



Australia's need to become a truly innovative nation

***A Submission to the Australian
Government's Energy Green Paper***

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SMR Nuclear Technology Pty Ltd

**Level 23 Governor Macquarie Tower
1 Farrer Place
Sydney NSW 2000
Australia
Telephone +61 2 9252 8900**

Australia's Need to Change

Australia's need to change is undeniable:

- we need to improve our low-carbon energy security
- and we need to become a truly innovative nation.

Modern Small Modular Reactor (SMR) technology can safely lead the way to a low-carbon, secure, energy future for Australia:

- SMRs can reduce Australia's greenhouse gas emissions over the short, medium and long terms.
- SMRs can diversify Australia's energy sources and increase its long-term energy security.
- SMRs can improve the resilience of Australia's energy system (making energy supply more reliable and affordable).
- SMRs can help Australia become an innovative country in the field of energy, creating jobs in a new field.
- SMRs can position Australia to help other countries, by example and through aid programmes.

Why SMRs?

1. **Modern SMRs are Australia's alternative to large, centralised power stations**

SMRs are now under construction in a number of countries. They represent a technological breakthrough that is particularly suitable for Australia.

SMRs incorporate the latest safety systems, they provide reliable base-load power and they decentralise power sources.

From around 2022, strategically located SMRs with outputs in the range of 25 – 300 megawatts can start to reduce Australia's greenhouse gas emissions, improve Australia's system resilience and enhance Australia's energy security.

Large power stations, nuclear and otherwise, are unlikely to be required in Australia for the foreseeable future.

2. **Over 30 countries presently utilise nuclear power**

Globally, nuclear power generates more than 11% of total electricity.

Over 30 countries presently utilise nuclear power in their generation mix, typically using large, centralised, nuclear power stations that provide economies of scale. Currently, according to the IAEA, there are 437 reactors in operation and another 72 under construction.

Major fossil fuel exporters such as Saudi Arabia and the United Arab Emirates are developing nuclear industries as part of their energy diversification and energy security strategies. Australia can do the same.

3. **SMRs have high inherent safety**

SMRs have been safely used in submarine operations for 60 years.

The latest, land-based SMRs have high natural safety. No external electrical supplies or pumps are required for emergency cooling, enabling them to remain safe under extreme conditions.

SMRs do not need to be sited in coastal locations for turbine condenser cooling water because they can be air-cooled.

SMRs can be installed underground, further enhancing their physical security against accidents or external events.

4. **SMRs are affordable**

According to the Australian Bureau of Resources and Energy Economics (BREE), SMRs could provide one of the lowest levelised cost of electricity (LCOE). Factors contributing to this are:

- a capacity factor in excess of 95%
- long operational life

- reduced on-site construction time due to factory production
- low fuel costs and extended refuelling cycles and
- simple systems requiring less maintenance

SMRs reduce investment risk in a competitive electricity market because they are less capital-intensive than the larger, traditional nuclear power plants and are faster to build. Additional modules may be installed in an incremental fashion when extra capacity is required. Plants can be “self-financing” with the generation profits from early modules paying for the cost of additional modules.

5. SMRs can bring other benefits to Australia

- SMRs can reduce the burden on the Australian transmission system.
- SMRs are particularly suitable for remote locations, such as for towns located at the end of the transmission system, where the transport of fuel for conventional generating plant can be expensive.
- SMRs can be multipurpose facilities - producing not only electricity but also heat for industrial processes such as desalination.
- Advanced SMRs can produce high-temperature industrial heat for oil shale and oil sands processing, coal gasification and high-temperature steam electrolysis.

6. Nuclear power is unnecessarily prohibited in Australia: it needs a line of sight to compete with other technologies

The Energy Green Paper Key Theme 4 posits that future energy supply should be secured in a technology neutral way. However, to achieve this, the legislation that currently prohibits the construction and operation of nuclear power plants for commercial purposes would need to be changed.

The Australian legislative prohibition is explained in part by safety concerns and in part by Australia’s abundance of other energy resources. At the time when the prohibitions were enacted, there was little community appreciation in Australia of the potential climate effects of greenhouse gas emissions.

The Australian legislative prohibition has remained in place despite the successful negotiation of the 1996 Convention on Nuclear Safety (CNS), to which Australia became a party. The CNS lays down fundamental safety principles with which all member states must comply and on which they must report.

Safe nuclear power plants can and should be designed and built to the latest safety standards, they should be installed in safe locations, they should be operated in accordance with best international practice and they should be regulated by a professional regulatory agency independent of government. This has been the case with the OPAL research reactor operated by the Australian Nuclear Science and Technology Organisation (ANSTO) at Lucas Heights near Sydney since 2006.

ANSTO and its predecessor the Australian Atomic Energy Commission have a long history of safely operating the HIFAR research reactor at Lucas Heights from 1958-2007.

7. Nuclear power previously had bipartisan support

In 2006, after an 18-month study, a multi-party Australian Parliamentary Inquiry produced an 800- page report on the strategic importance of Australia's uranium resources for the development of the non-fossil fuel energy industry in Australia ("the Prosser Report").¹ The report emphasised Australia's need for "*a mix of low-emission energy sources and technologies, including nuclear power.*" The report's findings were bipartisan and unanimous.

Also in 2006, a report for former Prime Minister Howard ("the UMPNER Report") found that nuclear power was the least-cost low-emission technology that could provide base-load power and play a role in the future generation mix.

8. Australia has an experienced, independent nuclear regulator that follows international best practice

The development of nuclear power plants, like all other developments, will require approval under applicable planning and environmental laws.

As well as planning and environmental approval, nuclear power requires to be licensed by the independent nuclear regulator, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), established under the Australian Radiation Protection and Nuclear Safety Act 1998 ('the ARPANS Act').

The objective of the ARPANS Act is "*to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation.*"²

In pursuing its statutory objective, and in deciding whether to issue a licence for a nuclear facility, ARPANSA is required to "*take into account international best practice in relation to radiation protection and nuclear safety.*"³

In 2006, ARPANSA licensed ANSTO to operate the 20 MW OPAL research reactor at Lucas Heights. ARPANSA first satisfied itself that ANSTO would operate in accordance with international best practice, as required by the ARPANS Act.

To be able to regulate commercial nuclear power generation, the Commonwealth would need to amend the ARPANS Act.

9. The transport of nuclear fuel is safely regulated

The transport of radioactive material is subject to international trans-boundary movement rules and technical standard rules.

The IAEA Transport Regulations have been adopted by ARPANSA to reflect international best practice and have been incorporated into Australian domestic legislation.⁴ ARPANSA contributes to the IAEA's regulatory revision process and the IAEA regulations are well understood in Australia from the operations of ANSTO.

¹ "Australia's Uranium – Greenhouse Friendly Fuel for an Energy Hungry World: A Case Study into the Strategic Importance of Australia's Uranium Resources for the Inquiry into Developing Australia's Non-Fossil Fuel Energy Industry", House of Representatives, Standing Committee on Industry and Resources, Parliament of Commonwealth of Australia, November 2006.

² S.3 of the ARPANS Act.

³ S.32(3) of the ARPANS Act.

⁴ See IAEA, Regulations for Safe Transport of Radioactive Material NoTS-R-1, and the ARPANSA Safety Guide *Approval Processes for the Safe Transport of Radioactive Materials* RP 2.

10. Radioactive waste and the management of spent fuel can be safely regulated

The disposal of radioactive waste and management of spent fuel must be taken into consideration by ARPANSA when assessing licence applications. ARPANSA has recently updated its Regulatory Guide, Licensing of Radioactive Waste Storage and Disposal Facilities, after a public consultation process.

In 2012, the Commonwealth enacted the *National Radioactive Waste Management Act 2012* to provide for the establishment and operation of a suitable facility for the safe management of radioactive waste in Australia. The site will be chosen by a national tender process for voluntary nominations.

11. Australia is able to draw on the International Atomic Energy Agency (IAEA)

Australia has been an active member of the 155-member IAEA, a UN agency, since its inception in 1957. Australia has a permanent seat on its Board of Governors.

The IAEA's statutory objective is "*to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.*"⁵

There are three pillars of the IAEA's work:

- i. nuclear verification and security;
- ii. safety; and
- iii. technology transfer.

The second pillar, safety, is of the greatest significance to the regulation of nuclear power in Australia. The IAEA's main work in the field of nuclear power generation is to provide guidance and inspection and monitoring services to its member states. In the future licensing of commercial nuclear power in Australia, ARPANSA will be able to draw on the knowledge and guidance of the IAEA, as it did during the licensing of the OPAL reactor.

12. Australia is required to implement the 1996 Convention on Nuclear Safety (CNS)

In the context of nuclear power programmes, the most significant of the IAEA's recommended instruments is the CNS. This was developed by the IAEA following the 1986 accident at the Chernobyl nuclear power plant in the Ukraine.

Each party to the CNS is required to implement the fundamental safety principles that the CNS articulates. These principles emphasise six main factors:

- i. the effective separation of the regulatory body;
- ii. the establishment of policies that give due priority to nuclear safety;
- iii. the implementation of procedures to evaluate site-related safety factors;
- iv. several levels of protection (defence in depth) against the release of radioactive materials;

⁵ The Statute of the IAEA, Article II.

- v. safe operational procedures; and
- vi. the minimisation of waste.

As a party to the CNS, Australia must report to the IAEA on its compliance.⁶

13. Australia can and should ensure public safety

With nuclear power generation, paramount priority must always be given to public safety. For this purpose, there are four indispensable attributes of an independent regulatory scheme for nuclear power:

- first, it must be open and transparent;
- secondly, it must be genuinely consultative;
- thirdly, the decision-making body must follow 'due process' in all of its decisions and be legally accountable for any failure to do so;
- and, finally, there must be a legislative guarantee of public participation in decision-making through representation on the decision-making body itself.

ARPANSA already has the first three attributes; it is required to implement a licensing process that is open, transparent, consultative and accountable.

To provide further transparency and to further enhance public trust in the regulatory system (the fourth attribute mentioned above), ARPANSA's legislation could be changed to provide for permanent participation by the public in ARPANSA's decision-making directorate.

14. Timing: 2022 for Australia's first SMR

It may take up to eight years for Australia to prepare for its first SMR. The preparatory work is costly and extensive. It could not be undertaken without a change in the law nor, in our opinion, without community consultation.

Although the Energy Green Paper has proposed technology neutrality as a key theme, we suggest that the Energy White Paper will need to specifically address when and how the legislative prohibition against nuclear power could be removed.

Given the need for community consultation, it would be reasonable to allow up to two years for this to occur. Any longer would, however, be detrimental to the opportunity that Australia may have to participate in SMR development.

After the law is changed, another four years will be required for site selection, system design, plant scoping and selection, preliminary engineering and technical studies, the obtaining of all planning and regulatory approvals and carrying out of financial and feasibility studies. During this entire period, there would need to be continuing consultation with the local and wider communities.

The success of community consultation would culminate with a contract with a selected plant supplier for delivery of the first plant. Detailed engineering, plant procurement, construction of civil works and commissioning of the plant would then require another two years, with operational commencement possible in 2022.

⁶ The national compliance reports by Australia are published on the ARPANSA website.

15. Australia should aim to be an innovative nation in this new field

There is every reason for Australia to become an innovative nation in the field of safe nuclear power generation, building on the knowledge and experience of both ANSTO and ARPANSA, with complete transparency and with genuine community consultation.

SMR design, development, installation and operation would provide skilled employment opportunities and jobs in a new field in Australia with important growth prospects and significant export prospects.

Australia's commercial, technological and regulatory success in this field could provide a model for other countries that are considering nuclear power development.

