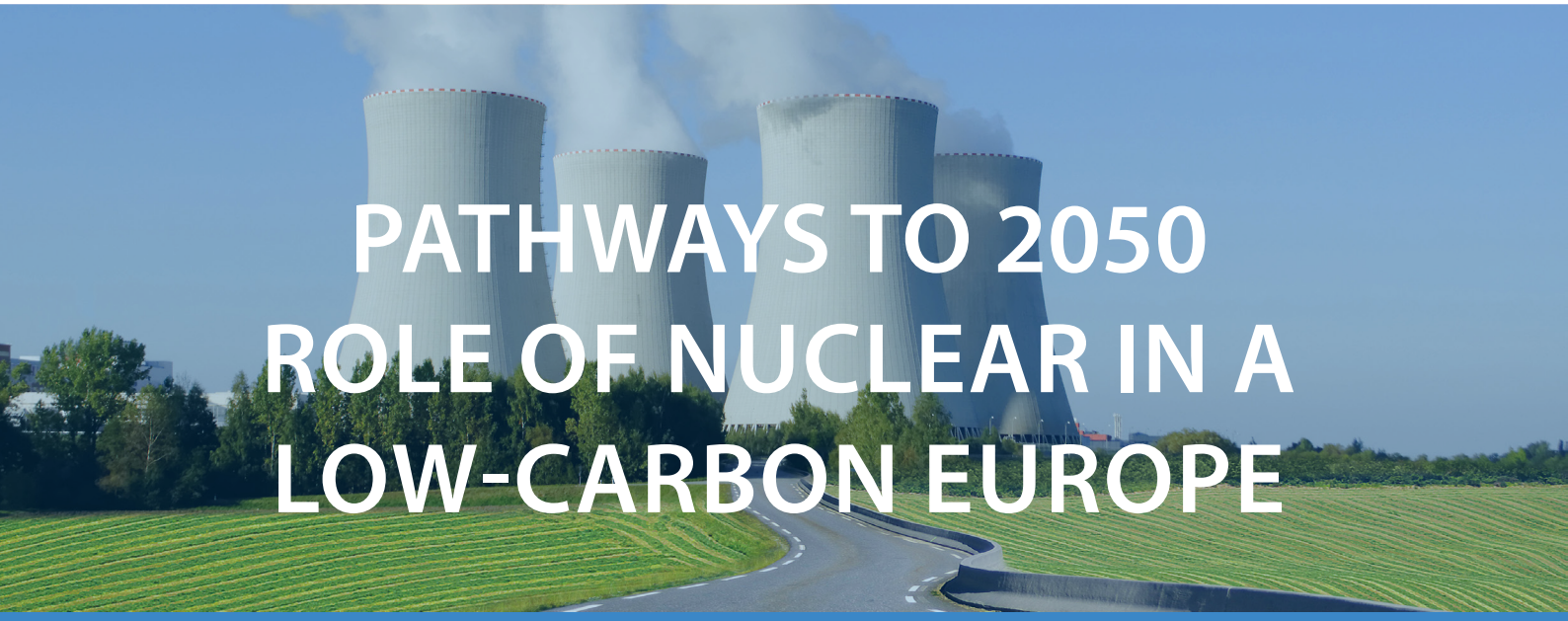
FORATOM
THE VOICE OF THE EUROPEAN NUCLEAR INDUSTRY



PATHWAYS TO 2050
ROLE OF NUCLEAR IN A LOW-CARBON EUROPE

Nuclear must account for one quarter of the energy mix to ensure that Europe meets its 2050 low-carbon targets

NUCLEAR

Is a low-carbon energy source

Ensures security of supply

Is environmentally, economically and socially sustainable

NUCLEAR INDUSTRY IN NUMBERS

Accounts for
26%
of electricity in the EU

Almost
50%
of low-carbon electricity

Supports around
800.000
jobs

Turnover of
70bn
per year

November 2018

Nuclear must account for one quarter of the energy mix to ensure that Europe meets its 2050 low-carbon targets

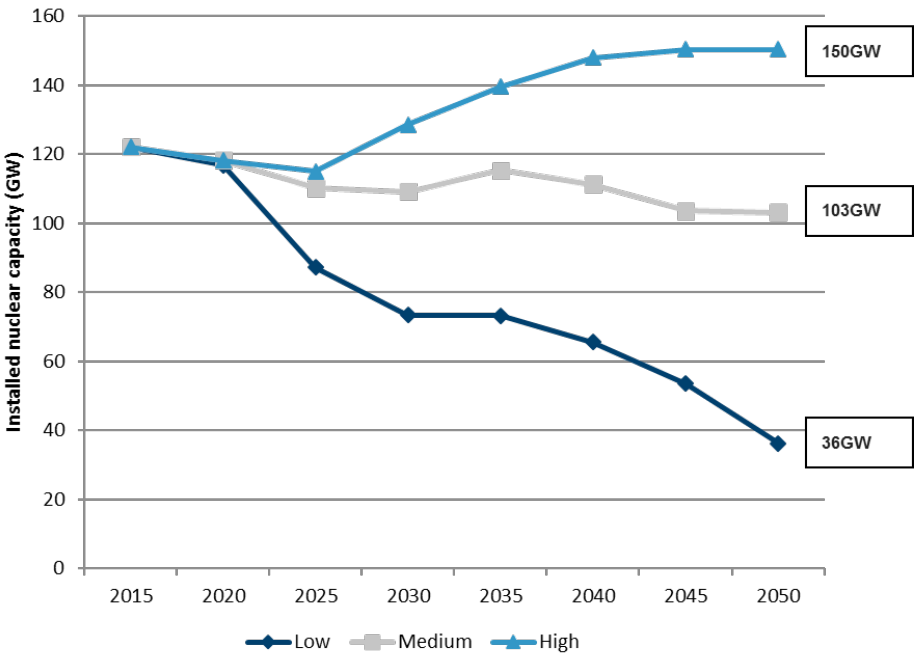
If Europe is serious about decarbonising its economy by 2050 then one quarter of the electricity produced in the EU will need to come from nuclear. This will ensure that citizens and industry have access to the low-carbon electricity they need – when they need it – and it will help to reduce the economic burden of the transition to a low-carbon economy on consumers. These are the conclusions of an FTI-CL Energy Consulting study commissioned by FORATOM. Entitled "Pathways to 2050: role of nuclear in a low-carbon Europe", the study analyses how nuclear can help Europe reach its 2050 low-carbon targets.

The latest Intergovernmental Panel on Climate Change (IPCC) report (Global Warming of 1.5°C) also recognises that nuclear power is essential if the world is to keep global warming to below 1.5 degrees. According to one of the IPCC scenarios, a six-fold increase in global nuclear capacity is needed if we want to achieve our climate goals.

Pathways to 2050: role of nuclear in a low-carbon Europe

The study focuses on three nuclear capacity scenarios in 2050: low (36GW), medium (103GW) and high (150GW). The high scenario combines the long-term operation of existing nuclear power plants, new build projects currently under consideration as well as additional new projects. The assumption for all 3 scenarios is that the EU will have decarbonised its economy by up 95% (compared to 1990), with electricity demand rising to more than 4100TWh (from currently 3100TWh) due to increased electrification.

EU-28 nuclear installed capacity outlooks in the 3 scenarios



Source: FTI-CL Energy modelling

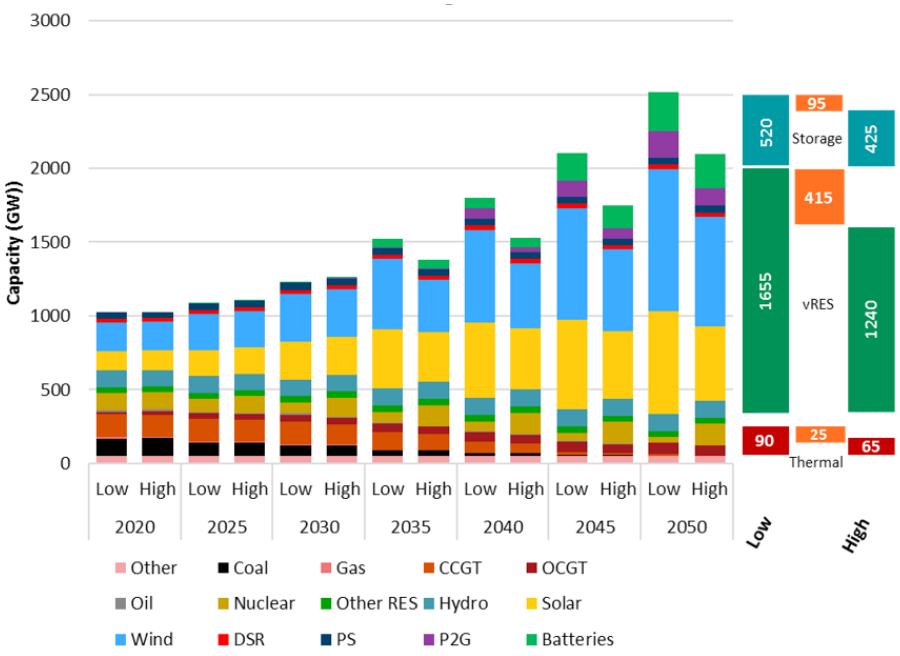
The authors also look at the European nuclear sector's contribution to several key energy policy objectives, namely security of supply, decarbonisation and sustainability, and affordability and competitiveness.

Ensuring security of supply

Decarbonising the European power mix by 2050 while maintaining security of supply will require the mobilisation of all low-carbon, secure and cost-efficient power generation sources. An analysis of the impact of reducing nuclear capacity to just 36GW highlights significant challenges.

The EU would need to invest in an additional 535GW of renewable, storage and backup capacity by 2050 in order compensate for the 114GW of lost nuclear capacity and ensure that it is still able to keep the lights on. This figure represents around half of the installed electricity capacity available today and would include 415GW of RES (190GW of solar and 225GW of wind), 95GW of new storage and around 25GW of new thermal power.

Low and High nuclear scenario capacity outlook to 2050



Source: FTI-CL Energy modelling

Europe will also have to rely on storage technologies which have yet to prove their technical and financial viability in order to store the energy produced by variable RES and release it when there is no wind or sun available. Should nuclear capacity fall to just 36GW (as in the low nuclear scenario), then Europe would need access to around 440 GW of batteries and seasonal storage such as Power2X in 2050.

A low nuclear scenario also translates into increased EU dependence on fossil fuels in the short to medium term to cover the loss of nuclear capacity. By closing nuclear capacity instead of investing in its long-term operation, 2790TWh of additional fossil fuel based thermal generation will be needed – the equivalent of 4 years of the EU's projected thermal power generation.

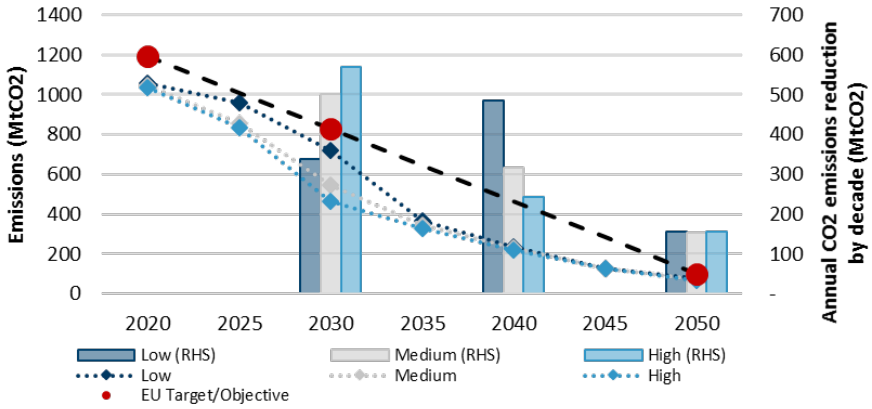
Without forgetting that an increase in fossil fuel power generation will translate into an increase in Europe's dependence on fossil fuels potentially rising to the equivalent of +36% in gas consumption and +18% in coal consumption between 2020 and 2050. Europe would also end up emitting 2200 million more tonnes of CO_2 over the same period.

A sustainable power system

Whilst reducing CO_2 emissions remains one of the main goals, the other environmental impacts of power generation must not be ignored. These include air pollution, land use and resource use. An energy mix composed of at least 24% nuclear would provide the following benefits:

- Air and water pollution would be reduced by 14%, including a 15% reduction in SO_2 emissions, 9% in NO_x and 18% in particulate matter.
- The amount of land needed for power generation would be about 15800km2 lower by 2050 – equivalent to half the size of Belgium – because nuclear generation requires less land than variable RES to produce the same amount of energy.

CO_2 emission outlooks from the EU power sector and annual CO_2 emission reduction by decade in the low/medium /high nuclear scenarios



Source: FTI-CL Energy modelling

Reducing the economic burden of the transition on consumers

The study also looks at what financial impact decarbonising the power sector will have on consumers. Not only does this European industry contribute significantly to Europe's economy, a high nuclear scenario would create about 1 million highly skilled direct job-years in Europe between 2020 and 2050.

The cost associated with decarbonising the power sector will depend significantly on the future possible cost reductions of different technologies, as a result of learning by doing and technology innovations. In the case of nuclear, capital expenditure (CAPEX) is expected to fall by 37% between 2020 and 2050 thanks to technological improvements and economies of scale.

When it comes to the economic benefits of a high nuclear scenario, Europe could save more than 440bn€ between 2020 and 2050 (compared to the low nuclear scenario). For example, the life time extension of existing capacity and the construction of new plants would save 350bn€ thanks to lower total generation costs. This represents a 5% saving in terms of total EU consumer costs over the same period.

Around 90bn€ could also be saved in relation to the additional Transmission and Distribution grid costs needed to accommodate the new solar and wind capacity which would replace the lost nuclear capacity.

Furthermore, given the 60-year lifespan of a nuclear reactor, combined with assumptions concerning new build projects under the high nuclear scenario, the residual value of investments is €960 billion higher in 2050 compared to the low scenario.

In a nutshell

The study demonstrates the important contribution of nuclear to the transition towards a decarbonised European power system. With nuclear accounting for 24% of the energy mix in 2050, the EU has a chance of meeting its 2050 decarbonisation targets. Nuclear can also support variable renewable sources of energy by providing proven, carbon free dispatchable power and flexibility to the system and reducing the system's reliance on yet unproven storage technologies.

In terms of the key enablers, these can be summarised as follows:

- Whilst the life time extension of existing nuclear plants is generally more competitive against other low carbon resources, new nuclear power will need to demonstrate significant cost reductions to succeed in liberalised European power markets.
- The timely development of storage technologies including the reduction of their cost and/or flexible operation of nuclear will be critical to ensure the complementarity of nuclear and variable renewables.
- A market design that rewards the system value of dispatchable and flexible resources and provides stable long-term investment signals is necessary to address the challenges the power system would face in a high variable RES environment.

More information: Pathways to 2050: role of nuclear in a low-carbon Europe

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About us

The European Atomic Forum (FORATOM) is the Brussels-based trade association for the nuclear energy industry in Europe. The membership of FORATOM is made up of 15 national nuclear associations and through these associations, FORATOM represents nearly 3,000 European companies working in the industry and supporting around 800,000 jobs.

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