ATSE REPORT

Small modular reactors

The technology and Australian context explained

JULY 2024

Australian Academy of Technological Sciences & Engineering

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EXECUTIVE SUMMARY

This report summarises the state of technical development and Australian context for small modular nuclear reactors in 2024.

Small modular reactors (SMRs) are a proposed nuclear power plant design with a smaller footprint than a conventional reactor.

SMRs could potentially form part of Australia's future low-carbon energy mix, utilising existing transmission infrastructure and contributing to baseload power, or providing dispatchable power in a high-renewables grid. As an emerging technology, in 2024 the cost and operational performance of this technology has not yet been demonstrated.

Currently, there are no licensed designs, or constructed or operating SMRs in Australia, or in any Organisation for Economic Co-operation and Development (OECD) countries (which are most comparable to Australia for reasons outlined in the report; in addition the reliability of publicly available information on non-OECD designs is questionable). A range of SMR designs are being actively pursued internationally; projected costs and performance attributes could only be accurately demonstrated once full-scale prototype SMRs are built. Based on developer announcements and regulatory processes, it is possible that several prototype SMRs may be licenced, commissioned and built in OECD countries by the mid-2030s.

Commercial releases could commence by the late 2030s to mid-2040s, with a mature market likely emerging during the mid to late 2040s, depending on regulatory approvals and investment and resource allocation.

A mature, well-functioning SMR market would:

- Have transitioned from full-scale prototypes to ongoing commercial SMRs delivered using well-established manufacturing facilities and robust supply chains.
- Offer a choice of SMR systems from various established and successful vendors.
- Provide transparent and proven capital and operating costs from multiple operating vendors and sites.
- Demonstrate the operational safety and environmental performance of SMRs in line with Australian society's expectations.
- Require a suitably scaled nuclear-power qualified skills base.

Currently, none of these conditions exists in Australia.

Given the nascent state of SMR development globally, associated uncertainty in costs and timelines, and relatively small size of the Australian nuclear-capable workforce, if Australia was to pursue establishment of SMRs, the least risky option would be to procure them after several designs have been commercialised and successfully operated in other OECD countries.

As the technology matures and is tested, SMRs may in the future represent a lower-cost, shorter build-time, smaller terrestrial footprint alternative to traditional, large-scale nuclear power plants.

This report identifies four potential SMR development entry points. The earlier a country enters the SMR development market, the greater the cost and technology risk. ATSE acknowledges that technological maturity is only one consideration when assessing the viability of new technologies, and encourages decision-makers to consider all factors, including infrastructure viability, investment landscape, social licence, skills and workforce capability, legislative and regulatory reform, and alternative technologies.

Federal and state moratoria on nuclear power currently disallow establishment of Australian SMRs. There is no national nuclear regulator, and social acceptance of the technology is not advanced. Foundational concepts supporting social licence include transparency, trust, ongoing dialogue with communities, clear roles and responsibilities, involvement of trusted sources (such as the CSIRO and Learned Academies), and political bipartisanship. A non-partisan approach with broad stakeholder engagement would be needed if Australia wished to advance a mature public discussion regarding whether to adopt nuclear power. Topics to be addressed would include economic viability, reliability, grid connections, private and public sector investment, environmental impact, workforce capability and job creation, governance and regulation, radioactive waste management, health and safety, and national security.

Scope of this report

This report aims to support an evidence-based conversation and build public understanding of SMR technology, by providing a factual overview of the evidence based on an extensive review of information in the public domain. This report does not promote a view with respect to establishing a nuclear energy industry in Australia.

The purpose of this report is to assist readers to understand:

Technological developments: Investigate and understand the latest advancements and innovations in the field of SMRs, including their design, safety features, scalability, and potential applications. Of importance is an understanding of the state of development and timing of commercial deployment across the various designs.

Risks and opportunities: Evaluate and assess the potential risks and opportunities associated with the deployment of SMRs, taking into consideration technological, environmental, economic, social, and wider strategic implications.

Australian context: Review and analyse existing political, regulatory, social licence, governance, investment, workforce, and other relevant constraints and opportunities regarding SMRs and their role in achieving net-zero emissions.

The following matters are not considered in this report:

- How SMRs could fit into the Australian power grid alongside renewable energy technologies.
- Analysis of the cost of supplying electricity from SMRs, including costs to consumers.
- Nuclear waste management and the relative waste burden of SMRs compared with conventional reactors.
- Potential contribution of SMRs to energy security.
- Analysis of non-OECD SMRs, noting the challenges in obtaining credible, verifiable, public information, and that OECD SMR designs are most likely to be socially accepted in Australia.
- Micro-reactor technologies, which are at an earlier stage of development than SMRs.

TECHNOLOGY ANALYSIS

Definition of SMRs

An SMR is characterised by the International Atomic Energy Agency and World Nuclear Association (WNA) as a system demonstrating the following features:

1. Reactor and other major components factory-produced, rather than custom-designed.
2. Standardised power plant infrastructure with a small physical footprint.
3. Inherent reactor passive cooling, in the case of power failure.
4. Individual capacity up to around 300 MWe (megawatts electrical – this is the unit conventionally used to describe power plant output (interchangeably with megawatts), as distinct from megawatts thermal, used to measure the thermal power input).
5. Some designs are capable of a “daisy chain” configuration - running multiple cores in one power plant (this feature is shared with conventional nuclear reactors).

Factors driving global SMR development

Different nations are moving at different rates when considering SMRs. SMR technologies are being developed in a range of nations, including the United States, United Kingdom, Canada, and Denmark. Private and state-owned energy corporations in Poland, Ukraine, and the United Arab Emirates have signed memoranda of understanding or Intention documents with appropriate caveats on timing, performance and cost.

The development is being driven by factors including:

- Nuclear energy produces low net carbon emissions compared with fossil fuel energy, with lifetime emissions from conventional nuclear plants comparable to that of wind energy.
- Nuclear energy generation has characteristics that are complementary to existing electricity generation such as solar and wind.
- Nuclear energy provides for more constant and reliable power generation than renewables, and could therefore theoretically be used to generate and distribute power as a back-up option in a grid that mostly relies on renewable energy (noting that the actual performance of SMRs as dispatchable generation will only be proven through a successful commercial scale demonstration).
- SMRs have potential to provide electricity and process heat at a significantly reduced cost compared to conventional nuclear reactors and fossil fuelled plants.
- SMRs are likely to be faster to construct than conventional nuclear and fossil fuel plants, and will occupy a significantly smaller footprint than conventional nuclear, fossil fuel, wind and solar energy generation.
- SMRs could contribute to energy security, such as if there is a shortage of resources for fossil fuel powered plants or critical minerals needed to produce photovoltaics.

Status of SMR development

There are 14 individual OECD designs that meet the definition of an SMR and are considered by the WNA to be in “near term deployment – development well advanced”. For this report, each of the 14 reactors has, where possible, been cross referenced with national nuclear regulatory bodies to assess their state of development and progress through the licensing process. The SMR developers listed have not been contacted for further information. Only SMR designs with licensing activities from accepted OECD nuclear authorities (i.e. USA, Canada and UK) have been considered in this report.

Non-OECD reactors have been excluded from this analysis due to the deficit of reliable and public information. Certain SMR designs are being developed internationally, some with known significant ongoing government involvement. According to publicly available information, none of the reactors classified as SMRs in China are intended for commercial production. The two SMR type reactors in Russia could not be commercialised in an OECD setting as Russia (and China) is not a member of the OECD Nuclear Energy Agency that facilitates cooperation and coordinates standards.

The WNA list of reactors categorised as “near term deployment – development well advanced” is updated typically on a six-monthly basis and is well referenced in sector assessments. This report uses the WNA listing of “near term deployment – development well advanced” as the basis of its analysis, thus focusing review efforts on OECD based developments. The list represents reactors most advanced in terms of technology and in developers’ partnerships with OECD governments, and therefore the most likely to come to market in OECD countries within the next few decades.

Research on the 14 SMR developments identified from the WNA database of reactors, and detailed review of regulatory authority reports from USA, Canada and the UK, confirm none has been licensed for construction, although most can be identified as progressing through an appropriate jurisdictional licensing process.

OECD developers publicise their design activities. This information indicates that designs are currently at the stage of advanced computer simulations, subcomponent evaluation, and/or the creation of small-scale electrically powered replicas used to evaluate the performance of various components. OECD-developed SMR designs have yet to be licensed for construction by relevant OECD country regulators, noting that an early iteration 55 MWe VOYGR reactor by the company NuScale was licensed in 2022 in the United States. This licence was cancelled by NuScale in 2023 as it has chosen to pursue a larger reactor size.

As no full-scale prototype SMR has been built in an OECD country, and limited publicly available information exists on any SMRs built elsewhere, the capital and operating cost claims promoted by developers vary, and could be considered highly speculative as they have not been demonstrated or tested. Figures for capital and operating cost performance will be reliable only after several vendors have built and operated a significant number of SMR power plants for an extended period.

Early-stage development reactors have been excluded as there is not enough reliable information to conduct meaningful analysis.

Like conventional nuclear power plants, SMRs use the heat produced from nuclear fission (splitting atoms) to create steam (e.g. from boiling water) that spins a turbine to produce electricity. Uranium-235 is the primary fission element (nuclear fuel) across all 14 reactor designs (Australia has abundant uranium reserves, including the world’s largest deposit at Olympic Dam). A coolant is used to transfer heat. The advanced development SMRs are categorised by coolant type as below.

SMR #1 - Boiling Water Reactor (BWR) (coloured yellow in the table overleaf) has a reactor core that heats water, which then boils and turns into steam directly within the reactor vessel. This steam is used to drive a turbine generator to produce electricity. Key characteristics:

- Direct production of steam within the reactor vessel.
- A single-loop system where the reactor coolant also serves as the steam source.
- Use of enriched uranium as fuel.

SMR #2 - High Temperature Gas-cooled Reactor (HTGR) (coloured orange in the table) uses a gas, typically helium, as the coolant. These reactors operate at high temperatures, which makes them efficient for electricity generation and suitable for industrial process heat applications. Key characteristics:

- Use of graphite as a moderator (to slow down neutrons, allowing the fission chain reaction to continue).
- Helium is used as a coolant because it does not absorb neutrons and remains chemically inert.
- Very high operating temperatures, which can exceed 750°C.

SMRs #3, 4, 5, 6 - Molten Salt Reactor (MSR) (coloured blue in the table) can have the reactor fuel dissolved in a molten salt (fluoride or chloride) mixture. These reactors also use molten salt as the primary coolant. MSRs can operate at high temperatures and low pressures, providing efficient thermal energy conversion. They are also suitable for process heat applications. Key characteristics:

- Can use molten salts as both fuel and coolant.
- High operating temperatures allow for efficient electricity generation.
- Two molten salt developments (Integral MSR and Seaborg CMSR) introduce a salt-soluble form of Uranium-235 into primary coolant to enable fission.

SMR NAME	CAPACITY MWE (Megawatts Electrical)	TYPE	COMPANIES	COUNTRY
BWRX-300	300 MWe	BWR	GE Hitachi	USA
Xe-100	80 MWe	HTR - Gas Cooled/ Triso	X-energy	USA
Integral MSR	192 MWe	MSR	Terrestrial Energy	Canada
Moltex SSR-W	300 MWe	MSR (Stable Salt Reactor)	Moltex	Canada/UK
Hermes Prototype (Low Power)	<50 MWe	MSR-Triso Pebble Fuel	Kairos	USA
Seaborg CMSR	100 MWe	MSR, Marine	Seaborg	Denmark
SMR-160	160 MWe	PWR	Holtec, Kiewitt	USA
SMR-300	300 MWe	PWR	Holtec, Kiewitt	USA
NuScale	77 MWe	PWR Integral	NuScale Power, Fluor	USA
SMART	100 MWe	PWR Integral	KAERI	South Korea
BANDI-60S	60 MWe	PWR, Marine	Kepco	South Korea
PRISM	311 MWe	Sodium FNR	GE Hitachi	USA
Natrium	345 MWe	Sodium FNR	TerraPower, GE Hitachi	USA
ARC-100	100 MWe	Sodium FNR	ARC with GE Hitachi	USA

FIGURE 1: SMR Developments Studied (Near-Term Deployment – Development Well Advanced) from WNA list.

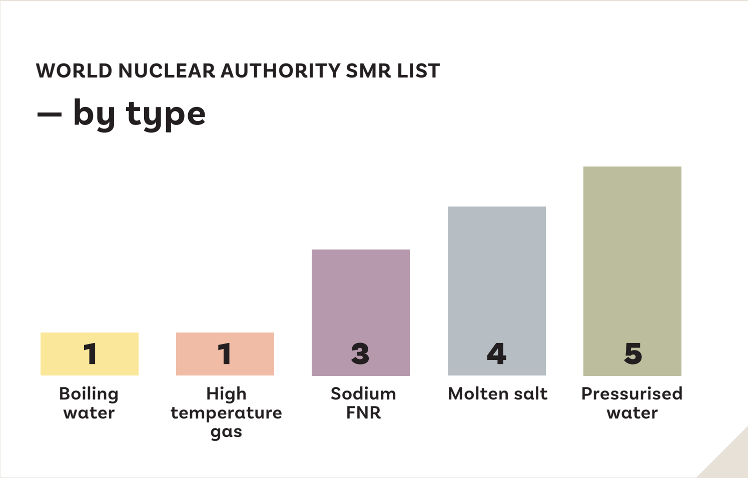
SMRs #7, 8, 9, 10, 11. Pressurised Water Reactor (PWR) (coloured green in the table) is a type of nuclear reactor that uses pressurised water as both a coolant and a neutron moderator. The primary loop of high-pressure water transfers heat from the reactor core to a secondary loop, where steam is generated to drive turbines. Key characteristics:

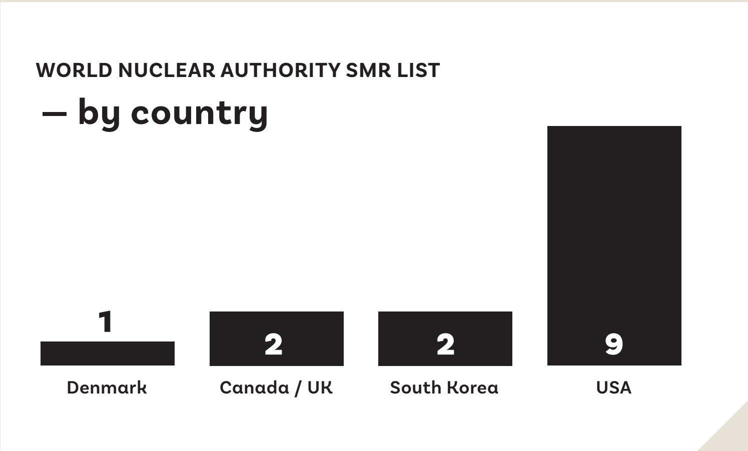
- Use of pressurised water to prevent boiling within the reactor core.
- A two-loop system separating the reactor coolant from the steam generator.

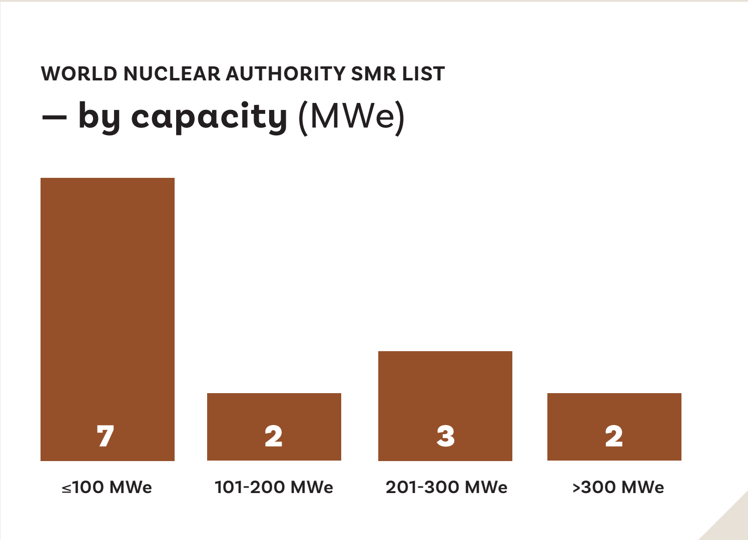
SMRs #12, 13, 14 - Sodium-cooled Fast Nuclear Reactor (Sodium FNR) (coloured purple in the table) uses liquid sodium as the coolant. Sodium FNRs operate at high temperatures and use fast neutrons to sustain the nuclear reaction, which allows for more efficient fuel utilisation and the ability to burn long-lived actinides. These reactors can be used for process heat applications. Key characteristics:

- Liquid sodium as the coolant, which has excellent heat transfer properties.
- Fast neutron spectrum, they do not use a moderator.
- High operating temperatures allow for efficient electricity generation.

Attributes of listed SMRs







Scale considerations

The cost of building a prototype SMR is speculative and will not be known until the market matures.

The cost will theoretically reduce over time if major components are manufactured in purpose-built factories as identical units and subsequently assembled in a standard design power plant with a significantly reduced physical footprint and build time when compared with current-generation nuclear power stations.

Estimates suggest that an individual SMR power-producing facility would require a physical footprint of 10% or less than a traditional nuclear power plant.

The term "small" in the context of an SMR is defined against the size of traditional nuclear power plants. The 77 MWe NuScale-VOYGR reactor will weigh approximately 700 tonnes and would be transported to an operating site in four sections. The assembled reactor would be 23m tall by 4.6m wide. Up to 12 individual reactors could be co-located at one power generation facility, totalling 924 MWe.

SMRs are generally up to 300 MWe with the smallest on the list being less than 50 MWe.

To put this in context, the electrical output of other types of power stations vary widely:

- The largest operating wind farm in Australia is the Stockyard Hill Wind Farm in Victoria that has a capacity of 528 MWe with 149 turbines. The planned Golden Plains Wind Farm in Victoria will have an even larger capacity. The developers claim it will have a capacity of 1,330 MWe and will occupy a footprint of 16,739 hectares with 215 turbines.
- There are also extremely small wind farms. For example, the Diapur Wind Farm in Victoria has an output of just 7.4 MWe with two turbines. The community-owned Hepburn Wind Project, also in Victoria, has an output of 4.1 MWe with two turbines.
- The largest capacity solar farms in Australia are the Western Downs Green Power Hub solar farm in Queensland with a capacity of 400 MWe with over one million solar panels, and New England Solar in New South Wales with a capacity of 400 MWe, and a further 320 MWe under construction with a combined 1.5 million solar panels.
- Most coal-fired power stations in Australia are in the 1000 MWe – 2000 MWe range. Eraring power station in New South Wales is Australia's largest power station, with four 720 MWe coal-fired units and one 42 MWe diesel generator, totalling 2,922 MWe. It is scheduled to close in 2027.

The principle of reduced capital costs requires leveraging economies of scale from volume factory production and knowledge from manufacturing increasingly identical units. This principle is well-established in engineering and manufacturing; this supports the potential for capital cost reductions through SMRs as the technology matures and is standardised.

OECD SMR developers have not yet built and operated a full-scale prototype SMR.

Consequently, the capital and operating cost performance, as promoted by the development community, remain unproven.

Capital, operating cost and generation performance data will only be reliable after a representative number of SMR commercial power plants have been built and operated for an extended period.

To realise capital cost reductions for SMRs requires a significant investment in a full-scale prototype, followed by the construction of multiple commercial-scale plants, with orders for multiple units of a particular commercial-scale SMR across a range of vendors.

Of note, the development community does not appear to use the phrases "prototype" or "demonstration plant" to describe the first-of-a-kind builds. We have referred to first-of-a-kind reactors as "prototypes" in this report for ease of understanding.

Potential markets for SMRs

Two principal market segments can be addressed by SMRs: electricity generation (measured in megawatts electrical – MWe) and process heat generation (measured in megawatts thermal – MWt). Electricity generation from nuclear power is well established.

A significant percentage of global greenhouse gas emissions (WNA estimate ~20%) arise from burning fossil fuels to produce heat at the high temperatures needed to drive the chemical reactions of many essential process manufacturing industries (such as iron and steel manufacturing).

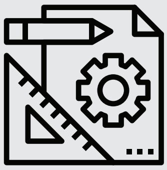
Conventional nuclear reactors, and SMRs based on downsizing traditional reactor designs and technologies (such as pressurised and boiling water reactors), do not operate at high enough internal temperatures to meet process heat provision needs. However, several SMR designs, particularly those including high-temperature gas, molten salt, or liquid sodium as coolants, do operate at elevated temperature levels and thus may be deployed to generate either electricity or high-temperature process heat, or a mixture of both.

Steps for potential commercial release of SMRs

To evolve the SMR market from the current development stage to an active, competitive, multi-vendor, multi-design, multi-customer market, four key steps are required. The uncertainty and timeframe of outcomes increase with each step.

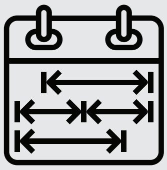
STEP 1
Developers seek to acquire a licence to construct, a site to locate their facility, and financing, including government support and partnerships with a range of entities to support a full-scale working prototype.

Describes the state of the OECD SMR developments as of 2024.



STEP 2
Developers build a full-scale working prototype, obtain a licence to operate, commission and operate the facility.

Developers indicate several full-scale prototypes may be built in the first half of the 2030s.



STEP 3
Developers incorporate learnings from their full-scale prototypes and, subject to regulatory clearance, offer a commercial package to the market. SMR developers will transition to become SMR vendors.

Developers do not publicly share this information. A reasonable timeframe from prototype to a commercial offering would be 3 to 5 years.

STEP 4
SMR vendors will compete to secure contracts to build multiple SMRs, creating an SMR market. As contracts are secured vendors can deploy multiple facilities and capture the advantages of factory production and optimised supply chains.

The timeframe is difficult to determine, but it is likely to take a decade for a market to form driven by the number of vendors and facilities built.

Untested developer announcements encompassing several SMR designs from the WNA list suggest that some full-scale prototypes could operate in a nuclear-regulated OECD country in the first half of the 2030s. At least three developers have acquired sites to locate their prototype plant, but developer estimates for the time to deliver the first working prototype have demonstrated significant volatility.

If the safe operation, technical and economic competitiveness of full-scale prototype SMRs is demonstrated, the focus will transition to a commercial offering. SMR developers do not indicate the length of time required to move from a prototype to an appropriately regulated commercial offering. The transition time will depend primarily on the insights gained from the first working prototype(s).

Historical information based on a single documented example, the GE Boiling Water Reactor (conventional nuclear reactor), illustrates that seven years elapsed from the first full-scale prototype to a commercial offering. Should this be repeated by SMRs, commercial releases can be expected between the late 2030s and mid-2040s. The GE Dresden Boiling Water Reactor example occurred in the late 1950s through mid-1960s, and the application of modern technology and systems design could reduce the time to commercialise these systems.

> *NOTE – The above is an extrapolation of a single historical example and may not be applicable in this instance. By way of comparison, the aircraft industry, which is not directly analogous to the nuclear sector, takes between 2.5 to 3.5 years from first flight to commercial aircraft release. It would be useful for SMR developers to detail their pathway and estimated timing from prototype build to commercial market release.*

In 2019, the Australian House of Representatives Standing Committee on the Environment and Energy commissioned the Report of the Inquiry into the Prerequisites for Nuclear Energy in Australia (Standing Committee on the Environment and Energy, 2019).

Recommendation 1.b.iii, "(Consider) procuring next-of-a-kind nuclear reactors only, not first-of-a-kind" is a logical and sound recommendation.

Next-of-a-kind SMR generation will not be available for some time and would need to be weighed against other energy generation options at that time.

Should Australia action this recommendation, a fully functioning OECD SMR market would:

1) **Have transitioned from full-scale prototypes to continual release of systems from multiple vendors delivered using well-established manufacturing facilities and supporting supply chains.**
2) **Provide transparent capital and operating costs data from multiple vendors.**
3) **Demonstrate operational safety and environmental performance per society's expectations.**

However, governments may for a variety of reasons choose to enter the SMR sector before the evolution of a fully functioning market.

AUSTRALIAN REGULATORY CONTEXT

Australian legal framework

ATSE worked with leading independent law firm Corrs Chambers Westgarth to consider relevant legal issues. A detailed report is available here.

Commonwealth law, under Section 140A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), creates a moratorium in the construction and operation of nuclear power plants. There is also moratorium legislation in Queensland, NSW and Victoria.

Potential legislative framework for SMRs

In December 2019, the Australian Parliament, through the House of Representatives Standing Committee on the Environment and Energy, issued a report on its inquiry into the prerequisites for nuclear energy in Australia, Not without your approval: a way forward for nuclear technology in Australia (Standing Committee on the Environment and Energy, 2019). The 2019 Report addressed previous inquiries into the nuclear fuel cycle, including the South Australian Nuclear Fuel Cycle Royal Commission 2016, commissioned by the Labor Government in South Australia, and the 2006 Uranium Mining, Processing and Nuclear Energy Review.

Based on the 2019 report and the matters identified earlier in this report, a Commonwealth government legislative framework for SMRs (and potentially other nuclear reactors) would, at a minimum, need to include:

(a) Lifting the Commonwealth and state moratorium legislation as it applies to SMRs.

(b) Creating a properly funded and resourced national regulatory body specific to the construction and operation of SMRs and the nuclear fuel cycle, as is the case in the UK with the Office for Nuclear Regulation, in Canada with the Canadian Nuclear Safety Commission and in the United States with the United States Nuclear Regulatory Commission. The remit of these regulatory bodies includes civil nuclear security and safeguards; site licensing; construction of new reactors; operation of nuclear power stations; decommissioning, fuel, and waste; transport of radioactive materials; and research, in each case supported by extensive incident response, emergency and enforcement powers.

(c) Making consequential amendments to the Commonwealth legislation discussed above, including the repeal, in whole or in part, of section 140A of the EPBC Act.

(d) Coordination of Commonwealth, state, and local government legislation, primarily to eliminate inconsistencies, duplication, and potential legal challenges.

Sections 21, 22, and 22A of the EPBC Act, concerning the protection of the environment from nuclear actions (e.g. transporting and storing radioactive waste products) and penalty regimes for nuclear actions impacting the environment, are expected to apply to SMRs. Like any infrastructure with the potential to have a substantial impact on matters of national environmental importance, SMRs should undergo assessment and approval before proceeding.

BROADER SOCIETAL AND ECONOMIC CONSIDERATIONS

SMRs in Australia would not be accepted and would not succeed unless there is ongoing broad community acceptance and engagement, over the entire life cycle of SMRs, including waste disposal and decommissioning.

Key foundational concepts that support social licence include:

- transparency and trust
- ongoing dialogue with local communities and Traditional Owners
- clear definition of roles and responsibilities of all stakeholders
- involvement of, and reliance on, trusted sources of facts such as CSIRO and Learned Academies
- political bipartisanship, including across different tiers of government

Workforce capability is another important consideration for assessing Australia's capacity for a nuclear power industry. Skills shortages, including in nuclear engineering, have already been identified as a concern for delivering AUKUS.

A focused and non-partisan investigation relating to SMRs with appropriate stakeholder engagement (including impacted local communities) is needed to assess the community benefits and drawbacks of SMRs, and assist governmental decision-making regarding the potential application of SMRs in a wider, decarbonised, Australian energy system.

Topics to explore and decide on include:

- affordability, including independently verified analysis of the whole system costs and timetable for connecting electricity generated by SMRs to consumers, in comparison with solar power, wind power, and supportive gas-fired power. This allows for an informed and transparent comparison of energy generation options across the entire project life cycle and on an ongoing system basis
- managing nuclear waste, including as compared to conventional nuclear reactors
- sovereign capability
- perspectives of Aboriginal and Torres Strait Islander Australians
- provision of electricity to remote communities
- bipartisanship and avoiding loss of social cohesion
- compliance with the Nuclear Non-Proliferation Treaty
- reliability, including grid saturation and stability, in the existing grid
- the need for transmission infrastructure including grid connections

  availability of investment from the private sector and governments, and the overall economic cost to government
- impact on Australia's net zero ambitions and commitments;
- impact on Australia's ecosystems, biodiversity protection and nature-positive objectives
- water usage requirements, in comparison to other energy technologies
- global trends, particularly in Europe, where renewable projects benefit from streamlined environment and planning approval processes, focusing on addressing global climate change concerns despite local biodiversity impacts and overriding public interest
- potential differences between greenfield (undeveloped) and brownfield (previously developed) sites
- governance and risk mitigation arrangements
- potential contribution to energy security
- health and safety of workers and of communities
- workforce requirements to build, operate and maintain SMRs
- potential impact on jobs and the economy, noting current skills shortages in Australia for qualified nuclear engineers
- federal, and local government cooperation.

CONCLUSION

Based on publicly available information on the current state of SMR technology, a fully formed and competitive SMR market capable of delivering significant numbers of next-of-a-kind reactors is a 10-year challenge. A number of prototype SMRs could be operational in OECD countries during the first half of the 2030s; this date range is not definitive as a range of regulatory and other factors impact the timing of nuclear facilities. Assuming successful prototype trials, licensed vendor supported commercial releases could occur during the late 2030s to early 2040s and a fully formed market could emerge in the late 2040s.

Sourcing either an in-development or a prototype SMR is a higher-risk proposition for both technical and commercial reasons. An Australian government that wished to pursue a prototype SMR earlier than the 2040s would need to undertake legislative reform, acquire social licence, work directly with developers, and build the requisite skilled workforce.

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