Adequacy assessment for delivery year 2024-2025 executed in the framework of the assessment of the need to organise a Low Carbon Tender

12 April 2023

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1. Introduction

The Low Carbon Tender (hereinafter 'LCT') is a mechanism that is designed specifically to cover a possible need for new capacity for the delivery year 2024-25. Following the worse than expected issues with nuclear units in France, the Federal Government recently decided to consider the unavailability of 4 additional nuclear units in France (instead of 2) for the reference scenario to be used for the Y-4 CRM auction for 2027-28. Whilst the Adequacy & Flexibility study published in June 2021 (hereinafter 'AdeqFlex21') did not reveal a GAP for delivery year 2024-25 under the assumption of the unavailability of 2 additional nuclear units in France [FR-NUC2 sensitivity], it did result in a potential gap of 500 MW in case of the unavailability of 4 additional nuclear units [FR-NUC4 or EU-SAFE scenario].

Therefore, by letter of July 25, 2022, and within the framework of the Government's Winter Plan, Elia was requested to take the necessary preparatory steps to organize a one-off auction for new low carbon technologies for the delivery year of 2024-25. The actual organization of the auction was nevertheless conditioned to the confirmation of a gap volume in the framework of Elia's next Adequacy and Flexibility study (hereinafter 'AdeqFlex23'), of which the delivery year 2024-25 results would be, contrary to the results of all years (i.e. from 2024 until 2034), published half of April instead of end of June.

This prudent approach ensured that, in case a need for new capacity would be identified for delivery year 2024-25 on the basis of latest input data, a mechanism would be in place in a timely manner to ensure security of supply. For the subsequent delivery years (i.e. as from 2025-26 onwards), the CRM mechanism is put in place to this effect.

This document and its underlying calculations are based on the instruction from the Minister on the reference scenario to be considered for delivery year 2024-25 (following an opinion from CREG and FPS Economy), given by letter dated March 15, 2023. The goal of this document is to assess the level of the gap or margin for delivery year 2024-25, ahead of the publication of the AdeqFlex23 in June '23 that will consider also subsequent delivery years, as required by the electricity law. **It is important to remind the reader that the results for 2024-25 cannot be extrapolated for future years since we are dealing with a rapidly changing context and a given deliver year is not representative of the following delivery years, particularly in a context of accelerated energy transition reinforced by the consequences of the war in Ukraine.**

2. Context

As part of the long-term measures included in the Winter Plan introduced by the Federal Government on 15 July 2022, and as presented by the Cabinet during the Working Group Adequacy of 25 August 2022, the Minister of Energy instructed Elia to prepare a targeted tender for low carbon technologies as one of the measures to ensure security of supply in delivery year 2024-25.

In October 2022, Elia launched a public consultation on the design of the LCT[1] to lay out its principles. In January 2023, Elia launched a public consultation on the detailed Functioning Rules of the LCT[2]. The design of the LCT is aligned with the market-wide CRM principles as far as possible. Whereas both the LCT and the CRM are capacity mechanisms, the LCT differs from the market-wide CRM in terms of scope and purpose. Whilst the CRM is conceived as a market-wide mechanism, focused on existing and new capacities, the LCT is solely focused on new capacities (targeted tender) that would allow to bridge a potential adequacy gap, by incentivizing new capacities to join the market. In that sense, the decision to launch a LCT will be made based on the results contained in this report

At the instruction of the Minister of Energy, Elia provided a recommendation on the scenario and input data to be used in the context of the LCT gap analysis for delivery year 2024-25. The recommendation by Elia followed a public consultation on the parameters of the scenario to be used for the delivery year 2024-2025 in the LCT gap analysis. This public consultation was part of the wider public consultation on the methodology, scenarios, input data and sensitivities on the next Adequacy & Flexibility study 2023 held in November 2022[3]. The CREG made a proposal on the input data and scenario. Afterwards, the FPS Economy sent an advice on the input data and scenario to be used. Ultimately, on 15 March 2023 Elia received a letter from the Minister of Energy indicating the input data and scenario to be used in the gap analysis for delivery year 2024-25.

While the public consultation on the scenario and input data for the LCT gap analysis was conducted as part of the public consultation for the Adequacy and Flexibility study 2023 and the base scenario consulted by Elia is the same as the base scenario for delivery year 2024-25 from AdeqFlex23, the conclusions from this document should not be generalized to the entire 2023 study that will be published in June 2023. This document assesses 1 specific target year, and 1 specific scenario, as a result of the process described above, and results from a combination of the base scenario with specific sensitivities. AdeqFlex23 will provide a view on a ten-year time horizon, including multiple sensitivities.

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1 https://www.elia.be/en/public-consultation/20221014_public-consultation-on-the-low-carbon-tender-design-note

2 https://eliagroup.sharepoint.com/:w:/s/MD/SR/ESj5w7iqBHNFvDdSxtHPDScBZ8JIJR-WpqjgcTuWJsR0Zw

3 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 2022-2032 and including also the scenario parameters for the "Low Carbon Tender" 2024-25 (elia.be)

3. Scenario dataset

3.1. Process to determine the scenario

A reference scenario consisting of hypotheses of electricity demand, the production coming from different technologies, storage, demand response, import capacities and technical and economic parameters forms the necessary basis to assess whether there is a gap or margin for the delivery year 2024-25. Market parties need clear and specific parameters and their determination can therefore only be derived from one unique scenario which provides unambiguous results on both the need of the LCT and its parameters.

Given the importance of the choice of reference scenario and its direct link with the security of supply of Belgium, the scenario selection process in the LCT followed the same process as established in the context of the market-wide CRM. As such the reference scenario is selected by the Minister of Energy and is based on a proposition by the CREG, recommendations from the transmission system operator (Elia), comments received during the public consultation and the advice of the General Directorate of Energy. The remainder of this section provides a more detailed description of the different steps in the process.

3.2. Determination of the reference scenario

As a first step, Elia, in collaboration with the FPS Economy and in concertation with the CREG, selected a scenario and sensitivities for delivery year 2024-2025. This step was integrated into the process of the upcoming Adequacy and Flexibility study 2023. The selected base scenario is based on the latest European study published by ENTSO-E, being the « European Resource Adequacy Assessment 2022»[4] but taking into account the latest available information for Belgium and other countries.

Secondly, the scenario was put to public consultation from October 28, 2022 to November 28, 2022. This public consultation was part of the wider public consultation of the Adequacy & Flexibility 2023 study[5]. In addition to the comments on the data and methodology for the upcoming Adequacy and Flexibility study, Elia also requested stakeholders to provide their input on relevant sensitivities to be included in the LCT reference scenario. This public consultation consisted of an Excel document with all the hypotheses proposed for the 2024-25 delivery year and an explanatory note. The content of the public consultation was presented during the Working Group Adequacy of 28 October 2022, and the outcome of the public consultation during the Working Group Adequacy of 17 February 2023. The consultation report as well as non-confidential answers to the public consultation can be found on Elia's website[6].

[4] ERAA 2022 | ERAA 2022 by ENTSO-E (entsoe.eu)
[5] https://www.elia.be/en/public-consultation/20221028_public-consultation-adequacy-study-2022-2032
[6] https://www.elia.be/en/public-consultation/20221028_public-consultation-adequacy-study-2022-2032

Following the public consultation, Elia provided the public consultation report to the Minister of Energy, the FPS Economy, and the CREG on 20 January 2023.

Taking into account the comments received during the public consultation, the Working Group Adequacy and further checks with realized figures of 2022, Elia provided a recommendation on the reference scenario. The reference scenario recommended by Elia sent on January 31st2023 to CREG, FPS Economy and Minister of Energy, included 2 sensitivities with potential impact on the security of supply of Belgium. **Elia recommended** taking into account the following sensitivities:

- Higher demand in Belgium considering a 'rebound effect' of electricity demand for Belgium after the 'energy crisis' ('high demand sensitivity'). This resulted in 87.3 TWh in 2024;
- A lower availability of nuclear units than what is published on REMIT for France to match with the minimum generation forecasts of EDF for 2024 on a yearly basis. This resulted in 9 units to be considered as unavailable on top of the forecast in REMIT.

Subsequently, the **CREG elaborated a proposition** on the reference scenario as published on 16 February 2023 in study (F)2512 with the following comments (non-exhaustive list):

- to use the most recent updates abroad (Nuclear and coal in the Netherlands…);
- to update the capacity of Zandvliet Power to 419 MW;
- to use the historical forced outage of Doel 4 and Tihange 3 only;
- if only one scenario should be chosen, to take average EDF forecasts as basis for the nuclear generation in France; CREG finds the yearly spreading of nuclear unavailabilities as applied by Elia conservative;
- to use the base scenario electricity consumption for Belgium (84.5 TWh).

Based on this, the **FPS Economy published an advice** on the CREG proposed scenario recommending (non-exhaustive list):

- to take the 'base' consumption as basis for Belgium (84.5 TWh);
- to use the 2% as FOR for batteries and 20.5% for nuclear in Belgium;
- to use the updated installed capacities of other countries as sent by Elia on 1st of March 2023;
- 5 to 7 nuclear units in France as unavailable on top of the REMIT forecasted unavailability (based on the average EDF forecasted for 2024 (5 units) with a margin for uncertainties (7 units)).

Ultimately, **the scenario was selected by the Minister** of Energy on 15 March 2023. The Minister decided to mostly follow FPS's advice with the following 2 sensitivities:

- 7 nuclear units in France as unavailable (on top of REMIT forecasts);
- A consumption for Belgium of 85.9 TWh being the average between the 'base' and 'rebound' scenario.

The underlying data of the scenario as chosen by the Minister can be found in Appendix A.

4. Methodology used for the LCT need assessment

The goal of the LCT is to bridge a potential adequacy gap for the delivery year 2024-2025. In order to identify a potential adequacy gap or margin for the delivery year in question, the iterative process illustrated in FigureFigure is used. This process is the same as the one used in Adequacy and Flexibility studies or in strategic reserve volume evaluations. The goal is to find a margin or gap to meet the legal reliability standard of Belgium (being LOLE < 3 hours on average).

Starting from the base scenario as defined in appendix A, a full Monte Carlo simulation is performed and periods of structural shortage are identified. The methodology is fully in-line with the methodology applied in AdeqFlex23 and the requirements defined in the ERAA methodology.

Once the moments of structural shortage are identified for each 'Monte Carlo year', their distribution (quantified in hours) is established. On this basis, the LOLE indicator of the electrical system is evaluated and compared to the legal adequacy criterion (reliability standard of 3 hours).

If the adequacy criterion for Belgium is not satisfied, additional generation capacity (in steps of 100 MW), which is considered 100% available is added to the concerned market area in the simulations. The adequacy level of the new system obtained is again evaluated. This operation is repeated several times, adding a fixed capacity of 100 MW (100% available) each time, as long as the legal criterion for Belgium is not satisfied. On the other hand, if the simulation without any additional generation capacity complies with the adequacy criterion, the margin on the Belgian electricity system is examined through a similar approach.

The block size of 100 MW is chosen to be as small as possible, while still ensuring statistically robust results for the determination of the volume. Especially when searching for the tail of the distribution (e.g. LOLE criterion), this statistical robustness is a limiting factor. Choosing a smaller step size might have led to a calculation result that differed depending on the random seeding of the model [ELI-1]. The 100 MW block size is also the resolution used in the scope of the evaluation of strategic reserve volume and the other adequacy analyses performed by other TSOs and within ENTSO-E. Figure 1 illustrates the process followed.

The interested reader can find more information on the applied methodology in paragraph 4.2.4 of the Adequacy & Flexibility study of 2021.

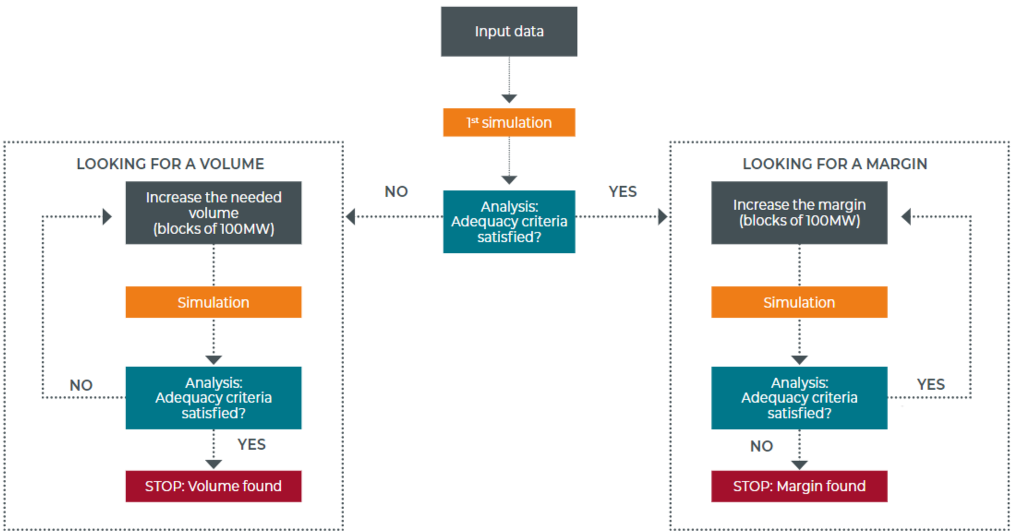

Figure 1: iterative approach used to determine the gap/margin on the system

5. Results and interpretation

As explained in Chapter 4, a margin (i.e. no identified need for new capacities) or gap (i.e. an identified need for new capacities) is calculated for the LCT scenario for delivery year 2024-25. The LOLE average for delivery year 2024-25 for the LCT scenario is 2.6 hours which is below the criterion defined by law (3 hours). The resulting margin found is 100 MW. Hence, there is no need identified for additional capacities to ensure security of supply in delivery year 2024-25.
As illustrated in Figure 2, the 100 MW **margin** identified for the LCT reference scenario differs from the potential gap of 500 MW which was identified in the EU-SAFE (FR-NUC4) scenario for delivery year 2024-2025 in the Adequacy & Flexibility study of 2021.
There are 5 main elements which explain the difference between the two assessments which are detailed in the paragraphs below. Indeed the previous assessment of the delivery year 2024-2025 was performed in June 2021 in the Adequacy & Flexibility study of 2021 (AdeqFlex21). Since then, several evolutions have taken place which are impacting the results.

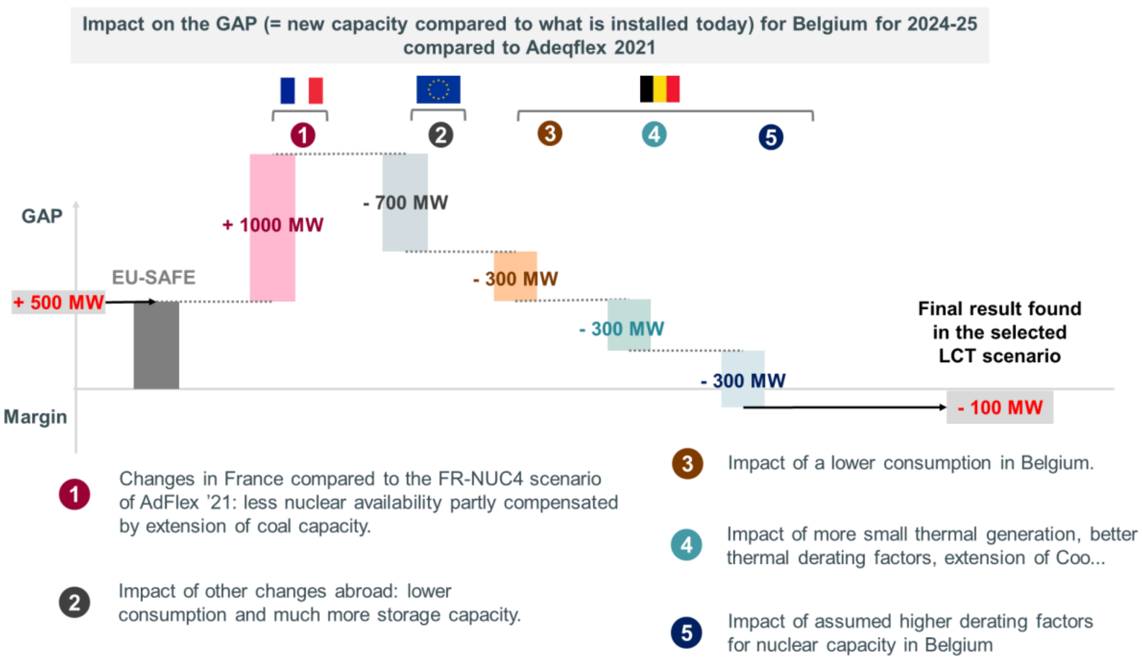

Figure 2: effects explaining the difference in volume estimation between the LCT scenario and AdeqFlex21

This difference in volume estimation is attributable to 5 main differences between the 2 scenarios which are illustrated on figureFigure . Each of these are further detailed in the following paragraphs.

1 Impact of the availability of French generation [+1000 MW]

The 500MW gap observed in AdeqFlex21 for the 2024-2025 delivery year was under the EU-SAFE (FR-NUC4) scenario, which took into account an additional unavailability of 4 French nuclear units on top of the REMIT announcements.

In the meantime, the expected nuclear availability has further decreased following the additional checks and repairs after the discovery of stress corrosion on some reactor pipes.

In the LCT, following the Minister's decision and as proposed by the FPS Economy, the availability of French nuclear units is calculated based on the expected generation during winter. For the average forecast of EDF, this corresponds to 5 units unavailable on top of current REMIT forecasts. The sensitivity included in the LCT reference scenario consists of an additional 7 unavailable nuclear units in France on top of what is reported in REMIT for the period 2024-25 (also corresponding to the low end of EDF forecasts for 2024 following FPS Economy approach).

The difference in availability of French nuclear capacities in the EU-SAFE scenario of AdeqFlex21, the LCT reference scenario and the historical observed nuclear availability for winter 2022-23 is illustrated in Figure 3. As visible on the figure there is a significant decrease in French nuclear availability in the LCT reference scenario compared to the EU-SAFE scenario taken into account in AdeqFlex21.

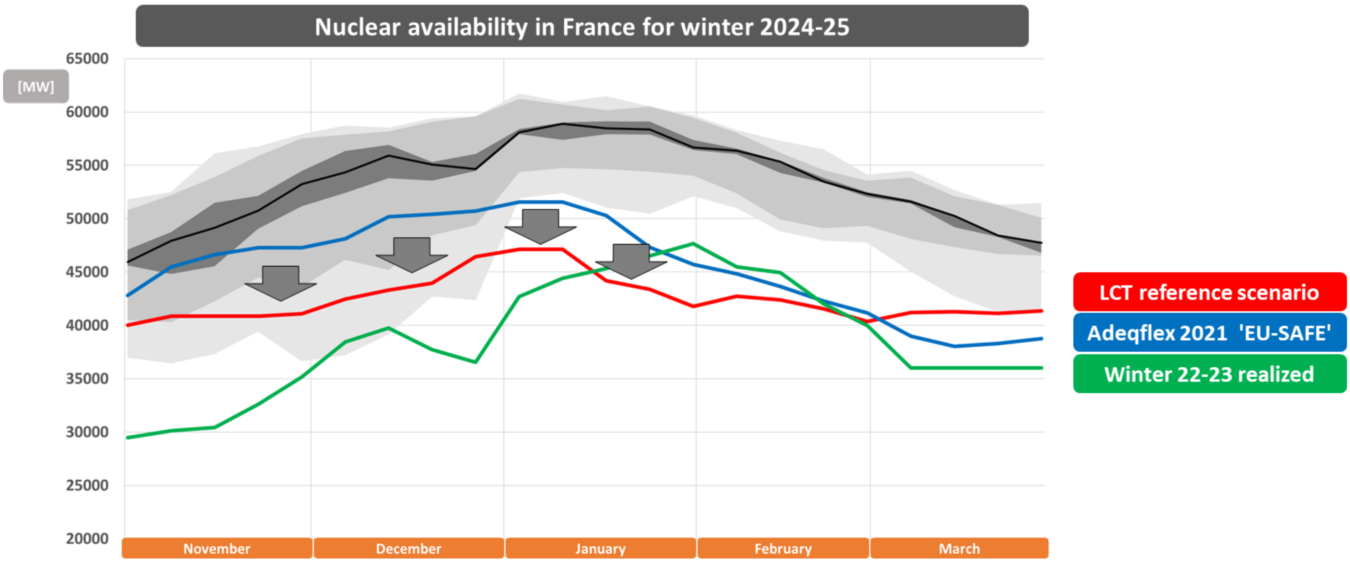

Figure 3: Nuclear availability in France

In addition, other changes in France mitigate the impact of a lower nuclear availability, such as the decision not to close all coal units, contrary to what was foreseen earlier (and hence assumed in AdeqFlex21)[7]. This effect allows to mitigate part of the impact of a worse nuclear availability in France. The total impact on the Belgian requirements for additional capacity is about **+1000 MW**.

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[7] Décret n° 2022-1233 du 14 septembre 2022 modifiant le plafond d'émission de gaz à effet de serre pour les installations de production d'électricité à partir de combustibles fossiles pris en application de l'article 36 de la loi n° 2022-1158 du 16 août 2022 portant mesures d'urgence pour la protection du pouvoir d'achat - Légifrance (legifrance.gouv.fr)

2 Impact of other countries [- 700 MW]

This paragraph discusses the differences between the LCT and AdeqFlex21 scenarios for other countries. In the context of this document, the other countries which are analyzed are the Netherlands, Germany, Great Britain, France, Poland, Spain, Italy and Denmark.
There is an **increase in the capacities of the energy limited technologies**, namely batteries and DSR installed in other countries in the LCT scenario compared to the AdeqFlex21 scenario. The combined expected installed capacity of DSR and batteries increased by more than 20 GW for the listed countries above. For instance in Germany there is a large amount of new storage capacities already installed today[8], with a large amount installed in 2022. In Great Britain, a large amount of capacities are being developed in the framework of the CRM[9].
These are technologies that gained a lot of attention in recent years and this is observable in both the currently installed and forecasted capacities for these technologies. The more than 20 GW increase in capacity of energy-limited technologies abroad reduces the gap in Belgium.

Another noticeable difference between the AdeqFlex21 scenario and the LCT scenario concerning other countries is an **increase in the capacities for renewable energy sources**, the result of higher than expected uptake of these technologies across Europe. Especially for solar capacity, there is almost a doubling of the installed capacity expected for end-2024. This increase of renewable energy generation across Europe slightly reduces the gap in Belgium.

Thermal generation in other countries remains **stable or is slightly higher** in the LCT scenario for delivery year 2024-25 compared to AdeqFlex21. The nuclear capacity remains constant and there is a slight decrease in coal capacity following the phase-out plans in Germany, compensated by some additional gas capacities in Germany and the UK.

Finally there is a **slight decrease in the forecasted total electricity demand** for other countries as visible in Figure 4. This decrease in demand can be attributed to the impact of the energy crisis which has led to a demand reduction across Europe. This event was not foreseen in AdeqFlex21 and is expected to still have an impact in 2024.

[8] (PDF) The development of battery storage systems in Germany: A market review (status 2023) (researchgate.net)

[9] UK energy storage deployments grew by record 800MWh in 2022 (energy-storage.news)

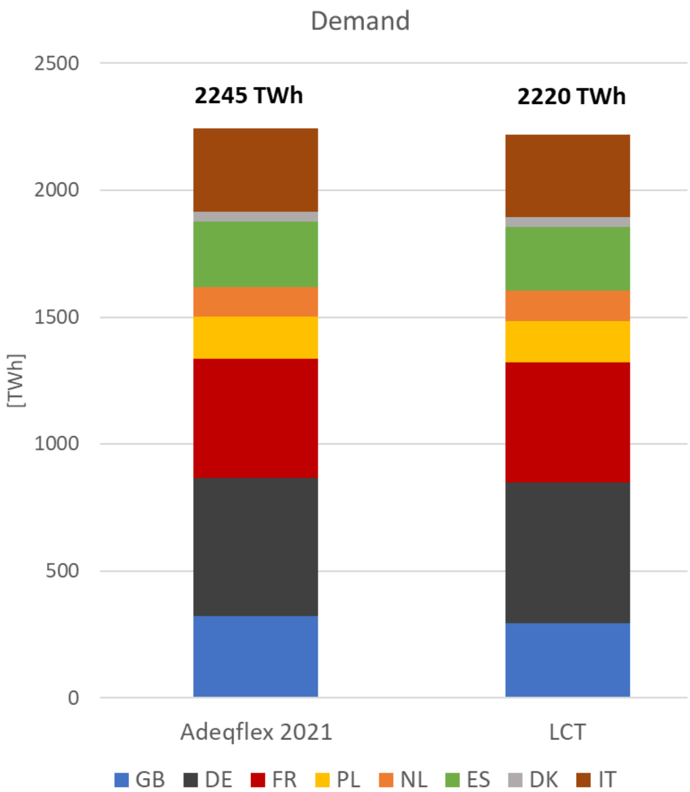

Figure 4: Overview of the total demand for other countries

The combined impact of the changes for other countries on the capacity necessary for Belgium is estimated to be about **-700 MW**.

The effects observed in our neighboring countries allow to partially compensate the impact of the lower availability of the French nuclear fleet. The total cross-border contribution is lowered by 300 MW (+1000 (impact of France) –700 MW (impact of other countries) compared to the previous AdeqFlex21 EU-SAFE scenario for 2024-25.

3 Impact of lower consumption in Belgium [- 300 MW]

In terms of electricity consumption for Belgium, the difference between the LCT scenario and the AdeqFlex21 Central scenario for delivery year 2024-25 is illustrated in the figure 5 below.

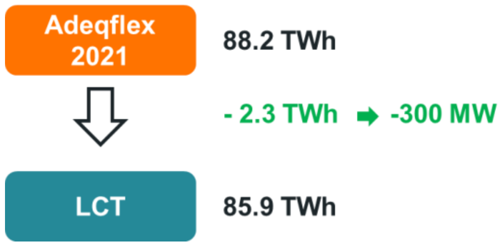

Figure 5: Difference between AdeqFlex21 and LCT scenarios for the Belgian electricity demand

The electricity demand for Belgium in the LCT scenario is 85.9 TWh, whilst the AdeqFlex21 estimated demand in 2024-25 to be 88.2TWh. The 2.3 TWh lower demand in the LCT scenario corresponds to a decrease in necessary capacity of about **300 MW**. It is important to note that the load reduction compared to the previous Adequacy & Flexibility study is temporary, as in the subsequent years load increases as a result of decarbonisation efforts will outweigh the (temporary) load reduction impact of the Ukraine crisis (and related high gas prices). Indeed load evolutions for 2025-26 onwards are estimated to be higher in the AdeqFlex23 reference scenario compared to the AdeqFlex21 scenario, as a result of the accelerated decarbonisation efforts (in Belgium and abroad) of society.

4 Changes in generation capacity [- 300 MW]

There have been many small changes concerning the available generation, storage and demand side response capacities in Belgium which together result in **300 MW** less 100% available capacity needed. A major difference between AdeqFlex21 and the LCT scenario are the forced outage rates as illustrated in Table 1. In AdeqFlex21 the forced outage rates were calculated based on historical data on outages from 2011 to 2020 of Belgian units only. After several discussions and comments of stakeholders, a study was requested in order to update and improve the calculations of the forced outage rates used in adequacy and flexibility assessments. The study performed by N-Side in the course of 2022 was based on historical data from Belgium combined with other countries from 2015 to 2021. The study was part of the public consultation of the AdeqFlex23 and presented to stakeholders in October 2022.

The study can be found on Elia's website[10]. The new forced outage rates (which are applied also for this LCT assessment) are generally lower than in AdeqFlex 2021. This is especially true for CCGT's, OCGT's and CHP's, which represent a significant amount of capacity in Belgium, and for which an increased contribution to adequacy in Belgium is therefore expected.

	AdeqFlex 2021	**LCT**
CCGT	8,4%	5,5%
OCGT	9,2%	8,2%
TJ	3,6%	9,8%
Waste	1,0%	6,4%
CHP	7,0%	6,4%
Pumped storage	4,5%	2,9%
Batteries	0%	2,0%

Table 1: Overview of forced outage rates

As illustrated in Figure 6, there is also an increase of the capacity of profiled thermal capacities in Belgium, especially for CHP's and biomass. These are units that are too small to model individually and are modelled as profiles.

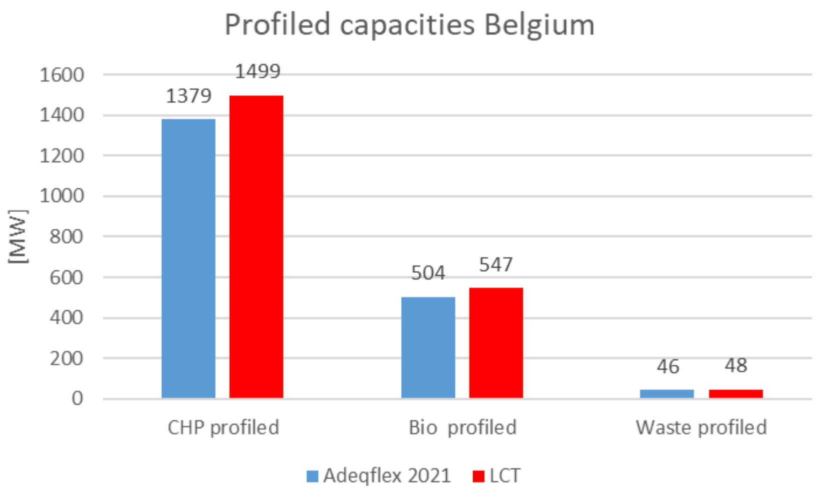

Figure 6: Profiled capacities in Belgium (small scale generation)

In addition, the extension of the pumped storage capacity of Coo to 1278 MW was taken into account (which was not the case yet in AdeqFlex 2021). As visible on Figure 7, a lower installed capacity of large-scale batteries was compensated by an increase in the capacity of small-scale batteries.

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[10] https://www.elia.be/-/media/project/elia/elia-site/public-consultations/2022/20221028_nside_study-on-the-outages-on-generation-units-and-dc-links.pdf

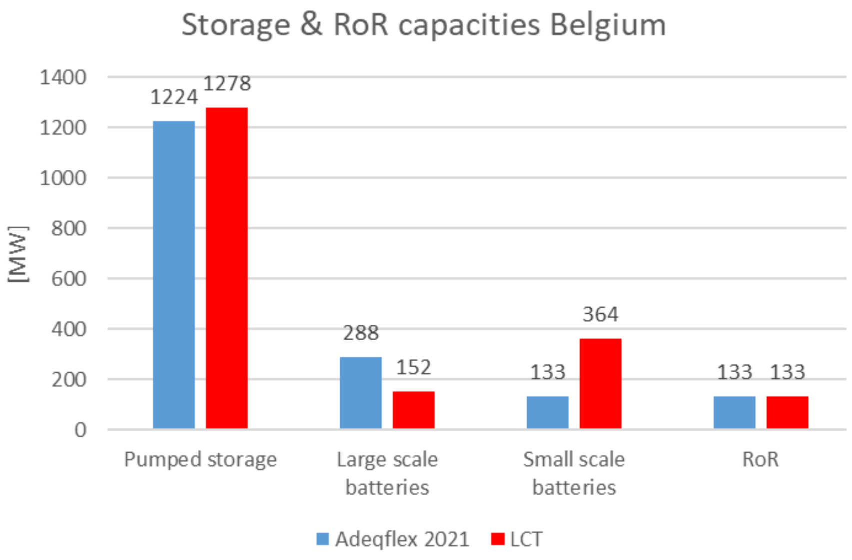

Figure 7: Storage & Run of River [RoR] capacities in Belgium

The installed capacities of wind onshore, wind offshore and solar are higher in the LCT scenario but this has only a marginal effect on the required volume given their more limited contribution to adequacy (see Figure 8).

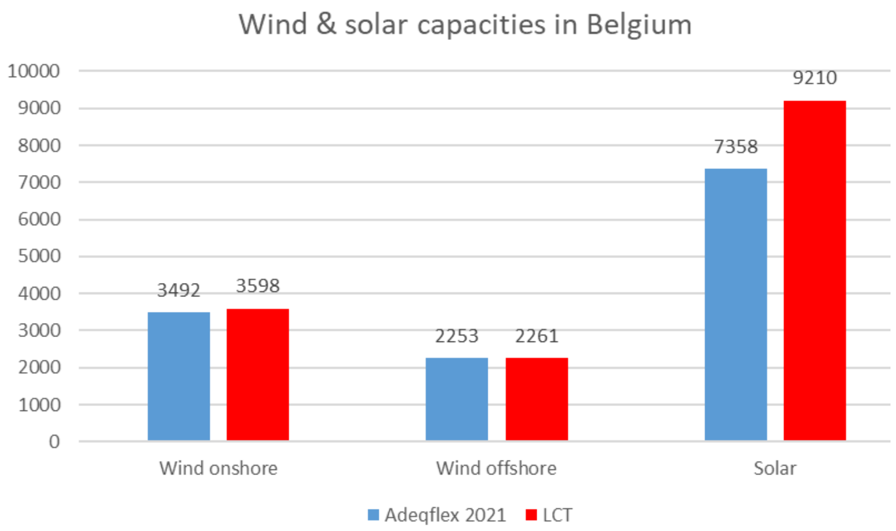

Figure 8: wind & solar capacities in Belgium

Ultimately, there have been changes to the individually modelled thermal units considered between the LCT reference scenario and AdeqFlex 2021. These are:

- Removal of Turbojet Volta;
- Removal of Seraing ST;
- Repowering of Zandvliet Power;
- Repowering of Saint-Ghislain.

The combined impact of all the differences in the scenario for Belgium is estimated at around **-300MW**.

5 Impact of nuclear forced outage rate in Belgium [- 300 MW]

In AdeqFlex21, long-lasting forced outages on nuclear units were taken into account by removing 1 GW or about 25% of nuclear generation capacity across the entire year. In addition a technical forced outage rate of 3.6% was also taken into account. This approach is described in section 3.3.2. of AdeqFlex21[11].

In the reference scenario chosen for the LCT, a technical forced outage rate of 4% and a long-lasting forced outage rate of 16.5% were taken into account. Such combined forced outage rate is similar to the one that was defined by the Minister for nuclear capacities in the Y-4 CRM auctions for 2026-27 and 2027-28.

This results in a total forced outage rate for nuclear units in AdeqFlex21 of about 28.6% versus 20.5% in the reference scenario chosen for the LCT. This difference in outage rates results in about **300 MW** additional capacity required in the LCT scenario and an equivalent reduction of the gap.

6. Impact for future years cannot be concluded from this assessment

The results found in this report cannot be extrapolated for future years. It is not because the capacity need for 2024-2025 has changed compared to AdeqFlex21 that this change will be similar for other years. Indeed, the winter 2024-2025 is completely different from subsequent winters. For example, some effects explaining the decrease in the need are only valid for 2024 and cannot be applied to other winters. The impact of nuclear deratings in Belgium for instance is not applicable to winter 2025-26 since there were no nuclear capacities foreseen for that winter in AdeqFlex21. In addition, the Belgian and European consumption is expected to recover as from 2025 and further increase due to the electrification of heat, transport and industry. The situation abroad will also change with the start or continuation of coal phase outs in several countries[12].

The next Adequacy and Flexibility study to be published in June 2023 will assess the situation in detail for the next 10 winters, in compliance with the ERAA methodology and in compliance with the legal requirements in terms of collaboration and concertation (CREG, Federal Planning Bureau, FPS Economy). A public consultation was held in November 2022 on the methodology, scenarios and sensitivities.

[11] https://www.elia.be/-/media/project/elia/shared/documents/elia-group/publications/studies-and-reports/20210701_adequacy-flexibility-study-2021_nl_v2.pdf

[12] https://www.reuters.com/business/energy/germanys-cabinet-approves-accelerated-coal-exit-by-2030-western-state-2022-11-02/

7. Conclusion

A 100 MW margin was identified for the LCT selected scenario for delivery year 2024-2025. This means that no need for additional capacities was identified for Belgium to ensure Security of Supply under the selected LCT reference scenario for delivery year 2024-2025. The elements put forward in this document are specific for the LCT with delivery year 2024-2025 and should not be generalized to the Adequacy & Flexibility study which will be published in June 2023.

Appendix A: Overview of key parameters of the scenario

1. Renewables & non-cipu

Technology	Net Generation Capacity [MW]
Wind onshore	3598
Wind offshore	2261
Photovoltaics	9210
Hydro RoR	133
Gas CHP - non-CIPU	1499
Turbines	982
Motors	517
Biomass - non-CIPU	547
Waste - non-CIPU	48

2. Storage

Pumped-storage facilities:

Turbining capacity at the end of the mentioned year	**Total capacity**	**1278**
	Coo 1-6	1134
	Platte Taille 1-4	144

Reservoir volume at the end of the mentioned year [MWh]	**Available storage for economic dispatch**	**5800**
	Storage reservoir	6300
	Storage reservoir derating (black-start services)	500

Large scale batteries:

Total potential capacity [MW]		**377**
Capacity [MW]	In service capacity	152
	Additional potential if economically viable	225
Total potential volume [MWh]		**1306**
Volume [MWh]	Existing volume	406
	Additional potential if economically viable	900

Small scale batteries:

Total potential capacity [MW]	364
Total potential volume [MWh]	728

3. Forced outage rates

Category	Number of FO per year	Average FO rate [%]	Average duration of FO rate [hours]
Nuclear	1.3	20.5%	199 hours [around 8 days]
CCGT	9.4	5.5%	110 hours [around 5 days]
OCGT	9.2	8.2%	221 hours [around 9 days]
TJ	3.2	9.8%	130 hours [around 5 days]
CHP, waste, biomass	2.9	6.4%	111 hours [around 5 days]
Pumped Storage	5.8	2.9%	46 hours [around 1 day]
Batteries	/	2.0%*	/
DC links	1.9	6.7%	158 hours [around 7 days]

* Regarding batteries, the forced outage rate is considered in the models by applying a derating factor on the installed capacity

4. Demand

Electrification of the transport sector	Units (thousands)
Passenger cars – BEV	240
Passenger cars - PHEV	360
LDV freight (Vans)	21
HDV freight (Trucks)	0.1
Buses	1.8

Electrification from the heating sector	Total amount of heat pump units (thousands)
Residential	743
Tertiary	58

Additional electrification in industry & data centers	TWh
Industry	0.6
Data centers	0.7

Total electricity demand	85.9 TWh

5. Balancing need

	Volume [MW]
Total FCR	97
Total FRR	1093
Total reserve capacity	1190

6. Economic parameters

Market Index	Value
Gas TTF [€/MWh]	48
Gas NBP [€/MWh]	58.6
Coal ARA [€/MWh]	19.6
Oil [€/MWh]	38.7
CO2 EUA [€/tCO2]	103.7
CO2 UKA [€/tCO2]	108.3

7. Other countries

		France	Germany	Netherlands	United Kingdom	Spain	Italy	Poland	Denmark
Demand (calendar year 2024)	TWh	473	554	120	293	251	325	165	39
Wind Onshore	GW	24	69	9	18	34	13	11	5
Wind Offshore	GW	2	10	6	21	0	2	0	3
Solar	GW	22	88	29	19	29	37	17	6
Hard coal & Lignite	GW	1,1	27,6	2,7	0	0,5	0,5	21	0,4
Nuclear	GW	62.9*	0	0,5	3,6	7,1	0	0	0
Gas	GW	7,2	30,7	12,8	39	24,5	43,5	3,7	2

** assumption that the EPR in Flamanville has a partial availability end of 2024 and is stopped beginning of 2025*

In France, an additional 7 nuclear units of 900 MW are considered unavailable on top of what is reported in REMIT beginning of 2023.