nuclearеurope
Supporting a sustainable future

#150GWnuclear2050

Designing a fit-for-purpose Nuclear Illustrative Programme

NUCLEAR

IS A LOW-CARBON ENERGY SOURCE

ENSURES SECURITY OF SUPPLY

IS ENVIRONMENTALLY, ECONOMICALLY AND SOCIALLY SUSTAINABLE

EU NUCLEAR INDUSTRY IN NUMBERS

ACCOUNTS FOR
24%
OF ELECTRICITY

ALMOST
50%
OF LOW-CARBON ELECTRICITY

SUPPORTS AROUND
0.9 million
JOBS

TURNOVER OF
100bn
PER YEAR

May 2025

EXECUTIVE SUMMARY

- Today, nuclear provides around a quarter of the EU's electricity, making a decisive contribution to Europe's energy security and sovereignty, climate goals, and industrial resilience. It also generates considerable economic benefits, with a value chain that comprises over 900,000 jobs (direct, indirect and induced) in the EU alone and stands as a testimony of European technological excellence.
- Significant investments are currently being considered in the nuclear sector. Based on the National Energy and Climate Plans (NECPs) submitted by the EU Member States and recent announcements by governments, installed nuclear capacity could reach 143 GW by 2050, up from around 100 GW today.
- The upcoming Nuclear Illustrative Programme (PINC) should provide an accurate picture of the status of nuclear in the EU today, reflecting the ambitious plans developed by the Member States, as well as a context which has changed significantly compared to the previous PINC (ever greater number of Member States considering nuclear, importance of lifetime extension, new large-scale projects, fuel cycle facilities, as well as Small Modular Reactor projects).
- It is essential that the PINC be accompanied by a clear action plan on advancing nuclear investments, focusing notably on a series of concrete actions. These should include:
    - A stable policy framework for nuclear expansion
    - A level playing field for all net zero technologies
    - An ambitious EU 2040 framework
    - Access to public and private financing
    - A streamlined State Aid process
    - Fair taxation measures
    - Support for a strong European nuclear supply chain
    - A clear framework for supply diversification
    - Supporting measures for research, skills, value chain and SMRs.

The European Union is confronted with significant challenges in terms of reducing our dependence on third countries, achieving our decarbonisation goals and rendering our industries more competitive.

Against this background, a significant number of EU Member States are considering investments in the nuclear sector, ranging from the lifetime extension of the existing nuclear fleet and increasing the installed capacity of current plants (power uprates) to the deployment of new nuclear projects, including large reactors, SMRs and Advanced technologies, as well as nuclear fuel facilities. These investments will play an essential role in ensuring energy sovereignty, security of supply and 24/7 access to affordable energy.

Nuclear energy also generates considerable economic benefits, contributing to a value chain that comprises over 900,000 direct and indirect jobs in the EU alone and stands as a testimony of European technological excellence, with a positive impact on multiple other economic sectors providing key components and materials for the construction and maintenance of nuclear facilities. As countries worldwide are launching significant investment programmes[1], it is critical for the EU and the European nuclear value chain to successfully deliver these projects and maintain its global industrial leadership. The EU has a real asset because it masters all nuclear technologies covering the whole value chain.

[1] A recent report from the International Energy Agency estimates that 70 gigawatts of new nuclear capacity are under construction globally.

In this respect, the upcoming Nuclear Illustrative Programme (PINC) should put forward concrete policy measures to facilitate investments in nuclear.

In particular, PINC should provide an accurate picture of the status of nuclear in the EU today, and most importantly should mirror the ambitious perspectives that Member States have in order to ramp up nuclear capacity over the coming decades. It should also adequately support objectives for the development of nuclear energy by setting out tangible actions, as well as providing an outline of the investments needed to achieve these goals in line with the Euratom Treaty, the National Energy & Climate Plans (NECPs) objectives, and the announcements made by governments and additional plans being considered by the Member States.

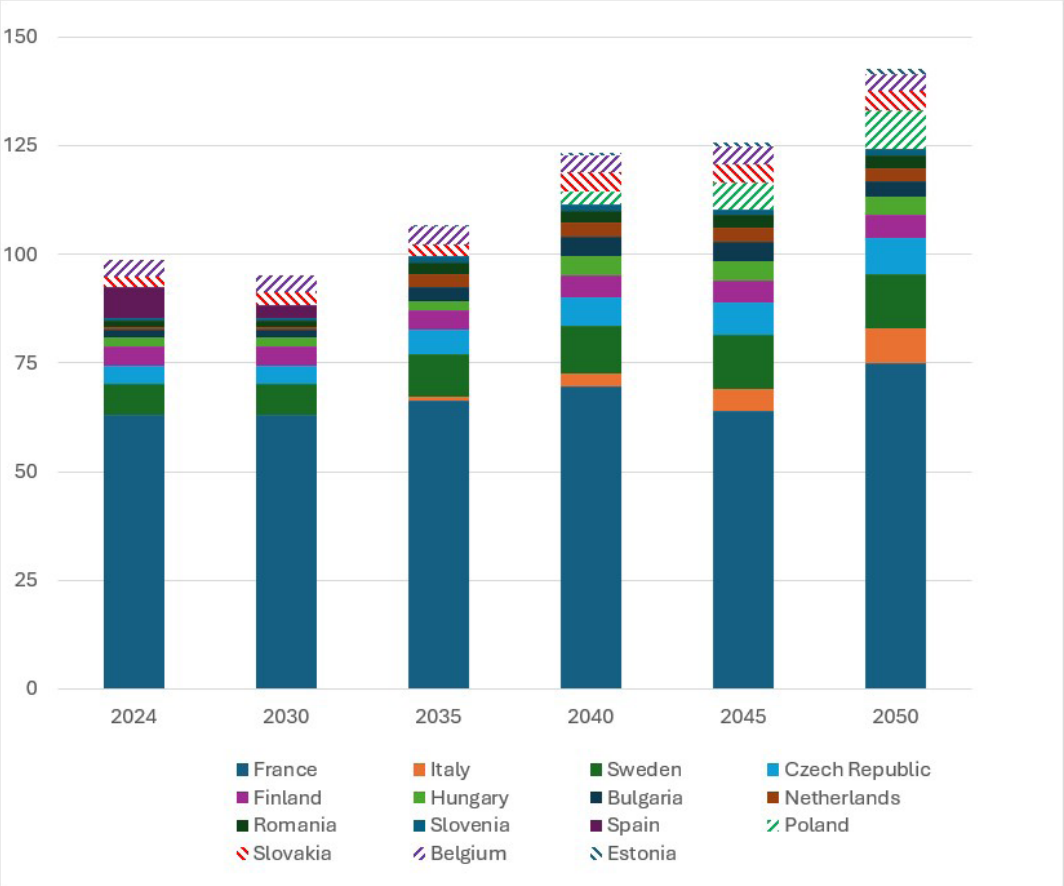
1. Planned nuclear investments up to 2050

In 2024, nuclear accounted for almost a quarter of all the electricity produced in the EU and was the single largest source of low-carbon electricity. There are currently 100[2] reactors in operation in 12 Member States.

Compared to the previous PINC published in 2017, the situation of nuclear investments across the EU has radically changed. A wide range of projects are currently at different stages of implementation and others are being considered, covering both lifetime extension and new build projects. Similarly, significant investments are planned in nuclear fuel cycle facilities. Some countries which currently do not have nuclear are now either well advanced in pursuing projects or seriously considering investing in this technology, with some plans already at an advanced stage. Furthermore, a large number of Small Modular Reactor (SMRs) projects are being considered, involving both governments and private actors.

In May 2023, the Nuclear Alliance of EU Member States set an ambitious target of having 150GW of installed nuclear capacity in the EU by 2050, which is a significant increase compared to around 100GW today. This is also partially reflected in the most recent NECPs submitted by the Member States which, whilst focused on the short and medium term, also provide a 2050 perspective.

Based on the final NECPs submitted so far, the 2050 forecast for installed nuclear capacity is as follows:



Source: nucleareurope, based on NECPs

[2] https://pris.iaea.org/PRIS/

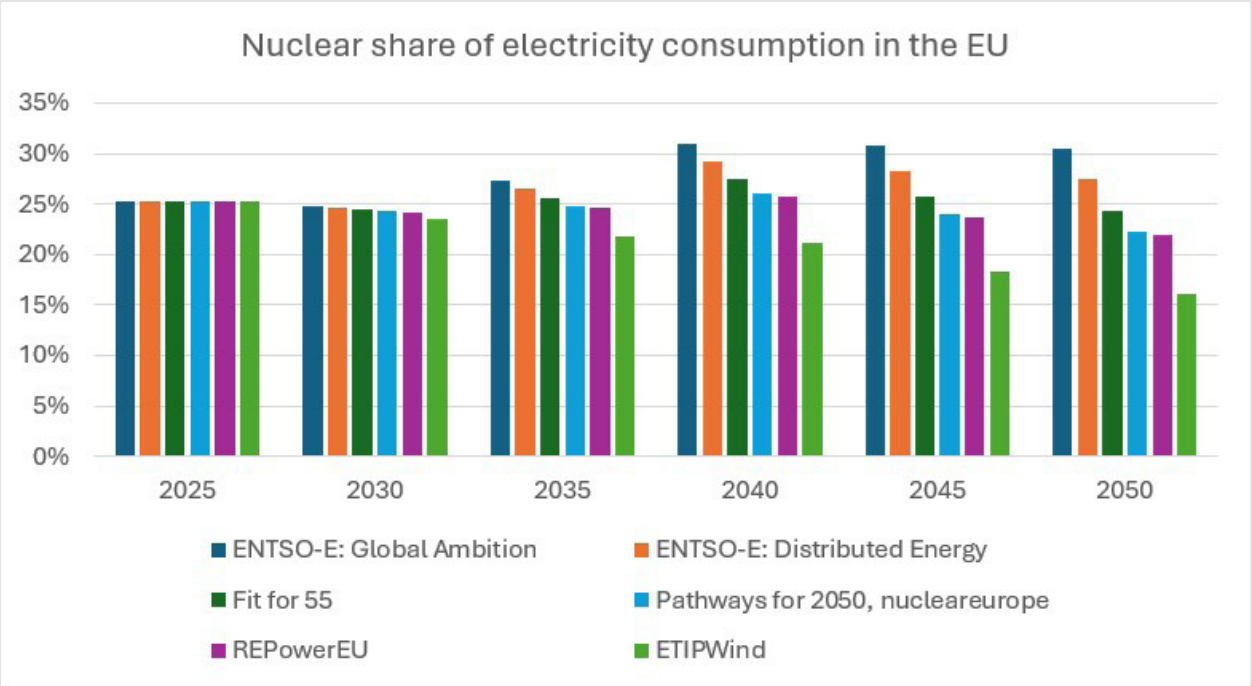
Final NECPs for Poland, Belgium, Slovakia and Estonia have yet to be submitted but based on recent announcements and draft NECPs, nuclear plants in these Member States could increase the EU's overall installed nuclear capacity by a further 18.6GW, translating into a total installed capacity of 143GW by 2050. Annex A of this paper presents a detailed analysis of the installed capacity in each EU country up to 2050. Linked to this, a Compass Lexecon study, commissioned by Nucleareurope, looks at three different installed nuclear capacity scenarios by 2050 (100GW, 150GW, 200GW).

2. Nuclear energy production targets

According to the Euratom Treaty[3], the PINC should put forward nuclear energy production targets. Whilst this target is non-binding, it is possible to estimate the share of nuclear electricity production in 2050 based on total EU electricity demand which is expected to be between 3.600TWh and 6.800TWh in 2050. [4] [5] [6] [7] [8]

Production targets, as required by Article 40 of the Euratom Treaty, should also be included in the PINC to provide clarity about the future of nuclear energy in the European energy mix.

The following chart (source: nucleareurope, based on NECPs) outlines the share of nuclear out of the total amount of electricity consumed in the EU up to 2050. It takes into account electricity consumption predictions according to different scenarios and the installed nuclear capacity put forward under the NECPs. As a result, nuclear will account for between 16 and 30% of the electricity consumed in the EU in 2050.



[3] Article 40

[4] ENTSO-E and ENTSOG's Ten-Year Network Development Plans (TYNDP) 2024

[5] European Commission, Fit for 55

[6] Nucleareurope, Pathways to 2050

[7] European Commission, REPowerEU

[8] ETIP Wind, Getting fit for 55 and set for 2050

3. Concrete policy measures to support investments

In addition to providing an accurate picture of the projects planned by EU Member States and exploring all future investment needs, the upcoming PINC should address ways to support the deployment of these ambitious plans through concrete actions.

This includes supporting investment in all nuclear fission projects encompassing all nuclear technologies, from large scale nuclear new build and lifetime extensions to development and deployment of SMRs. Furthermore, strong support should be provided to the entire nuclear value chain, including the nuclear fuel cycle (from the front-end, including mining, conversion and enrichment, to the back-end, including processing and recycling of used fuels and waste management) in the EU. This is of particular importance given the focus on phasing imports of Russian nuclear in accordance with the recent Communication from the European Commission[9]. This is a unique opportunity: a clear and ambitious PINC should reflect the contribution that nuclear can bring to industrial competitiveness, ensuring that the EU remains a global leader and reaffirming the role of this technology in achieving energy security and decarbonisation at affordable and stable prices.

The PINC should therefore be accompanied by a clear action plan on advancing nuclear investments, focusing notably on the following concrete actions:

- **Stable policies for nuclear investments.** Ensure consistent and coherent long-term policies to facilitate the LTO of the existing fleet and the deployment of new nuclear projects (large reactors, SMRs and Advanced technologies) as well as the nuclear value chain and fuel cycle facilities.
- **Provide a level-playing field for all net zero technologies through the application of technology neutrality, in order to achieve a successful energy transition**. It is particularly important that the implementation of the measures featured in the Clean Industrial Deal – for instance the publication of the Low-carbon hydrogen Delegated Act, as well as new initiatives such as the Competitiveness Fund and the Clean Energy Investment Strategy for Europe and the Clean Technology Investment Plan – put all sources of clean energy on an equal footing. This is essential both for end consumers of energy and to provide clear signals for investments in the nuclear sector.
- **Put forward an ambitious 2040 framework that incentivises nuclear investments and supports electrification.** Investors need long-term certainty to deliver nuclear investments. The upcoming 2040 framework should be based on an ambitious greenhouse gas emissions reduction target (e.g. 90% reduction in net greenhouse gas emissions by 2040 compared to 1990 levels, as recommended by the Commission in 2024) and should not include targets for specific technologies (e.g. renewables target) but rather feature a clean electricity objective, allowing all forms of clean generation to play a role. In parallel, it is essential to advance an ambitious electrification action plan, as foreseen under the Clean Industrial Deal/Affordable Energy Action Plan.

[9] Roadmap towards ending Russian energy imports, European Commission, 6 May 2025

- **Enable access to public financing to encourage nuclear investments which will also trigger and ease private financing** Nuclear projects are long-term projects in which the cost of capital is a major factor. De-risking nuclear financing through institutional support (for example the European Investment Bank and European Bank for Reconstruction and Development) and lower interest rates is therefore essential. Similarly, the nuclear fuel cycle should be recognised as an enabling activity under the EU's Sustainable Finance Taxonomy, and nuclear should be put on an equal footing with other clean energy technologies (i.e. no longer treat nuclear as a transitional technology). Regarding EU funds which currently exclude nuclear (InvestEU, Just Transition Fund, ERDF/Cohesion Fund), these should be reviewed in order to align them to the technology neutrality approach and bring them in line with recent developments (Sustainable Finance Taxonomy, Net Zero Industry Act). New funds developed under the next Multiannual Financial Framework, including the upcoming Competitiveness Fund, should automatically include nuclear alongside renewables, and the criteria applied should be justified. Finally, the foreseen launch of an Important Project of Common European Interest (IPCEI) on nuclear will be important to support the entire value chain.
- **Work towards streamlining and accelerating the State Aid process**. Given the time span of nuclear projects, it is critical that the European Commission ensures a timely analysis on decisions concerning State Aid requests introduced by EU Member States.
- **Promote fair taxation**. Policymakers should ensure that taxation policies do not discriminate against low-carbon technologies which contribute to decarbonisation and electrification. In addition, taxies and levies which are not energy-related should also be removed.
- **Support a strong European nuclear supply chain**: upcoming investments will necessitate a strong EU-based nuclear supply chain. Today, this supply chain comprises over 900,000 direct and indirect jobs in the EU alone. It will be critical to support it through various measures (e.g. policies skills, financing, research, State Aid, etc., as noted in this paper) to ensure that Europe retains its leadership on nuclear and successfully delivers on planned investments.
- **Establish a clear framework supporting efforts for diversification of supply:** while REPowerEU and the recent Communication on ending Russian energy imports emphasise the need for certain Member States to diversify their supply sources for enriched uranium, it is crucial that the EU provides adequate support to grow uranium conversion and enrichment capacities in the EU. Likewise, further consideration on potential uranium mining capacities in the EU should be given. Concrete steps should be taken to ensure a robust, diverse and secure supply chain and address the distortive practices of third countries on the European Market.
- **Support nuclear research**. Enable greater synergies with other EU programmes (eg Horizon Europe) to leverage an increase in funds for nuclear activities, particularly in the fields of skills, digital, medical, advanced materials and all non-power applications. Increase the Euratom Research and Training programme budget and allocate a greater share to nuclear fission activities to cover all nuclear technologies (e.g. both large reactors, SRMs and Advanced technologies) as well as skills (given the importance of having a skilled workforce). Support for nuclear research cooperation with the wider European countries such as the UK or Switzerland should also be ensured.
- **Support the development of a skilled workforce** by promoting and making STEM subjects attractive amongst pupils to ensure European technological leadership. Clear EU-level signals supporting nuclear's role in the energy mix will be key to attracting and retaining talent. In addition, developing more cross-sectoral actions in the field of skills could help address similar challenges faced by multiple industries, for example in the area of construction-related skills.

- **Encourage stronger cross-cooperation between regulators to enable more efficient licensing procedures and standards**. A true Single Market for nuclear means enabling the use of standardised power plant designs and components across Member States, with minimal national deviations. These efforts must extend to both large nuclear reactors and SMRs and Advanced technologies. These efforts will also support the development of resilient European supply chain.
- **Support the European Industrial Alliance on SMRs** "*to facilitate and accelerate the development, demonstration, and deployment of the first SMRs projects in Europe in the early 2030s*", including through measures on innovation, supply chain, fuel cycle, skills and financing for the scaleup of identified projects.

In conclusion, the European nuclear industry calls on the European Commission to ensure that the upcoming PINC provides the necessary financial, regulatory and policy framework to support current and future nuclear projects, reaffirming the importance of nuclear energy in driving Europe's transition to a clean, sustainable, and carbon-neutral future.

Annex A - Detailed analysis of the planned nuclear energy installed capacity, 2024-2050, based on National Energy and Climate Plans (NECPs)

Country	Capacity by year (GW)					
	2024	2030	2035	2040	2045	2050
France	63	63	66,3	69,6	63,9	74,9
Italy	0	0	1	3	5	8
Sweden	7,2	7,2	9,7	11	12,5	12,5
Poland	0	0	0	3	6	9
Czech Republic	4,24	4,24	5,59	6,5	7,4	8,3
Finland	4,4	4,4	4,7	5	5,3	5,3
Slovakia	2,3	2,74	2,74	4,44	4,44	4,44
Hungary	2	2	2	4,4	4,4	4,4
Belgium	4	4	4	4	4	4
Bulgaria	2	2	3,27	4,53	4,53	3,35
Netherlands	0,5	0,5	2,9	3,2	3,2	3,2
Romania	1,4	1,4	2,8	2,8	2,8	2,8
Slovenia	0,7	0,7	1,4	1,4	1,4	1,4
Estonia	0	0	0,3	0,6	0,9	1,2
Spain	7,1	3	0	0	0	0
Total	**99**	**95**	**107**	**123**	**126**	**143**

1. Countries for which a final NECP is available

Bulgaria

2025	**2 GW**	Current operation of Kozloduy Units 5 and 6	
2030	**2 GW**		
2035	**3.27 GW**	Kozloduy Unit 7	NECP page 89 / 201 / 313
2040	**4.53 GW**	Kozloduy Unit 8	NECP page 89 / 201 / 313
2045	**4.53 GW**		
2050	**3.35 GW**	Kozloduy 5 decommissioning	NECP page 89

Czech Republic

2025	**4.24 GW**	Current fleet	
2030	**4.24 GW**		
2035	**5.59 GW**	Dokovany Unit 5 operational and SMR introduction	NECP page 128
2040	**6.5 GW**	More SMR capacity	
2045	**7.4 GW**	More SMR capacity	
2050	**8.3 GW**	More SMR capacity, objective to have up to 3GW of SMRs	NECP page 128

Finland

2025	**4.4 GW**	Current capacity from Olkiluoto 1, 2, and 3 (OL1–OL3) and Loviisa 1 and 2 reactors	
2030	**4.4 GW**		
2035	**4.7 GW**	Potential SMR deployment	
2040	**5 GW**	Continued SMR deployment	
2045	**5.3 GW**	Continued SMR deployment	
2050	**5.3 GW**	Continued SMR deployment, up to 3GW thermal (~1 GW electric)	NECP page 166

France

2025	**63 GW**	Flamanville 3 Commissioning (1.6 GW)	
2030	**63 GW**		
2035	**66.3 GW**	First EPR2 Reactors at Penly (3.3 GW)	NECP page 73
2040	**69.6 GW**	Additional EPR2 Reactors at Gravelines (3.3 GW)	NECP page 73
2045	**63.9 GW**	Third EPR2 Pair at Bugey (3.3 GW) + SMRs (1 GW) Some of the oldest 900 MW reactors phased out (13GW)	NECP page 73 Assumption of 13 GW decommissioned
2050	**74.9 GW**	Up to 8 more EPR2s and SMRs (2–3 GW)	NECP page 73

Hungary

2025	**2 GW**	Current capacity	NECP page 236
2030	**2.2 GW**	Addition of Paks II first unit	
2035	**4.4 GW**	Full operation of Paks II with two new reactors	
2040	**4.4 GW**		
2045	**4.4 GW**		
2050	**4.4 GW**		

Italy

2025	**0 GW**		
2030	**0 GW**		
2035	**1 GW**	Initial SMR deployment	
2040	**3 GW**	More SMR capacity	
2045	**5 GW**	More SMR capacity	
2050	**8 GW**	More SMR capacity up to 8GW in conservative scenario. Full reactor potential of 16GW	NECP page 89

Netherlands

2025	**0.5 GW**	Current operation of the Borssele reactor	
2030	**0.5 GW**		
2035	**2.9 GW**	Two new large reactors expected to be operational	NECP page 7
2040	**3.2 GW**	Introduction of potential SMRs	NECP page 51
2045	**3.2 GW**		
2050	**3.2 GW**		

Romania

2025	**1.4 GW**	Current operation of Units 1 and 2 at Cernavodă	NECP page 230
2030	**1.4 GW**		
2035	**2.8 GW**		
2040	**2.8 GW**		
2045	**2.8 GW**		
2050	**2.8 GW**		

Slovenia

2025	**0.7 GW**	Current operation of Krško Nuclear Power Plant Unit 1	
2030	**0.7 GW**		
2035	**1.4 GW**	Krško Unit 2	NucNet
2040	**1.4 GW**		
2045	**1.4 GW**		
2050	**1.4 GW**		

Spain

2025	**7.1 GW**	Current operation	
2030	**3 GW**	Gradual phase-out begins	
2035	**0 GW**	End of phase-out	NECP page 10
2040	**0 GW**		
2045	**0 GW**		
2050	**0 GW**		

Sweden

2025	**7.2 GW**	All six existing reactors operational	
2030	**7.2 GW**		
2035	**9.7 GW**	At least two new large-scale reactors (2.5 GW total) expected by this year	NECP page 16
2040	**11 GW**		
2045	**12.5 GW**	Objective to have at least the equivalent of 10 large reactors	NECP page 16
2050	**12.5 GW**		

2. Countries for which no final NECP is available

Belgium (final NECP not available)

2025	**4GW**		
2030	**4GW**		
2035	**4GW**		
2040	**4GW**		
2045	**4GW**		
2050	**4GW**	Announcement by Government of objective to maintain 4 GW in 2050	BelgaNews

Estonia (final NECP not available)

2025	**0 GW**		
2030	**0 GW**		
2035	**0.3 GW**	First operational SMR	
2040	**0.6 GW**		
2045	**0.9 GW**		
2050	**1.2 GW**	Plans for up to 4 SMRs	NucNet

Poland (final NECP not available)

2025	**0GW**		
2030	**0GW**		
2035	**0GW**		
2040	**3GW**		
2045	**6GW**		
2050	**9GW**	Announcement by Government of objective to have 9GW in 2050	NucNet

Slovakia (final NECP not available)

2025	**2.3GW**	Current capacity	
2030	**2.74GW**	Addition of Mochovce 4	
2035	**2.74GW**		
2040	**4.44GW**	New NPP up to 1.7 GW	CeEnergyNews
2045	**4.44GW**		
2050	**4.44GW**		

About us

nucleareurope is the Brussels-based trade association for the nuclear energy industry in Europe. The membership of nucleareurope is made up of 15 national nuclear associations and through these associations, nucleareurope represents nearly 3,000 European companies working in the industry and supporting around 0.9 million jobs.

Avenue des Arts 56
1000 Brussels
tel +32 2 502 45 95
www.nucleareurope.eu