Mid-term Adequacy Forecast Appendix 3

COUNTRY COMMENTS

2019 EDITION

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Note: All country comments were prepared by the TSOs on a voluntary basis. This appendix aims to present national insights linked to the present MAF, especially with regards to input assumptions.

Contents

1 Belgium 3
2 Finland 4
3 France 5
4 Germany 6
5 Great Britain 7
6 Ireland 7
7 Italy 8
8 Northern Ireland 9
9 Poland 10
10 Portugal 10
11 Switzerland 11
12 Slovakia 11

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1 Belgium

1.1 Overview of national adequacy reports

Elia, beyond its active involvement in the ENTSO-E MAF report and the regional PLEF GAA study, publishes, in accordance with the Belgian Electricity Law, an adequacy assessment covering the three forthcoming winters every year. Furthermore, also in accordance with this law, every second year, Elia publishes an assessment investigating the level of adequacy and the flexibility needs for Belgium for up to 10 years ahead.

Elia is committed to ensuring a high level of consistency between the above-mentioned assessments and MAF via developing and applying a common probabilistic methodology and ensuring complementarity of the results obtained between the different studies.

The latest report, 'Adequacy Study for Belgium: Need of strategic reserve capacity for the next winters: Edition - Winters 2019-20, 2020-21 and 2021-22' [SR19-20], was published in December 2018. This study evaluated the need for strategic reserve capacity, as defined by Belgian law, and was based on a forecast of production and demand in Belgium and 20 other countries. The conclusions of this study were updated twice in Summer 2019 at the request of the Belgian Minister of Energy and took into account the most recent evolutions in the electricity market. The yearly update of this study will be published in December 2019 and will cover winters 2020-21, 2021-22 and 2022-23 [1].

Furthermore, the latest 'Adequacy and flexibility study for Belgium 2020-2030' was published by Elia in June 2019 [2]. This study analysed the level of adequacy for the coming 10 years and includes the impact that the planned nuclear phase-out will have on adequacy. From 2025 onwards, i.e., once the nuclear phase-out is complete, the study identifies a structural need for new capacity of up to 3.9 GW. This need includes about 1.5 GW to deal with uncertainties in terms of the short-run availability of generation or interconnection capacity in other countries, both of which are beyond Belgium's control.

1.2 Assumptions used in the MAF are in line with national reports (for the corresponding time horizons)

For the 2021 and 2025 time horizons tackled in the MAF, the assumptions for Belgium are in line with the recent 2019 study [2]. Those preserve all existing gas units for both time horizons. RES assumptions are based on the 'Draft National Energy and Climate Plan' submitted by Belgium at the end of December 2018. The DSR and storage capacities are based on the 'Belgian Energy Pact' assumptions agreed upon by different Belgian authorities in 2018. For 2025, no nuclear capacity is assumed in Belgium, in accordance with the planned nuclear phase-out.

1.3 Comments on the 2021 results

For 2021, nuclear assumptions include an assumed unavailability of one-third of the nuclear fleet, which is the result of an analysis of the observed nuclear availability in recent winters. For a country such as Belgium, which nowadays relies greatly on nuclear capacity, it is key to include a realistic unavailability estimate based on past experience with outages of long duration at these plants due to specific overhauls which highlights the impact these events have on the country's adequacy. This assumption is also in line with the 'high impact – low probability' storyline used in studies [1] and [2].

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For the Base-Case scenario in 2021, the MAF 2019 NTC results show an average LOLE of close to 1 hour, which is below than the current adequacy criteria for Belgium of LOLE ≤ 3. Furthermore, a Flow-Based sensitivity was performed in MAF 2019 for 2021. The method applied is in line with the implementation approach followed in the latest SR19-20 and PLEF study and includes a 20% minimum Remaining Available Margin (MinRAM20%). The results for Belgium under this sensitivity provide values of LOLE around the adequacy criteria, with an average LOLE ~ 3 (see Flow-Based sensitivity results in Chapter 3 of Appendix 1: "Detailed Results, Sensitivities and Input Data"). The FB approach provides a more accurate representation of what is observed daily within the CWE region. Furthermore, the use of Flow-Based methods is the target for future evolutions of the MAF methodology within the new requirements of the Clean Energy Package (CEP) Regulation.

1.4 Comments on the 2025 results

On top of the above developments, 2.5 GW new-built capacity is considered for 2025 (on top of assumed developments in DSR, storage and RES). This 2.5 GW capacity was identified in [2] as the new-built capacity needed to meet the reliability criteria in the 'CENTRAL/EU-BASE' scenario for 2025 (which corresponds to the MAF scenario). It should be stressed that, as demonstrated in [2] and other studies, there is no guarantee that such investments in new capacity would materialise in the future without a market-wide CRM mechanism.

For the Base-Case 2025 scenario, the MAF 2019 NTC results show an average LOLE of ~1.6, which is below the adequacy criteria for Belgium of LOLE ≤ 3. The MAF 2019 results for 2025, notwithstanding the differences between the NTC and FB approaches used in MAF 2019 and [2], respectively, for 2025, confirm that 2.5 GW new-built capacity should allow Belgium to meet its reliability criteria in the 'CENTRAL/EU-BASE' scenario used for 2025.

[1] SR20-21, link: https://www.elia.be/en/electricity-market-and-system/adequacy/strategic-reserves.
[2] AdFlex19, link: https://www.elia.be/en/electricity-market-and-system/adequacy/adequacy-studies.

2 Finland

We can see improved quality of results related to data, methodology and level of detail when comparing the results from this MAF edition to MAF 2018. Naturally, there is also evolution in generation capacity since different years were studied in the previous report. MAF 2018 targeted the year 2020 while in the current edition 2021 is studied instead.

The main differences in input data between the two target years, i.e., 2020 for MAF 2018 and 2021 for MAF 2019, are presented below:

- Increase in total wind power capacity from 2.0 GW to 3.0 GW;
- Improved availability of the new nuclear unit Olkiluoto 3 assuming that during second year of operation the availability will be improved from its first year in operation;
- Increased demand side response;
- Increased level of detail in plant-by-plant maintenance and forced outage modeling which improves the flexibility of the total system;
- The results do not take the availability of system reserves in Finland into account, which means that LOLE and EENS in this report do not mean curtailment of demand for Finnish end-consumers. LOLE and EENS should be considered as hours and energy when system reserves are needed to cover the demand in Finland

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3 France

3.1 The National Energy and Climate Plan (NECP)

Since 2015, a new legal framework known as “loi de transition énergétique pour la croissance verte” with its planification documents “stratégie nationale bas-carbone” and “programmation pluriannuelle de l’énergie” has been established to provide a roadmap for the energy field in the next years. In early 2019, the National Energy and Climate Plan (NECP), elaborated in these two documents, has been officially updated through a draft version.

Related links:
https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031044385&categorieLien=id
https://www.ecologique-solidaire.gouv.fr/programmations-pluriannuelles-lenergie-ppe

3.2 Load and annual demand forecast provided for 2021 and 2025

Over the past several years, RTE has observed a stabilization of electricity demand in France, due mainly to moderate economic growth and energy efficiency measures, in compliance with the ambitions of the French NECP. These efficiency measures will be further developed in the coming years; hence, the electricity demand is likely to remain stable in spite of sustained demographic growth, a recovery in economic activity and the development of items using electricity (transport, hydrogen, heating and so forth) with reduced CO_2 emissions.

3.3 Net generating capacity forecast provided for 2021 and 2025

The targets of the French NECP are reached within the central scenario of the MAF. The paramount evolutions for the French energy mix are :

- Accelerated development of RES (wind and solar capacities are multiplied by more than three in the next ten years);
- Coal phase-out complete by the end of 2022;
- No commissioning of new gas units, except OCGT Landivisiau in 2021;
- Two nuclear units in Fessenheim will be shut down in mid-2020;
- Commissioning of the new Flamanville power plant in 2023[1];
- Decrease in the nuclear power fleet forecasted after 2025 in order to reduce the nuclear share in electricity production to 50% by 2035.

3.4 National view on the Generation and System Adequacy forecast and its relation to the MAF results

RTE produces an annual risk assessment through its national generation adequacy report with a time horizon of five years. The MAF results seem to be in line globally with national elements, even though the

[1] Due to technical issues, the producer EDF has announced that the power plant will not be commissioned before the end of 2022. The assumption for the MAF is thus based on a commissioning in 2023.

LOLE is slightly higher in the MAF[2]. Indeed, for the time horizon 2021, the MAF highlights an average LOLE of 4.1 hours, even though the last French national adequacy study did not point out security of supply issues for this time horizon.

The discrepancies between the analyses result mainly from the fact that they do not use the same climate database. While the database used in the French study models 200 potential forecasting climatic years with a full correlation between load, solar and wind conditions, the database used for the different studies at ENTSO-E (Seasonal Outlook, MAF, TYNDP) is based on 35 historical climatic years. Among these 35 scenarios, the cold wave of 1985 is the most critical event regarding adequacy issues in France. Thus, approximately three-quarters of the LOLE in France in the MAF result from the single climatic year 1985. Within 35 historical climatic years, this outlier can have a predominant weight, which is distributed more smoothly in the French dataset of 200 forecasting climate scenarios.

The nuclear availability in France is also taken into account differently in both resource adequacy assessments. The availability patterns for nuclear plants are determined through a fully probabilistic process in the MAF, whereas the French generation adequacy study combines a deterministic approach for the ten-year inspections (information shared via the official transparency channels - REMIT) with a probabilistic approach for the other outages. Hence, the impact of this methodological discrepancy depends on the target year since the declared unavailability planning is not constant throughout the years.

In addition, the Flow-Based approach, which is studied through a sensitivity in the MAF, is modelled for the central scenario in the French national study.

Lastly, the data collection for the French generating fleet does not occur at the same time, leading to potential discrepancies based on the latest information.

As a consequence, the results of the MAF adequacy study for France must be treated cautiously and read jointly with the French national generation adequacy study, which is published every year (known as “Bilan prévisionnel”).

Related links:
https://www.rte-france.com/sites/default/files/synthese-bilan-_previsionnel-2018.pdf
https://www.rte-france.com/sites/default/files/bp2018_variantes.pdf
https://www.rte-france.com/sites/default/files/bp2018_analyses_complementaires_vf.pdf

4 Germany

The MAF 2019 foresees no critical adequacy issues for Germany in 2021 and 2025, neither in Base-Case nor in the Low-Carbon sensitivity. LOLE values are expected to be below 1h/year which is in line with the national reliability target (LOLE < 5h) as defined by the German Authority in the national adequacy report (BMWi Monitoringbericht zur Versorgungssicherheit [1]). The MAF 2019 takes an increasingly important role in the assessment of the future generation adequacy considering recent political as well as economic developments (Shut-down of conventional units to meet national CO2 targets, non-profitability of units etc.).
It should be noted that LOLE and EENS results represent average values over a large number of synthetic Monte Carlo years. Even if a LOLE of 1 h/year can be achieved, the Loss of Load Duration (LLD) in a significant number of Monte Carlo years is actually above this value. Therefore, more critical results, such as the P95 value, are important metrics to consider besides the LOLE and EENS. A detailed analysis of

[2] Since the last French adequacy report covered up to 2023, only 2021 is analyzed in both assessments.

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these critical situations would be an improvement for future MAF studies, in order to have an understanding of possible climate conditions and outage occurrences that hamper the generation adequacy. In the German Adequacy report (Leistungsbilanzbericht2) of the 4 German TSOs, the remaining capacity is assessed for a worst-case situation, i.e. a simultaneous occurrence of low wind feed-in during peak demand at night-time. Besides a probabilistic assessment, an overall adequacy assessment should analyse this kind of situations in more detail.
Further challenges that should be accounted for, in future MAF studies, are as follows:

- Consideration of Common-Mode events which could be observed in recent years (e.g. low water level in Germany in the river Rhein in Summer 2018 which resulted in limited availability of coal units; nuclear unavailability due to missing operation licenses)
- Uncertainties and risks for the power system resulting from the climate change should be analysed and assessed

[1] https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/monitoringbericht-versorgungssicherheit-2019.html
[2] https://www.netztransparenz.de/Weitere-Veroeffentlichungen/Leistungsbilanzbericht

5 Great Britain

The assumptions for Great Britain are based on the scenarios published in Future Energy Scenarios 2018. Assumptions for 2021 were based on the Base-Case scenario published in the 2018 Electricity Capacity Report [1], while the assumptions for 2025 were based on the Steady Progression scenario published in Future Energy Scenarios 2018 [2].

The results of the MAF indicate that no adequacy issues are expected in Great Britain in the next few years, which is consistent with recent experience in Great Britain, where the LOLE for Winter 2019-2020 is expected to be below 0.1 hours per year, based on National Grid ESO's analysis in its Winter Outlook report [2].

The adequacy analysis for GB also indicates a low LOLE for 2025. Note that the highest peak used in this study is 59877 MW. A LOLE nearer to 3 hours would be expected for an ACS peak demand of 60500 MW, as in the Steady Progression in FES 2018 report. These results further support the way in which the capacity market in Great Britain continues to ensure that the country will remain within the reliability standard of 3 hours LOLE set by the government.

The electricity system in Great Britain is undergoing significant change to meet decarbonisation targets, as highlighted in the third allocation round for Contracts for Difference, which will deliver further growth in offshore wind. In addition, National Grid ESO has the ambition to be able to operate the electricity system with zero carbon by 2025. The capacity market is expected to continue to deliver security of supply in Great Britain during this period, as older coal and nuclear stations are scheduled to close in the early 2020s.

[1] https://www.emrdeliverybody.com/Lists/Latest News/Attachments/189/Electricity Capacity%20Report 2018_Final.pdf
[2] http://fes.nationalgrid.com/fes-document/fes-archives/

6 Ireland

The new Integrated Single Electricity Market has been running successfully in Ireland and Northern Ireland since October 2018, meaning that this electricity market is now compliant with the European Target Model.

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Thus, we are benefitting from better price coupling and more efficient cross-border transfers with our European neighbours.

Our Capacity Market continues to deliver sufficient capacity to ensure we have an adequate system. This is reflected in the low values of LOLE (Loss of Load Expectation) that are the outcomes of the Base-Case adequacy simulations for MAF 2019 in 2021 and 2025. This broadly agrees with the adequacy analysis in the All-Island Generation Capacity Statement 2019-28 (published by EirGrid in September 2019, and with slightly different assumptions than in the MAF19).

Given the challenge the Clean Energy Package poses, Ireland expects the closure of some high-carbon generation plants. These closures are explored in the Low-Carbon Scenario in the MAF 2019, where 1.1 GW of high-carbon plant is removed from the 2025 model –resulting in significant increases in LOLE, which rises from 2 hours in the Base-Case scenario for 2025 to 56 hours in the Low-Carbon scenario. However, it is assumed that any proposed removal of plant will be reflected in our Capacity Market Auctions, which should result in Low-Carbon capacity solutions. Such solutions could be a combination of new generation and/ or interconnections.

7 Italy

The generation fleet in Italy is changing significantly due to the growth of renewable sources (mainly PV and wind) and the reduction in thermal capacity (15 GW of traditional generation have been already lost in last 6 years and another 3 GW are currently unavailable). This combination implies potential adequacy issues.

One of the most recent Terna analyses, the National Adequacy Report[3], highlights, for the next five to ten years, a worsening of adequacy figures due to the progressive coal phase out, driven by the NECP, and additional decommissioning of other technologies that are no longer economically viable (e.g., oil-fired plants).

In particular, the coal phase out is not reflected in the MAF 2019 Base-Case scenario due to the scheduling of the ENTSO-E process, which required the hypothesis to be frozen at the beginning of 2019, while a more specific coal decommissioning plan was only defined later this year. The MAF 2019 Low-Carbon sensitivity scenario presented in Appendix 1 is much closer to the NECP scenario.

One additional aspect not fully highlighted in MAF report is the impact of import availability on the adequacy of Italian transmission system, especially for North market area. In case of import scarcity conditions (e.g. related to a global/regional deficit of available power generation) the north of Italy is strongly dependent, in order to guarantee adequacy, to the available generation, including the thermal technology currently interested by a progressive reduction.

Terna is committed to ensuring a high level of consistency between the European and national assessments by developing and applying common methodology and scenarios; nevertheless, in order to have a complete overview of adequacy forecasting in Italy, it is necessary to complement the MAF 2019 analysis with the National Adequacy Report 2019.

The main purpose of the latter document (published on August 8th 2019) is to assess the thermal generation needed in order to guarantee the adequacy of the Italian electric system while taking into consideration the

[3] https://download.terna.it/terna/Rapporto%20Adeguatezza%20Italia%202019_8d71cb7ff32ad37.pdf

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most recent information available in the NECP, especially that concerning the forecasts for demand and generation, and a more conservative approach related to the import availability.

Indeed, the scenario considered in National Adequacy Report is based, for the 2025 time horizon, on a lower (about 325 TWh) demand value (higher energy efficiency impact) but also a much lower value of thermal generation capacity (about 49 GW) in the absence of strategic actions.

Based on these hypotheses, the value of LOLE in the National Adequacy Report increases to up to 30 h/year (ten times higher than the target of 3 h/year as defined recently by national law[4]), which is comparable to the figure identified in Low-Carbon sensitivity scenario described in MAF 2019 (24 h/year for the whole Italian perimeter, including islands).
In order to keep the value of LOLE below 3 h/year, the National Adequacy Report concludes that a threshold of about 54 GW of conventional generation will be necessary (jointly with 3 GW of additional storage capacity).

To ensure the above-mentioned installed capacity by 2025, the electrical system needs new production units to replace those units which are expected to be decommissioned (primarily coal-fired). In order to ensure the timely deployment of new capacity and to maintain existing capacity at full efficiency, strategic actions are needed, which include the necessity of providing producers with the long-term price signals. These signals will be delivered by the Italian capacity market, which will see its first auctions in November 2019 for capacity to be delivered in 2022 and 2023.

8 Northern Ireland

The new Integrated Single Electricity Market has been running successfully in Northern Ireland and Ireland since October 2018, meaning that this electricity market is now compliant with the European Target Model. Thus, Northern Ireland is benefitting from better price coupling and more efficient cross-border transfers with its European neighbours.

Northern Ireland's capacity market continues to deliver sufficient capacity to ensure an adequate system, as reflected in the low values of LOLE projected in the Base-Case adequacy simulations in MAF 2019 for 2021 and 2025.

The closure of some coal plant in Northern Ireland is assumed to occur by 2024. Even so, the MAF 2019 Base-Case study for 2025 shows Northern Ireland to be adequate, with a LOLE value of less than 1 hour – assuming the availability of the second North-South Interconnector between Ireland and Northern Ireland. This LOLE value is in contrast with the Generation Capacity Statement 2019-28, which shows small deficits in the Northern Ireland study for 2025 but does ***not*** assume the availability of the second North-South Interconnector with Ireland.

In the Low-Carbon scenario in MAF 2019, 1.1 GW of high-carbon plant is removed from Ireland in 2025, which results in the LOLE for Northern Ireland increasing to 5 hours – this value exceeds the standard for Northern Ireland of 4.9 hours. However, the capacity market is expected to react to any potential adequacy issue by encouraging new capacity to meet this challenge. This new capacity could be a combination of new generation and/ or interconnections.

[4] https://www.mise.gov.it/images/stories/normativa/dm_disciplina_capacita_28062019.pdf

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9 Poland

The capacity market was implemented in Poland in early 2018 and, prior to 2019, the first three auctions were carried out for power delivery in years 2021, 2022 and 2023. As visible in the results, in the analysed year, 2021, the capacity marked successfully reduced the adequacy threat in Poland identified, for example, by the MAF 2017 mothballing sensitivity scenario [5]. The average LOLE value for 2021 does not exceed the target of 3 h/year and amounts to 1.35 h/year.

The Base-Case scenario results for 2025 rely on producers' data and were provided to ENTSO-E in spring 2019. At that time, the final regulations regarding CO_2 emissions were not known; therefore, the information provided assumed continuous support coming from the capacity market.
Data for the Low-Carbon sensitivity scenario were collected by ENTSO-E in September 2019, which was after CEP entered into force (in July 2019). Hence, the finally-agreed-upon CO_2 limitations will probably exclude existing coal units from participation in the capacity market from July 2025 onwards. Based on power plants owners' declarations, this sensitivity scenario indicated that 4.85 GW of coal generation would not be viable in the energy-only market and would be decommissioned/mothballed, resulting in an average LOLE of 27.5 h/year in the Low-Carbon scenario.

10 Portugal

The inputs to MAF 2019 concerning the future development of the Portuguese electricity system correspond to the best estimates that result from long-term forecasts performed in 2018 for the national adequacy report that was published by the Portuguese Directorate-General for Energy and Geology[6]. It should be noted that MAF 2019 does not take into account further updates that were introduced by the Portuguese NECP in 2019.

The electricity demand in Portugal provided for 2021 and 2025 is based on national "central" growth estimations with efficiency measures, as defined in the revised "National Energy Efficiency Action Plan". The projected number of additional electric vehicles is estimated according to the "National Renewable Energy Action Plan". No Load Management is assumed.

The MAF expected scenario of generating capacity for 2021 and 2025 is based on national energy policy drivers defined by the Portuguese government (as foreseen in 2018).

Concerning the NTC between Portugal and Spain, a total import capacity of 4200 MW (from Spain) is assumed in MAF for both 2021 and 2025, already taking into account an expected interconnection in the north of Portugal. However, it should be noted that this reinforcement project is delayed due to social and environmental problems, pointing to commissioning date in late 2021, which is already considered in TYNDP 2018. Moreover, given the purpose of MAF and the expected lower/upper limits of NTC after the interconnection reinforcements (3600/4200 MW from Spain to Portugal), a more conservative approach with a lower value for NTC could be adopted instead.

Nonetheless, the suggested reduction in NTC contributions to security of supply should have had no impact in MAF outputs for the Base-Case scenario. In fact, the results from the national assessment of security of supply are consistent with MAF 2019 indicators, confirming that LOLE and ENS indicators are nearly zero,

[5] MAF 2017, page 22: https://www.entsoe.eu/Documents/SDC%20documents/MAF/MAF_2017_report_for_consultation.pdf
[6] National Adequacy Report of Portugal, http://www.dgeg.pt?cr=17180

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even when the contribution from neighbouring systems (Spain) is limited to 10% of NTC (according to national adequacy criteria).

In the Low-Carbon sensitivity analysis for 2025, assuming a reduced generation capacity of 1756 MW due to the decommissioning of existing coal power plants (which is consistent with the current Portuguese NEPC), the Portuguese generation system is expected to comply with national reliability standards, due mainly to the commissioning of new hydro capacity, along with maintaining all other base-load generation capacities (CCGT).

11 Switzerland

The findings of the MAF 2019 Base-Case scenarios for the time horizons 2021 and 2025 are consistent with the corresponding national studies for Switzerland commissioned by the Federal Office of Energy and the national regulatory authority ElCom, published in October 2017, December 2017 and in May 2018, respectively. No adequacy issues have been detected for the Base-Case scenarios in these studies. The national studies commissioned by ElCom are based on the MAF 2017 methodology. Additionally, several stress scenarios (as defined by ElCom) were performed, taking into account supply shortages due to technical failure on a regional scale. Furthermore, import limitations have been introduced to address network security issues arising from the non-participation of Switzerland in FBMC. Such limitations should be considered in future calculations.

12 Slovakia

The MAF document, as a study which deals with the adequacy assessment of the ENTSO-E countries (and some non-ENTSO-E countries too), has been developing for a few years now. It is important to note that the current MAF 2019 has significant changes compared to the previous ones. The changes consist mainly of methodological improvements and increases in input data granularity. It is evident the both factors have made a positive impact on the final outcomes in terms of precision, but they have also increased the quality and quantity requirements for the data.

From the EENS and LOLE points of view, the MAF 2019 outcomes are no different from those of MAF 2018 for Slovakia.

In comparison to the 2021 scenario, two coal-fired power plants (NGC = 401.76 MW) were decommissioned in the 2025 Base-Case scenario. The decommissioning of these power plants did not affect the EENS and LOLE values and is in line with the National Development Plan to decrease generation from fossil fuels and also with the decarbonisation goals for Slovakia.

The Low-Carbon sensitivity scenario basically has the same source structure as the 2025 Base-Case scenario. Of course, others fossil-fired power plants are operated in Slovakia as well; however, these plants are CHP and industrial power plants. With regards to the Slovak national decarbonisation targets, which are in line with NECP for Slovakia, the fossil fuels used in these plants should probably by replaced by new fuels types such as, e.g., biomass or natural gas until 2030.

A significant contribution to fulfilling the decarbonisation targets in Slovakia is made by the new nuclear power plant, Mochovce (NGC = 942 MW), which will also make a significant contribution to the positive generation adequacy in Slovakia.

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