KPMG

Which role can Small Modular Reactors play in Belgium's future energy mix?

Why should Belgium envisage new energy transition options?

March 2024

Which role can Small Modular Reactors play in Belgium's future energy mix?

Belgium, like many countries, is committed to transitioning to net zero emissions and embracing a sustainable energy future. The Belgian government has set ambitious goals to reduce greenhouse gas emissions and increase the share of renewable energy sources in its energy mix.

Belgium aims to achieve carbon neutrality by 2050, meaning that the country's total greenhouse gas emissions will be balanced by removing an equivalent amount of carbon dioxide from the atmosphere.

Today's societal dialogue on decarbonization focuses largely on electricity (which accounts for only 77 TWh out of the total Belgian final energy consumption of 429 TWh) and does not address the most difficult issue, namely industrial decarbonization.

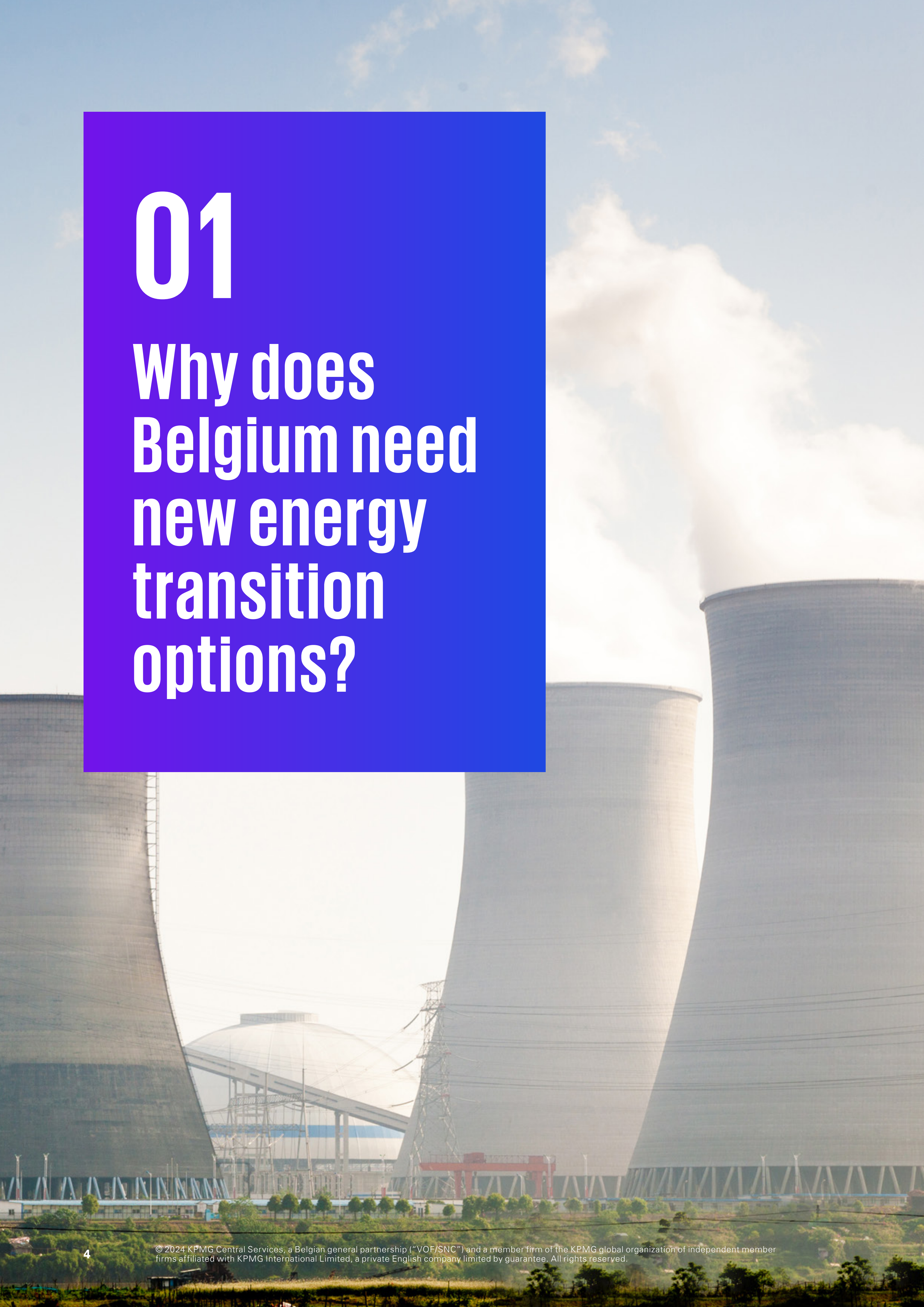
Since the Belgian energy demand exceeds the potential of local renewable energy production (about 132 TWh), the current plan towards net zero is heavily reliant on energy imports, weighing on security of supply and increasing the risks of industrial delocalization.

This document presents a view on how Small Modular Reactors (SMRs) could transform the Belgian energy landscape by addressing the toughest challenges of the 21st-century energy market, namely flexibility to accommodate intermittent production, a stable and reliable low-carbon baseload profile, industry decarbonization, improved investment attractiveness, and inherent safety.

Recent progress in licensing, financing, and technological developments confirms that several commercial grade SMRs are on track to be delivered between 2027 and 2029 in North America.

Our objective with this report is not just to present a perspective on the significance Small Modular Reactors can have in Belgium's upcoming energy mix, but also to provoke discussion and inspire our readers to explore new energy transition options. In today's era, where security of energy supply, affordability, and consideration for the environment, have rightly become focal points for all those involved, the choices we make today will undoubtedly shape our future.

Contents



01

Why does Belgium need new energy transition options?

Which should be the key building blocks of Belgium's energy strategy?

Belgium's energy strategy should address the three dimensions of the energy trilemma: security of supply, affordability, and environmental sustainability.

The Energy Trilemma

Security of supply:

Belgium should focus on diversifying its energy sources and ensuring a stable energy supply. The COVID-19 crises and the geopolitical issues have reminded us that security of energy supply is vital to a country's economic growth, national security, and environmental sustainability. It ensures stability, resilience, and long-term prosperity for the country and its citizens. Several industrials in Belgium also indicated that security of electricity supply is one of their key concerns and an important driver for investment in Belgium[1].

Sustainability:

The energy trilemma emphasizes the need for sustainable and environmentally friendly energy solutions. Belgium can prioritize the reduction of greenhouse gas emissions, promote renewable energy sources, and implement energy-efficient practices. This can contribute to preserving the environment, mitigating climate change, and achieving long-term sustainability goals.

Belgium can develop an energy strategy that encompasses all three dimensions, leading to a balanced, and sustainable energy system.

Affordability:

Affordable energy is essential for societal prosperity as it enables businesses and industries to thrive by reducing operational costs. This, in turn, stimulates economic growth and creates job opportunities, ultimately contributing to a vibrant and prosperous economy. Accessible energy prices directly impact the affordability of essential services, such as heating, cooling, and electricity. When energy costs are reasonable, individuals and families can allocate their budgets effectively, leading to improved living standards and overall quality of life. Moreover, affordable energy is a vital tool in reducing poverty. A report from the Koning Boudewijnstichting/Fondation Roi Baudouin[2] indicates that more than 1 out of 5 households in Belgium is experiencing energy poverty.

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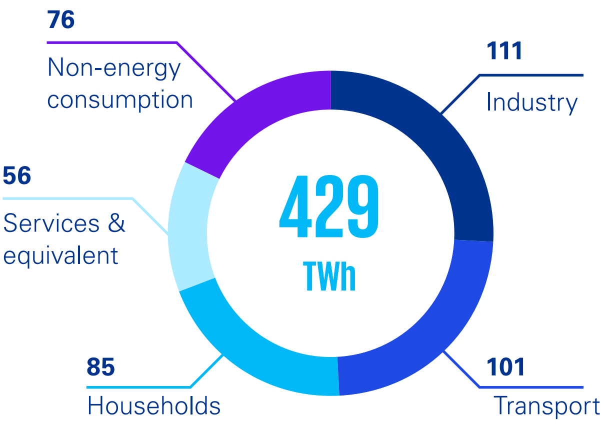
1 *Febeliec Report*
2 *Barometers energie- en waterarmoede | Koning Boudewijnstichting (kbs-frb.be)*

What is the magnitude of the endeavor to move away from fossil fuels?

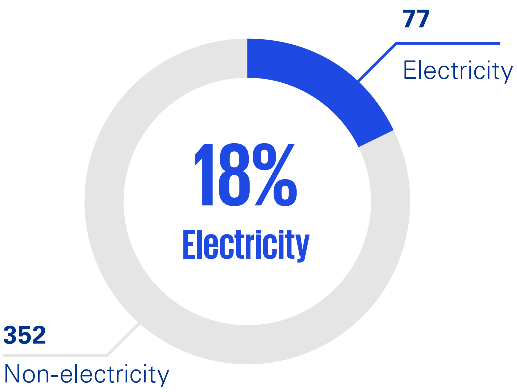
Belgium, as a highly industrialized country with a strong economy, requires a substantial amount of energy to power its industries, businesses, and infrastructure. According to the latest report from FPS Economy[3] final energy consumption amounted to 429 TWh in 2022.

Figure 01 : Final energy Consumption per sector in TWh in 2022



Over 85% of the energy sources comes from imported fossil fuels such as gas, oil, and coal. Moreover, electricity accounts for only 18% (77 TWh) of Belgium's final energy consumption.

Figure 02 : Share of electricity in final energy consumption in TWh in 2022



This share is expected to increase progressively with the electrification of energy uses (e.g., heat pumps and electric vehicles). Elia, in its Adequacy & Flexibility study of June 2023 estimates the yearly electricity consumption to be well above 100 TWh in 2030[4].

Public debate has mainly concentrated on how to green electricity production, but alternatives should be found for non-electrifiable hard-to-abate sectors such as energy-intensive industrial processes and long-distance transport. Moreover, solutions should be found to store energy to enhance reliability and deal with intermittency.

The Belgian Federal Strategy & Vision for hydrogen report estimates an import need of 200 to 350 TWh of H2 or derivatives, of which half will be for transit to neighboring countries[5]. Creating a completely new value chain and importing such large quantities of green molecules will entail important barriers that will need to be overcome.

By diversifying energy sources and investing in domestic energy production, countries can ensure a stable and sustainable energy future. Recent experiences highlight the risks of over reliance on energy imports to enhance energy security, economic stability, geopolitical independence, environmental sustainability, and promote local job creation and economic growth.

What are Belgium's options given its geographical characteristics?

The energy strategy of Belgium should take its geographical constraints into account. Our kingdom has no domestic fossil fuel resources, and it has a relatively flat topography, which is impractical for large hydroelectric projects.

However, our country is well interconnected with neighboring countries and belongs to an exclusive economic zone of about 3000m² with greater than 8m/s wind speed, which is ideal for offshore wind projects.

EnergyVille considers that Belgium's potential for renewables is about 132 TWh[6] (with 24 TWh available in 2022[7]). Contemplating the decommissioning of all nuclear power plants, except for Doel 4 and Tihange 3 as presently planned, Belgium is faced with the prospect of relying significantly on imports and investing in new nuclear capacity. These two alternatives, renewables and nuclear, could harmoniously coexist.

3 Belgian Energy Data Overview - Editie winter 2024 (fgov.be)
4 Elia publishes its adequacy & flexibility study for Belgium for the period 2024-2034
5 View-strategy-hydrogen.pdf (fgov.be)
6 BREGILAB project releases online tool visualize technical wind and solar potential - EnergyVille
7 Belgian Energy Data Overview - Editie winter 2024 (fgov.be)

“A climate-neutral energy system will require a balanced mix of technologies. Including nuclear energy will lead to lower system costs for all Belgian consumers.”

Peter Claes,
Director General, Febeliec

02

How can SMRs enable new solutions?


Holcim
ALADIN

What are SMRs?

The International Atomic Energy Agency defines a small modular reactor as having an electricity output of up to 300 megawatts electric, about a third of the output of a conventional reactor and takes up a fraction of its physical size. An SMR is built in a modular fashion in a factory and shipped as a unit to where it will produce power, rather than assembled on-site.[8] There are only a few models of SMR reactors operating worldwide at present, although there are several dozen more under construction, planned for deployment soon or at earlier stages according to the World Nuclear Association.[9]

While existing nuclear reactors were designed to meet the needs of the 20th century namely, baseload production of electricity, SMRs could offer a range of new technology options that can provide answers to the crucial questions of the 21st century in terms of applications, flexibility, financial attractiveness, safety features, and ESG considerations.

> **Reaching carbon neutrality will require all clean energy solutions available. SMR technologies can be an essential component to meeting the needs of the industry in the next decade. And that starts with mature water-cooled SMRs that can be deployed before 2035."**
>
> **Denis Dumont**
> CEO – Nuclear, Tractebel Belgium

Different applications

Small modular reactors have the potential to play a significant role in addressing the toughest energy transition challenges: namely by facilitating the production of hydrogen and high temperature heat, by providing flexibility and enabling GWh scale energy storage. In addition, some SMR designs can use recycled fuel.

Heat generation:

SMRs not only generate electricity but can also produce large amounts of heat. This heat can be harnessed and utilized for various purposes, such as district heating and industrial processes. By integrating SMRs into heat networks, they can provide reliable and low-carbon heat to communities and industries, thereby reducing dependency on fossil fuel-based heating systems.

Production of hydrogen:

Hydrogen is considered a versatile and sustainable energy carrier that can be used to decarbonize various sectors, including transportation and industry. SMRs can produce hydrogen through a process called electrolysis. By leveraging the electricity produced by SMRs, electrolysis can split water molecules into hydrogen and oxygen gases. This hydrogen can then be stored and used as a clean and efficient fuel source.

Circular fuel economy:

Some SMR designs, namely fast reactors, can run on "recycled fuel" made from depleted uranium and other by-products of uranium used in conventional nuclear power stations. This could contribute to resource sustainability, waste minimization, and enhanced proliferation resistance in nuclear energy generation.

Flexibility:

SMRs have the potential to contribute to the flexibility of the energy system in several ways:

Modular Design: SMRs have a smaller power output compared to traditional large-scale nuclear power plants. Their modular design should enable easier and faster deployment, allowing for incremental capacity additions and flexibility in meeting various energy demands.

Load Following Capability: SMRs can be designed with enhanced load-following capability, which means they can adjust their power output more quickly to match the fluctuations in demand. This flexibility allows them to complement intermittent renewable energy sources like wind and solar, ensuring a more stable and reliable energy supply.

8 What are Small Modular Reactors (SMRs)? | IAEA
9 Small nuclear power reactors - World Nuclear Association (world-nuclear.org)

Co-location and Hybridization: SMRs can be co-located with other energy sources, such as renewables or energy storage systems. This enables the integration of different energy technologies into a single flexible energy system. They can provide a constant and reliable baseload power while renewables meet the variable demand.

Decentralized Power Generation: SMRs can be deployed in remote and off-grid areas, reducing the need for long-distance transmission lines, and improving the overall reliability and resilience of the energy system. They can provide localized power generation, increasing energy autonomy and flexibility in meeting local energy demands.

Energy storage:

One of the key challenges in transitioning to renewable energy sources is the intermittent nature of renewables like solar and wind. SMRs can help address this challenge by providing a dispatchable and reliable power source that complements renewables. During periods of high renewable energy generation, SMRs can store excess electricity in various forms, such as thermal energy, compressed air, or through advanced energy storage technologies like molten salt or hydrogen production, allowing for more stable and consistent power supply when renewables are not sufficient. The latter is not specific to SMRs as storage technologies can be applied to any plant producing electricity or heat.

SMRs offer several advantages that make them well-suited for these applications. Their small size and modular design allow for easier deployment, scalability, and cost-effectiveness. They can be located closer to the end-users, reducing transmission losses, and enabling more efficient use of generated heat. Additionally, SMRs can be designed with enhanced safety features and flexibility to accommodate various heat and power requirements, increasing their attractiveness for different applications.

Financial attractiveness

As interest in SMRs grows, the economic competitiveness of SMRs compared to large nuclear reactors is a key topic. SMRs may have the potential to overcome economies of scale typically associated with large power plants through various strategies and inherent design advantages. SMRs offer unique features including:

Lower upfront costs

SMRs have significantly smaller power capacities (generally below 300MW) compared to traditional reactors, resulting in lower upfront investment costs. This makes them more financially viable for smaller utilities.

Factory fabrication:

SMRs are typically designed with modular components that can be manufactured in factories and easily transported to the reactor site. This standardized fabrication process lowers construction costs and reduces construction time, resulting in overall cost savings.

Scalability:

SMRs offer the advantage of scalability. Utilities or countries can initially invest in a few SMRs and gradually expand their capacity as needed, minimizing the risk of investing in a large reactor that may not be fully utilized initially.

Enhanced safety features:

SMRs have inherent safety features due to their design, such as passive cooling systems and built-in containment structures. These safety features reduce the need for additional safety measures and emergency planning zones, which can lead to cost savings.

Flexibility in site selection:

SMRs do not require large sites as traditional reactors, enabling their deployment in more locations, including remote or off-grid areas. Avoiding the need for extensive site preparation and infrastructure can result in lower costs.

Enhanced operational flexibility:

SMRs can operate at a range of capacities and can be used for both electricity generation and non-electric applications, such as desalination or industrial processes. This versatility increases their economic viability by allowing them to be utilized for various applications, depending on demand.

Potential for quicker revenue generation:

Due to their smaller size and modular design, SMRs can be built and brought online more quickly than traditional reactors. This allows for earlier revenue generation, contributing to the project's financial attractiveness.

It is important to note that while SMRs offer financial advantages, they currently also face challenges such as lack of regulatory clarity, government support and established supply chain, potentially higher fuel costs, and the need for market demand to justify investment.

Learning curve effect

The price per megawatt (MW) for a First-of-a-Kind (FOAK) SMR and a series of SMRs developed subsequently can vary due to several factors associated with the different stages of technology development, economies of scale, and learning curve effects.

The initial development of a FOAK SMR involves substantial research and development costs. These costs include designing the reactor, obtaining regulatory approvals, and addressing any unforeseen challenges. These expenses contribute to a higher cost per MW for the first unit.

FOAK projects often face uncertainties and risks that can lead to cost overruns. These risks could include unexpected technical issues, delays in regulatory approvals, or challenges in the construction process.

As more units of a technology are deployed, there is typically a learning curve effect. With each subsequent unit, developers gain experience, optimize construction processes, and identify cost-saving measures. The modular design of SMRs is well suited for identifying and implementing cost-saving measures. This learning curve can result in a reduction in the cost per MW over time.

The development of a series of SMRs allows for standardization of designs and components. This standardization can lead to economies of scale in manufacturing and construction, reducing costs for subsequent units.

Over time, advancements in technology and engineering practices can lead to improvements in SMR designs, making them more efficient and cost-effective. These innovations may be incorporated into later units, contributing to a decrease in the price per MW.

Besides this, the regulatory approval process for the first-of-a-kind reactor can be time-consuming and costly. As regulatory authorities gain experience with a particular SMR design, future approvals may become more streamlined, reducing the associated costs.

Safety & ESG considerations

SMRs have several enhanced safety features:

Passive safety features:

SMRs incorporate passive safety systems that rely on natural phenomena like gravity, natural circulation, and convection for cooling and shutdown in case of emergencies. These systems reduce the reliance on active safety mechanisms and human interventions, increasing their reliability and safety.

Reduced fuel inventory:

SMRs typically have a smaller core and fuel inventory compared to traditional reactors. This means smaller amounts of radioactive material in use, lowering the potential consequences of accidents.

Robust containment structures:

SMRs are designed with robust containment structures that can withstand external impacts and natural disasters, minimizing the risk of radioactive material release.

Lower reactor power output:

SMRs typically have lower power outputs, reducing the scale and potential consequences of any accident.

03

Why are SMRs a credible option for Belgium?

Nuclear energy currently holds a significant position in the energy systems of numerous countries, contributing to about 10% of the world's electricity through 436 operational nuclear power reactors[10]. These reactors, typically of gigawatt scale, play a crucial role in supplying non-emitting baseload electricity to the grid. There is potential for nuclear energy to have an even more substantial impact. According to recent analysis by the Nuclear Energy Agency, meeting the average requirements outlined by the Intergovernmental Panel on Climate Change (IPCC, 2018) for a 1.5°C scenario necessitates a threefold increase in global installed nuclear capacity, reaching 1,160 gigawatts by 2050 [11,12]. This expansion can be accomplished by extending the operation of existing nuclear reactors, implementing large-scale Generation III nuclear projects, and deploying SMRs for both power generation and non-power applications.

The market for SMRs is gaining attention and support for their potential to provide flexible and scalable nuclear power solutions for a wider range of users and applications, offering solutions for decarbonizing electricity, heat, and industry.

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10 *World Nuclear Power Reactors | Uranium Requirements | Future Nuclear Power - World Nuclear Association (world-nuclear.org)*
11 *The NEA Small Modular Reactor Dashboard_Volume 1.pdf*
12 *The NEA Small Modular Reactor Dashboard_Volume 2.pdf*

$6.2bn
Value of the global SMR market in 2023 (USD)[13]

$7.6bn
Projected value of the global SMR market by 2030 (USD)[12]

The SMR market is in the early stages of development with activity significantly increasing. There are currently five SMRs in operation around the world, with a further four under construction and around 65 at design stage[14].

The market is fragmented along technology lines. The four main technologies being developed are: light water reactors, fast neutron reactors, graphite moderated high temperature reactors, and various kinds of molten salt reactors. Innovative designs range in size from 5 MW electric up to 300 MW electric. They vary in outlet temperatures from about 285°C to nearly 900°C, with some designs in research and development stage seeking to exceed 1000°C.

Global leading policies

United States
The Advanced Reactor Demonstration Program (ARDP) was launched in May 2020 as part of the Department of Energy (DOE) to support the development and deployment of advanced nuclear technologies through cost shared partnerships with the US industry. Under this program, the DOE awarded Terrapower about 2bn$ for the Natrium™ Demonstration in Wyoming and awarded X-energy about 1,2bn$ for the Xe-100 Demonstration in Washington State[15].

Canada
In 2020, the federal government launched its SMR action plan, which identifies and outlines the various actions being executed for advancing the SMR projects recommended under Canada's SMR roadmap[16]. Several projects obtained government funding and an SMR at Darlington is expected to be commissioned by the late 2020s[17].

United Kingdom
The 2022 Energy Security Strategy recognizes SMRs as a key part of its 24 GW by 2050 nuclear ambition. Great British Nuclear set up by the UK Government to drive delivery of new nuclear projects in the UK is currently undertaking a technology selection process for selecting SMR technologies.

Europe
On 7 February 2024, the European Parliament reached an agreement designating nuclear power as a strategic technology for the EU's decarbonization efforts. This acknowledgment highlights the importance of nuclear power in realizing the objectives outlined in the Green Deal. The approved list of technologies includes established nuclear designs as well as third and fourth-generation technologies such as SMRs and Advanced Modular Reactors (AMRs).

Simultaneously, the European Commission aims to establish an industrial alliance to support the development of SMRs, with the goal of having the first reactor operational by 2030 in countries opting for this approach. The alliance aims to bring together key stakeholders, including industry players, research organizations, government officials, and civil society groups, to expedite the growth of the nuclear industry. Initially, the focus will be on SMRs based on proven third-generation nuclear technologies, while also encompassing AMRs in its scope[18].

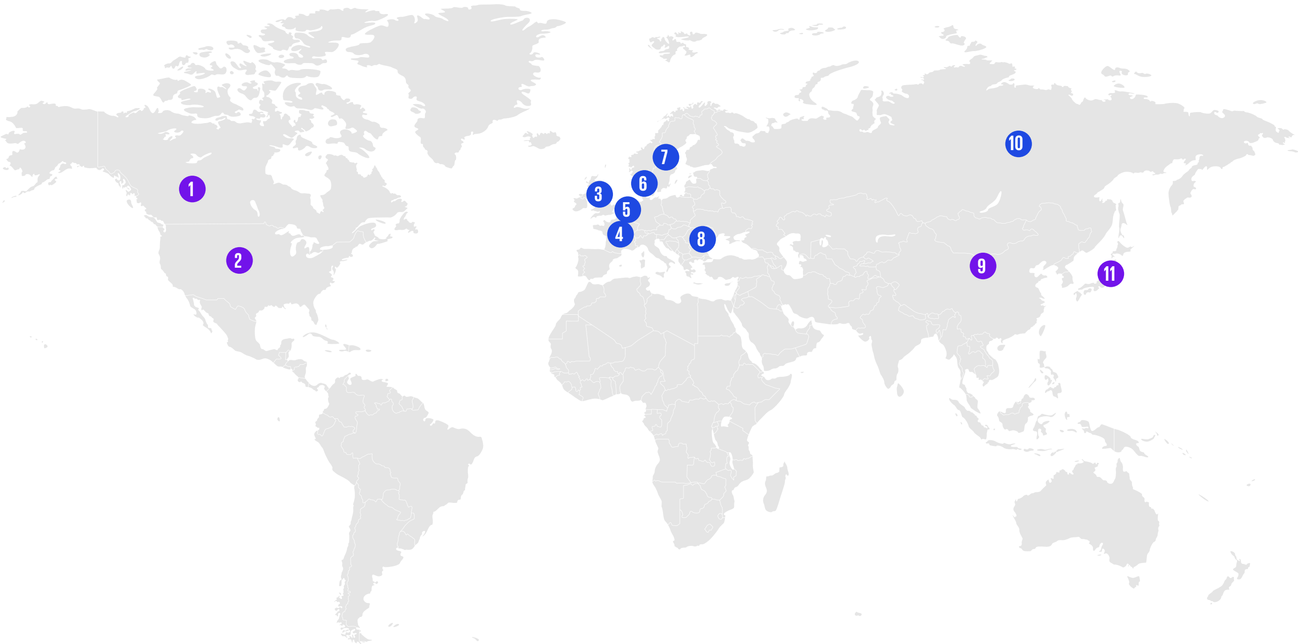
> **“The chemical and life sciences industry stands as Belgium's largest and most efficient industrial energy consumer. Secure access to competitive and low-carbon energy carriers is essential for its future existence in Europe during the transition to climate neutrality. Nuclear energy and SMRs could offer promising solutions in this perspective. Given the challenging developments in technology and cost that need to take place, policymakers must provide a robust regulatory framework to successfully integrate these technologies in Belgium's future energy mix. This starts with the urgent modification of the 2003 nuclear exit law.”**

Yves Verschueren,
Director General, Essenscia

13 *Small Modular Reactor Market Size To Hit USD 8.06 Bn By 2032 (precedenceresearch.com)*
14 *Small nuclear power reactors - World Nuclear Association (world-nuclear.org)*
15 *Nuclear Energy Projects: DOE Should Institutionalize Oversight Plans for Demonstrations of New Reactor Types [Reissued with revisions on Sept. 15, 2022] | U.S. GAO*
16 *More details can be found here: A Call to Action: A Canadian Roadmap for Small Modular Reactors (smrroadmap.ca)*
17 *More details can be found here: Our story | OPG's Darlington Small Modular Reactor project passes significant milestones – OPG*
18 *EU aims to deploy Europe's first small nuclear reactor 'by 2030' – Euractiv*

Key players

SMR designs are at various stages of development, with regional differences emerging



Key players in Europe[19]
SMR designs are at various stages of development, with regional differences emerging

Other global key players[20]
Growing investment in industrial demonstration initiatives

1 Canada

BWRX-300
GE Hitachi has entered phase 2 of the Canada Nuclear Safety Commission's (CNSC) pre-licensing Vendor Design Review. In October 2022, OPG submitted an application to the CNSC for a license to construct one reactor at the Darlington site in Ontario.
Secured private and public funding, including a 0,8bn$ in financing support and the ability to recover costs associated with the construction and operation of the project from the electricity ratepayer through a regulatory amendment.

2 United States

VOYGR
The design was approved by the US Nuclear Regulatory Commission in 2020. In 2020, the Department of Energy (DOE) approved a multi-year cost-share award of 1,355 bn$ for the development and construction at the US DOE Idaho Laboratory site. This project, developed by Nuscale, was recently terminated due to lack of subscription.

Natrium
Terrapower was selected as one of the two awardees of the US ARDP in October 2020 and received an 80m$ initial funding. The ARDP authorized 1,23 bn$ for the Natrium nuclear reactor demonstration. Terrapower has also secured over 1bn$ in funding for Natrium through one of the largest private capital raises in advanced nuclear industry. The technology is undergoing pre-licensing with the US Nuclear Regulatory Commission.

XE-100
X-energy was selected as one of the two awardees of the ARDP in October 2020 and received 80m$ initial funding. The ARDP currently authorized 1,23 bn$ across seven years. Xe-100 is shortlisted by Energy Northwest for their nuclear-licensed site in Richland Washington and is currently undergoing pre-licensing review by the US Nuclear Regulatory Commission.

19 *We have selected the most advanced projects from the first and second edition of [Nuclear Energy Agency (NEA) - The NEA Small Modular Reactor Dashboard (oecd-nea.org)] and added the project of SCK CEN in Belgium.*
20 *We have selected the most advanced projects from the first and second edition of [Nuclear Energy Agency (NEA) - The NEA Small Modular Reactor Dashboard (oecd-nea.org)]*

3 United Kingdom

Rolls-Royce SMR
Design certification application in progress. The UK Nuclear Decommissioning Authority (NDA) is exploring possibilities to support with NDA land. Has attracted more than 500m£ public and private sector funding.

LFR AS 200
This is a 480 MWth fast spectrum lead-cooled reactor using MOX and is developed by Newcleo. Three-step approach: beginning with the construction of an electrical prototype in Italy, followed by a first-of-a-kind mini 30 MWe LFR in France, before deploying the LFR 200 in the United Kingdom. Raised 400m€, and is working to additionally raise up to 1,0bn€ equity.

4 France

NUWARD
The nuclear safety authorities in France, Finland and Czech Republic are collaborating on the pre-licensing. The French government has provided more than 500m€ in funding for development.

5 Belgium

New demonstrator project
SCK CEN is in the process of developing an LFR demonstrator project. Granted 100m€ by the Belgian government.

6 Denmark

Seaborg CMSR (MSR)
Currently aiming to complete concept verification in 2024 with delivery of first barge in 2028.

CA Waste Burner (MSR)
First test of demonstrator is planned for 2025.

7 Sweden

SEALER-55 (LMFR)
LeadCold Reactors (renamed Blykalla) formed a JV with Uniper.

The development of the reactor is planned as an iterative process. Construction of an electrically heated protype is expected in 2024, to be followed by the deployment of the nuclear demonstration reactor at the same site by 2030.

8 Romania

ALFRED
A 300 MWth demonstration, ALFRED4, unit will be built at ICN's facility in Mioveni, near Pitesti. The total cost of the project is put at some 1,0bn€ (1,1bn US$)

9 China

ACPR50S
This first demonstration project of the floating nuclear power plant is under construction. Its purpose is to support deep-water oil and gas exploration in the South China and Bohai seas. The project is fully owned by China General Nuclear Power Corporation (CGNPC), a state-owned enterprise.

ACP100
Preliminary safety approval obtained in 2020. Construction of one reactor started in 2021. The project includes two ACP100 reactors. Wholly-owned by China National Nuclear Corporation (CNNC), a state-owned enterprise.

HTR-PM
The 500 MWth high-temperature gas-cooled (HTGR) pebble-bed generation IV reactor is fully licensed and financed. It is operating and connected to the grid as Shidaowan Nuclear Power plant in the Shangdong province.

10 Russia

In 2021, the Russian government approved a project cost of 6,9bn$ for new nuclear technologies by 2030.

BREST-OD-300 (LMFR)
Under construction at the Siberian Chemical Combine in Seversk. Installation of the reactor base plate began in July 2022 and the reactor is scheduled to begin operation in 2026.

RITM-200N
Six RITM-200 units are licensed and in operation on dual-draft ice breakers. Licensing for the land-based RITM 200N will benefit from past-precedence. License to construct is currently under consideration.

RITM-200S
This is a marine-based SMR in the RITM-200 series. A license to construct is currently under consideration to supply power and heat to the Baimskaya copper mine. The first unit is expected to be deployed in 2027.

11 Japan

HTTR
The High Temperature Engineering Test Reactor is an operating 30 MWth high-temperature gas-cooled reactor built to advance technology readiness. Operations started in 1998. The construction was led by Toshiba, Hitachi, Fuji Electric, and Mitsubishi Heavy Industries.

Belgium's past successes in terms of nuclear energy

Belgium's successful development and construction of its seven nuclear power stations, totaling approximately 6 GW[21], can be attributed to a combination of key factors starting with the Belgian government's strong commitment to nuclear energy as part of its long-term energy strategy during the 1960s and 1970s. Significant investments were made to diversify energy sources and reduce reliance on fossil fuels.

International collaboration played a pivotal role as Belgium partnered with experienced nuclear countries, such as the United States. In 1956, SCK CEN mandated the Nuclear Development Corporation in New York with the design. A large delegation of researchers from SCK CEN, engineers from Tractebel and designers and operators joined the local development team. This collaboration facilitated the transfer of technology, expertise, and knowledge, expediting the overall progress of Belgium's nuclear program. In 1961, the Prime Minister, the Euratom President, the US ambassador and the Minister of Economic Affairs attended the launch of the Belgian Reactor 2 (BR2).

The operation of BR2 began with a cooperation agreement concluded between SCK CEN and the European Atomic Energy Community (Euratom) which allowed trans-national research programs.

The country also focused on cultivating technical expertise in nuclear technology. Investments in education and training for scientists, engineers, and technicians specializing in nuclear energy ensured a skilled workforce capable of effectively managing and operating nuclear power plants.

Public-private partnerships were established to fund and manage the construction and operation of nuclear power plants. This approach allowed for efficient resource allocation and risk-sharing between the government and private industry.

Belgium's commitment to stringent safety and regulatory standards was crucial for gaining public acceptance and ensuring the long-term viability of the nuclear industry.

A stable political environment throughout the planning and construction phases of the nuclear power plants was another contributing factor. Political stability and cross-party political support are essential for the success of long-term projects involving significant investments and potential risks.

In addition, Belgium invested in ongoing research and development to continuously enhance nuclear technology, improve safety features, and address environmental concerns.

21 The operation of Doel 3 (1006 MW) and Tihange 2 (1008 MW) has been halted in September 2022 and January 2023 respectively. This leaves the country with 4 GW of nuclear capacity in operation. During the following years, the other nuclear plants will be shut down, except for Doel 4 (1039 MW) and Tihange 3 (1038 MW) which are envisaged to be extended until 2035.

04

How to make it happen

During the COP 28, more than 20 countries launched the Declaration to Triple Nuclear Energy by 2050.[22] They recognize the key role of nuclear energy in achieving global net-zero gas emissions by 2050 and keeping the 1,5°C target within reach.

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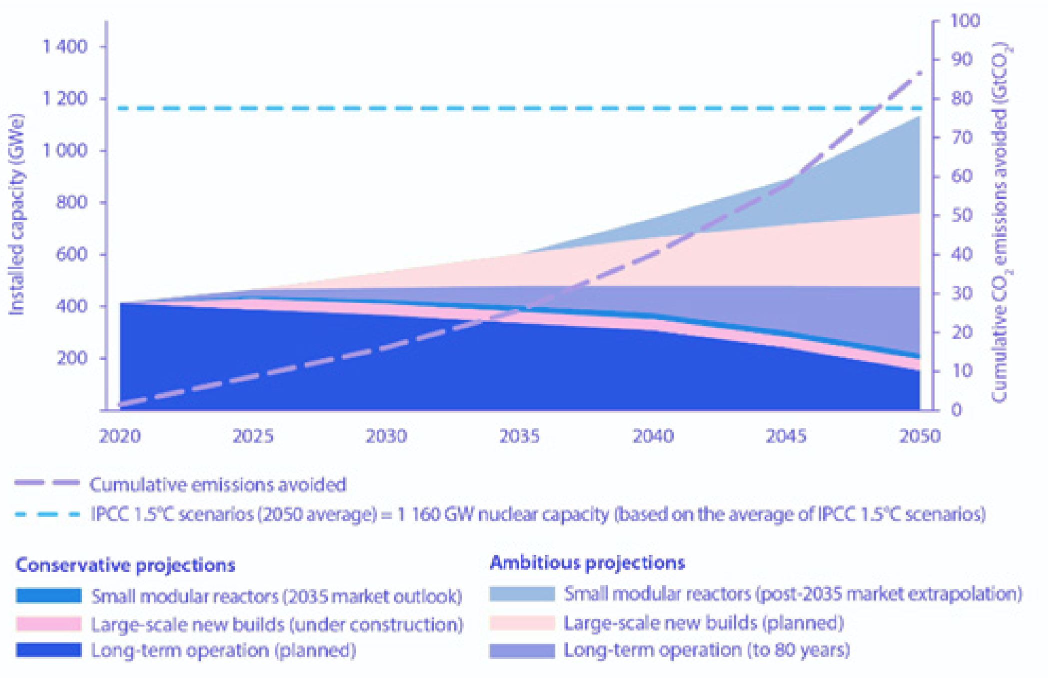
22 At COP28, Countries Launch Declaration to Triple Nuclear Energy Capacity by 2050, Recognizing the Key Role of Nuclear Energy in Reaching Net Zero | Department of Energy

Figure 03



Source: Nuclear Energy Agency (NEA) - Countries launch joint declaration to triple nuclear energy capacity by 2050 at COP28 (oecd-nea.org)

SMRs represent a promising set of technologies that could contribute to the realization of Belgium's climate goals. Over the last decade, the SMR industry has largely been in a mode of technology development. The developers of these new technologies must now make the transition from technology development to project delivery.

While finance will need to be unlocked across all phases of the project lifecycle, funding project development presents the most immediate challenge. If reactor developers see themselves only as "technology providers", then someone must play the role of "project developer". This is a crucial, high-risk, and costly phase of the project lifecycle and involves critical activities including siting, consenting, developing funding mechanisms, and procurement. With no organizations currently capable of fulfilling this role, this task could be delivered by:

- Technology providers transitioning into project developers;
- Regulated utilities and other private sector entrants; or
- Government or their Arm's Length Bodies (ALBs).

While governments might drive demonstration projects forward, credible parties will need to take on the role of project developer if SMRs are to play a meaningful part in addressing the nuclear COP 28 challenge. To unlock private sector involvement, project developers will require appropriate remuneration for the risk taken, and/or the presence of a robust regulatory framework to de-risk this critical phase. Without project developers, there will be no viable projects and the 3x challenge (to Triple Nuclear Energy) cannot be met.

Once a robust pipeline of new projects is established, the challenge continues since projects must also be structured in a manner to secure financing over the entirety of the remaining lifecycle: construction, operation, and decommissioning. This is a highly complex area with many lessons which could be learned from the recent large nuclear new build programs in Europe. From precedent new builds, it is apparent that the development of an appropriate funding mechanism is a key driver in unlocking private sector equity. The sector is still considered to be limited by a constraint in financing capacity which has often required governments to step-in.

There are three key financing challenges to overcome: financing project development, developing appropriate funding mechanisms, and financing project delivery. All these elements will need to be addressed to create an investible proposition and to unlock financing for the sector. Importantly, the structuring for these first projects should be cognizant of the wider program of SMRs. The model should strive to be replicable and adaptable to support "nth-of-a-kind" projects. The remainder of this section considers these three challenges in more detail.

Financing project development

Beyond technology risks, there remains a significant risk of project abandonment due to an inability to obtain key consents or being unable to source investment and achieve final close. This risk may be fully borne by the State, through the development of a State-owned development company[23], but this presents a significant challenge given the scale of deployment needed to achieve the goals from a financing and human resource perspective. Sourcing private sector project developers remains a key challenge.

Project development companies can be private institutions who bear all development risks of the project. However, these are typically reserved for mature asset classes where risks are known, and a clear investment appetite exists. It is unlikely that the private sector will be willing to come forward to take this role without significant State support in the form of grants, or other forms of government support.

Alternatively, private sectors can develop the pipeline through a regulatory framework (i.e. similar to utilities regulatory frameworks). There are several instances of this across regulated markets where an economic regulator will grant development allowances to licensed utilities, which allows development costs to be collected from revenues from customers as they are incurred. This significantly de-risks the development activities for the utilities by transferring the risk of project abandonment to customers. Examples of such regulatory mechanisms can be found across Europe, including those carried out by the different regulators in Belgium[24] to regulate the transmission and distribution of electricity and natural gas.

Current status of the global SMR market

The SMR project development landscape is complex, with several expressions of interest for SMR fleets of varying sizes. The project developers who have announced the largest pipelines have a degree of commonality in that they benefit from significant state ownership, effectively sharing the development risk with taxpayers. Notable examples include:

- Ontario Power Generation (OPG), SaskPower, and Tennessee Valley Authority (TVA) have all expressed interest in deploying SMRs at multiple sites and are all 100% state-owned entities.
- OSGE is a 50:50 joint venture (JV) with PKN Orlen (49.9% state-owned) and Synthos Green Energy (privately held) which recently announced 24 SMR units across six locations[25].

Smaller scale deployment of single unit SMRs has attracted some private sector-led development, but with varying degrees of state support. Notable examples include:

- RoPower, a 50:50 JV of Societatea Nationala Nucleareletrica (100% state-owned) and Nova Power & Gas (privately owned), is taking steps to deploy the first SMR in Romania. In July 2023 DS Private Equity (DSPE) invested €75m into the project's Phase 2 FEED study.[26]
- Fermi Energia, a project development company, plans to deploy GE Hitachi reactor technology in Estonia. Fermi Energia is owned by its founders, with institutional investors holding minority shareholdings including Vattenfall AB, and Tractebel.[27]
- KGHM Polska Miedź SA (31.79% state owned) is a Polish copper mining company that is exploring the possibility of building a nuclear power plant using one of the following light water SMR technologies to meet its long-term power needs: UK-SMR (Rolls-Royce), Nuward (EdF), VOYGR-6 (NuScale), SMR-300 (Holtec) or BWRX-300 (GE-Hitachi).
- Standard Power is a US-based provider of data processing and hosting services. The company recently announced plans to deploy two NuScale reactor units to help meet its long-term power requirements.

The current SMR landscape suggests that development still requires government-led support in the initial phase. This mirrors the market for large scale reactors where European new builds have typically been dominated by companies with significant state ownership: EdF (100% state-owned), CEZ (69.8% state-owned), PEJ (100% state-owned), MVM Group (100% state-owned), and Societatea Nationala Nucleareletrica (100% state-owned). Although there have been instances of private sector development – such as the Mankala model (which was the only instance of cooperative financing) and the Horizon Nuclear program (which failed to achieve FID) – these have not proved to be replicable.

The UK remains one of the potentially large markets for nuclear deployment, and the sector is rapidly evolving. Following the launch of the state-owned Great British Nuclear (GBN) in 2023, the UK's strategy appears to be for GBN to be a founding shareholder in the initial SMR development companies - after which it will "set up future development companies to

23 *Notable precedents for large scale nuclear reactors include EDF (100% owned by the French Government), and CEZ a.s. (69.8% owned by the Czech Government).*
24 *CREG, VREG, CWaPE and Brugel.*
25 *Poland approves construction of SMR nuclear units at six sites | Reuters*
26 *DSPE to invest EUR 75 million in RoPower to develop the Doicesti SMR Power Plant in Romania – Nuclearelectrica*
27 *https://www.funderbeam.com/company/fermi-energia-as*

support SMRs" whose ownership is to be decided.[28] The UK Government has made clear that they welcome private sector involvement in their recent Civil Nuclear Roadmap.[29] This may be supported by the introduction of a nuclear regulatory framework which is currently being developed for Sizewell C (see UK case study).

However, regulatory frameworks for nuclear remain untested and alone may be insufficient to attract investment. The viability of such frameworks will also be influenced by the credibility of the regulator, which will be an added challenge for countries with a nascent nuclear sector or without a strong regulatory precedence.

Developing an appropriate funding mechanism

Funding refers to the revenue that the generator will receive during operations to meet operational costs, asset maintenance, debt service costs, and shareholder returns. Infrastructure typically involves high-upfront costs, debt finance, volatile market prices, and construction and operational phases times which push positive cashflows into the future. Without a clear funding stream and ability to meet these costs, it can be difficult to access the finance needed to deliver the new infrastructure.

Solutions have been found across the wider infrastructure space through the development of longer-term Power Purchase Agreements (PPAs), contract for difference contracts (CfDs), Cap & Floor regimes, and regulatory frameworks. These typically have the effect of sharing key project risks directly with customers or state-owned offtakers, thereby reducing the overall risk profile of the project for capital providers and making the project more attractive. These mechanisms also tend to have the effect of limiting upside for the investors and ensures that the customers or offtakers are fairly remunerated for the risks they are taking.

Nuclear technologies bear many of the same risks as wider infrastructure projects, but to a greater extent. The propensity for cost overruns during construction and exposure to long-term electricity prices has limited the nuclear sector's ability to obtain finance. Where successful projects have reached Final Investment Decision (FID), this has typically required bespoke funding mechanisms for each project, and in many cases they have not been replicable. The precedent funding mechanisms for European large-scale nuclear reactors are given below:

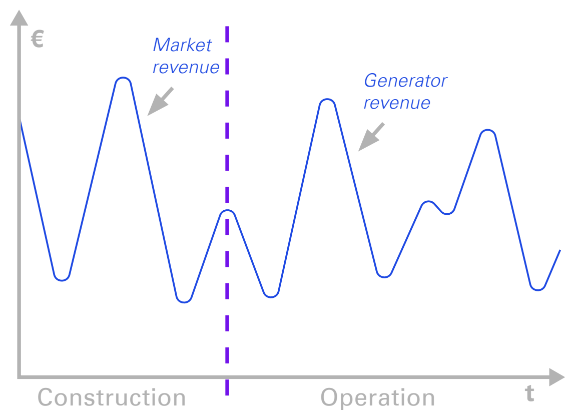
Direct exposure

Direct exposure refers to the generator selling directly to the power markets in the absence of any funding mechanism. The project company will be fully exposed to market volatility and any cashflow shortages must be facilitated by the investor to avoid insolvency.

By necessity, this requires an investor with surplus funds and a very large balance sheet. For large-scale nuclear, the only precedent for this model is through public ownership by the state, such as the UK's Magnox reactor fleet or France's EDF new build program.

To date, there is no private investor who has committed equity to a nuclear new build, except for Olkiluoto 3 under the Mankala model (discussed further below).

Figure 04: Direct Exposure



- Under Direct Exposure the generator will be fully exposed to market revenue volatility.
- The generator cashflows will be determined by the market price and cashflows will be volatile.
- Following sustained low market prices, cash reserves and shareholder funds are likely required to meet debt service costs.

28 UK Nuclear Ambitions Face Election Year | Energy Intelligence
29 Civil nuclear: roadmap to 2050 (accessible webpage) - GOV.UK (www.gov.uk)

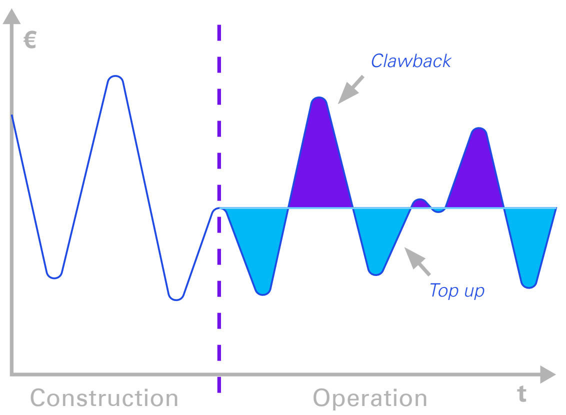
CfD

The Contract for Difference (CfD) scheme was first developed for the UK's Hinkley Point C. The underlying funding mechanism allows the generator to trade directly with the market and receive a guaranteed return per MWh (the 'Strike Price') but does not cover licensing risks or certain black swan risks during construction. The CfD contract mitigates the key market risk of price volatility over a 35-year operating period.[30]

To facilitate this mechanism, the UK Government launched an Arms Length Bodies (ALB), the Low Carbon Contracts Company (LCCC), to act as the counterparty to this contract.

Following the successful FID for Hinkley Point C, this model was applied to wider UK renewables to facilitate investment. These 15-year contracts were awarded via an auction process run by the UK Government.[31] Following its success in the UK, the European Commission also adopted this model for certain applications under the Electricity Market Reform in 2023.[32]

Figure 05: Contract for Difference



- Adjusts the amount of revenue the generator could have earned in the market (the "Reference Price") to equal an amount established upfront (the "Strike Price").
- The actual revenue received will be determined by the ability of the generator to achieve the Reference Price.

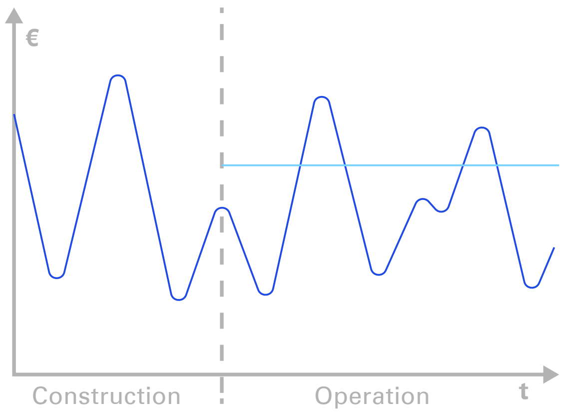
Power Purchase Agreements (PPAs)

PPAs are the most common form of long-term guarantees in the current energy market. They involve an energy supplier and an energy consumer making fixed agreements in advance covering purchases and prices over a 10-to 15-year period. PPAs generally have an immediate start date, or a start within a few years. It's not feasible to sign a PPA with a start date beyond 11-15 years in the future, as there is currently no active market due to the typical length of construction and commissioning for large nuclear plants.

For nuclear generators, longer-term PPAs can be used to reduce market price and/or volume risks for the investor. As a bilateral agreement, this requires a single large offtaker to act as the counterparty. Since it is a bilateral agreement, a PPA can take many forms and is usually tailored to the specific application.

Dukovany II in the Czech Republic serves as a current example of such a structure, where the Czech state has proposed a long-term PPA. This project is yet to reach FID, with the proposal currently being reviewed through the European Commission's State Aid process.[33]

Figure 06: PPA



- Rather than looking to mitigate market exposure while leaving incentives on equity to manage power trading, geneartor could be structured on an 'availability' basis.
- Long-term agreements to take generator capacity with a (public or private sector) counterparty, transfers market risk away from the asset owner.

Regulated Asset Base (RAB)

This model creates a project-specific regulatory framework whereby an economic regulator will provide an allowance to a licensed project company.

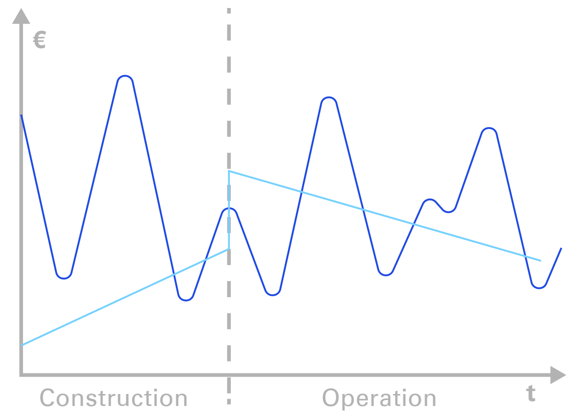
The allowance must be high enough to ensure 'reasonable' costs are covered (including depreciation costs on the investment, operating and

30 Hinkley Point C - GOV.UK (www.gov.uk)
31 Contracts for Difference - GOV.UK (www.gov.uk)
32 Electricity market reform - Consilium (europa.eu)
33 State aid – Czechia – State aid SA.58207

decommissioning costs), while also providing a reasonable market-based return on the regulated assets. A regulator, typically with the assistance of an independent third-party (Independent Technical Advisor), determines the 'reasonable costs'. Costs above the reasonable level are paid for by the private investors. This achieves a certain degree of risk allocation with customers, although needs a credible regulator to facilitate this model.

The Nuclear Energy (Financing) Act (NEFA) was passed in the UK in 2022, enabling the adaptation of this model for nuclear projects.[34] The UK Government intends to apply this model to Sizewell C, which is yet to reach financial close.[35]

Figure 07: Regulated Asset Base



- Like the contracted approach, the Regulated Asset Base (RAB) mechanism takes away market risk – substituting market revenues for an Allowed Revenue set by a regulator
- The RAB mechanism can also address other risks, such as construction and operating cost uncertainty to potentially support a lower cost of capital.

The Mankala model

This model, which is only applied in Finland, involves several parties coming together and participating in the financing of nuclear energy. A consortium is formed by multiple parties which collectively hold a majority of shares in the nuclear reactor. The private investors meet the needs of the consortium by contributing both equity and debt.

Olkiluoto 3 was financed through a combination of vendor financing and export credit, alongside the financing provided by the private participants. The vendor is obliged to deliver a turnkey reactor, and thus bears the construction risk. The French government provided loan guarantees for the project through their export credit agency.

The participants are required to purchase the generated power in quantities proportionate to their shares in the consortium. The parties can then use the energy for their own activities or sell it on the energy market. How the other risks are shared depends on separate agreements and, potentially, guarantees.

Application to SMRs

SMR technologies share many of the same risks as large-scale reactors - principally driven by the uncertainty over construction costs and exposure to long-term electricity prices due to a c. 60-year operational life.

SMRs could have an advantage in terms of financing over more traditional reactors because they are smaller and can be built more quickly through a standardized manufacturing process. However, this is still theoretical at this stage, with no commercial SMRs yet being constructed. As a result, we expect SMRs to face many of the financing constraints experienced by large nuclear. This is particularly true for early units, where investors will be exposed to FOAK risk and with construction and operational efficiencies yet to be demonstrated. This is compounded in instances where SMRs are planned to be coupled with energy storage solutions or non-grid applications such as the provision of industrial heat and power, hydrogen and synthetic fuels, and district heating. As novel solutions and applications, it is unlikely that initial investors will be willing to price in any additional revenues or efficiencies from these processes.

As a result, the implementation of appropriately structured funding mechanisms is viewed as critical in facilitating SMR delivery. Through these mechanisms, customers will share a degree of FOAK risk for initial reactors which will, in effect, be amortized over each subsequent reactor. Due to the nature of the risks and the long-term customer benefits, customers are better placed to bear some of the risks than private sector investors. This should be accompanied by a carefully designed incentive mechanism to encourage timely and on budget delivery of the project.

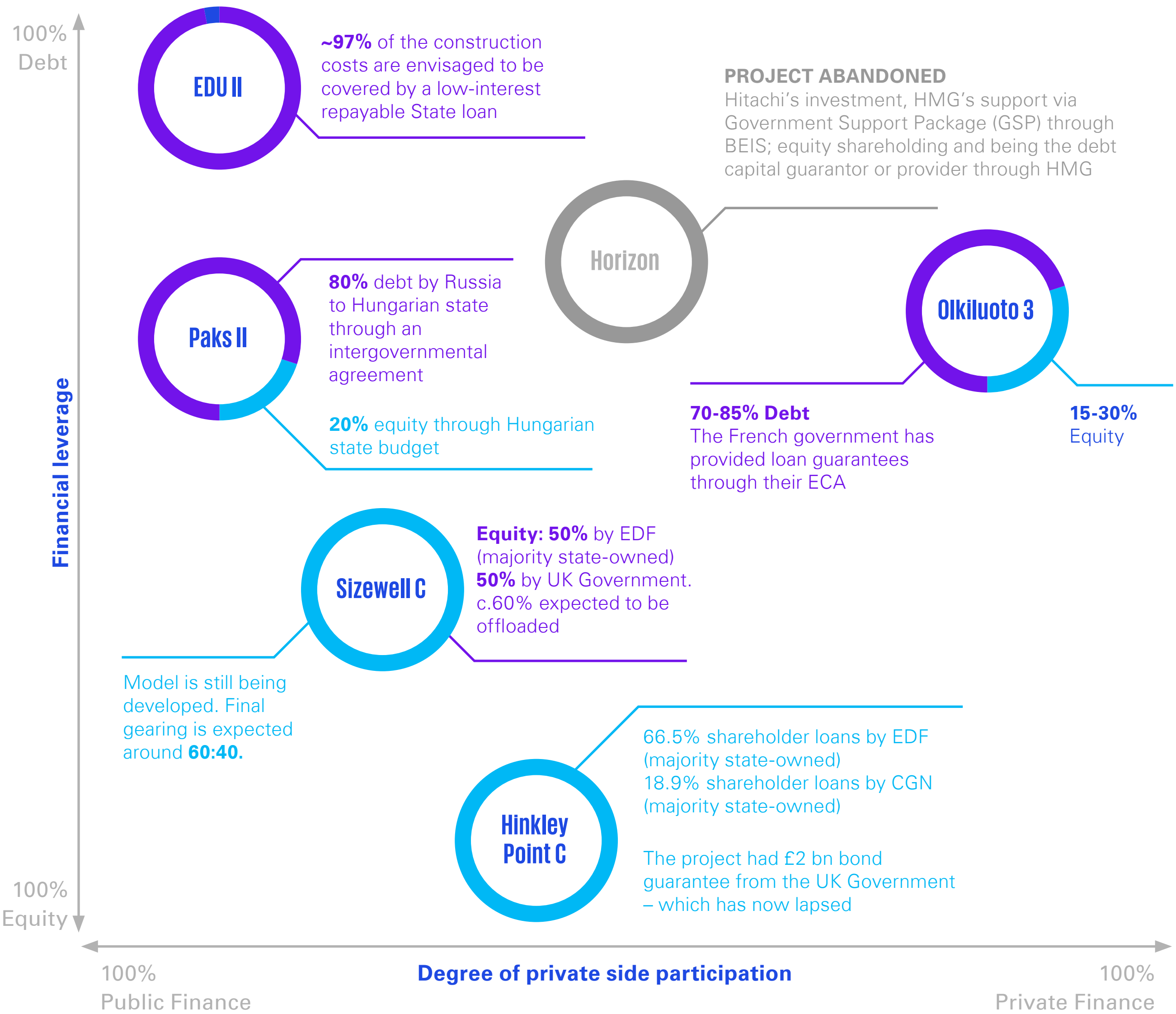
Any funding mechanism developed must be suitably structured and tailored to the specific risks faced during SMR delivery. The imminent need for increasing nuclear capacity in Belgium and the wide range of possible applications add additional complexity in that the solution should be both: i) scalable, for application across the wider SMR program, and ii) flexible, to accommodate the wide range of SMR applications.

34 Nuclear Energy (Financing) Act 2022 (legislation.gov.uk)
35 Funding Sizewell C - Sizewell C

Financing project delivery

To date, investments in delivering large nuclear projects in Europe has been underpinned by significant government intervention – whether through direct or indirect government financing or through policy interventions.

Figure 08: Precedent financing structures



In instances where debt financing has been used, it has notably been sourced from government sources. The use of commercial financing for large reactors is limited because of two primary factors:

Duration

- Long construction times result in long lead times until there are positive cashflows to service debt
- Extended recovery times due to long operational life (60 years for large reactors)

Intensity

- Large debt requirements are unattractive for financiers due to a concentration of risk
- Large construction risk borne by investors increases the risk of insolvency
- Nuclear is exposed to heightened political risk, which could result in project abandonment before repayment of principal

Notably, these risks have not been a limiting factor for large reactor developments outside Europe. The US's Vogtle 3 & 4 reactor was recently commissioned and secured 30% of its financing needs for delivery through long-term bond financing. This was achieved through significant policy interventions including government debt guarantees and the implementation of the Advanced Cost Recovery (ACR) funding mechanism, which shares construction risk with customers in a similar manner to the RAB model.

Application to SMRs

SMRs share many of the same barriers to accessing finance but have several benefits when compared to their large-scale counterparts:

Duration

- Estimated construction length is dependent on SMR reactor design but are expected to be significantly shorter than large-scale reactors, with most technology providers suggesting between two and a half to five years. Shorter lead times until debt repayment will increase the attractiveness of SMR projects for commercial lending.
- SMRs have comparable operational lives to large-scale reactors, with many designs suggesting 60 years.[36] In contrast, Holtec quotes a minimum service life of 80-years for its SMR-300, with a potential of achieving 100-years with pro-active maintenance, which indicates that some could have a longer operational life than large-scale reactors.[37] This remains significantly longer than many common sources of commercial debt, such as bank financing which is unlikely to exceed a 25-year tenor.

Intensity

- With individual SMR units being smaller than large-scale reactors, the quantum of financing required will be less than large-scale reactors. Financiers may be more willing to provide funding to SMRs due to the reduction in the concentration of risk in a single project.
- The application of new funding mechanisms such as the nuclear RAB could direct much of the construction risk away from investors and significantly reduce the risk of insolvency for financiers.
- Nuclear remains exposed to heightened political risk, but evidence of political commitment to an SMR program will act as a key market signal in mitigating this risk.
- Similarly, the presence of a respected regulatory regime will add credibility to certified reactor designs and future operational stability.

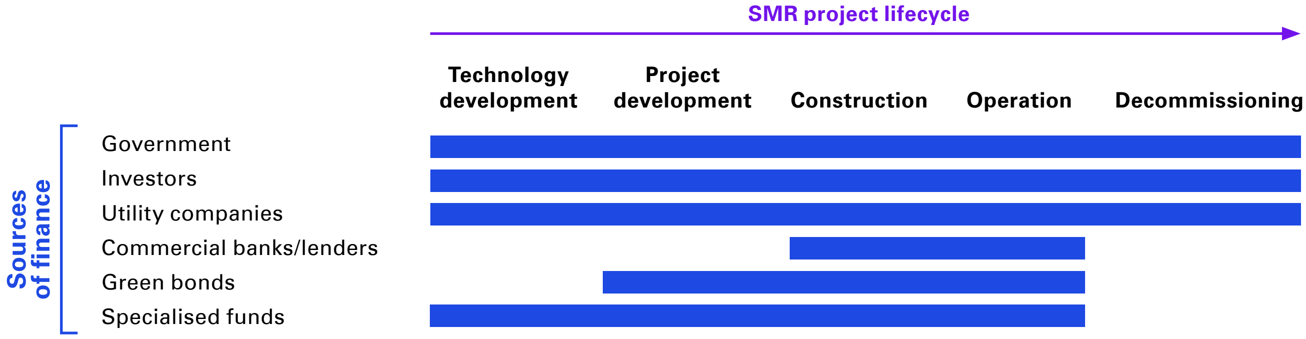
SMRs also present an opportunity to increase competition in the sector and lower the cost of capital. This is primarily driven by the reduced size of investment, which will increase the number of eligible investors and financiers and may allow more efficient financing solutions to be found. Furthermore, SMR projects are more likely to be replicable and have a greater probability of developing into a successful program. Typically, large programs with clarity on pipeline of projects are viewed to be more attractive by investors and financiers due to the ability to participate in a growing market and apply the lessons learned from earlier investments.

The reduction in duration and intensity suggests that financing may become more available for SMRs, potentially resulting in a lower cost of capital compared to larger-scale counterparts. However, this outcome will depend on the stage in the project lifecycle and the funding model applied. The diagram below illustrates the types of financing that may be available across the SMR project lifecycle. The willingness of each party to participate will be dependent on the structuring of each project, and the allocation of risk achieved through the funding mechanism and/or government support mechanisms.

36 *BWRX-300 Small Modular Reactor | GE Hitachi Nuclear (gevernova.com), Benchmark international sur le cadre de développement de l'éolien en mer (nuward.com).*
37 *FAQs - Holtec International*

An illustration of different financing sources that may be available for SMRs:

Figure 09: SMR project lifecycle



Although government, investor and utility investors have always been potential financing sources in the nuclear sector, there have been recent developments which could suggest additional sources of financing from green bonds and specialized funds. Green bonds follow the inclusion of nuclear technologies in the European Union's Green Taxonomy in 2022 and have since been used by EDF to raise €1bn for its nuclear program,[38] a first of its kind transaction in Europe. Meanwhile, specialized funds are a new development in the sector, where asset managers such as BlackRock have noted market demand for a nuclear ETF.[39] This may be joined by the International Bank for Nuclear Infrastructure (IBNI) which is currently being mobilized and intends to launch funds to invest across the entire lifecycle of nuclear technologies. Currently the IBNI has expressed interest in launching an Ordinary Operations Fund which will finance programs through long-term loans, minority equity shareholding, guarantees, hedging and investments, advisory services, and their Special Operations Fund, providing grants, concessionary loans, social impact bonds, and venture equity to specific programs.

38 *EDF announces the success of its first senior green bond issue dedicated to the financing of the existing nuclear fleet, for a nominal amount of 1 billion euros | EDF FR*
39 *BlackRock eyes potential nuclear ETF launch (etfstream.com)*

Case study: UK SMR

The UK has a strong reputation in pioneering nuclear technologies and was the first country to deploy a commercial scale nuclear reactor in 1956. The UK's nuclear generating capacity reached its peak in the 1990s and contributed c. 25% of the UK's annual electricity generation, but this has since declined to c. 15%, with most of the current capacity expected to be retired by the end of the decade. To replace its ageing fleet and achieve its net zero by 2050 goals, the UK has committed to an ambitious nuclear program which will encompass a wide range of nuclear technologies. The UK is aiming to quadruple its nuclear power by 2050 up to 24GW – the biggest expansion for 70 years.

SMRs are expected to play a key role in achieving this goal and the UK Government has taken significant steps to realize their deployment. The launch of Great British Nuclear (GBN) in 2023 was a key milestone and was accompanied by the passing of the Energy Act 2023 which gave GBN the scope needed to be a flexible, enduring delivery vehicle. GBN is currently running a technology selection process (TSP) with six shortlisted SMR designs: EDF, GE Hitachi, Holtec , NuScale Power, Rolls-Royce SMR, and Westinghouse. GBN is expected to select c. three to four technology providers to be offered government contracts for multiple units for deployment in the mid-2030s.

The UK Government are also offering direct support to technology providers, through grants to technology providers shortlisted in the TSP. These grants will support the reactor designs progress through the UK's reactor certification process (the Generic Design Assessment), which the Government is continuing to review for opportunities to streamline and accelerate reactor deployment.

With the TSP expected to conclude in 2024, GBN has recently indicated its intention to support project development. Its Chairman Simon Bowen has indicated that GBN will be the founding shareholder of the initial project development companies and that GBN are currently reviewing all the UK's remaining nuclear sites for potential deployment of SMRs.

The UK's Department for Energy Security and Net Zero (DESNZ) has also launched a consultation on alternative routes to market for new nuclear projects to consider how the government will support delivery of these projects. DESNZ recognize the difficulties in securing private investment without a funding mechanism and has indicated that the RAB model developed for Sizewell C may be a preferable option due to the risk sharing between investors and consumers, and the potential to obtain a lower cost of capital. This consultation also considers possible off-grid applications for SMRs and will continue collecting market views until the consultation closes in April 2024.

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- In quotes: Simon Bowen on UK's 24GW plan and SMR contest : Perspectives - World Nuclear News (world-nuclear-news.org)
- Alternative routes to market for new nuclear projects - GOV.UK (www.gov.uk)

05

Conclusion

The global shift towards a clean energy future and carbon neutrality is a crucial aspect of addressing climate change and creating a sustainable world. Within this context, Belgium faces unique challenges. Contemplating the decommissioning of all nuclear power plants, except for Doel 4 and Tihange 3 as presently planned, Belgium is faced with the prospect of relying significantly on imports unless it invests considerably in new nuclear capacity. This is in a context where the demand for electricity in Belgium is expected to continue to grow in the coming years.

As the public debate on decarbonization has been mostly focused on electricity production, it is important to note that electricity represents less than 20% of the total energy mix. It is imperative that we find solutions to decarbonize non-electrifiable, hard-to-abate sectors, such as energy-intensive industrial processes and long-distance transport at an affordable cost for society.

As a result, the country must find ways to meet these requirements while ensuring energy security, economic stability, geopolitical independence, and environmental sustainability. Belgium will need to diversify its energy sources and invest in domestic energy production to promote local job creation and economic growth.

More than 20 countries declared their willingness to triple nuclear capacity by 2050 at COP 28, recognizing that nuclear plays a key role in achieving climate ambitions. The development and deployment of SMRs have gained support and recognition from governments and policymakers worldwide. They emerge as a promising solution to tackle some of these challenges, offering scalable and flexible power solutions for a range of users and applications. However, while the potential benefits of SMRs are clear, caution must be exercised to ensure that safety and environmental impact are carefully considered.

Besides this, developing effective SMR funding mechanisms will be crucial in ensuring the successful delivery of new nuclear capacity, as demand for nuclear energy increases. Financing SMR projects presents significant challenges that must be overcome, including project development financing, funding mechanisms, and project delivery financing. Private sector involvement in the development of SMR projects remains a constraint, and demonstration projects need to be driven forward to facilitate the deployment of SMRs. Governments should consider the implementation of regulatory frameworks necessary to de-risk critical phases of the project lifecycle and appropriately remunerate private sector project developers for the risk taken. Belgium can learn from the experience of neighboring countries that have taken concrete steps to develop nuclear projects and SMRs. Their nuclear programs offer important insights and potential lessons.

As the country strives towards energy transition, it requires a collaborative effort of government, the energy sector, industries, and individuals to explore new solutions and make informed decisions that shape the future and achieve a clean energy transition.

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