

NUCLEAR POWER IN THE EU

May 2024

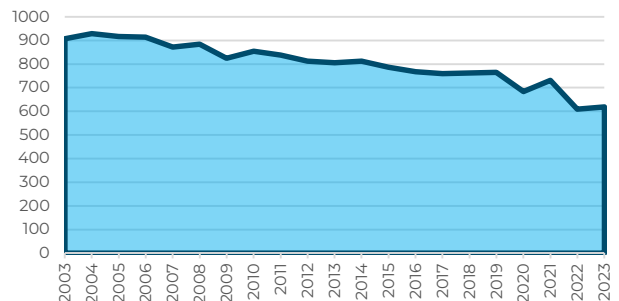
In 2023 nuclear power accounted for approximately 23 % of the electricity generation in the EU.

The European Union (EU) in total generated 2 789 TWh of electricity in 2023. The major share was generated by renewable energy (44,4%), followed by fossil fuels (32,6%) and nuclear (23%). Compared to the year 2003, there was a significant increase in the low-carbon electricity generation, specifically 21%. The increase in low-carbon electricity is mainly due to the increase in renewable energy (↑30%). On the other hand, in the last 20 years the share of nuclear generation decreased. This was caused mainly due to countries phasing out nuclear and lack of construction of new nuclear power plants (NPP).

The total electricity generation from nuclear decreased significantly in the last 20 years.

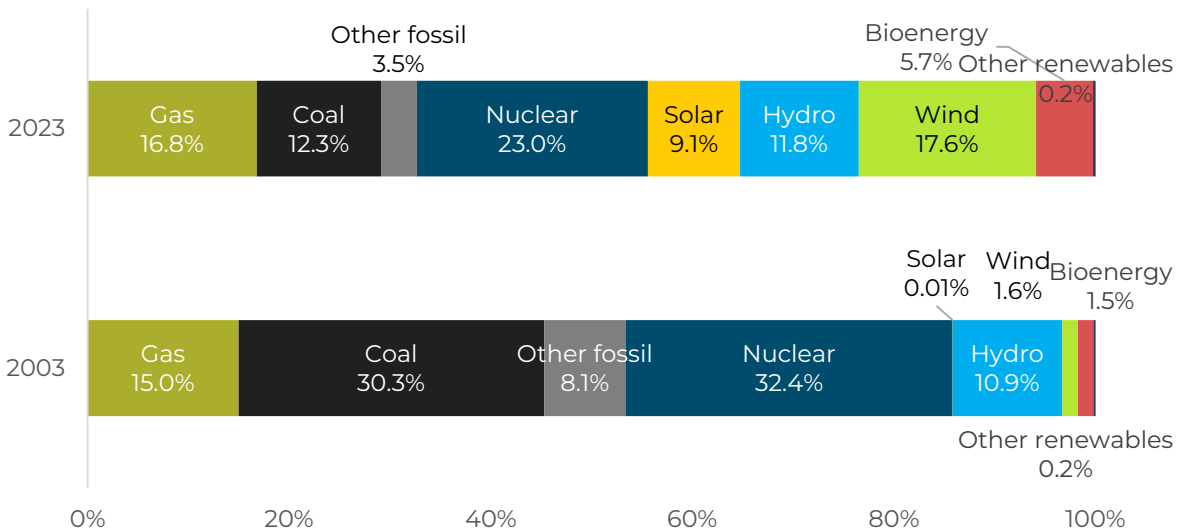
Between the years 2003 and 2023 the electricity generation from nuclear dropped for about 32% (907 TWh in 2003 → 618 TWh in 2023).

Graph 2. Nuclear electricity generation [TWh]



Source: EMBER, Electricity Data Explorer, 2024

Graph 1. Electricity generation in the EU 2003 vs. 2023



Source: EMBER, Electricity Data Explorer, 2024

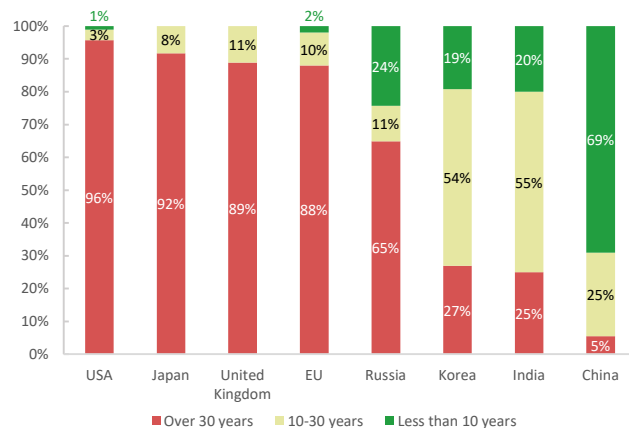
Nuclear power is needed to achieve the decarbonization targets.

The EU has made a firm commitment to achieve carbon neutrality by 2050. The primary emphasis will be on RES, supported by a complementary role of nuclear power. In 2023 the renewables accounted for almost 45% of electricity generated in the EU. This number should rise in the coming years reaching more than 80% in 2050. In 2050 the nuclear power should produce about 16% of electricity in the EU compared to today's about 25%. According to the EU the installed capacity of nuclear power in 2050 should approximately 100 GW. **The EU acknowledged nuclear power as a strategic low-emission source, important step for the future financing and construction of new NPPs.**

The NPPs in the world are ageing, more than 85 % of the NPPs in the EU are older than 30 years.

To achieve decarbonization nuclear power is needed. However, the NPPs in the world and specifically in the EU are ageing. The average age of NPP in the EU is 37 years, meaning they are beyond or about to reach the original lifetime. The EU is operating 100 reactors, out of these 88% are older than 30 years and 42% are even older than 40 years. This trend shows that the focus must be to the prolongation of the lifetime, so-called Long-Term Operation (LTO). The standard LTO period is 60 years, with few voices suggesting 80 or even 100 years of operation. If one would work with the 60 years LTO and the age of the reactors in the EU, a disturbing result presents itself. **Out of the 100 currently operated reactors 76 will be shut down by 2050.** The EU needs a robust LTO, to operate NPPs over the 60 years lifetime and the construction of new NPPs must start as soon as possible.

Graph 3. Reactor age distribution in different regions

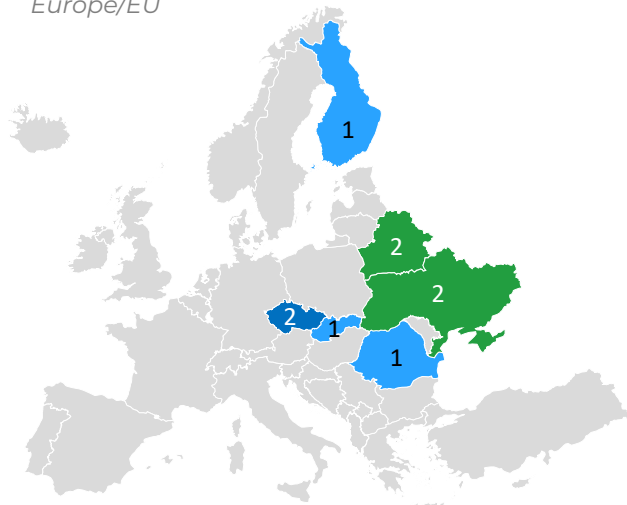


Source: PRIS IAEA, Moore analysis, 2024

Will the EU be able to build the necessary nuclear capacity to substitute the shut down nuclear power plants by 2050?

In the last 20 years, several factors influenced the construction of new NPPs in the EU. The focus was put mainly to renewable energy sources, the Fukushima Daichi accident, Energiewende and others caused the stagnation of nuclear power. Since 2000 Europe has built only 9 reactors, within the EU only 5 reactors were built. The current projects are battling with delays and cost overruns, as were seen in Olkiluoto, Flamanville and Hinkley Point C. **Substituting the shut down reactors in 26 years will certainly be challenging. The construction of the planned units must start as soon as possible.**

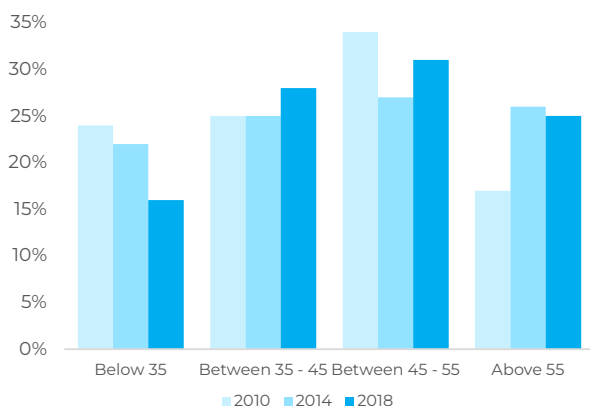
Figure 1. Number of reactors built since 2000 in Europe/EU



A critical issue that must be addressed is not only ageing reactors but also ageing workforce.

As the reactors are ageing also the workforce is ageing. The construction in Europe stagnated for almost a generation (25 years) leaving the workforce without new talents. The number of nuclear experts younger than 35 years decreased from 2010 to 2018 (see graph 4). Almost 25% of nuclear experts in 2018 were older than 55 years, nuclear experts younger than 35 years made up only approximately 15%.

Graph 4. Normalized age span for nuclear experts in different years



Source: Results of surveys of the Supply of and Demand for Nuclear Experts within the EU-28 Civil Nuclear Energy Sector, EHRO-N, 2019

Educating nuclear experts is a long and demanding process. Looking at the secondary technical education, university and specific work training required, it can take up to 12 years. The nuclear sector continues to lose its attractiveness and young people are choosing different sectors (EV, IT, space engineering).

Nuclear needs young people to survive.

More focused approach is needed for the in-time development of nuclear power.

Addressing the presented issues is not an easy task, it requires a strong collaboration of the main players in the nuclear sector: **politicians, regulators, industry and academia**. Main points that are needed to ensure in time construction and safe reliable operation of NPPs are:

- A **clear political support** and commitment to nuclear power on the EU and Member States level.
- A **focused and well defined LTO program**. Without LTO it may not be possible to fulfil the climate objectives.
- **Standardisation and harmonization**. Standardisation and harmonization is vital for achieving a simpler and faster construction.
- **Better project management** to ensure on-time and on-budget construction.
- The **cooperation between industry and academia** is a key to attract new talents into nuclear sector.
- Research centers and research reactors should be supported to **educate a new cohort of nuclear experts**.
- **Knowledge management/sharing** must become a top priority.

To find out more please contact one of our experts below:



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