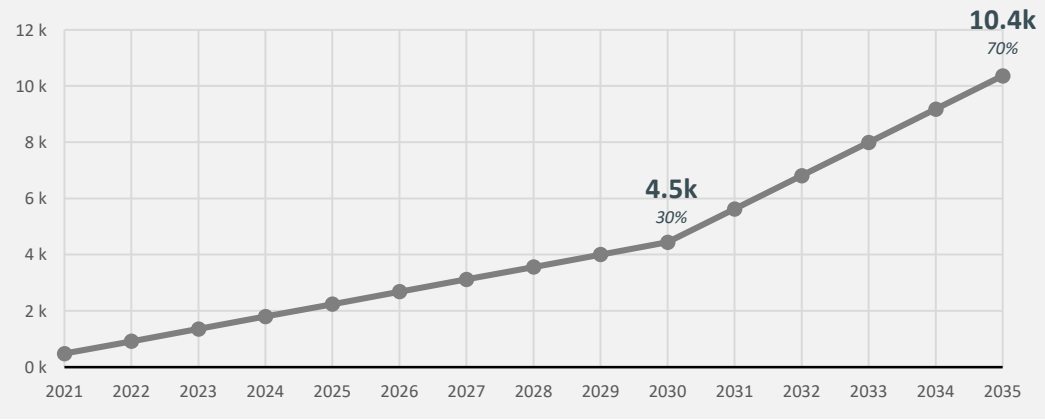
- Total market +/- 150k with +/- 8k sales/y
- No real Belgian policies, some deductions for zero-emission fuel (blending)
- Daimler & Traton aiming for 50% zero-emission sales from 2030 , Volvo 100% in 2040



Open points:
- HDV quite conservative assumptions
- Taking truck builder pledges could increase share to 40% in 2035
- Reality check will be performed early 2022

Assumed evolution EV+PHEV in the bus fleet

- Total market: +/- 15k
- FL: De Lijn; 100% EV in 2035
- BXL: MIVB: 100% EV in 2030



Sources

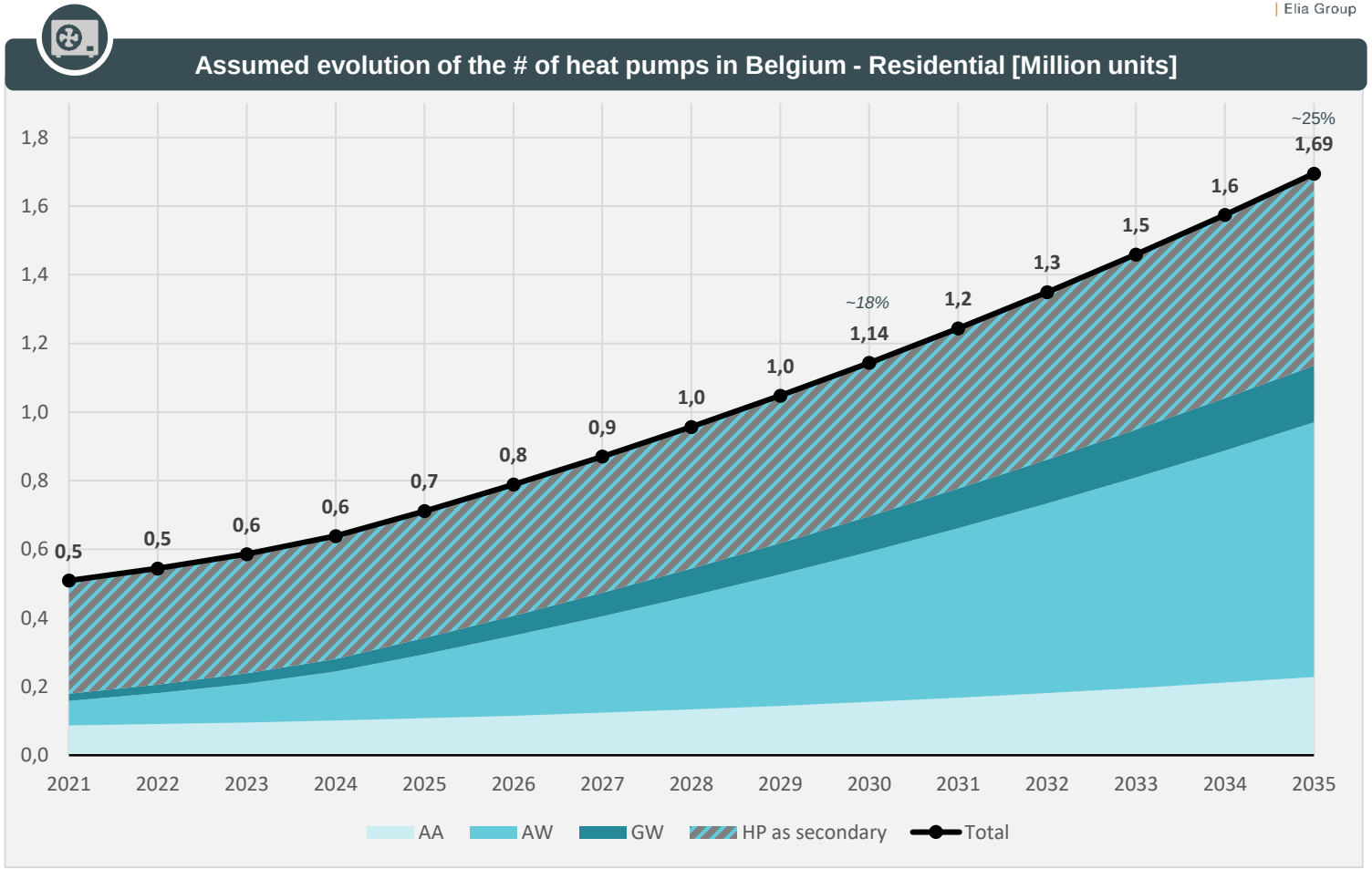
LDV
- Fit for 55: MEPs back objective of zero emissions for cars and vans in 2035 | News | European Parliament (europa.eu)

Bus
- VL: E-bussen: De Lijn gaat volop voor groen - De Lijn
- BXL: 100% elektrische busvloot tegen 2030 - Pascal Smet

HDV
- TRATON boosts investments in e-mobility | TRATON → 50% ZEV 2030
- Mercedes-Benz All eActros LongHaul: In Pictures | Trucks.cardekho.com → 60% ZEV 2030
- The future of electromobility | Volvo Trucks → 100% ZEV 2040
- VR 2021 0511 DOC.1237-1 Visienota VEKP Bijkomende maatregelen.pdf (energiesparen.be)
  - *"C.7 Aanmoediging emissievrij vrachtvervoer door gunstig belastingsregime"*
  - *"C.9 Versnelde transitie naar zero-emissie vrachtvervoer over de weg"*

The latest trends and policies are reflected in the trajectory HP trajectory: Residential

Measure	CENTRAL
Total Dwellings: +/- 5.2M	
New builds *(current +/- 55k)*	55k/y *Avg last 5y*
Renovations *(current +/- 0.7%)*	1.2% *by 2035* *1% avg over the period*
Flanders: **ban on new gas connections from 2025***	100% full-electric HP in new built FL *75% of new builds are in FL*
Heating system in **new built**	85% in 2025 100% by 2033
Replacement of heating system after **renovation**	25% HP by 2030 35% HP by 2035
Replacement of heating system **end of lifetime**	18% HP by 2030 25% HP by 2035

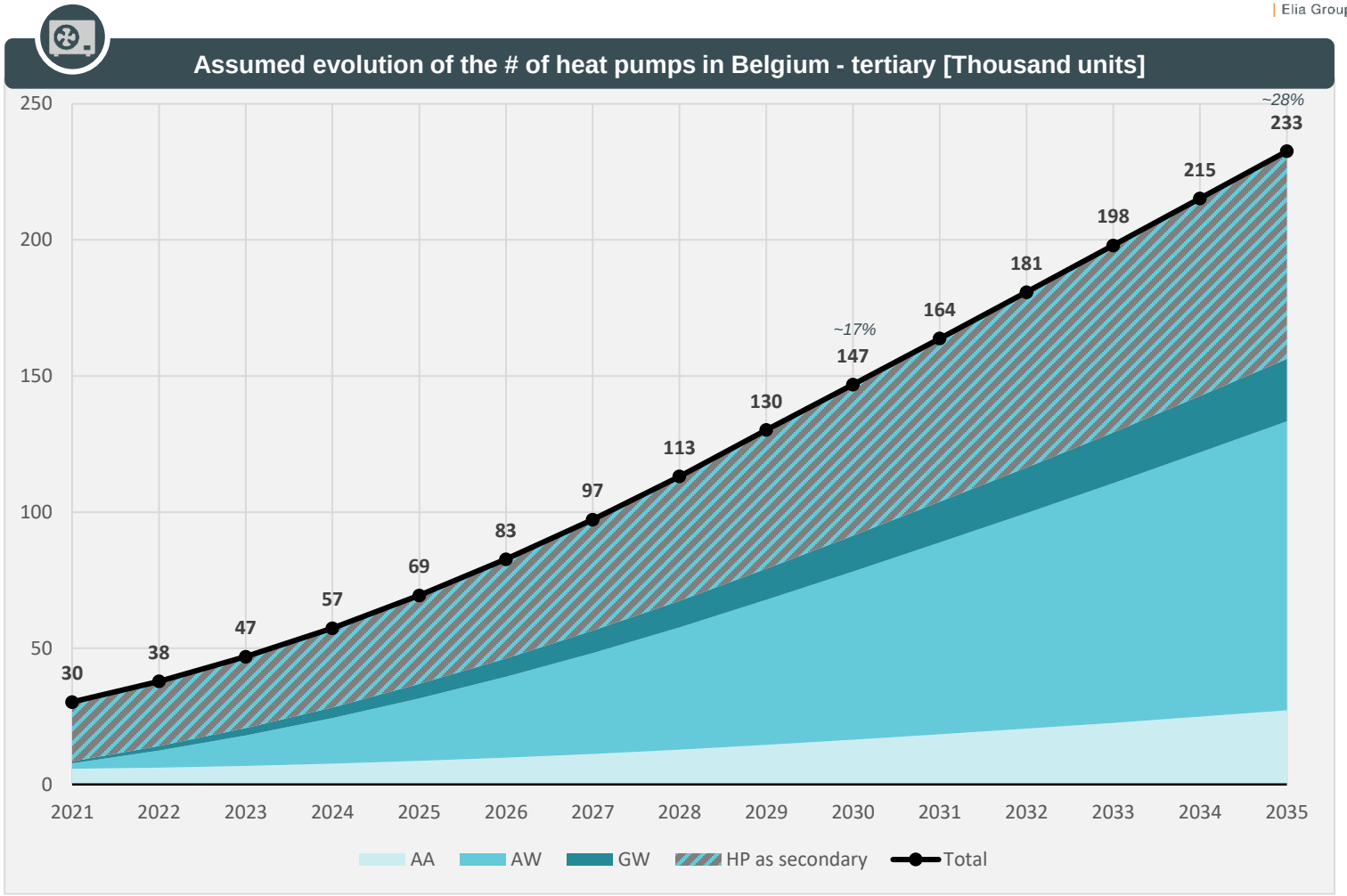


Sources

- BE
  - ATTB
  - FRIXIS
  - Delta-EE: internal analysis + European Heat Pump Association
  - EurObserv'ER online database - EurObserv'ER (eurobserv-er.org)
  - Belgium: number of heat pumps in operation | Statista
- FL:
  - https://apps.energiesparen.be/energiekaart/vlaanderen/warmtepompen-aantal rapp-2021-18.pdf (vreg.be)
  - *Verplichting elektrische warmtepomp bij nieuwbouw vervroegd naar 2025 – Ode
- WL:
  - bilan-domestique-et-equivalents-2019-v2.pdf (wallonie.be) p29

The latest trends and policies are reflected in the trajectory HP trajectory: Tertiary

Measure	CENTRAL
Total buildings: +/- 780k	
New builds *(current +/- 5.8k)*	5.8k/y *Avg last 5y*
Renovations *(current +/- 0.7%)*	1.2% *by 2035* *1% avg over the period*
Flanders: **ban on new gas connections from 2025***	100% full-electric HP in new built FL
Heating system in **new built**	87% in 2025 100% by 2030
Replacement of heating system after **renovation**	100% HP by 2030
Replacement of heating system **end of lifetime**	25% HP by 2030 35% HP by 2035



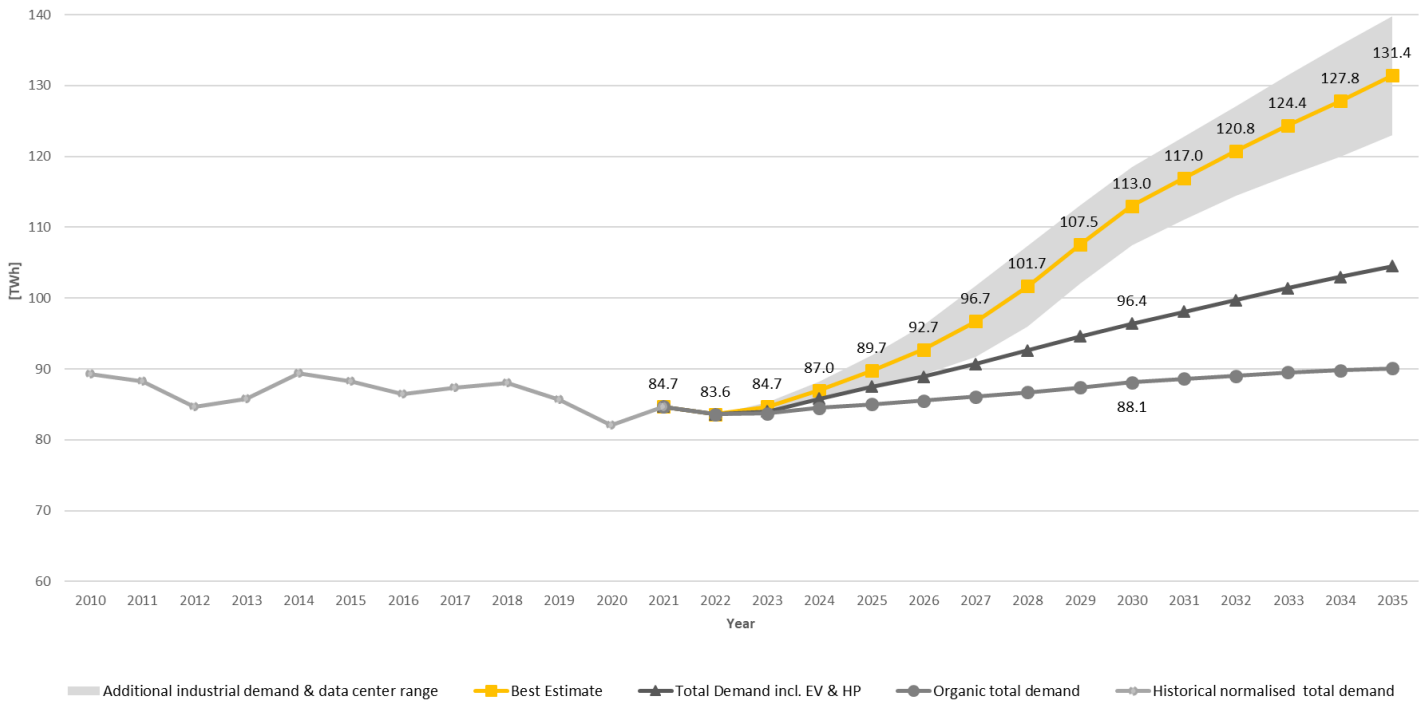
Sources

- BE
  - ATTB
  - FRIXIS
  - Delta-EE: internal analysis + European Heat Pump Association
  - EurObserv'ER online database - EurObserv'ER (eurobserv-er.org)
  - Belgium: number of heat pumps in operation | Statista
- FL:
  - https://apps.energiesparen.be/energiekaart/vlaanderen/warmtepompen-aantal rapp-2021-18.pdf (vreg.be)
  - *Verplichting elektrische warmtepomp bij nieuwbouw vervroegd naar 2025 – Ode
- WL:
  - bilan-domestique-et-equivalents-2019-v2.pdf (wallonie.be) p29

Electricity consumption in Belgium – summary of the proposal including additional electrification from industries and new data centers

Evolution of total electricity demand for Belgium [TWh]

Normalised, excl. electrolysers, incl. losses and refineries

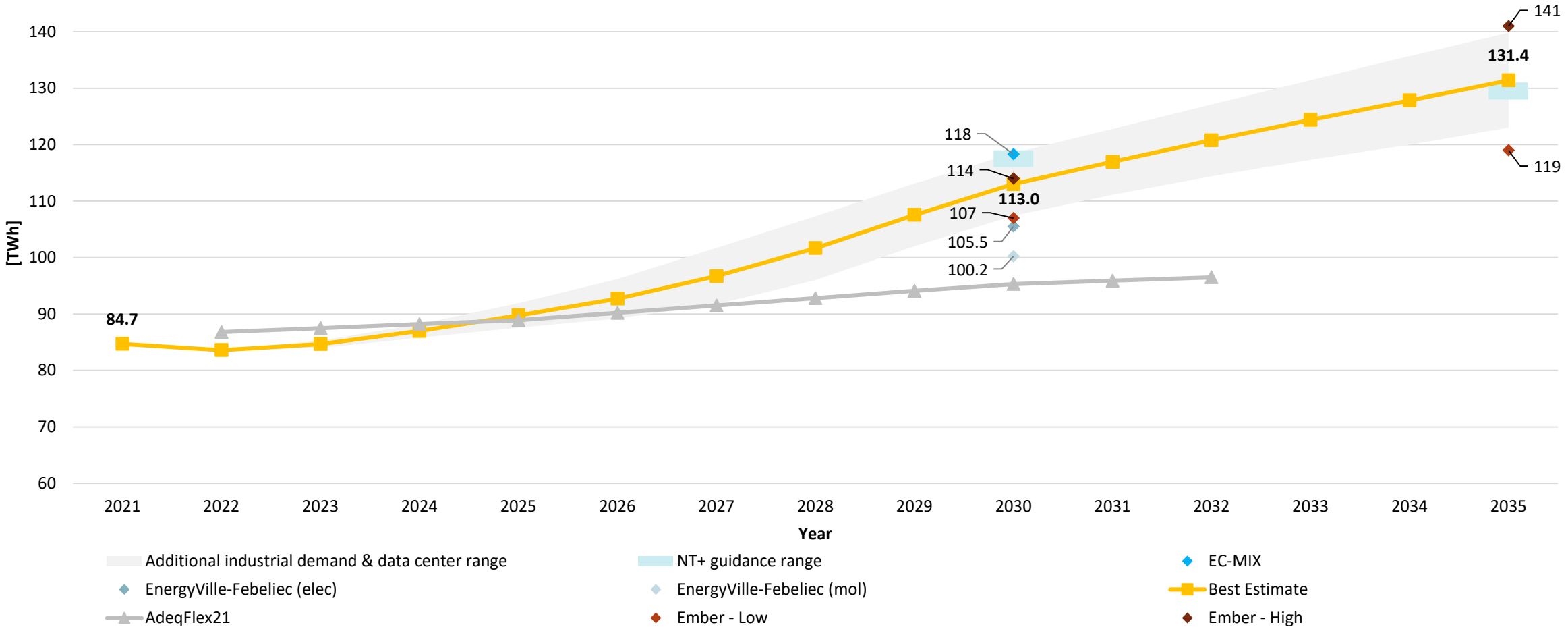


The ranges for additional electrification are based on bilateral exchanges between Elia and industries, requests for orientation and detailed studies, information from direct clients... Elia Group will publish a study on the topic mid of November.

Electricity consumption for Belgium: comparison with other recent studies

Evolution of total electricity demand for Belgium [TWh]

Normalised, excl. electrolysers, incl. losses and refineries



Demand side response to be taken into account

DSR from residential and tertiary sector

- Cfr study DELTA-EE
- Flexibility in EV, HP (and different mode of optimizing their assets)

DSR from existing large clients/industry

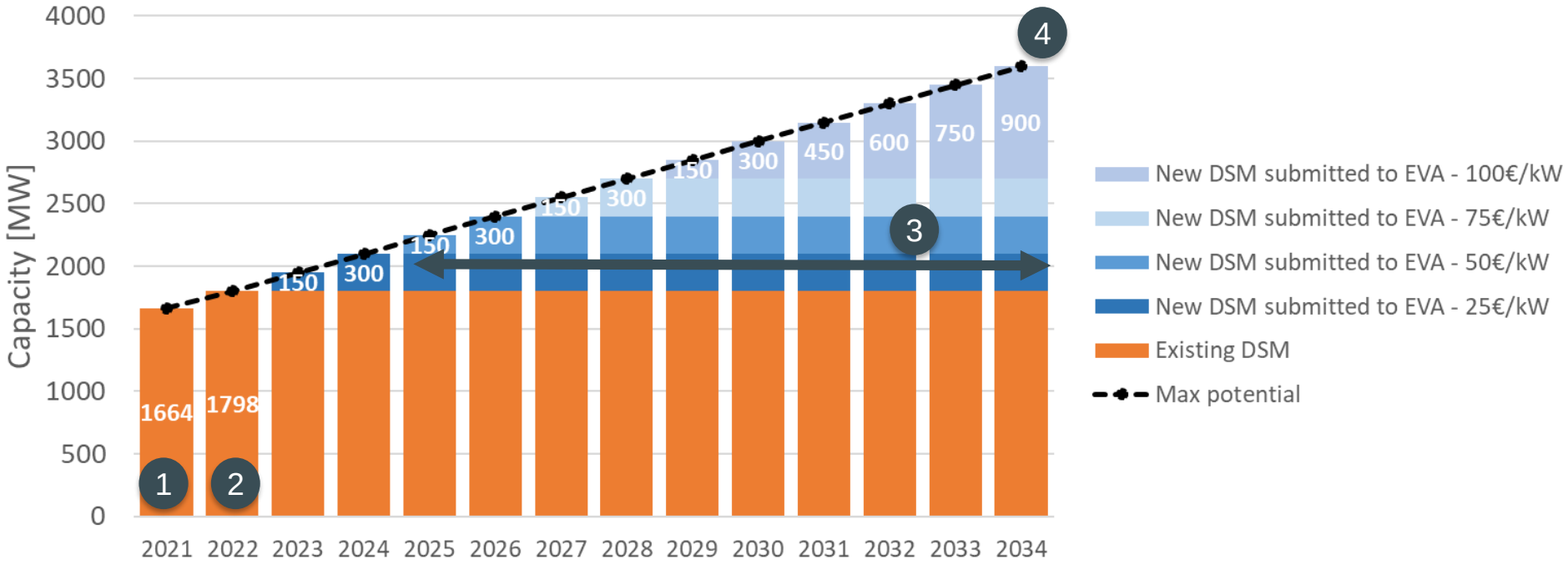
- Quantified based on historical values (E-CUBE study) assuming that those volumes are from existing large clients & industry
- Max potential for new DSR defined
- Economic viability applied

Additional DSR from new electrified processes

- To be taken into account depending on the electrification and processes

Proposal for DSR from existing industry/large clients

Evolution of DSR capacities for existing industry/large clients to be used in the study – considered as shedding capacity



1. Value for winter 2021-22 from the latest E-cube study.
2. Extrapolation from e-cube study, considering a growth rate of 8% (the highest from historical evolution).
3. Additional potential is submitted to EVA (capacity will be considered if economically viable).
4. Maximum potential is defined as 25% of the total peak load of Belgium today. Such value goes way beyond any study on the potential of DSR (even more that the potential is usually defined on the total load – and not only on the industry one).

Scenario definition elements

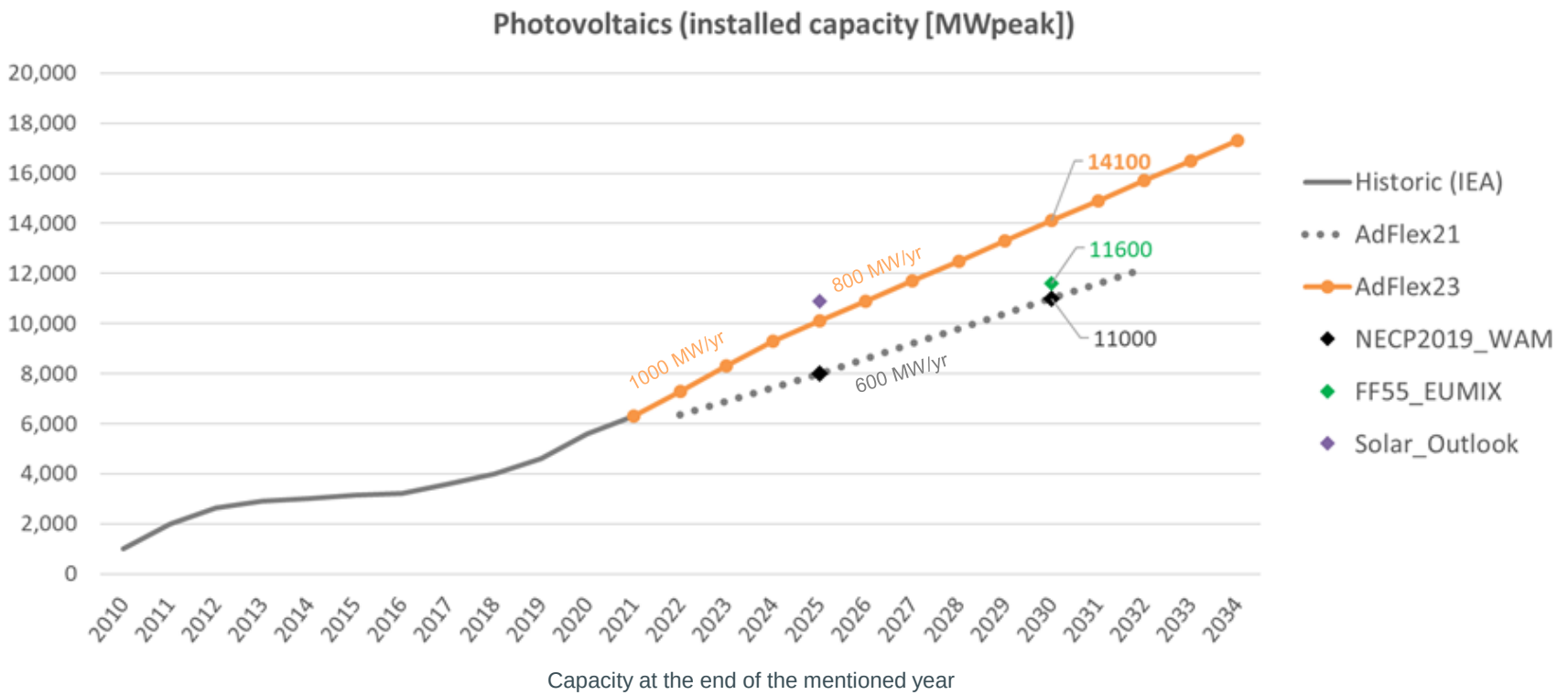
Electricity demand and demand side response

Available generation & storage

Reference grid and XB capacities

PV – proposal for future evolution

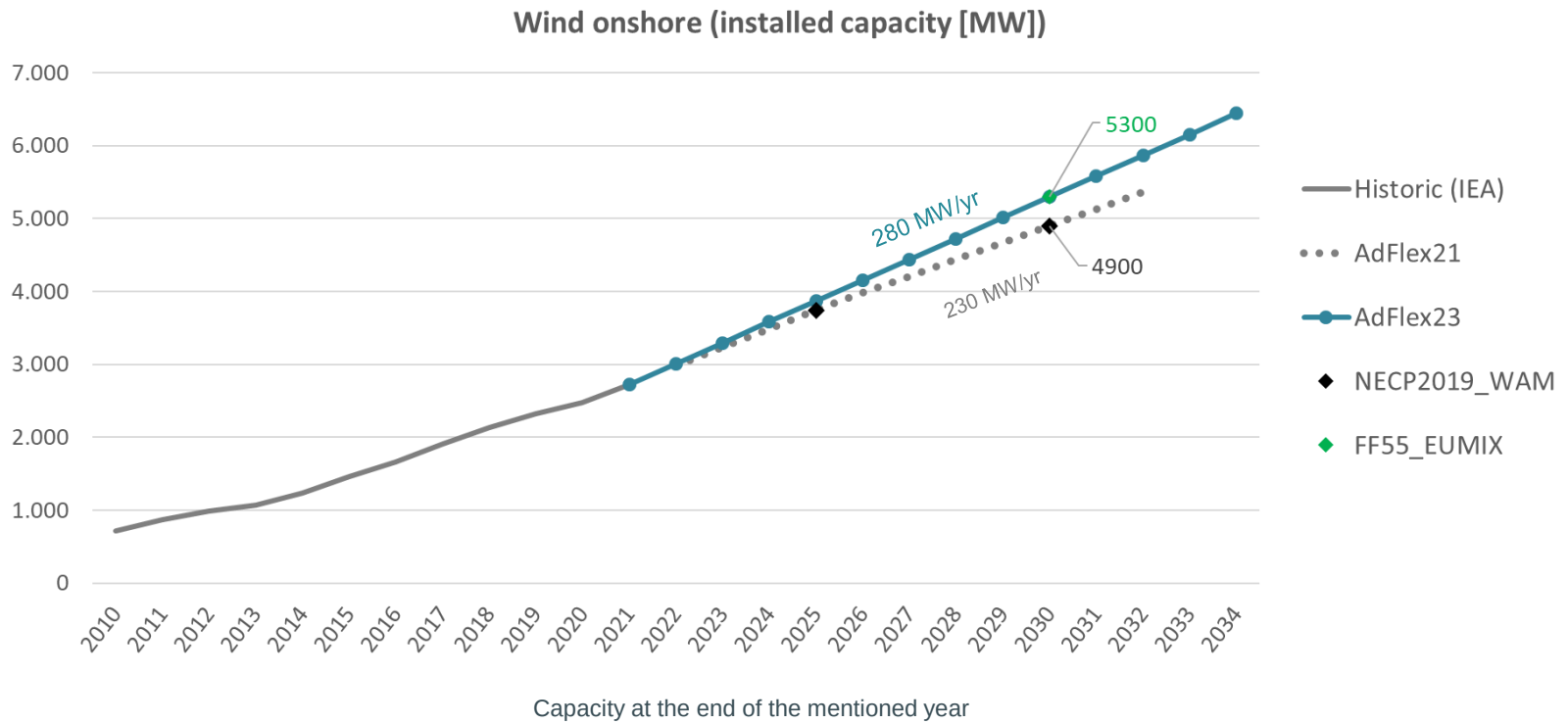
- An important jump in capacity is expected for 2022.
- The high demand for PV has lead to important delays in supply chain and installation. Therefore, not all the expected capacity will be installed in 2022. A yearly increase of 1000 MW per year is also assumed for 2023 and 2024.
- After 2024, changes in policies in Wallonia could slower down the rate and electricity prices might have decreased.
- However, with electricity prices that might stay higher than before and with lot of roofs still to cover (incl. social housing, public buildings, etc.), a still important installation rate in assumed (800 MW/year).



The proposed trajectory accounts for important jumps until 2024 (1000 MW/year) followed by a continued high installation rate (800 MW/year), leading to **14.1 GW by 2030**.

Wind onshore – proposal for future evolution

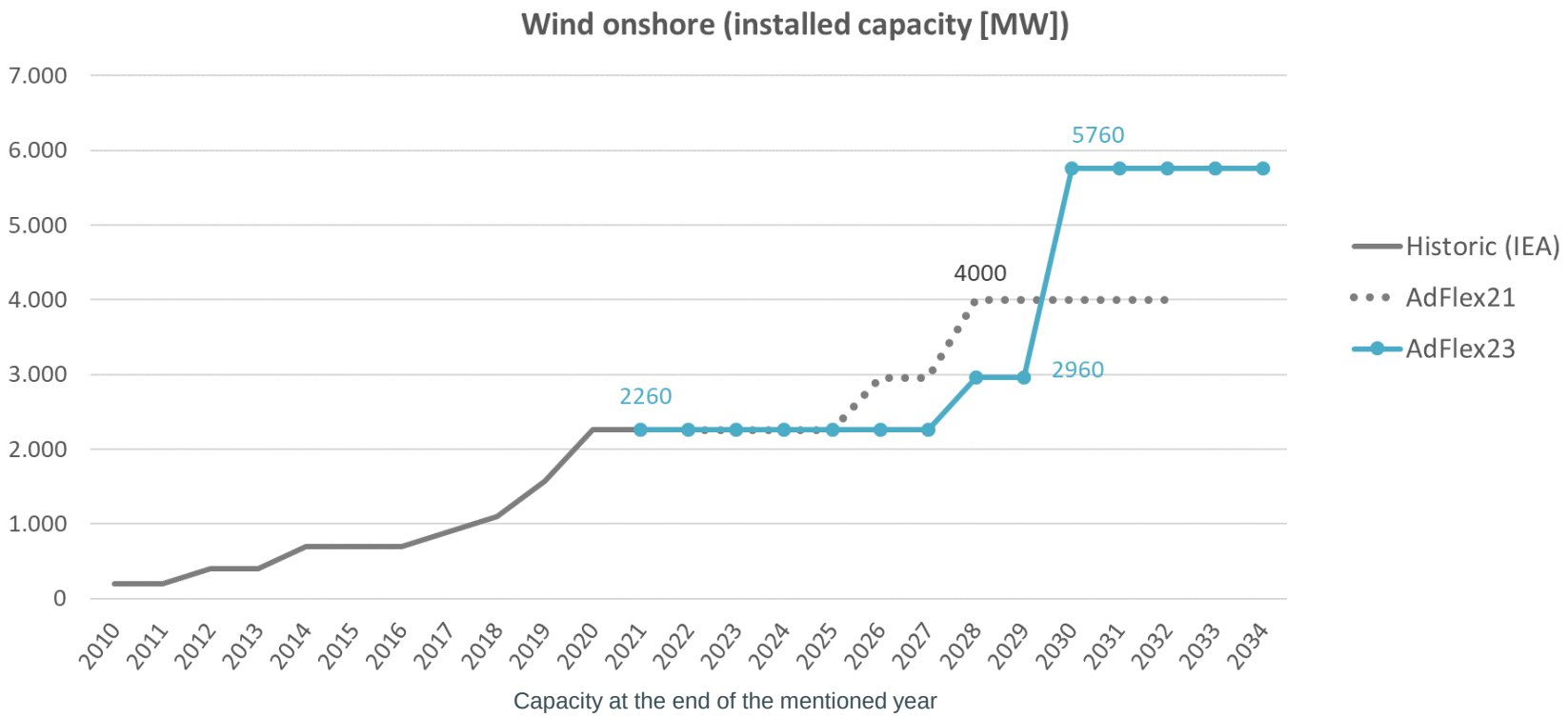
- In Flanders, the yearly increase has recently been updated from 108 MW to 150 MW for 2022 and 2023 [VEKA], while keeping 2500 MW as target for 2030.
- In Wallonia, around 70-100 MW is assumed each year from 2022 to 2026 [SPW], with extra potential capacity (380 MW split on 4 years) that might come on top of it.
- In Wallonia, the “pax eolienica” will aim to facilitate the installation of onshore wind, which will positively influence the yearly increase.



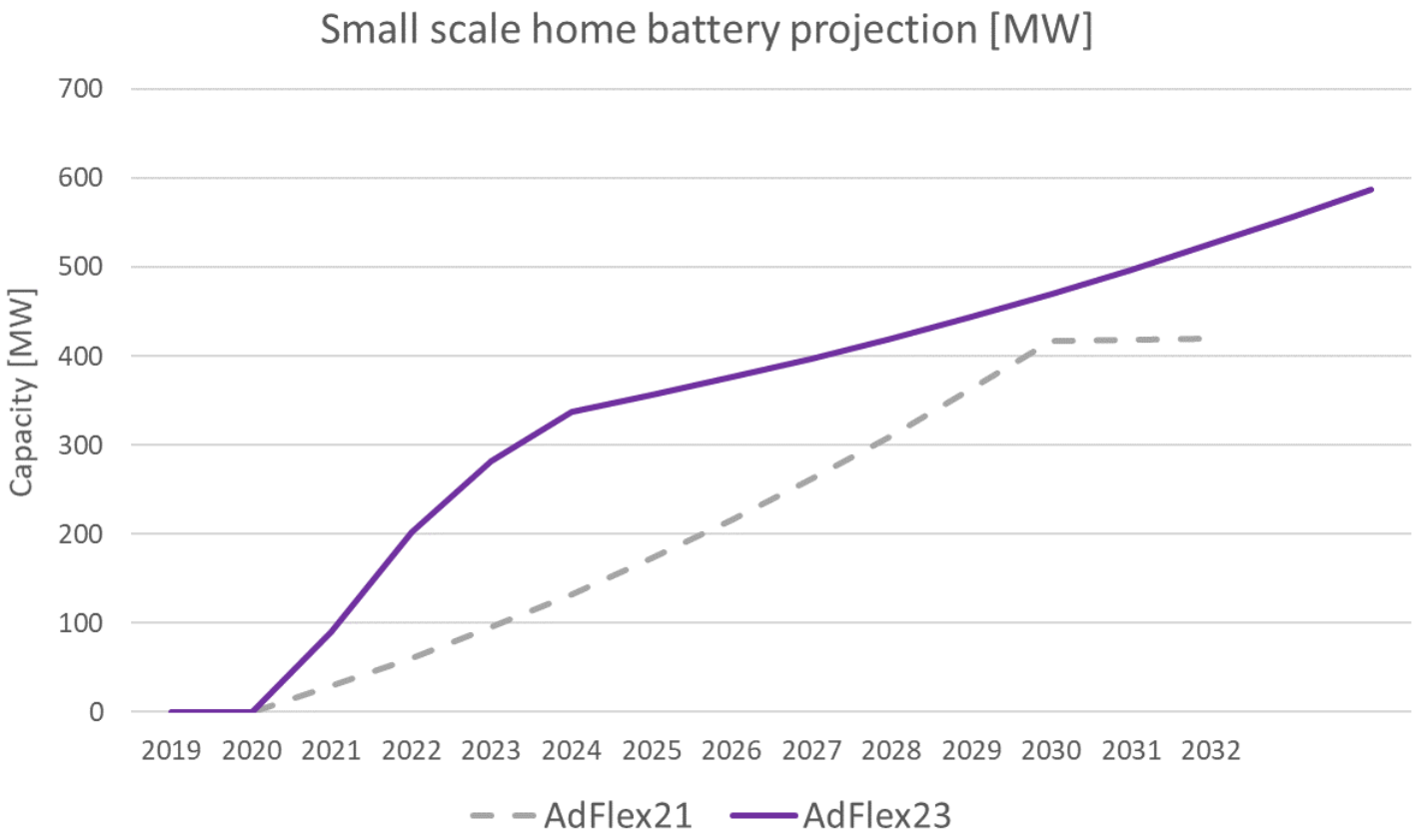
The proposed trajectory accounts for updated yearly increase in Wallonia and Flanders for the short term and is assumed to reach the estimated FF55 EUMIX 2030 target from the EC.

Offshore wind – proposal for future evolution

- The latest planning of MOG 2 published on the SPF Economie website is used to build the projection
- First 700 MW is expected for Q1/Q2 2028;
- The other 2800 MW of MOG2 is expected for 2030
- Those developments are under the condition that the necessary grid reinforcements onshore and offshore are realized on time



Small scale batteries – proposal for future evolution



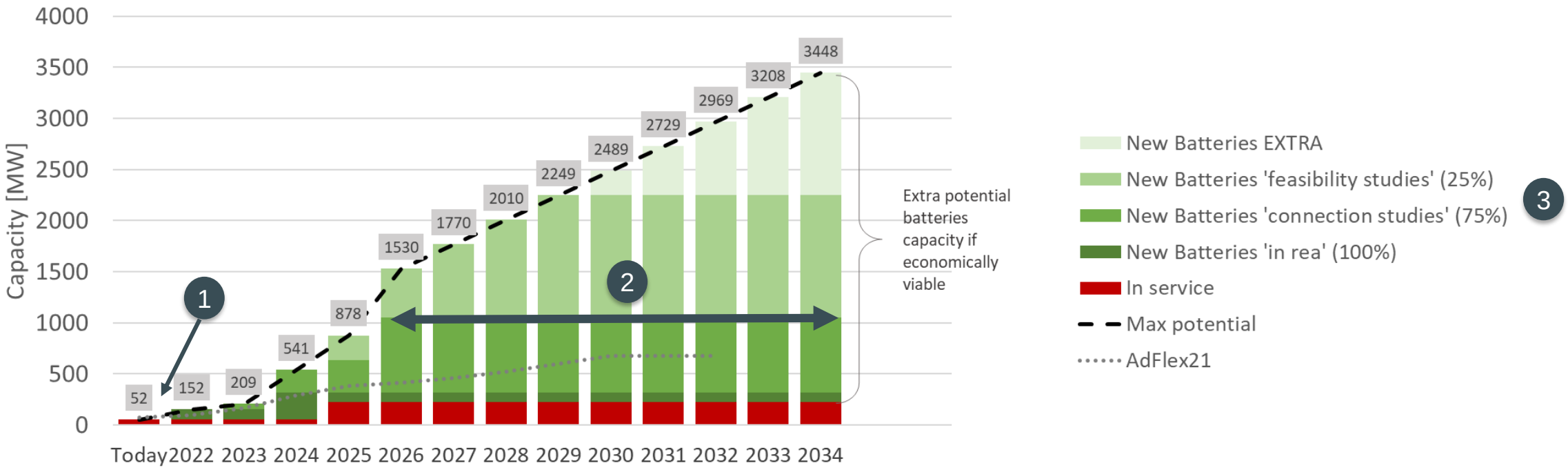
- Bonus/incentive for home battery in Flanders: from max 2550 EUR in 2021 to max 425 EUR in 2024 (stop in 2025).
- Around 19,000 bonus were asked in 2021 in Flanders for home batteries, similar amount expected for 2022.

Assuming

- Battery of 4,5 kW and 2 hours duration;
- No other incentives after 2024;
- In 2021, 2% of the PV installations in Flanders have added a battery capacity of the size of the PV installation (and 0,13% in Wallonia);
- After 2024, 0,2 % of PV installations in Flanders will add a battery capacity of the size of PV installation.

Note that this projections does not include the recent announcement from the Flemish Energy Minister on 27th of October (yesterday) stating that the subsidy will be stopped beginning of 2023

Large scale batteries – proposal for future evolution



1 Capacity **'in service' today** and capacity already contracted in the CRM Y-4 auction DY 2025/26 (considered 'in service' in 2025).

2 Additional **potential batteries** capacity for each year, based on projects in 'realization', with 'feasibility study' ongoing or with 'connection studies' ongoing. **Final capacity** will be the one proven to be **economically viable** (to be determined via EVA).

3 Likelihood of projects not to materialize represented by considering 75% of the potential of projects with 'connection study' ongoing and 25% of the potential of projects with 'feasibility study' ongoing.
The potential of projects with 'feasibility study' ongoing is assumed to be spread over 5 years as from 2025 (no 'expected year' is associated and unlikely to be there before).
Extra potential post 2030 to account for probable increase over the years.

Thermal fleet in Belgium – proposal for the CENTRAL scenario

- **Nuclear**
  - Closure of the other nuclear units as planned currently in the law;
  - 10-year nuclear extension of Doel 4 & Tihange 3 as of winter 2026-27;
- **Gas**
  - Closure of Vilvoorde ST (2023) and Vilvoorde GT (2025) & Seraing ST (2025);
  - 2 new CCGT units (Seraing & Awirs) as of winter 2025-26, contracted in the Y-4 auction for Delivery Period 2025-26 with a 15 years contract;
- **TurboJet**
  - Closure of turbojet Volta (2023);
- **Biomass**
  - Rodenhuize as back-up of Knippegroen as from 2023 (cfr. communication on REMIT from ENGIE);
  - No new biomass capacity considered as discussed during CRM public consultation. To be confirmed by regional plans;

Scenario definition elements

Electricity demand and demand side response

Available generation & storage

Reference grid and XB capacities

Proposal for the evolution of cross border capacity calculation parameters

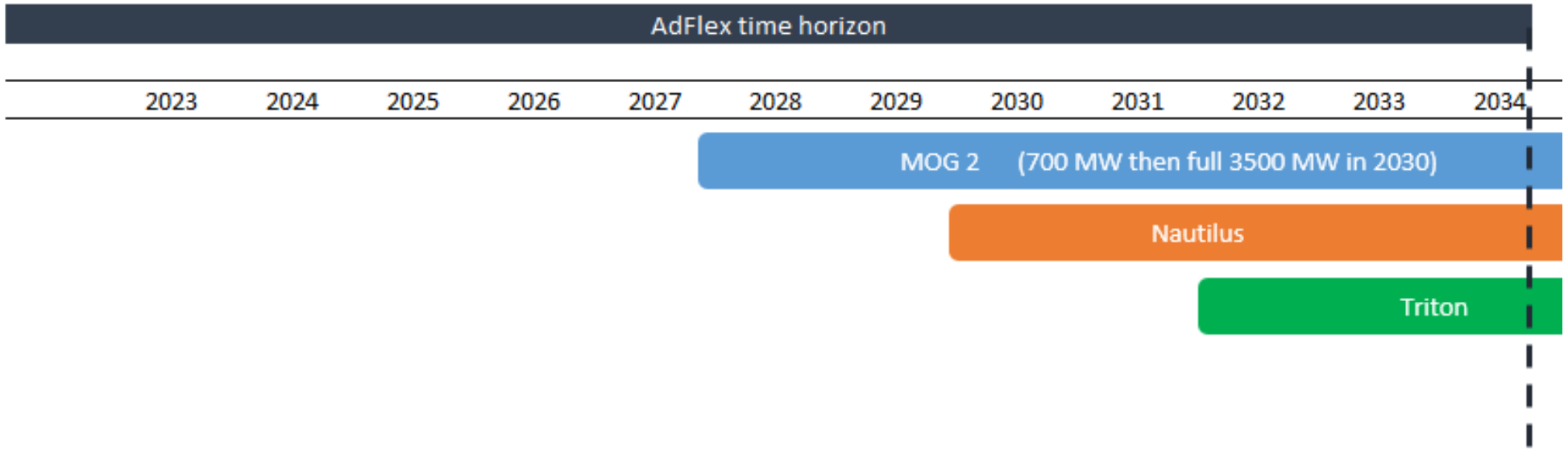
Market Parameters	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Flow-based perimeter	CORE											
Bidding zones	As Is											
minRAM	See table below											
Treatment of external flows	Standard Hybrid Coupling (SHC)		Advanced Hybrid Coupling (AHC)									
External & Allocation constraints	No allocation constraint for Belgium from 2024 onwards* Dynamic Allocation constraint for PL for all years** External constraint on Core net position of NL (Import: 6500/Export: 6500) until 2023**											
Use of PST in capacity calculation	For Belgium: 1/2 For other: 1/3											
Use of HVDC in flow-based capacity allocation	Only ALEGrO											
Modelling of Channel HVDC (NemoLink, IFAs, BritNed, Noth Sea Link, etc..)	Consideration of 'Explicit Allocation' after Brexit											

Assumed minRAM trajectories per country in [%]

Country		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Austria	CORE borders	39	49	60	70	70	70	70	70	70	70	70	70
Belgium*	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Netherlands	CORE borders	48	55	63	70	70	70	70	70	70	70	70	70
Germany	CORE borders	41	51	60	70	70	70	70	70	70	70	70	70
France	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Slovenia	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Kroatia	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Romania	CORE borders	48	55	63	70	70	70	70	70	70	70	70	70
Czechia	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Slovakia	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70
Poland	CORE borders	50	56	63	70	70	70	70	70	70	70	70	70
Hungary	CORE borders	70	70	70	70	70	70	70	70	70	70	70	70

Proposal for the evolution of offshore cross border capacity with Belgium

Projects expected to be realised by end of the mentioned year according to date mentionned in Draft Federal Development Plan *



*to be published in a few days

Economic parameters

Proposal for fuel and CO2 prices

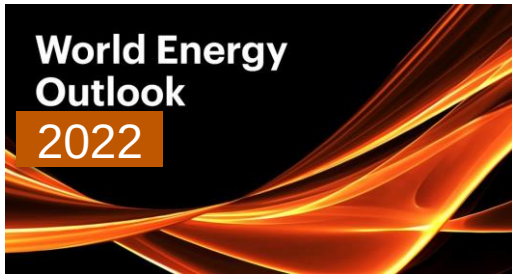
General approach:

- The **latest forwards (27/10/2022)** are be proposed. An update will be foreseen in the beginning of 2023 (in the framework of the 'reality check' process).
- For **the long term**, the use of the World Energy Outlook 2022 published on 27th of October (yesterday) will be used as target value. The scenario 'Announced Pledges' is proposed to be used.
- **All prices will be expressed Euros2022** (end of year).

2022 – 2023 – 2024 – 2025 2026 – 27 – 28 – 29 **2030** **2035**

Forward prices

Interpolation

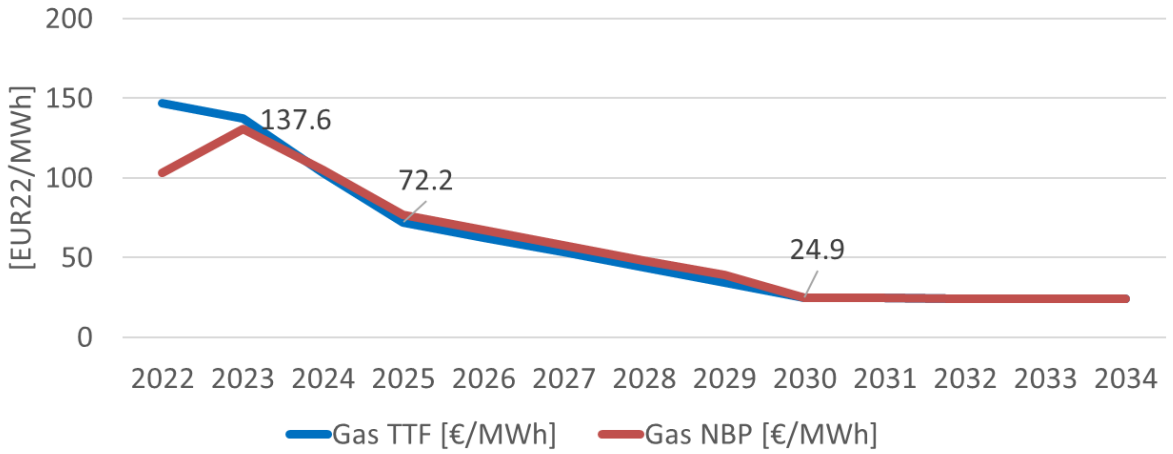


WEO 2022 published 27/10/2022

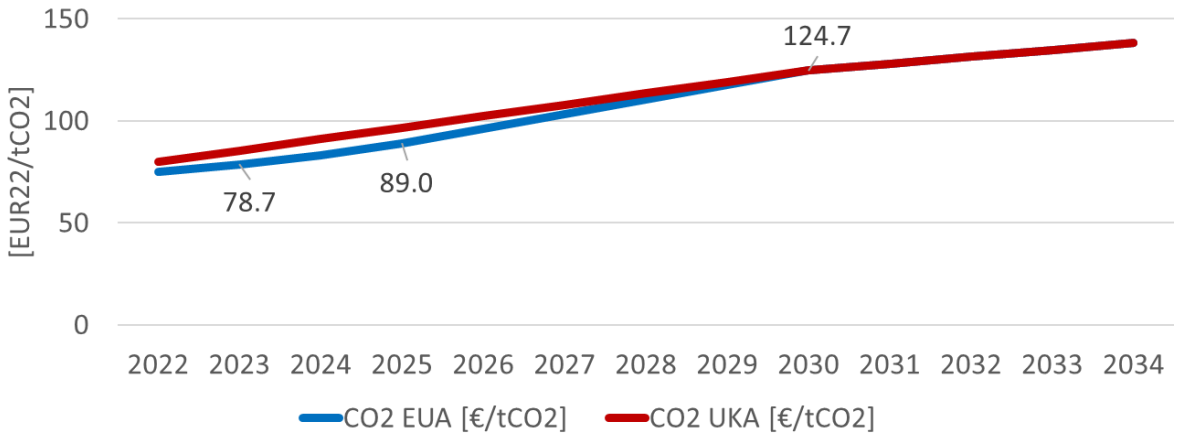
Proposal for fuel and CO_2 prices

Note that given the volatility of fuel and CO_2 prices, sensitivities can be foreseen.

Proposed evolution of the gas price [€/MWh]



Proposed evolution of the carbon price [€/tCO_2]



Proposal for investment costs

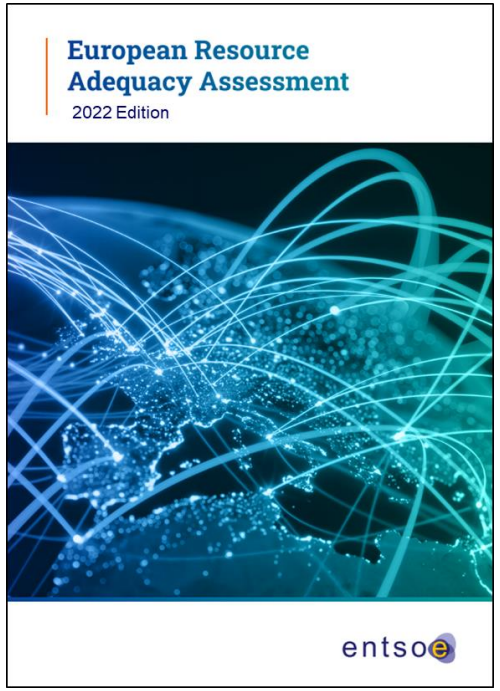
General approach:

- AFRY numbers (presented in the last WG Adequacy) and which report will also be submitted to the public consultation, will be taken into account. An aggregation per type of unit will be taken into account. 4000 running hours will be taken as basis for CCGTs although if the units would run more or less, this could be adapted.
- CAPEX of thermal units (including extension costs) of the last study **will be increased by around 25 %** based on the information provided by AFRY due to inflation, equipment & material costs but also labour costs:
- CAPEX of batteries will be the ones used now for the CRM auction parameters with inflation with different costs per year
- Wind onshore, offshore and PV will also be added with different costs per year
- For some technologies, an evolution in time will be foreseen (RES and storage)
- All costs of the study will be expressed in current Euros: **Euros of end of 2022.**

Other countries’ assumption

General aspects

- Starting point: European Resource Adequacy Assessment – Edition 2022 (ENTSO-E) – (*not yet published*)
- Complemented by latest policies/published studies*
- Discussion / Validation with neighboring TSO's



+

July 2021 European Commission

EC published
"Fit for 55" package

May 2022 European Commission

EC published
"REPowerEU"

+

National Studies

(Many) government announcements

*Note that new publication are still expected (public consultation for Bilan prévisionnel in November, new Monitoringsleveringzekerheid in January, …)

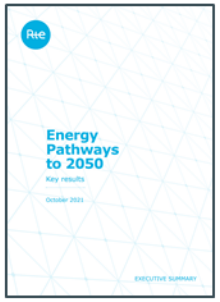
Global trend at European level

- Electricity demand
  - Many uncertainties regarding the demand in the short-run, explained by the current geopolitical context.
  - Significant increase of the demand in the mid and long-run (after 2025) due to additional electrification.
- Renewables
  - Significant increase of **solar** installed capacity for all time horizons.
  - Significant increase of **wind offshore** installed capacity, driven by high ambitions in Germany, United-Kingdom, Netherlands, Denmark or Norway.
  - Stagnation of investments in **onshore wind** due to public acceptance / land use.
- Dispatchable capacities
  - Coal phase-out with some delay in the short-run.
  - Maintain of nuclear generation if available in France and United-Kingdom.

Note that the trajectories presented are for **end of the year**.

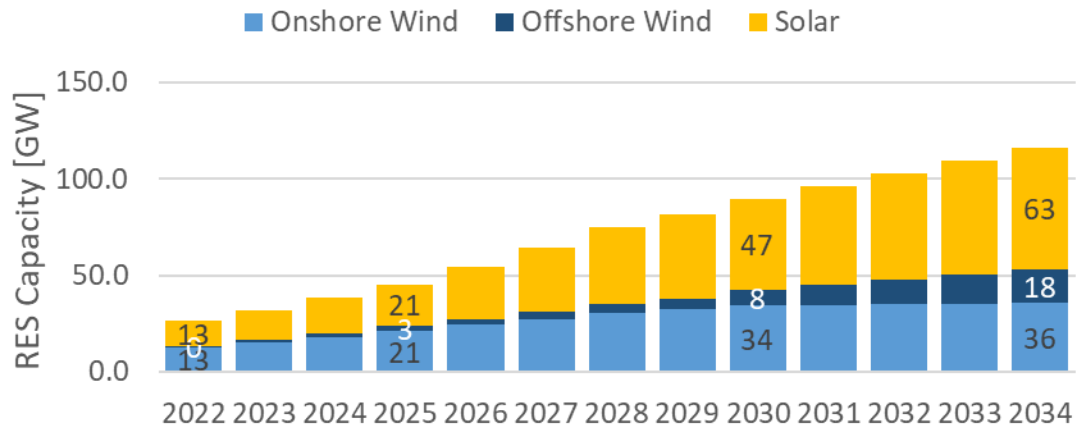
EU Assumptions - France

Sources

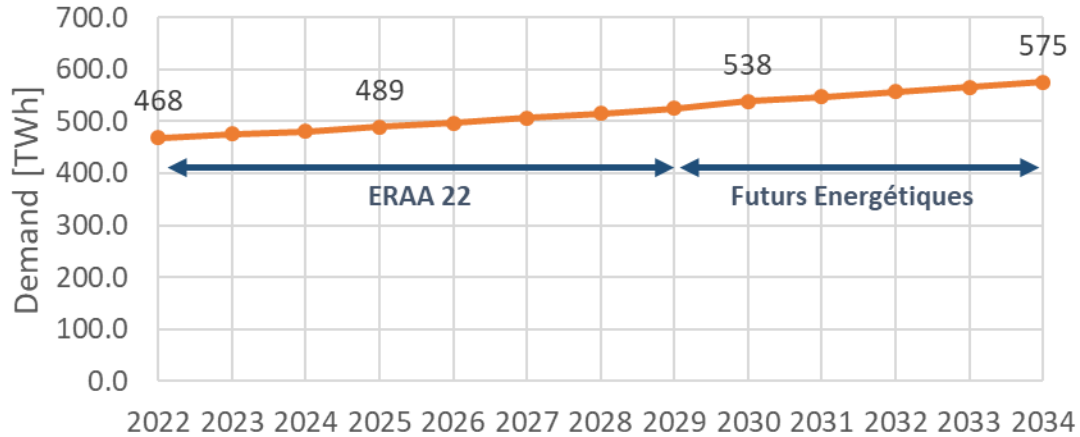


- ERAA 2022, Futurs Energétiques (October 2021)
- Public consultation for the next “Bilan Prévisionnel” foreseen in November 2022
- Macron’s announcement from February 2022 (lower investments in onshore wind* + nuclear extension**)

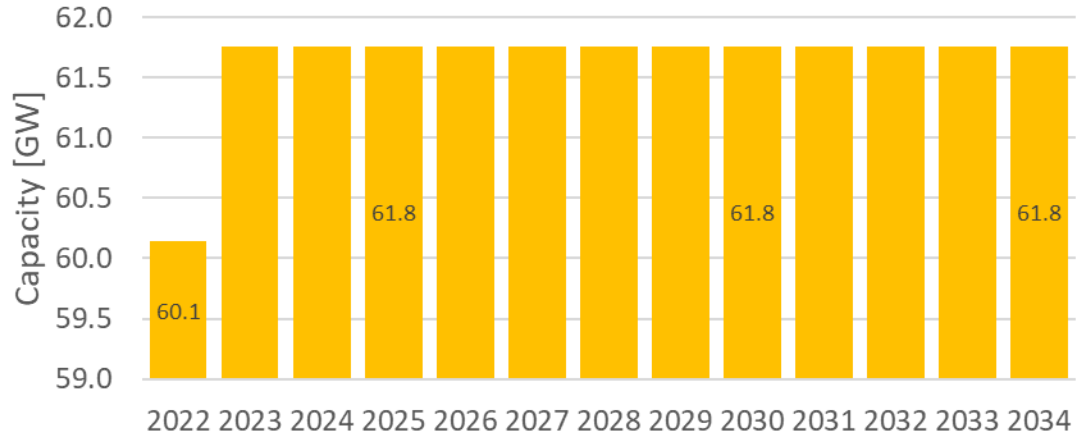
RES Capacity [GW]



Electricity demand [TWh]



Nuclear



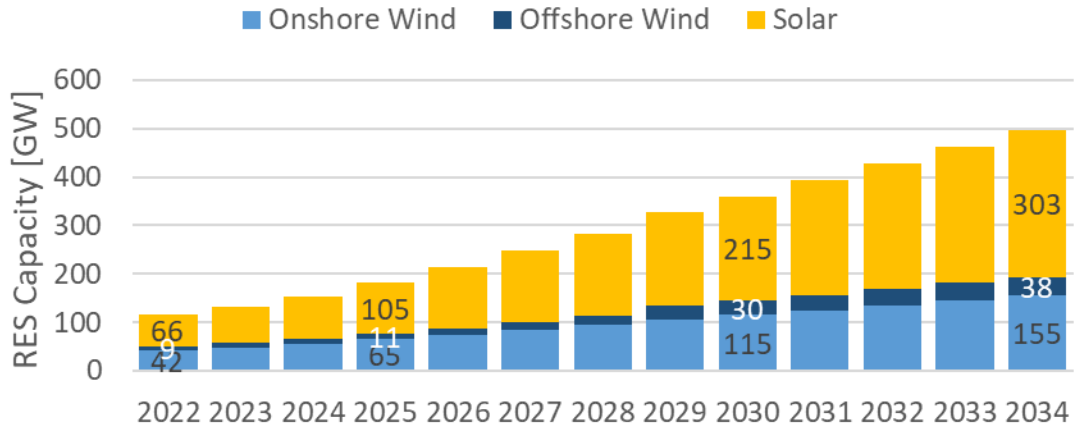
*reduction by a factor 2 of the onshore installed capacity from 2026 compared to ERAA22 (to be further aligned with latest RTE BP public consultation)
**to be further aligned with latest RTE BP public consultation

EU Assumptions - Germany

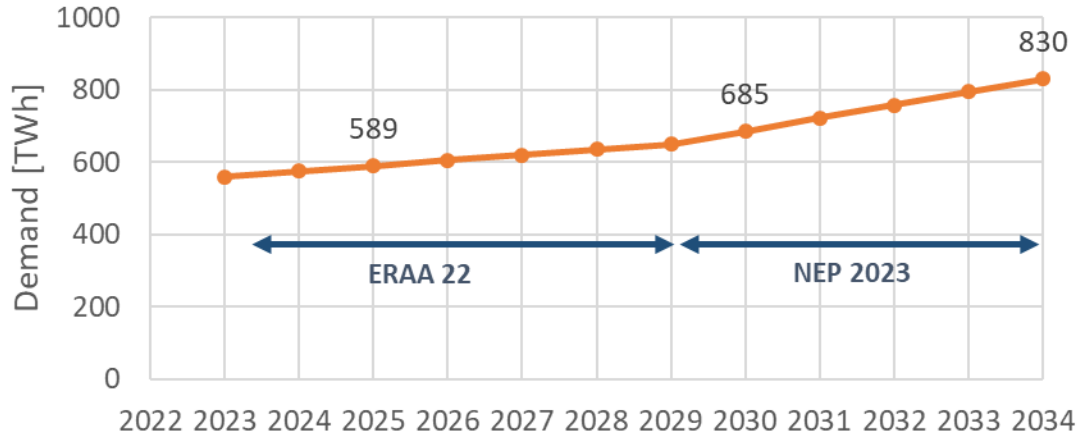
Sources

- ERAA22
- Easter package (April 2022)
- NEP 2023, scenario from 2037 (January 2022)

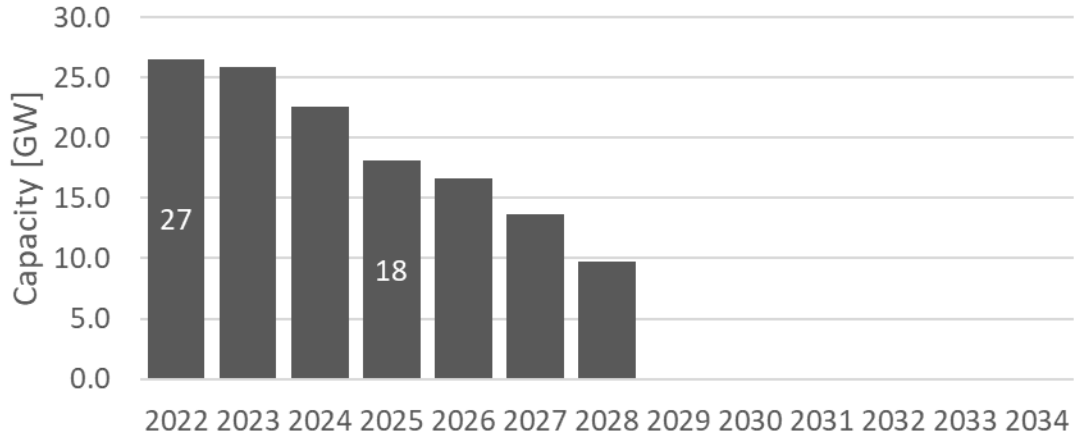
RES Capacity [GW]



Electricity demand [TWh]



Coal & lignite phase-out

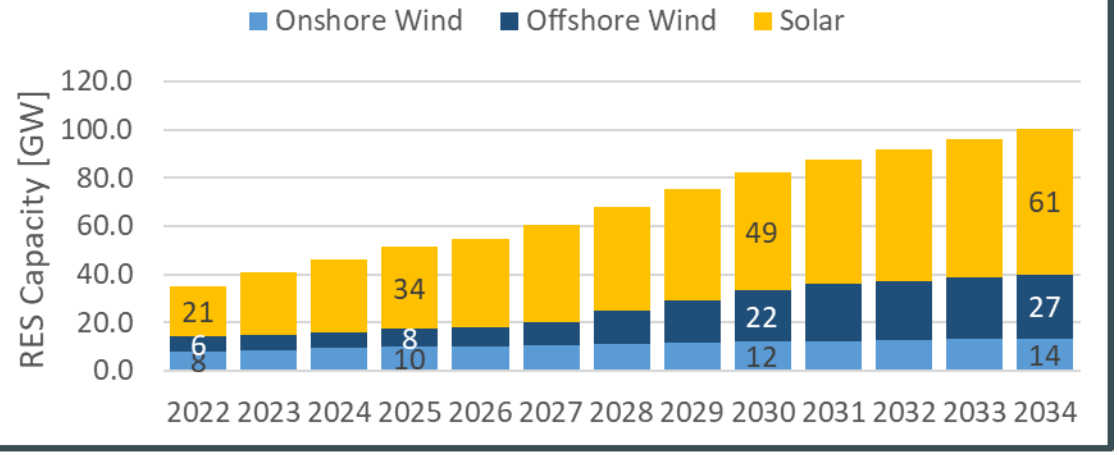


EU Assumptions - Netherlands

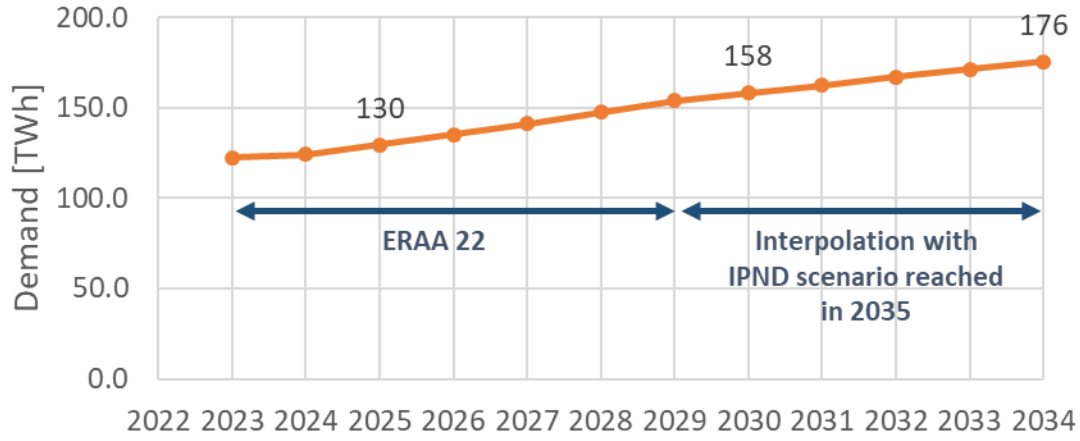
Sources

ERAA22
Monitoring leveringszekerheid (TenneT, 2021)
Monitor Zon-PV and Wind op Land 2022 in Nederland
Offshore government announcement (March, 2021)
Ontwikkelkader windenergie op zee (June 2022)

RES Capacity [GW]



Electricity demand [TWh]



Coal phase-out

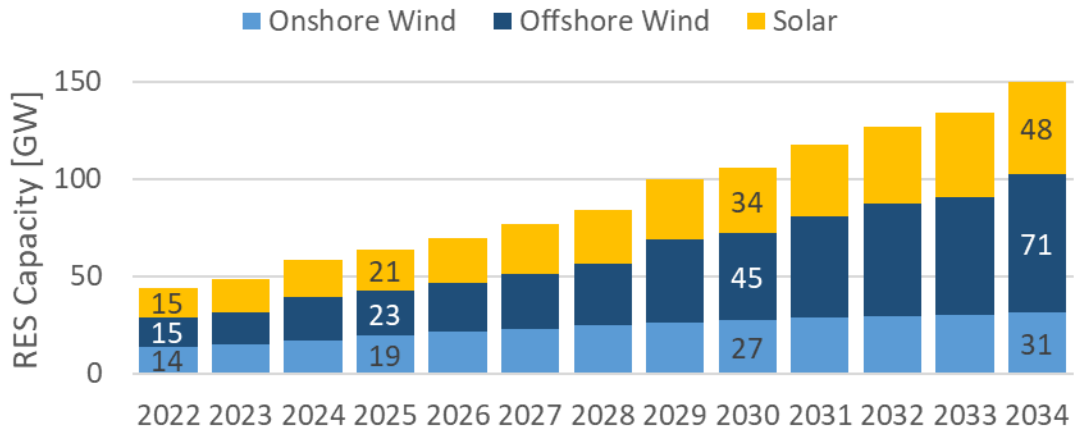
Refurbishment of existing coal units is considered (biomass, hydrogen)

EU Assumptions – United Kingdom

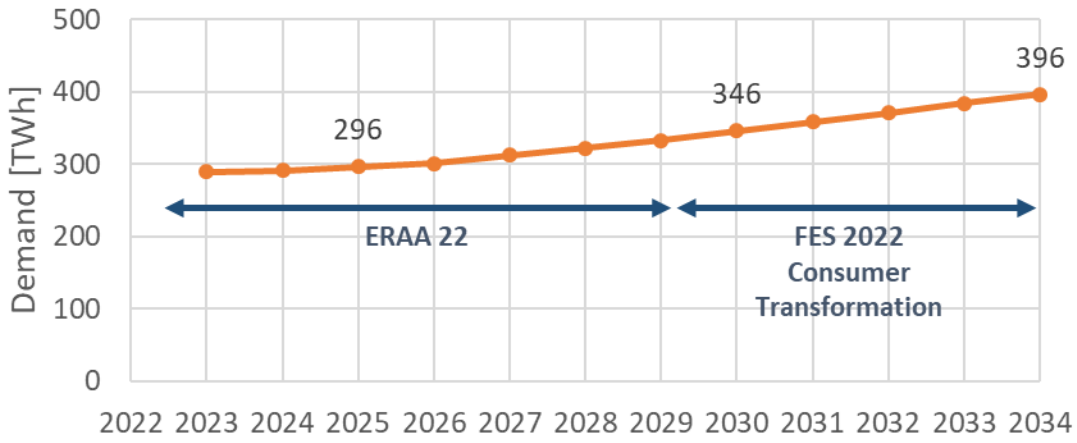
Sources

- ERAA22
- Future Energy Scenarios (July 2022)
- Unit-by-unit analysis for nuclear

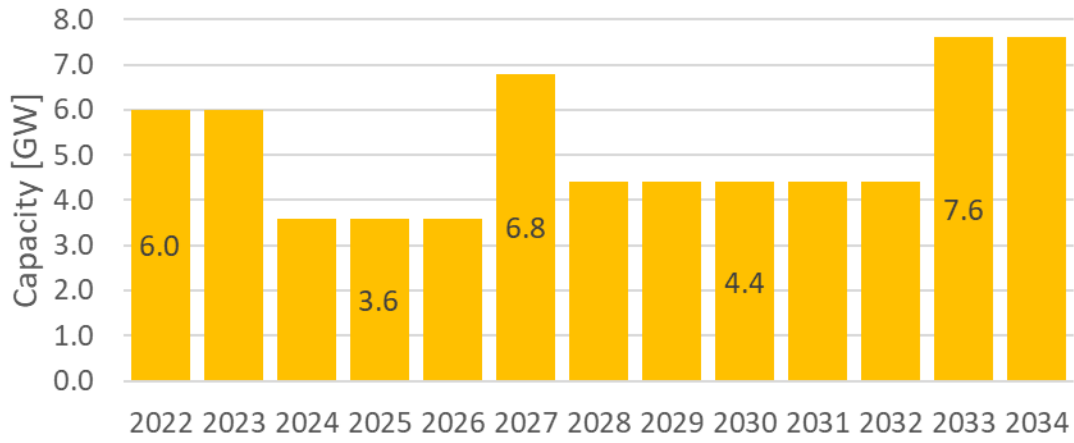
RES Capacity [GW]



Electricity demand [TWh]



Nuclear

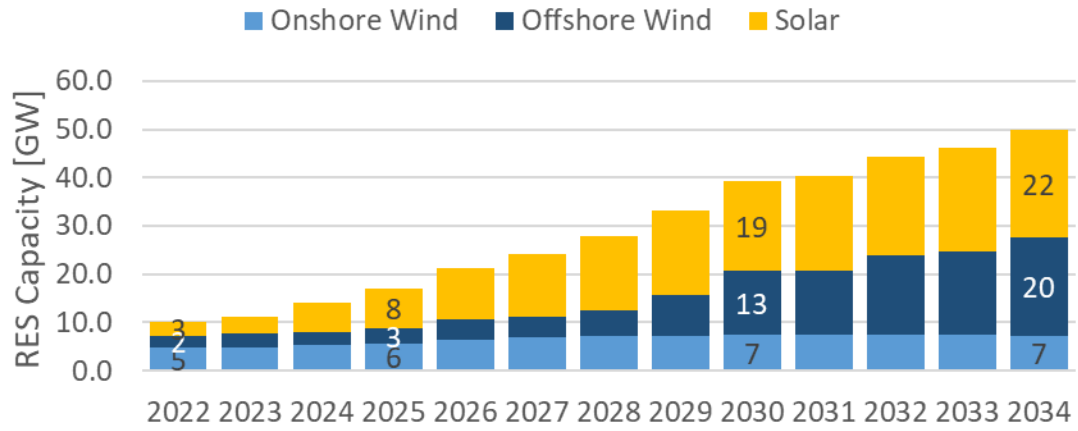


EU Assumptions – Denmark

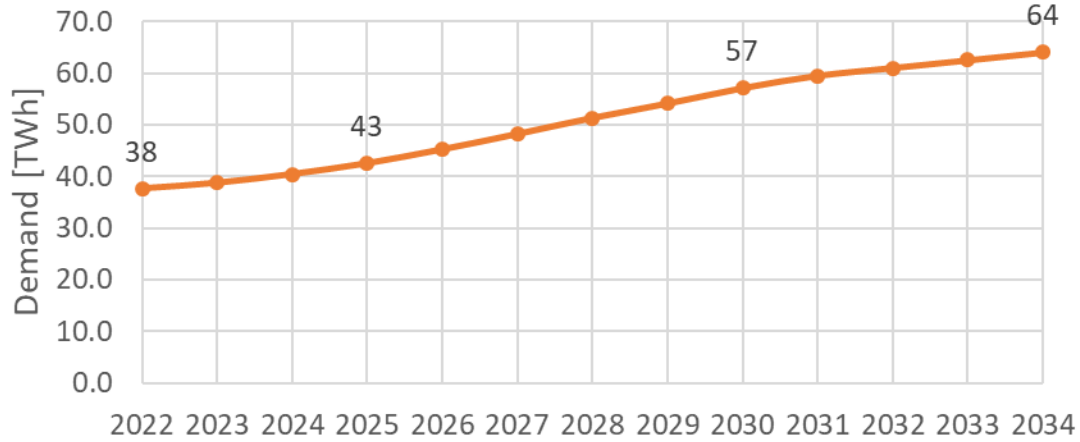
Sources

- Analyseforudsætninger til Energinet (23/09/2022)
- Energy Agency revisits cases of planned coal plant closures (01/10/2022)

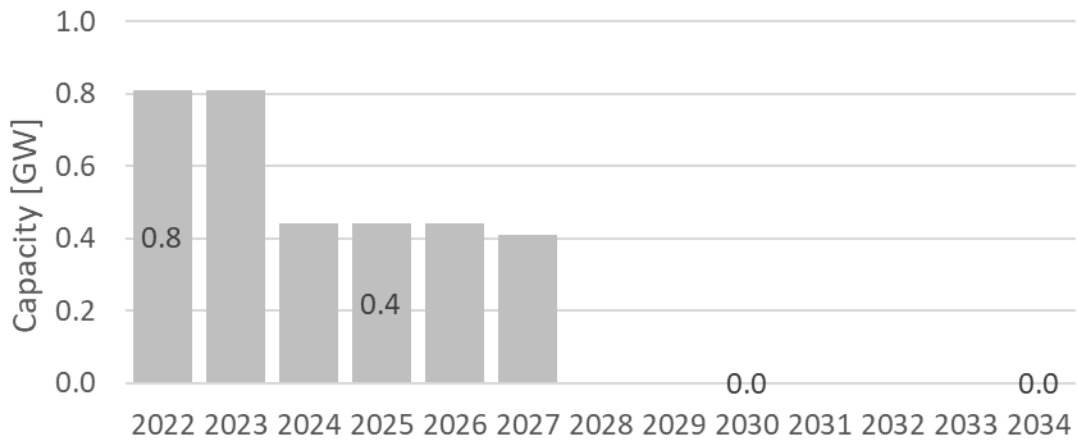
RES Capacity [GW]



Electricity demand [TWh]



Coal phase-out



Overview of documents available and submitted to public consultation linked to the scenario assumptions

Main consultation document

- Details the assumptions for each technology, sources used.

Excel file containing the scenario data

- Gives an overview of the data proposed for the scenario for Belgium and other countries

Study by N-SIDE on the outages rates

- Details the methodology and the calculations of the outage rate indicators

Study by DELTA on the end-user flexibility from residential and tertiary potential

- Details the methodology and the calculations of the end user flexibility proposed as well as associated profiles

Study by AFRY on the fixed operating & maintenance costs for existing units in Belgium

- Details the methodology and the calculations of FOM for existing units

Agenda

1. **Context of the Adequacy & Flexibility study (timeline, process, regulatory framework)**

2. **Methodology**

   - General description
   - Adequacy
   - Flexibility
   - Economic viability (incl. study by Prof. Boudt on the hurdle rates)

3. **Detailed scenario assumptions**

   - Study on residential and tertiary flexibility potential (DELTA-EE study): update and forecasts
   - Forced outages study (N-SIDE)
   - Generation, storage & demand for Belgium
   - Economic parameters (investments costs & fuel/CO2 prices)
   - Other countries

4. **LCT scenario parameters**

LCT (‘Low Carbon Tender’) 24-25

As part of the public consultation, the scenario and additional parameters needed for the LCT calibration are also provided

- The values for 2024 are corresponding to the values to be used in the context of the LCT (indeed those are corresponding to the values of the period 2024-25).
- The comments on those values (and other comments as part of the whole public consultation) will be handed over to the competent authorities to determine the scenario on which the LCT need and parameters will be quantified
- A short separate document collects the different data for the period 2024-25

In addition to the data presented today, the following aspects are also defined:

- preselected capacity types
- scenarios for post-delivery periods
- IPC technology list

Public consultation will start today

Documents submitted for consultation

- Document providing explanations on the input data
- Excel file with detailed input data
- **9** comprehensive methodology appendixes
- Separate document focusing on 2024-25 for the LCT

- AFRY study on fixed costs of existing units
- DELTA EE study on residential and tertiary future flexibility
- N-SIDE study on forced and planned thermal plant outages
- Prof. K. Boudt study on the WACC and the hurdle premiums

Public consultation on data & methodology: How ?

From 28/10 until 28/11/2022 6 PM

WHAT ?

- **Data:**
  - Any feedback is welcome on the proposed values for the CENTRAL scenario
- **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 is also part of the public consultation. Any comments or suggestions are welcome taking into account the existing regulation on adequacy studies
- **Specific data for the LCT:**
  - Additional parameters required in the framework of the LCT for winter 2024-25 are also provided

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

Any comments on the 4 above topics are more than welcome. This will help us make a valuable study for the stakeholders.

Next meetings

Foreseen timeslots for next meetings

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

Have a nice weekend !