SMR Nuclear Technology Pty Ltd

The development of nuclear power generation in Australia will lead to the establishment of an entire new industry with long-term environmental, technological, economic and social development benefits. These benefits will flow on progressively to other industries, all while bringing the economy closer to net zero emissions.

NuScale Power SMR

Image: NuScale Power SMR, 12 x 77 MWe modules, 924 MWe total on a 18 hectare site.
US Nuclear Regulatory Commission (NRC) Final Safety Evaluation Report issued in August 2020 - first SMR to achieve NRC design approval.

The Case for SMRs

IN AUSTRALIA

AUGUST 2021

Contents

The Case for SMRs in Australia

The development of nuclear power generation in Australia will lead to the establishment of an entire new industry with long-term environmental, technological, economic and social development benefits. These benefits will flow on progressively to other industries, all while bringing the economy closer to net zero

EXECUTIVE SUMMARY

Nuclear power, particularly in the form of Small Modular Reactors (SMRs), provides diversity in electricity generation and long-term energy security. Here we outline the case for Australia to consider SMRs as part of the clean energy mix:

1. **Reaching Net Zero Emissions in Australia:** SMRs will make the ultimate contribution to the reduction of greenhouse gas emissions from electricity generation, enabling Australia to reach net zero emissions economy-wide.
2. **The Political Standstill on Nuclear Energy:** Moving forward on nuclear energy and having an SMR by 2030 is not possible with the current ban in place and its lack of priority as a low emissions technology.
3. **Reliability:** SMRs will improve the reliability and resilience of Australia's electricity system by providing dispatchable generation, system inertia and frequency control.
4. **Affordability:** Modern SMRs are most likely to become the lowest system cost clean generation in Australia because of their high capacity factor.
5. **Safety:** Modern SMRs are designed to be inherently safe.
6. **Radioactive Waste and Used Fuel:** SMRs produce very little waste from day to day operations and the used fuel for the lifetime of the facility can be managed on site.
7. **Sustainable Development of Uranium Resources:** Australia can realise its potential in becoming the top uranium producer in the world by utilising this valuable resource for carbon-free electricity.
8. **Creating Jobs and Facilitating Economic Development:** SMRs bring local job creation and regional economic development, especially in communities with retiring coal plants.
9. **Industry and Innovation:** Reliable, clean energy from SMRs will reduce emissions from industry and open the door to innovation, such as producing cheap, clean hydrogen.

Reliable, clean energy from SMRs will reduce emissions from industry and open the door to innovation, such as producing cheap, clean hydrogen.

1. Reaching Net Zero Emissions in Australia

SMRs will make a valuable contribution to the reduction of greenhouse gas emissions from electricity generation and other sectors, enabling Australia to reach net zero emissions economy-wide.

Australia's annual emissions from electricity generation for the year 2013 were 183 million tonnes CO_2-equivalent (National Greenhouse Gas Inventory).

Six years later, and after billions of dollars spent on wind and solar, Australia's annual emissions from electricity generation for the year 2019 were 176 million tonnes CO_2-e.

Australia has one of the world's highest emission intensities, typically 820 kg CO_2-e/MWh (Finkel Review). Countries with low emissions intensities either have large hydro resources (e.g., Norway) or have nuclear as part of their energy mix (e.g., France, Belgium) .[1]

Nuclear power already makes a significant contribution to reducing emissions from electricity generation worldwide.

In 2019, 2,657 TWh were generated by nuclear power reactors worldwide, saving over 2 billion tonnes of CO_2-e emissions (World Nuclear Association). In 2020, nuclear generated 11% of the world's electricity, more than solar and wind combined (International Energy Agency).

In 2019/20, Australia exported 7,195 tonnes of uranium oxide concentrate (ASNO Annual Report)[2] which would have generated ~243 TWh of clean electricity and saved the recipient countries around 200 million tonnes CO_2-e, yet Australia does not take advantage of this valuable resource.

Australia must utilise every safe, low-emissions technology to reduce its emissions, including nuclear. Nuclear energy is already deployed in 31 other countries, with four new countries currently building nuclear power plants for the first time.

Nuclear has zero operating emissions and low whole of life cycle emissions comparable with renewables.

Nuclear power, like wind, solar and hydro, has zero operating emissions. The South Australia Nuclear Fuel Cycle Royal Commission examined in

[1] https://www.electricitymap.org/map
[2] https://www.dfat.gov.au/sites/default/files/asno_annual_report_2019-2020.pdf
[3] https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/data-dashboard-nem#average-price-table

detail the whole of life cycle emissions for different electricity generation technologies. The median value for nuclear is 12 kg CO_2-e/MWh, the same as wind. Solar is slightly higher at 18-50 kg CO_2-e/MWh. The Finkel Review reported a very large difference between low-emissions technologies (wind, solar, hydro, nuclear) that have zero operating emissions and the lowest intensity fossil technology, combined cycle gas turbine (CCGT), that has an operating emissions intensity of 370 kg/MWh. Firming renewables requires more open cycle gas turbine (OCGT) use as seen in South Australia. It is useful to examine the Australian Energy Market Operator (AEMO) fuel mix record for South Australia.[3] The wind generation is seen to vary between <10% to 80%. To compensate, gas generation is 15% to >80%. This is not a long-term solution for low emissions.

Australia needs to move towards a clean energy economy as fast as it can afford to do so. This is not confined to renewables, all options should be kept on the table. Many countries, such as the US, Canada, and the United Kingdom, are including both existing nuclear power and advanced nuclear technologies in their portfolios for clean energy.

The recent International Energy Agency (IEA) report[4] on Net Zero by 2050 projects that the amount of energy supplied by nuclear power will increase by 40% by 2030 and double by 2050, even with huge scale ups of wind and solar. Hydro and nuclear, the two largest sources of low-carbon electricity today, provide an essential foundation for the clean energy transition. Through 2050, almost half of global emission reductions will come from new technologies currently being developed, including SMRs.

NUCLEAR HAS ZERO OPERATING EMISSIONS

The median value for nuclear is 12 kg CO_2-e/MWh, the same as wind. Solar is slightly higher at 18-50 kg CO_2-e/MWh.

NuScale: 77 MWe
SMR Module
Source: NuScale Power

40%

INCREASE IN ENERGY SUPPLIED BY NUCLEAR

The recent International Energy Agency (IEA) report on Net Zero by 2050 projects that the amount of energy supplied by nuclear power will increase by 40% by 2030 and double by 2050

[4] https://www.iea.org/reports/net-zero-by-2050 (May 2021)

2. The Political Standstill on Nuclear Energy

Moving forward on nuclear energy and having an SMR by 2030 is not possible with the current ban in place and its lack of priority as a low emissions technology.

The future development of nuclear power in Australia has been blocked by a moratorium that was put in place when there was no real appreciation of the contribution that modern, safe nuclear power plants could make to energy security, affordability, and emission reductions.

This Minister for Energy and Emissions Reduction called for the House of Representatives Standing Committee on Environment and Energy to conduct an inquiry into the prerequisites for nuclear energy in Australia. The report from this inquiry was published in December 2019 but the government has yet to issue a response.

The Committee put forward three broad recommendations to the government:

1. that it consider the prospect of nuclear technology as part of its future energy mix;
2. that it undertake a body of work to progress the understanding of nuclear technology in the Australian context; and
3. that it consider lifting the current moratorium on nuclear energy partially—that is, for new and emerging nuclear technologies only, and conditionally—that is, subject to the results of a technology assessment and to a commitment to community consent for approving nuclear facilities.

There would be value to the economy and the environment if there were to be a strong, bipartisan commitment to long-term energy policy stability. It would encourage investment, improve productivity, lower costs, and maintain vital skills.

We believe that there is wide community support but that progress is delayed by political rivalries. There is a political standstill that is holding back progress in evaluating all of the options that should be available for Australia.

With the repeal of Australia's legislative ban on nuclear power, it will be feasible to build an SMR by 2030 and several gigawatts of nuclear by 2040

The construction and operation of a nuclear power plant in Australia is presently prohibited by the Environment Protection and Biodiversity Conservation (EPBC) Act and the Australian Radiation Protection and Nuclear Safety (ARPANS) Act.

The legislative prohibitions act as a disincentive to any serious consideration of the merits of nuclear power generation in Australia and make it difficult to engage with the public. SMR vendors will not treat Australia as a potential market whilst the prohibitions remain.

Although government reports have repeatedly endorsed the merits of 'technology neutrality' in power system planning, the legislative prohibitions have prevented its accomplishment.

System reliability, as well as affordability and lower emissions, beyond 2030 can only be underwritten by including load-following nuclear generation in the generation mix and allowing all technologies to compete with each other.

The actual time of construction of an SMR is planned to be around 36 months. This would be preceded by a period of around 4 years for community consultation, site selection, feasibility studies, environmental and development approvals

and arranging financial facilities, making a total development period of around 7 years after the law is changed to lift the prohibition on nuclear power.

SMRs should be given priority as a low emissions technology in Australia's Technology Investment Roadmap.

In September 2020, the Australian Government released the first Low Emissions Technology (LET) Statement, the first milestone in Australia's Technology Investment Roadmap.[5] The statement identifies four technology categories: priority low emissions technologies, emerging and enabling technologies, watching brief technologies, and mature technologies.

The five priority low emissions technologies are: clean hydrogen, energy storage, low carbon materials (steel and aluminium), carbon capture and sequestration (CCS), and soil carbon. While these technologies have apparent high potential to reduce emissions across multiple sectors, nuclear energy could reduce emissions on a much larger scale and provide the carbon-free energy and heat to produce clean hydrogen and low-carbon materials, for example.

SMRs are included as a 'watching brief technology' with transformative potential, for which international developments will be closely monitored and supporting infrastructure needs assessed. However, SMRs are already beyond the stated 'early stage of development,' with designs licenced and even in operation in other countries. In order for SMRs to be seriously considered and make meaningful emission reductions in Australia in 2030, investment in the infrastructure needed for nuclear power needs to start now.

Construction of an SMR is planned to be around 36 months

7 years

TO OPERATION

4 years for community consultation, site selection, feasibility studies, environmental and development approvals and arranging financial facilities, making a total development period of around 7 years after the law is changed to lift the prohibition on nuclear power.

5. https://www.industry.gov.au/data-and-publications/technology-investment-roadmap-first-low-emissions-technology-statement-2020

3. Reliability

Small modular reactors (SMRs) will improve the reliability and resilience of Australia's electricity system by providing dispatchable generation with capacity factors in excess of 95%, along with system inertia and frequency control.

SMRs have been deployed to power submarines and icebreakers for more than 60 years, in applications where reliability is essential.

SMRs with power station outputs of between 50 and 900 MW are particularly suitable for the Australian power system. SMRs have features that will enable them to work effectively in a power system that has intermittent renewables.

The leading US example is the NuScale SMR which has received design approval from the US Nuclear Regulatory Commission (NRC) for the 50MWe version. Up to twelve 77 MWe modules can be accommodated in one power plant to provide a gross output of 924 MWe, with a capacity factor of greater than 95%.

Nuclear power plants operate regardless of the weather. They are designed to continue operating in extreme weather conditions. There are many examples in the US where nuclear power plants have continued to supply electricity in extreme weather conditions, when other electricity generators have failed. PV panels, for example, can easily be damaged by storms and particularly by hail.

Modern SMRs are designed to 'load follow' and can support weather-dependent renewables.

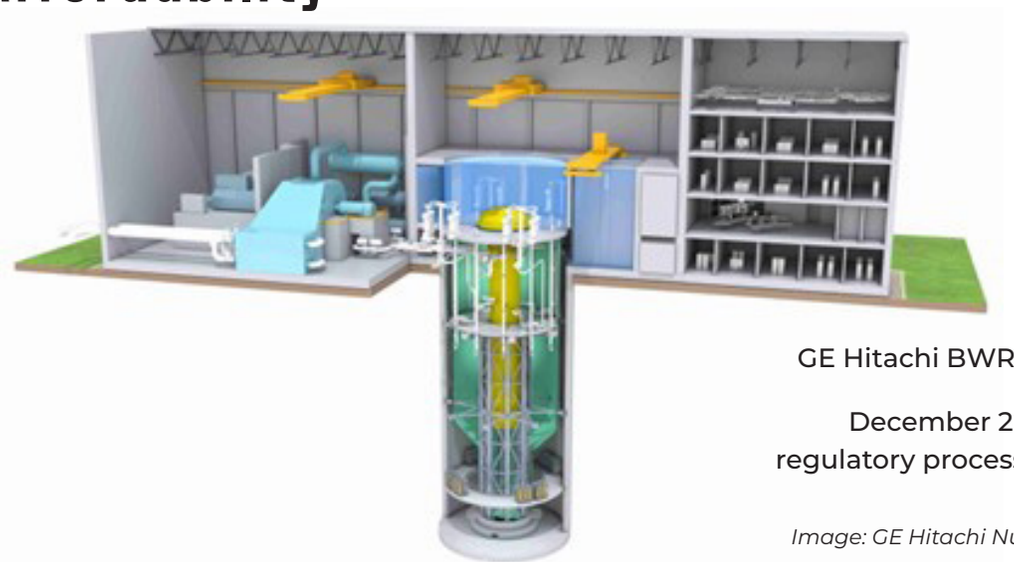
SMRs are designed to load-follow and enable the further operation of intermittent renewables. For example, the NuScale SMR has a 100% turbine bypass to enable flexible operations to meet the US Utility Requirements for load following. The NatriumTM sodium fast reactor, developed by TerraPower and GE-Hitachi (GEH), includes thermal energy storage as part of its design and is well suited to support electricity grids with high levels of renewable generation sources.

With large spinning turbines, SMRs also provide system inertia and frequency control needed for a stable electrical grid, which renewables cannot provide.

SMRs do not rely on grid supplies for safety. On loss of grid, modern SMRs can remain in operation and are then ready to contribute to re-establishing the grid. If an SMR had been operating in South Australia at the time of the September 2016 State blackout, the grid could have been restored quicker than it was. However, if an SMR had been operating in South Australia at the time, it is unlikely that the State blackout would have occurred in the first place.

NUCLEAR OPERATES REGARDLESS OF WEATHER

4. Affordability



GE Hitachi BWRX-300 SMR
(300 MWe)
December 2019 started
regulatory process with NRC

Image: GE Hitachi Nuclear Energy

Modern SMRs are likely to become the lowest system cost clean generation available in Australia because of their high capacity factor.

The final cost of individual plants will depend on location-specific factors determined during feasibility studies. However, as with wind and solar energy, nuclear costs are coming down due to simpler and standardised design; factory-based manufacturing; modularisation; shorter construction time and enhanced financing techniques.

Nuclear power plants were traditionally very large in order to capture economies of scale. In some cases, this has caused construction delays and increased costs. Modern SMRs will be factory-built, and the complete reactor module is transported to site and installed with minimum on-site work. This reduces site construction time and the risk of expensive delays.

The GenCost data published by CSIRO and AEMO do not provide a valid basis for comparing future energy generation costs and should not be used to justify the continuation of the existing moratorium on nuclear power in Australia. One can arrive at the GenCost estimate of A$300/MWh for SMRs by using an extremely high capital cost assumption and other input values. By making a few modest and reasonable changes in the input assumptions, based on actual data from vendors and third-party studies on SMR costs, a figure of A$65/MWh is obtained for electricity from a modern SMR.

The 2017 report by the US Energy Innovation Reform Project found that the costs for the new generation of advanced reactors would be much lower than for conventional nuclear power plants. The US study found that the average levelised cost of electricity (LCOE) from advanced reactors was US$60/MWh. According to US company NuScale, its SMR will be able to generate electricity for US$65/MWh. These LCOEs would be A$78-84/MWh (0.77 exchange rate).

Another example of a US SMR reducing costs is GEH's BWRX-300, which is based on GEH's existing large-scale reactor design but has an estimated 50% less construction material per MW, significantly decreasing construction time and cost. The overall operation and maintenance costs are also projected to be 40% less per MW compared to currently operating large reactors.

The 'whole of system' advantages of nuclear power have important strategic implications for the NEM and the entire economy. Electricity needs to be available on demand, 24 hours a day, 7 days a week and in all weather conditions.

In looking at the economics of different power generation options, it is essential to understand the distinction between generation costs and power system costs and to adjust for the low capacity factors, additional transmission costs and firming costs of intermittent renewable energy options.

Nuclear is available at full capacity 24 hours a day but solar, for example, starts with a low ouput at sunrise, rises to maximum output around midday and then drops to zero at sunset. You must therefore multiply the capital cost of solar by at least four times to get the same amount of electricity. Importantly, solar is not available at the time of the evening peak.

Although the operating costs of wind and solar are lower than nuclear, the real cost to the power system is higher. This is due to their low capacity factor, additional transmission costs and firming costs.

Modelling by the Australian consultancy Electric Power Consulting of Kiama in 2018 showed that the cost of a system with 100% renewables would be more than 4 times the cost of a system where coal was replaced by nuclear.[6]

This assessment has been confirmed by other international studies including the OECD NEA report "The Costs of Decarbonisation - System Costs with High Shares of Nuclear and Renewables"[7]

5. Safety

Modern SMRs are designed to be inherently safe.

Currently, nuclear power already has the lowest incidence of death and accidents amongst all energy production technologies, comparable to renewables, and many times lower than fossil fuels.

Following the accident at the Chernobyl nuclear power plant in the Ukraine in 1986, the nuclear power industry became one of the most highly regulated industries in the world. In this regard, the Convention on Nuclear Safety (CNS) came into force in 1994, laying down the fundamental principles for the protection of individuals, society and the environment from the harmful effects of ionising radiation. The CNS has 152 Member States, including Australia.

Australia's safety regulations are laid down by Commonwealth law and are enforced by the Australian Radiation and Nuclear Protection Agency (ARPANSA) for Commonwealth entities.

In 2013, the UK Tyndall Centre for Climate Change, in a report for Friends of the Earth, found that:

> "... overall the safety risks associated with nuclear power appear to be more in line with lifecycle impacts from renewable energy technologies and significantly lower than for coal and natural gas per MWh of supplied energy".

In 2016, the South Australia Nuclear Fuel Cycle Royal Commission concluded that safety was not a basis for ruling out nuclear power in Australia.

Learning from the past operations of nuclear power plants, modern SMRs are designed to be inherently safe, avoiding Chernobyl-type or Fukushima-type accidents.

6. Electric Power Consulting https://epc.com.au/index.php/nem-model/
7. OECD NEA https://www.oecd.org/publications/the-costs-of-decarbonisation-9789264312180-en.htm

Modern SMR designs have now become a game-changer for nuclear safety. Although traditional reactors are already safe, SMRs take safety to a new level of 'walk-away safety'. For example, the NuScale SMR does not require any operator action, backup electrical supplies or water supplies and would have survived even the Fukushima accident. The passive safety systems enables decay heat to be removed indefinitely without attention. The US NRC has confirmed that the NuScale plant does not require any emergency electrical generators to keep the plant safe. The NuScale SMR is the first nuclear reactor design to have achieved this accreditation in the US.

6. Radioactive Waste and Used Fuel

The small quantity of radioactive waste produced by nuclear power can be managed.

The 924 MW 12 module NuScale SMR would produce each year only 120 m3 (two shipping containers) of low level waste that is packaged and stored in drums before being transported to a low level waste repository. The required repository is a simple, near-ground level engineered facility to hold the waste securely, usually in concrete cells, for around 300 years.

A NuScale module would also produce only ~1500 kg/year of used fuel which is initially stored in cooling pools in the reactor building and then can be stored in dry casks on site for the life of the plant, or reprocessed. The final disposal of the small amount of waste from reprocessing or disposal of complete used fuel assemblies will be in a deep geological repository. Construction of this type of facility is in progress in Finland. Sweden and France are in the final stages of licensing their geological repositories. Several countries, including Australia, are looking at borehole final disposal.

Sustainability

Nuclear energy is also more sustainable from a materials perspective, using significantly less concrete, steel, and other materials than solar, wind, and hydro per unit energy output.[8]

The NSW Nyngan solar plant has 1,350,000 PV panels on frames supported by 150,000 posts but produces only 102 MW peak output, ~230 GWh/year. A single NuScale 74 MWenett module will produce 616 GWh/year (95% capacity factor).

The other consideration with sustainability is plant lifetime. SMRs are designed for a 60 year life. Wind plants have a lifetime of <30 years and solar farms < 25 years.

All the currently operating wind and solar plants will have to be replaced before the target net zero date 2050.[8A]

Wind and solar farms also require large areas of land. For example, the 150 MW Coleambally (NSW) solar plant occupies 550 hectares. This can be compared to a 924 MW NuScale plant that occupies only 18 hectares.

The turbine condensers for modern SMRs can be air cooled and do not require large quantities of water. They do not need to be located near a river or on the coast.

[8] https://www.brightnewworld.org/media/2021/1/27/materials-use-project
[8A]. https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information

7. Sustainable Development of Uranium Resources

Australia can realise its potential in becoming the top uranium producer in the world by utilising this valuable resource for carbon-free electricity.

As mentioned previously, Australia is already a major exporter of uranium, comprising about one-quarter of energy exports. Australia's known uranium resources are the world's largest at 30% of the world total (World Nuclear Association[9]). However, Australia currently ranks behind Kazakhstan and Canada in uranium production.

Canada serves as a good example for what could be achieved by a large uranium exporter also utilising nuclear energy domestically. Canada's nuclear industy supports 60,000 jobs and generates more than A$6.5 billion in revenues per year. Carbon emissions from electricity generation are only 160 kg/MWh. In contrast, Australia's nuclear industry provides only 3000 jobs and has an economic value of A$600 million. Australia's carbon emissions from electricity some are of the highest in the world at above 800 kg/MWh.

Australia could become the top producer of uranium in the world if we took advantage of our own resources by utilising nuclear energy for domestic electricity production. Domestic use of uranium would further increase investment in uranium exploration and mining and therefore activate underutilised resources to allow for expanded uranium exports. If Australia realised its uranium potential, 20,000 new jobs would be created by 2040, contributing an economic value of A$9 billion, according to a study by the Minerals Council of Australia.[10]

The nuclear industry supports 60,000 jobs in Canada only 3,000 jobs in Australia

WE CAN CREATE MORE JOBS

If Australia realised its uranium potential, 20,000 new jobs would be created by 2040

A$9 billion

THE NUCLEAR INDUSTRY CAN CONTRIBUTE BILLIONS TO AUSTRALIA'S ECONOMIC VALUE

9. https://world-nuclear.org/information-library/country-profiles/countries-a-f/australia.aspx
10. https://www.minerals.org.au/minerals/uranium

8. Creating Jobs and Facilitating Economic Development

SMRs allow for local job creation and regional economic development, especially in communities with retiring coal plants.

The first NuScale SMR is planned to be sited near Idaho Falls, USA. The Idaho Department of Labor has forecasted that the SMR will generate 12,800 local jobs during construction and 1,500 during operations.

The 1,000 direct construction jobs would create or support an additional 11,800 jobs through 'inter-industry' trade and local services for the new workforce. NuScale expects direct construction jobs to peak at 1,100 employees and this would last for much of the three year site build.

The new plant will also support long term employment in Idaho Falls. NuScale expects the plant to directly employ 270 workers when it is online and the Department of Labor expects this will support 1,500 local jobs, equating to annual revenues of US$389 million for local industry in this regional area.

In Australia, SMRs would be ideal to re-power retiring coal-fired power station sites. Much of the supporting infrastructure – transmission connections, cooling water supplies, admin and maintenance buildings, etc. – could be reused. As in the UK and US, the existing staff can be retrained to operate and maintain the plant, saving jobs and the local economy.

NuScale has issued a report on repurposing US coal plants including the transition of workers to similar positions.[11]

Trade unions recognise the value of the high-quality jobs that nuclear power can provide Australians.

Trade unions are amongst the strongest supporters of nuclear energy in countries that already have operating nuclear power plants. Unions in Australia are already recognising the merits of SMRs in replacing existing dispatchable generation. Coal plant workers and their communities demand a 'Just Transition' of their industry, a transition where their livelihoods are not unwittingly destroyed by the rush to reduce emissions.

Social costs of job losses from the closure of coal plants and mines in regions such as the Latrobe and Hunter Valleys will be immense. Many claim that renewables can provide a transition in employment for coal plant workers. However, jobs in wind and solar are often in a different regions and do not provide the same level of sustained income as coal jobs. SMRs utilise similar equipment to coal plants on the secondary side of the plant and therefore can transfer jobs more directly and at the same location.

The CFMMEU Mining & Energy Division of Victoria has also stated concern about a renewables-only approach to emission reduction because it would lead to 'major blackouts, unaffordable electricity and the future economic shutdown of Victoria's industry; resulting in massive job losses and citizen wealth decline.' Australia already has the skilled people needed for a nuclear power industry but a 7 year lead time will be required to build SMR replacements for Australia's aging coal power plants. Therefore, the green light needs to be given sooner rather than later.[12]

[11] http://www.smrnuclear.com.au/wp-content/uploads/2021/04/nuscale-smr-technology-an-ideal-solution.pdf
[12] https://www.energypolicyinstitute.com.au/images/2-20__Geoff_Dyke_PP.pdf

Community consultation, including with local Indigenous peoples, is crucial to obtaining the social licence to mine uranium and operate nuclear power plants in Australia.

The mining of uranium in Australia has occurred mostly on Indigenous land. Historic mines had rudimentary environmental standards, some of which resulted in extensive environmental damage and affected local communities. Mining practices have greatly improved in the last few decades. Safe working standards and regulation of uranium mining in Australia are based on international best practice. Community consultation, including with local Indigenous peoples, is crucial to any mining project and will also be a key factor in siting nuclear power plants.

An expanded domestic nuclear industry with uranium mining and nuclear power generation would give many communities across Australia the opportunity for economic development. All sites should develop an Indigenous employment strategy including training, mentoring, apprenticeship support for local students, and incorporating unique cultural skills, especially in environmental management.

9. Industry and Innovation

Reliable, clean energy from SMRs will reduce emissions from industry and open the door to innovation, such as producing cheap, clean hydrogen.

Emission reductions are required in all areas of energy production and use. Industry commonly uses coal or gas for process heating. Modern nuclear reactors can produce process heat which can reduce emissions from industry. Wind and solar cannot provide process heat directly. Nuclear power not only reduces emissions from electricity generation, but also provides a pathway to emissions reductions in many other industries.

Australia is looking at hydrogen as a key fuel for the future. This relies on the efficient and economic production of hydrogen. In his address to the Press Club on 12 February 2020, Chief Scientist Alan Finkel stated that “There’s a nearly A$2 trillion global market for hydrogen come 2050, assuming that we can drive the price of producing hydrogen to substantially lower than A$2/kg.” Process heat increases the efficiency of hydrogen production. Renewables cannot produce process heat, but nuclear reactors do, particularly the Gen IV types like the Terrestrial Energy Molten Salt Reactor which supplies process heat at 600°C for high temperature electrolysis. This enables hydrogen production at a cost comparable to steam methane reforming from gas, but with no emissions and a cost less than one third of renewable energy electrolysis (Terrestrial Energy submission 260 to Federal Nuclear Inquiry).

A new UK report[13] identifies the important role nuclear can play in hydrogen production. Operating 24/7 a nuclear source maximises the utilisation of electrolysers, reducing unit costs of hydrogen generated.

[13] https://www.nnl.co.uk/wp-content/uploads/2021/07/Hydrogen-Round-Table-FINAL-v2.pdf

Finally, a thriving nuclear industry spurs innovation in other sectors and inspires students to study nuclear and related fields. Nuclear techniques have applications in medicine, agriculture, mining, space, and many other industries. The Australian Nuclear Science and Technology Organisation (ANSTO) produces nuclear medicine and also conducts important scientific research in other sectors. However, ANSTO often has to recruit from abroad since the pool of nuclear specialists in Australia is small. Removing the ban and seriously exploring SMRs would encourage more students to study nuclear, having positive effects on other sectors in having national capability for nuclear technology.

Microreactors.

Microreactors are very small, factory fabricated, transportable reactors which could provide power and heat for off-grid mining operations and remote communities which rely on diesel generation.

An example is the Westinghouse eVinci microreactor which is the size of a shipping container with generation output of 200 kWe to 25 MWe. In December 2020 the US Department of Energy Awarded Westinghouse $7.4m under their Advanced Reactor Demonstration Program to support deployment of a demonstration unit by 2024.

RELIABLE, CLEAN ENERGY

SMRS WILL REDUCE EMISSIONS FROM INDUSTRY AND OPEN THE DOOR TO INNOVATION, SUCH AS PRODUCING CHEAP, CLEAN HYDROGEN

Image: Westinghouse

CONCLUSION

SMRs will enable an Innovative, Net Zero Emissions Economy

In the modern era, the nuclear industry is transforming itself to meet contemporary community expectations and enable countries to transition to net zero emissions. Modern SMRs are designed to be inherently safe and will provide reliable, affordable and low-emissions power for 60-80 years. Nuclear power is a mature technology.

For advanced economies, nuclear has been the biggest low-carbon source of electricity for more than 30 years and taking nuclear out of the equation results in higher electricity prices for consumers.[14] Dispatchability should be properly valued and the electricity market designed to value the system services needed to maintain electricity security, including capacity availability and frequency control services.

When the legislative prohibitions on nuclear facilities are repealed, SMRs could be deployed and be a game-changer in Australia power system planning, progressively replacing obsolete power generators as they close down over the next 30 years.

The development of nuclear power generation in Australia will lead to the establishment of an entire new industry with long-term environmental, technological, economic and social development benefits for the people of Australia. These benefits would flow on progressively to other industries, all while bringing the economy closer to net zero emissions.

SMR Nuclear Technology Pty Ltd
Governor Macquarie Tower
Level 23, 1 Farrer Place
Sydney NSW 2000
ABN: 88 160 242 428
www.smrnuclear.com.au

SMR Nuclear Technology Pty Ltd
August 2021

[14] https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system