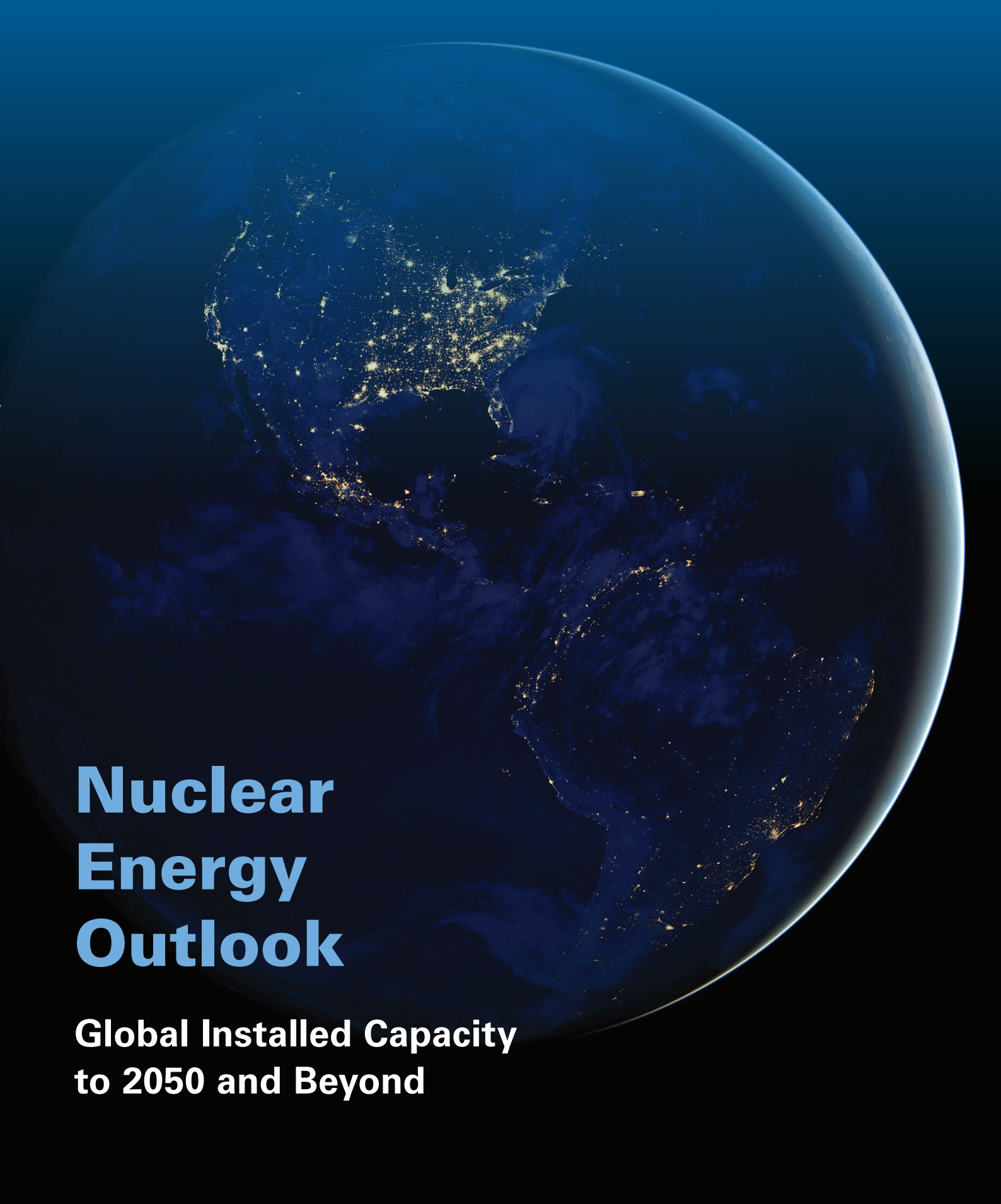




Nuclear Energy Outlook

**Global Installed Capacity
to 2050 and Beyond**

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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT



Foreword

“As for the future, your task is not to foresee it, but to enable it.”

– Antoine de Saint-Exupéry

For the first time in decades, a broad global consensus is emerging around the strategic role of nuclear energy – not only as a source of clean, dispatchable electricity, but also as a foundation for energy security, industrial progress, and long-term economic competitiveness. After years of stagnation, established and newcomer countries alike are expanding their commitment to nuclear energy, while major industrial end-users increasingly recognise its value as a reliable and scalable energy source. Together, these developments signal a profound shift: nuclear energy is becoming a central pillar of global energy strategy for the first time in nearly 50 years.

In this evolving landscape, the *Nuclear Energy Outlook* (NEO) provides an in-depth assessment of how those commitments to nuclear energy are translating into concrete projects and deployment plans. More than a set of normative scenarios, the report examines the realities of implementation – from the long-term operation and refurbishment of existing reactors to large-scale new builds and the emergence of small modular reactors (SMRs).

The NEO also highlights some of the most pressing challenges facing the nuclear sector. Meeting future ambitions for nuclear energy will require a significant acceleration in deployment, supported by effective policy and regulatory frameworks, investment, skilled workforces and resilient supply chains. However across many NEA countries, decades of limited new-build activity have eroded key supply chains and workforce capabilities. Restoring this capacity will be a complex and long-term endeavour, the scale of which should not be underestimated. Success will require sustained strategic cooperation among like-minded governments, industry, and financial institutions.

The future of nuclear energy will not be shaped by ambition alone, but by the ability to deliver projects successfully and at scale. By systematically tracking progress and identifying the opportunities and challenges ahead, this report aims to support informed decision-making and, ultimately, to help enable the future global expansion of nuclear energy.

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Executive summary

Nuclear energy stands at a decisive moment

After three decades of limited new build in many OECD countries¹, governments and industries are once again placing nuclear energy at the centre of energy security, climate and industrial strategies. At the same time, large electricity users such as data centres and energy-intensive industries are seeking reliable, low-carbon heat and power, creating new commercial pathways for nuclear deployment beyond traditional utility-led models.

By systematically tracking nuclear energy projects around the globe, the NEO assesses some of the most pressing issues regarding the future of nuclear energy:

- The report examines the current status and outlook for nuclear energy projects in OECD and non-OECD countries, including long-term operation of existing reactors, large-scale new build and small modular reactors (SMR) deployment. It also assesses recent policy and legislative measures adopted to expand nuclear capacity, how these measures are shaping project development. In doing so, this publication helps track progress towards meeting long-term nuclear energy targets, including the objective of tripling installed nuclear capacity by 2050.
- To address these questions, this report defines four scenarios to describe how global installed nuclear capacity could evolve to 2050 and beyond. The four scenarios incorporate the roles of the existing fleet, refurbishments and long-term operations of the existing fleet, as well as new builds of both large-scale nuclear reactors and SMRs.

Governments are placing greater policy emphasis on nuclear energy to support the energy policy priorities

The war in Ukraine has led many countries to increase the importance placed on energy security, exposing the dependence on Russian fossil fuel imports – especially natural gas – as a major strategic vulnerability. Many countries noted that this reliance posed not only risks to the security of their energy supply but to their economic resilience and national security more broadly. Since the war in Ukraine began in 2022, geopolitical disruption, energy price volatility, decarbonisation commitments and rising electricity demand have strengthened the case for nuclear energy.

Nuclear energy has also gained renewed recognition in climate policy. The Declaration to Triple Nuclear Energy, made in the margins of COP28 and now signed by 38 countries, alongside the inclusion of nuclear energy in the Global Stocktake. For countries pursuing net zero, nuclear energy provides firm, low-carbon electricity that complements variable renewables and supports system reliability. This role becomes increasingly important as electricity demand grows and as grids integrate larger shares of wind and solar generation.

Global electricity demand could rise by nearly 50% by 2040 and almost double by 2050 across a range of reference scenarios (BP, 2025; IEA, 2025b; IPCC, 2023; Shell, 2025), driven by economic growth, electrification, digitalisation and industrial development. While renewables will continue to expand rapidly, high shares of variable generation increase the need for balancing, grid reinforcement and firm capacity. NEA system-cost studies (NEA, 2025a, 2019) show that in the cases examined as carbon constraints tighten, electricity systems relying exclusively on variable renewables can face sharply rising costs. Nuclear energy helps contain these costs by providing dispatchable low-carbon generation and reducing the need for back-up capacity, storage and grid services.

New industrial customers, including data centres, are contributing to demand for reliable, low-carbon nuclear heat and power

The market for nuclear energy is also being reshaped by new industrial customers. Data centres, driven by cloud computing and artificial intelligence, require uninterrupted electricity and have made strong clean-energy commitments. Since 2024, companies including Microsoft, Google, Meta and Amazon have announced a range of measures such as power purchase agreements, equity investments, memoranda of understanding or other arrangements with nuclear developers. These partnerships include equity investments, power purchase agreements (PPAs) and co-location opportunities to support existing assets and new builds, especially SMRs. Other energy-intensive industries, such as chemicals, are also exploring nuclear energy for low-carbon heat and power. These developments could significantly influence future business models and financing structures for new nuclear projects.

1. For analysis purposes, “OECD countries” is used to refer to OECD member countries, including accession countries. The full list is presented in Annex 1.

LTO decisions are central to the 2040 outlook for OECD installed nuclear capacity

Long-term operation (LTO) of the existing nuclear fleet remains a key contributing factor in meeting global nuclear capacity targets. Most reactors in OECD countries were built in the 1970s and 1980s and many will reach the end of their initial licences before 2040. Extending operations to 60 years and, increasingly, 80 years could preserve reliable low-carbon capacity, support energy security and avoid the need to replace large volumes of firm generation at short notice. For most reactor designs, refurbishment and maintenance can enable continued operation without fundamental technical barriers (NEA, 2021). Consistently, LTO is the lowest-cost source of clean electricity available (NEA-EPRI, forthcoming).

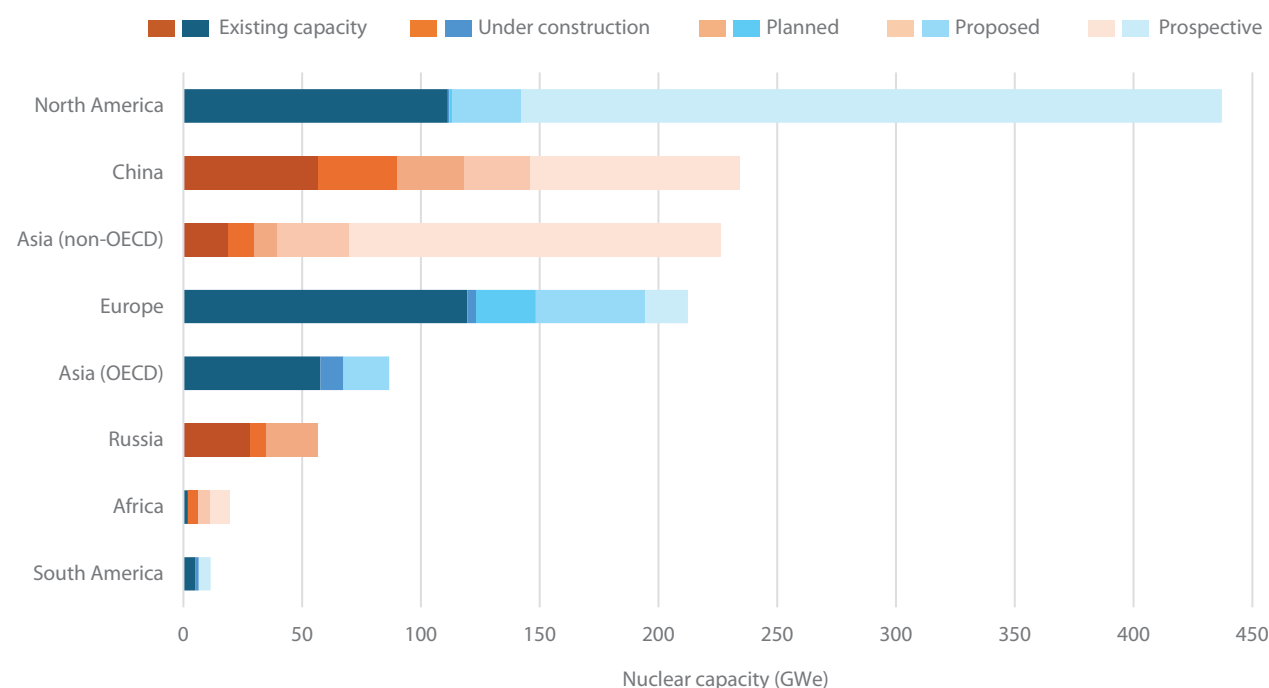
The NEO estimates that more than 50 GWe of OECD nuclear capacity has not yet secured licences for operation to 2040. Decisions taken in the near term will therefore determine whether global nuclear capacity contracts, stabilises or expands. In non-OECD countries, fleets are generally newer, and retirements are expected to be limited, with most reactors continuing under their original licence terms.

The pipeline of near-term nuclear new build projects underscores a shift in the centre of gravity of new build activity towards non-OECD countries

Global installed nuclear capacity is currently close to 400 GWe, with about 78% located in OECD countries. However, the project pipeline points to a changing geography of nuclear development. As of 2025, the NEO tracks nearly 313 GWe of new nuclear projects under construction, planned or proposed, with non-OECD countries accounting for 55% of this capacity. The trend is strongest in the near term: of the 70 GWe under construction, around 80% is in non-OECD countries, led by the People's Republic of China (China) with more than 33 GWe. Non-OECD countries also account for around 65% of the 85 GWe of planned projects.

The picture changes for less advanced projects. OECD countries account for 65% of proposed capacity, including more than 50 GWe in Europe, reflecting recent policy shifts and project announcements. OECD countries also represent 55% of prospective capacity, with North America leading due largely to the United States' target to quadruple nuclear capacity by 2050. Non-OECD Asia remains a major source of prospective growth, with ambitious capacity targets from countries such as India, Indonesia and Pakistan. The outlook therefore combines near-term leadership by non-OECD countries with a substantial but less certain OECD pipeline that must move quickly from announcements to project delivery.

Figure ES1: **Nuclear capacity under construction, planned, proposed, and prospective by region**



China and Russia hold a strategic advantage in the international nuclear market

Technology and vendor choices will have long-lasting commercial and geopolitical implications. Across reactors under construction, planned and proposed, around 60% of projects are expected to use domestic reactor suppliers, 25% are expected to procure from foreign vendors, and 15% have not yet selected a technology. China leads with 85 GWe under construction, planned or proposed based on Chinese designs, including 51 GWe of Hualong One reactors, although almost all Chinese projects remain domestic. Russia follows a different model: of the 57 GWe of Russian-designed reactors in the pipeline, 54% are export projects, and Russian technology accounts for more than 40% of internationally procured reactors.

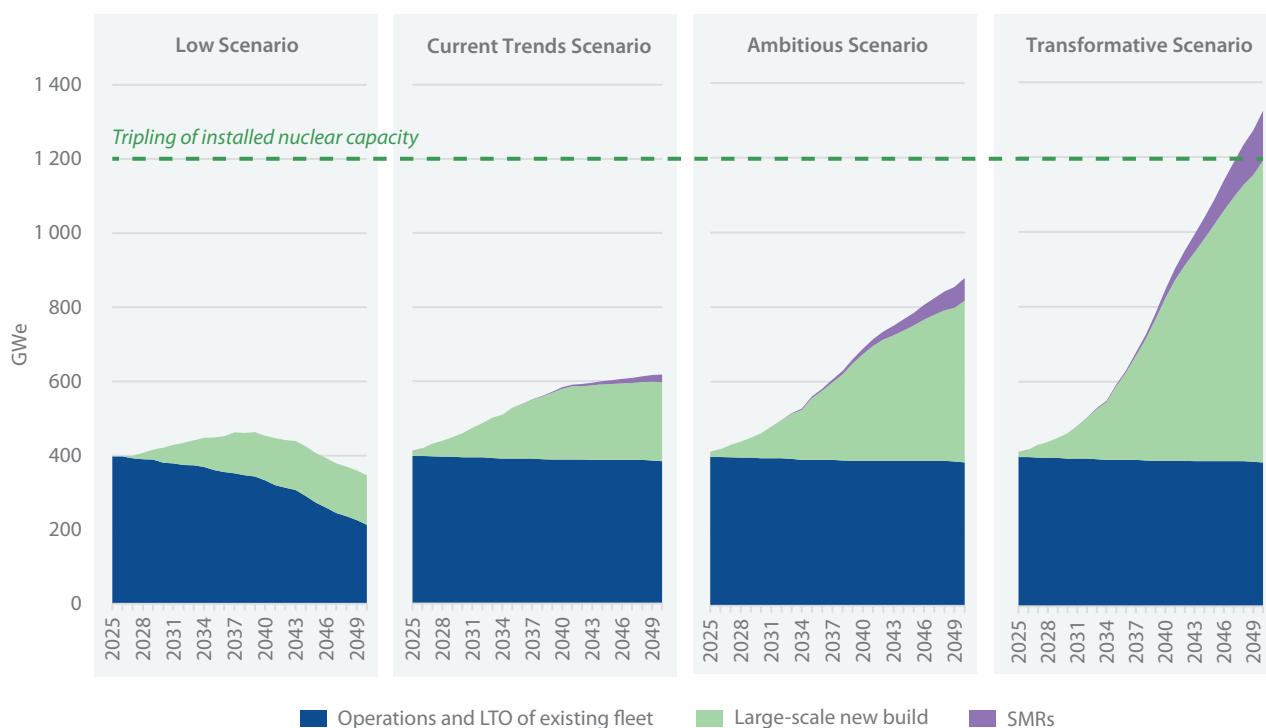
OECD-based vendors from the France, Korea and the United States have a combined pipeline of about 75 GWe and are active internationally, with export projects representing 54% of OECD-designed reactor projects. However, many OECD projects remain at earlier stages than those in China or Russia. Around 40% of proposed projects have not yet selected a vendor, leaving important markets in Asia, Africa and the Middle East open to competition. The outcome will shape not only the nuclear sector but also affect long-term strategic relationships.

Tripling installed nuclear capacity by 2050 is achieved only in a Transformative Scenario

The four NEO scenarios illustrate the scale of the challenge. In the Low Scenario, global installed nuclear capacity reaches only 347 GWe by 2050, as retirements in the OECD offset new projects and recent momentum fails to translate into sustained deployment. In the Current Trends Scenario, capacity reaches 619 GWe, driven largely by non-OECD planned and proposed projects, but still leaves an approximately 600 GWe gap with the tripling objective. In the Ambitious Scenario, global capacity reaches 883 GWe, with a larger contribution from OECD new build and SMRs, but remains around 300 GWe short of tripling.

The Transformative Scenario provides a clear vision of how nuclear energy could expand across the world and have a major impact on the world's energy picture. This scenario reaches about 1 324 GWe of global nuclear capacity by 2050, which exceeds the tripling target. This scenario is driven by long-term national capacity goals, including the United States' goal to quadruple nuclear capacity by 2050 and India's target of 100 GWe by 2047, combined with successful LTO, accelerated large-scale new build and significant SMR deployment. It requires deployment rates that far exceed recent experience and, in OECD countries, would require a major step change in project execution, industrial capability and financing.

Figure ES2: **Nuclear Energy Outlook scenarios for nuclear energy installed capacity**



SMR deployment at scale depends on new delivery models

SMRs are included in all four scenarios, but their contribution depends on the delivery model achieved. In the Low Scenario, demonstration projects only yield limited deployment. In the Current Trends Scenario, programme-based onsite construction could support 2–3 GW per year. In the Ambitious Scenario, high modularisation, drawing on advanced modular manufacturing practices, could enable SMR deployment to reach 5–8 GW per year. A Transformative Scenario would require mass manufacturing, product-based licensing, pre-qualified sites and aggregated demand sufficient to support robust order books, enabling 12–16 GW per year in the long term.

Under the Transformative Scenario, global SMR capacity could exceed 150 GWe by 2050, shared broadly between OECD and non-OECD countries. However, the enabling conditions for mass manufacturing are unlikely to be fully in place before the 2040s, limiting the contribution of SMRs before 2050. A larger role for SMRs may emerge in the second half of the century, particularly if regulatory harmonisation, factory production and customer demand aggregation can be advanced in parallel.

OECD countries will need to rapidly expand their nuclear supply chain and workforce to meet the pipeline of new nuclear projects

Supply chain and workforce capacity are critical constraints for OECD countries, where few new reactors have been commissioned over the past 25 years and some industrial capabilities have atrophied. In the Current Trends Scenario, OECD countries would need to increase concurrent nuclear construction from around 9 GWe on average over the last decade to more than 40 GWe in the 2030s. The Ambitious Scenario would require a more substantial ramp-up, while the Transformative Scenario would require up to 300 GWe under construction concurrently from the mid-2030s – almost twice the historical OECD peak.

Meeting this challenge will require close co-operation among like-minded countries, stronger industrial partnerships and a shift from project-by-project approaches to programme-based deployment. Programmatic strategies provide visibility for investment, support standardisation, enable learning effects and reduce construction costs. Historical experience in France, Canada, Japan and Korea, as well as current experience in China, shows that fleet deployment can improve delivery performance when supported by stable policy frameworks and capable supply chains.

OECD countries face financing needs of up to USD 200 billion annually for new nuclear build by the 2030s

Financing is another decisive condition. Recent global capital expenditure on new nuclear has averaged around USD 30 billion per year, mainly driven by China and Russia. To meet higher deployment scenarios, this will need to rise sharply. For OECD countries, annual capital requirements would increase from about USD 12 billion per year over the last decade to an average of USD 68 billion in the Ambitious Scenario and USD 143 billion in the Transformative Scenario. During the 2030s, the Transformative Scenario could see OECD capital requirements approach USD 200 billion per year.

Given fiscal pressures on public budgets, mobilising private capital will be essential. This will require bankable project structures, clear risk allocation, credible revenue models and government-backed mechanisms that reduce construction, market and political risks. Non-OECD financing needs are comparatively more modest, reflecting recent construction experience and lower average construction costs. The Ambitious Scenario could require USD 40 billion per year, and up to USD 62 billion per year in the Transformative Scenario.

Cost reduction will be equally important. If OECD countries can achieve greater standardisation and fleet-based deployment, cumulative capital expenditure needs in the Transformative Scenario could fall by nearly USD 850 billion, a reduction of about 24%. This reinforces the central conclusion of the NEO: the renewed momentum behind nuclear energy is real, but achieving global ambitions will depend on converting policy commitments into executable projects, strengthening supply chains, mobilising capital and adopting delivery models capable of scaling nuclear energy deployment at unprecedented speed.



Chapter 1.

Introduction

1.1. Assesses global progress in existing and new nuclear projects

While the majority of global nuclear installed capacity currently in operation was built in OECD countries¹ during the 1970s and 1980s, new build since 1990 has been predominantly located in non-OECD countries, led by China and Russia.

At the time of writing, a growing number of both OECD and non-OECD countries are revising their energy strategies, placing renewed emphasis on nuclear energy. Governments around the world, power companies and private sector players, particularly major industrial consumers such as data centres and heavy industry, have declared plans to dramatically expand nuclear capacity and many have taken substantive steps to implement these plans. The calls for new nuclear deployment are coming from a far broader collection of players than ever in the past and in countries in all parts of the world.

In this evolving landscape, the *Nuclear Energy Outlook* (NEO) assesses global progress in existing and new nuclear projects. The aim is to track how governments and industry commitments are being implemented in tangible project decisions and to shed light on some of the challenges that must be addressed for nuclear energy to meet national and international deployment targets.

By systematically tracking nuclear energy projects around the globe, the NEO delivers insights into some of the most pressing issues regarding the future of nuclear energy:

- i. What is the current status and outlook for nuclear energy projects in both OECD and non-OECD countries, taking into consideration the long-term operation of existing reactors, the construction of large-scale new build projects, and the deployment of small modular reactors (SMRs)?
- ii. What are the recent policies and legislative measures adopted by countries aiming to expand their nuclear capacity? How are these measures influencing project development?
- iii. Are countries on track against their objective to triple installed nuclear capacity by 2050? To which extent will the rollout of new nuclear capacity need to increase to meet this objective?

To address these questions, four scenarios are defined to describe how global installed nuclear capacity could evolve to 2050 and beyond. The four scenarios incorporate the roles of the existing fleet, refurbishments and long-term operations of the existing fleet, as well as new builds of both large-scale nuclear reactors and small modular reactors (SMRs). The analysis and conclusions in this report are structured around these four scenarios and their component parts.

These core findings further create the basis to consider implications for nuclear supply chains, fuel supply and financing requirements as well as broader policy implications. Some of these issues are addressed within the pages of this publication, while others – such as the implications for nuclear fuel supply – are addressed in additional forthcoming NEA publications which aim to provide a more comprehensive understanding of the evolving nuclear energy landscape.

1.2. Nuclear energy and energy security

Its association with energy security has been an important factor behind nuclear energy from its inception, and particularly during the 1970s and 1980s in response to oil price shocks. Compared with fossil fuels, nuclear energy has certain technological advantages that help to reduce vulnerability to disruptions linked to fuel market volatility or geopolitical events. For example, significantly smaller fuel volumes for nuclear reactors compared with fossil fuel-fired plants mean that countries can more easily insulate their power systems from market volatility through strategic storage of fuel. A typical 1 gigawatt electric (GWe) nuclear reactor uses between 3.5 and 4 tonnes of fuel to produce 1 TWh of electricity, versus 210 000 cubic metres of natural gas, or more than 500 000 tonnes of coal to produce the same quantity of power (EIA, 2025).

The war in Ukraine that began in 2022 has led many countries to increase the importance placed on energy security, exposing the dependence on Russian fossil fuel imports – especially natural gas – as a major strategic vulnerability. Many countries noted that this reliance posed not only risks to the security of energy supply but also carried significant threats to economic and national security more broadly.

In many OECD countries, policymakers have highlighted the role that nuclear energy plays in supporting energy security and enhancing the resilience of energy systems in the face of evolving global challenges.

1. For analysis purposes, “OECD countries” is used to refer to OECD member countries, including accession countries. The full list is presented in Annex 1.

Energy security is also very much a driver for nuclear energy in non-OECD countries, with countries like China and India accelerating investment into nuclear energy. Eight non-OECD countries are either constructing or have advanced plans to build their first civil nuclear reactors, many in response to energy security imperatives. Many more countries in the Global South have initiated plans for their first nuclear plants for many of the same reasons, along with the vital need to reduce energy poverty and support economic development.

1.3. Nuclear energy and the industrial demand for reliable low-carbon power

Globally, electricity demand is projected to rise steadily in the coming decades, driven by economic development and population growth, alongside the electrification of several sectors of the economy, such as transport and industry, and the expansion of digital technologies. Table 1.1 and Figure 1.1 present the wide range of future electricity demand expected across reference scenarios from the International Energy Agency (IEA), the International Panel on Climate Change (IPCC), British Petroleum (BP), and Shell, ranging from a 17.4% growth (IPCC SSP30-60) to nearly a tripling of global electricity demand (BP Below 2 Degrees) by 2050 (BP, 2025; IEA, 2025b; IPCC, 2023; Shell, 2025). These scenarios reflect different assumptions regarding electrification of key sectors of the economy, progress with energy efficiency, economic growth, demography, and climate commitments. Overall, these scenarios suggest that the global demand for electricity could increase by nearly 50% by 2040 and could almost double by 2050. This growth in electricity consumption is expected to be especially significant in emerging economies, where access to reliable energy remains a cornerstone of social and economic progress.

Figure 1.1: **Global electricity demand by 2050 in selected scenarios**

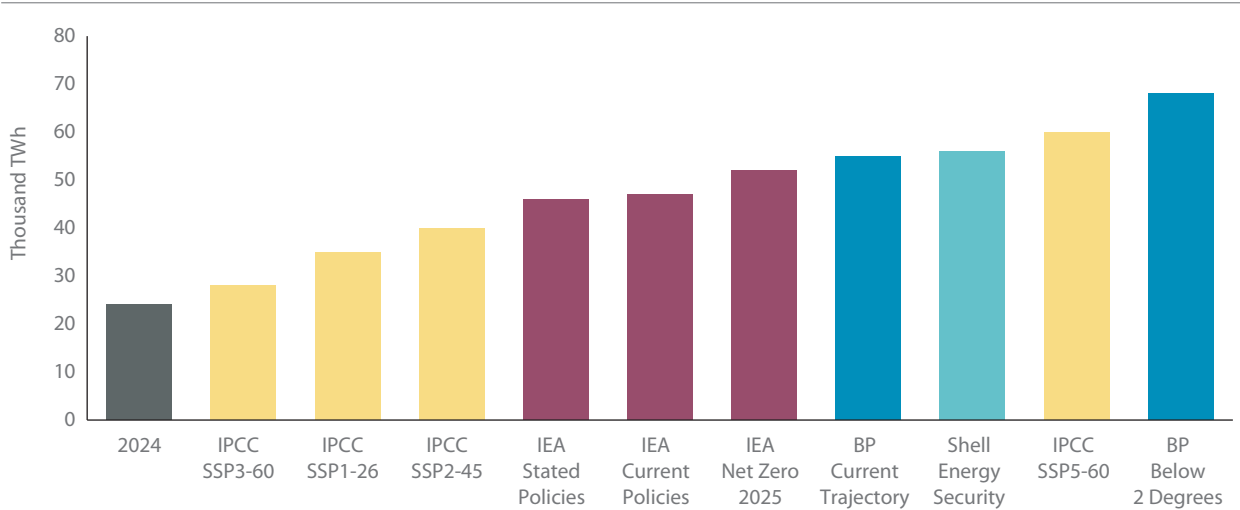


Table 1.1: **Percentage growth in global electricity demand by 2050 in selected scenarios**

Scenario	Per cent increase from IEA 2024 historical demand
IPCC SSP3-60	17.4%
IPCC SSP1-26	44.2%
IPCC SSP2-45	58.0%
IEA State Policies	77.6%
IEA Current Policies	81.5%
IEA Net Zero 2050	102.5%
BP Current Trajectory	119.0%
Shell Energy Security	124.6%
IPCC SSP5-60	131.2%
BP Below 2 Degrees	166.5%

Despite the uncertainty about the rate of growth for electricity demand, all the scenarios point towards the need to expand and modernise electricity generation capacity, ensuring that growing demand is met while maintaining reliability and advancing decarbonisation objectives. In recent years, this growth in electricity demand has been mostly met by the rapid deployment of intermittent variable renewables such as wind power and solar photovoltaics. However, as the share of variable renewables in the electricity mix increases, grid operators and utilities are facing new challenges for maintaining grid stability, including frequency control and inertia (IEA, 2024). Recent high-profile blackouts in locations such as Texas, United States (2021), South

Africa (2022-2023) and parts of Europe such as Spain (2025) demonstrate some of the vulnerabilities of electricity grids growing increasingly reliant on intermittent renewable energy sources without sufficient firm baseload capacity. This dynamic represents another driver for renewed interest in nuclear energy.

1.4. Nuclear energy, national decarbonisation targets and future energy mixes

Many countries have made commitments to decarbonise their economies, including targets to reach net zero carbon emissions by 2050. As countries chart paths toward meeting their national climate targets, a role for nuclear energy emerges as a complement and enabler for variable renewable energy.

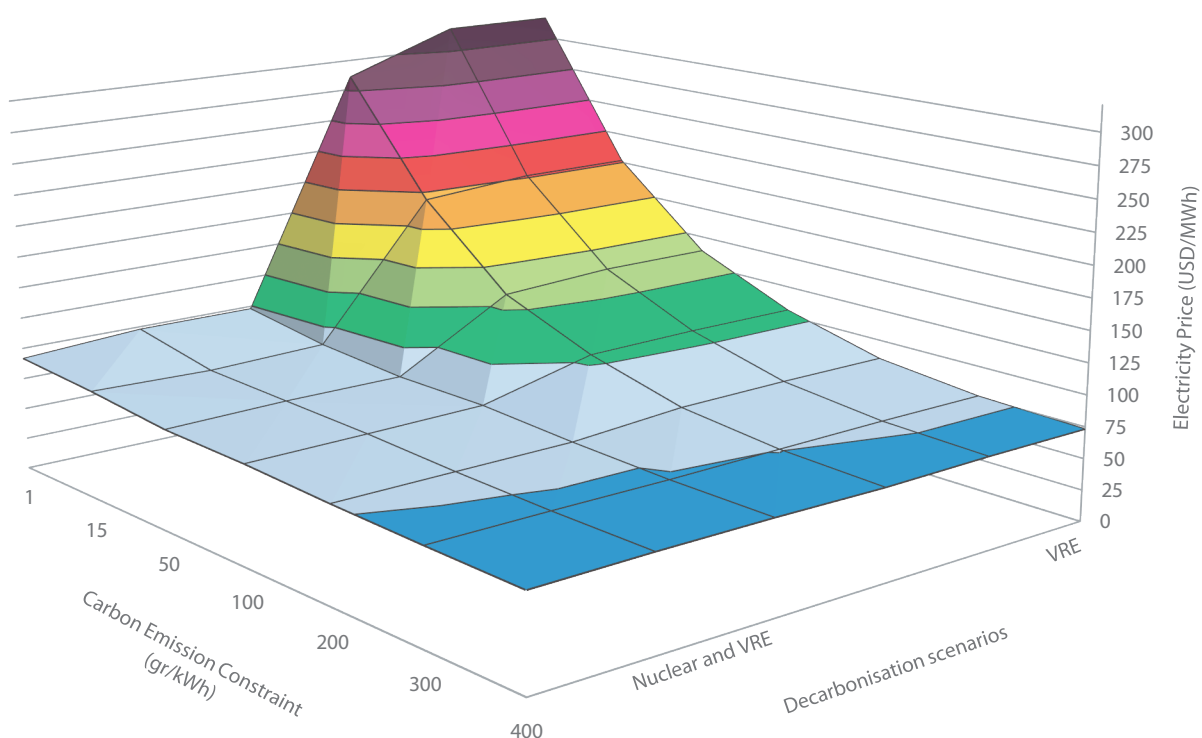
Understanding the complementarities between nuclear energy and variable renewable energy requires a system-level approach. In recent years, the NEA has conducted a series of country-level system costs studies (NEA, 2025a, 2019) complementing a growing body of literature (IEA, 2025a; Aarflot Moen et al, 2025).

System costs are the total costs to supply electricity, taking into account plant-level costs as well as grid-level costs required to integrate generation sources into the wider electricity system. This includes investments to expand and reinforce transmission and distribution grids, connect new capacity to the grid, balance supply and demand in the short term, and maintain long-term adequacy of electricity supply. Taking a systems-level approach to estimating costs allows policymakers to accurately compare the costs of different generating options by comparing like for like.

Variable renewable energy sources impose greater system costs than dispatchable generating options as the grid must respond to variability and intermittency. Initially, when variable renewable sources are added into the mix, the impacts on system costs can be modest. However, system costs imposed by variable renewable sources grow as the penetration of variable renewable sources grows. In a carbon constrained system, system costs will further grow as carbon constraints become more stringent as options to backstop variable renewable sources with unmitigated coal or natural gas become increasingly limited. System costs are also influenced by national characteristics. For instance, systems rich with hydropower, including pumped hydro, or systems with large interconnections will be able to integrate larger shares of variable renewables with lower system costs. However, even in systems with favourable characteristics, NEA system cost studies consistently show a role for nuclear energy in the lowest costs mix (NEA, 2025, 2019; NEA-EPRI, forthcoming).

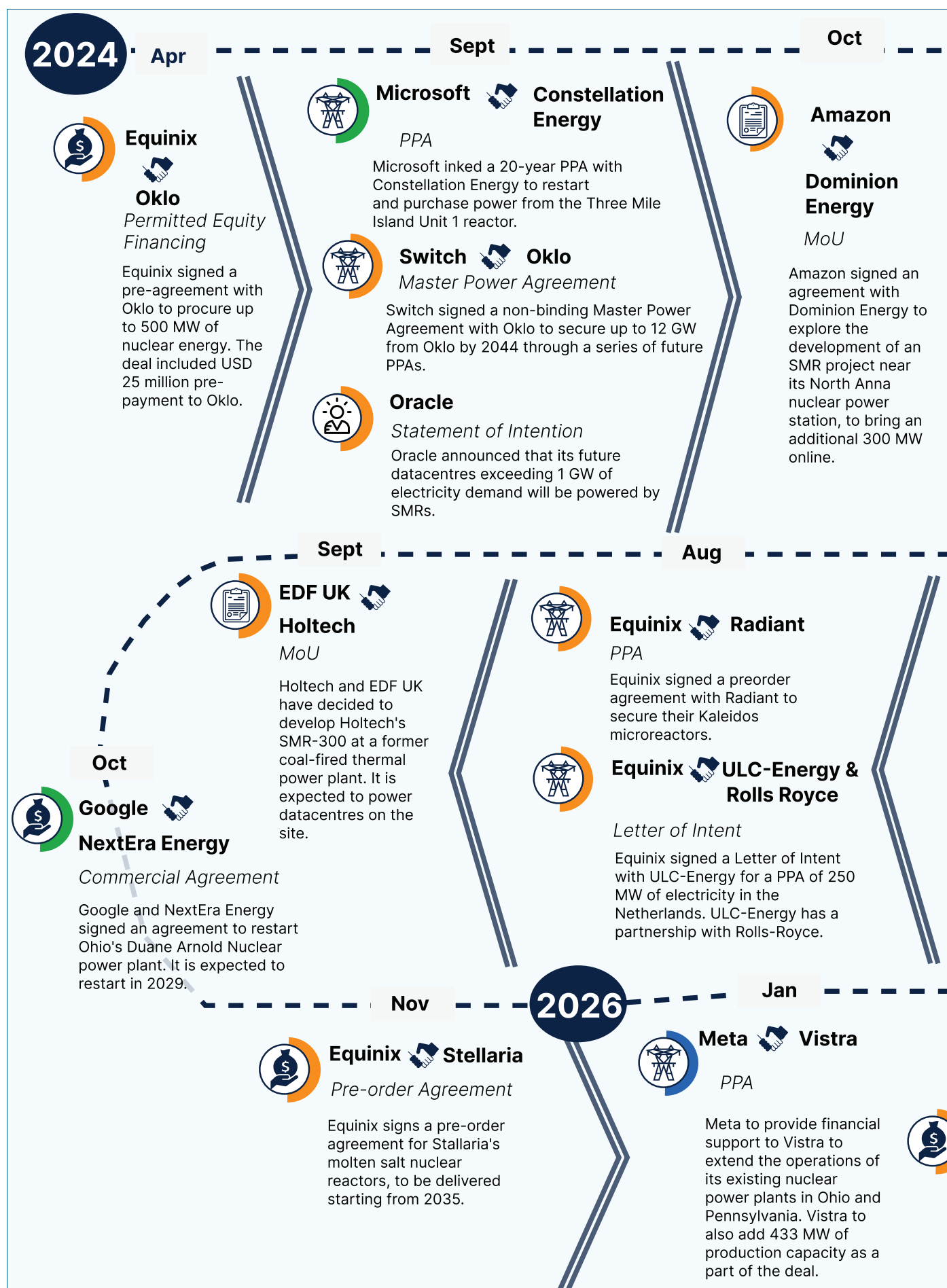
A key takeaway from the NEA studies, as illustrated in Figure 1.2, is that system costs increase sharply as both carbon constraints tighten and the share of variable renewables increases. Initially, adding variable renewables can be economically backed up by options like natural gas, but as emission targets become more stringent, unmitigated natural gas ceases to be an option, and the costs of maintaining system reliability become increasingly expensive. In other words, for countries with long-term climate commitments, relying exclusively on variable renewable energy sources risks creating a path dependency that may provide short-term cost savings but ultimately would make achieving long-term climate goals prohibitively expensive.

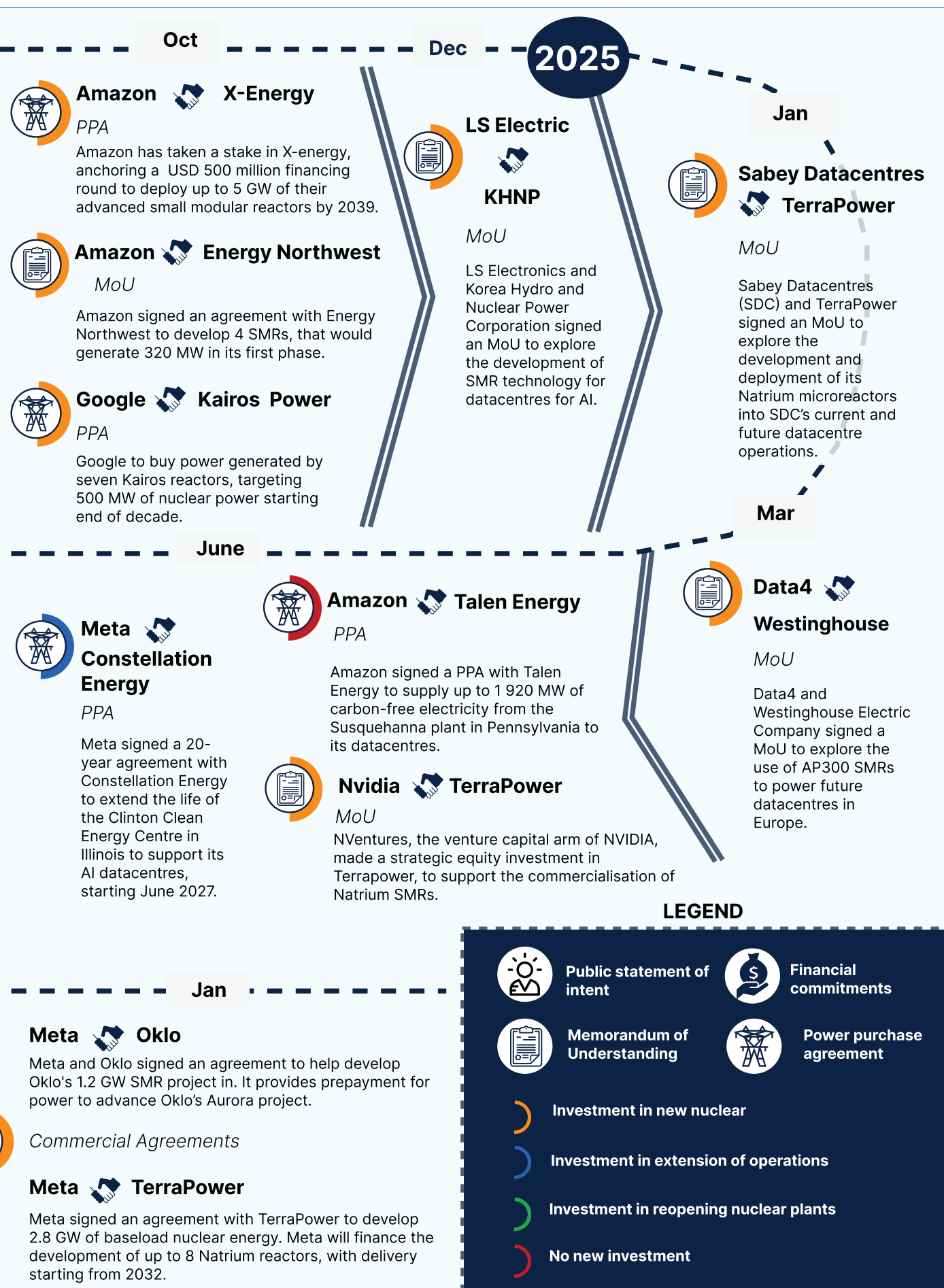
Figure 1.2: **Total costs for different mixes of electricity as a function of the share of variable renewables and carbon constraints**



Source: NEA based on Sepulveda (2016).

Figure 1.3: Recent announcements by technology and data centre companies to support new nuclear investments





Source: Based on (NEA, 2025d) *Roadmaps to New Nuclear 2025: Report for Ministers and CEOs*.

1.5. Nuclear energy, industrial customers and clean power demand

Beyond the overall trend in electricity demand, specific industries such as data centres and the chemicals sector are reshaping the market for nuclear energy. Data centres are emerging as major electricity consumers, driven by significant growth in cloud computing and artificial intelligence applications. Currently, global power demand for data centres is estimated at 100 GW, but demand in 2050 could increase severalfold (Kou and Limandibhratha, 2025; Green et al., 2024; EPRI, 2024). These facilities require uninterrupted power supply and leading companies, such as Microsoft, Google, Meta and Amazon, have made corporate commitments for decarbonisation. This is resulting in these major data centres' owners exploring novel partnerships with nuclear energy companies. As summarised in Figure 1.3, most of these announcements have been made since 2024 and include equity investments, power purchase agreements (PPAs), virtual PPAs, as well as potential co-location opportunities.

Other industries, such as the chemicals industry, are also exploring nuclear energy as an option to meet their substantial heat and power requirements while pursuing emissions reduction targets. For instance, in the United States, Dow Chemical has selected X-energy to develop an advanced capacity to provide power and steam to its facility in Seadrift, Texas using four Xe-100 reactors, 200-MWth high temperature gas-cooled reactor design (X-Energy, 2025). According to the IEA (IEA, 2025b), the chemicals industry consumes more than 2 000 TWh of coal and natural gas for process heat and electricity annually, nearly equal to the annual electricity consumption of India.

These partnerships are reshaping the way industrial end users engage and collaborate with the nuclear sector to secure their future energy needs and could significantly influence business models and financing strategies for new nuclear capacity deployment.

Chapter 2.

Taking stock of existing capacity and status of new builds

The NEO defines four scenarios to describe how global installed nuclear capacity could evolve to 2050 and beyond, as summarised in Table 2.1 below:

Table 2.1: **Nuclear Energy Outlook Scenarios**

Scenarios	Descriptions
Low Scenario	This scenario assumes minimal investment, leading to a gradual decline in capacity as reactors retire without substantial replacement.
Current Trends Scenario	This scenario assumes a continuation of present policies and investment levels, resulting in modest growth supported by long-term operation of the existing fleet.
Ambitious Scenario	This scenario assumes accelerated policy support and increased investment, with significant expansion of both traditional and SMR technologies.
Transformative Scenario	This scenario assumes a profound shift, where nuclear energy becomes a cornerstone of global energy strategies, requiring unprecedented rates of new build deployment.

The analysis and conclusions in this report are structured around these four scenarios and their component parts. This chapter takes stock of the status for long-term operation of existing nuclear reactors, progress with large-scale new build projects, and the emerging deployment of small modular reactors (SMRs). Additionally, this chapter reviews recent policy developments and legislative measures adopted by various governments to support nuclear capacity expansion, analysing their impact on project development.

2.1. Short-term outlook for the long-term operation of existing nuclear reactors

Long-term operation of nuclear power plants can be defined as “operation, justified by a comprehensive safety assessment that goes beyond a previously conceived time frame, which typically corresponded to so-called initial design assumptions” (NEA, 2021). These initial design assumptions do not limit how long a plant can safely and economically operate and should not be confounded with the remaining, useful life of the plant, which can be periodically re-evaluated as part of plant inspections and refurbishments. Currently, most plants operate significantly longer than expected at the time of construction.

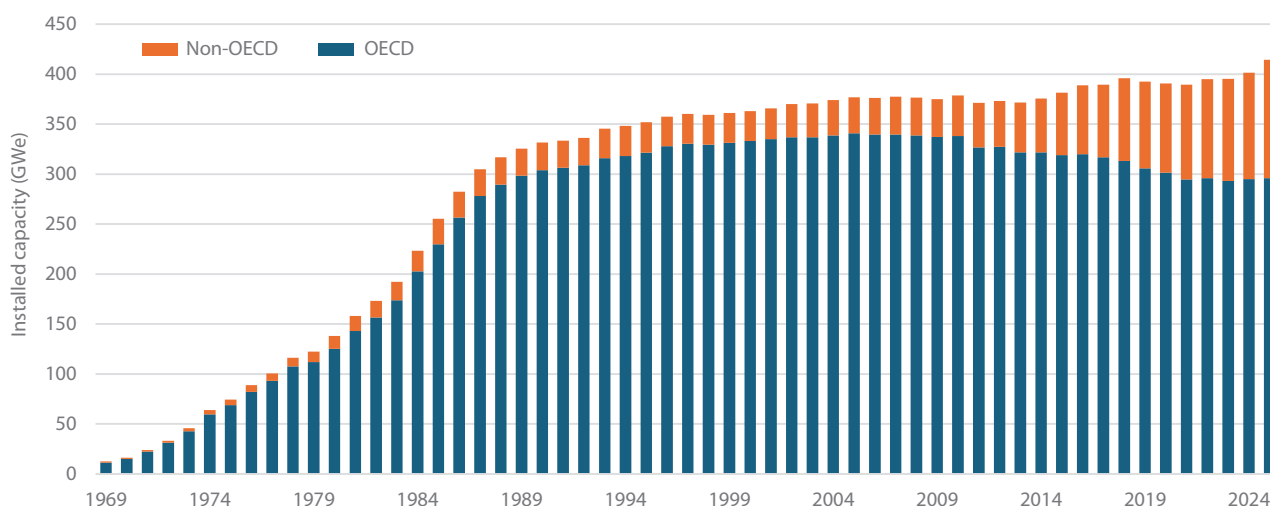
The case for long-term operation of existing reactors is further strengthened by its significant economic benefits (IEA, 2020). LTO has the advantage of being significantly less expensive and with shorter timescales than new nuclear projects and compares favourably in economic terms with non-nuclear sources of power and heat. This means that LTO programmes can provide significant benefit to both meeting nuclear capacity targets as well as meeting energy security needs.

As of 2025, OECD countries’ fleets represent about 80% of nuclear reactors in operation (see Figure 2.1); 85% of those reactors were built in the 70s and 80s, during a period when more than 20 GWe of new nuclear capacity was deployed per year. Consequently, the average age of reactors in OECD countries is currently 38 years, which makes LTO an increasingly important issue among OECD countries. By comparison, nuclear reactors in non-OECD countries, where fleets are newer, are mostly expected to continue operating under their original licence terms, with only limited retirements anticipated. These retirements are primarily confined to RBMK reactors in Russia (see Figure 2.4).

Figures 2.2, 2.3, and 2.4 illustrate the distribution of installed nuclear capacity, highlighting the proportion of capacity currently operating under LTO programmes. These figures also show how the share of nuclear capacity under LTO is projected to change by 2040, based on four scenarios:

- **Low Scenario – LTO Component:** Reactors without specific LTO plans are expected to close at the end of their initial operating licence period.
- **Current Trends Scenario – LTO Component:** All reactors receive LTO programmes to 60 or 80 years where it is technically feasible.
- **Ambitious Scenario – LTO Component:** All reactors receive LTO programmes to 80 years where it is technically feasible.
- **Transformative Scenario – LTO Component:** All reactors receive LTO programmes to 100 years where it is technically feasible.

Figure 2.1: **Global installed nuclear capacity in operation (Q4 2025)**

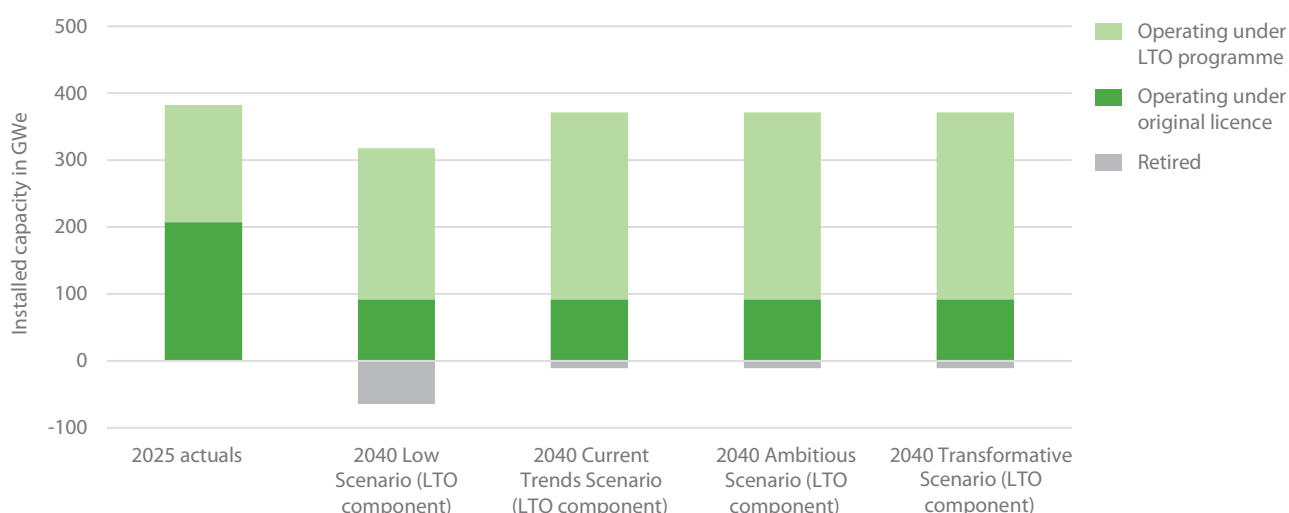


Source: NEA based on IAEA (2025) PRIS Database.

For the 2040 time horizon, the Ambitious and Transformative Scenarios do not require developing additional assumptions for LTO beyond the assumptions of the Current Trends Scenario as the latter implies continued operation for the existing nuclear fleet through 2040.

As can be seen in Figure 2.2, in the Low Scenario, i.e. without any further LTO programmes, refurbishments and licence renewals, more than 50 GWe of capacity would reach end of initial design licence and would therefore be retired over the next 15 years. Nearly all of this capacity would be in OECD countries. In the Current Trends case, the amount of capacity expected to retire before 2040 declines to just 10 GWe.

Figure 2.2: **Change in status of current global nuclear capacity by 2040**



In recent years, many OECD countries have taken steps to address demand for nuclear power by developing or expanding LTO programmes. Currently, LTO programmes are not yet planned for around 15% of capacity in OECD countries (45 GWe). If these reactors are retired, it is likely that the nuclear fleet in OECD countries will not expand before 2040, as new nuclear projects will mostly be offset by retirements (see Figure 2.3). This makes LTO a key component for expanding installed nuclear capacity in OECD countries. Decisions on LTO programmes in 2026 can mean the difference between global nuclear capacity contracting, holding steady or even expanding by a significant margin by 2040.

In non-OECD countries, LTO plays a less important role between 2025 and 2040 (see Figure 2.4). While some countries, Russia in particular, have reactors at or near the end of operating licences, typically these reactors are being slowly retired for safety and efficiency, rather than receiving LTO investments. Furthermore, average reactor age in non-OECD countries is less than half that of OECD countries, making LTO a more long-term consideration.

Figure 2.3: **Expected changes in capacity due to long-term operations for OECD countries**

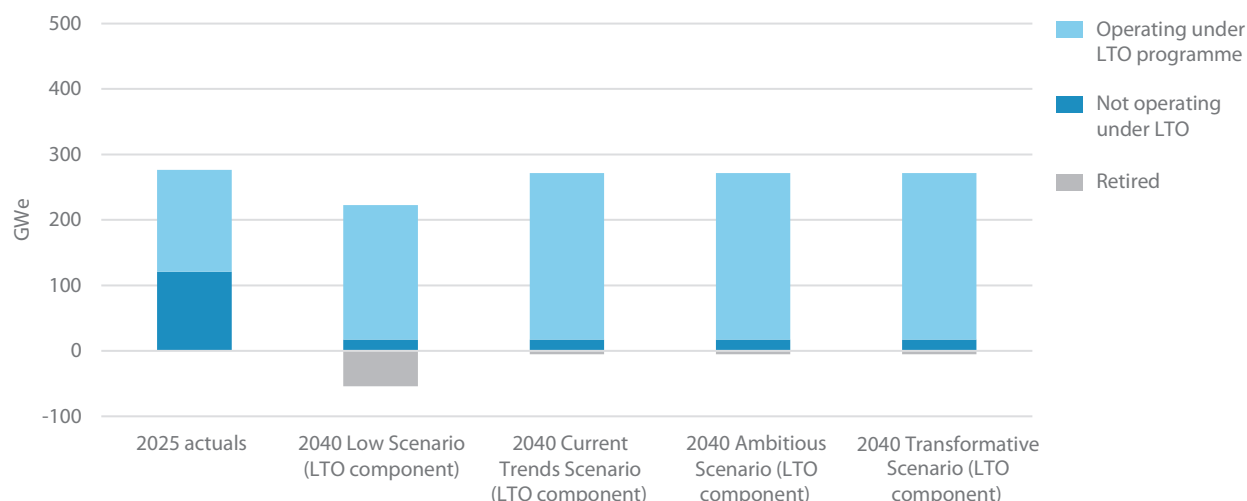
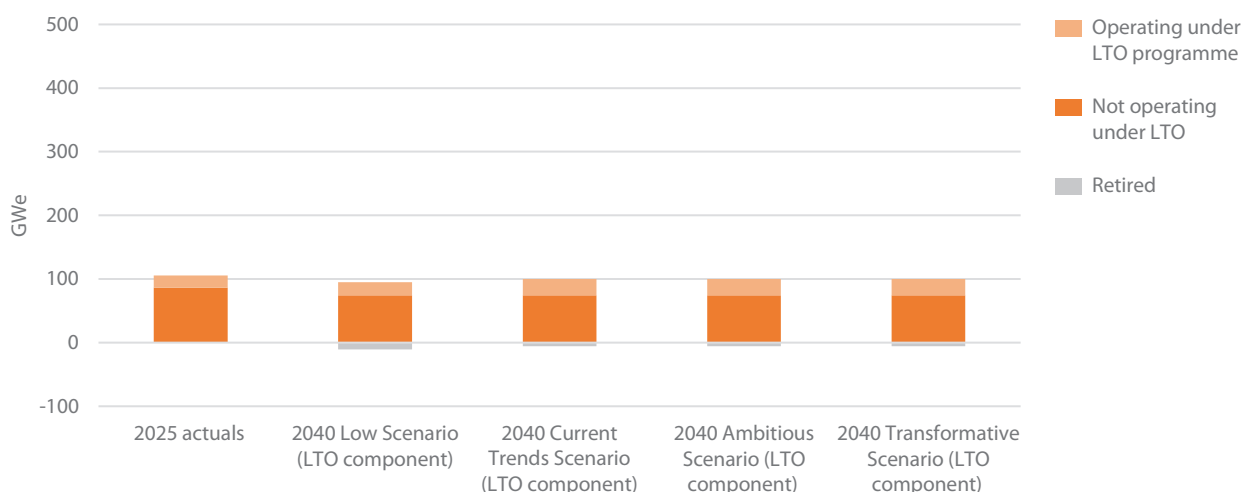


Figure 2.4: **Expected changes in capacity due to long-term operations for non-OECD countries**



Box 2.1. **Trend for the US nuclear fleet – Renewals, restarts, and uprates**

With the largest and oldest fleet of nuclear reactors in the world, the United States has been at the forefront of long-term operations. In 2025, nearly 60% of US nuclear capacity was in LTO, with many reactors applying for subsequent renewals. Of the 30 US reactors that will reach the end of their 40-year licence in the next 10 years, 26 have already received licence renewals, and the other four potential renewals are under review (US NRC, 2025b). The United States is also pioneering subsequent licence renewals, restarts of shuttered reactors, and significant investment in uprates to expand its nuclear generation without new builds.

- **Subsequent licence renewals:** This term refers to licensing reactors for an additional 20-year period of operation beyond 60 years. As of August 2025, 13 reactors have already received subsequent licence renewals, with the first reactor set to enter its second period of extended operation in 2030. Another 12 reactors have their subsequent licence renewals under review (US NRC, 2025b).
- **Restarts:** Because of the rapid growth in demand for electricity in the United States, two utilities are pursuing restarts of nuclear power plants that have recently closed: Palisades in Michigan and Three Mile Island Unit 1 in Pennsylvania (which was unaffected by the 1979 accident at Unit 2). These could both come back online within five years. In addition, the utility that owns the VC Summer plant in South Carolina is looking to restart work on Units 2 and 3, which saw construction suspended in 2017 when the project was less than 50% complete.
- **Uprates:** The US Nuclear Regulatory Commission anticipates that applications for roughly 2 GW worth of power uprates at operating nuclear plants will be submitted between now and 2030 across 30 reactors (US NRC, 2025a).

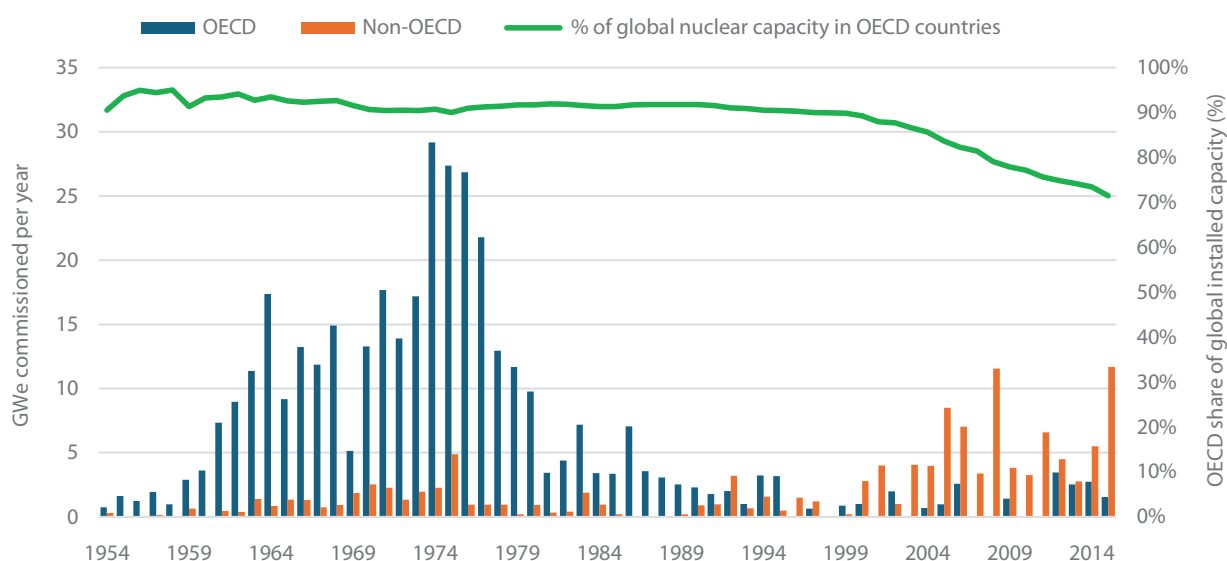
The combination of LTO, restarts and uprates means that the total capacity of the US nuclear fleet – which was on the decline at the turn of the century – will grow steadily over the next decade even excluding anticipated new builds.

2.2. Short-term outlook for new nuclear capacity from deployment of large-scale reactors

At the end of 2025, there were more than 69 GWe of nuclear capacity under construction globally, with an additional 20 GWe expected to begin construction 2026. This represents a significant departure from the last two decades, during which nuclear projects being commissioned would often barely offset those being retired, particularly in OECD countries (see Figure 2.5).

About 25% of the total nuclear capacity under construction worldwide is taking place within OECD countries, predominantly in Korea and Türkiye. In non-OECD countries, construction is further concentrated in China, where nearly half of the total nuclear capacity under construction worldwide is situated.

Figure 2.5: **Installed nuclear capacity commissioned per year and share of OECD countries in global installed capacity**



Source: NEA based on IAEA (2025) PRIS Database.

Looking beyond nuclear capacity under construction, the NEO applies a methodology to classify future nuclear new build projects based on their development stage, recognising that these projects occur in a wide range of national and industrial contexts. Table 2.2 below summarises the stages of the nuclear project development pipeline.

Table 2.2: **Pipeline of nuclear energy projects: Under construction, planned, proposed and prospective**

Pipeline of nuclear energy projects	Construction underway	Site selected	Reactor technology selected	Additional assumptions
Under construction	Yes	Yes	Yes	Projects are considered to be “under construction” once the first nuclear concrete has been poured.
Planned	No	Yes	Yes	Projects are considered to be “planned” once key project decisions have been made, most importantly site and reactor technology.
Proposed	No	Yes (either site or technology selected)	Yes (either site or technology selected)	Projects are considered to be “proposed” based on policy, utility or end-user statements of intention, paired with either site or technology selection.
Prospective	No	No	No	Projects or capacity targets are considered to be “prospective” based on policy or utility or end-user statements of intention, for which neither the technology nor the site has yet been specified.

Table 2.3: **Reactors under construction, planned, proposed and prospective by region***

		Under construction (GWe)	Planned (GWe)	Proposed (GWe)	Prospective (GWe)	Total (GWe)
OECD	North America	0.7	1.3	28.9	294.9	325.8
	Europe	3.7	25.2	46.0	18.0	92.9
	Asia	9.8	0.0	19.3	0.0	29.1
	South America	1.3	0.0	0.0	5.0	6.3
	Sub-total OECD	15.5	26.5	94.2	317.9	454.1
Non-OECD	Africa	4.4	0.0	4.8	8.4	17.6
	China	33.2	28.2	27.8	88.0	177.2
	Russia	6.5	21.7	0.0	0.0	28.2
	Asia	11.2	9.3	30.3	156.2	207.0
	Sub-total Non-OECD	55.3	59.2	62.9	252.6	430.0
Global total		70.8	85.7	157.1	570.5	884.1

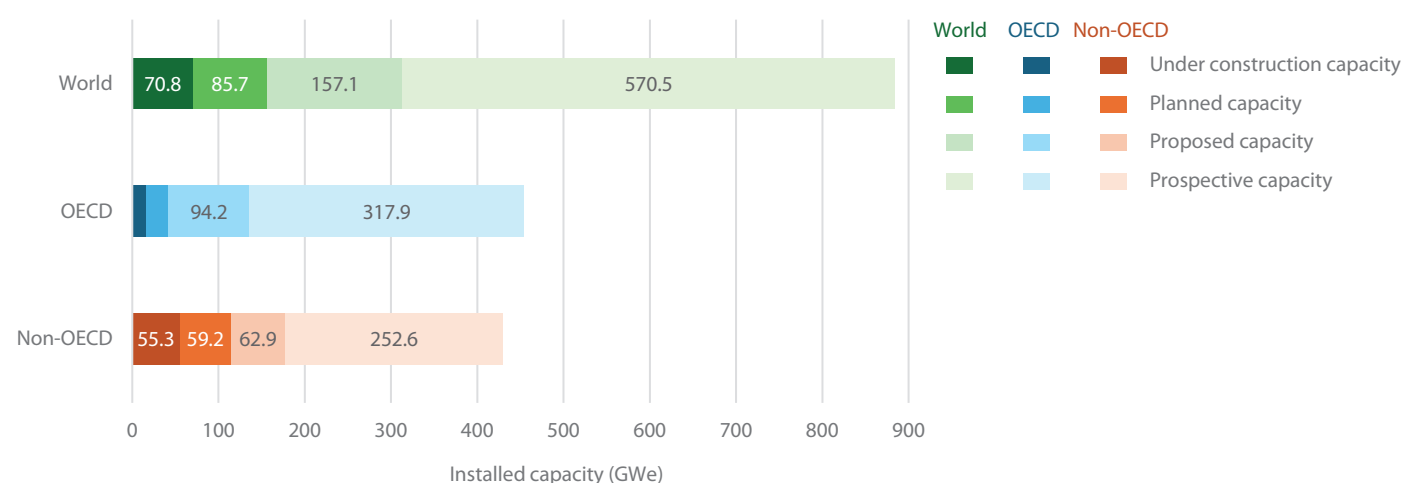
* See Annex 1 for the classification of countries by region and by OECD versus non-OECD status.

Table 2.3 details the total capacity in GWe of reactors under construction, planned, proposed and prospective by region. These data are also presented in Figures 2.6, 2.7 and 2.8.

In 2025 there was over four times as much nuclear capacity under construction in non-OECD countries, led by China, compared to OECD countries (see Figure 2.6).

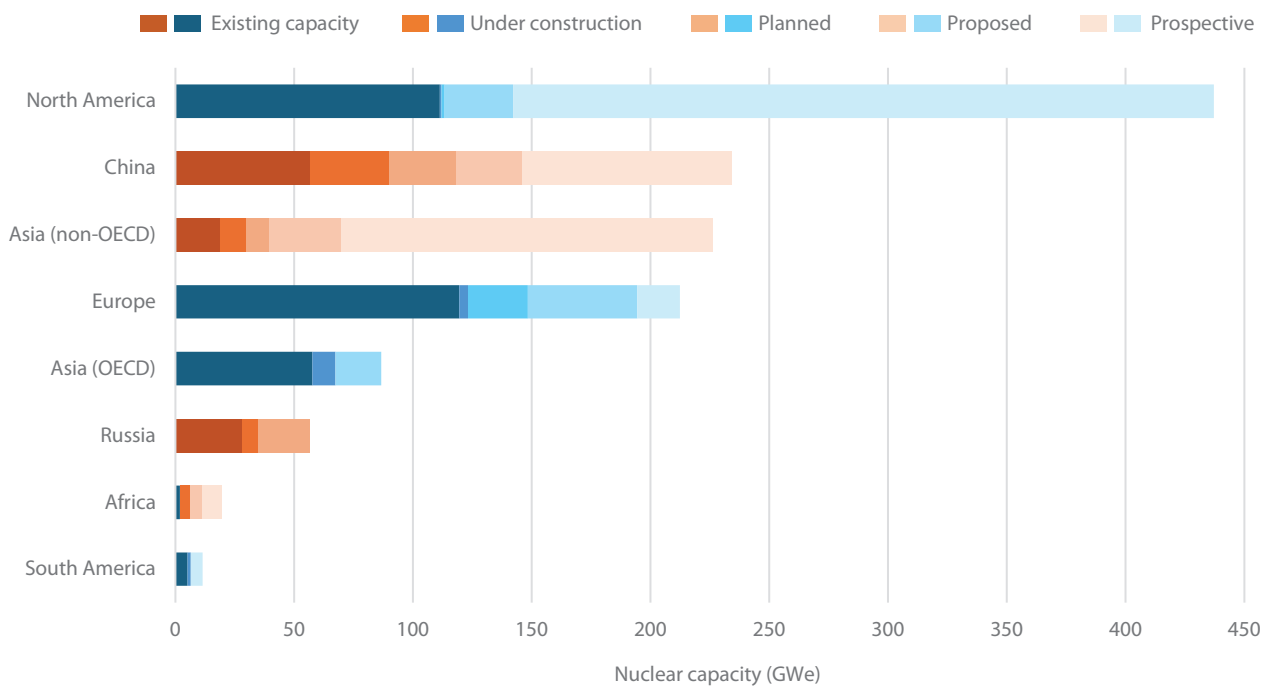
Over 82 GWe of new nuclear capacity is planned globally. Of this planned capacity, OECD countries account for 26 GWe, with the majority of projects concentrated in Europe. Planned capacity across non-OECD countries exceeds 56 GWe. This reflects a more robust pipeline for nuclear development in China (27 GWe capacity planned) and Russia (21.7 GWe capacity planned), which have been steadily developing and building new nuclear capacity over the last two decades (see Figure 2.7).

OECD countries collectively have much more proposed new nuclear capacity than non-OECD nations – 94 GWe compared to 63 GWe – reflecting recent shifts in energy and investment policies in OECD countries, as well as differences in project development pipelines. Notably, European countries account for over 40 GWe of the proposed capacity, which is partly attributable to many nations across Europe having shifted their policies in favour of nuclear power over the last five years.

Figure 2.6: **Nuclear capacity under construction, planned, proposed and prospective in OECD and non-OECD countries**

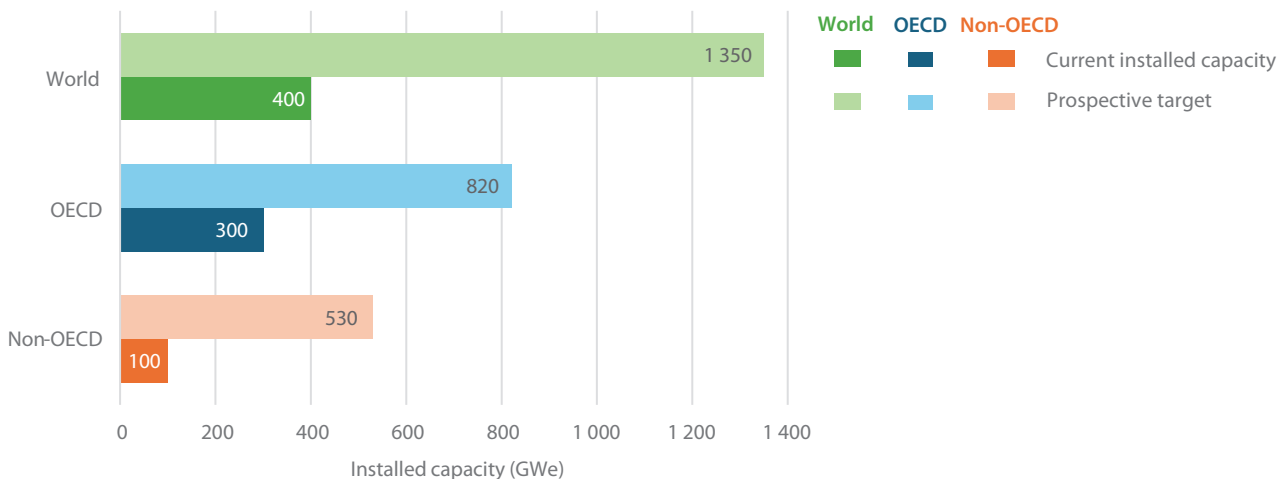
Prospective capacity includes the long-term nuclear power targets set by countries and represents the point at which OECD and non-OECD nations are most closely matched in terms of ambitions. These targets are often tied to national commitments for reducing carbon emissions, and enhancing energy security.

Figure 2.7: Nuclear capacity under construction, planned, proposed, and prospective by region



As can be seen in Figure 2.8, global installed nuclear capacity will exceed the target of the Declaration to Triple Nuclear Energy by 2050 if all local and national-level targets are met before 2050. Prospective capacity includes the United States’ target to quadruple nuclear capacity by 2050 (equivalent to 300 GWe of new capacity), India’s target of 100 GWe by 2047 (about 80 GWe new capacity), and Indonesia’s 2060 target of 44 GWe (Office of the U.S. President, 2025; Ministry of Finance of India, 2025; Ministry of Energy and Mineral Resources of Indonesia, 2024). The likelihood that nuclear capacity targets like these are met is uncertain, as many are not legally binding. Success will depend on the actions of governments and the private sector alike to ensure enabling conditions are robust, including efficient regulatory pathways, resilient supply chains, secure fuel supply, adequate workforce, and effective financing strategies, among other essential conditions and frameworks.

Figure 2.8: Prospective new nuclear capacity targets in OECD and non-OECD countries



2.3. Short-term outlook for small modular reactors

Progress in SMRs globally is uneven but accelerating particularly in the areas of SMR funding, licensing and siting (NEA, 2025c). Figure 2.9 presents a map of planned SMR projects.

Figure 2.9: **Planned SMR projects**



Source: NEA (2025c), *The NEA Small Modular Reactor Dashboard: Third Edition*.

NEA analysis, particularly on progress in the areas of SMR funding, licensing and siting, creates a clear short-term outlook for SMRs:

- **Public-private partnerships underpin the financing of SMRs.** As of early 2025, more than USD 15.4 billion had been committed to SMR projects worldwide, with public funds complemented by private investment from major corporations. Several SMR companies are now publicly listed, illustrating the confidence of public and private capital markets. Furthermore, the World Bank's recent policy change in favour of nuclear financing signals a shift in global attitudes towards innovations in nuclear energy (WBG, 2025).
- **Regulatory frameworks are adapting, and regulators are increasingly engaged with SMR developers worldwide.** More than 50 SMR designs are engaged in pre-licensing or licensing discussions worldwide. This includes light-water designs as well as advanced SMR concepts that have been granted construction licences, notably in the United States under the Department of Energy's Advanced Reactor Demonstration Program (ARDP).
- **New business models and partnerships are emerging for SMRs.** There are around 85 active siting discussions between a site owner and SMR developers worldwide (Figure 2.9), half of which are led by utilities and the other half by new types of site owners and customers, such as industrial firms and universities. These projects represent diverse applications, from electricity generation to hydrogen production and heat supply.

Supply chain development and fuel availability remain critical challenges for the deployment of SMRs at scale and speed. Some first movers can access limited high-assay low-enriched uranium (HALEU) supplies through government-led programmes, and some early fuel supply chain capacity is emerging through collaborations between universities, nuclear laboratories and engineering firms. However, more than 50% of the SMRs under development plan to use fuels based on HALEU, for which no commercial supply is yet available in OECD countries (NEA, 2025c).

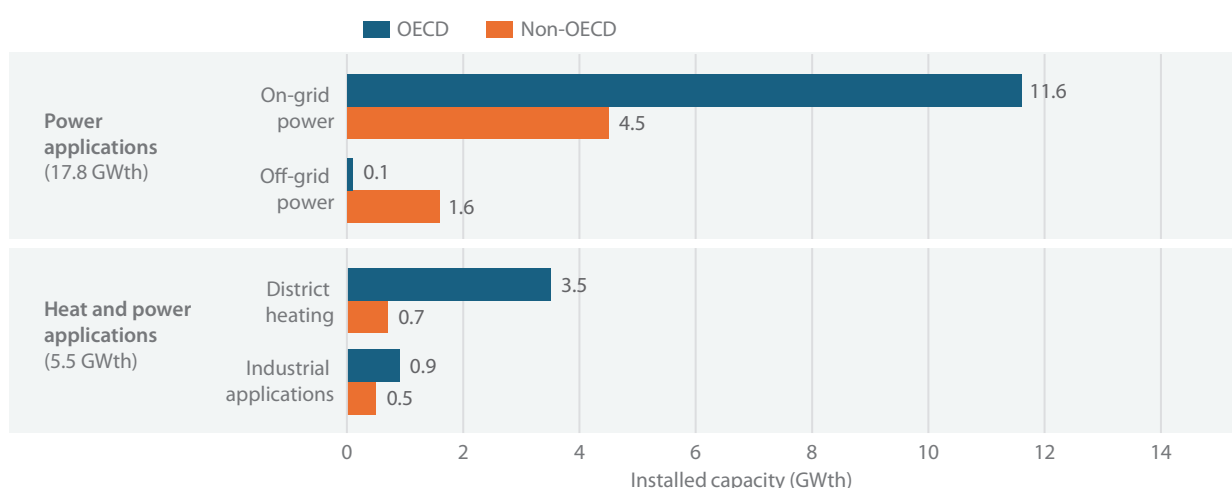
Despite the aforementioned challenges with supply chains and fuel, markets currently can support the deployment of several demonstration and commercial projects. To estimate early global deployment, the NEO focusses on the most advanced siting activities, those where a site owner has selected an SMR design and the licensing process has begun.

The NEO estimates a short-term capacity of 23.3 GWth worldwide, including 16 GWth in OECD countries (see Figure 2.10). Nearly 70% of this capacity is expected to provide on-grid power. This outlook mostly depends on a limited number of demonstration projects and light-water SMR designs. It is important to note that these projects do not reflect the full diversity or innovative potential of SMRs, such as advanced reactor concepts for industrial applications. In addition, while clear early interest from a range of heavy industries is observed, this has yet to translate into firm commitments. Demonstration and first-of-a-kind projects will play a significant role to build credibility among industrial end users.

One-third of siting activities occur in five near-term markets for SMRs:

- replacing coal-fired power for grid supply;
- replacing fossil fuel cogeneration in industries, including hydrogen production;
- replacing diesel in remote mining operations;
- providing district heating;
- delivering off-grid power solutions.

Figure 2.10: **Pipeline of planned SMRs for power and heat applications**



Source: NEA (2025c), *The NEA Small Modular Reactor Dashboard: Third Edition*.

2.4. Expected change in global installed nuclear capacity by 2040

As of October 2025, the world had 442 operating reactors providing 398 GW across 32 countries and economies, with an additional 23 reactors (20 GW) in suspended operation. This reflects a stagnation in growth following the major buildout undertaken during the 1970s and 1980s. Since that period, especially in OECD countries, new capacity being commissioned has seldom exceeded

that being retired. Total electricity generation from nuclear energy has stagnated over the last three decades, though global generation reached a new high in 2025, surpassing the previous peak in 2006 by 2% (IEA, 2025b).

Following the Fukushima Daiichi accident in 2011, there was a temporary drop in total global nuclear energy generation, as Japan suspended much of its nuclear fleet, and as other countries responded to the accident with changes to their own nuclear energy strategies. For the first time since, the pace of new builds is starting to pick up, particularly in East Asia.

Furthermore, as detailed in Section 2.1, many countries have begun to extend the operations of their existing fleets with LTO programmes in response to legislative targets for energy security and emissions reductions. With older facilities being refurbished and receiving operating licence extensions, and a growing number of reactors under construction, planned and proposed, global capacity is now projected to grow significantly through 2040.

Figures 2.11 and 2.12 show the expected change in total installed nuclear capacity through 2040 under the Current Trends Scenario. In OECD countries, 6 GWe of reactors are not technically suitable for LTO, and thus are likely to suspend operations in the next 15 years. New nuclear capacity is expected to be primarily driven by new builds of large-scale reactors, with 44 GWe of nuclear capacity to be deployed by 2040. By comparison, the current pipeline of SMR projects could lead to about 1 GWe to be deployed in OECD countries by 2040.

OECD countries currently generate over two-thirds of global nuclear energy. However, this could decline significantly over the next decade, as the nuclear new build pipeline in non-OECD countries is more robust, as can be seen in Figure 2.13. Non-OECD countries are expected to deploy 140 GWe of large-scale nuclear capacity by 2040. SMRs are expected to account for about 6 GWe in non-OECD countries by 2040.

Figure 2.11: **Current Trends Scenario – Expected change in installed nuclear capacity in OECD countries, 2025-2040**

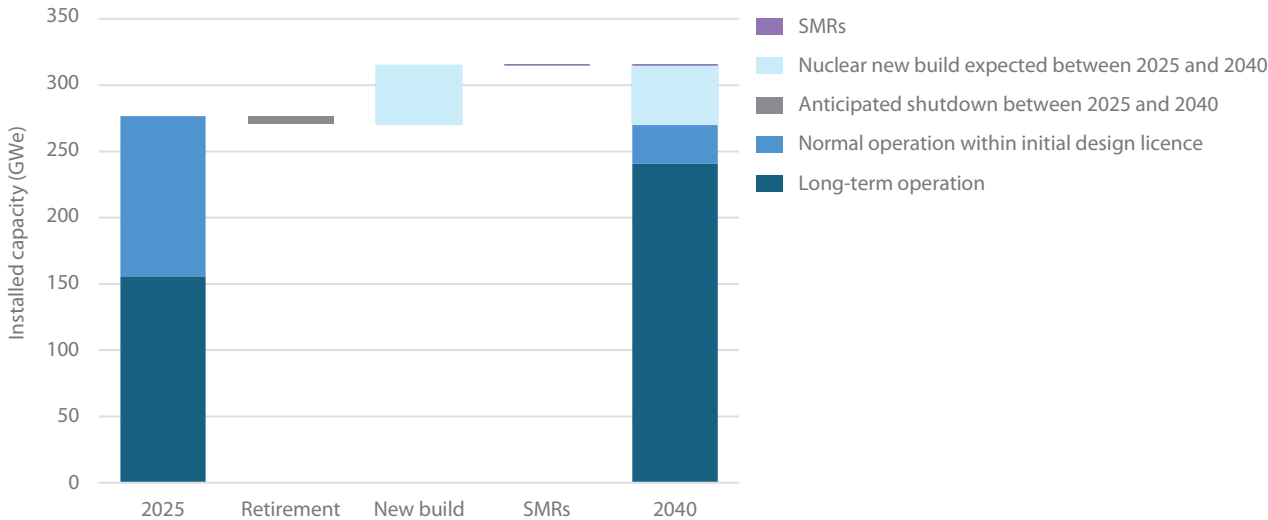


Figure 2.12: **Current Trends Scenario – Expected change in installed nuclear capacity in Non-OECD countries, 2025-2040**

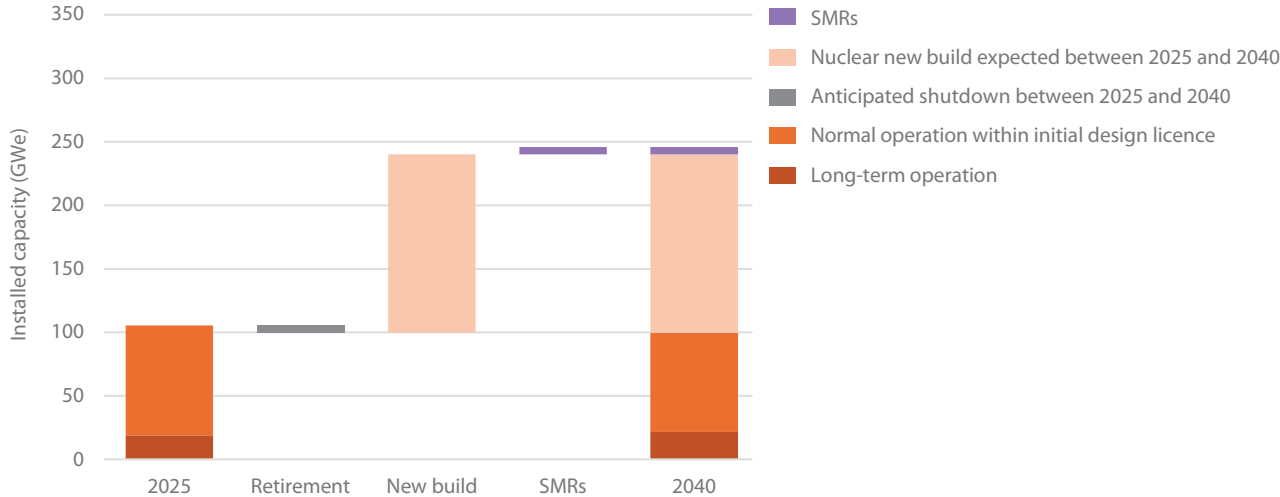
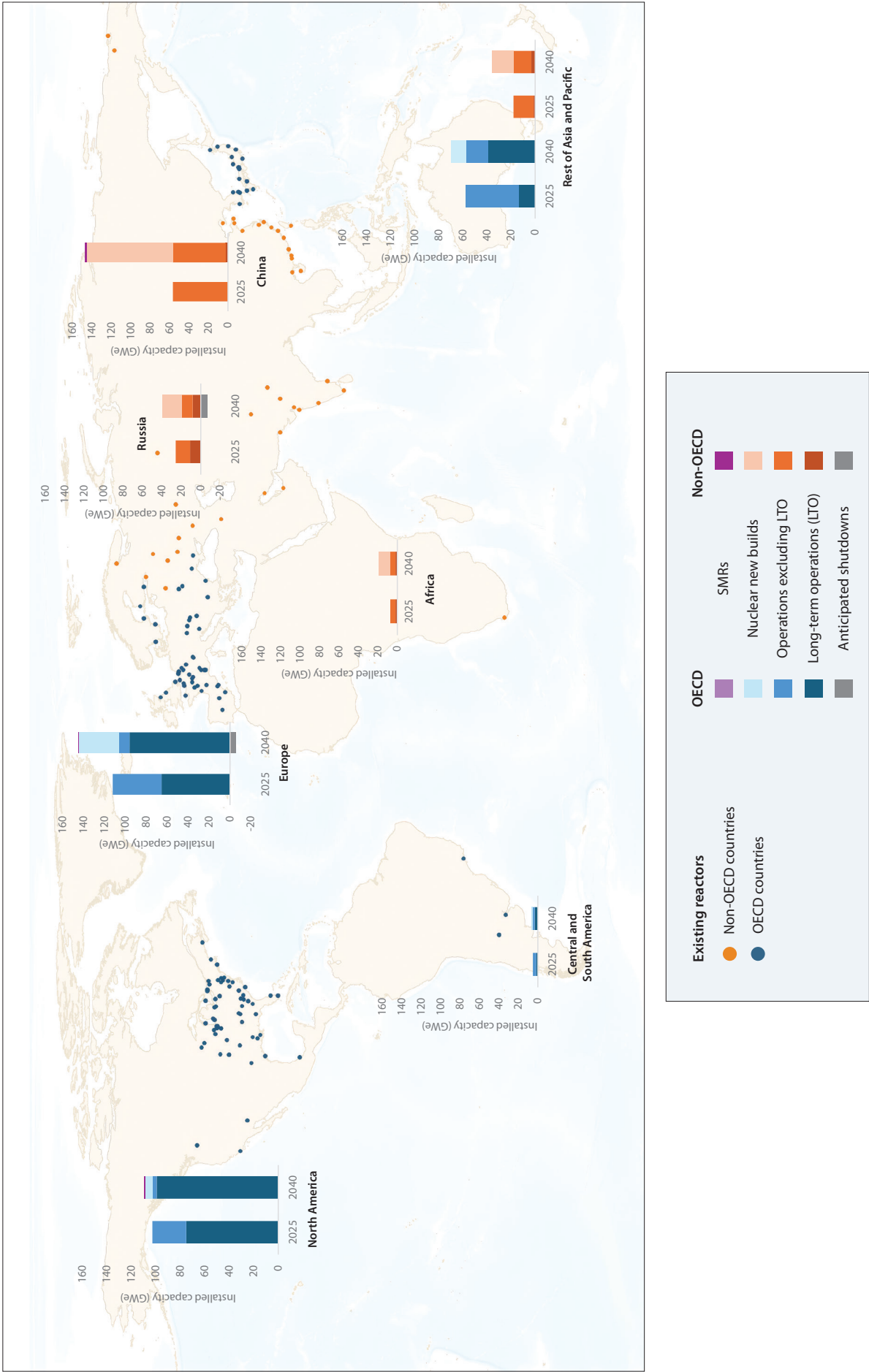


Figure 2.13: **Current Trends Scenario – Expected change in installed nuclear capacity, 2025-2040**

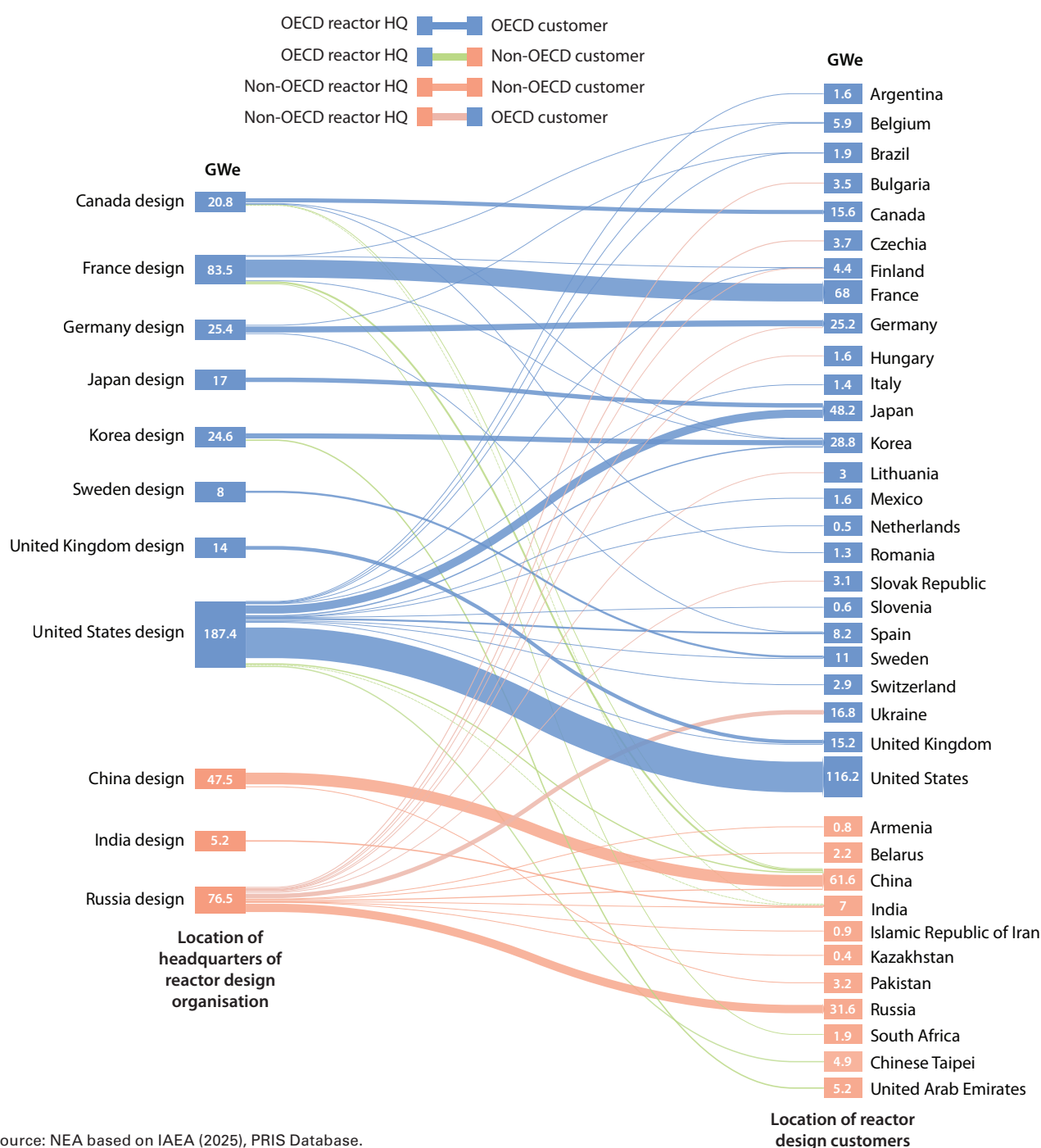


2.5. Reactor design-specific outlooks

Understanding the global outlook for large-scale new build depends in part on tracking reactor vendors and nuclear technology exports. The choice of reactor technology and vendor can have profound, long-lasting geopolitical implications. Accordingly, ongoing NEA analysis tracks design families and the country or economy where the vendor for all new build projects has its headquarters.

Figures 2.14, 2.15, and 2.16 present Sankey diagrams that map the location of the headquarters of design organisations (shown on the left) to the location of reactor design customers (shown on the right). These charts reveal the evolution of international nuclear technology markets, and the current role of exports in meeting new build targets in countries and economies that lack domestic commercial nuclear reactor designs. Flows in blue designate designs originating from OECD-headquartered designers being built in OECD countries, while flows in orange designate designs from non-OECD-headquartered designers to countries that are not members of the OECD, and economies. Flows in red indicate when a reactor was designed in a non-OECD country or economy but built in an OECD member, while green indicates the inverse, an OECD-origin reactor design being built in a non-OECD country or economy. In Figure 2.16, the flows in grey designate projects with an as-yet undetermined design and therefore correspond to market opportunities presently open to both OECD and non-OECD headquartered designs.

Figure 2.14: **Mapping historical and current installed nuclear capacity by location of the headquarters of the reactor design organisation and the location of the reactor customers**



Source: NEA based on IAEA (2025), PRIS Database.

As Figure 2.14 illustrates, US designs make up a plurality of operating nuclear reactors, due in large part to exports in the 20th century under the “Atoms for Peace” programme. At present, the second largest source of operating reactor designs is France. More than two-thirds of French-designed reactors were built domestically, with some exports to Asia and the rest of Europe. The third largest source is Russia, although the bulk of this capacity is in countries that were formerly members of the Soviet Union, with some exports further afield in Eastern Europe.

Figure 2.15 shows the pipeline of reactors under construction and planned by the location of the headquarters of the reactor design organisation and the location of the reactor customers. Compared with the historical and current fleet, shown in Figure 2.14, the pipeline of reactors under construction and planned reveals a significant shift in the origin of reactor technology. Since the late 1980s the role of US-origin reactor technology has greatly diminished, although there is still some representation in projects across Asia, Europe and North America. By contrast, the share of Chinese-origin reactors in projects has grown substantially, although its designs are almost exclusively constructed domestically in China. Russia is the most internationally important nuclear technology exporter at present, with nearly 25 GWe of projects based on Russian-origin reactors under construction or planned in China, Egypt, Hungary, India, Iran, Kazakhstan, the Slovak Republic and Türkiye.

Figure 2.15: **Pipeline of new nuclear capacity under construction and planned reactors by the location of the headquarters of the reactor design organisation and the location of the reactor customers**

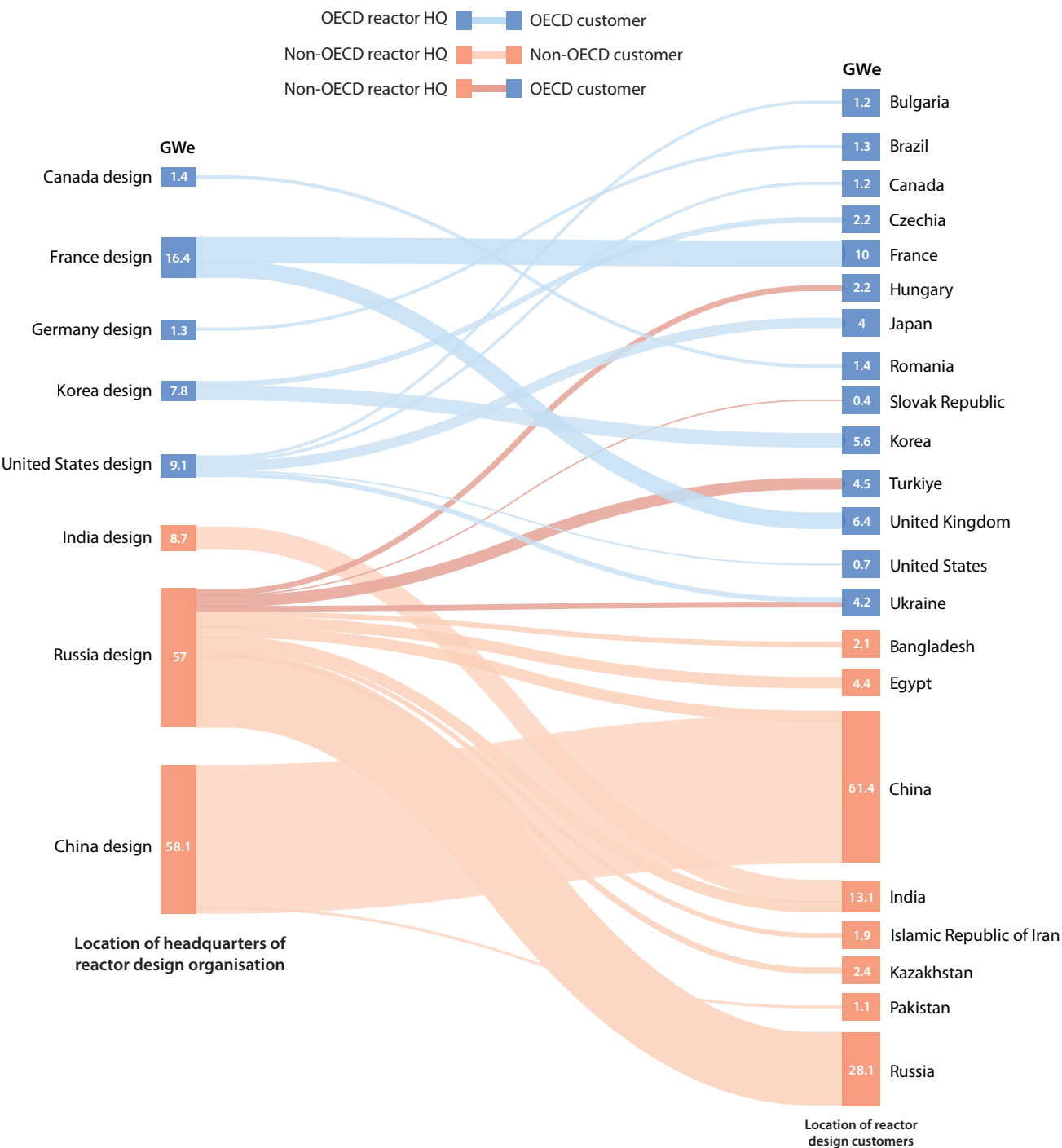
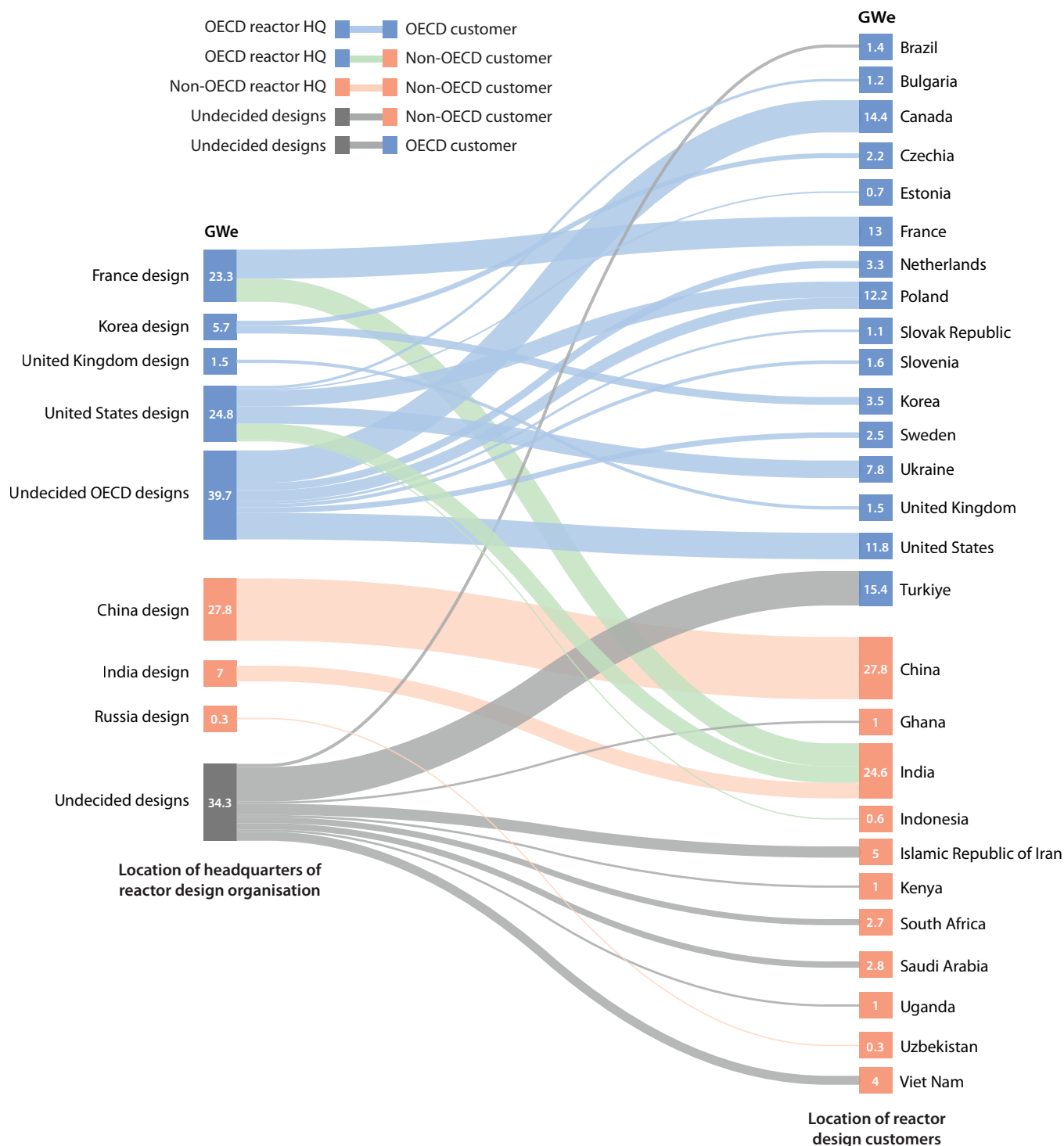


Figure 2.16 shows the pipeline of new nuclear capacity proposed by the location of the headquarters of the reactor design organisation and location of the reactor customers. Nearly 60 GWe of proposed projects have yet to select a reactor technology, of which nearly 30 GWe is expected to choose from OECD-origin options.

Figure 2.16: **Pipeline of proposed new nuclear capacity by the location of the headquarters of the reactor design organisation and location of the reactor customers**¹



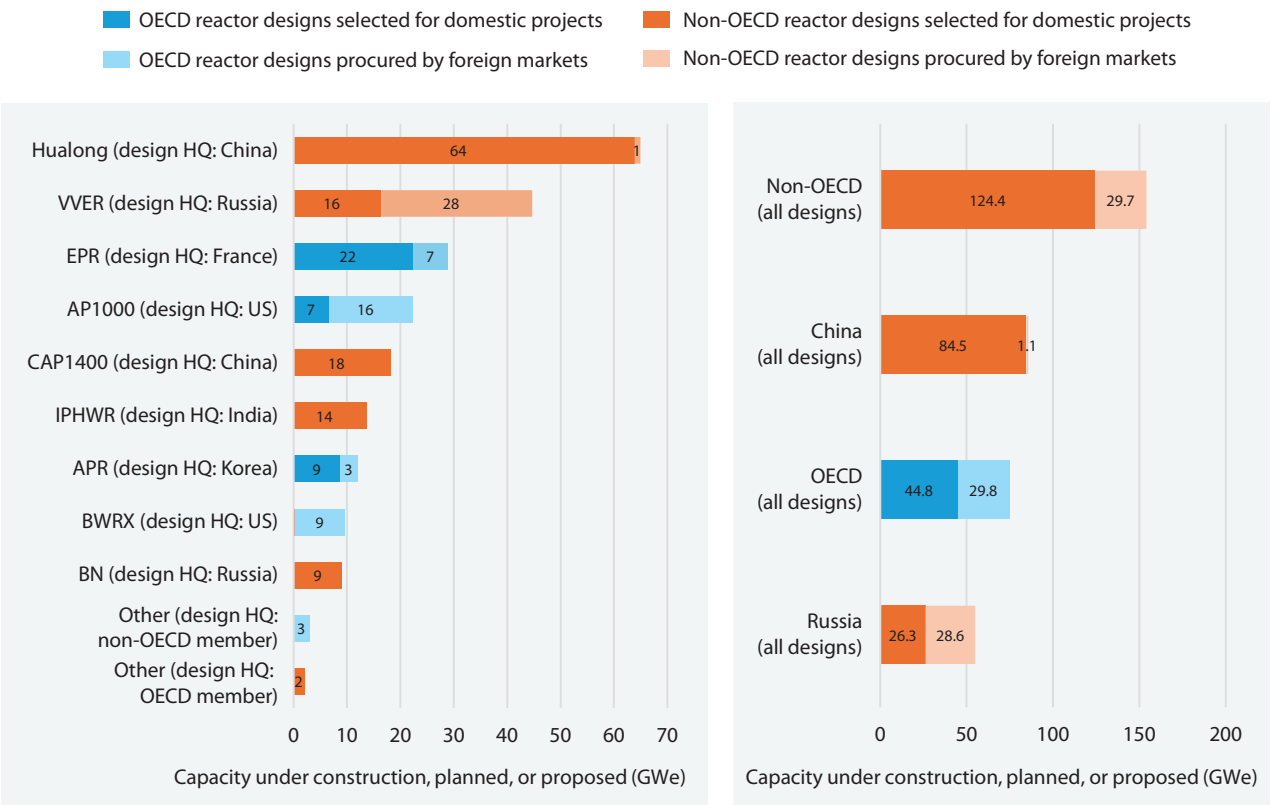
1. For the category "Undecided OECD design", customer countries have confirmed that the reactor technologies will be sourced from OECD countries, although the specific vendors have not yet been selected.

Figure 2.17 presents another view of the same data, showing which reactor designs are active in domestic versus export markets. Chinese and Russian designs currently dominate the new build pipeline. In the case of Russian designs, this is due to the country's pursuit of export markets, with the Russian federal government underwriting project financing for countries like Egypt, Hungary and Türkiye.

For China, the focus is on the domestic market. The success of its reactor designs can be attributed to a combination of growing demand for electricity and the country's long-term policy of nuclear buildout as an energy security measure. Though China has exported two Hualong One reactors to Pakistan, the design has so far otherwise only been constructed domestically.

Among OECD countries, the most prolific design in the short term is the AP1000 from Westinghouse – headquartered in the United States – with 11 GWe planned and proposed domestically in the United States and proposals for an additional 20 GWe in export projects in Europe. This is followed by the French EPR, with 5.6 GWe under construction or in final stages of planning in the United Kingdom and a further 22.4 GWe planned and proposed in France. Recently, the Korean APR design family has seen some success both domestically and in export markets, with the 2024 completion of the Barakah plant in the United Arab Emirates and the 2025 win in the competitive tender to build up to four reactors in Czechia.

Figure 2.17: **Under construction, planned and proposed nuclear new capacity by reactor design headquarters**



* Prospective capacity not included in these figures because neither the site nor reactor technology are known yet for prospective projects.

2.6. National developments and recent legislation supporting nuclear new build

Both long-standing and emergent drivers of demand for low-emission, secure energy are leading many countries to rethink their policy stance towards nuclear power. The late 2010s saw the United States and a few European countries commission their first nuclear reactors in decades. However, cost overruns and delays with these first-of-a-kind projects led to muted demand for successive reactors and in some cases the cancellation of projects already under construction, such as Virgil C. Summer 2 and 3 in the United States. After the beginning of the war in Ukraine in 2022, and the subsequent turbulence in hydrocarbon markets, many European countries have announced plans for new nuclear energy projects. In Japan, high prices for liquified natural gas (LNG) have accelerated plans to restart reactors in suspended operation.

International interest in new nuclear capacity was evident at the 2023 United Nations Climate Change Conference (COP28) where a Declaration to Triple Nuclear Energy – an initiative underpinned by NEA (2022) analysis – was signed by 22 countries. At the same time nuclear energy was included in the Global Stocktake, a comprehensive review of progress since the 2015 Paris Climate Agreement. The 2023 Declaration had, as of 2026, been endorsed by 38 countries (WNA, 2026). Some 31 OECD countries and 26 non-OECD countries, ranging from projects already under construction to planned, proposed and prospective projects:

- Two countries (Argentina and Egypt) have new nuclear under construction but no additional plans for new nuclear at this point in time.

- Twelve countries have new nuclear under construction as well as planned and/or proposed projects. Seven are OECD countries and five non-OECD countries. Only one is a nuclear newcomer country.
- Twenty-three countries have planned and/or proposed projects for new nuclear capacity. Fourteen are OECD countries and nine non-OECD countries. In this category, ten countries are nuclear newcomers, with seven being non-OECD countries.
- Twenty countries are in early discussion regarding new nuclear capacity, evenly split between OECD and non-OECD countries. Sixteen are either nuclear newcomer countries or returning nuclear countries. The two returning nuclear countries are OECD countries (Italy and Lithuania).
- Out of the thirty-one countries with installed nuclear capacity in 2026, only three do not have plans for new nuclear capacity: Belarus, Spain and the United Arab Emirates.

More information about countries' interest in nuclear new build is presented in Table 2.4 and illustrated in Figure 2.18 and Figure 2.19.

Table 2.4: **Countries and economies grouped by interest in new nuclear capacity**

Level of interest	Reactor(s) under construction?	Plans or proposals for nuclear new build?	Discussions regarding new nuclear capacity?	OECD countries	Non-OECD countries
New nuclear under construction	Yes	No	No	Existing nuclear power countries: Argentina	Existing nuclear power countries: None
				Nuclear newcomer countries: None	Nuclear newcomer countries: Egypt
Under construction as well as planned and/or proposed	Yes	Yes	Yes	Existing nuclear power countries: Brazil; Canada; Japan; Korea; Slovak Republic	Existing nuclear power countries: Bangladesh; China; India; Pakistan; Russia
				Nuclear newcomer countries: Türkiye	Nuclear newcomer countries: None
Planned and/or proposed	No	Yes	Yes	Existing nuclear power countries: Bulgaria; Czechia; Finland; France; Hungary; Netherlands Romania; Slovenia; Sweden; Ukraine; United States	Existing nuclear power countries: Iran; South Africa
				Nuclear newcomer countries: Estonia; Indonesia; Poland	Nuclear newcomer countries: Kazakhstan; Kenya; Philippines; Rwanda; Saudi Arabia; Uzbekistan; Viet Nam
Early discussion regarding new nuclear capacity	No	No	Yes	Existing nuclear power countries: Belgium; Mexico; Switzerland	Existing nuclear power countries: Armenia
				Nuclear newcomer countries: Colombia; Denmark; Greece; Latvia; Norway	Nuclear newcomer countries: Ghana; Malaysia; Morocco; Serbia; Singapore; Tanzania; Thailand; Togo; Uganda
				Returning nuclear countries: Italy; Lithuania	Returning nuclear countries: None
Nuclear countries without plans for new nuclear capacity	No	No	No	Existing nuclear power countries: Spain	Existing nuclear power countries: Belarus; United Arab Emirates

Detailed country profiles for OECD and non-OECD countries are presented in Annex 6, which summarise their new nuclear energy projects, short- and long-term capacity targets, as well as recent legislation and policy changes concerning civil nuclear energy.

Figure 2.18 shows the trend first connections of nuclear power plants to the grid in countries worldwide. The trend almost shows a double-inverted bell shape curve. Since the 1950s, 31 countries have commissioned nuclear power plants, 20 in OECD countries and 11 in non-OECD countries.

Bangladesh, Egypt, and Türkiye, which are constructing their first nuclear power plants, are set to integrate them into their grids in the late 2020s.

Looking at the pipeline of new nuclear projects, ten countries are set to commission their first nuclear power plants into their grids in the 2030s. If fully realised, the next decade would come second only to the decade of the 1970s, when a record 11 countries integrated their first nuclear power plants into the grid.

Out of 26 countries that are in the planned and/or proposed stages, one-third of them are OECD countries while the remaining two-thirds are non-OECD countries.

Out of the four countries that phased out nuclear energy, two countries – Italy and Lithuania – are working towards bringing back nuclear energy into their electricity mix.

Figure 2.18: **Nuclear countries and economies based on the decade when the first nuclear power reactor was commissioned**

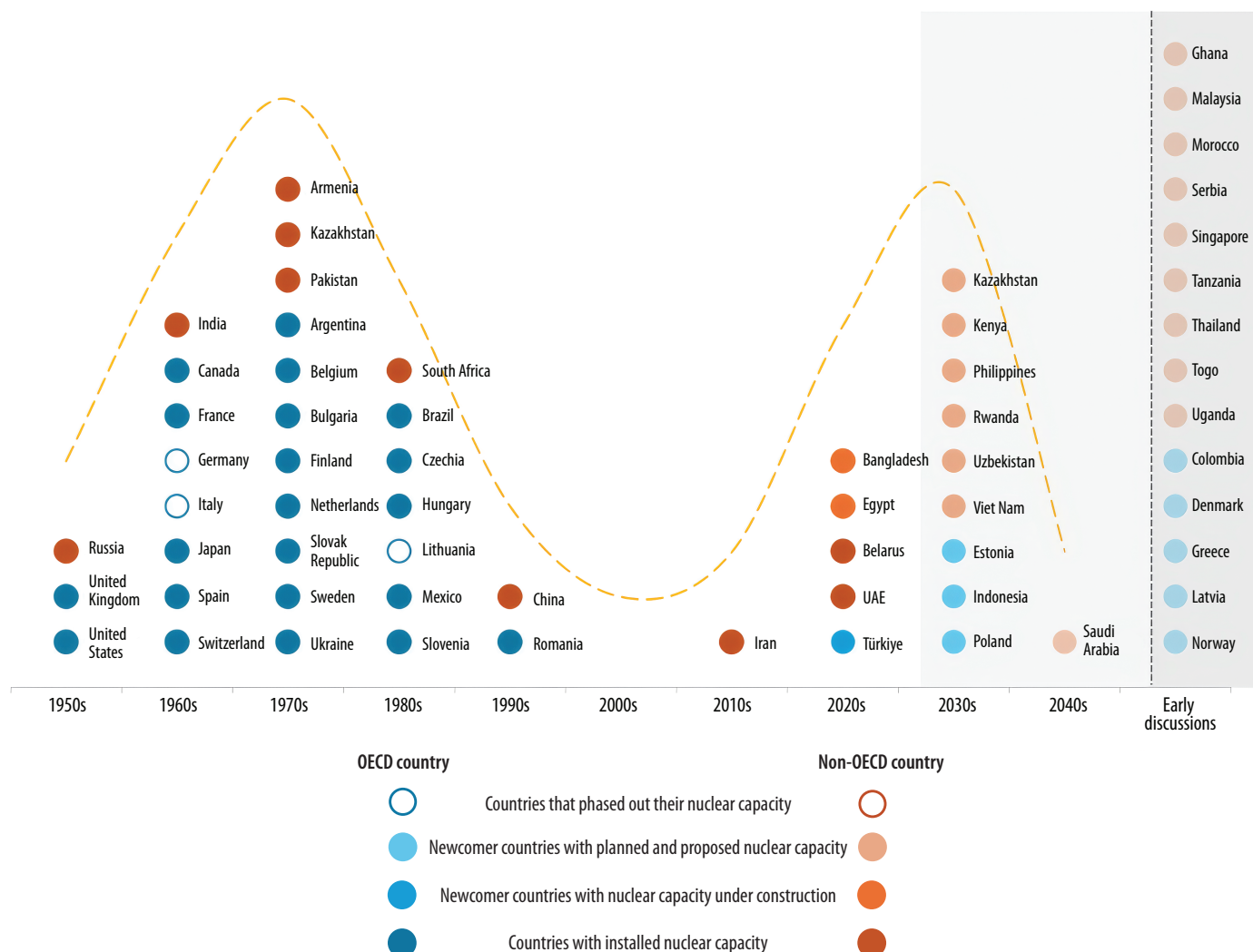
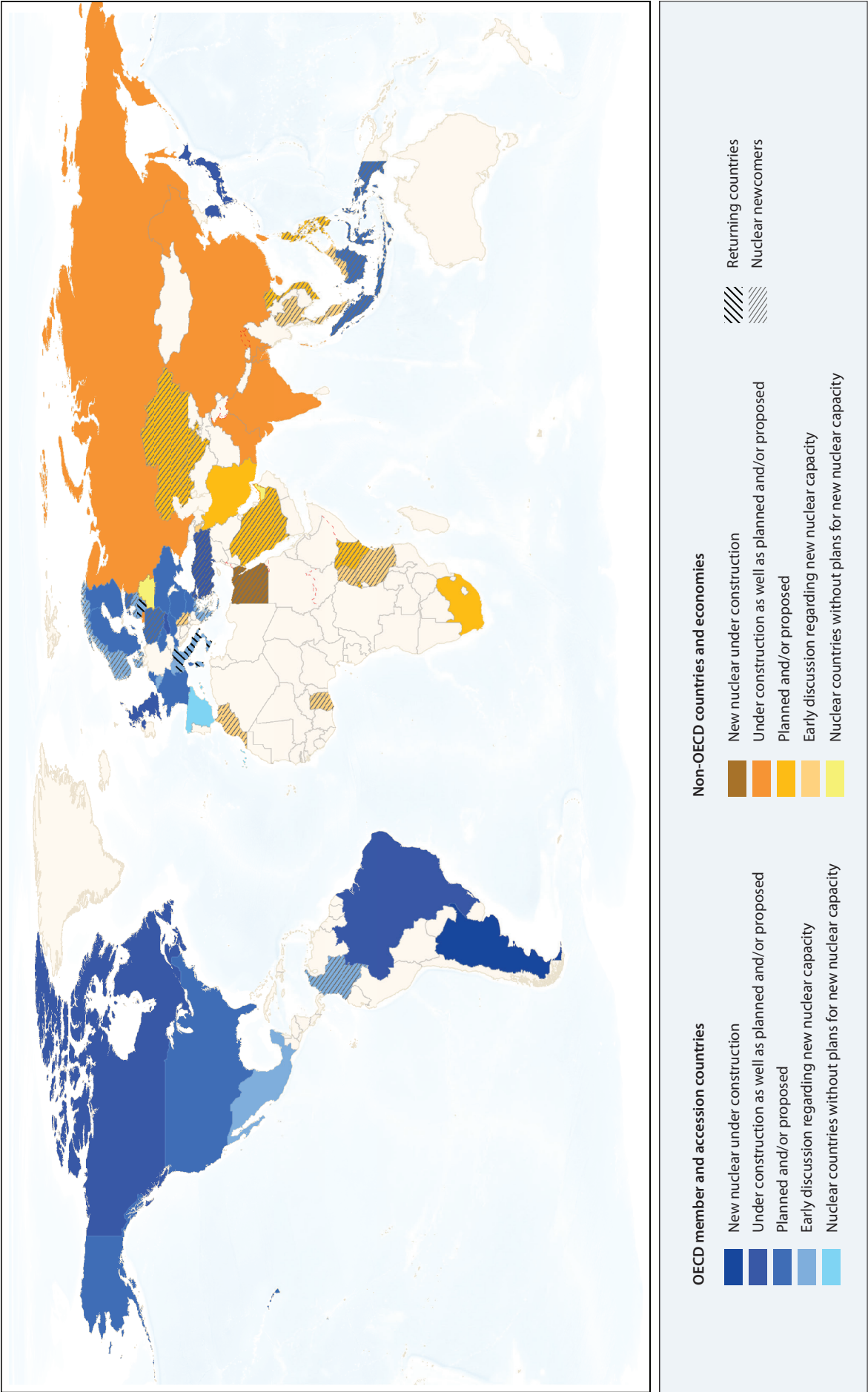


Figure 2.19: Countries and economies interested in new nuclear capacity



Chapter 3.

Tracking global progress towards greatly increased nuclear capacity

This chapter presents the progress countries are making to vastly increase nuclear energy capacity. Each of the four NEO scenarios incorporates the long-term operation of existing reactors, the construction of large-scale new nuclear plants, and the deployment of SMRs. Project and country announcements are closely tracked and new NEA modelling results are introduced to fully elaborate each scenario.

3.1. NEA Nuclear Energy Outlook scenarios

Each of the NEO's four scenarios can be broken down into its component parts: LTO, large-scale new build and SMRs. Methods for estimating the component parts vary by availability of bottom-up project and country announcements. The NEA has developed new modelling to estimate the outlook for SMRs, building on the *NEA Small Modular Reactor Dashboard* database (NEA, 2025c). Table 3.1 summarises the methods used to elaborate the four scenarios.

Table 3.1: **The component parts of the four NEO scenarios: Long-term operation, large-scale new builds, and SMRs**

	2025-30	2030-35	2035-40	2040-45	2045-50	Post-2050
Operations and LTO of existing reactors	Bottom-up Reactor level (<i>Low, Current Trends, Ambitious, Transformative</i>)					
Large-scale new build	Bottom-up Reactor and/or country level (<i>Under construction, planned, proposed, prospective</i>)				Rate of deployment = supply constraint (<i>i.e. X GW/y for OECD and non-OECD countries based on historical benchmarks</i>)	
SMRs	Bottom-up Project level (<i>Dashboard database</i>)		Rates of deployment based on supply constraint based on 3 delivery models (<i>i.e. X GW/y</i>) Assessment of expected deployment in different markets as a function of accessible SMR markets (<i>i.e. X GW/market/y</i>)			

Long-term operation of existing reactors

Across the four scenarios, the long-term operation of existing reactors is estimated using a bottom-up approach, taking into account announced plans for refurbishments and long-term operations of every reactor as well as broader national and local policy decisions.

Large-scale new build

Large-scale new build is characterised by relatively long lead times in terms of upfront project development, site preparation and construction. Future installed capacity deployment up to the early 2040s can therefore be estimated primarily based on a bottom-up project-by-project approach. Large-scale new build projects can be classified into four distinct categories:

- under construction;
- planned;
- proposed;
- prospective.

These four categories are further explained in Section 2.2 and in Annex 3. Looking beyond the early 2040s, additional assumptions regarding the rate of deployment are used to estimate additional capacity by region.

Small modular reactors

The near-term pipeline of SMR deployment can be tracked based on siting announcements in the *NEA Small Modular Reactor Dashboard* (NEA, 2025c). This approach is suitable for capturing SMR deployment progress up to the early 2030s.

Building on the insights from the NEA SMR Industrial Case Studies (NEA, 2025b, 2024, forthcoming a, forthcoming b), it is anticipated that in the longer-term demand for SMRs will substantially outpace supply. As a result, the potential size of the SMR market will, in practice, be dictated primarily by supply-side constraints. The significance of the gap between supply and demand for SMR deployment by 2050 is examined in greater detail in Chapter 4 and Annex 5.

Looking beyond the 2030s, Table 3.1 presents the NEO key assumptions regarding annual SMR deployment rates based on four potential delivery models and anticipated supply chain constraints. The Low Scenario assumes that SMR deployment will be limited to demonstration projects currently under construction or planned. The Current Trends Scenario assumes that SMR deployment could reach 2-3 GWe per year, enabled by a programmatic approach to engineering procurement and construction. The Ambitious Scenario would see this figure increase to 5-8 GW per year with the adoption of advanced modular manufacturing practices. In the Transformative Scenario, the next generation manufacturing practices would lead SMR deployment to reach 14-16 GW per year.

Figure 3.1 illustrates how annual rates of SMR deployment evolve during the 2025-2050 period in each of the four scenarios. These deployment rates serve as the basis for the cumulative capacity projections set out in Figure 3.2.

Figure 3.1: **Scenarios for annual SMR deployment**

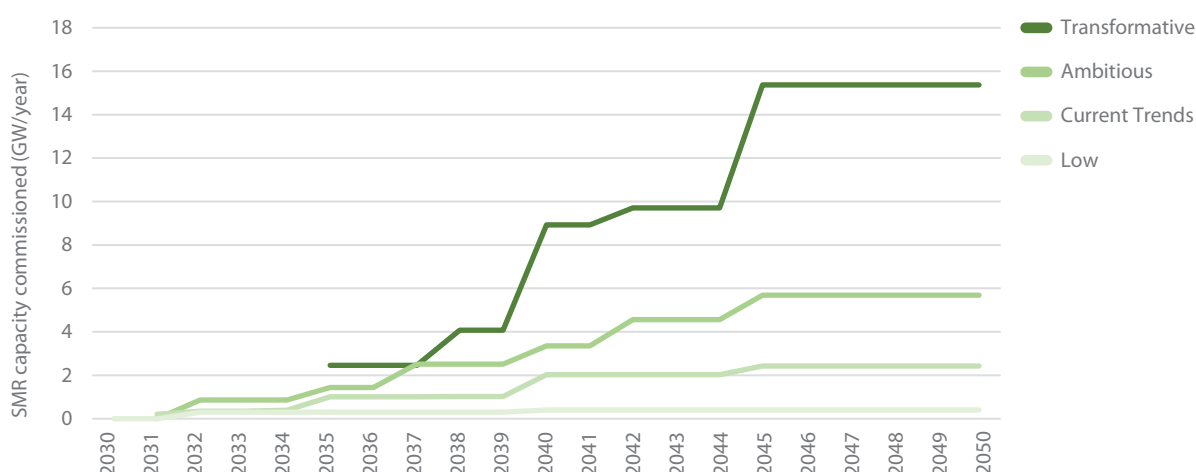
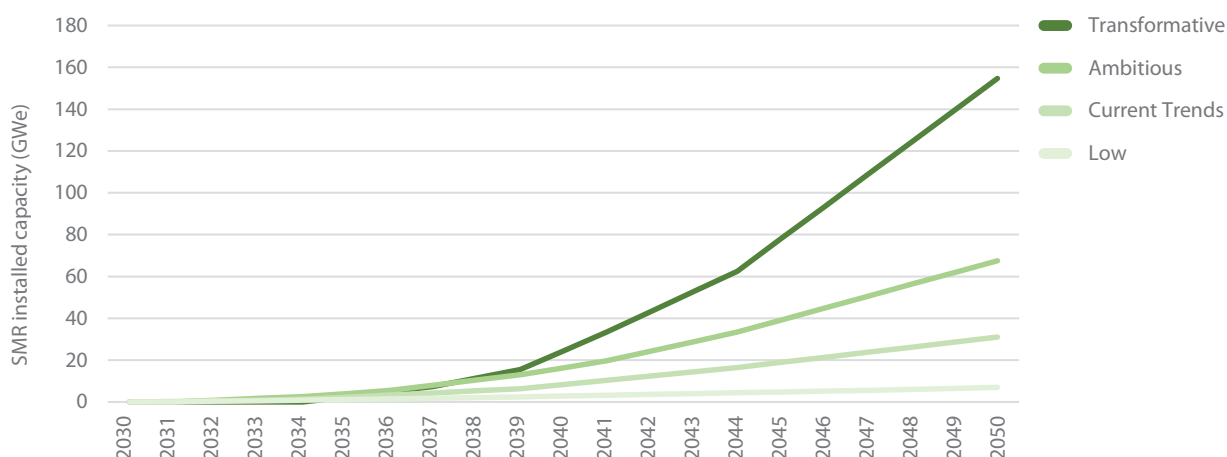


Figure 3.2 presents the global capacity of SMRs through 2050 across the four NEO SMR scenarios. These project that global SMR capacities could exceed 150 GW under a transformative scenario, shared evenly between OECD and non-OECD countries, with Asia set to lead among non-OECD regions and North America emerging as the principal market within the OECD.

Figure 3.2: **Scenarios for global cumulative SMR deployment**



The Transformative Scenario highlights how large-scale deployment of SMRs would depend on implementing innovative delivery models that could dramatically increase the speed and scale of SMR rollout. Achieving this potential will likely require a transformation in the global governance of nuclear energy projects, such as establishing policy and regulatory frameworks for product-based licensing and the use of pre-qualified sites, as well as measures such as aggregating demand for robust order books. These enabling conditions are not expected to be fully in place prior to the 2040s, which will limit the total level of SMR capacity deployed by 2050. This implies that SMRs could play an increasingly important role in global installed capacity during the second half of the twenty-first century.

Table 3.2: **Delivery models for SMR components of the four NEO scenarios**

Scenario	SMR delivery models	Long-term SMR deployment	Timelines	Assumptions
Low	EPC-based, non-programmatic approach This scenario assumes that countries do not pursue longer-term programmatic approaches to SMRs. SMRs in this scenario are limited to demonstrators and very early commercial projects.	0 GW/year	First deployment after 2030 in Asia, and between 2032-35 in North America, followed by Europe.	Assumes that interest in nuclear energy as a whole wanes in favour of other energy sources. SMRs are not widely constructed in this scenario.
Current Trends	Programmatic EPC approach This resembles historical nuclear energy delivery, where civil works and much of the assembly occur on site, with limited use of prefabricated modules to improve productivity. Large reactor projects provide examples of modular approaches used to support site construction, including the AP1000's modular construction philosophy and Hinkley Point C's use of offsite prefabrication workshops. Near-term SMR deployments are expected to follow a broadly similar approach, while potentially leveraging higher modularisation and increased offsite fabrication to improve field productivity and schedule performance.	2-3 GW/year	First deployment by 2030 in Asia, and between 2032-35 in North America, followed by Europe in the late 2030s.	Assumes historical maximum deployment rates can be reached again across multiple regions through co-ordinated, government-led strategies, similar to France's nuclear programme in the 1970s and 80s, the Province of Ontario, Canada in the 1980s or, more recently, the Barakah project in the United Arab Emirates.
Ambitious	Modular manufacturing practices As plant size and complexity decrease, more systems can be packaged into transportable modules, enabling higher levels of modularisation, preassembly and integration in an industrial setting such as a fabrication yard or shipyard. Developers such as Prodigy Clean Energy and Blue Energy are adapting existing designs to modular manufacturing approaches.	~5-8 GW/year	Module factories could be fully licensed and operating at maximum capacity in Asia and North America by 2032-35, followed by Europe in 2037.	Increased modularity would enable higher rates of deployment by leveraging offsite assembly to reduce bottlenecks in the workforce and supply chain.
Transformative	Next generation manufacturing practices The most factory intensive model targets components and modules that are small and standardised enough to move through repeatable manufacturing with higher automation and lower use of on-site labour. This approach allows for economical production of microreactors, while also helping enable higher rates of deployment for larger SMRs, depending on the vendor and design. Examples of vendors explicitly positioning around mass production include Radiant, Copenhagen Atomics and Aalo Atomics.	~12-16 GW/year	In North America and Asia, first factories could be fully licensed and operating at maximum capacity by 2035-38, followed by Europe by 2040. Africa deploys its first reactors after 2038.	Assumes transformative innovation in design, regulation and manufacturing, enabling mass production. Advanced offsite assembly techniques help accelerate the rate of reactor deployment by further reducing workforce and supply chain bottlenecks.

NEO Scenarios

Figure 3.3 outlines the four scenarios explored in the NEO. Each scenario is constructed using different combinations of long-term operation of existing reactors, large-scale new build and SMRs.

Figure 3.3: **Scope and definition of the four NEO scenarios**

	Low Scenario	Current Trends Scenario	Ambitious Scenario	Transformative Scenario
LTO	Existing LTO programmes	60-80 years	80 years	100 years
Large-scale new build	Under construction	Under construction	Under construction	Under construction
	Planned	Planned	Planned	Planned
		Proposed	Proposed	Proposed
			Prospective	Prospective
SMRs	Under construction	Programmatic approach	Advanced modular manufacturing	Next generation mass manufacturing

* Hashed lines represent elements that are only partially included, e.g., in the Low Scenario only part of the “Planned” reactor projects are included in the calculations.

Low Scenario

The Low Scenario relies predominantly on existing commitments without significant expansion. It falls short of deployment targets as well as corresponding decarbonisation targets. It may also fall short of objectives related to long-term energy security.

The Low Scenario includes operations and LTO of the existing fleet, large-scale new build, and SMRs as described in Table 3.3 below.

Table 3.3: **Scope and definition of the Low Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Only currently announced plans for LTO and refurbishments are carried out.
Large-scale new build	Only the large-scale new build projects currently under construction or in the most advanced stages of planning are eventually commissioned.
SMRs	Only SMR projects currently under construction are eventually commissioned.

Current Trends Scenario

The Current Trends Scenario reflects a moderate approach that balances existing commitments with incremental growth in nuclear capacity. This pathway assumes that feasible operating licence extensions and advanced new build projects are pursued, potentially supporting steady progress towards decarbonisation goals while maintaining energy reliability. However, it may not deliver the scale of deployment needed for the most ambitious energy and climate targets.

Table 3.4: **Scope and definition of the Current Trends Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions up to 60 years are carried out for all existing reactors where it is economically feasible and all announced operating licence extensions to 80 years are carried out.
Large-scale new build	All large-scale new build projects currently planned or under construction are carried out, and the proposed reactors in relatively advanced stages of planning are eventually commissioned.
SMRs	SMRs follow an onsite construction model similar to the current model employed by large-scale new build.

Ambitious Scenario

The Ambitious Scenario outlines a proactive strategy that leverages both existing assets and future opportunities to accelerate decarbonisation and reinforce energy security. This assumes robust investment in extending reactor licences, commissioning all planned and proposed large-scale new builds, and adopting innovative modular construction methods for SMRs. While offering greater potential to meet stringent climate objectives, it requires substantial policy support and sustained industry commitment.

The Ambitious Scenario includes operations and LTO of the existing fleet, large-scale new build and SMRs as described in Table 3.5 below.

Table 3.5: **Scope and definition of the Ambitious Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions to 80 years are carried out for all existing reactors where it is technically feasible.
Large-scale new build	All large-scale new build projects currently under construction, planned or proposed are built, and the most economically viable prospective projects are eventually carried out.
SMRs	SMR construction follows an advanced, modularised model, which helps to relieve some the supply constraints on SMR technology.

Transformative Scenario

The Transformative Scenario represents a bold vision for the future, where the nuclear energy landscape is fundamentally reshaped through widespread adoption of advanced technologies and manufacturing processes. This would require extensive investment and collaboration, with a focus on rapid deployment and mass production of SMRs to drive significant progress towards deep decarbonisation and enhanced energy resilience. Success in this scenario hinges on overcoming technical and supply-side challenges, as well as fostering robust policy frameworks to support innovation and growth.

The Transformative Scenario includes operations and LTO of the existing fleet, large-scale new build and SMRs as described in Table 3.6 below.

Table 3.6: **Scope and definition of the Transformative Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions to 100 years are carried out for all existing reactors where it is technically feasible.
Large-scale new build	All large-scale new build projects are carried out, including all prospective projects.
SMRs	SMR construction follows a next generation mass manufacturing model, which enables widespread deployment of a variety of SMR designs and applications.

3.2. Tracking global progress

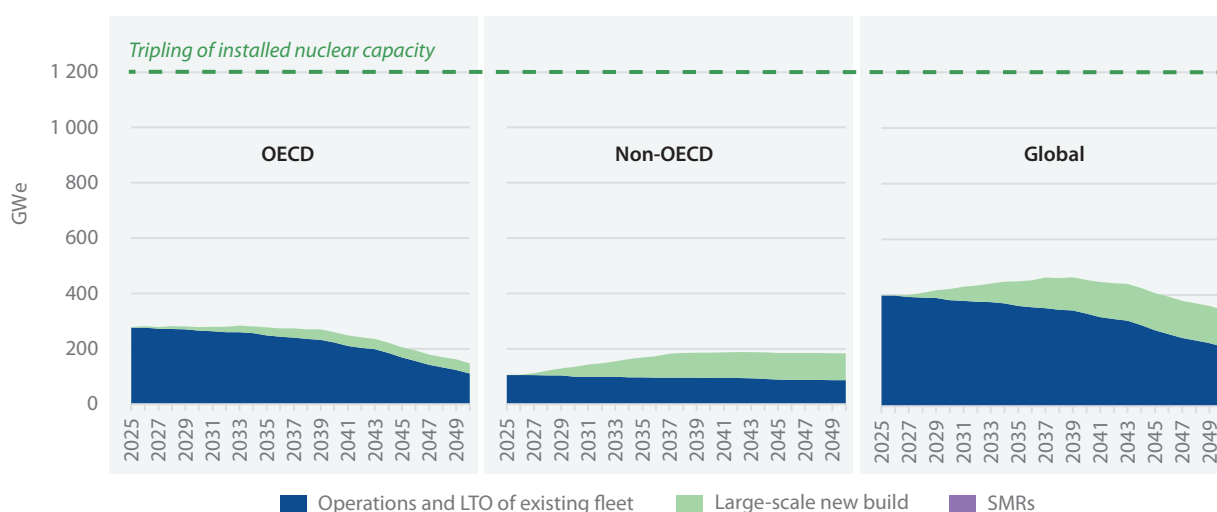
Since 2022, there has been a growing interest in nuclear energy as a clean, reliable and secure source of power. This shift was evident in the 2023 Declaration to Triple Nuclear Energy, which has so far been endorsed by 38 countries (WNA, 2026). Achieving such a target would require a return to the pace of construction seen during the 1970s and 1980s, along with the development of supporting infrastructure on a comparable scale.

This section compares the four scenarios outlined in Section 2.1 against the objective of tripling global nuclear capacity by 2050. The analysis further distinguishes between global, OECD and non-OECD regions, and examines the contributions of the three components of nuclear capacity: long-term operations, large-scale new build projects, and small modular reactors. The key outcomes of each scenario are summarised in Table 3.7.

Low Scenario: Outlook for nuclear capacity to 2050

The Low Scenario, presented in Figure 3.4 below, sees global installed nuclear capacity temporarily rise as projects already under construction and some planned projects are commissioned until the mid-2030s, followed by a decline in capacity in the OECD as many reactors do not enter into long-term operations. Non-OECD countries make up a much greater share of the world nuclear fleet by 2050 in this scenario, increasing from 25% of current global capacity to just over 50%.

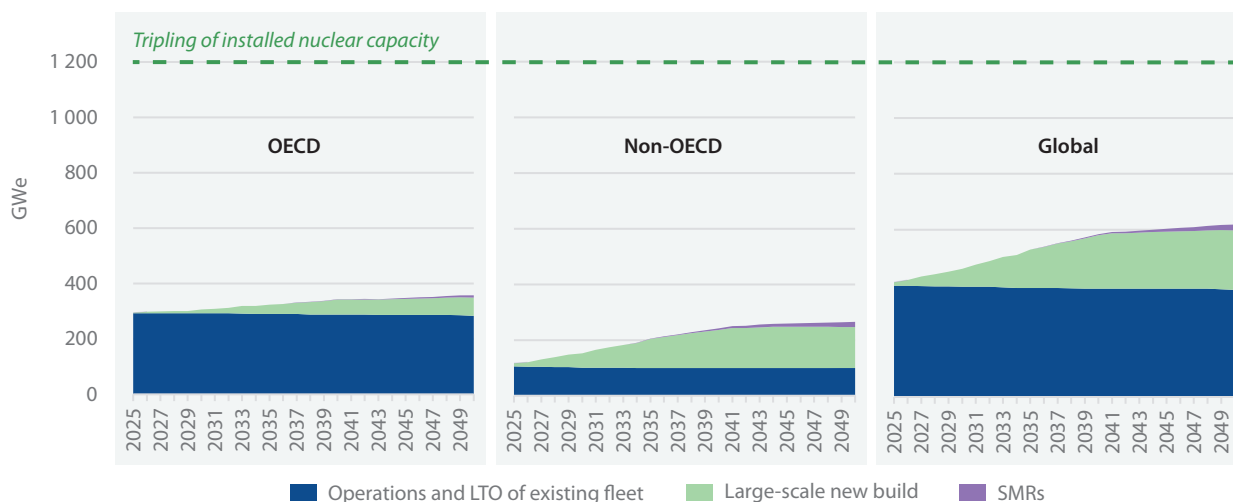
Figure 3.4: **Low Scenario outlook for nuclear capacity to 2050**



Current Trends Scenario: Outlook for nuclear capacity to 2050

The Current Trends Scenario, presented in Figure 3.5, sees nuclear capacity rise to over 600 GWe by 2050, driven in large part by planned and proposed projects in non-OECD countries. This leaves a gap of approximately 580 GWe compared with the 2023 Declaration to Triple Nuclear Energy by 2050. While the proportion of global installed nuclear capacity in the OECD does not decline to the same extent as in the Low Scenario, non-OECD countries do grow significantly, reaching levels representing over 40% of worldwide capacity.

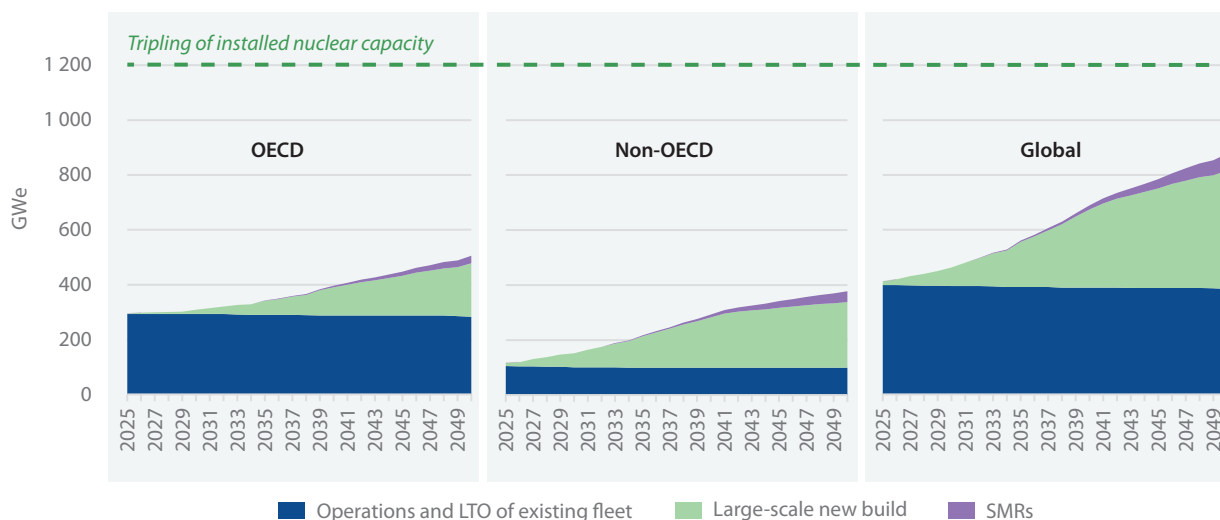
Figure 3.5: **Current Trends Scenario outlook for nuclear capacity to 2050**



Ambitious Scenario: Outlook for nuclear capacity to 2050

In the Ambitious Scenario, presented in Figure 3.6, worldwide capacity exceeds 883 GWe by 2050. This scenario sees a more significant role for SMRs, as well as more large-scale new build activity in the OECD. However, the pace of nuclear new build in non-OECD countries means that the per cent of global installed capacity located in OECD countries is still expected to decline.

Figure 3.6: **Ambitious Scenario outlook for nuclear capacity to 2050**



Transformative Scenario: Outlook for nuclear capacity to 2050

The Transformative Scenario, presented in Figure 3.7, sees global installed capacity exceed 1 400 GWe in 2050, more than triple today's global nuclear energy capacity. Nuclear expansion is driven in large part by sizeable targets announced by a few countries, such as the United States' goal of 300 GWe of new nuclear capacity by 2050, India's target of 100 GWe total capacity by 2047, and France's goal to build 14 EPR reactors by 2050. In this scenario, 150 GWe, more than 10% of global installed capacity, comes from SMRs.

Figure 3.7: **Transformative Scenario outlook for nuclear capacity to 2050**

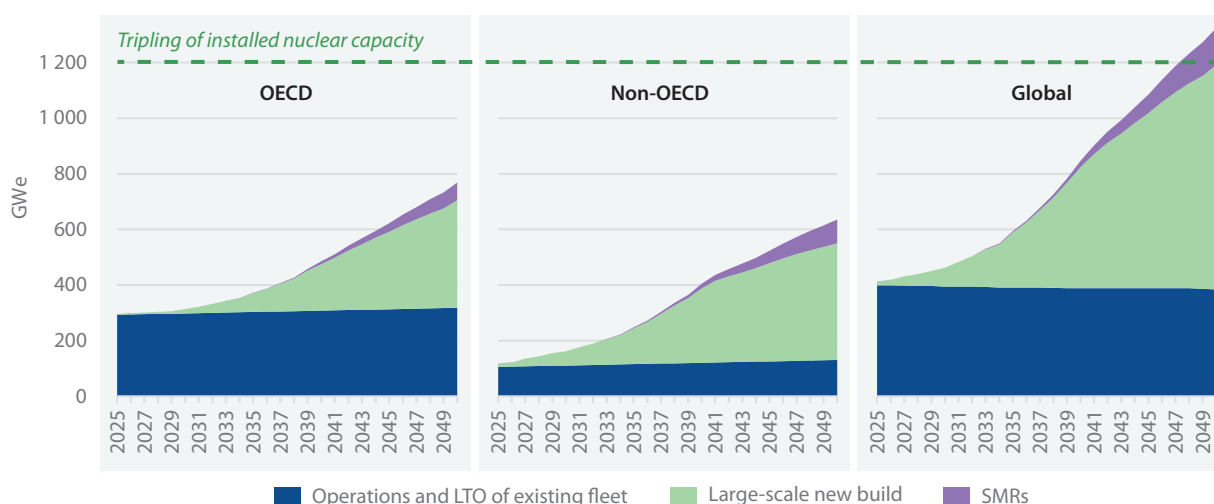


Table 3.7: **Nuclear Energy Outlook scenarios to 2050**

Scenario	Installed capacity by 2050	OECD share of capacity in 2050	Non-OECD share of capacity in 2050	Installed capacity by 2050
Low Scenario	347 GWe	47%	53%	Global installed nuclear capacity rises as projects under construction and some planned projects are commissioned by the mid-2030s, followed by a decline in capacity in the OECD as many reactors do not enter long-term operations. This scenario serves as an important reminder that recent momentum towards nuclear energy may not deliver the anticipated results, especially if global energy policy priorities shift away from the present strong focus on energy security and climate action, or if the industry fails to deliver on the pipeline of near-term projects. In this scenario, non-OECD countries will also comprise a much greater share of the world nuclear fleet by 2050, increasing from about 22% of current installed capacity to just over 50% by 2050.
Current Trends Scenario	619 GWe	57%	42%	Nuclear capacity increases to over 600 GWe by 2050, driven in large part by planned and proposed projects in non-OECD countries. This leaves a gap of approximately 600 GWe compared with the pledge to triple nuclear capacity. While the percentage of global installed nuclear capacity in the OECD does not decline as much as in the Low Scenario, non-OECD countries rise to over 40% of worldwide installed nuclear capacity.
Ambitious Scenario	883 GWe	57%	43%	Worldwide capacity reaches about 900 GWe by 2050, leaving a 300 GWe gap compared with the pledge to triple nuclear. This scenario sees a more significant role for SMRs, as well as more large-scale new build activity in the OECD.
Transformative Scenario	1 324 GWe	52%	48%	Global installed capacity reaches over 1 400 GWe in 2050, exceeding by 200 GWe the goal of tripling nuclear capacity. Nuclear expansion is driven in large part by a few sizeable country-level, long-term nuclear capacity goals, such as the United States' goal to quadruple installed nuclear capacity by 2050, as well as India's target of reaching 100 GWe total capacity by 2047. In this scenario, 150 GWe, more than 10% of installed capacity, comes from SMRs.

3.3. Beyond 2050: Exploring scenarios for nuclear energy through 2075

The long-term nature of nuclear energy projects means that decisions made today will have consequences for decades to come. Continued growth in nuclear capacity beyond 2050, even if only to keep pace with growth in electricity demand, will require continued investment to ensure robust and resilient supply chains for reactor components, specialised materials and skilled labour. Similarly, fuel supply arrangements across the nuclear fuel supply, from natural uranium exploration to conversion and enrichment services, necessitate forward-thinking strategies to ensure availability and security over the long term. Strategic planning by policymakers and industry stakeholders can help to mitigate risks, avoid bottlenecks and maintain momentum in expanding global nuclear capacity beyond 2050.

Some additional assumptions are employed to extend the four NEO scenarios beyond 2050, given the evolving nature of technology, policy, and global energy demand over longer time horizons. In particular:

- **Climate policy and energy security** – the Low and Current Trends Scenarios both assume that the current revival of interest in nuclear energy is not sustained, and therefore use of nuclear energy stagnates in the long term, driven by a change in political messaging around climate and energy security which deprioritises nuclear energy in favour of either

renewable energy, or renewed use of hydrocarbons. To a certain extent, the Ambitious and Transformative Scenarios conversely assume that energy security and related factors like grid resilience remain high priorities into the 2070s, helping drive favourable economics for further nuclear buildout.

- **International collaboration** – the Ambitious and Transformative Scenarios are based on an assumption of widespread international collaboration to help enable nuclear newcomer countries to build and scale their nuclear fleets.
- **Nuclear fuel supply** – long-term nuclear deployment will also depend on secure and resilient fuel supply, including considerations on closing of the nuclear fuel cycle with reprocessing and recycling. NEA's forthcoming report *Security of Nuclear Fuel Supply* ("Orange Book") will analyse the adequacy of nuclear fuel services, including natural uranium, conversion, enrichment and fuel fabrication, to meet demand using the four scenarios put forth in NEO.

Low Scenario: Outlook for nuclear capacity beyond 2050

As illustrated in Figure 3.8, the Low Scenario projects a stagnation and eventual decline of nuclear capacity after 2050. This trend is largely driven by reactors retiring after reaching the end of their initial and extended licences, combined with limited post-2050 new build. In 2075, 260 GWe of the 2025 nuclear fleet will be over 60 years old, with 46 GWe over 80 years old. Without significant new build between now and then, global nuclear capacities could shrink by a meaningful amount, even accounting for LTO programmes and the additional capacity added by current projects. This evolution would disproportionately affect OECD members, in particular the United States, whose fleet by 2075 will be almost a century old.

Current Trends Scenario: Outlook for nuclear capacity beyond 2050

In the Current Trends Scenario, capacity expansion moderately outpaces retirements and worldwide nuclear capacities double from the present level to exceed 800 GWe by 2075. Of this, SMRs would make up just under 100 GWe, or around 12% of global capacity. In this scenario, retirements of the oldest Generation II and III reactors offset new capacity growth in the 2060s as older fleets in the Canada, France, Russia, and the United States are replaced.

Ambitious Scenario: Outlook for nuclear capacity beyond 2050

In the Ambitious Scenario, worldwide capacity reaches approximately 2 000 GWe in 2075. This is driven in part by SMR adoption, which makes up approximately 200 GWe, or 10% of total capacity in 2075.

Transformative Scenario: Outlook for nuclear capacity beyond 2050

In the Transformative Scenario, the global buildout of new nuclear continues until 2075, with worldwide capacity reaching and exceeding 2 600 GWe. Of this, around 20%, more than 550 GWe, is projected to come from SMRs, enabled by new delivery models driving efficiencies in scale and construction.

Figure 3.8: **Global installed nuclear capacity projections to 2075**

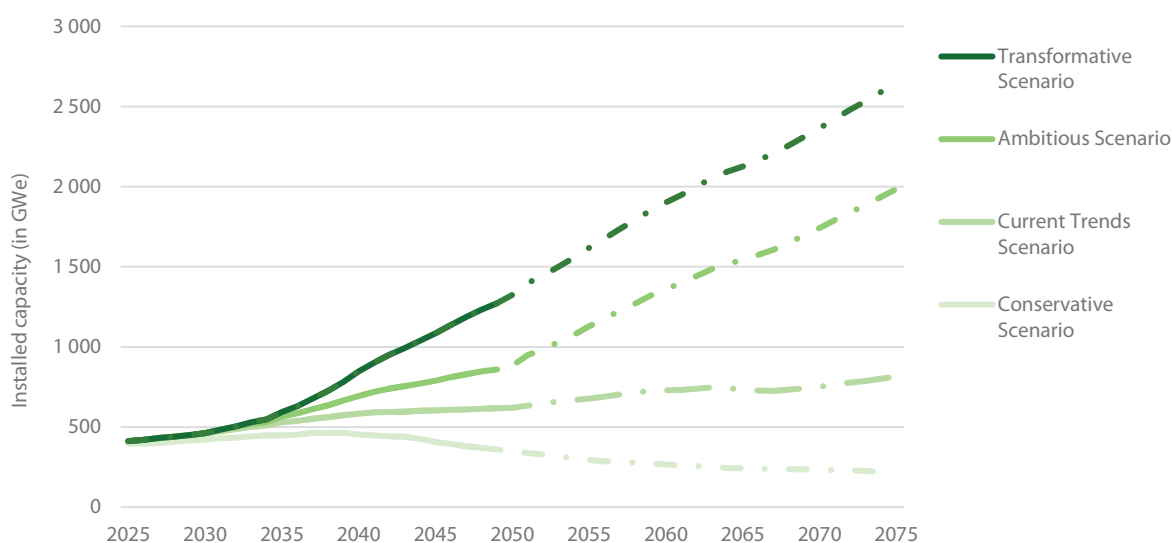


Table 3.8: **Nuclear Energy Outlook scenarios beyond 2050**

Scenario	Installed capacity by 2075	OECD share of capacity in 2050	Non-OECD share of capacity in 2050	Highlights
Low Scenario	209 GWe	25%	75%	Global installed nuclear capacity rises temporarily as projects planned and under construction are finished in the mid-2030s. This is followed by a decline in capacity in OECD countries as many reactors do not realise LTO programmes in this scenario. This decline continues after 2050, leading to a significant reduction of global operational capacity.
Current Trends Scenario	815 GWe	39%	61%	Nuclear capacity increases to over 800 GWe by 2075. In this scenario, roughly half of global installed nuclear capacity is in OECD countries and half is in non-OECD countries, resulting in large part from a significant increase in non-OECD capacity between 2030 and 2050, with more limited construction post-2050.
Ambitious Scenario	1 968 GWe	49%	51%	Worldwide capacity reaches 1 968 GWe by 2075, exceeding the goal of tripling installed capacity by the late 2050s. This scenario sees a more significant role for SMRs, which by 2075 make up nearly 10% of global installed capacity, as well as more large-scale new build activity in the OECD.
Transformative Scenario	2 649 GWe	53%	47%	Global installed capacity reaches over 2 700 GWe in 2075, of which more than 400 GWe is expected to be SMRs. Capacity of both large-scale reactors and SMRs are expected to be about equal between OECD and non-OECD members, marking a significant shift from the current situation.

Chapter 4.

SMR delivery models and implications for deployment rates

This chapter sets out the assumptions, methodologies and conclusions concerning the role of SMRs in the four NEO scenarios. Strong demand signals already exist for SMRs across various markets and applications and are expected to grow in the coming decades.

Case studies on SMR industrial applications (IEA, 2025a; NEA, 2026, 2025b, 2024, forthcoming a) highlight increasing demand from energy-intensive industries where SMRs offer a unique value proposition compared to gigawatt-scale nuclear reactors. This includes:

- **On-demand high-temperature heat and power:** While cogeneration is proven in traditional large light water reactors (LWRs), SMRs leverage Generation IV nuclear technologies to deliver electricity and core outlet temperatures up to and exceeding 800°C.
- **Flexibility of deployment:** Lower power outputs are combined with enhanced safety features and the potential for reduced emergency planning zones, cooling and grid constraints (including off-grid or behind-the-meter configurations), which enables siting closer to end users.
- **Energy density:** Some Generation IV SMR designs have higher energy density on a land-use basis than traditional large-scale reactors, which facilitates integration in brownfield sites or configurations where space is more limited.

These features make SMRs attractive for a broader range of applications beyond electricity generation, including co-location with industrial facilities, replacement of retiring fossil fuel assets, district heating and cooling facilities, as well as off-grid applications for remote mining or marine propulsion. However, deployment of SMRs at speed and scale has yet to be demonstrated, and the actual costs of real-world projects remain largely unknown.

The key underlying assumption is that demand for SMRs, especially from industrial customers, exceeds the sector's capacity to deploy SMRs at scale and speed, and this will continue to be true for the coming decades. Accordingly, the contribution of SMRs in all four NEO scenarios is constrained by the supply side, rather than demand.

Delivery models will play a central role in shaping supply side constraints and determining commercial deployment rates. Figure 4.1 and Table 4.1 set out the NEA's approach to estimating the size of the market that could be addressed by SMRs. First, the total energy requirements for global markets and applications are elaborated. These figures are then filtered to estimate the size of markets that could reasonably be addressed by SMRs.

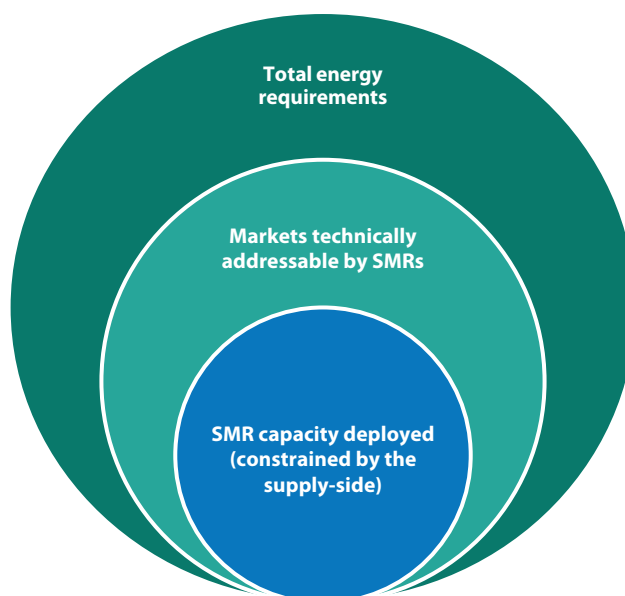
The final step is to estimate the maximum SMR capacity that could be deployed in the period 2030-2040, but which was constrained in 2026 – was expected to continue to be constrained to some extent – by supply-side limitations.

Table 4.1: **SMR market tier-based approach**

Tier 1 Total energy requirements	The total energy demand by 2050 corresponds to the aggregate energy requirements across all sectors and applications by 2050, including industrial, residential and transport. It sets the broad context for understanding both the scale and limitations of the SMR market potential within the wider energy system.
Tier 2 Market technically addressable by SMRs	The market technically addressable by SMRs by 2050 corresponds to the portion of total energy demand that SMRs could technically supply, based on the temperature and process requirements of various applications. It excludes sectors or processes where SMRs are not currently suitable, such as those needing very high temperatures or involving significant transport energy needs.
Tier 3 SMR capacity deployed (constrained by the supply-side)	SMR capacity deployed by 2050 corresponds to the amount of SMR capacity commissioned and is determined by supply constraints to SMR deployment.

Additional information about this methodology is detailed in Annex 5.

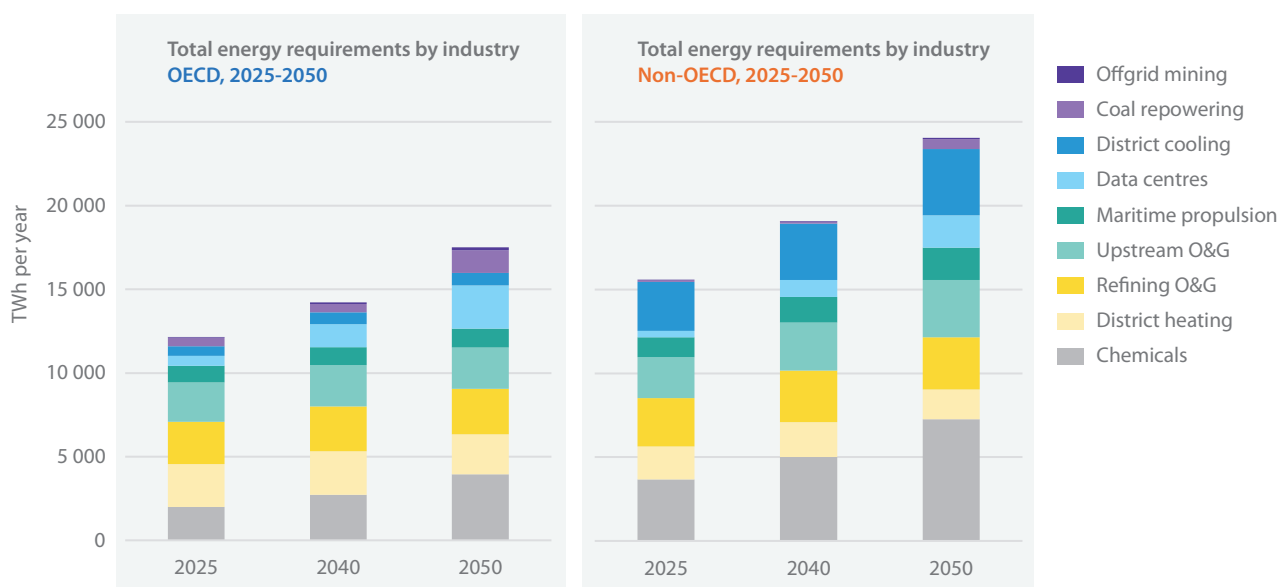
Figure 4.1: **NEA's approach to estimating the SMR market**



4.1. Total energy requirements

Industrial energy demand in key sectors is projected to exceed 17 000 TWh in OECD countries and 24 000 TWh in non-OECD countries by 2050, as illustrated in Figure 4.2 (IEA, 2025a). Globally, chemicals, oil and gas, and district heating together account for over 60% of total industrial energy demand. Data centres are expected to see a five-fold increase, though their share of total energy demand will remain below 15%. In non-OECD countries, energy demand for district cooling is projected to be twice that of data centres.

Figure 4.2: **Industrial energy demand outlook to 2050, OECD and non-OECD**



Note: NEA analysis. See Annex 5 for additional details.

4.2. Technical requirements of potential SMR markets

A closer look at the technical requirements of different industrial end users reveals some limits on the potential of SMRs to address the full demand for SMR heat and power.

Generation IV SMRs technologies can provide recoverable heat over 300°C, making them technically suitable to supply heat to key industrial processes. However, there are upper limits to the temperatures that can feasibly be achieved by SMRs based on current materials limitations. SMRs likely to be deployed in the next decade will not be suitable for certain industrial processes requiring

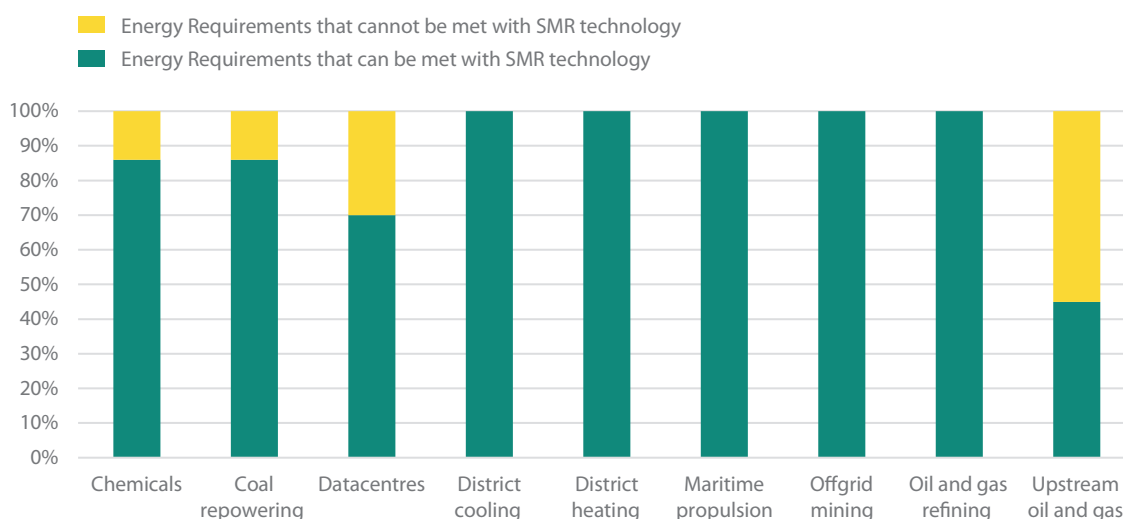
very high temperatures, such as those exceeding 800°C. While some reactor designs may allow core outlet temperatures to exceed 800°C, challenges persist in transporting the heat (usually in steam) at high temperatures. Steam becomes increasingly corrosive as temperature and pressure increase. Common industrial practice is to transport steam at temperatures less than 600°C in cogeneration systems (Angulo et al., 2012). This means that application of steam reaching or exceeding 800°C is presently unproven at industrial scales, though this could change with further research and development in materials science. There are other methods for augmenting an SMR with other sources of heat to produce higher working temperatures, but these hybrid systems are also unproven.

For the off-grid mining sector, approximately half of the total energy demand is associated with transportation needs, specifically for moving mined products. Due to the nature of such as transport operations – often remote and mobile – these energy demands are generally not well-suited to be met by SMRs. As a result, SMRs are primarily capable of addressing the non-transport energy requirements, such as those related to processing and site operations, rather than the significant transport-related demands in this sector.

The estimates illustrated in Figure 4.3 are informed by in-depth analysis of the technical requirements of nine market segments. Details of this analysis are presented in Annex 5.

Taken together, these estimates mean that SMRs would be technically capable of meeting over 85% of total global industrial energy requirements, providing both electricity and heat across key sectors (see Figure 4.3). This translates to 34 000 TWh of demand per year globally for heat and power combined applications that could realistically be addressed with SMRs.

Figure 4.3: **SMR technical potential share in various market segments**



Heat represents about 50-60% of the energy requirements that can technically be met by SMRs. This highlights significant opportunities for nuclear cogeneration. The demand for heat is primarily driven by the chemicals, oil and gas, and district energy sectors, with SMRs showing different potential use cases to meet heat needs (see Figure 4.4):

- **Cogeneration mode:** Nuclear reactors that produce both heat (via high temperature steam or with other coolants) and electricity. This is particularly valuable in the chemical and oil & gas sectors, which have both heat and electricity needs. Operation in cogeneration mode improves system efficiency, helping bring generation costs down.
- **Heat-only mode:** This configuration can be applied in any sector with heat demand, but it is particularly adapted for district energy, where no electricity is needed. Heat-only applications are highly efficient and do not require steam generators nor heat sink infrastructure of the Rankine cycle (i.e. condenser, tertiary circuit) potentially achieving even lower costs than cogeneration.

Electricity demand accounts for the remaining half of the potential and is concentrated in data centres and coal repowering, particularly in OECD countries. For electrical applications alone, more than 2 000 GWe of capacity would be necessary to fully address the technical potential.

Over 85% of the technical potential for heat is for temperatures below 300°C, primarily in the district energy and chemical sectors. This includes chlor-alkali and ethanol production, as well as drying or evaporation processes. High-temperature heat needs (300-800°C) are mainly concentrated in the chemical and oil and gas refining sectors, and in general are more difficult to electrify.

Figure 4.5 below compares annual demand for high-temperature and low -temperature heat. Globally, high-temperature heat accounts for around 10% of total heat demand, which remains significant, equivalent to hundreds of gigawatts of thermal capacity, or around 25% of the current annual global nuclear thermal output. Given the sheer size of demand for sub-300°C heat and the fact that it is easier to electrify with heat pumps, SMRs are not expected to dominate this sector in the short term. However, in the smaller market for 300-800°C industrial heat, SMRs could become a significant mode of production by 2050.

Figure 4.4: **SMR technical potential by carrier and industry, OECD and non-OECD**

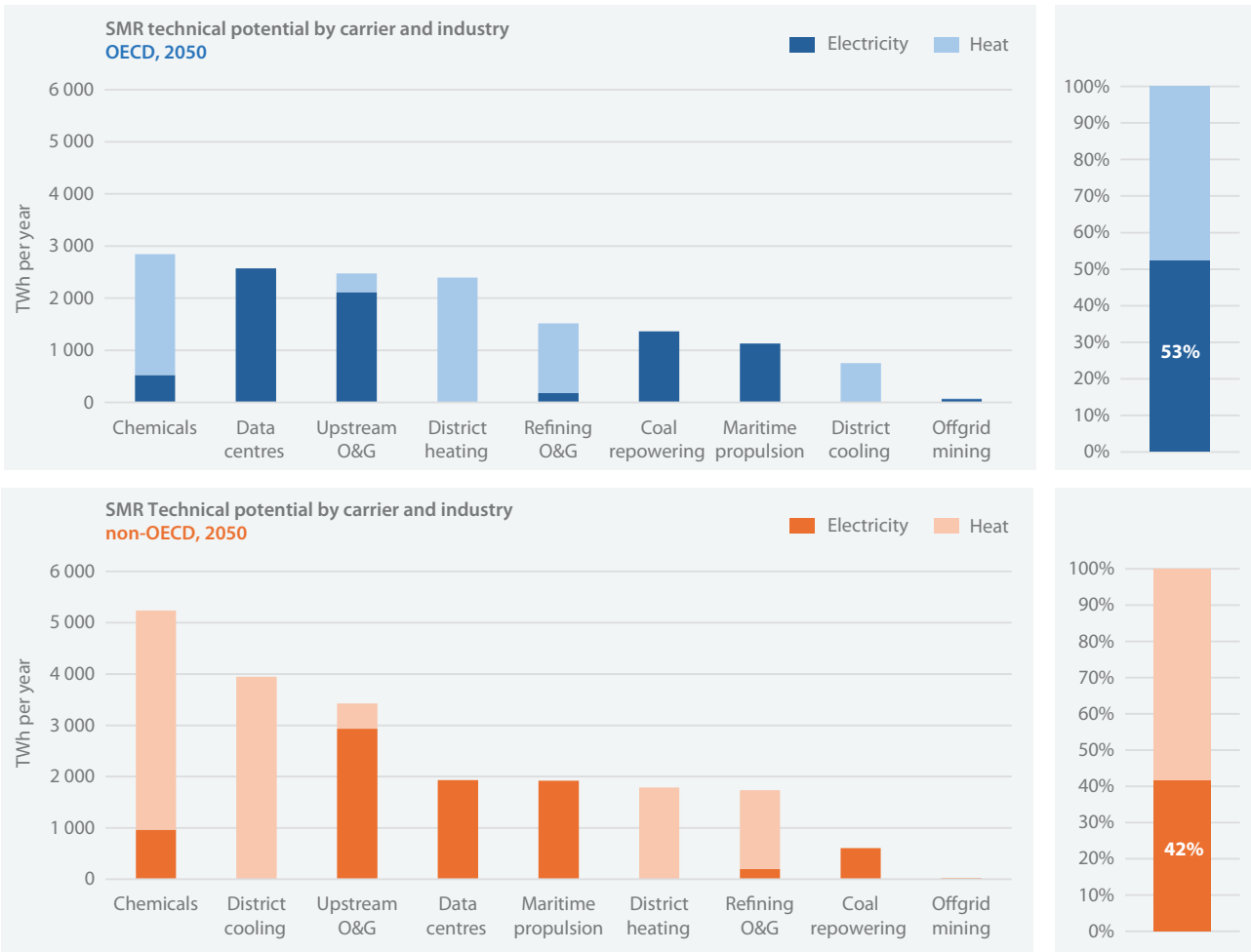
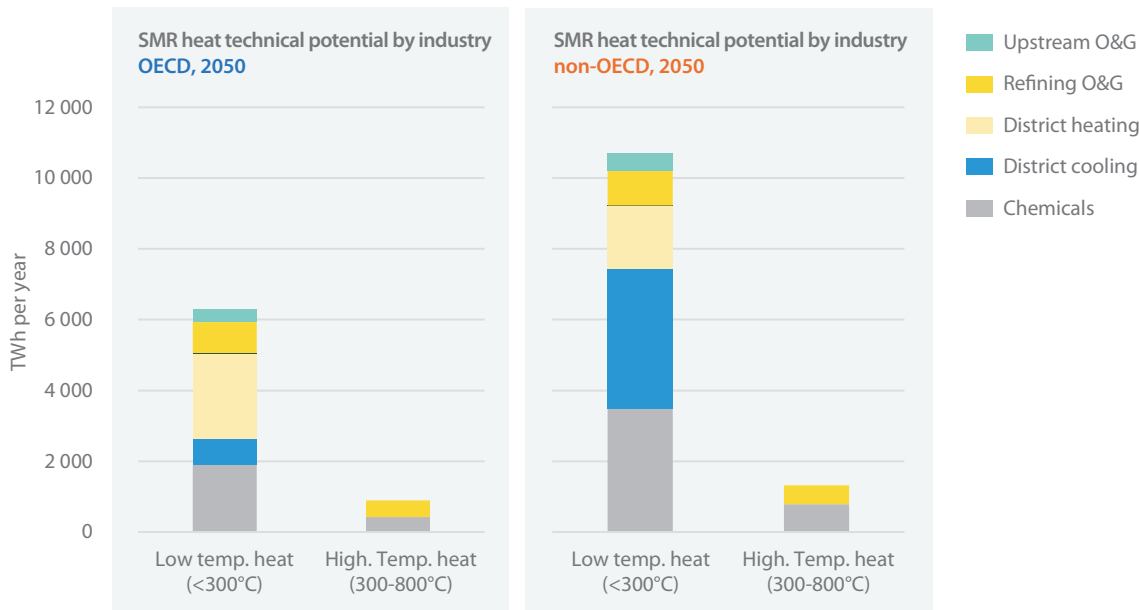


Figure 4.5: **SMR heat potential by industry, OECD and non-OECD**



Box 4.1: Unlocking new delivery models for SMRs

By Antonio Vaya Soler, LucidCatalyst

Different delivery models being explored

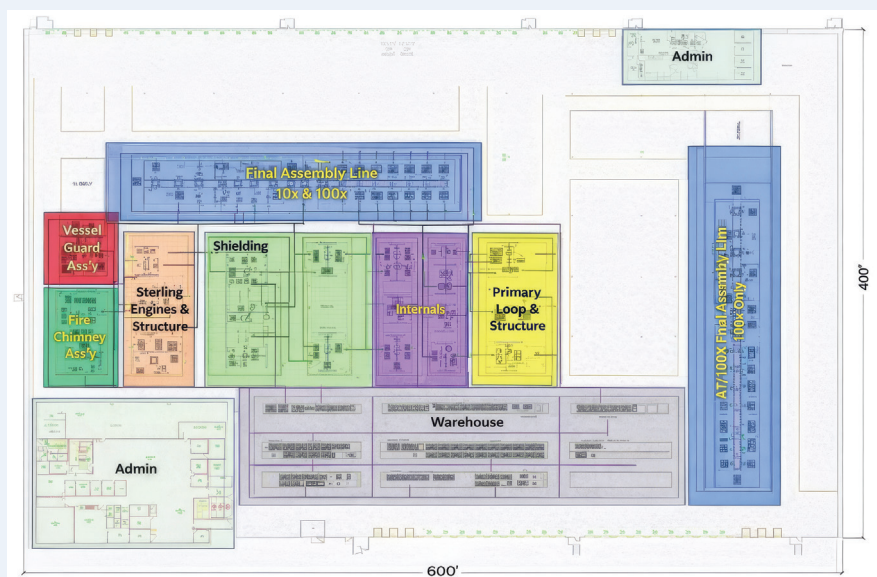
The emergence of small modular reactors (SMRs) is driving the adoption of new delivery models. Figures 4.6 and 4.7 illustrate some of the prospective opportunities for SMRs to access new markets as well as new delivery models. In practice, higher degrees of factory fabrication are feasible only when major plant elements are small and simple enough to fit within available manufacturing and logistics constraints. The rationale is to shift more work from the field to controlled fabrication environments, improving schedule predictability, reducing costs, and enabling scale by drawing on practices used in sectors such as shipbuilding and aerospace.

Figure 4.6: **Vision of ammonia production, floating production storage, and offloading platforms being assembled in shipyard**



Source: EPRI (2021), *Rethinking Deployment Scenarios for Advanced Reactors: Scalable Nuclear Energy for Zero-Carbon Synthetic Fuels and Products*.

Figure 4.7: **Overview of the microreactor factory layout for 10 and 100 units/year production volumes for the Microreactor Applications Research, Validation, and Evaluation (MARVEL) use case**



Source: Abou Jaoude et al. (2023) *Assessing the Impact of Mass Production on Microreactor Costs*.

Delivery model as an industry requirement

To unlock new delivery models, it is necessary first to understand their rationale and goals. SMRs do have unique technical features, such as smaller size, simpler geometries, fewer components and in some cases lower pressures, which enable higher levels of factory fabrication and can reduce costs, time and delivery risks. These features, however, belong to a technology push vision that has traditionally dominated nuclear design and does not by itself say much about the ultimate customer needs being served. A requirement-driven approach does. Product design does not see the delivery model as a purely technical choice, but rather as a necessity to meet customer needs. Under this lens, new delivery models become an industry requirement, often the only way to meet customer needs. The constraints of traditional nuclear delivery mean that it does not fully meet the requirements of some markets.

Table 4.2 illustrates the mismatch that can arise between traditional nuclear delivery – understood as bespoke, on-site construction of gigawatt-scale Gen III+ reactors – and key generic industrial requirements. The traditional model offers familiarity, proven contracting structures, and established regulatory procedures. It may also suit applications requiring several hundred megawatts of capacity. However, it remains too slow and difficult to replicate at the speed and scale that many industrial customers require.

Table 4.2: **Traditional nuclear delivery vs. industrial requirements**

Traditional nuclear delivery	Generic industrial requirements
GW-scale plants	Few MW to several hundred MW, scalable and modular
High upfront capital	Lower upfront capital; preference for OPEX over CAPEX
7+ year deployment timelines	2-3 year industrial planning cycles
On-site, project-specific, cost-plus contracts	Manufacturing-style procurement; fixed-price, performance-based contracts
Custom FOAK designs; shallow supply chains	Proven, standardised products; deep, resilient supply chains
Customer bears licensing risk and operations	Energy-as-a-service; limited customer operational involvement
Site-specific licensing	Replicable deployment; standardised licensing
Nuclear safety standards for utilities	Integration with industrial safety standards

Source: Lucid Catalyst (2021).

Consider the maritime sector: it must deliver and replace many ships annually using standard solutions. Power systems must align with shipyard processes and regulatory timelines that ensure safety without creating bottlenecks. Aviation follows a similar logic. Aircraft are delivered through deliberate design and certification enabling large-scale production while maintaining the highest safety standards, relying on factory fabrication, extensive supply chain co-ordination, and type certification¹ reusable across many units.

Many industries seek proven solutions with shorter timelines, predictable costs and compatibility with industrial procurement. When these requirements drive decisions, SMRs and new delivery models become not just a technology option but the best way to serve these markets at scale.

What must change to unlock new delivery models

Seven critical areas require targeted action to enable new delivery models. Early efforts are emerging in each.

- **Timelines:** One key challenge is the misalignment between current SMR deployment and industrial customers' timelines. This misalignment is twofold. First, some industrial users need firm, low-carbon power in the very short term, but SMR technology, while advancing quickly, is not yet fully commercial at scale. Second, typical nuclear planning and delivery timelines are longer than the 2-3 year planning and investment cycles used by many industrial firms. New delivery models have the potential to shorten delivery schedules and better align nuclear delivery with industrial planning cycles.
- **Industrial capabilities:** Factory and yard fabrication are standard in shipbuilding, aerospace, oil & gas, and renewables but largely untested for commercial nuclear energy. Some advanced reactor vendors (e.g. Aalo Atomics, Copenhagen Atomics, Radiant Nuclear) are already investing in early factory and prototype facilities, while maritime firms like Allseas are developing SMR concepts that build on existing yard and offshore engineering capabilities to enable new nuclear delivery models (Aalo Atomics, 2025; Allseas, 2025; Copenhagen Atomics, 2025; Radiant Nuclear, 2025).
- **Financial risk:** New delivery models require financing for factories, tooling and serial manufacturing processes, not just reactor design. This can raise perceived risk and front-load capital needs, compared with traditional EPC approaches where the risk profile, even if large, is better understood by investors.

1. Type certification is the formal regulatory approval of a standard design ("type") confirming that it meets all applicable safety and performance requirements, so that multiple identical units can be produced and deployed under that single design approval.

- **Regulation:** High-volume production collapses if every unit needs bespoke licensing. The aviation and maritime sectors solve this with type certification, where a design is certified once and applied to many units. The nuclear sector has already some regulatory rules enabling similar approaches. For example, the 10 CFR Part 52 Subpart F (“manufacturing licence”, ML) in the United States allows for factory-produced reactors be pre-approved on design and manufacturing so that the associated site licences only need to verify if the site fits the approved envelope under the ML, and address site-specific issues. Practical experience with this licensing procedure in the United States is very limited, but it is codified and could support factory-based delivery models.
- **Market and demand signalling:** Without a sufficiently large and predictable demand, investors will not commit to factories and supply chain development efforts. Google, Microsoft and Nucor’s joint Advanced Clean Electricity RFI aims to aggregate long-term offtake (Nucor, 2024). The Open Group consortium defines common requirements across industrial users so nuclear vendors can design to shared specifications and design products for multiple markets (The Open Group, 2025). This consortium-led standardisation mirrors open architecture precedents such as Volkswagen’s MQB platform (standardised interfaces enabling high part commonality and flexible production across many vehicle models), aviation’s modular subsystem interoperability enabled by type certification, and data centres’ Open Compute Project, where open specifications reduced bespoke engineering and vendor lock-in and accelerated scaling.
- **Site availability:** Pipelines of pre-screened sites, with land access, grid connections and preliminary environmental work in place, are also needed so deployment can keep pace with factory output.
- **Fuel availability:** Many advanced SMR designs use HALEU and require reliable fuel supply to scale. Current HALEU capacity is limited and historically Russia-dependent. The United States has launched the HALEU Availability Program and new domestic supply contracts to address this bottleneck (US Department of Energy, 2025).

These seven areas confirm that the implementation of new delivery models depends on co-ordinated progress across industrial capabilities, finance, regulation, demand formation, sites and fuel, not on technology alone. Early efforts exist in each area, which is encouraging, but further action is needed to unlock the full potential of these emerging delivery models for nuclear energy.

A multistakeholder approach

Governments can set direction, create incentives and reduce early risk, but they cannot deliver this transformation alone. Without private developers, financiers, industrial customers and fuel suppliers actively shaping new delivery models, SMR markets may not materialise because their requirements go unmet. Each stakeholder therefore has a critical role to play:

- **Customers** can aggregate demand and facilitate financing with initial purchase agreements above average market tariffs. They play a critical role in shaping technologies to their needs by adopting a customer-requirements-first approach and defining and sharing common performance, safety and commercial requirements with vendors so that solutions fit real operations and procurement practices.
- **Policymakers** could support innovation in delivery models, not just reactor technology. This includes enabling product-based licensing and type certification approaches, and developing banks of prequalified sites so deployment can match manufacturing pace.
- **Financiers** should recognise that new delivery models hold significant value if high-volume deployment succeeds and instruments are developed that better characterise risk and enable the financing of factories and fleets, not only single projects.
- **Technology developers** must embrace Design for Manufacturing and Assembly (DfMA) from the start, designing reactors as products, co-defining requirements with customers, and engaging critical suppliers early to de-risk deployment.
- **Fuel suppliers** should plan for scaled, diversified fuel demand, moving from purely contract-based arrangements towards more market-based approaches that enable timely investment in enrichment and fabrication capacity without constraining the market.

Again, this set of actions across key stakeholders illustrates the systemic nature of enabling new delivery models in the nuclear sector. This goes beyond technology and requires product-oriented mindsets that have not traditionally been at the core of nuclear development. The five areas and actions outlined here set, however, a clear path to unlock these new delivery models. The convergence of AI-driven energy demand, policy momentum and nuclear innovation creates a unique moment in history to push the frontier of nuclear delivery and open new markets at scale.

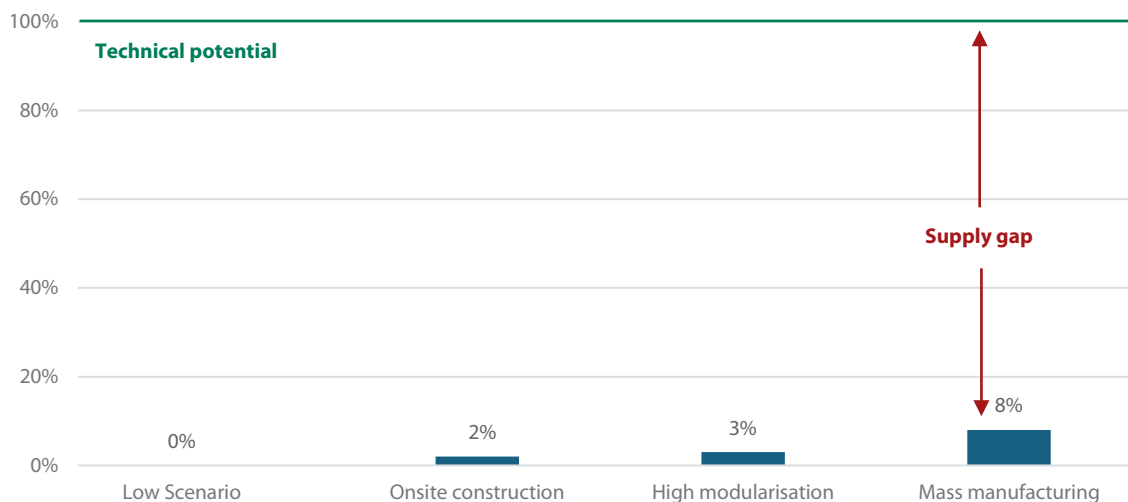
4.3. SMR outlook for 2050: Gap between demand and supply

While the potential addressable market of SMRs for industrial heat and power is significant, actual SMR deployment is expected to be limited by supply-side constraints for the coming few decades. Those supply chain constraints are further detailed in Annex 5.

By 2050, the global SMR capacity is projected to range from 30 GWe under the Current Trends Scenario to as much as 150 GWe with the Transformative Scenario. As detailed in Chapter 3, this difference can be explained by innovations in the delivery models. The enabling conditions to unlock new delivery models for SMRs are further discussed in Box 4.1.

These levels of SMR deployment by 2050 represent less than 10% of the technical potential in the Transformative Scenario due to the sheer scale of demand, as seen in Figure 4.8 below.

Figure 4.8: **Gap between technically addressable market and supply constraints**



4.4. SMR outlook for 2050: Possible SMR deployment in key markets and applications

To better understand the economic and technical constraints on widespread adoption of SMRs, the NEA has published several case studies to chart the progress and barriers to the industrial use of SMRs. These case studies form the basis of the sector-by-sector analysis and help identify which industrial sectors are best suited to adopt SMRs. Currently, the NEA has published four such case studies on SMRs, for district energy, marine merchant shipping, mining, and repowering shuttered coal facilities, and more are forthcoming (NEA, 2025b, 2024, forthcoming a, forthcoming b).

End users will have varying requirements for SMR size, siting and outlet temperatures, among others. In turn, this means that delivery models will influence the adoption of SMRs in key markets. Figure 4.9 proposes possible SMR deployment in key markets and applications based on the quantitative and qualitative insights of the NEA SMR industrial case studies.

Low Scenario: EPC-based, non-programmatic approach

Under an EPC-based model akin to current large-scale new build, the deployment of SMRs is expected to be limited to demonstration projects for on-grid power and some non-power applications such as district heating. The broader lack of interest in new nuclear energy in the Low Scenario further contributes to the deployment of SMRs in only a limited number of industrial end users.

Current Trends Scenario: Programmatic EPC delivery approach

In the Current Trends Scenario, a programmatic EPC delivery approach as well as higher levels of interest and investment in nuclear energy contribute to a larger deployment of SMRs to meet both power and non-power applications, including chemicals production.

While some of the inherent characteristics of SMR designs can help open new markets to nuclear energy, without further progress on efficient delivery, SMRs may not meet industrial end users' requirements in terms of cost and schedule, making it challenging for many industries to justify investment and use of SMRs.

Ambitious Scenario: Advanced modular manufacturing practices

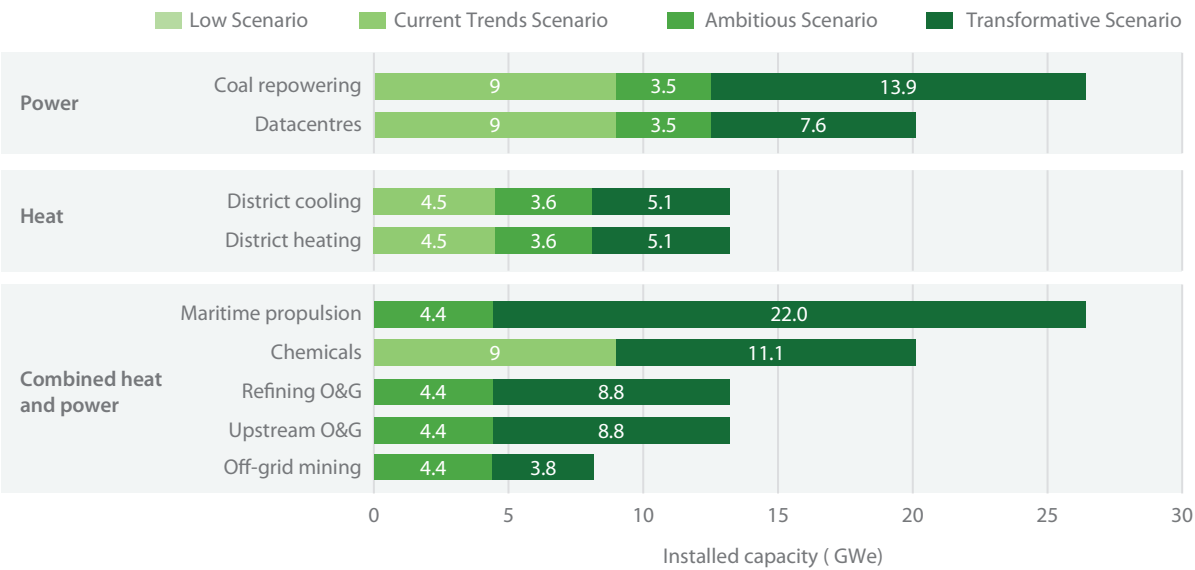
More ambitious delivery models, leveraging on advanced modular manufacturing practices, could broaden SMR applications to markets with smaller or more distributed demand, such as maritime propulsion, off-grid mining, and district energy. SMRs are

also expected to expand their share in traditional power production, but combined heat and power activities are also likely to grow in importance. In this case, the efficiencies unlocked by higher modularity could help bring delivery cost and times closer to industrial end users' requirements, improving the business case in some industrial sectors for investing in nuclear energy.

Transformative Scenario: Next generation manufacturing practices

With next generation manufacturing practices, closer alignment with industrial end users' requirements can be achieved. Consequently, industries looking to meet energy security and emissions goals can take full advantage of SMR technologies. While this still represents a relatively small share of the technically addressable demand by 2050, maintaining the Transformative Scenario growth trajectory after 2050 could see SMRs meeting a significant share of industrial demand by 2075.

Figure 4.9: **Possible SMR deployment in key markets and applications by scenario, 2050**



Chapter 5.

Nuclear Energy Outlook policy takeaways

As presented in Chapter 3, only the Transformative Scenario achieves the tripling of the global nuclear fleet's capacity by 2050. By comparison, both the Current Trends and Ambitious Scenarios fall short, leaving shortfalls of 580 GWe and 250 GWe, respectively. These gaps underscore the urgent need for robust and targeted policy efforts, particularly to tackle pressing challenges in financing, supply chain readiness and workforce development. Near-term actions to strengthen these areas will be critical to realising plans for nuclear new builds.

This report builds on an existing body of work by the NEA, including the 2020 publication *Unlocking Reductions in the Construction Costs of Nuclear: A Practical Guide for Stakeholders* (NEA, 2020). The key policy recommendations from the 2020 publication are summarised in Figure 5.1.

Figure 5.1: **Key policy recommendations from the NEA (2020) *Unlocking Reductions in Nuclear Construction Costs: A Practical Guide for Stakeholders***



Capitalise on lessons learnt

Capitalise on lessons learnt from recent Gen-III construction projects. The nuclear industry and its supply chain have in large part redeveloped their capabilities in several OECD countries. Governments have a window of opportunity to realise cost reductions in the early 2020s through timely new build decisions. Delaying these decisions will prevent the sustainment of capabilities and therefore raise near-term project construction costs.



Design maturity and regulatory stability

Prioritise design maturity and regulatory stability. Designing policies to support nuclear construction is critical to ensure that new build projects start in the right conditions. Policy support mechanisms should include requirements for design maturity and, more specifically, construction readiness, and should ensure that the regulatory framework for nuclear safety remains stable and predictable throughout construction.



Standardised nuclear programme

Consider commitment to a standardised nuclear programme. For countries considering multiple new build projects, commitment to a standardised nuclear programme is the most promising means to effectuate cost reductions through series effect.



Enable and sustain supply chain

Enable and sustain supply chain development and industrial performance. Industrial and energy strategies for new nuclear plants need to be carefully articulated and adjusted to integrate supply chain constraints. Investors in supply chain capabilities require assurance of long-term energy policy commitment to new nuclear construction to adopt the latest technical and organisational advances under the best conditions.



Foster innovation and talent

Foster innovation, talent development and collaboration at all levels. Governments can support cost reduction opportunities arising from innovative nuclear technologies by ensuring timely development of demonstration projects and licensing frameworks required to foster market deployment. Supporting talent development is also essential given the high level of technological expertise needed in nuclear power. National and international collaboration remains a key vector to achieve these objectives.



Robust market and financing frameworks

Support robust and predictable market and financing frameworks. Nuclear new build projects require long-term government planning involving both specific commitments and market regulations. In addition, financial support is currently essential in Western OECD countries – at least as a transitional measure – to deliver cost-competitive new nuclear construction.



Stakeholders engagement

Encourage concerted stakeholder efforts. Governments should create an environment that fosters social contract with industry and society to reduce nuclear construction costs. Recent national initiatives such as the UK nuclear sector deal provide clear evidence of how such frameworks can be developed and implemented.



Tailor government support

Tailor government involvement to programme needs. The enabling role of governments will differ based on the nature of the programme. Whereas government financial support in countries considering a fleet programme can be expected to decrease gradually as the industry reaches maturity and the perceived risk level falls, countries restarting a nuclear programme or considering only a single-plant project are likely to require further government support.

Source: NEA (2020), *Unlocking Reductions in Nuclear Construction Costs: A Practical Guide for Stakeholders*.

Taking into consideration the NEO scenarios as well as other prior works, such as those summarised in Figure 5.1, leads to the conclusions about financing, supply chain and workforce presented in this chapter.

5.1. Financing requirements

Significantly increasing installed nuclear capacity by 2050 will require substantial amounts of capital to be mobilised to finance a new wave of nuclear construction.

Estimating financing requirements: Base Case

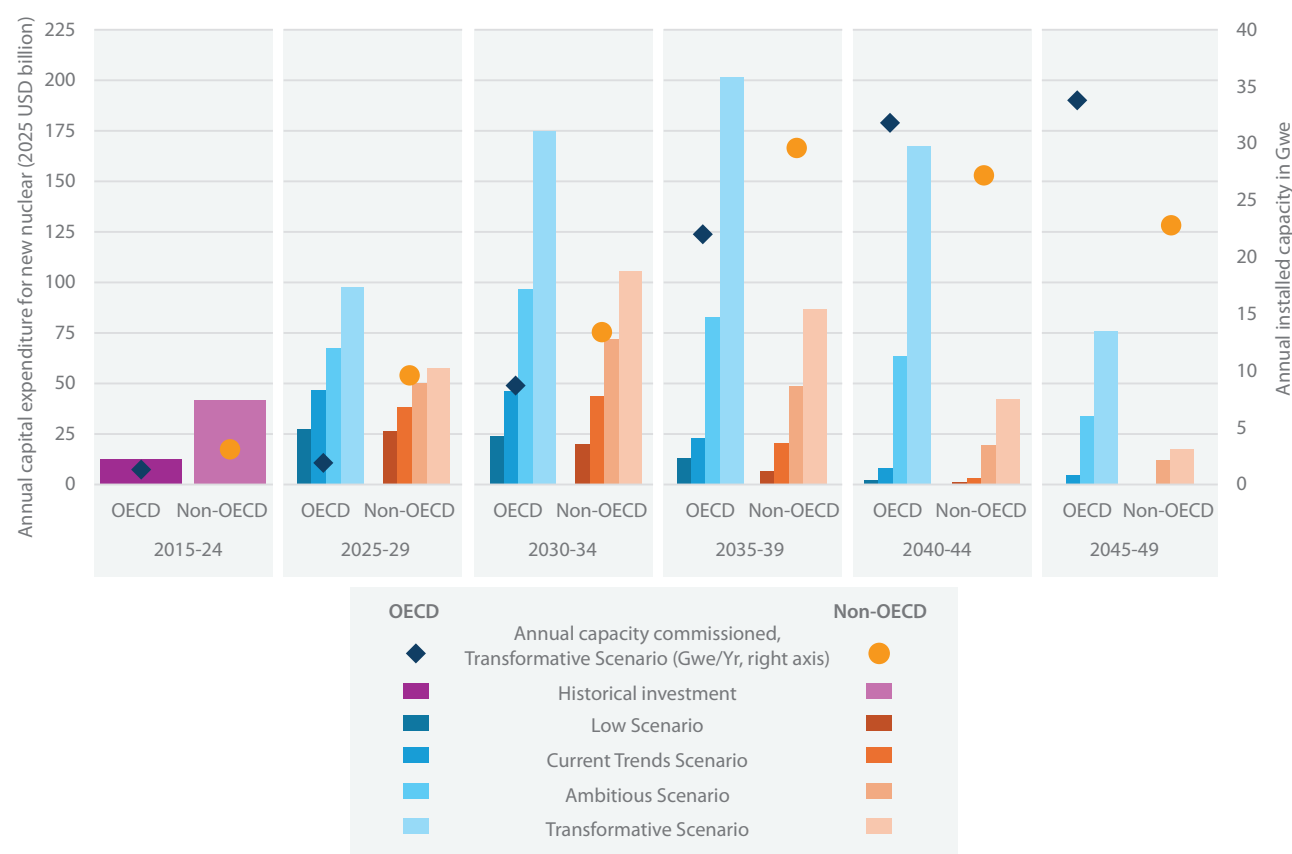
To estimate annual capital expenditure (CAPEX) requirements, regional averages of overnight CAPEX for new nuclear construction, found in Table 5.1 below, were used in conjunction with project-level data to project the capital requirements for the four NEO Scenarios. The regional average CAPEX figures were drawn from country-level data from the forthcoming NEA-EPRI joint publication *Costs of Generating Electricity* (NEA-EPRI, forthcoming).

Overall, it is projected that implementing the Transformative Scenario will require USD 5.1 trillion in investment over the next 25 years, with more than two-thirds of this funding allocated to new nuclear projects in OECD countries.

Table 5.1: **Estimated overnight CAPEX costs for new nuclear projects by region**

	Europe	Russia	China	North America	Asia	Africa	Latin America
Overnight construction cost in USD/kWe of near-term deployment	12 000	11 000	6 000	10 000	7 000	8 000	11 000
Overnight construction costs in USD/kWe of nth-of-a-kind reactors	6 000	5 500	3 000	5 000	3 500	4 000	5 500

Figure 5.2: **Five-year average annual CAPEX for new nuclear in the NEO scenarios**



Note: CAPEX estimates are based on unit costs drawn from NEA-EPRI (forthcoming) *Costs of Generating Electricity*.

For reference, the International Energy Agency estimated that global energy investment exceeded USD 3 trillion in 2024, with approximately USD 2 trillion being invested in clean energy technologies and grid infrastructure (IEA, 2025c). This highlights that the capital required to significantly increase nuclear capacity by 2050, although substantial, represents only a small fraction of the overall energy investment landscape. If annual nuclear CAPEX were to rise to over USD 200 billion per year as projected in the Transformative Scenario, it would still constitute less than 10 percent of total annual energy investment.

Figure 5.2 illustrates that over the last ten years, global CAPEX for new nuclear deployment has averaged around USD 50 billion per year. Most of this investment has been concentrated in China and Russia. To reach the Transformative Scenario, annual spending will need to rise significantly, reaching more than USD 200 billion per year in the late 2030s and 2040s.

For OECD countries, the need to scale up capital for new nuclear construction will be particularly acute, given the past two decades of relative underinvestment in the nuclear sector. At a time of increasing fiscal constraints on government budgets, achieving these levels of capital expenditure is likely to require significant contributions from the private sector. In turn, this will necessitate financial frameworks, including risk allocation and mitigation models, to successfully mobilise private capital.

Estimating financing requirements for new nuclear: Accelerating Learning Case

Costs for new nuclear in OECD countries have greatly increased since the heyday of nuclear construction, due in large part to longer construction times and greater variability in costs, which both lead to higher costs of capital. For example, China and Korea do not require the same CAPEX as many OECD countries to finance their nuclear targets. This is because their record of consistently delivering projects on time translates into lower costs of capital. If the best practices in terms of construction management and project delivery from countries with recent success constructing new nuclear capacity can be adopted more widely, then it can be expected that long-term nth-of-a-kind costs can be further reduced with access to lower-cost capital and that financing for new nuclear will be easier to secure.

An accelerated learning case assumes that the level of investment envisioned by the Transformative Scenario should result in economies of scale which enable construction timelines to fall and per-project costs to decline considerably, eventually matching the lowest new nuclear construction costs of China and Korea.

The underlying assumptions of the accelerated learning case are threefold:

- **Commitment to nuclear targets:** Countries are committed to achieving their nuclear energy targets by 2050.
- **Programme-based approach:** Countries implement a programme-based strategy for nuclear new builds, repeatedly constructing the same reactor design to maximise economies of scale within the supply chain and workforce.
- **Regulatory framework:** Countries ensure that safety and regulatory agencies have the required resources to deliver on their mandates, ensuring projects can swiftly and efficiently comply with regulations.

Table 5.2 below presents the CAPEX assumptions for an accelerated learning case.

Table 5.2: **Estimated overnight CAPEX costs for nth-of-a-kind new nuclear projects under an Accelerated Learning Case**

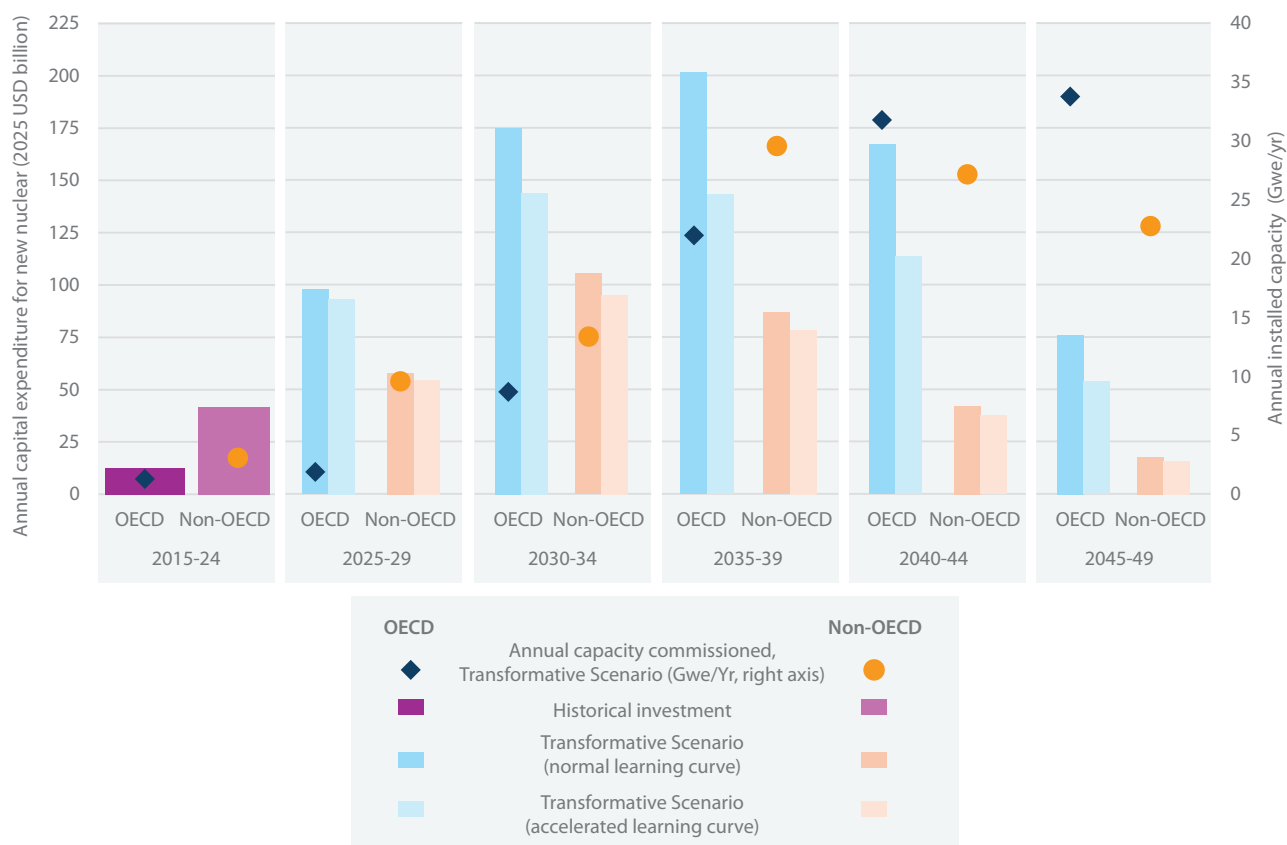
	Europe	Russia	China	North America	Asia	Africa	Latin America
Overnight construction cost in USD/kWe of nth-of-a-kind reactors	7 000	5 500	3 000	5 000	3 500	4 000	5 500
Overnight construction costs in USD/kWe of nth-of-a-kind reactors (accelerated learning curve)	3 500	3 500	2 500	3 500	3 500	3 500	3 500

Source: NEA-EPRI (forthcoming) *Costs of Generating Electricity*.

Countries such as France, Japan, and the United States have previously achieved overnight CAPEX costs on par with those currently observed in China and Korea. This suggests that they could be achieved again. The levels of learning reflected in the accelerated learning curve assumptions have already been attained in the past, when the necessary enabling conditions were in place. This suggests that they could be achieved again.

Overall, an accelerated learning case would translate into a substantial reduction in CAPEX requirements for OECD countries over the next 25 years under the Transformative Scenario. In total, this would lead to cumulative savings of nearly USD 850 billion for OECD countries, representing a 24% reduction in overall CAPEX requirements. Applying the best practices from countries with a track record of completing projects on time is even more important for fulfilling nuclear targets, considering the pressure on government budgets in many OECD countries.

Figure 5.3: **Comparison of average five-year average annual CAPEX by learning curve**

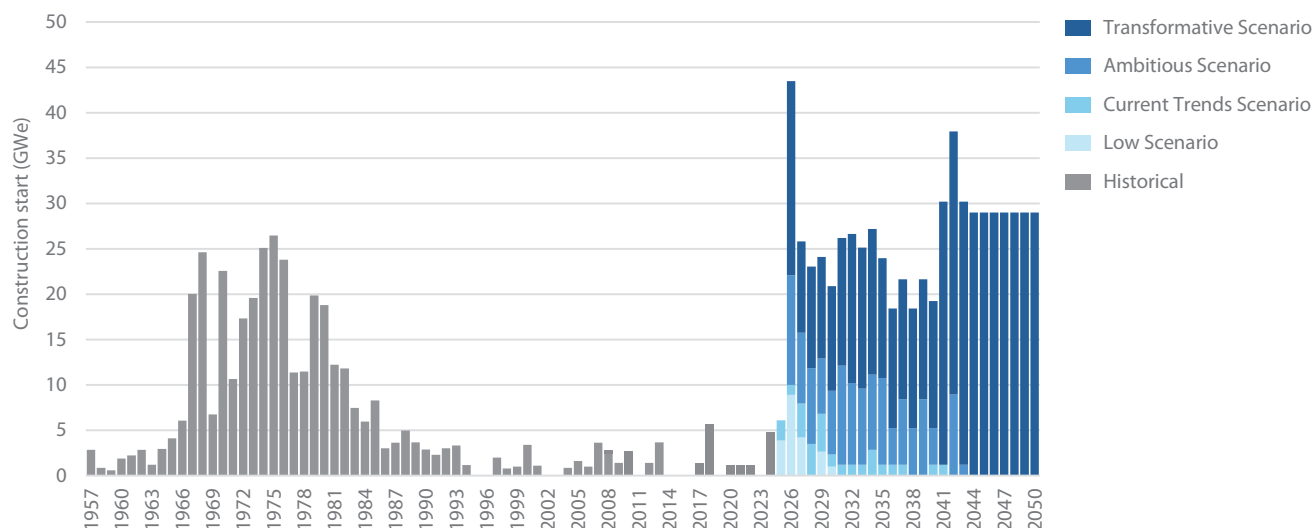


Note: CAPEX estimates are based on unit costs drawn from NEA-EPRI (forthcoming) *Costs of Generating Electricity*.

5.2. Supply chain and workforce requirements to meet new nuclear deployment targets

Figure 5.4 presents the number of nuclear construction projects that were started every year from 1957 to 2025. The significant decline in construction that started in the 1990s and 2000s was associated with a marked reduction in supply chain and workforce capabilities. Figure 5.4 also presents the construction starts that are required every year from 2025 to 2050 for each of the four NEO scenarios. It is clear that OECD countries will need to expand their nuclear sector to levels of activity last seen in the 1980s to achieve the Ambitious or Transformative Scenarios, which correspond most closely to stated levels of ambition.

Figure 5.4: **Nuclear capacity beginning construction in OECD countries by year**

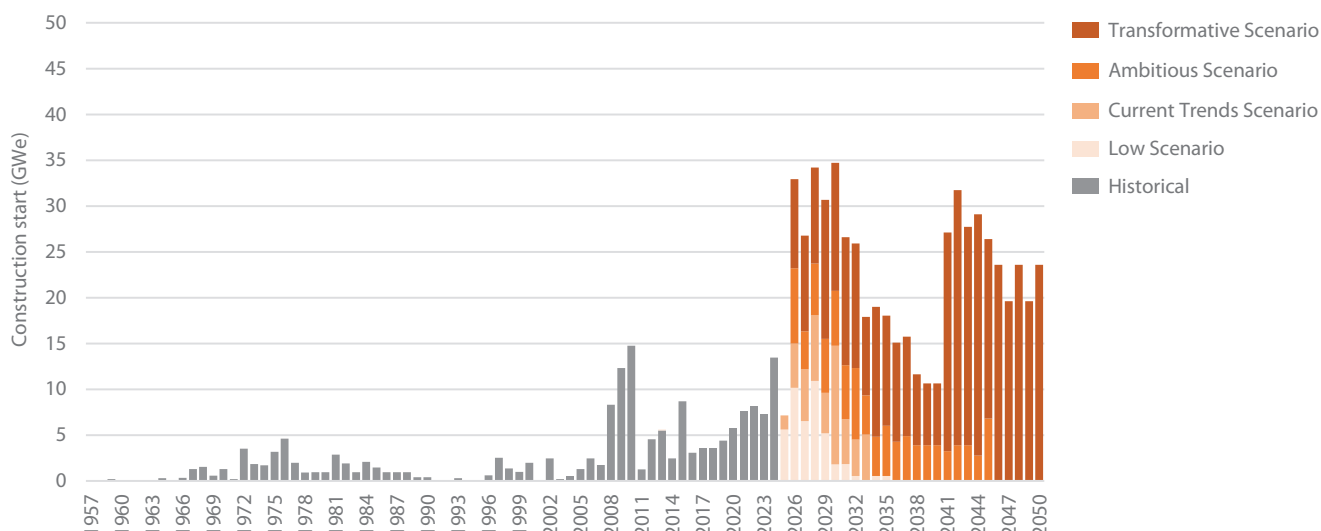


Source: NEA, historical information based on IAEA (2025), PRIS Database.

A key additional challenge facing OECD countries in 2026 lies not only in maintaining the rate at which new nuclear projects are initiated, but also in ensuring these projects are completed swiftly. Nuclear project construction duration – in other words, the amount of time it takes to complete construction – is a key variable that will impact the implementation of new nuclear programmes. As the number of projects simultaneously under construction increases, so too does the pressure on nuclear supply chains and the available workforce. Faster project timelines can relieve pressure on the nuclear workforce and supply chains.

Compared to OECD countries, non-OECD countries are currently better positioned to achieve the Ambitious or Transformative Scenarios. Non-OECD countries will need to approximately double the rate of projects beginning construction compared with the last decade in order to fulfil the Transformative Scenario (see Figure 5.5). Given faster construction times in some non-OECD countries, such as China, they are likely to experience lower pressures on the supply chain and workforce as fewer projects need to be under construction simultaneously.

Figure 5.5: **Nuclear capacity beginning construction in non-OECD countries by year**



Source: NEA, historical information based on IAEA (2025), PRIS Database.

There is no perfect metric for estimating stress on the supply chain. Nevertheless, one useful proxy is to compare the projected amount of concurrent new nuclear capacity under construction with historical averages. The NEO estimates concurrent new nuclear projects under construction using project-level data, with regional averages for construction duration applied to all projects in that region. A table with these averages can be found in Annex 4, Table A4.3.

Figures 5.6 and 5.7 illustrate the concurrent new nuclear capacity under construction in OECD and non-OECD countries, respectively. The figures present both historical data since 1964 and, for each of the four NEO scenarios, projections up to 2050 (IAEA, 2025).

Figure 5.6: **Historical trend in total nuclear capacity under construction by year in OECD countries**

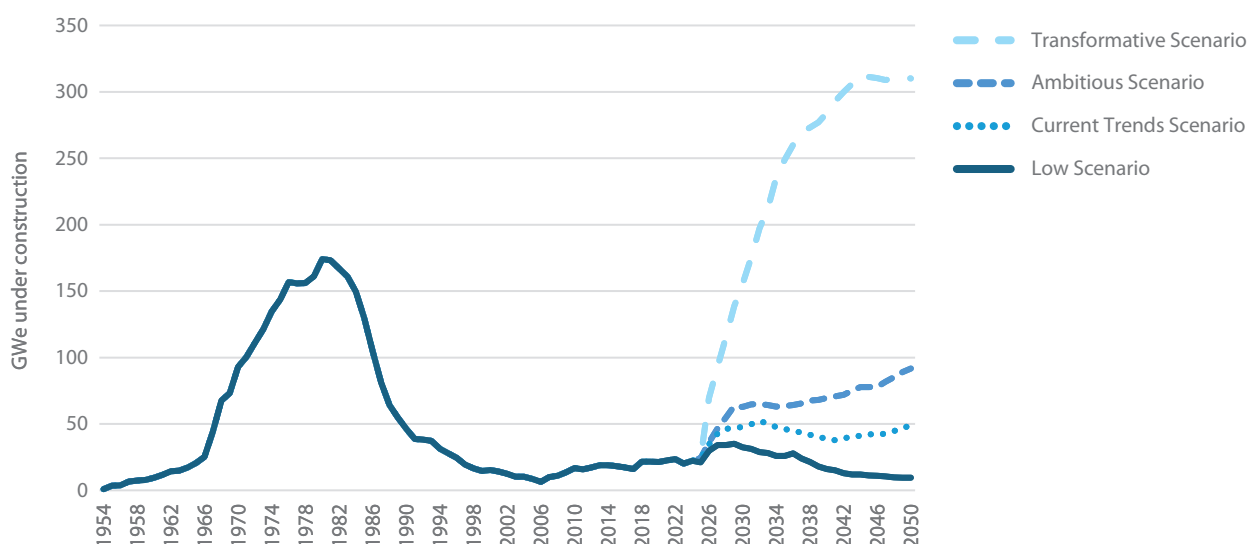
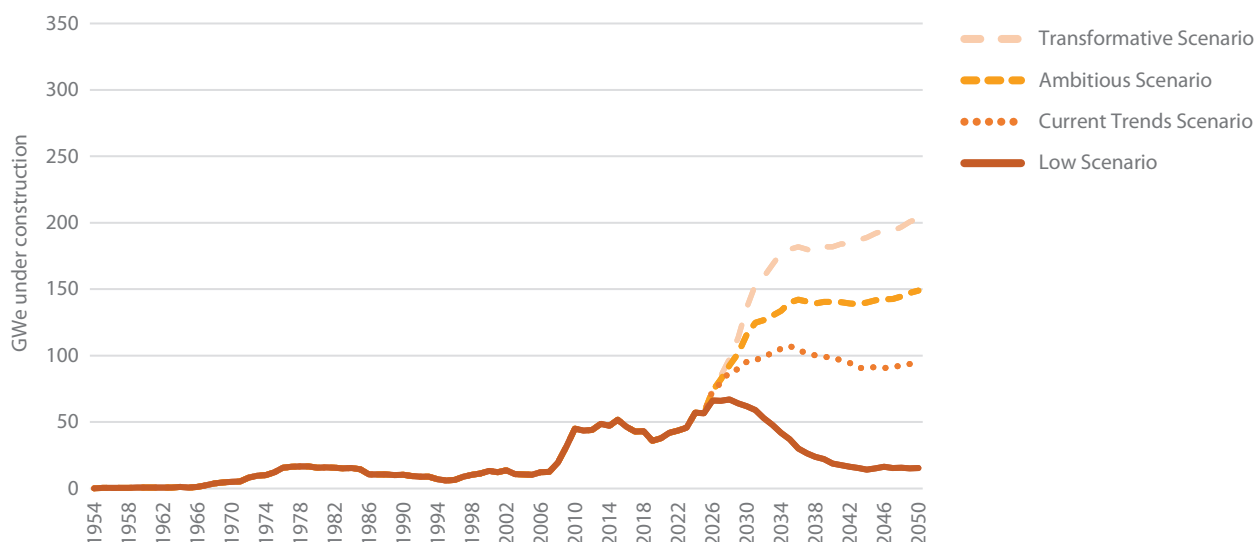


Figure 5.7: **Historical trend in total nuclear capacity under construction by year in non-OECD countries**



For the Current Trends and Ambitious Scenarios, OECD and non-OECD countries would require similar increases in project capacity. However, in order to fulfil the Transformative Scenario, OECD countries would require substantially more ramp-up compared to non-OECD countries and would be required to exceed the historical peak of concurrent capacity under construction that was achieved in the early 1980s. These projections assume that current and future projects in OECD countries will be completed in similar lengths of time to recent reactors, i.e. nine or more years from first concrete to commissioning. If timelines can be improved, the concurrent nuclear capacity under construction could be sharply reduced.

While non-OECD countries would still have to expand existing workforces and supply chains to reach the Transformative Scenario, the required expansion is proportionally much smaller than in OECD countries. This reflects the commitment that non-OECD countries have had to building new nuclear energy over the last two decades.

Figure 5.8: **Total nuclear capacity under construction by year in OECD countries, sensitivity analysis**

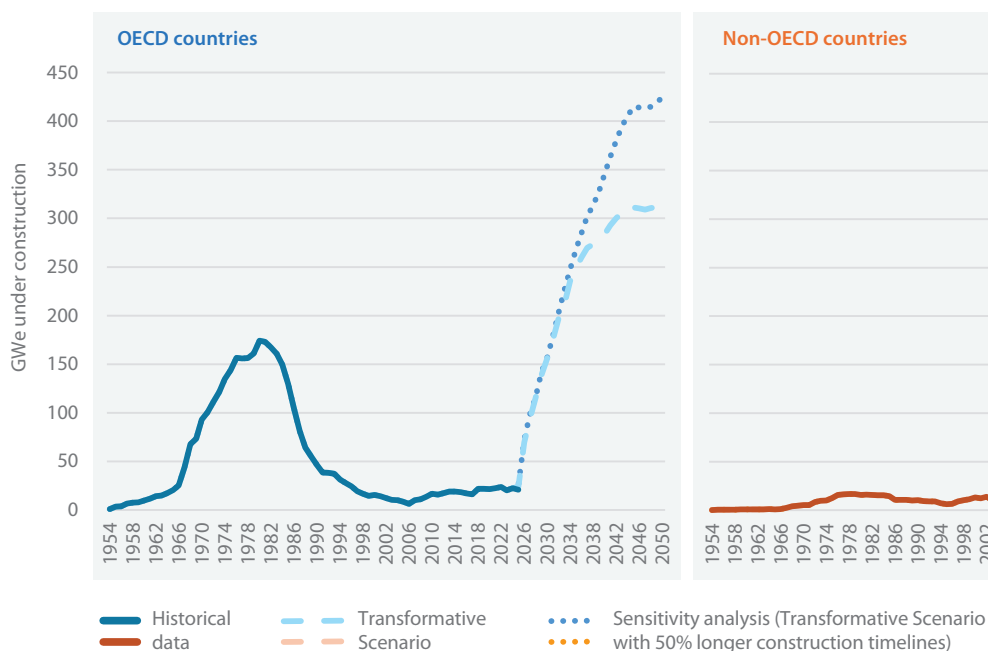
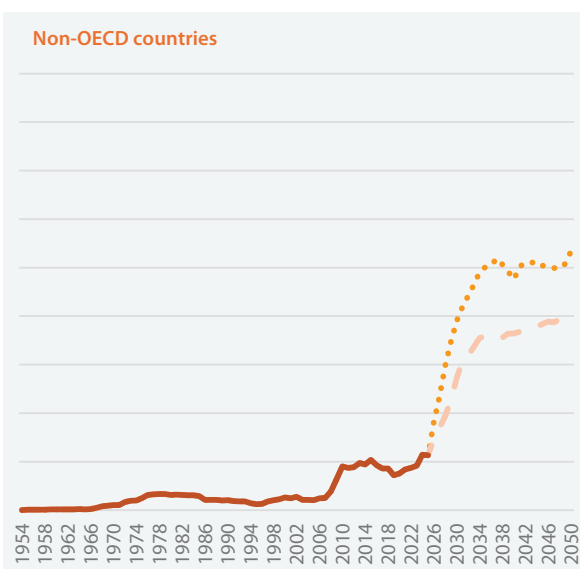


Figure 5.9: **Total nuclear capacity under construction by year in non-OECD countries, sensitivity analysis**



Box 5.1: Delivering the pipeline of nuclear new builds – insights from past nuclear construction in different parts of the world

By Antonio Vay Soler, Manager, LucidCatalyst

Today, while many non-OECD countries deliver new nuclear projects within 5-6 years, OECD countries face the challenge of rebuilding their capabilities to achieve a pace of nuclear construction not seen since the 1990s.

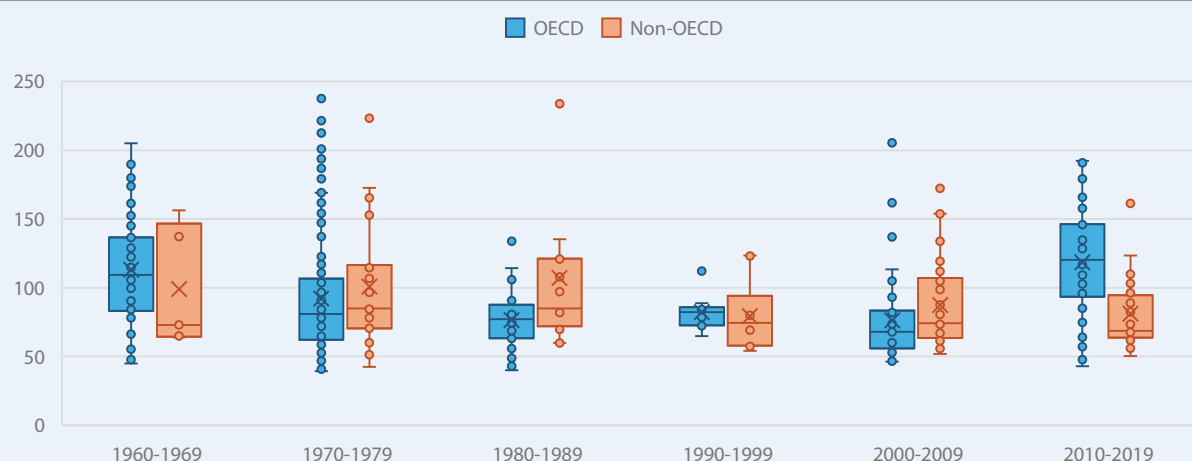
Historical data on nuclear construction timelines reveal significant variability across regions and decades (IAEA, 2025). In the United States during the 1970s, projects frequently encountered delays due to factors such as regulatory changes, financing challenges, and evolving safety requirements. These setbacks often led to extended construction periods and increased costs, underscoring the importance of stable policy frameworks and robust project management.

Conversely, the construction landscape in Japan and Korea during the 1990s demonstrated a marked improvement, with projects regularly completed within planned schedules. This success was attributed to strong government support and the implementation of advanced project management methodologies.

Regions that achieved shorter construction durations tended to have integrated supply chains, skilled workforces and clear programme-based fleet deployment strategies.

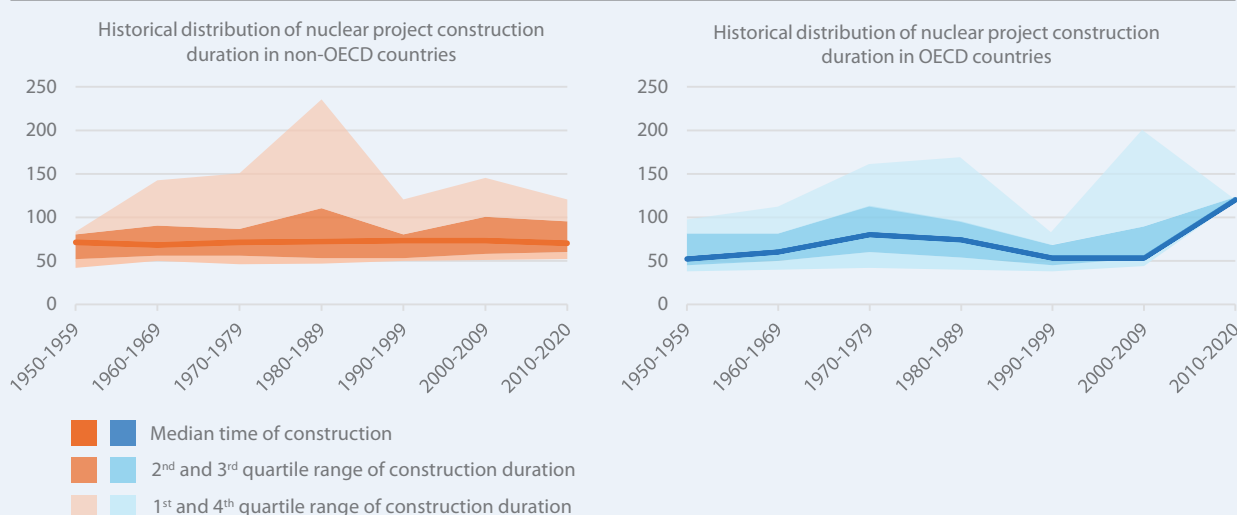
Figures 5.10 and 5.11 suggest that lessons from past experiences should inform future nuclear new builds. To achieve the speed and scale required to meet ambitious national targets will necessitate a review of past practices that delivered high build out rates in past periods of success. However, there may be challenges to repeating past practices in modern day contexts as policy, regulatory and financial frameworks have changed significantly, along with public expectations for engagement and environmental assessments, especially in OECD countries. New and innovative delivery models may be the key to unlocking the speed and scale needed for the future of nuclear energy.

Figure 5.10: New nuclear project construction duration, by decade



Source: NEA based on IAEA (2025) PRIS Database.

Figure 5.11: Reactor construction time by decade, OECD and non-OECD



Source: NEA based on IAEA (2025) PRIS Database.

Delays in construction can have a significant impact on the number of concurrent projects under construction over the next 25 years. Figure 5.8 and Figure 5.9 compare the Transformative Scenario with a sensitivity analysis, in which the reactors take 50% longer to be completed. This would imply that construction duration in OECD countries would increase on average from 108 months to 162 months. In non-OECD countries, construction duration would increase on average from 97 months to 146 months. In OECD countries, the concurrent capacity under construction would increase from 300 GWe to over 400 GWe. Concurrent capacity under construction in non-OECD countries would increase from 200 GWe to 250 GWe. Timely delivery of nuclear projects will be essential to mitigate potential cascading effects on ongoing and future nuclear construction projects, which would further exacerbate challenges for the nuclear supply chain.

5.3. Understanding the readiness of the OECD supply chain for nuclear new build

Sustaining the amount of new capacity concurrently under construction outlined in Figure 5.6 and Figure 5.7 will require a significant amount of effort to expand the nuclear workforce and supply chains. To meet demand, the nuclear construction supply chain must scale to meet the moment with the right skillsets, designs, systems and project management, incorporating both traditional and new areas of expertise and evolving execution models.

The NEA has collaborated with international nuclear industry associations to launch a Global Nuclear Supply Chain Survey. Between June and August 2024, two surveys on supply chain readiness across OECD countries were carried out: one targeted at government organisations and the other at industry participants, including utilities and supply chain companies. Further details regarding the survey methodology and participant demographics can be found in Annex 6. In addition to the survey, in-depth interviews were carried out in 2025 with industry representatives from OECD-member countries across Asia, Europe and North America. These discussions provided additional qualitative insights regarding supply chain readiness, workforce challenges and evolving project management practices within the nuclear sector.

The results of the survey and expert interviews are summarised in this section.

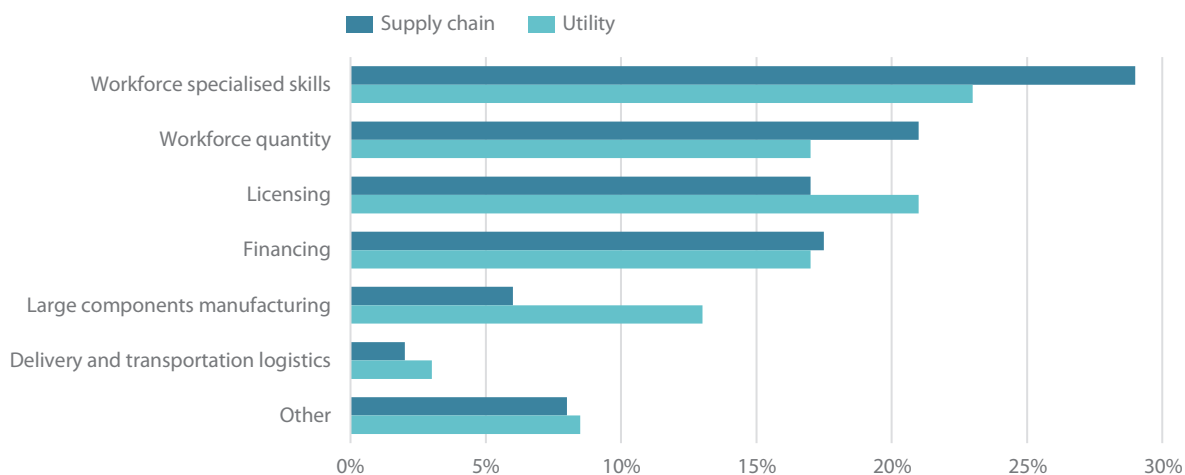
Utilities, supply chain companies and government are aligned on three key supply-side bottlenecks: workforce, financing, and licensing

An exponential increase in the workforce remains a top concern both in terms of skills and capacity, as reflected across survey and interview results. Strategies used in the first round of nuclear new build in the 1970s-1990s do not all translate for the contemporary nuclear environment, especially given demands to lower upfront costs, expanded interest in nuclear energy globally and changing expectations of job conditions by workers.

There are currently new opportunities to address workforce training and recruitment. As more than one interviewee noted, there are many facets of nuclear plant construction that do not require deep nuclear-specific expertise. Remote, modular construction can more easily tap into off-site, satellite workforces, including with suppliers whose businesses are not exclusively in the nuclear sector. Survey respondents identified education and training as essential. Digital technologies, online learning and other innovations can support faster, scaled workforce training. Robotics and artificial intelligence are helping to supplement and support workforces, reducing manpower needs as they reduce costs and improve performance. However, employing digital technologies opens another required talent pool and new skillsets. It is not surprising that workforce, along with financing and licensing, is a focus for many respondents currently in early nuclear new build programme development. Two other bottlenecks, identified in the survey, were large component manufacturing and transportation logistics (Figure 5.12). These could gain prominence as countries move past planning and licensing into procurement and engineering for nuclear plant construction. For example, the current heavy forging bottleneck in nuclear construction stems from limited global capacity to produce ultra-large, high-integrity steel components such as reactor pressure vessels, steam generators and pressurisers. Currently, only a handful of suppliers can meet these specifications, resulting in long lead times and limited annual global throughput. The problem is compounded by decades of underinvestment in forging facilities in OECD countries as new build demand stagnated, as well as stringent nuclear quality assurance standards, and geopolitical risks tied to supplier concentration. As nuclear new build globally grows towards the apex of construction activity, this threatens to become a choke point unless new forging capacity, strategic partnerships and early procurement programmes are implemented. Figure 5.14 illustrates the effects of this underinvestment in nuclear energy, as workforce quantity, a dearth of sector-specific skills, and large component manufacturing are considered the three biggest bottlenecks to new nuclear by government respondents.

For transportation and logistics, as identified below in Figure 5.12 and Figure 5.13, the bottleneck concern rises when related to an international supply chain while financing concerns are reduced for international projects. These are facets of the discussion on the merits of domestic versus global supply chains.

Figure 5.12: **Utility and supply chain perspective on domestic bottlenecks**



Notes: Respondents chose all that applied. Values are rounded to nearest whole number.

Figure 5.13: **Utility and supply chain perspective on international bottlenecks**

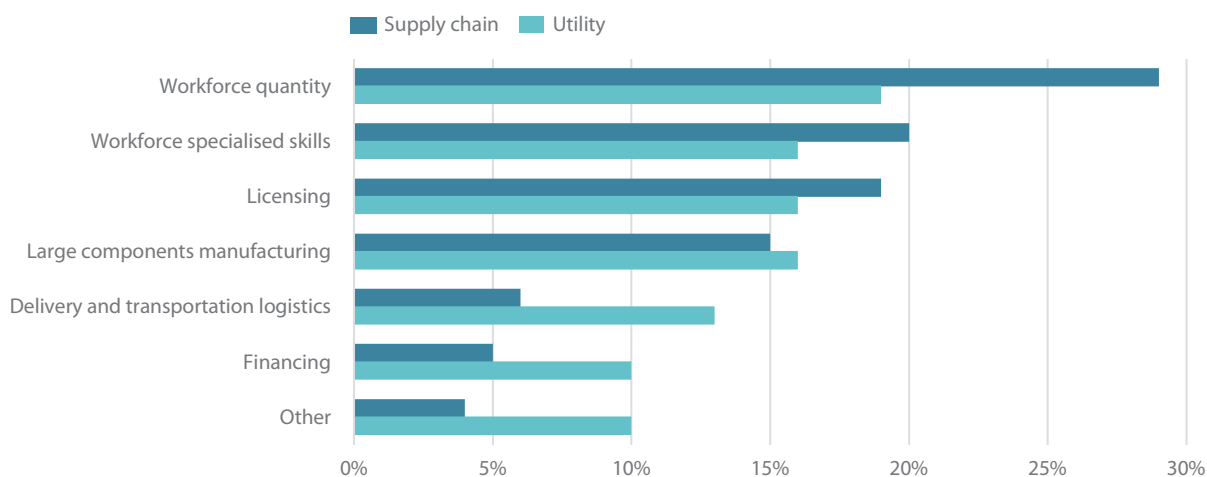
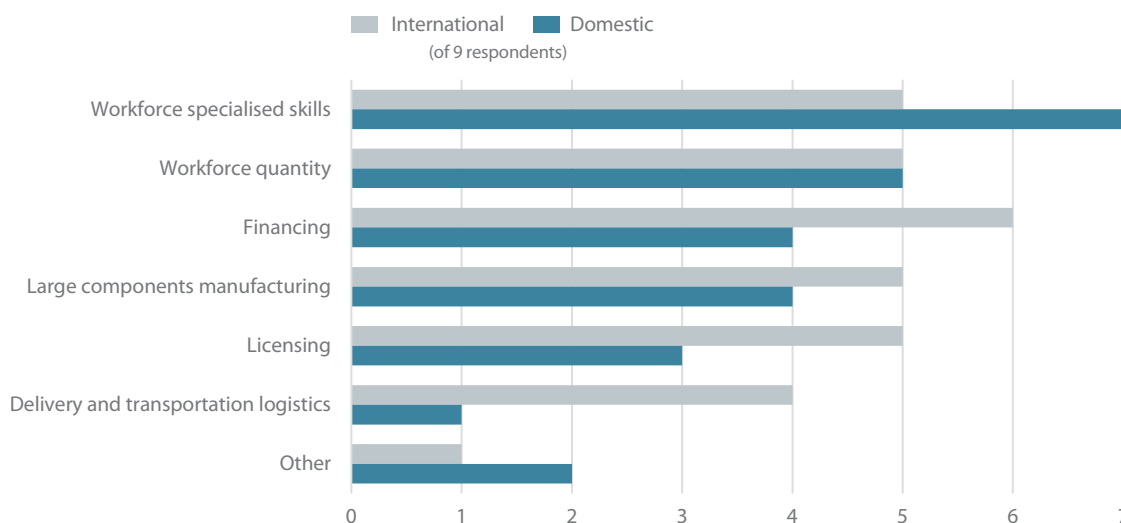


Figure 5.14: **Government perspectives on domestic and international bottlenecks**



Supply chain companies show greater confidence in the supply chain's capacity to support new nuclear build projects compared to utilities

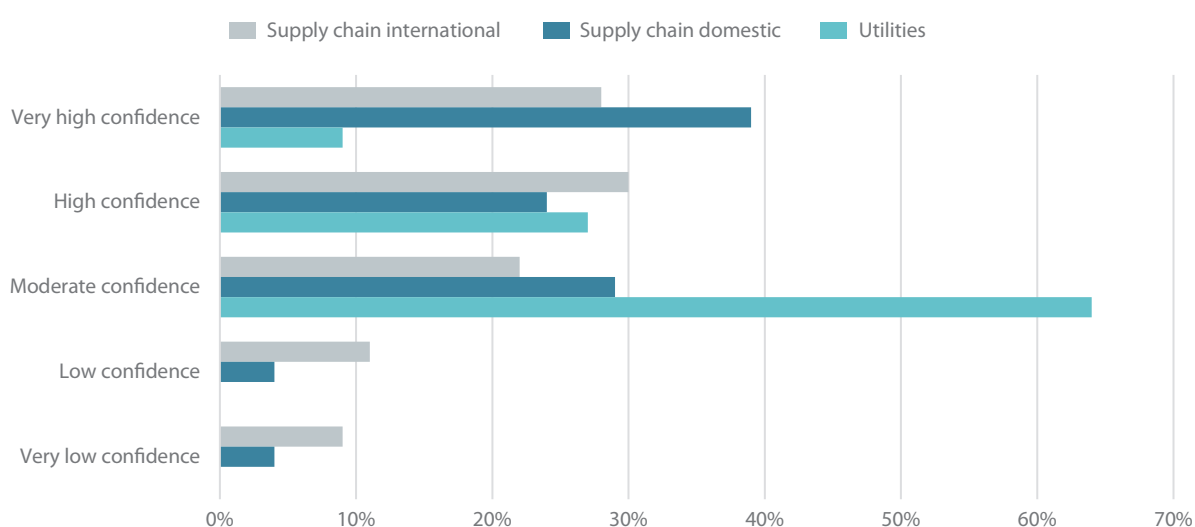
There is an active discussion on the root causes of supply chain capacity challenges and whether they originate primarily from demand-side or supply-side issues. Some industry insiders suggest demand-side issues are inhibiting supply chain capability and capacity growth. Assurances in the form of long-term policy commitments, suitable financial conditions and certainty in regulation and standards, specifically risk-informed specifications, are cited as being needed.

With greater certainty on these issues, some respondents/interviewees believe supply chains could make the required investment in equipment, workforce and other requirements to meet market demand. This, in turn, would strengthen governments' and utilities' confidence in greenlighting projects. As one interviewee observed, confidence "is chicken and egg."

Some supply chain respondents show higher degrees of confidence in the industry's ability to deliver nuclear new build than utilities (Figure 5.15). However, a small percentage of supply chain respondents took the least optimistic view.

Suppliers were also asked to assess their confidence of execution with international versus domestic supply chains. As demonstrated, companies have more confidence in domestic supply chains.

Figure 5.15: **Confidence in supply chain execution by utilities and supply chain companies**



Clear expectations for the role of collaboration for nuclear new build success

Respondents from both government and industry indicated clear expectations of the roles each plays in supporting nuclear new build, including through government-to-government and industry-to-industry co-operation, as well as utility-supplier collaboration.

Government-to-government co-operation in nuclear energy advancement has traditionally spanned policy alignment, safety standards, technology transfer, non-proliferation and commercial partnerships. This has included bilateral and international agreements on trade related to technologies, fuels and services, as well as safeguard and security protocols. In part, these initiatives have helped to build trust and regulatory standardisation as well as certainty. Government-to-government relationships have helped to foster R&D partnerships, reactor co-development and joint ventures as well as fuel agreements, training and infrastructure support. In the NEA survey, utility respondents identified regulatory frameworks and safety standards as the highest priorities in current government-to-government co-operation, followed by several other priorities ranked relatively equally. These range from policy and strategic alignment to technology transfer, financial support, workforce training and education, and supply chain and logistics (Figure 5.16).

Supply chain respondents overwhelmingly identified financial support and regulatory frameworks and safety standards as their two top priorities for government-to-government collaboration, followed by several others, aligned to the utility perspective (Figure 5.17).

While government sees cost and schedule risk management as industry's role, industry identified enabling activities, especially on the demand-side, as important roles for government-to-government co-operation. Utilities identify enabling financial frameworks as a top priority for both government-to-government and business-to-business collaboration.

Technology transfer and innovation knowledge sharing, as well as supply chain and logistics management, are identified as top priorities for business-to-business collaboration, suggesting that these areas are seen as strong determinants of success in nuclear new build.

All government respondents agreed there is value in further international integration of nuclear supply chains with all also agreeing that international business-to-business collaboration is essential (Figure 5.17).

Figure 5.16: **Utility and supply chain perspectives on government-to-government co-operation**

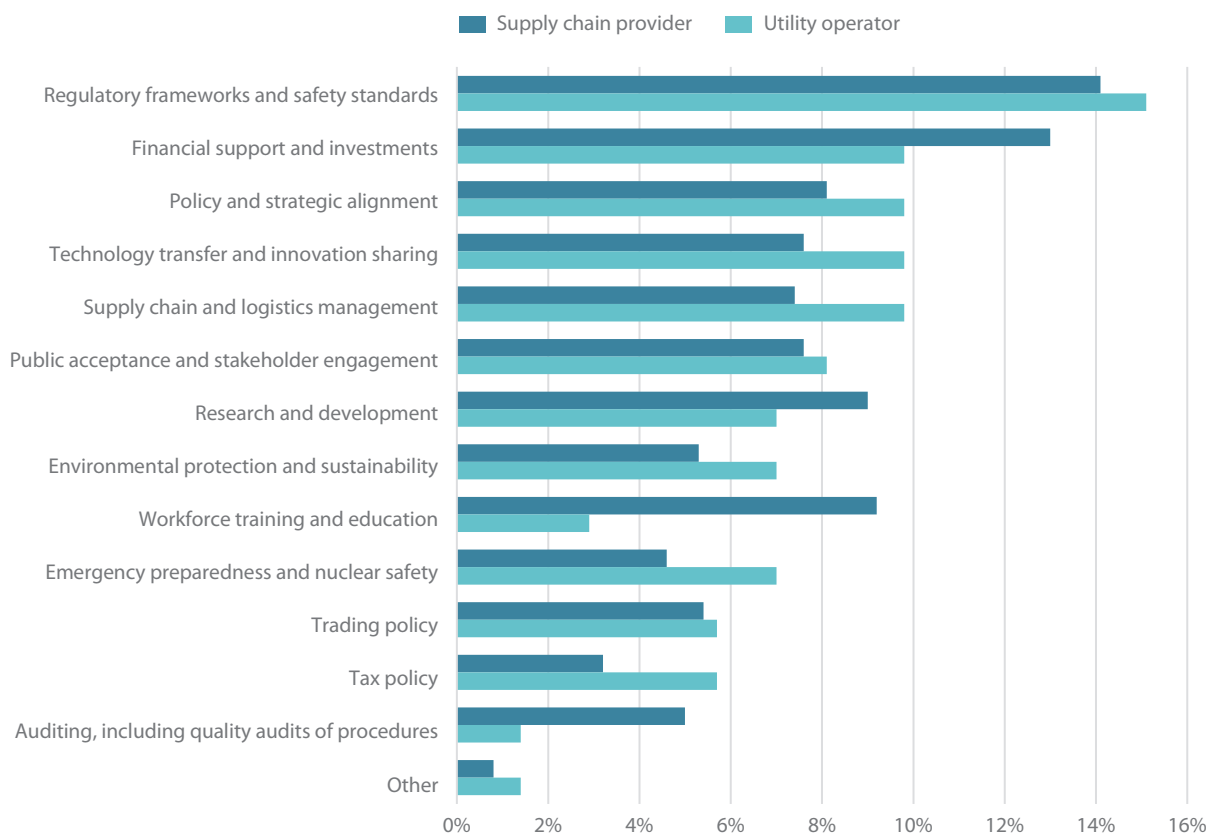
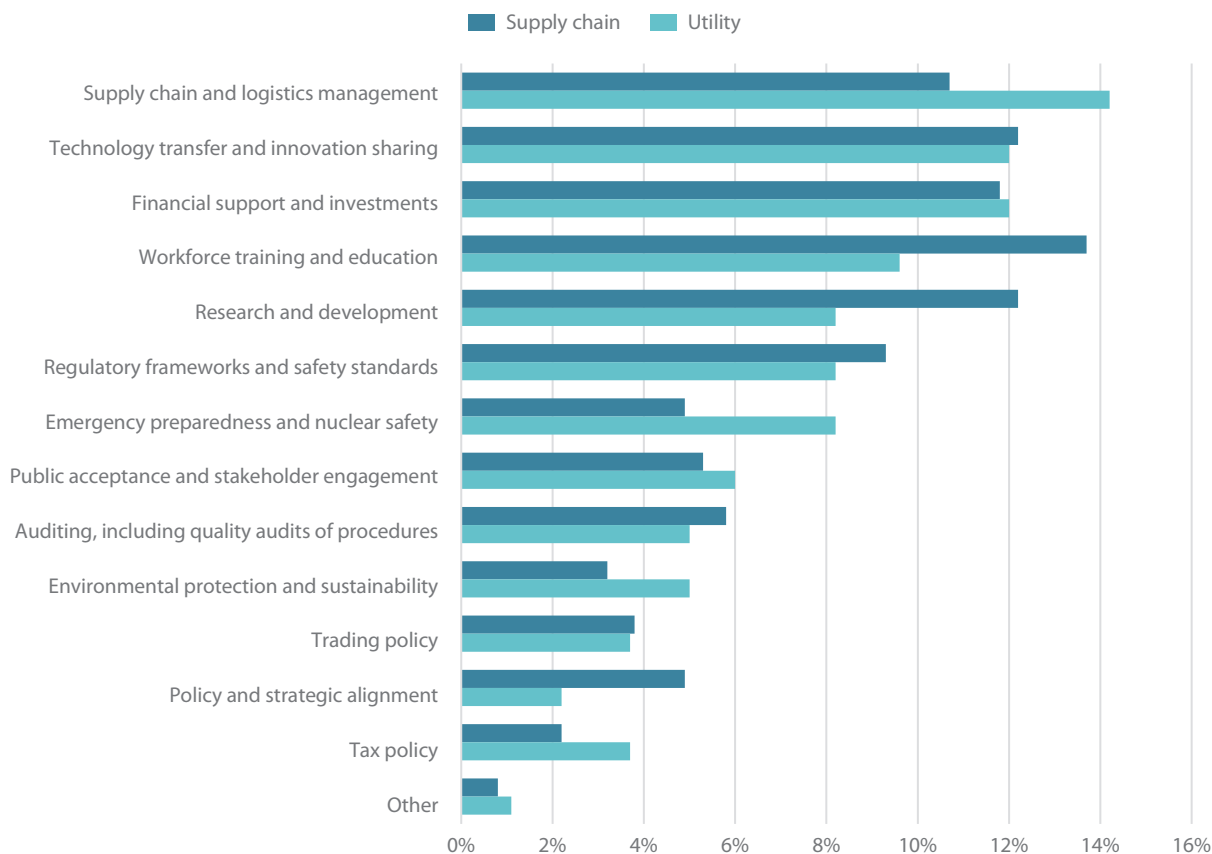
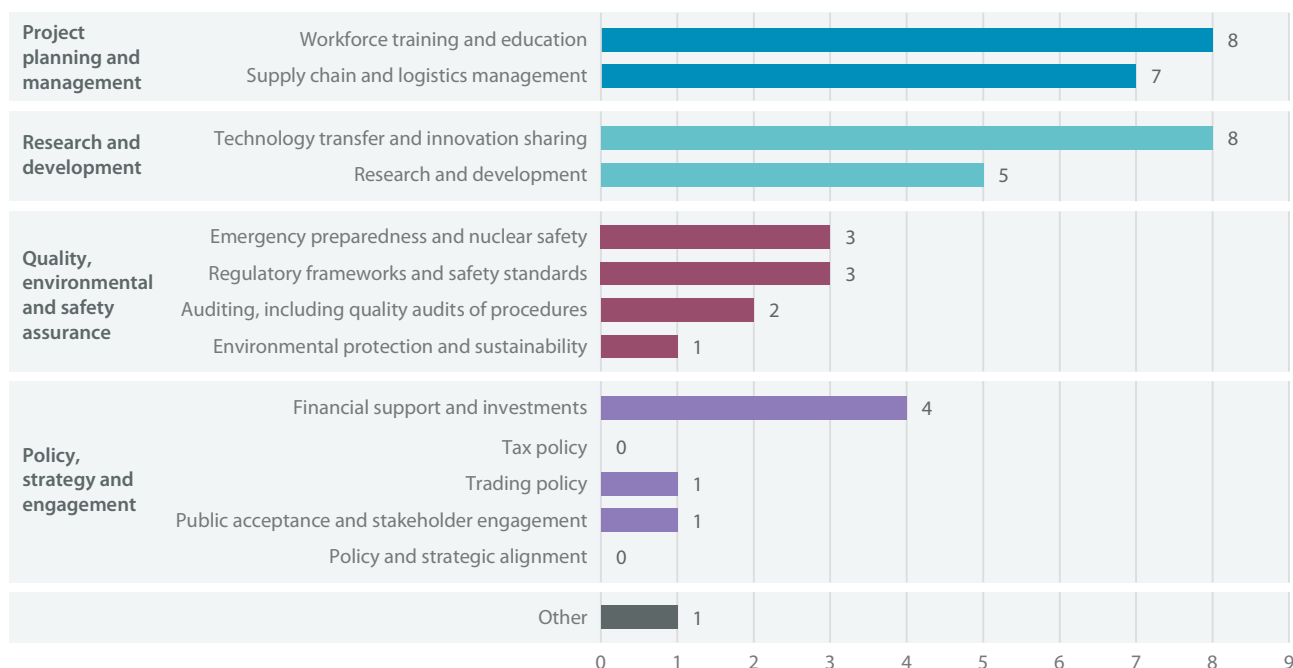


Figure 5.17: **Utility vs. supply chain priorities for business-to-business co-operation**



As illustrated in Figure 5.18, below, the factors government organisations consider vital to effective utility-supply chain collaboration include project management aspects related to costs, schedules and related risks. Specifically, they include contract schemes (most common), followed in equal measure by risk management plans, stakeholder engagement strategies, and quality assurance frameworks.

Figure 5.18: **Government perspective: International business-to-business co-operation areas that contribute to the success of nuclear new builds**



5.4. Summary of key findings and policy recommendations

The earlier sections of Chapter 5 addressed the interconnected challenges and opportunities associated with nuclear new build. This section summarises key findings and corresponding policy recommendations.

Priority area 1: Meeting financing requirements

Access to financing will be one of the key conditions for the success of plans in new nuclear build:

- OECD countries will need to increase annual capital expenditures in new nuclear construction from about USD 9 billion over the last decade, to more than USD 68 billion in the Ambitious Scenario or USD 143 billion in the Transformative Scenario.
- Non-OECD countries will need to sustain annual capital expenditures in new nuclear construction at about USD 40 billion in the Ambitious Scenario, a level similar to the last decade, and increase to USD 62 billion in the Transformative Scenario.

Policy recommendation: OECD governments and private investors should work together to effect financing frameworks that allocate risk efficiently and take into consideration the realities of the national context such as market structure and existing frameworks. In all cases, financing frameworks must address construction risks, such as cost overruns and project delays, as managing these challenges is essential for lowering the cost of capital. This will help attract private investors, with both debt and equity financing, which is essential given the scale of financing requirements in OECD countries.

Priority area 2: Meeting supply chain requirements

One useful proxy to estimate supply chain requirements is to compare the projected amount of concurrent new nuclear capacity under construction with historical averages:

- To achieve either the Ambitious or Transformative Scenarios, OECD countries will need to start constructing up to 25 GWe of new nuclear capacity annually. This would require ramping up concurrent new nuclear capacity under construction to levels not seen since the 1980s.

- To achieve either the Ambitious or Transformative Scenarios, non-OECD countries will need to approximately double the rate of projects beginning construction compared with the last decade. This would lead to a quadrupling of concurrent new nuclear capacity under construction compared to the last decade.

Policy recommendation: OECD governments and industry should implement structured programmes anchored in standardised designs and sequenced deployment. Committing to multi-unit pipelines over a 10-20-year horizon is essential to provide the visibility needed for utilities, supply chain companies and regulators to align investments and approaches. In parallel, OECD governments and industry should address structural supply chain constraints by investing in critical manufacturing capacity (including heavy forgings) and improving co-ordination of international logistics and procurement to reduce delays and increase certainty in project delivery timelines.

Priority area 3: Ensuring workforce readiness

In 2024, the NEA conducted a comprehensive survey and follow-up interviews to assess key challenges and bottlenecks for new nuclear across OECD countries, capturing both quantitative and qualitative insights from governments and industry:

- Across OECD countries, utilities, supply chain companies and governments agree that workforce constraints – both in skills and capacity – remain the most immediate bottleneck to nuclear new build.
- Low levels of investment in new nuclear over the last two decades have constrained investment due to uncertainty around long-term demand, financing and regulatory conditions. This uncertainty has in turn been detrimental to developing and expanding the pool of skilled and qualified nuclear workers. Clear policy commitments and stable market signals are seen as critical to unlocking supply chain capacity and strengthening confidence across stakeholders to rebuild the nuclear workforce.

Policy recommendation: OECD governments and industry should collaborate on workforce expansion with efforts to attract and retain talent across multiple pipelines, including trades and university programmes, as well as mid-career and senior executives from other industries. Policy stability and investment can help further incentivise prospective nuclear workers to acquire relevant skills and knowledge, enabling the workforce expansion required to meet national and international nuclear capacity targets. These efforts should be aligned with long-term project pipelines so that workforce development keeps pace with deployment needs.



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Annex 1.

List of countries by typology

For the purposes of this report, countries are considered “OECD countries” if they are full and active members of the OECD, or countries in the OECD accession process. All other countries are considered “non-OECD countries”. Regions are based on the classifications used in the IAEA’s Power Reactor Information System.

Country Name	Region	OECD Categorisation
Argentina	Latin America	OECD Accession Country
Armenia	Asia	Non-OECD
Belarus	Europe	Non-OECD
Belgium	Europe	OECD Member Country
Brazil	Latin America	OECD Accession Country
Bulgaria	Europe	OECD Accession Country
Canada	North America	OECD Member Country
China (People’s Republic of)	Asia	Non-OECD
Czechia	Europe	OECD Member Country
Egypt	Africa	Non-OECD
Estonia	Europe	OECD Member Country
Finland	Europe	OECD Member Country
France	Europe	OECD Member Country
Ghana	Africa	Non-OECD
Hungary	Europe	OECD Member Country
India	Asia	Non-OECD
Indonesia	Asia	OECD Accession Country
Iran	Asia	Non-OECD
Japan	Asia	OECD Member Country
Kazakhstan	Asia	Non-OECD
Kenya	Africa	Non-OECD
Korea	Asia	OECD Member Country
Lithuania	Europe	OECD Member Country
Mexico	Latin America	OECD Member Country
Netherlands	Europe	OECD Member Country
Pakistan	Asia	Non-OECD
Philippines	Asia	Non-OECD
Poland	Europe	OECD Member Country
Romania	Europe	OECD Accession Country
Russian Federation	Europe	Non-OECD
Rwanda	Africa	Non-OECD
Slovak Republic	Europe	OECD Member Country
Slovenia	Europe	OECD Member Country
South Africa	Africa	Non-OECD
Spain	Europe	OECD Member Country
Sweden	Europe	OECD Member Country
Switzerland	Europe	OECD Member Country
Türkiye	Asia	OECD Member Country
Uganda	Africa	Non-OECD
Ukraine	Europe	Prospective OECD Member
United Arab Emirates	Asia	Non-OECD
United Kingdom	Europe	OECD Member Country
United States	North America	OECD Member Country
Uzbekistan	Asia	Non-OECD
Viet Nam	Asia	Non-OECD

Annex 2.

New nuclear country reports

The following country updates present the latest developments, policies, legislation, and project statuses across OECD and non-OECD countries pursuing or considering new nuclear energy projects. These updates are essential for contextualising the quantitative analysis presented in the *Nuclear Energy Outlook*, as they underpin the capacity projections and inform the assessments of future trends in global nuclear deployment.

New nuclear country updates: Projects under construction, planned and/or proposed

OECD countries

Argentina

Recent developments: In 2024, the government launched a new National Nuclear Plan to expand nuclear generation through small modular reactors (SMRs), seeking to leverage its uranium reserves to achieve self-sufficiency in fuel production and position Argentina as an export country in the nuclear sector (President of Argentina, 2024).

Recent legislation: Through Decree 695/2025, the government of Argentina authorised the partial privatisation of Nucleoeléctrica Argentina S.A.(NA-SA), selling 44% of the shares to private investors while retaining state ownership of 51% of the shares (Government of Argentina, 2025a).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1.6 GW	0.03 GW				

Brazil

Recent developments: The National Energy Plan 2050 outlines a target of 10 GW of installed nuclear capacity by mid-century (Danilow, 2020). In 2024, Brazil made renewed efforts to restart construction of the Angra-3 nuclear reactor. The state-owned company Eletronuclear obtained the necessary legal and administrative approvals to resume limited construction activities (Eletronuclear, 2025). In 2025, the Ministry of Mines and Energy instructed Eletronuclear and the Brazilian Development Bank (BNDES) to conduct updated economic and financial assessments to inform a final decision on the future of Angra-3 (Ministry of Mines and Energy Brazil, 2025).

Recent legislation: NA

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1.8 GW		1.3 GW		6.9 GW	10 GW

Canada

Recent developments: In March 2024, the federal government issued a national statement that reaffirms Canada's ambition to scale nuclear capacity, support SMR deployment and become a global technology leader, signalling nuclear energy is a central driver in Canada's clean-energy transition (Natural Resources Canada, 2024). In September 2025, the Darlington New Nuclear Project was selected by the government to be referred to the new Major Projects Office which has been tasked to advance major projects and streamline approvals (Government of Canada, 2025c). In October 2025, the federal budget announced a CAD 2 billion investment to support the construction of the Darling SMR project via the Canada Growth Fund (Government of Canada, 2025a). In November 2025, the Province of Ontario approved the decision to refurbish units 5-8 at the Pickering Nuclear Generating Station (Ontario Province, 2025).

Recent legislation: In the Clean Electricity Regulations finalised in December 2024, the federal government introduced binding pollution limits for fossil-fuelled electricity generation and enshrined the role of non-emitting technologies – including nuclear energy – in achieving a net zero grid by 2050 (Government of Canada, 2025b).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
12.6 GW	0.3 GW	0.9 GW	14.4 GW	4 GW	

Japan

Recent developments: In the 7th Strategic Energy Plan published in February 2025, a target of about 20% of electricity generation from nuclear power by 2040 was set (Ministry of Economy, Trade and Industry, 2025a,b). In July 2025, Kansai Electric Power announced that it would resume the voluntary on-site survey to evaluate the possibility of constructing the successor plant of its Mihama Nuclear Power Station Unit 1 (Kansai Electric Power Company, 2025).

Recent legislation: In 2023, the parliament passed the GX Decarbonised Power Supply Act, which enables nuclear power plants to operate beyond 60 years, excluding offline periods (Ministry of Economy, Trade and Industry, 2025c).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
31.6 GW	2.7 GW	1.3 GW			20% of electricity generation by 2040

Korea

Recent developments: In February 2025, the 11th Basic Plan for Long-Term Electricity Supply was approved. The document forecasts that nuclear power will account for 35.2% of the electricity mix by 2038, representing 28.3 GW. The plan projects the construction of one 0.7 GW SMR by 2035-36 and two APR1400s by 2037-38 (Ministry of Trade, Industry and Resources, 2025). In September 2024, the construction of Shin-Hanul units 3 and 4 was approved by the Nuclear Safety and Security Commission. In May 2025, the project started construction (Nuclear Safety and Security Commission, 2024) (Korea Hydro & Nuclear Power, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
25.9 GW	5.6 GW		3.5 GW		

Slovak Republic

Recent developments: In 2024 the Slovak government approved resolution 279/2024 in which it confirmed the intention to build a new nuclear facility in Jaslovské Bohunice with an expected installed capacity of up to 1.2 GW. In September 2025, the Slovak government approved an intergovernmental agreement (IGA) with the United States that establishes a legal and institutional framework for co-operation in the field of civil nuclear and which would support the construction of a new nuclear unit in Jaslovské Bohunice (Government of Slovak Republic, 2025a). The IGA was signed by both parties on 16 January 2026.

Recent legislation: In 2024 and 2025, the Parliament passed the Strategic Investment Act and the Construction Law, respectively, to modernise and streamline approval procedures for new constructions, including nuclear new builds (Government of Slovak Republic, 2025b).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
2.3 GW	0.4 GW		1.1 GW		

Türkiye

Recent developments: Akkuyu Nuclear Power Plant is currently under construction in Mersin province under an agreement signed with the Russian Federation in May 2010. The commissioning permit for Akkuyu Nuclear Power Plant Unit 1 was granted during November 2023. All four units of the Akkuyu Nuclear Power Plant are planned to be operational by the end of 2028 (IAEA, 2025). Discussions are also underway with international vendors for a second plant, in Sinop, and a third in the Thrace region (Ministry of Energy and Natural Resources, 2025a). In November 2025, the Minister of Energy and Natural Resources announced the goal of producing 10-15% of electricity from nuclear energy in 2050 through a total of 12 conventional reactors and an additional 5 GW of SMRs (Ministry of Energy and Natural Resources, 2025b).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
	4.5 GW		15.4 GW		10-15% of electricity production by 2050

United Kingdom

Recent developments: In June 2025, the UK government announced an investment of up to GBP 14.2 billion for Sizewell C and an additional GBP 2.5 billion for SMR development, with Rolls-Royce SMR selected as the preferred bidder (Department for Energy Security and Net Zero etc, 2025a). In July 2025, the Sizewell C nuclear power project secured Final Investment Decision (FID), with the overall financing framework underpinned by the United Kingdom's new Regulated Asset Base (RAB) model. The project reached financial close in November 2025 (Department for Energy Security and Net Zero, 2025a). In November 2025, Great British Energy -Nuclear selected Wylfa as the site for the United Kingdom's first SMR, with Rolls-Royce SMR as the selected nuclear technology. Alongside the siting announcement, the government announced that Great British Energy-Nuclear has been tasked with identifying suitable sites that could potentially host a further large-scale reactor project beyond Hinkley Point C and Sizewell C. (Great British Energy – Nuclear, 2025). In November 2025, the Nuclear Regulatory Taskforce published its final report, which called for a radical reset of the “overly complex” nuclear regulatory system. The Prime Minister has signalled that he will accept the recommendations of the Taskforce ahead of a formal Government response in 2026.

Recent legislation: The Nuclear Energy (Financing) Act 2022 formally established the legal framework for using the Regulated Asset Base (RAB) model, which lowers risk for private investors to fund new nuclear projects (Department for Energy Security and Net Zero and Department for Business, Energy and Industrial Strategy, 2022). The United Kingdom deposited its instrument of accession to the Convention on Supplementary Compensation for Nuclear Damage (CSC) on 3 October 2025, strengthening the global nuclear liability regime and enhancing the capacity of nuclear power to support climate change mitigation, economic development and energy security. The CSC will enter into force for the United Kingdom on 1 January 2026, by which time the United Kingdom will become the 12th Contracting Party to the Convention (IAEA, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
5.8 GW	3.2 GW	3.2 GW	1.5 GW		

Non-OECD countries

Bangladesh

Recent developments: Bangladesh is proceeding with the construction of the Rooppur Nuclear Power Plant, consisting of two units (each 1 200 Mwe) using Rosatom's VVER-1200 technology. Unit 1 is expected to load nuclear fuel in 2026. In 2024, the government announced the location for a second nuclear power plant in the southern region of the country. According to the Power System Master Plan, Bangladesh aims to expand its national nuclear generation capacity to approximately 7 GW by 2041 (PSMS, 2016). According to the final report of the Integrated Energy and Power Master Plan (IEPMP) 2023, Bangladesh to build eight nuclear power units by 2050.

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW	2.1 GW			4.8 GW	7 GW by 2041

China

Recent developments: As of 2025, China's nuclear power programme continues its expansion, with more than 30 reactors under construction. Additionally, in April 2024 the State Council approved construction for ten new reactors across multiple sites (CNNC, 2024; CNNPN,2024). China aims to increase installed nuclear capacity to 200 GWe by 2040 (CNEA, 2025).

Recent legislation: In September 2025, China's Standing Committee of the National People's Congress adopted the Atomic Energy Law, which took effect on 15 January 2026. This law enhances the legal framework for the peaceful use, management and regulation of atomic energy, including research and development, fuel-cycle management, utilisation of reactor and nuclear technology, safety and security, non-proliferation and emergency preparedness (IAEA, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
56.7 GW	33.2 GW	28.2 GW	27.8 GW	54.1 GW (by 2040)	200 GW (by 2040)

Egypt

Recent developments: Egypt is developing its first commercial nuclear power plant at El-Dabaa, in partnership with Russia's Rosatom. The plant will include four VVER1200 reactors, expected to provide around 10% of Egypt's electricity when fully operational (Rosatom, 2024).

Recent legislation: Egypt's nuclear energy framework is governed by the Nuclear Power Plants Authority (NPPA) and the Nuclear and Radiological Regulatory Authority (NRRRA). Recent legal updates include Presidential Decree No. 515 of 2024, which ratified the financing agreement with Russia for El-Dabaa, and amendments to the NPPA law (1976), granting NPPA authority over desalination, plant operation and supplier contracts (Business Egypt, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW	4.4 GW				

India

Recent developments: Under the recently announced Nuclear Energy Mission as part of India’s Viksit Bharat initiative, the Government of India is committed to a significant expansion of nuclear capacity, with a long-term target of achieving 100 GW of installed nuclear power capacity by 2047. The construction of ten new 700 MW pressurised heavy water reactors (PHWRs) has been approved, with deployment planned at multiple sites of the Nuclear Power Corporation of India Limited (NPCIL).

Recent legislation: In late 2025, India’s Parliament approved the SHANTI bill, which will reform the country’s civil nuclear framework by replacing the Atomic Energy Act of 1962 and the Civil Liability for Nuclear Damage Act of 2010. The new law will allow private sector participation in the nuclear energy sector, including through building, owning, operating or decommissioning nuclear power plants under government licence and safety authorisation from the Atomic Energy Regulatory Board (AERB).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
8.1 GW	8.1 GW	7 GW	24.6 GW	53.3 GW (by 2047)	100 GW (by 2047)

Pakistan

Recent developments: The Pakistan Nuclear Regulatory Authority (PNRA) issued a construction licence in December 2024 to the Pakistan Atomic Energy Commission (PAEC) for Unit 5 at the Chashma nuclear complex which will be based on the Chinese Hualong One design.

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
3.2 GW	1.1 GW			35.7 GW	40 GWe

Russian Federation

Recent developments: Under the draft Unified Energy System development plan, Russia anticipates adding 34-38 new reactors by 2040-2050, depending on demand growth and export commitments. Russia’s new build will include a combination of large-scale VVER light water reactors, sodium fast reactors BN-1200, lead- cooled fast reactors BREST OD-300, and SMRs, including floating nuclear reactors (Government of Russian Federation, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
26.8 GW	6.5 GW	21.7 GW			

New nuclear country updates: Planned and/or proposed projects

OECD countries

Bulgaria

Recent developments: Recent developments: In February 2024, the Bulgarian government signed an intergovernmental agreement with the United States for the construction of nuclear capacity on the Kozloduy Nuclear Power Plant site and the civil nuclear programme in Bulgaria (Ministry of Energy, 2024). In November 2024, Westinghouse, Hyundai Engineering & Construction and Kozduloy Nuclear Power Plant-New Build EDA signed an engineering services contract for two AP1000 reactors to be built at the Kozduloy site (Westinghouse, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
2 GW		1.15 GW	1.15 GW		

Czechia

Recent developments: In June 2025, ČEZ and KHNP signed the engineering, procurement construction (EPC) contract for the construction of two units at the Dukovany site, with an option for two additional units at Temelin (Ministry of Industry and Trade, 2025). In July 2025, ČEZ and Rolls-Royce SMR signed an Early Works Agreement to start site-specific work for potential small modular reactors at Temelin (Rolls-Royce SMR, 2025).

Recent legislation: In January 2024, the government issued a decree to prepare for the construction of additional nuclear reactor units at the Dukovany and Temelin sites beyond the already-planned Dukovany 5 and 6 (Ministry of Industry and Trade, 2024a). In April 2024, the European Commission approved the Czech government's state aid plan for the first reactor of the Dukovany project (Official Journal of the European Union, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
3.9 GW		2.2 GW	2.2 GW		

Estonia

Recent developments: In February 2024, the Estonian government presented the final report of the nuclear energy working group which concludes that the deployment of nuclear energy in Estonia is feasible and would support the achievement of climate targets, security of supply, and stability of the energy system (Government of Estonia, 2024). In January 2025, Fermi Energia, a private Estonian energy company, submitted an application to the Ministry of Economic Affairs and Communications on initiating a state spatial planning process that would permit site investigations for an SMR in Estonia. The company plans to build a nuclear power plant comprising two BWRX-300 units (Fermi Energia, 2025).

Recent legislation: In June 2024, the Estonian parliament passed a decision that clears the way for a "Nuclear Energy and Safety Act", endorsing the preparation for potential nuclear energy deployment in Estonia (Parliament of Estonia, 2024). The Act is planned to enter into force on 1 January 2027.

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			0.6 GW		

Finland

Recent developments: In March 2025, Fortum, Finland's state-owned energy company, concluded a feasibility study affirming the viability of new nuclear power projects. Fortum will proceed with preliminary preparations, aiming to enable future investment decisions regarding new nuclear capacity, including SMRs and large reactors (Fortum, 2025).

Recent legislation: Since 2022, the Finnish government has been working on a renewal of the Nuclear Energy Act to renew nuclear energy legislation. This process considers potential new energy or operating companies and emerging nuclear power plant concepts, such as small modular reactors (Radiation and Nuclear Safety Authority, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
4.3 GW					

France

Recent developments: In March 2025, the National Nuclear Policy Council took stock of the progress made by EDF in developing its programme to build six new EPR2 reactors in France. The Council reaffirmed its support for the project and examined the main principles of its financing framework, enabling discussions on State Aid to be initiated with the European Commission, with a view to a final investment decision by EDF in 2026 (President of France, 2025). In June 2025, the French government signed a “strategic contract” with key industry players and trade unions outlining priorities to revive the French nuclear sector. The construction of the six EPR2 reactors near the Penly, Gravelines and Bugey sites was outlined, along with the need to recruit 100 000 personnel in the next 10 years to support the sector’s revival (Comité stratégique de la filière nucléaire, 2025).

Recent legislation: In June 2023, the French Parliament passed a law that aims to accelerate the expansion of nuclear power generation’s capacity in France, abolishing the objective to reduce the share of nuclear electricity and removing the cap on nuclear generation capacity (Government of France, 2023). The law of 21 May 2024 merged France’s Nuclear Safety Authority (ASN) and its Institute for Radiological Protection and Nuclear Safety (IRSN) into a single independent authority, the ASNR (Authority for Nuclear Safety and Radiation Protection). This merger aims to improve the efficiency of procedures related to nuclear security and the attractiveness of jobs in the sector (Government of France, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
63 GW		10 GW	13 GW		

Hungary

Recent developments: Hungary is moving forward with the Paks II project of the construction of two new Russian-designed VVER-1200 reactors (Hungarian Government, 2025). In September 2025, the European Court of Justice annulled the European Commission’s 2017 decision approving the State aid for the Paks II nuclear project. The judgement concluded that the Commission should have examined whether the direct award of the construction contract to a Russian company complied with EU public procurement rules (Court of Justice of the European Union, 2025). In November 2025, the US Treasury Department issued a general authorisation for certain transactions related to the Paks II project, thereby ensuring exemption from US sanctions.

Recent legislation: In 2024, the Hungarian Parliament adopted an amendment to the Atomic Energy Act, which simplified the licensing process. The government also submitted a bill allowing an increase in the cost of the Paks II project (PAKS II, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1.9 GW		2.2 GW			

Netherlands

Recent developments: In May 2025, in a first Progress Letter on New Nuclear Energy Construction submitted to the Dutch Parliament, the Dutch government announced it was preparing the process to select technology, location and financing for two new nuclear power reactors (Government of the Netherlands, 2025a). In October 2025, a second Progress Letter highlighted the following updates (Government of the Netherlands, 2025a):

- the establishment of NEO-NL – a state-owned company that will become the developer, owner and operator of the new nuclear power plants;
- an update on the phased procurement process to enable negotiations on aspects of the final bidding while finalising other processes such as site-selection in parallel;
- the aim of having a draft preferred location decision by the summer of 2026;
- a proposed first outline for the Government Support package (GSP);
- the publication of the Dutch SMR strategy Government of the Netherlands (2025c).

Recent legislation: In 2024, the Environment and Planning Act introduced changes for the Authority for Nuclear Safety and Radiation Protection, including simplifying the procedure for Environmental Impact Assessments (EIAs) or EIA judgements for new nuclear projects (Authority for Nuclear Safety and Radiation Protection, 2024). In October 2025, the proposed amendment of the Nuclear Energy Act, which is essential for extending the operating licence of the Borssele Nuclear Power Plant beyond 2033, was presented to Parliament.

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0.4 GW			Up to 3.3 GW	Up to 3.3 GW	7 GW

Poland

Recent developments: In May 2025, the draft of the revised Polish Nuclear Power Programme (PEJ) reconfirmed targets for the construction of two nuclear power plants with a total installed capacity of 6-9 GW. The programme also recognised the potential role of SMRs to meet energy demand from industry (Ministry of Energy, 2025). In July 2025, PEJ notified the investment project involving Poland's first nuclear power plant to the European Commission, in accordance with its obligations under Article 41 of the Euratom Treaty (PEJ, 2025). In December 2025, the European Commission approved State aid for the construction and operation of Poland's first nuclear power plant, including price support in the form of a two-way contract for difference, government equity investment to cover 30% of the project costs, and State guarantees (European Commission, 2025).

Recent legislation: In March 2025, the Council of Ministers adopted legislation allocating EUR 14 billion for the capital phase of EJ1, Poland's first nuclear power plant project (Government of Poland, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW	0 GW	3.4 GW	Up to 12.2 GW		6-9 GWe Government target for large-scale reactors

Romania

Recent developments: Romania is advancing its nuclear energy programme by proceeding with the completion of two additional large reactors at the Cernavodă site and initiating a small modular reactor project at Doiceşti (Nuclearelectrica, 2025a, 2025b).

Recent legislation: In March 2023, the Romanian Parliament passed a law that establishes the Support Agreement between the Romanian government and Nuclearelectrica in order to lay the legal and financial foundation for the construction of Cernavodă Units 3 and 4. The legislation includes state guarantees for project financing and state support mechanisms for unforeseen risks (Romanian Parliament, 2023).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1.3 GW		1.4 GW			

Slovenia

Recent developments: In mid-2025, the Ministry of Natural Resources and Spatial Planning published the initiative for the preparation of the National Spatial Plan (NSP) for the Krško 2 nuclear power plant project (JEK2), formally initiating the spatial planning procedure. The initiative was subject to public consultation (Energetika-portal, 2025). In September 2025, GEN energija published the results of the Technical Feasibility Study (TFS) for JEK2. The study assessed the AP1000 and EPR/EPR1200 reactors and concluded that those designs are technically feasible for deployment at the proposed Krško site, subject to further project development and detailed design activities (GEN energija, 2025).

Recent legislation: In 2023, the National Assembly of Slovenia adopted the Resolution on Nuclear and Radiation Safety for the period 2024-2033, which establishes the strategic framework for nuclear and radiation safety policy and recognises the long-term role of nuclear energy. The Resolution provides a policy basis for activities related to new nuclear projects (Nuclear Safety Administration, 2023). In 2024 the National Assembly of Slovenia adopted the Resolution on the Long-Term Peaceful Use of Nuclear Energy in Slovenia "Nuclear Energy for the Future of Slovenia" (ReDMRJE), establishing Slovenia's commitment and framework for utilising nuclear power for its long-term energy needs with existing and new nuclear power plants. (Pravno-informacijski sistem RS, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0.6 GW			Up to 1.6 GW		

Sweden

Recent developments: In June 2024, the Swedish government set targets to enable 2.5 GW in new nuclear power capacity by 2035 and a considerable expansion of capacity by 2045 that corresponds to, for example, ten large reactors, depending on future demand for electricity (Government Offices of Sweden, 2024). In August 2025, the state-owned utility Vattenfall shortlisted two SMR designs, the Rolls-Royce SMR and GE Vernova Hitachi's BWRX-300, for potential deployment at its existing Ringhals nuclear power plant site (Vattenfall, 2025).

Recent legislation: In May 2025, the Swedish Parliament passed a law enabling a state-backed financing and risk-sharing scheme. Starting 1 August 2025, Sweden will allow companies that construct or operate new nuclear plants to apply for state aid, including loans and contracts for difference, for investments totalling up to 5 GW of new nuclear capacity (Government Offices of Sweden, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
6.9 GW			2.5 GW		

Ukraine

Recent developments: Ukraine's new-build programme is centred on completing Khmelnytskyi Nuclear Power Plant Units 3 and 4. Construction activities have also begun for the first Westinghouse AP1000 in the country at Khmelnytskyi Unit 5, as part of a planned fleet of AP1000 units (Westinghouse, 2025). In parallel, Ukraine is preparing an SMR roadmap, including through a co-operation agreement between Energoatom and Holtec International to deploy up to 20 SMR units and develop domestic component manufacturing (Ukrinform, 2023).

Recent legislation: In February 2025 the Verkhovna Rada passed legislation authorising the state operator Energoatom to purchase two Soviet-designed reactor units from Bulgaria for use at Khmelnytskyi (Ukrinform, 2025). Ukraine has undertaken regulatory alignment with European Union nuclear safety directives, with recent laws entering into force to bring Ukraine's nuclear-sector regulation in line with European standards (European Parliament, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
13.1 GW		4.2 GW	7.8 GW		

United States

Recent developments: In May 2025, a series of Presidential Executive Orders included modernising regulation for new nuclear reactors, restarting closed nuclear reactors, increasing nuclear installed capacity to 400 GW by 2050, and deploying SMRs and advanced reactors to meet power demand from data centres and AI (White House, 2025). In October 2025, Brookfield and Cameco announced a partnership with the US government to launch a USD 80 billion programme to build AP1000 reactors (Brookfield, 2025) (Cameco, 2025).

Recent legislation: In June 2024, the United States passed the ADVANCE Act, which aims to accelerate the development of SMRs and microreactors, directs the Nuclear Regulatory Commission (NRC) to streamline licensing in the process, reduce fees, and enable reactors to be built on retired coal power plant sites, among other things. It also includes measures to strengthen the domestic nuclear supply chain (United States Congress, 2024). In July 2025, the United States passed the One Big Beautiful Bill Act, which aims to strengthen the support for nuclear energy by further integrating it into the broad financial and tax credit frameworks for zero-emissions energy (United States Congress, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
98.5 GW		0.66 GW	11.8 GW	287.5 GW	400 GW

Non-OECD countries

Iran

Recent developments: Iran is constructing two additional Russian-designed units at the Bushehr Nuclear Power Plant (AEOI, 2025). In recent years, Iran has stated its aim of deploying 20 GWe of nuclear energy capacity by 2040 (IAEA, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1 GW	2.2 GW	1.9 GW	5 GW	12.1 GW	20 GW

Kazakhstan

Recent developments: In June 2025, the Agency of the Republic of Kazakhstan for Atomic Energy announced that the Russian state nuclear corporation Rosatom was selected as a leader of the consortium for the first nuclear power plant (The Astana Times, 2025). In August 2025, engineering and survey works began for the construction of the first nuclear power plant near Lake Balkhash (Almaty region).

Recent legislation: In March 2025, the country established the Agency of the Republic of Kazakhstan for Atomic Energy (The Astana Times, Kazatomprom, Kazinform, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW		2.4 GW			

Kenya

Recent developments: Kenya's draft National Energy Policy for 2025-2034 includes nuclear energy as part of the country's energy strategy (Ministry of Energy & Petroleum, Kenya, 2025). Kenya is aiming to start construction of its first nuclear power plant by 2027, with initial electricity generation expected by 2034. Two coastal locations have been shortlisted as potential sites (Power Magazine, 2024).

Recent legislation: Kenya's Energy Act 2019 mandates development of infrastructure for a national nuclear power programme and co-ordination of IAEA technical co-operation activities (IAEA, n.d.).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			1 GW		

Philippines

Recent developments: In 2024, the Philippines government released a Nuclear Energy Roadmap outlining plans to achieve commercial nuclear power operations by 2032, starting with approximately 1.2 GW of capacity and expanding to around 4.8 GW by 2050 (Department of Energy - Philippines, 2024).

Recent legislation: In June 2025, the Senate of the Philippines passed a bill to establish the Philippine Atomic Energy Regulatory Authority (PhilATOM), which would serve as the country's independent regulator for nuclear and radiation-sources activities (Republic of the Philippines, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW		0.6 GW		4.2 GW	4.8 GW

Rwanda

Recent developments: Under its Vision 2050, Rwanda has launched its nuclear energy programme, with the establishment of the Rwanda Atomic Energy Board (RAEB). The country plans to have a nuclear power plant operational by early 2030s, with SMRs as a key component of the strategy (Ministry of Infrastructure of Rwanda, 2020).

Recent legislation: The Government of Rwanda is in the process of approving national nuclear policy, along with a bill of reviewed nuclear law. The policy shall be approved along with some of its first implementing strategies. These measures aim to strengthen the regulatory and institutional framework for future reactor deployment (IAEA, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW				0.1 GW (scalable to 1.1 GWe)	Up to 1.1 GWe

Saudi Arabia

Recent developments: Saudi Arabia is advancing preparations for its first commercial nuclear power plants as part of its Vision 2030 strategy. The leading site under development is Khor Duwaiheen, where the planned Duwaiheen Nuclear Power Plant (2.8 GW) is moving towards the procurement phase. Since 2023, the Kingdom has held ongoing technical and commercial negotiations with shortlisted vendors, including EDF, Rosatom and KHNP (MEED, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			2.8 GW		

Uzbekistan

Recent developments: In May 2024, Uzbekistan signed a contract with Rosatom for the construction of a 330 MW SMR plant, comprising six 55 MWe RITM-200N units (Caucasus–Central Asia Analyst, 2024). In June 2025, Uzbekistan and Rosatom signed a study agreement to also evaluate a large-scale plant potentially featuring two to four VVER-1000 or similar units (AtomMedia, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			0.3 GW		

Viet Nam

Recent developments: In April 2025, Viet Nam approved the revised National Power Development Plan VIII (PDP8), formally incorporating nuclear energy for the first time. The plan aims to instal 4 to 6.4 GWe of nuclear capacity by 2030-2035, primarily through two plants planned in Ninh Thuan Province. The national utility EVN and PetroVietnam have been assigned to lead the Ninh Thuan 1 and Ninh Thuan 2 projects, respectively (Government of the Socialist Republic of Viet Nam, 2025). By 2050, the country aims to reach about 8 GWe of nuclear capacity as part of a diversified energy mix.

Recent legislation: In 2025, the National Assembly of Viet Nam approved a revised Law on Atomic Energy, which recognises nuclear power plants and research reactors and mandates alignment with international safety standards (Viet Nam News, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			4 GW	4 GW	8 GW

New nuclear country updates: Early discussions regarding new nuclear capacity countries

OECD countries

Belgium

Recent developments: In May 2025, the Belgian parliament reversed the 2003 nuclear phase-out law, allowing long-term operation of existing reactors beyond 2025 as well as paving the way for new projects (Strada lex, 2025). The government’s new energy strategy aims to maintain or restore around 4 GW of nuclear capacity by 2035, effectively doubling the country’s future nuclear generation potential compared with the previous phase-out scenario (Federal Climate Change Department, 2025).					
Recent legislation: In May 2025, Belgium’s legislature repealed the 2003 law mandating the phasing out of nuclear power by the end of 2025 (Strada lex, 2025).					
Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
3.4 GW				TBC	4 GW by 2035

Colombia

Recent developments: Colombia’s National Energy Plan (2022-2052) introduces nuclear power, including SMRs, as a long-term option (Mining and Energy Planning Unit, 2024).					
Recent legislation:					
Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Denmark

Recent developments: In May 2025, the Danish Parliament passed a resolution acknowledging that the government will initiate analysis to identify the risks and benefits associated with new nuclear technologies. The analysis will also consider the broader implications of potentially lifting the current ban on nuclear power in Denmark (Danish Parliament, 2025).					
Recent legislation:					
Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Greece

Recent developments: In June 2025, Greek Prime Minister Mitsotakis signalled Greece’s openness to engage with countries that support nuclear energy as part of Europe’s clean energy strategy, showing particular interest in discussions around merging nuclear technologies, especially SMRs and potential applications in the maritime sector (Prime Minister of Greece, 2025).					
Recent legislation:					
Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Italy

Recent developments: Italy's 2024 National Integrated Plan for Energy and Climate (PNIEC) cites the potential scenario of up to 8 GW of nuclear energy being generated by SMRs and advanced reactors by 2050 on the condition that the necessary legislative and regulatory reforms enable nuclear development (Ministry of the Environment and Energy Security, 2024).

Recent legislation: In 2025, the Council of Ministers approved a draft delegation law to reintroduce nuclear energy in the country, which emphasises the use of best available technologies, including SMRs, and provides, inter alia, for the development of a National Programme on sustainable nuclear energy and the establishment of an independent authority for regulation (Presidency of the Council of Ministries, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Latvia

Recent developments: In 2024, the Ministry of Climate and Energy published a report outlining possible scenarios for developing nuclear power in Latvia (Government of Latvia, 2024). In May 2025, the Cabinet of Ministers instructed the Ministry of Climate and Energy to initiate negotiations with Estonia to conduct a more in-depth evaluation of co-operation opportunities with Estonia in the development of a regulatory and supervisory framework for nuclear energy, as well as in the construction and operation of a nuclear power plant (Radiation Safety Centre of the State Environmental Service, 2025).

Recent legislation: NA

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Lithuania

Recent developments: In Lithuania, the June 2024 amendment of the National Energy Independence Strategy identifies the opportunity to introduce an initial SMR capacity of 0.5 GW by 2040, and of 1.5 GW by 2050 (Ministry of Energy, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW				1.5 GW	Up to 1.5 GW

Mexico

Recent developments: The Electricity Sector Development Plan for 2025-2039 considers the addition of 83.7 GW to the electric network by 2039. While nuclear energy is not directly considered, the publication mentions large-scale nuclear technologies as part of the set of technologies studied (Government of Mexico, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1.5 GW					

Norway

Recent developments: In June 2024, the Norwegian government appointed a committee to investigate nuclear energy as a possible energy source. The committee is task with conducting a broad review and assessment of various aspects of the possible future nuclear deployment in Norway (Government of Norway, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Spain

Recent developments: In November 2025, the licence owner of the Almaraz-Trillo Nuclear Power Plant requested that the Ministry for the Ecological Transition and Demographic Challenge extend the operating period of the two units until 2030 instead of 2027 and 2028 (Foro Nuclear, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
7.1 GW					

Switzerland

Recent developments: In August 2025, the Swiss Federal Council proposed a legislative amendment to the Nuclear Energy Act that aims to lift the current prohibition on the construction of new nuclear power plants, repealing current provisions introduced after the 2011 Fukushima accident (Fedlex Die Publikationsplattform des Bundesrechts, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
2.9 GW					

Non-OECD countries

Armenia

Recent developments: The government has committed to replacing the existing Armenian Nuclear Power Plant with a new nuclear unit. In August 2024, it created a state-owned company dedicated to the nuclear power plant construction project. The Armenian government has endorsed a new agreement between the Armenian Nuclear Power Plant and Rosatom Service to extend the plant's operational licence to 2036. The current plant's operating licence has been extended until 2036 (Arka News Agency, 2023).

Recent legislation: In November 2024, Armenia approved the Comprehensive and Enhanced Partnership Agreement with the European Commission to modernise nuclear safety infrastructure, improve radiation protection, and manage radioactive waste in compliance with European and international standards. Under that framework, its national regulatory body is drafting a new atomic-energy law aligned with international best practices (Business Media, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
1 GW					

Ghana

Recent developments: As of 2025, Ghana is continuing preparations for its first nuclear power plants, with construction expected to begin around 2027. Two sites have been shortlisted in the Western and Central regions. One site will host a large 1 200 MW nuclear power plant, while the other will host a small modular reactor (SMR). The government has selected NuScale Power, in partnership with Regnum Technology Group, to supply the SMR project, and the China National Nuclear Corporation (CNNC) to supply the large reactor (Ghanaweb, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			1 GW		

Malaysia

Recent developments: Malaysia continues a phased, science-based evaluation of nuclear energy as part of its long-term National Energy Transition Roadmap and National Energy Policy 2022-2040. MyPower Corporation has been designated as the Nuclear Energy Programme Implementing Organization (NEPIO), co-ordinating cross-ministerial planning activities, including feasibility studies, regulatory capacity building, and public engagement (PETRA, 2025).

Recent legislation: Malaysia relies on the Atomic Energy Licensing Act 1984 (Act 304) and is considering amendments to align with international nuclear safety, security, and safeguards standards (PETRA, 2025).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Serbia

Recent developments: In March 2024, Serbian President Aleksandar Vučić announced a long-term target of generating 1 200 MW of electricity through SMRs (IAEA, 2024). In July 2024, the Government of the Republic of Serbia signed a Memorandum of Understanding with relevant ministries, institutions and energy sector stakeholders concerning the development and application of nuclear energy for peaceful purposes. The memorandum establishes a framework for co-operation in assessing the potential role of nuclear energy in Serbia's energy mix (Government of the Republic of Serbia, 2024). In October 2024, the Ministry of Mining and Energy awarded a contract to EDF and Egis to conduct an initial study on nuclear energy deployment in Serbia, aimed at supporting technical and strategic evaluations related to a possible civil nuclear programme (Egis, 2024).

Recent legislation: In 2024, the National Assembly of the Republic of Serbia introduced the Law on Amendments to the Energy Law, ending the ban introduced by the Law Prohibiting Construction of Nuclear Power Plants in 1989 (Serbian Radiation and Nuclear Safety and Security Directorate, 2024).

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW				1.2 GW	1.2 GW

Singapore

Recent developments: In October 2025, Minister of Energy and Science and Technology Tan See Leng announced that Singapore is seriously considering nuclear energy, with a particular interest in SMRs. The Energy Market Authority (EMA) and the National Environment Agency (NEA) have been tasked with conducting further engagement and analyses to inform potential future decisions (Energy Market Authority, 2025). To make an informed decision, Singapore is building capabilities in line with the IAEA's Milestone Approach to understand the requirements for the deployment of nuclear energy. As part of these efforts, Singapore is strengthening collaborations with international partners, including France, Korea, the United Arab Emirates and the United States, to learn from their experiences.

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW					

Thailand

Recent developments: Under the country's 2024-2037 power-development plan, Thailand aims to deploy small modular reactors (SMRs), with 600 MW of SMR capacity by 2037, likely via two 300 MW units (Thai Times, 2025). The Office of Atoms for Peace (OAP) and the Energy Regulatory Commission (ERC) are proceeding in the preparatory work (OAP, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW				0.6 GW	0.6 GW

Uganda

Recent developments: Uganda aims to generate an initial 1 GW of nuclear power by 2031. In May 2025, the government signed a contract with Korea Hydro & Nuclear Power (KHNP) to perform detailed site evaluation and pre-feasibility studies (The East African, 2025).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
0 GW			1 GW	8.4 GW	

Established nuclear countries without plans for new nuclear capacity

Belarus

Recent developments: Belarus has commissioned the Belarusian Nuclear Power Plant, with Unit 2 connected to the grid in 2023 (BelNPP, 2024). In March 2026, the government stated it would be considering the feasibility of new nuclear capacity (BELTA, 2026).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
2.2 GW					

United Arab Emirates

Recent developments: In September 2024, Unit 4 of the Barakah nuclear power plant started commercial production, marking the completion of the plant. Electricity generation from Barakah now meets 25% of the UAE’s electricity needs (ENEC, 2024). In November 2024, the Emirates Nuclear Energy Company and ADNOC signed a Strategic Collaboration Agreement that would involve a comprehensive technical and economic assessment of the deployment of small modular reactors and advanced reactor technologies to evaluate the best-fit technologies for ADNOC and a joint effort to explore the use of excess heat from the Barakah nuclear power plant (Emirates Nuclear Energy Company, 2024).

Recent legislation:

Existing capacity	Under construction	Planned	Proposed	Prospective	Long-term target
5.6 GW					

Annex 3.

NEO methodology for long-term operation of existing reactors and large-scale new builds

The Nuclear Energy Outlook is organised around four scenarios:

- Low Scenario
- Current Trends Scenario
- Ambitious Scenario
- Transformative Scenario

Each scenario can be broken down into its component parts: long-term operation (LTO) of existing reactors, large-scale new build and small modular reactors (SMRs). These component parts are estimated differently depending on the time period, based on the availability of bottom-up project-level data and country announcements. For example, where relevant information is available on a project-by-project basis past 2050, LTO can be estimated using a purely bottom-up approach based on announced plans for refurbishments and the local political and technical conditions of each reactor. Table A3.1 summarises the methods used to elaborate the four scenarios.

Table A3.1: **The component parts of the four NEO scenarios: Long-term operation, large-scale new builds and SMRs**

	2025-30	2030-35	2035-40	2040-45	2045-50	Post-2050
Operations and LTO of existing reactors	Bottom-up Reactor level (Low, Current Trends, Ambitious, Transformative)					
Large-scale new build	Bottom-up Reactor and/or country level (Under construction, planned, proposed, prospective)				Rate of deployment = supply constraint (i.e. X GW/y for OECD and non-OECD countries based on historical benchmarks)	
SMRs	Bottom-up Project level (Dashboard database)		Rates of deployment based on supply constraint based on 3 delivery models (i.e. X GW/y) Assessment of expected deployment in different markets as a function of accessible SMR markets (i.e. X GW/market/y)			

This Annex describes the methodologies used to estimate LTO and large-scale new builds. Methodologies for estimating SMRs are presented in Annex 5.

Operation and LTO of existing reactors – Data and assumptions

Data on LTO programmes come from several sources. Basic data are drawn from the PRIS database, which provides reactor technology information as well as the years of operation (IAEA, 2026). National and subnational legislation forms the basis of current LTO programmes and therefore the LTO component of the Low Scenario. Unless an explicit programme has been put forth, reactors are assumed to be suspended and eventually retired at the end of their current licence.

For the LTO component of the Current Trends Scenario, all reactor technologies which do not have apparent safety issues or challenges with economical LTO are assumed to have their operations extended to 60 years. The principal exceptions are RBMK designs in the former Soviet Union, and Magnox gas-cooled reactors in the United Kingdom.

For the LTO component of the Ambitious and Transformative Scenarios, all reactor technologies which do not have apparent safety issues or challenges with economical LTO are assumed to have their operations extended to 80 years.

Large-scale new build – Data and assumptions

Large-scale new build, given the relatively long lead times for new reactors to be constructed, can also be estimated using a bottom-up approach until the early 2040s. New build projects are categorised by status: under construction, planned, proposed and prospective, as defined in Table A3.2.

Table A3.2: **Pipeline of nuclear energy projects: Under construction, planned, proposed and prospective**

Pipeline of nuclear energy projects	Description
Under construction	Projects which have announced the first pouring of nuclear concrete and commenced nuclear construction
Planned	Projects which have selected both a site <i>and</i> a reactor technology
Proposed	Projects which have selected either a site <i>or</i> technology
Prospective	Projects or capacity targets based on policy or utility or end-user statements of intention, for which neither the technology nor the site has yet been specified

For most countries, the planning horizon for new nuclear ends in the early 2040s, and thus an average rate of deployment based on supply constraints is used to estimate capacity additions until 2050. This assumes that the country will continue a trend of commissioning a certain number of GWe of new nuclear per year until it meets its announced nuclear energy target.

It should be noted that, for countries with ambiguous targets for new nuclear energy, the projected SMR capacity is subtracted from their total nuclear target to avoid double counting. For example, in the case of the United States, SMRs are subtracted from the Transformative Scenario as the US national target does not indicate the amount of SMRs vs large-scale capacity. Therefore, including both the total 300 GWe target and the modelled SMR capacity would likely be double-counting capacity. Figure A3.1 illustrates the four NEO scenarios and their three component parts.

Figure A3.1: **Summary of the three components of the four NEO scenarios**

	Low Scenario	Current Trends Scenario	Ambitious Scenario	Transformative Scenario
LTO	Existing LTO programmes	60-80 years	80 years	100 years
Large-scale new build	Under construction	Under construction	Under construction	Under construction
	Planned	Planned	Planned	Planned
		Proposed	Proposed	Proposed
			Prospective	Prospective
SMRs	Under construction	Programmatic approach	Advanced modular manufacturing	Next generation mass manufacturing

Characteristics of the four scenarios

This section explains the characteristics of four NEO scenarios:

Low Scenario

The Low Scenario relies predominantly on existing commitments without significant expansion. It falls short of deployment targets as well as corresponding decarbonisation targets. It may also fall short of objectives related to long-term energy security.

The Low Scenario includes LTO and large-scale new build as described in Table A3.3 below.

Table A3.3: **Scope and definition of the Low Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Only currently announced plans for LTO and refurbishments are carried out. Reactors without LTO plans are assumed to deactivate at the end of their current licence.
Large-scale new build	Only the large-scale new build projects currently under construction or in the most advanced stages of planning are eventually commissioned.

Current Trends Scenario

The Current Trends Scenario reflects a moderate approach that balances existing commitments with incremental growth in nuclear capacity. This pathway assumes that feasible operating licence extensions and advanced new build projects are pursued, potentially supporting steady progress towards decarbonisation goals while maintaining energy reliability. However, it may not deliver the scale of deployment needed for the most ambitious energy and climate targets.

The Current Trends Scenario includes LTO and large-scale new build as described in Table A3.4.

Table A3.4: **Scope and definition of the Current Trends Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions up to 60 years are carried out for all existing reactors where it is economically feasible and all announced operating licence extensions to 80 years are carried out.
Large-scale new build	All large-scale new build projects currently planned or under construction are carried out, and the proposed reactors in relatively advanced stages of planning are eventually commissioned.

Ambitious Scenario

The Ambitious Scenario outlines a proactive strategy that leverages both existing assets and future opportunities to accelerate decarbonisation and reinforce energy security. This assumes robust investment in extending reactor licences, commissioning all planned and proposed large-scale new builds, and adopting innovative modular construction methods for SMRs. While offering greater potential to meet stringent climate objectives, it requires substantial policy support and sustained industry commitment.

The Ambitious Scenario includes LTO and large-scale new build as described in Table A3.5.

Table A3.5: **Scope and definition of the Ambitious Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions to 80 years are carried out for all existing reactors where it is technically feasible.
Large-scale new build	All large-scale new build projects currently under construction, planned or proposed are built, and the most economically viable prospective projects are eventually carried out.

Transformative Scenario

The Transformative Scenario represents a bold vision for the future, where the nuclear energy landscape is fundamentally reshaped through widespread adoption of advanced technologies and manufacturing processes. This would require extensive investment and collaboration, with a focus on rapid deployment and mass production of SMRs to drive significant progress towards deep decarbonisation and enhanced energy resilience. Success in this scenario hinges on overcoming technical and supply-side challenges, as well as fostering robust policy frameworks to support innovation and growth.

The Transformative Scenario includes LTO and large-scale new build as described in Table A3.6.

Table A3.6: **Scope and definition of the Transformative Scenario**

Scope	Definitions
Operations and LTO of existing fleet	Operating licence extensions to 100 years are carried out for all existing reactors where it is technically feasible.
Large-scale new build	All large-scale new build projects are carried out, including all prospective projects.

Annex 4.

Capital expenditure model – Data and assumptions

This Annex presents the methodology and assumptions used to estimate capital expenditure requirements for the four NEO scenarios. The foundation of the model is derived from a forthcoming joint publication by the Nuclear Energy Agency (NEA) and the Electric Power Research Institute (EPRI) entitled *Costs of Generating Electricity*, which provides average overnight costs for new nuclear projects in different regions. Table A4.1 quantifies the regional differences in overnight capital expenditure (CAPEX) costs for new nuclear, based on the figures from *Costs of Generating Electricity*. To estimate annual CAPEX requirements for the four scenarios, the NEA-EPRI figures were applied to the *Nuclear Energy Outlook* database.

Table A4.1: **Estimated overnight CAPEX costs for new nuclear projects by region**

	Europe	Russia	China	North America	Asia	Africa	Latin America
Local cost USD/kWe of near-term reactors	12 000	11 000	6 000	10 000	7 000	8 000	11 000
USD/kWe of nth-of-a-kind reactors	6 000	5 500	3 000	5 000	3 500	4 000	5 500

Many countries, including the France, Japan, and the United States, have a history of building nuclear reactors for even less than the estimated nth-of-a-kind reactors. Given their previous success in nuclear new build, it should be possible for these countries to achieve even lower per-unit costs with an accelerated learning curve. Table A4.2 contains the CAPEX assumptions used for an accelerated learning curve. An accelerated learning curve assumes that the scale of investment envisioned by the Transformative Scenario should enable construction timelines to fall, and per-project costs to decline considerably, to match those of China and Korea. Countries like France, Japan, and the United States have all reached similar costs of new nuclear to those in the table below during their periods of peak new nuclear construction, indicating that such CAPEX estimates should be technically feasible, given other enabling conditions. The underlying assumptions of the accelerated learning curve are that:

- countries remain committed to reaching their nuclear energy target through 2050;
- in doing so, the countries take a programmatic approach, with repeated construction of reactor designs to reach significant economies of scale in the supply chain and workforce;
- as part of their commitments to nuclear power, the countries properly resource safety and regulatory agencies to ensure swift and efficient compliance with relevant regulations.

Table A4.2: **Estimated overnight CAPEX costs for nth-of-a-kind new nuclear projects under an accelerated learning curve**

	Europe	Russia	China	North America	Asia	Africa	Latin America
USD/kWe of nth-of-a-kind reactors	6 000	5 500	3 000	5 000	3 500	4 000	5 500
USD/kWe for nth-of-a-kind reactors (accelerated learning curve)	3 500	3 500	2 500	3 500	3 500	3 500	3 500

The CAPEX figures explained above were applied to the large-scale nuclear new build database with the following methodology. The project-level data were divided into near-term and nth-of-a-kind projects based on technology, if a country had recently built at least 2-3 of a given reactor design, further projects in that country with that design were considered NOAK, if not they were considered near-term projects.

Overnight CAPEX costs were then divided by the average construction time for new nuclear in a given region to generate an average annual CAPEX cost per kWe for that region for both FOAK and NOAK projects. Table A4.3 contains the average nuclear project construction duration by region.

Table A4.3: **Regional average nuclear construction project duration**

	Europe	Russia	China	North America	Asia	Africa	Latin America
Average construction project duration (months)	124	93	73	112	104	96	145

These annual CAPEX costs per kWe were then multiplied by the amount of anticipated NOAK and FOAK construction by year to yield a regional CAPEX estimate for each year of the period 2025-2050.

The regional estimates were then summed into OECD and non-OECD categories, and a five-year average of the sums was taken to better approximate the average annual CAPEX. Table A4.4 demonstrates an example of how the Annual Project CAPEX is calculated.

Table A4.4: **Demonstration of CAPEX model**

	FOAK/NOAK	Overnight CAPEX cost (USD/kWe)	Average regional construction time (years)	Annual CAPEX (USD/kWe)	Illustrative reactor capacity (Mwe)	Annual project CAPEX (USD)
China	Near-term	6 000	6.1	980	1 000	980 000 000
	NOAK	3 000	6.1	490	1 000	490 000 000
	NOAK (accelerated)	2 500	6.1	410	1 000	410 000 000
OECD Europe	Near-term	12 000	10.3	1 165	1 000	1 165 000 000
	NOAK	6 000	10.3	583	1 000	583 000 000
	NOAK (accelerated)	3 500	10.3	340	1 000	340 000 000

Annex 5.

NEO methodology for SMRs

This annex sets out additional information about the assumptions and methodologies for estimating the role of SMRs in the four NEO Scenarios.

Industry selection

The industries considered in the analysis are summarised in Table A5.1, with each representing a potential market.

Table A5.1: **Selected industries to be evaluated for the NEO**

Industry	SMR opportunity	Market signals examples
Chemicals	Cogeneration of high amounts of electricity and high temperature heat	Dow-X-energy Seadrift project; Tata Chemicals-BWXT microreactor letter of intent
Oil & gas refining	Cogeneration of high amounts of electricity and high temperature heat	Industrial Advanced Nuclear Consortium (Chevron, Shell, Exxon, etc.)
Oil & gas upstream	Reliable power in remote locations with limited footprint and logistical options	Industrial Advanced Nuclear Consortium (Chevron, Shell, Exxon, etc.)
Coal repowering	Reuse of existing site infrastructure, and potentially components, to save cost	TerraPower–PacifiCorp Natrium at Kemmerer; NuScale/RoPower at Doicești
District heating	Proven application using low temperature heat	Steady Energy pilot project in Helsinki; Calogena in Cadarache, France
District cooling	Proven application using low temperature heat	None right now. However, it is an interesting option as district cooling loads increase with global warming, particularly if district heating application become mature.
Data centres	Reliable behind-the-meter power supply and potential for cooling integration	Amazon's stake in X-energy; Google working with Kairos for reactor design and Element1 for sites
Maritime propulsion	Greater cost efficiency than synthetic fuels; higher speed, autonomy and cargo room due to high power density	NEMO initiative; Allseas building its own reactor design; Russian ice-breakers; HD Korea Shipbuilding's nuclear LNG carrier design
Off-grid mining	Reliable power in remote locations with limited logistic options	Existing SMRs like Akademik Lomonosov; Saskatchewan government and Westinghouse eVinci demo in Canada

Regions

SMR market estimates will be provided as aggregated figures at the regional level, rather than as country-by-country estimates. A specific country estimate is provided for the United States. By doing so, SMR capacity projections in the United States are subtracted from the 2050 target of 400 GWe. This avoids double counting of SMR capacity, as the 2050 target is assumed to be inclusive of both large-scale reactors and SMRs.

Additional details are provided in Tier 1: Total Energy Demand, which describes the methodology for estimating sectoral energy demand.

Timeline and forecasting approach

Annual projections cover the period from 2025 to 2050. The approach to extrapolate demand over time will assume industry growth rates using a compounding growth formula, with the growth rate determined based on industry-specific forecasts and historical data.

The main framing scenario driving the projections is SSP2-4.5 from the IPCC, which corresponds to an intermediate socio-economic scenario by 2100 and projects peak oil around 2040. This projection directly affects energy demand in the chemical, oil and gas, and maritime sectors.

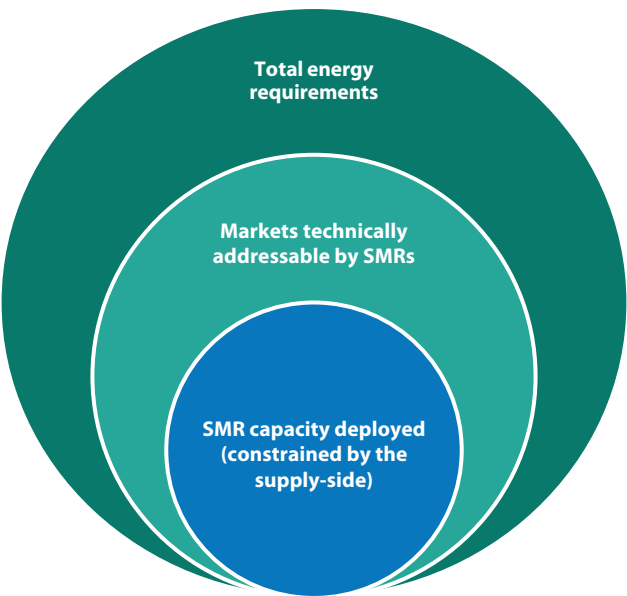
SMR market outlook: A tier-based approach

Table A5-2 and Figure A5.1 highlight the market tier-based approach used to estimate the size of the market accessible to SMRs. This approach first pares down total energy demand by 2050 into the market technically addressable by SMRs. Only a subset of the technically addressable market will be realised as a function of the SMR capacity deployed, given supply side constraints. Additional details regarding the methodology are detailed in Annex 5.

Table A5.2: **SMR market tier-based approach**

Tier 1 Total energy requirements	The total energy demand by 2050 corresponds to the aggregate energy requirements across all sectors and applications by 2050, including industrial, residential and transport. It sets the broad context for understanding both the scale and limitations of the SMR market potential within the wider energy system.
Tier 2 Market technically addressable by SMRs	The market technically addressable by SMRs by 2050 corresponds to the portion of total energy demand that SMRs could technically supply, based on the temperature and process requirements of various applications. It excludes sectors or processes where SMRs are not currently suitable, such as those needing very high temperatures or involving significant transport energy needs
Tier 3 SMR capacity deployed (constrained by the supply-side)	SMR capacity deployed by 2050 corresponds to the amount of SMR capacity commissioned and is determined by supply constraints to SMR deployment.

Figure A5.1: **SMR market tier-based approach**



- **Tier 1 - Total energy demand by 2050:** This tier corresponds to the total energy demand needs of a given sector by 2050. This demand will be broken down into electricity and industrial process heat. For heat, three different temperature bands will be determined:
 - Low temperature heat below 300°C
 - High temperature heat between 300-800°C
 - Very high temperature heat over 800°C – this temperature range is not accessible to SMRs with current technology
- **Tier 2 – Market technically addressable by SMRs:** This tier corresponds to energy demand that could technically be met with SMRs. It includes all electricity and process heat needs below 800°C. Non-process energy needs met with fuel as a carrier (not electricity or steam, such as machine drive) are also excluded if data on these energy needs are available.
- **Tier 3 – SMR capacity deployed based on supply chain constraints:** Even if the SMR technical potential is economically addressable, the market may not be met due to supply constraints. This tier corresponds to the SMR economically addressable market that can be accessed after taking into account supply constraints.

To move from Tier 1 (energy demand) to Tier 2 (technical potential), a set of industry-specific filters will be applied, as detailed in the following sections. The transition from Tier 2 to Tier 3 is achieved by matching demand with actual SMR supply, evaluated through supply projections using a funnel model, which is described in greater detail later in this Annex.

Tier 1: Total energy demand by 2050

Chemicals

The main steps, key assumptions, and references to determine the total energy demand for chemicals through 2050 by region are detailed in Table A5.3.

The definition of chemicals is consistent with the IEA Energy Balances Database which relies on the United Nations' International Standard Industrial Classification (ISIC) Division 20 and Division 21. Division 20 covers the manufacture of chemicals and chemical products, while Division 21 covers the manufacture of basic pharmaceutical products and pharmaceutical preparations.

Table A5.3: **Key steps and assumptions to estimate energy demand in the chemical sector**

Step	Description	Assumption	Key reference/dataset
1. Determine the total amount of energy by region today	Total energy for chemicals in a given region	N/A	IEA (2025b)
2. Breakdown total energy demand in a given region	The total energy demand is broken down into electricity and process heat, then process heat into temperature bands. This step allows determination of the SMR technical potential	Total process heat in the chemical sector accounts for around 80% of the total energy demand. Non-process electricity and fuel represent around 15% and 5%, respectively. From the process heat, around 60% is low temperature heat, 10% high temperature heat and 30% very high temperature heat. This breakdown is assumed to be constant across regions.	Vanetta et al. (2024), US EIA (2018), JISEA (2016)
3. Project demand through 2050 by region	Demand will be projected using growth rates and the compounding growth formula	NEA analysis. Growth rates are assumed identical across regions	NEA analysis

Data centres

The main steps, key assumptions, and references to determine the total energy demand for data centres through 2050 by region are detailed in Tables A5.4 and A5.5.

Table A5.4: **Key steps and assumptions to estimate energy demand in the data centre sector**

Step	Description	Assumption	Key reference/dataset
1. Determine current global data centre energy consumption projections and through 2050	Total energy consumed by data centres globally from 2026 up to 2050	NEA analysis	NEA analysis
2. Allocate globally energy demand projection by region	The global projection is allocated to the regions of interest based on region-specific projections	The region-specific projections assume growth rates detailed in Table A5.5	IEA (2025d)
3. Break down total energy demand in a given region	The total energy demand is broken down into electricity and heat, then heat into temperature bands	All energy will be assumed to be electricity	N/A

Table A5.5: **Assumed data centre growth rates by region, 2023-2050**

Growth rate	2023-2024	2024-2030	2030-2035	2035-2050
United States	20%	25%	5%	1%
Americas	20%	25%	5%	1%
Europe	3%	10%	3%	1%
Asia	20%	25%	5%	1%
Africa	10%	20%	15%	10%
Oceania	3%	10%	3%	1%
Reference	IEA (2025b)	IEA (2025b)	LucidCatalyst (2025b)	LucidCatalyst (2025b)

Oil & gas refining

The main steps, key assumptions, and references to determine the total energy demand for oil & gas refining through 2050 by region are detailed in Table A5.6.

Table A5.6: **Key steps and assumptions to estimate energy demand in the oil and gas refining sector**

Step	Description	Assumption	Key reference/dataset
1. Determine the current total amount of energy in a region	Total energy used for oil & gas refining in a given region	Estimated energy demand in the United States will be used as reference and then extrapolated based on refining capacity by region	IEA (2025b), MECS (2018)
2. Break down total energy demand in a given region	The total energy demand is broken down into electricity and heat, then heat into temperature bands	Total process heat in the chemical sector accounts for around 92% of the total energy demand. Non-process electricity and fuel, represent around 7% and 1% respectively. From the process heat, around 35% is low temperature heat, 20% high temperature heat and 45% very high temperature heat. This breakdown is assumed to be constant across regions	Vanetta et al. (2024), US EIA (2018), JISEA (2016)
3. Project demand through 2050 by region	Demand will be projected based on consumption trends from IEA WEO scenarios	Global oil consumption projections from IPCC SSP2-4.5 scenario are used to estimate growth rates. The growth rates identified are assumed identical across regions	IIASA (2018)

Oil & gas upstream

The main steps, key assumptions, and references to determine the total energy demand for oil & gas upstream through 2050 by region are detailed in Table A5.7.

Table A5.7: **Key steps and assumptions to estimate energy demand in the oil and gas upstream sector**

Step	Description	Assumption	Key reference/dataset
1. Determine the current oil and gas production in a region	Total energy for oil & gas extraction in a given region	N/A	Energy Institute (2024)
2. Transform production into energy consumption using energy return on investment (EROI)	Energy use in oil & gas extraction is determined by dividing the energy contained in the production by the EROI. This metric indicates energy obtained from a given energy source divided by the energy used to extract it	Production of oil and natural gas all have distinct EROI values. Aramendia et al (2024) provides final EROI values for oil and gas by country. The following countries are considered as representative a of a region based on their production: United States (Americas), Saudi Arabia, China and Iran (Asia) Norway (Europe), and Australia (Oceania).. The final EROI values are then multiplied by 1.6 (for oil) and 1.3 (for gas) to obtain extraction EROI values consistent with Murphy et al (2022). EROI is then projected up to 2050 based on historical values	Aramendia et al. (2024), Murphy et al. (2022)
3. Break down total energy demand in a given region	The total energy demand is broken down into electricity and heat, then heat into temperature bands	It is assumed that 85% of the energy is electricity and 10% is low temperature heat. This breakdown is assumed to be constant across regions	N/A
4. Project demand through 2050 by region	Demand will be projected based on consumption trends from IEA WEO scenarios	Global oil consumption projections from IPCC SSP2-4.5 scenario are used to estimate growth rates. The growth rates identified are assumed identical across regions	IIASA (2018)

District heating and cooling

District heating and cooling demand projections through 2050 by region are provided by the NEA following its own analysis (NEA, forthcoming a). This analysis included a top-down projection of global cooling and heating demand using the global human settlement layer, UN population projections, and NASA earth exchange (NEX) data. Using these three datasets, the forthcoming publication sets out contemporary global energy demand for both cooling and heating and through 2050. This global demand was then filtered by country-level policies that support nuclear energy to arrive at an addressable market. Twenty per cent of this addressable market was assumed to be accessible based on IEA estimates for global district energy systems.

Maritime propulsion

The main steps, key assumptions and references to determine the total energy demand for maritime propulsion through 2050 by region are detailed in Table A5.8.

Table A5.8: **Key steps and assumptions to estimate energy demand in the maritime sector**

Step	Description	Assumption	Key reference/dataset
1. Determine contemporary global maritime energy consumption projections and through 2050	Total energy consumed by contemporary maritime sector globally and up to 2050	NEA analysis	NEA analysis
2. Allocate globally energy demand projection by region	The global projection is allocated to the regions of interest based on region-specific projections	Regional projections are based on DNV 2024 data for maritime energy demand by carrier type. For liquid fuels, the reported values represent chemical energy content. These are multiplied by 0.7 to isolate demand from tankers, bulkers, and container ships, which account for roughly 70% of emissions and are the most suitable candidates for SMR adoption. Finally, the resulting values are multiplied by 0.5 to convert chemical energy demand into mechanical energy	DNV (2024)
3. Break down total energy demand in a given region	The total energy demand is broken down into electricity and heat, then heat into temperature bands	All energy will be assumed to be electricity	N/A

Coal repowering and off-grid mining

The SMR market projections for coal repowering and off-grid mining are taken from the NEA publications “SMRs for Replacing Coal” (NEA, 2025b) and “SMRs for Mining” (NEA, 2024).

Tier 2 – Market technically addressable by SMRs

Once the energy demand by sector is determined, this value is multiplied by the technical potential factor. The technical potential factor is the ratio of the total energy that can technically be met by SMRs versus the total energy demand. The energy demand that is considered not technically addressable by SMRs corresponds to process heat beyond 800°C and non-process energy used in the form of fuel. Table A5.9 summarises the technical potential ratio assumed by sector.

Table A5.9: **Estimated technical potential by industry**

Industry	Technical potential ratio	Explanation	Reference
Chemicals	72%	Petrochemicals require temperatures above 750°C for steam cracking, which necessitates direct firing beyond the technical capabilities of SMRs. Some nitrogenous fertiliser processes also operate at similar temperature levels. Additionally, there are non-process energy demands typically met with fuel. These processes are often highly integrated within facilities, requiring extensive reengineering. As such, they are conservatively considered not technically addressable by SMRs.	Vanetta et al. (2024), US EIA (2018), JISEA (2016)
Data centres	100%	All energy is assumed to be electricity.	Assumption
Oil & gas refining	56%	Similar to petrochemicals, some products require high temperatures over 800°C. There is also some residual non-process energy demands that are met with fuels and cannot be addressed with SMRs.	Vanetta et al. (2024), US EIA (2018), JISEA (2016)
Oil & gas upstream	100%	Most of the energy needed is electricity. Heat is required at temperatures lower than 300°C.	Assumption
District heating and cooling	100%	All energy is low temperature heat provided by the reactor.	Assumption
Maritime propulsion	100%	Electricity is generated from nuclear reactors powering electro-mechanical engines*.	Assumption
Off-grid mining	50%	Around 50% of the energy consumed in off-grid mining operations is used for transport and is therefore not technically addressable by SMRs.	Assumption

* Most next-generation nuclear ships are likely to choose turbo-electric drive, as this provides superior manoeuvrability, a more flexible layout, and improved modular construction (i.e. the reactor in one isolated, nuclearised section and the non-nuclear electric mechanical motors in another).

Tier 3 – SMR capacity deployed based on supply chain constraints

Tier 3 represents the accessible SMR market, which is the market that could be technically and economically addressed, assuming supply perfectly follows demand. In reality, supply is physically constrained by the nature of the project delivery model and specific enabling conditions within the nuclear sector.

To determine the accessible SMR market, the following steps are taken:

1. determining SMR supply through 2050, accounting for supply constraints;
2. matching supply and demand values and allocating supply to define the Tier 3 (accessible) market.

SMR supply is assumed to be shaped by the following key constraints or bottlenecks:

- **Delivery model innovation:** Nuclear power plants are currently delivered as unique, onsite construction projects using the engineering-procurement-construction (EPC) model, which limits productivity and deployment rates. The smaller size and innovative design of SMRs create opportunities for higher levels of modularisation, similar to practices employed in sectors like shipbuilding or jet engine production. These delivery models are currently being explored by several vendors (see Table A5.10).

- **Workforce:** Nuclear standards require a highly specialised workforce, particularly for the installation of safety-related structures, systems and components. On-site construction depends on large numbers of qualified workers, making scaling constrained by workforce availability. In contrast, delivery models based on assembly lines or factory manufacturing embed qualification within the production process itself, reducing dependence on human specialisation and enabling rapid scale-up through the addition of a new line.
- **Licensing:** Current licensing frameworks are reactor-specific, which slows deployment. Type certification approaches¹, similar to those used in the maritime and aviation sectors, could allow faster verification of compliance with nuclear standards, thereby accelerating supply rates.
- **Siting:** Sites must also be qualified to host reactors. It is possible that the rate of reactor production will exceed the number of available sites, creating a supply constraint. Faster permitting and pre-qualification of site banks could help alleviate this bottleneck.

In addition, fuel availability can also become a major supply bottleneck. However, in this analysis, it is assumed that fuel supply will adjust to match deployed SMR capacity, after accounting for the above constraints. The adequacy of nuclear fuel supply to meet projected demand by 2050 is further studied in a forthcoming NEA publication.

Table A5.10: **Overview of SMR delivery models currently being explored**

Delivery model	Description	Size range	Contemporary example
EPC/programmatic	Traditional engineering-procurement-construction (EPC) model with site-specific builds. Proven but slow, capital-intensive, and vulnerable to cost overruns.	All ranges but more adequate for SMRs over 100 MWe	X-Energy for Dow Chemicals and Amazon AWS, BWRX-300 for Darlington, OSGE and TVA Clinch River site. A large order can help improve EPC model efficiency.
Advanced modular manufacturing	Modular reactor components built in a factory setting, leveraging existing heavy industrial infrastructure. Offers potential cost and schedule advantages, but regulatory and logistical challenges remain.	50-300 MWe	Rolls Royce, Prodigy Energy and Blue Energy are adapting existing designs to advanced modular manufacturing. HD Korea Shipbuilding & Offshore Engineering are working on a 15 000-TEU container ship using SMRs.
Next generation manufacturing	Factory-built reactors shipped to site for final assembly. Promises faster deployment, scalability, and better quality control. Still in early stages of commercialisation.	Mass manufacturing is more adapted for reactors below 50 MWe	Multiple vendors (e.g. Aalo Atomics and Copenhagen Atomics) are exploring reactor designs optimised for manufacturability with the potential for cost reductions of up to 80% if scaled successfully.

To estimate SMR supply, four scenarios are considered, each corresponding to different delivery models currently being explored. Each scenario has an associated theoretical deployment rate (in GW per year), derived from historical deployment trends and industry benchmarks.

Supply projections are modelled assuming varying deployment rates, operational start dates, and the commissioning of new production facilities. Each time a new facility becomes operational, the slope of the supply curve increases to reflect the added throughput of all facilities online. This approach is illustrated in Table A5.10, and the main assumptions of each scenario are detailed in Table 5.11.

The resulting supply projections are then adjusted downward using a constraint factor accounting for workforce, licensing, and siting limitations. Since these constraints are interdependent, they are applied simultaneously. The factor for each constraint is evaluated qualitatively, as shown in Table A5.11, resulting in an effective SMR supply lower than the theoretical maximum.

For example, assume a theoretical deployment rate of 20 GW/year for mass manufacturing in a given region. Under this model, workforce and licensing constraints are minimal (factors of 0.9 each), while siting is more restrictive (factor 0.5), as more reactors could be produced than there are sites available.

The actual deployment rate is therefore:

$$20 \text{ GW/y} \times \text{Workforce (0.9)} \times \text{Licensing (0.9)} \times \text{Siting (0.5)} \approx 8 \text{ GW/y.}$$

1. Type certification is the process through which a regulatory authority approves the design of a standard product, such as an aircraft or ship class, confirming that it meets all safety, performance, and regulatory requirements. Once a type certificate is granted, identical units of that design can be produced and operated without undergoing full re-approval, allowing faster replication, lower costs and consistent quality assurance. This concept is often referenced as a model for future product-based nuclear licensing approaches.

Table A5.11: **Assumptions for supply projections by scenario**

Scenario	Delivery model	Theoretical deployment rate	Timelines	Assumptions
Onsite construction	EPC/programmatic	~5-10 GW/y	First deployment by 2030 in Asia, and between 2032-35 in the Americas, followed by Europe. Africa and Oceania deploy their first reactors after 2038.	Scale: Assumes historical maximum deployment rates can be reached again across multiple regions through co-ordinated, government-led strategies, similar to France's 20th century civil nuclear programme or the Barakah project in the United Arab Emirates. Regional dynamics: Regulatory and policy uncertainty is assumed to be higher in Europe than in North America, resulting in later SMR rollouts. Asia could deploy first SMRs by 2030. Africa and Oceania are newcomers, with deployment after 2038.
High modularisation	Modular manufacturing practices	~10-15 GW/y	Module factories could be fully licensed and operating at maximum capacity in Asia and the Americas by 2032-35, followed by Europe in 2037. Oceania could deploy its first reactors after 2038.	Scale: Increased modularity would allow higher rates of deployment by leveraging offsite assembly to reduce bottlenecks in the workforce and supply chain. Regional dynamics: Assumes 1-2 facilities per region. Regulations are expected in place between 2030-35. Europe faces higher regulatory uncertainty. Asia leads early deployment. Africa and Oceania follow after 2038.
Mass manufacturing	Next generation manufacturing practices	~15-30 GW/y	In the Americas and Asia, first factories could be fully licensed and operating at maximum capacity by 2035-38, followed by Europe by 2040. Oceania could deploy its first reactors after 2038.	Scale: Assumes transformative innovation in design, regulation, and manufacturing, enabling mass production. Each factory produces 100 units/year of 50 MWe reactors. Regional dynamics: Assumes 1-2 facilities per region. North America and Asia take the lead. Europe follows due to higher regulatory barriers. Africa and Oceania follow after 2038.

Table A5.12: **From theoretical to actual SMR deployment**

Scenario	Theoretical deployment rate	Bottleneck	Qualitative evaluation	Constraint factor	Actual deployment rate
Onsite construction	~5-10 GW/y	Workforce	Severe	0.2	~1-2 GW/y/region
		Licensing	Severe		
		Siting	Minimal		
High modularisation	~10-15 GW/y	Workforce	Moderate	0.25	~3-4 GW/y/region
		Licensing	Moderate		
		Siting	Severe		
Mass manufacturing	~15-30 GW/y	Workforce	Minimal	0.4	~6-12 GW/y/region
		Licensing	Minimal		
		Siting	Severe		

SMR deployment in key markets and applications

To allocate overall supply to specific demand, allocation factors are derived from an assessment of the suitability of each delivery model to serve specific markets (Table A5.13). The underlying assumption is that on-site construction is better suited for delivering relatively large SMRs, such as those used for coal repowering or chemical applications, while high modularisation and mass manufacturing are more appropriate for microreactor markets such as maritime and off-grid mining. Those estimates are based on qualitative insights collected in recent SMR industrial case studies conducted by the NEA.

This approach may result in excess allocated capacity within a given market. In such cases, once a market is saturated, the excess capacity is reallocated among the remaining markets by renormalising the allocation factors.

Table A5.13: **Suitability-based allocation ratios**

	Onsite construction	High modularisation	Mass manufacturing
Chemicals	0.25	0.13	0.12
Upstream O&G	0.00	0.06	0.08
Refining O&G	0.00	0.06	0.08
District heating	0.13	0.13	0.08
District cooling	0.13	0.13	0.08
Coal repowering	0.25	0.19	0.16
Data centres	0.25	0.19	0.12
Maritime propulsion	0.00	0.06	0.16
Off-grid mining	0.00	0.06	0.12

Illustrative example: Consider a scenario in 2050 with 100 GW of SMR supply available that needs to be allocated across three industries (A, B, C), each with the technical potential and suitability-based allocation ratio indicated in Table A5.14.

Table A5.14: **Illustrative values for suitability-based allocation approach**

Industry	Suitability-based allocation ratio	Technical potential (GW)
A	0.5	40
B	0.3	80
C	0.2	50

The initial allocation is as follows:

- Industry A: $100 \times 0.5 = 50 \text{ GW} > 40 \text{ GW} \rightarrow$ market saturated
- Industry B: $100 \times 0.3 = 30 \text{ GW} < 80 \text{ GW} \rightarrow$ market not saturated
- Industry C: $100 \times 0.2 = 20 \text{ GW} < 50 \text{ GW} \rightarrow$ market not saturated

Since Industry A is saturated, there remains 10 GW of excess capacity to be reallocated. To do so, the allocation ratios of the remaining industries are renormalised to ensure the full 10 GW is distributed proportionally:

- New ratio for B = $0.3 / (0.3 + 0.2) = 0.6$
- New ratio for C = $0.2 / (0.3 + 0.2) = 0.4$

Reallocating the excess capacity:

- Industry B: $10 \times 0.6 = 6 \text{ GW} \rightarrow$ New total: $30 + 6 = 36 \text{ GW} (< 80 \text{ GW})$
- Industry C: $10 \times 0.4 = 4 \text{ GW} \rightarrow$ New total: $20 + 4 = 24 \text{ GW} (< 50 \text{ GW})$

The 100 GW of available must be properly allocated, including the excess of capacity: Industry A (40 GW) + Industry B (36 GW) + Industry C (24 GW) = 100 GW. The process stops here, as no further excess capacity remains. If additional markets became saturated in later iterations, the same reallocation and renormalisation steps would be repeated until all capacity is fully allocated.

Annex 6.

NEA supply chain survey and interview methodology

This annex describes the methodology used for the 2024 NEA Global Nuclear Supply Chain Survey and the follow-up interviews conducted in 2025. The work aimed to assess supply chain readiness and questions focussed on identifying key bottlenecks and exploring solutions through investment, policy and co-operation. The methodology combined quantitative survey data with qualitative insights from interviews. Surveys provided a broad view of supply chain challenges and opportunities across OECD countries, while interviews offered deeper context and explored specific risks, trends and potential interventions.

2024 surveys

Following the first Roadmaps to New Nuclear conference in 2023, where supply chain readiness was identified as a key area of focus, the NEA, in collaboration with nuclear industry associations worldwide, conducted a series of surveys targeting different stakeholder groups across participating countries, including:

- supply chain providers;
- utilities;
- government organisations.

Respondents included 103 supply chain providers, 18 utility operators, and 9 government organisations from Asia, Europe and North America.

These surveys were distributed with the support of nuclear industry associations:

Bulgarian Atomic Forum	Nuclear Industry Association
Canadian Nuclear Association	Nucleareurope
CANDU Owners Group (now Conexus)	Nucleair Nederland
French Nuclear Industry Association	Organization of Canadian Nuclear Industries
Hungarian Nuclear Forum	Slovenian Nuclear Forum
Italian Nuclear Association	Spanish Nuclear Industry Forum
Japan Atomic Industrial Forum	Swedish Atomic Forum
Korea Atomic Industrial Forum	World Nuclear Association
Nuclear Energy Institute	

2025 interviews

To complement the survey results, six interviews and an environmental scan were conducted between March and September 2025 with participants from nuclear member associations and Tier 1 suppliers. These included representatives from Canada, France, Italy, Japan, the United States and an international utility-member organisation.

Interviews explored:

- supply chain readiness and capacity for new build projects;
- the role of government and international co-operation;
- key bottlenecks, including workforce, skills, manufacturing, logistics, financing, and component quality;
- innovation and technological evolution, including modular manufacturing, AI, digital twins, and other emerging technologies;
- standards and regulatory frameworks supporting quality assurance;
- additional factors influencing supply chain effectiveness.

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The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

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Nuclear Energy Outlook

Global Installed Capacity to 2050 and Beyond

In *Nuclear Energy Outlook: Global Installed Capacity to 2050 and Beyond* the reader will find an evidence-based global assessment of nuclear energy. Tracking nuclear energy projects across the OECD and beyond, the publication examines progress with the long-term operation of existing reactors, large-scale new build and the deployment of small modular reactors. It also reviews the policy and legislative measures shaping project development and progress towards long-term objectives, including the ambition to triple installed nuclear capacity by 2050.

Through four scenarios to 2050 and beyond, the report explores how global nuclear capacity could evolve under different conditions. It identifies the investment frameworks, supply chain capabilities, workforce needs, industrial readiness and international co-operation required to turn ambition into delivery. For governments, industry and stakeholders it offers a clear reference point for understanding the choices that will shape nuclear energy's potential role in future energy systems.