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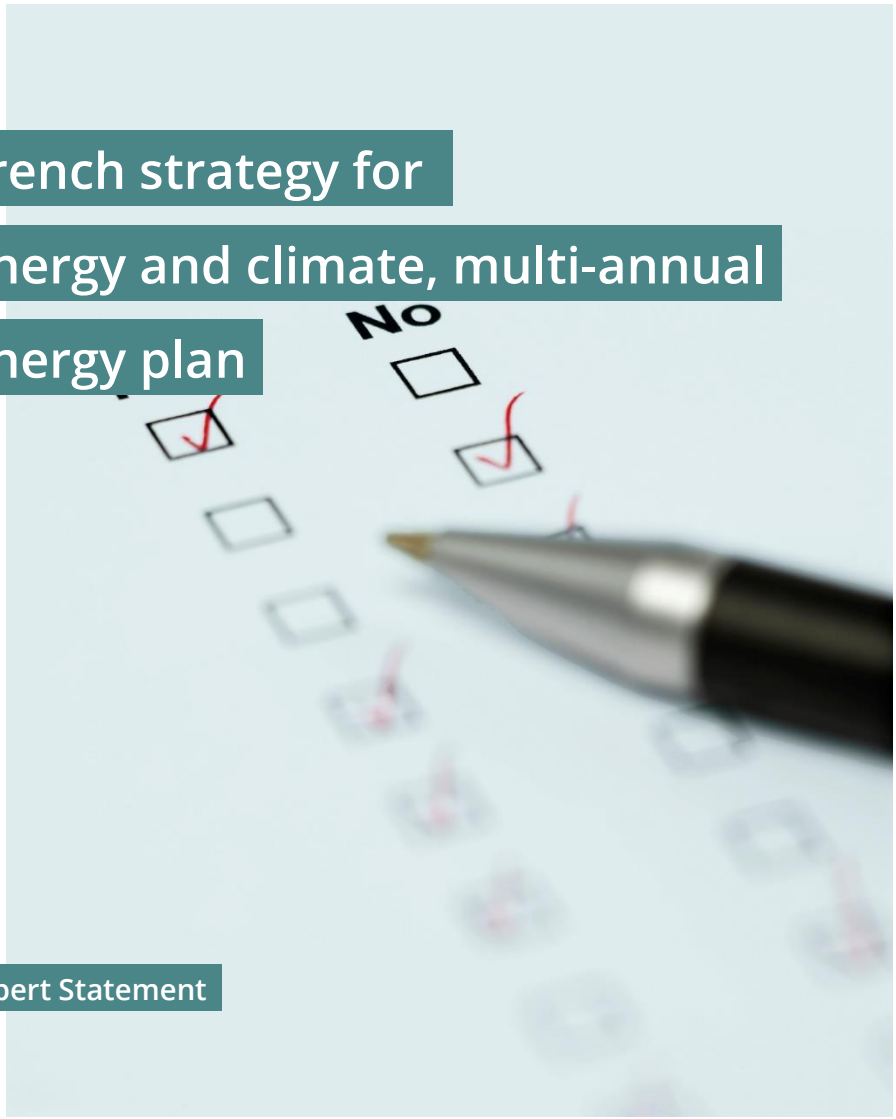
French strategy for energy and climate, multi-annual energy plan



Expert Statement

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FRENCH STRATEGY FOR ENERGY AND CLIMATE, MULTI-ANNUAL ENERGY PLAN

Expert Statement

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CONTENTS

1 INTRODUCTION

France has notified Austria about the Strategic Environment Assessment (SEA) procedure under the Protocol on Strategic Environmental Assessment to the Espoo Convention and the SEA-Directive 2001/42/EC related to the "Stratégie française pour l'énergie et le climat, Programmation pluriannuelle de l'énergie (2025-2030, 2031-2035)" (French Multi-Annual Energy Plan – PPE 3).

Austria is participating in the transboundary SEA.

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology commissioned the Federal Environment Agency to prepare an expert statement on the submitted documents.

This statement focusses exclusively on aspects related to the utilization of nuclear energy relevant parts of the PPE 3. The aim of Austria's participation in the SEA process is to address issues which could contribute to the minimization of or prevention of possible significant adverse effects of the strategy on Austria. In this respect all relevant aspects which can contribute to strengthen nuclear safety are the main focus of this assessment.

Austria participated in the SEA on PPE 2, submitted expert statements on LTE procedures on VD4[1] and VD5[2] of the 900MW reactors in 2019 and 2024 respectively, and in the LTE procedure on VD4[3] of the 1300MW reactors in 2024, and issued several recommendations.

[1] Austrian Expert Statements related to LTE procedures (VD4) of the French 900MW fleet (2019 – 2021), https://www.umweltbundesamt.at/frankreich-vd4-900mw-2019

[2] Austrian Expert Statement related to the LTE (VD5) procedures of the French 900MW fleet (2024), https://www.umweltbundesamt.at/frankreich-vd5-900mw-2024

[3] Austrian Expert Statement related to LTE procedures (VD4) of the French 1300 MW fleet (2024), https://www.umweltbundesamt.at/frankreich-kkw-1300

2 TOPICS

2.1 General

The Multi-Annual Energy Plan (PPE) sets out Frances´ State's energy priorities for mainland France, over the next 10 years, divided into two 5-year periods. Every 5 years, the PPE is updated, the second 5-year period is revised and a subsequent 5-year period is added.

It was one of the objectives in the French Multi-Annual Energy Plan 2019-2028 (PPE 2) to reduce the share of electricity production from nuclear power to 50% by 2035. This objective has been dropped by the Act no. 2023-491 of 22 June 2023 on “the acceleration of procedures relating to the construction of new nuclear facilities near existing nuclear sites and the operation of existing facilities” and therefore the French Multi-Annual Energy Plan 2025-2030, 2031-2035 does not have any nuclear share reduction target. (PPE 3, 2025, p.103)

France is relying heavily on electricity produced by nuclear power plants (NPP). France has 57 operational NPPs with an installed capacity of 62.9 GWe producing 320 TWh in 2023, which equals 65% of the national electricity production. The PPE 3 assumes a constant nuclear output of 360TWh per year over its projection period. The scenario assumption are illustrated on page 85 of PPE 3. In relative numbers, due to the expected increase in total electricity generation in France to 602 TWh in 2030 and 685 TWh in 2035, the share of nuclear generated electricity is expected to decrease from 65% in 2023 to 53% in 2035. (PPE 3, 2025, p.85)

The central scenario on which PPE 3 is based on, assumes that the yearly nuclear output over the projected period until 2035 is 360TWh. EDF´s ambition is to increase the output over the assumed period of its nuclear installations to 400TWh per year until 2030. (PPE 3, 2025, p.105) The reason for the use of more conservative assumptions in the nuclear output is argued due to the low production number in 2022 (280TWh) and to reflect so called "unforeseen" events. (PPE 3, 2025, p.83) EDF ambitions of producing 400TWh per year, would imply that the target load factor would be around 72%. The conservative assumption of 360TWh implies load factors in PPE 3 of 65%. Even in the case of increased load and availability factors as planned by EDF, French nuclear power plants would be below average compared to other European countries. One of the reasons is the partially load following operation mode in France, which is necessary due to the high share of nuclear energy and the rising share of renewable energy.

For the period until 2035 no new grid connections of nuclear power plants are expected, but construction of several is planned to begin. This is caused by the long lead time of nuclear power plants constructions. As mentioned in the SEA of the PPE 3 “Given the delays associated with the construction of new nuclear reactors, France will not have any additional nuclear generation capacity before 2035, apart from increasing the capacity of existing nuclear reactors.” (SEA 2025,

p.106 Instead, long-term operation of existing NPPs incl. power uprates are envisaged in PPE 3. (PPE 3, 2025)

Those assumptions result in ageing French nuclear reactors as backbone of the French electricity system. This is reflected in the PPE 3 were the central pillars of the nuclear strategy is long-term operation up to 60 years and beyond, and the increase of the output of the existing nuclear power plants. There is no scenario in the PPE 3, which considers the possibility that some or all reactors, in particular the 900 MWe reactors, might not qualify for long-term operation. Common safety issues and climate effects can have a significant impact on the amount of electricity generated by the NPPs, as seen in the year 2022, when several NPPs had to be shut down due to safety concerns. Further, dry and hot summers caused a decline in electricity production by NPPs due to elevated temperatures in rivers in mainland France.

Remarks

- Scenarios in which parts of the 900 MWe reactors are not eligible for long term operation should be included.
- Effects of a higher share of renewable energies in the electricity system regarding load and availability factors of nuclear power plants should be discussed and elaborated on.

As elaborated on page 157f in PPE 3 the "electricity mix scenario chosen for the PPE 3 was based in particular on RTE's "Energy Futures 2050" report, published in 2021, and its 2023-2035 Generation Adequacy Report, published in 2023." An update of the supporting documents for PPE 3, seems necessary in light of the report by the Cour the Comptes in early 2025. The Cour des Comptes evaluated the cost for nuclear power plants in France. The estimated costs for the planned three pairs of EPR2 presented in the PPE 3 (PPE 3, 2025, p.147), based on the report of the Cour des Comptes from January 2025, are already outdated. Instead of overnight costs of €51.7 billion the Cour the Comptes projects overnight costs of €67.4 billion. Noting that the EPR Flamanville 3 faced massive cost overruns, with an estimated total cost of €23.7 billion. (Cour the Comptes 2025) An increase in estimated costs of around 30% in only 3 years raises questions on the viability of such projections.

Remark

- Supporting documents, on which the electricity mix scenarios are based on, should be up to date and include different cost projections i.e. for nuclear power plants.
- The cost estimations elaborated by the Cour des Comptes in January 2025 should be reflected in PPE 3.

2.2 Safety levels and continuous improvement of nuclear safety

Safety of NPPs is of utmost importance, for new builds but also for long-term operation of existing NPPs. Directive 2014/87/EURATOM amending Directive 2009/71/EURATOM stresses the need for continuous improvement of nuclear safety. Safety of nuclear installations should have the highest priority in the long-term operation program. The EPR reactor design is used as benchmark for the safety improvements in VD5 of the 900MW reactors in 2024 and in VD4 of the 1300MW reactors in 2024. (Umweltbundesamt 2024a, 2024b) In recent years indications increased, that EDF faces difficulties in meeting deadlines for studies and work, and in some cases it was observed, that complying with regulations had not been properly met. This lead to situations where ASNR had to deal with challenging situations to ensure that EDF complies with its commitments (i.e. elaborated in the report by Cour des Comptes 2025). There is a certain risk that the implementation of safety improvements faces delays. Such a case could be observed, when ASNR hat to grant a 4-5 year delay to EDF regarding works planned on the VD4 of the 900MWe and the completion of the final post-Fukushima upgrades. (Umweltbundesamt 2024a, p.29). Further, the "Hardened Safety Core" concept for the 1300 MWe has to be fully realized in a timely manner, while the implementation of the Hardened Safety Core for the 900MWe is still pending (Umweltbundesamt 2024a, p.32). The open issues have to be addressed as soon as possible in order to reduce the risk imposed by NPPs.

Independent regulatory oversight is paramount to assure nuclear safety. Independence of ASNR (including adequate funding and staffing) is key for nuclear safety. ASNR must be in a position to define terms and conditions for long-term operation and the relevant safety goals without political and financial pressure. (Umweltbundesamt 2024a). In order to enable EDF to comply with all relevant regulations in a timely manner, funding and stuffing of EDF must be ensured.

Remarks

- The safety levels of 900MWe and the 1300MWe reactors should be as close as possible to the EPR safety level. Gaps between the EPR and the 900MWe reactors and the 1300MWe reactors should be highlighted.
- Risks posed by nuclear power plants should be reduced via timely implementation of safety upgrades and continuous improvement of nuclear safety.
- Adequate financing and independence of ASNR should be ensured.

Planned construction of EPR2 are the focus of new constructions as laid out by EDF and confirmed in PPE 3. There is only little information available on the intended design of the EPR2 reactors. The first EPR2 reactors will be First of a Kind design. Stressing Directive 2014/87/EURATOM amending Directive 2009/71/EURATOM and the Vienna Declaration on Nuclear Safety (CNS/DC/2015/2/Rev.1) the EPR 2 should be designed in a way that makes it

safer than existing nuclear power plants. Safety of nuclear installations should be the highest priority. If cost reduction priorities affect the design and the robustness of EPR2 in a negative way and would make it less safe than the EPR, the design selection process should be re-evaluated.

Remark

- The safety level of the EPR 2 should be higher than or at least equal to the safety level of the EPR.

One of the described actions regarding the so called relaunch of the nuclear industry is the support of breakthrough innovation through the France 2030 plan with the aim of launching at least on prototype of an innovative small nuclear reactor by 2030. (PPE 3, 2025, p.59) Additionally it is elaborated in Action Nuc 5 on page 106 of the PPE that the aim is to have one design for a small modular pressurised water reactor and at least one prototype of an innovative small nuclear reactor using a different technology in the beginning of the 2030. (PPE 3, 2025, p.106) The aim of having a prototype of an innovative small nuclear reactor by 2030 is challenging. There is no information available, which would support such a claim. For the period after 2035, which is not in the scope of PPE 3, a gradual deployment of SMR and AMR is envisaged. (PPE 3, 2025, p.74)

Remark

- The safety level of SMRs and AMRs should be higher than or at least equal to the safety levels of EPR and/or EPR2.

The planned development and deployment of fast reactors, with the aim to close the fuel cycle, faces several technological and financial challenges that need to be taken into account. France already operated fast reactors, but all of them were shut down, due to different challenges. Technological challenges need to be tackled, and a safe and robust design needs to be developed. Several challenges in the fuel cycle need to be addressed, but fast reactors do not seem to have any impact on the PPE 3. If considering fast reactors, those designs should be at least as safe as the most advanced and modern existing light water reactors.

Remark

- The safety level of the planned Fast Reactors should be higher than or at least equal to the safety level of the EPR and/or the EPR2.

2.3 Severe accidents

The SEA of the PPE 3 sees an increased risk posed by nuclear power, although mentioning that the overall risk remain low. (SEA 2025, p.15) Neither the PPE nor the Strategic Environmental Assessment of the PPE addresses severe acci-

dents in nuclear power plants and potential adverse transboundary impacts resulting therefrom. As pointed out in HERCA-WENRA 2014 severe accidents with large releases cannot be completely excluded. (HERCA/WENRA 2014) This holds true for new reactors and even more for ageing reactors.

Fuel cycle facilities located in France, i.e. the reprocessing plant in La Hague, is part of the supply chain for French nuclear power plants. Risks associated with these facilities and potential accidents or incidents might affect the environment and humans. Risks associated with fuel cycle facilities should be addressed in the SEA of the PPE 3.

Remarks

- Severe accidents in nuclear power plants and potential adverse transboundary impacts should be addressed.
- Incidents and severe accidents in fuel cycle facilities and potential effects on the environment should be addressed.

2.4 Security of supply

The French nuclear fleet is completely import dependent when it comes to natural uranium. Nevertheless, it is stressed in the PPE 3 on page 104f, that the French nuclear industry makes “a major contribution to France´s energy independence”. Unfortunately, the dependency on uranium is not elaborated in the necessary depth in the SEA of the PPE 3 while resources for PV and wind are discussed. The dependency on uranium imports should be analysed in depth especially with a rapidly changing international environment encountered in the last years. E.g.: the situation in Niger and its implications to the security of supply as well the war in Ukraine have an impact on potential sources of natural uranium for the French nuclear industry. The PPE 3 should consider (potential) disruptions in the supply chain and its effects on the strategy as a whole.

Fuel cycle dependency on the Russian Federation is mentioned in PPE 3 especially with conversion and enrichment of reprocessed uranium. It is planned to have an operational facility by 2030 to become independent from the facilities in the Russian Federation. The construction of those facilities need to be implemented in time and budget and comply with all relevant safety and security regulations.

Remark

- The import dependence regarding natural uranium should be elaborated. This elaboration should include, the availability of natural uranium over time (until 2035 and beyond), potential suppliers, mining capacities and competition for the same natural uranium deposits on a global scale.

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