Building Energy Security Through Accelerated Energy Transition

What you need to know about...

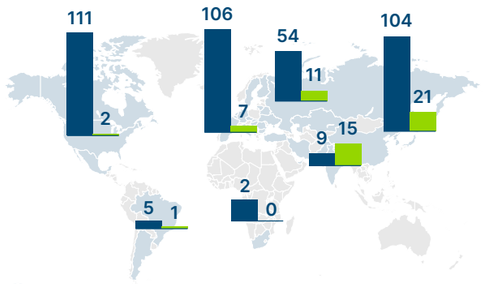
The role nuclear power might play in supporting energy security

Energy Transitions Commission

What is the role of nuclear power in the global power system today?

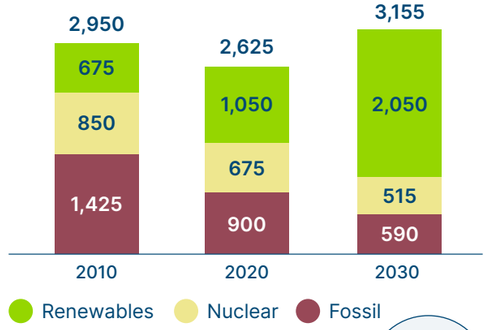
Most operational nuclear capacities are located in North America, Europe and Eastern Asia. Most new build capacity is in China and Eastern Asia.

Global nuclear capacity, GW



Nuclear accounts for 25% of current EU power generation but is set to decrease to 15% in 2030.

Gross power generation in Europe, TWh/yr



What are the benefits and drawbacks of nuclear power?

PROS

- Limited land & resource footprint
- Existing plant running costs cheaper than renewables in some locations
- Low-carbon and reliable energy (relative to fossil generation)

CONS

- High cost of new generation capacity compared to alternative low-carbon sources in many locations
- Safety concerns due to ageing of plants require prudent risk management
- Radioactive waste requires active, long term management
- Presents physical risks (e.g. natural disasters, geopolitical tensions, etc.)

Position of selected European countries on nuclear

Nuclear as an enabler for transition:

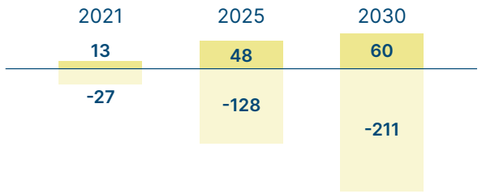
- No premature closure of operational reactors and reactor lifetimes extended >50 years
- Ambition to add new capacity

Phase out of nuclear:

- By 2022
- By 2025

How much nuclear is set to come offline in the coming decade?

Projection of global nuclear capacities to 2030 GW (cumulative)



- **210 GW** of nuclear capacity is expected to **come offline by 2030**, replaced by just 60 GW of new capacity
- **45% of capacity coming offline is in Europe**
- **45% of newbuild capacity is located in China, India and South Korea**

Can nuclear plant lifetimes be extended safely?

Reactors are extended to produce **low-cost and low-carbon power** and **compensate for limited alternative capacities.**

Nuclear lifetime extensions are frequent but present risks:

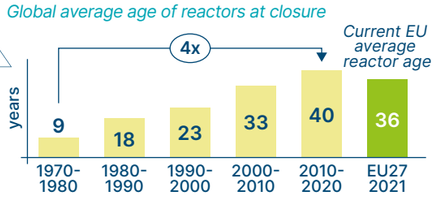
- **Structure and component ageing**
- **Physical ageing** of system design
- **Technical limitations** and loss of know-how
- Increased investment needs and maintenance costs
- Sufficient fuel reserves

Two US reactors were recently extended to 80 years.

Risk hedging difficulty:

- Feasible
- Complex

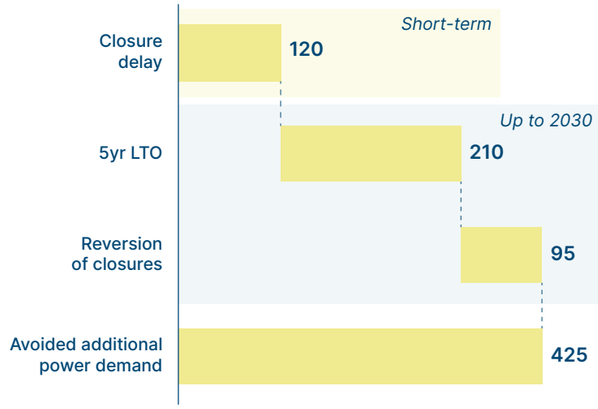
Global average age of reactors at closure



How much difference can existing nuclear make in the medium-term?

Optimising and extending existing nuclear power can be an option for Europe to **move away from fossil products** imported from Russia.

Impact of selected nuclear levers on power production in TWh of gas equivalent per year



However the feasibility of options varies, and reversion of recent closures is unlikely:

Technical feasibility: Low / High

Political feasibility: Low / High

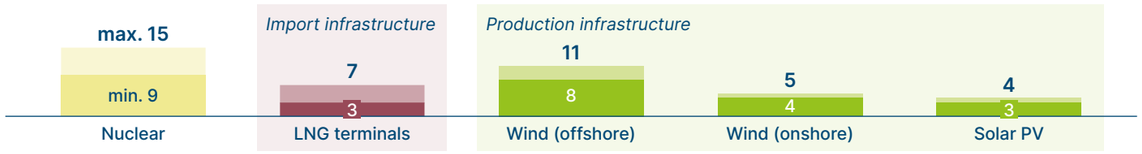
- **Closure delay:** delaying the closure of 5 reactors initially planned for 2023 and extending production to 2030 (assuming fuel rod and qualified staff availability)
- **Lifetime extension (5-yr LTO):** extending lifetime from 40 to 45 years with a feasibility factor of 75%, assuming constant load factor (80%) and sufficient fuel supply
- **Reversion of closures:** reversion of 6 nuclear reactors shut down in 2020 and 2021 (France, Germany, Sweden)

An additional **40 TWh** of gas equivalent can be displaced by **returning reactors closed for maintenance and safety checks back to operation in 2022**.

Can new nuclear make a difference?

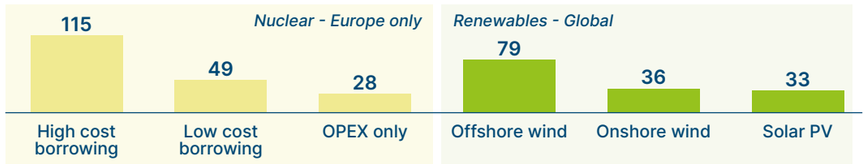
1 The development of new nuclear capacities takes 9 years on average, or 2-3x longer than renewable capacities.

Indicative project development times – in years



2 The cost of nuclear newbuilds is 2-5x more expensive than new renewables and highly sensitive to the cost of borrowing money for large upfront investments.

Median LCOE – in €/MWh



However, nuclear can provide firm power supply and some flexibility, contrary to variable renewables which must be paired with storage.