nuclearеurope
Supporting a sustainable future

PATHWAYS TO 2050

ROLE OF NUCLEAR IN A LOW-CARBON EUROPE

NUCLEAR

IS A LOW-CARBON ENERGY SOURCE

ENSURES SECURITY OF SUPPLY

IS ENVIRONMENTALLY, ECONOMICALLY AND SOCIALLY SUSTAINABLE

EU NUCLEAR INDUSTRY IN NUMBERS

ACCOUNTS FOR
25%
OF ELECTRICITY

ALMOST
50%
OF LOW-CARBON ELECTRICITY

SUPPORTS AROUND
1Mn
JOBS

TURNOVER OF
100bn
PER YEAR

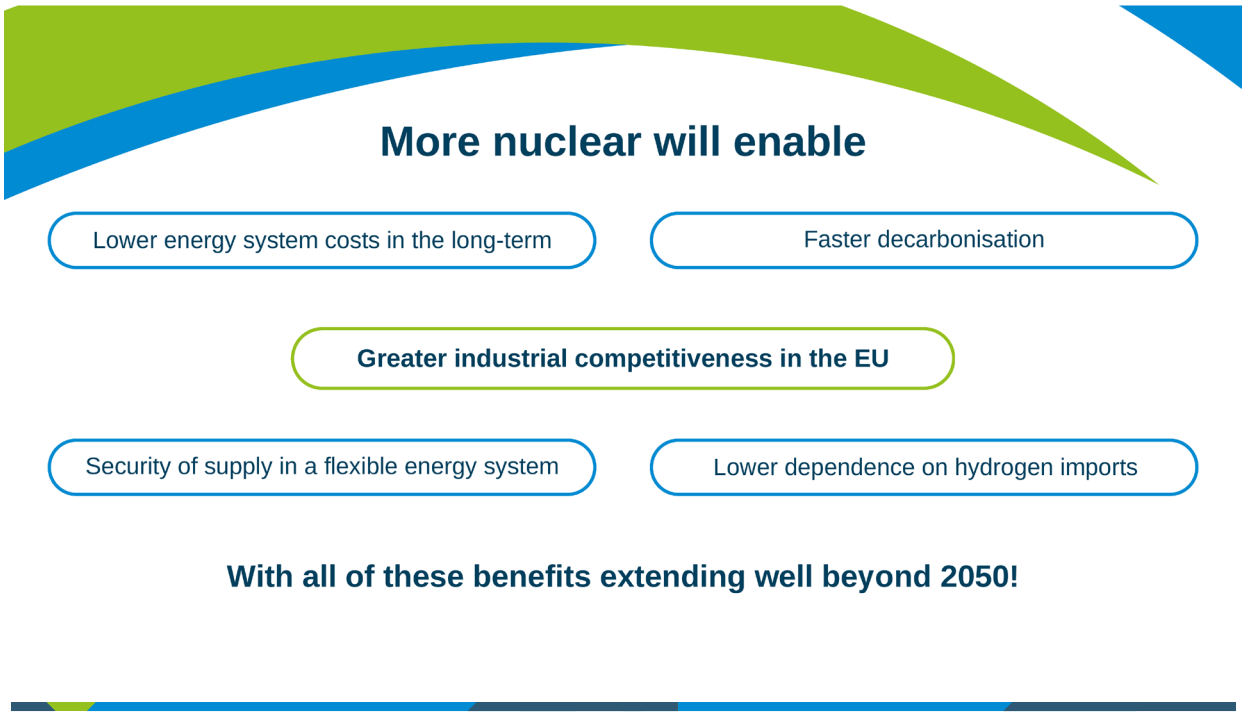
October 2024

Executive Summary

Europe is facing a series of challenges which have the potential to significantly undermine its competitiveness and its ambitious Net Zero plans. Citizens and businesses across Europe are struggling with rising energy costs and energy intensive industries in particular need to find ways of decarbonising their processes at an affordable price, whilst making sure they have access to enough energy to meet their needs.

Against this backdrop, Compass Lexecon has updated the Pathways to 2050 study undertaken with nucleareurope back in 2021 and 2018 in order to incorporate latest developments, including the target set by the Nuclear Alliance of Member States of 150 GW of installed nuclear capacity in the EU by 2050.

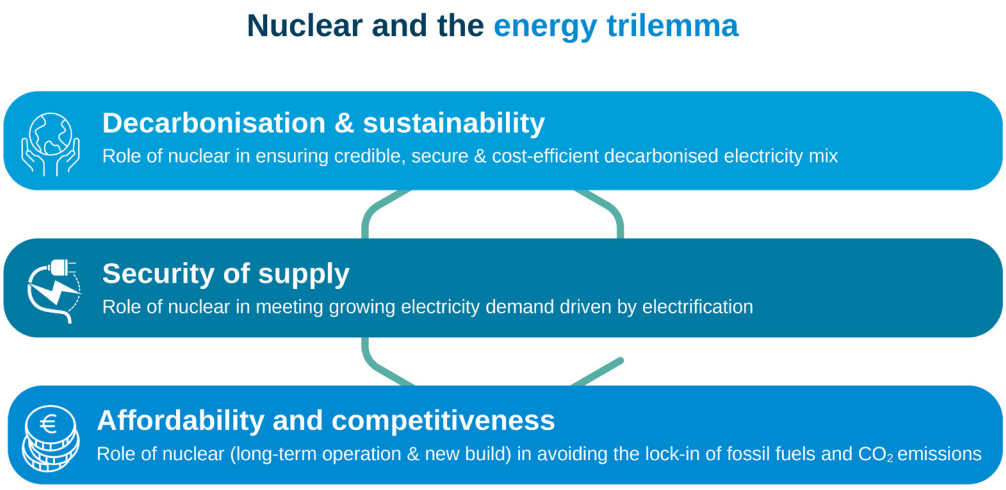
The results of this work shows that nuclear has a key role to play in achieving net zero in an affordable way whilst at the same time ensuring security of supply. Thanks to an increase in nuclear capacity, CO_2 emissions will fall faster, energy system costs will be lower in the long term, energy imports (gas, hydrogen) will be reduced and security of energy supplies guaranteed.



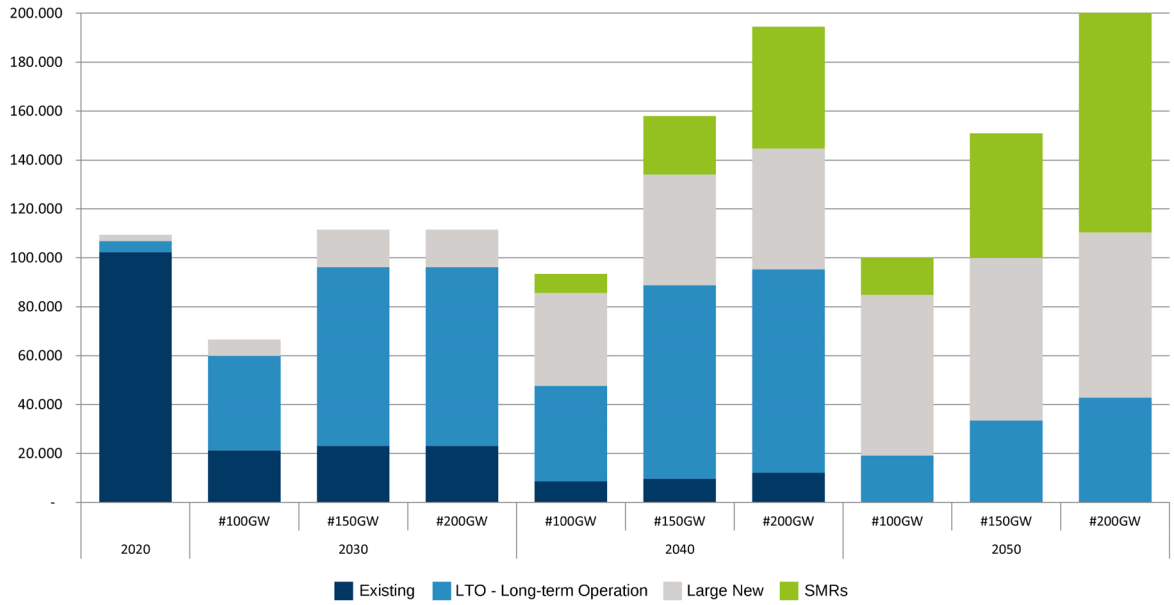
Nuclear & the Energy Trilemma

Europe has three major challenges which it needs to find solutions for: achieving net zero, ensuring security of supply, and providing access to affordable energy. This report demonstrates how nuclear can help by:

- Ensuring a credible, secure & cost-efficient decarbonised electricity mix
- Meeting growing electricity demand driven by electrification
- Avoiding the lock-in of fossil fuels and CO_2 emissions



The work is based on three scenarios of installed nuclear capacity in the EU by 2050. The first scenario (#100GW) is based on a business-as-usual approach and envisages 100 GW of installed capacity by 2050. The second scenario (#150GW) focuses on the target set by the Nuclear Alliance of Member States, reflecting more ambitious policies to develop nuclear across the EU. The third scenario (#200GW) represents a change in paradigm, with nuclear playing a central role in the energy transition.

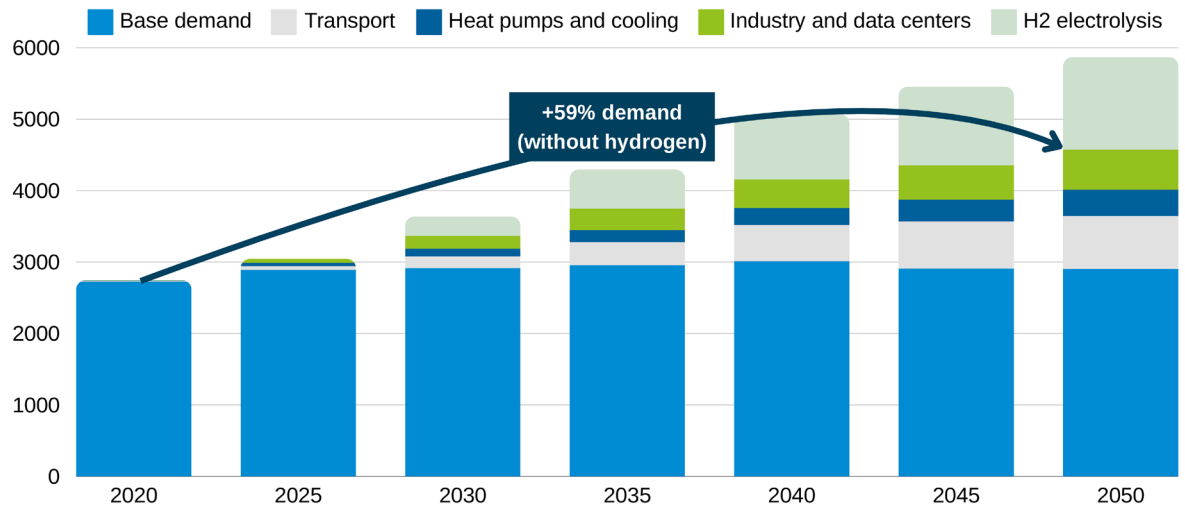


For the modelling itself, Compass Lexecon used the latest information from ENTSO-E (draft Ten-Year Network Development Plans Distribute Energy Scenario), the International Energy Agency (World Energy Outlook 2023) and the European Commission (Technology Assumptions 2024). Furthermore, total power system costs take into account CAPEX (Capital expenditures), OPEX (Operational expenditures), Fuel costs (excluding CO_2 costs which are not considered a system cost) and Network costs (more distributed renewable capacity leads to higher network costs). These are compared using two modelling approaches across the different scenarios, with the first one focusing on an electricity system approach and the second on an energy system approach. More information on this can be found on the dedicated webpage.

In this respect, aggregated electricity demand is expected to increase significantly over the next three decades, with much greater demand for flexibility due to the increase in renewable energy sources. And this is before we take into account demand for clean hydrogen, which will also lead to a further increase in demand for low-carbon electricity.

Aggregated power demand, EU27 - 2020-2050 [TWh]

(based on ENTSO-E TYNDP 2024 Distributed Energy scenario)



Nuclear as a solution provider

According to Compass Lexecon, a greater share of nuclear compared with the #100GW scenario can bring significant benefits to Europe as follows.

More nuclear enables faster decarbonisation

Under the #150GW scenario, nuclear has the potential to save around 430 million tonnes (Mt) of CO_2 in the run up to 2050, rising to 500Mt of CO_2 under the #200GW scenario. This is particularly evident between 2030 – 2040 where additional nuclear capacity can avoid the emission of 36 Mt of CO_2 per year. As a result, it will help the EU to not only reach net zero by 2050, but also meet the interim 2040 targets.

#150GW scenario

The 150GW scenario would **halve yearly CO_2 emissions** compared to the current EU 2030 targets.

This represents saving the equivalent of last year's total CO_2 emissions in the Czech Republic.

#200GW scenario

The 200GW scenario would **avoid 500 Million tonnes of CO_2 emissions** compared to a business-as-usual approach.

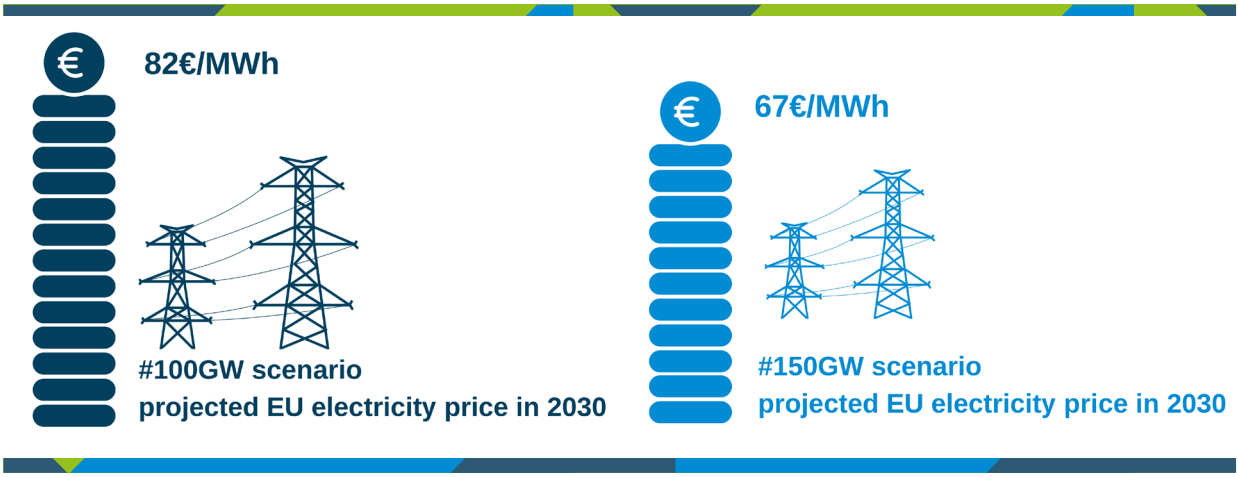
This is the equivalent of all of the CO_2 emitted by international air travel in the past year.

More nuclear lowers costs in the long-term

According to the report, #150GW nuclear has the potential to drive down electricity prices throughout the energy transition. This, combined with a more cost-efficient energy system, could save around €310 billion (Bn) in total energy system costs. Under a more ambitious #200GW scenario, the saving would be even greater at €450Bn.

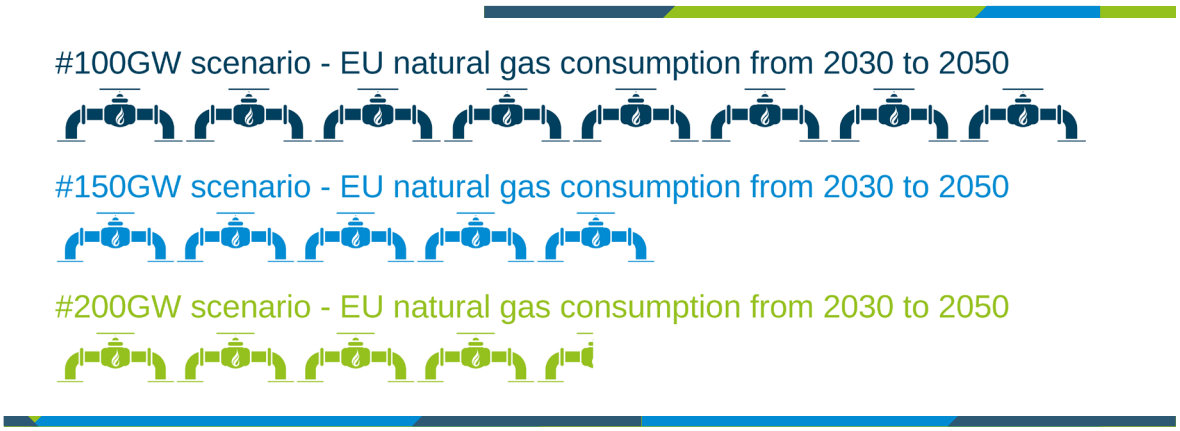
These savings are due to the fact that more nuclear reduces the need for coal and gas, for example, thus leading to significant fuel costs savings (even if in the short term, higher nuclear capacity leads to slightly higher CAPEX costs due to the higher investments in nuclear). In the long term, more nuclear can partly replace a combination of renewables and flexible resources. This reduces capital expenditure and overall system costs.

Looking beyond 2050, given that nuclear assets have a much longer life than some renewables (potentially 80 years or more), this also means that under a higher nuclear scenario the residual asset value will be much greater.



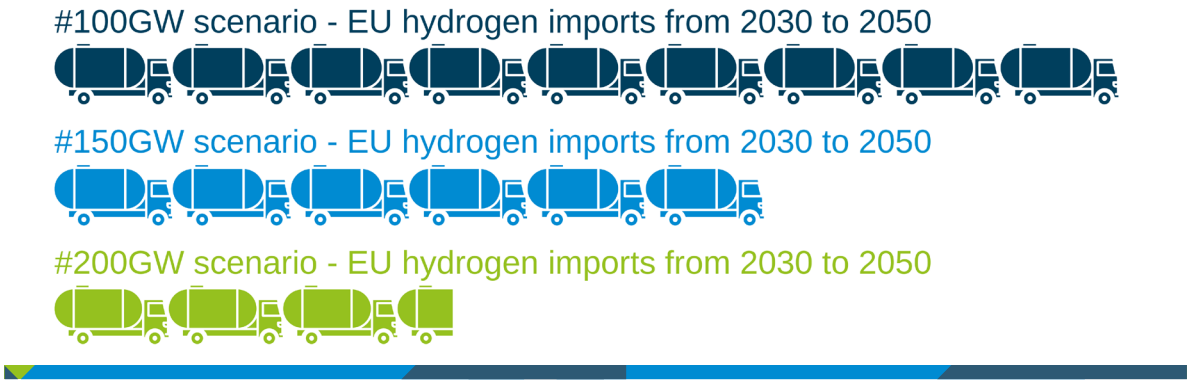
More nuclear supports security of supply

By having more nuclear in Europe, much less gas would need to be imported from third countries, leading to greater security of supply. #150GW nuclear would reduce gas consumption by around 180 billion cubic metres (bcm) between 2031 and 2050 (which is the equivalent of 37% of total gas consumption). Under the #200GW scenario, gas consumption would fall by about 220 bcm.

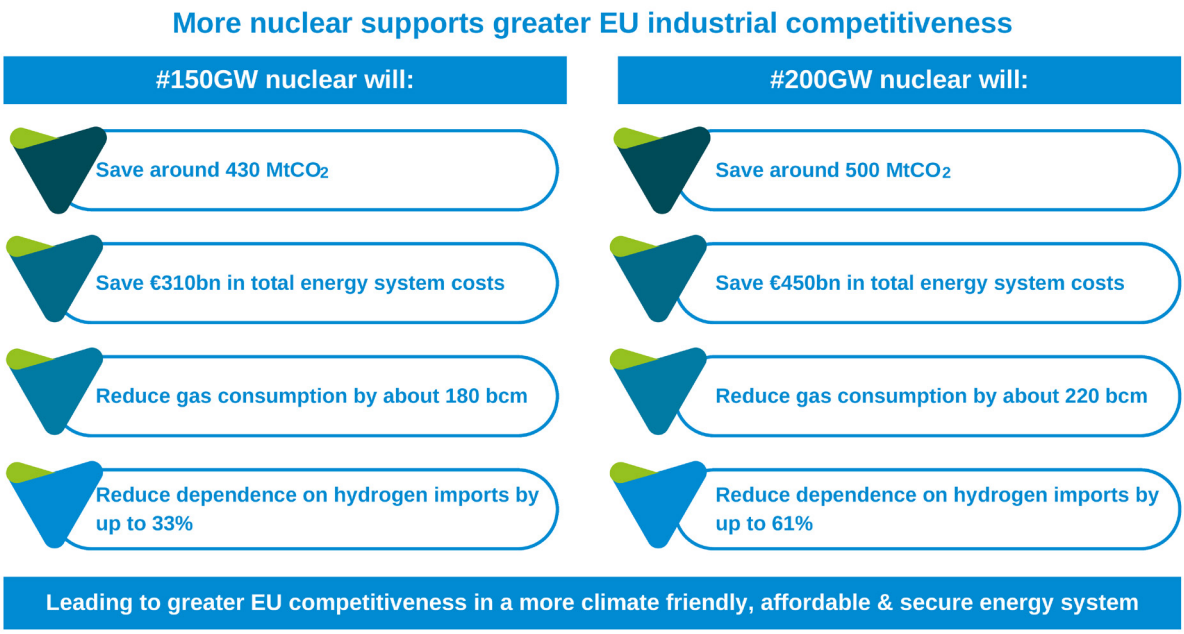


More nuclear reduces dependence on clean hydrogen imports

Clean hydrogen (H2) is expected to play an important role in the decarbonisation of sectors such as industry and transport. In this respect, #150GW nuclear will help support the generation of clean hydrogen in Europe, thus reducing the need for imports. Indeed, according to Compass Lexecon, under such a scenario 33% of clean H2 imports would be replaced by domestic EU production between 2030-2050 (Mt). Under a #200GW scenario, over 60% of imported clean H2 could be replaced by domestic production.

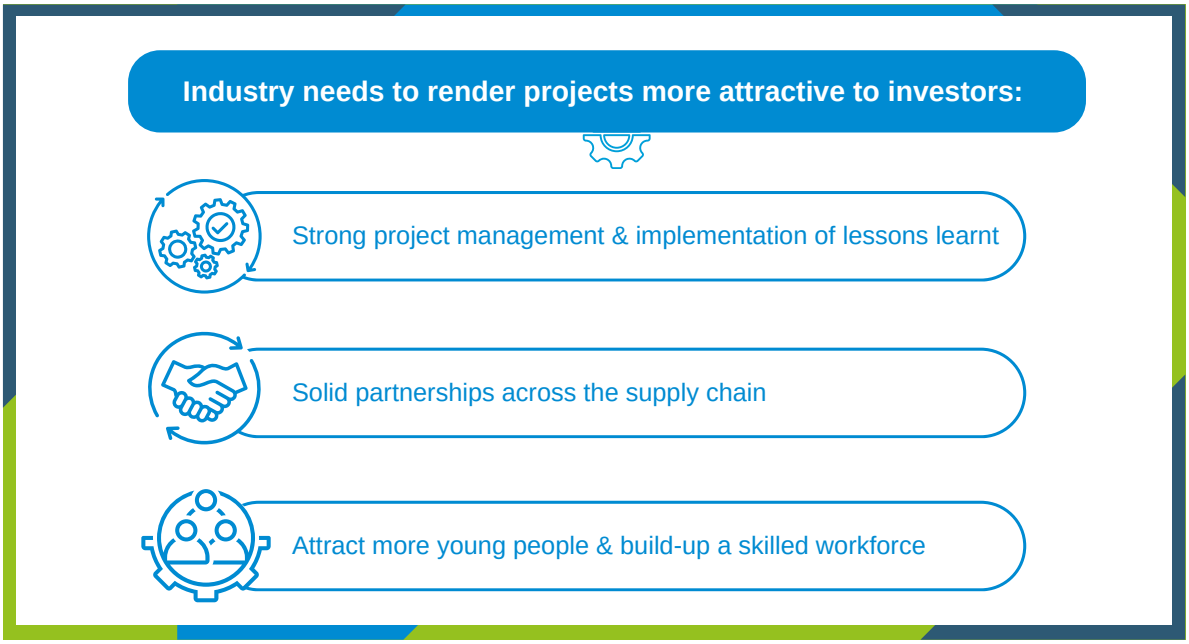


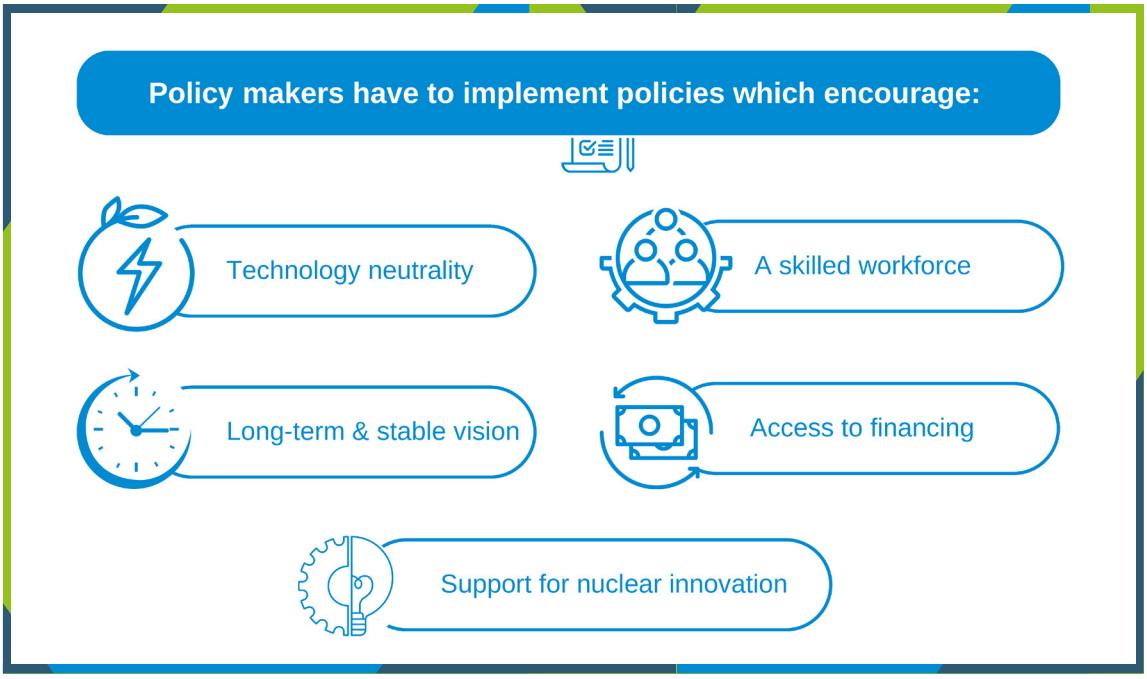
In a nutshell: More nuclear supports greater EU industrial competitiveness

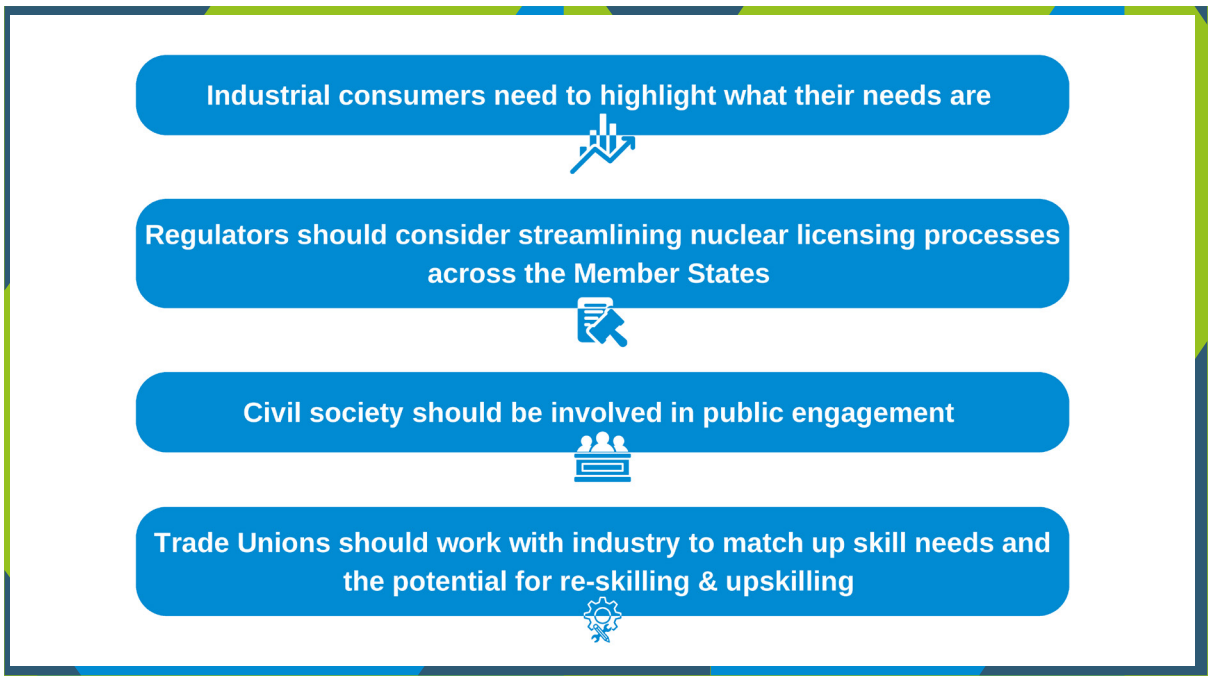


Enabling Recommendations

It is clear that achieving the #150GW or #200GW scenarios will be very challenging. It is therefore essential that all stakeholders – industry, policymakers, investors, consumers etc – come together to work on solutions that can make this happen. In this respect the following enablers have been identified:




Policy makers have to implement policies which encourage:
Technology neutrality
A skilled workforce
Long-term & stable vision
Access to financing
Support for nuclear innovation


Industrial consumers need to highlight what their needs are
Regulators should consider streamlining nuclear licensing processes across the Member States
Civil society should be involved in public engagement
Trade Unions should work with industry to match up skill needs and the potential for re-skilling & upskilling

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 1.1 million jobs.

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