



Review of Small Nuclear Power Reactors for Australia

A project to independently evaluate the technical, commercial and regulatory challenges for the implementation of small modular nuclear reactors to meet some of the future energy needs of Australia

THE CONTEXT

Many regions and resource developments in Australia do not have access to grid base load power supply. Power supplies for non-grid base demand are primarily diesel fuel and gas. The need is for an equal, or lower cost, and more sustainable alternative which is less cost sensitive in operation. Wind and solar are sustainable, but expensive, and can not provide base load capacity.

A potentially viable alternative is evolving from the development of small modular nuclear reactors, based on more advanced nuclear technology within an enhanced safety environment and capable of relatively short delivery times.

Australia is a significant producer of uranium and has in excess of 30 percent of the world's known recoverable resources. However, Australia has no significant nuclear industry, with the exception of the Australian Nuclear Science and Technology Organisation (ANSTO), and no legislative framework for the operation of other nuclear reactors

Australia warrants an appraisal of the technical, commercial and regulatory challenges for the implementation of small modular nuclear reactors in the Australian domestic power environment, including a comprehensive evaluation of all issues associated with safety, waste and proliferation. If this technology is viable for Australia, the benefits of a process for its implementation will potentially enhance Australia's energy security through direct use of its own resources as well as the development of its expertise in delivering such technology.

The Warren Centre for Advanced Engineering is a not-for-profit, self funded, industry-linked institute based within The University of Sydney. Its objective is to foster excellence and innovation in advanced engineering throughout Australia. It is in a unique position to provide a framework for an independent evaluation drawing on all the potential stakeholders and without any preconceived outcomes.

THE OBJECTIVES OF THE PROJECT

This project aims to better inform the public and, in particular, the media, on the changing global scene in nuclear energy through the study of the potential for small modular reactors (SMRs) to meet some of Australia's energy needs. It will do this by

- reviewing the current state of small modular reactors (up to 150MWe), and their possible application, and
- comprehensively tabling the issues associated with waste, safety, proliferation and the current, and required, regulatory framework, and
- using the findings to inform the community and stimulate discussion on the potential for the implementation of SMR technology in Australia.

WHO WILL BE INVOLVED?

This project has been initiated by The Warren Centre for Advanced Engineering and will be supervised by a Steering Committee jointly chaired by Mr Sandy Longworth and Mr John Doherty from the Centre to include representatives of key supporters.

This project has the active support of Mr John Grill, CEO of WorleyParsons and Dr Adrian Patterson, CEO of ANSTO. WorleyParsons is an Australian listed engineering and project services company and one of the world's leading providers of nuclear engineering services. ANSTO is an Australian Government agency, which has the capacity to bring to the project world-class advice on research and innovation in nuclear science and technology.

Project management services for the project will be provided by WorleyParsons under the direction of Mr Matt Robinson.

A project advisory panel will be identified to provide input from all stakeholder perspectives under the leadership of the Project Fellow, Professor Barry Brook who holds the Foundation *Sir Hubert Wilkins Chair of Climate Change* and is Director of Climate Science at The Environment Institute at the University of Adelaide.



AUSTRALIA AND THE NUCLEAR WORLD

Currently there are 440 nuclear power reactors in service world-wide, with a further 61 under construction and 158 planned (*WNA, April 2011*).

Australia is a significant producer of uranium but has no significant nuclear industry, with the exception of the Australian Nuclear Science and Technology Organisation (ANSTO). There is no legislative framework for the operation of other nuclear reactors.

WHAT ARE SMALL MODULAR NUCLEAR REACTORS?

SMRs are factory made units with a design life of up to 60 years, operating on a 24/7/365 basis, and with fuel re-charging intervals from 5 to 30 years. They have the potential to provide a relatively stable cost of power over their refuelling cycle, and have a low carbon emissions profile. The units of interest to this project are in the 10 to 150 MWe category. They incorporate passive safety systems and are designed to be safe on emergency shut-down. It is projected that the first of these units could receive licensing in the USA in 2015.

WHAT ARE THE POTENTIAL APPLICATIONS?

SMRs in Australia have potential application for:

- Satellite towns, grid connected, or otherwise
- Decentralised project orientated towns
- Remote mine site developments
- Mines with process facilities e.g. oxide copper/SXEW, nickel laterite
- Replacement of diesel facilities on NSW & Queensland Islands
- Irrigation projects
- Desalination plants
- Stand alone vehicle electric charging stations

WHO ARE THE POTENTIAL STAKEHOLDERS?

Potential stakeholders may include government, mining companies, engineering companies, utilities, SMR engineering companies, legal firms, media and the public generally

HOW WILL THE PROJECT PROCEED?

Working groups will be established in three areas – technology, application and regulation. The technology group will evaluate the emerging small modular nuclear reactor technologies and their potential for commercial application with particular reference to safety, fuel cycle, spent fuel handling, waste disposal, transportation of reactors, fuel, spent fuel & waste, emergency shut-down, maintenance, and training requirements. The application group will study a number of real life potential SMR power applications in Australia taking into account estimates of capital and leasing expenses, operating expenses, power costs (with forecast escalation) and installation lead times. The studies will provide capital and operating cost data for the hypothetical nuclear power sourcing over a 30 to 60 year life span. The regulation group will look at the options for a regulatory framework.

The project will proceed in three phases – data gathering, scenario modelling/testing and reporting.

The results will be promulgated through seminars and technical sessions where appropriate together with public forums, where available, and through the media (TV and radio). A web site will be established to assist in this process and a number of reports will be published



THE WARREN CENTRE FOR ADVANCED ENGINEERING

The Warren Centre for Advanced Engineering is a not-for-profit, industry-linked institute based within the University of Sydney. Its objective is to foster excellence and innovation in advanced engineering throughout Australia. It does this by:

- stimulating the application and further development of new engineering technology
- encouraging the integration of innovation and engineering technology into the development of Australia's public policy and wealth creation
- providing independent comment and advice to government and industry on these and related issues.

The Warren Centre's activities are initiated and performed by a volunteer group of motivated and committed people who believe in its objectives and donate their time and talent to achieve particular outcomes. Its extensive network of supporters allow the Centre to respond appropriately to client and stakeholder needs and enable it to draw on a wide range of resources to create and service interdisciplinary teams.

The Warren Centre brings together the leading edge people in a selected field of engineering technology to work as a project team to:

- Focus on removing barriers to commercial success in that field,
- Develop new insights and knowledge in the technology; and
- Accelerate the technology's application in Australian industry.

These major projects invariably result in important breakthroughs in the technology itself and impact on Australian engineering practice and business enterprise.

Since 1983, The Warren Centre has initiated many major projects in a diverse range of engineering industries. The Warren Centre is recognised for its inclusive, progressive approach and the wide impact of its many initiatives.

Its achievements can be viewed on the Centre's website at <http://sydney.edu.au/warrencentre/> and in the publication "Pushing the Engineering Envelope" available from the Centre

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