

NUCLEAR ENERGY IS AN OPTION

AUGUST 2014

In a carbon-constrained international policy environment, nuclear energy is an option to provide Australia's future low-emission baseload power needs

NUCLEAR POWER TODAY

In March 2014 there were 435 nuclear power reactors in operation worldwide representing a total installed electricity generation capacity of approximately 372,000 megawatts. This installed capacity is distributed across 30 countries with the share of total generation capacity in each country ranging from about 73 per cent in France to two per cent in China, although this small percentage still represents about 16,000 megawatts of capacity through 20 operating plants.

Nuclear power plants in operation and under construction today typically achieve or exceed 1,000 megawatts per plant. They are designed to provide base-load power with capacity factors in the range of 80 per cent to more than 90 per cent.

The major growth in nuclear generation capacity occurred during the 1970s and 1980s and a new growth spurt arguably underway with 72 reactors currently under construction. The continuing growth of nuclear power worldwide will depend on its economics (including its value in contributing to reducing emissions), financing (given the large capital outlays), its continued need to demonstrate safety as an over-riding priority and its social acceptance relative to alternative energy sources. The industry is investing to reduce capital costs and construction times of plants, but factors outside the industry's control, such as the price of natural gas and emissions pricing will determine, for each investor, whether nuclear is a cost-effective option.

Australia's Reasonably Assured Resources (RAR) of uranium recoverable at costs of less than US\$130 per kilogram uranium were estimated at 1,174,000 tonnes in December 2012, which represented 34 per cent of world resources in this category. Australia is the third-largest uranium producer after Kazakhstan and Canada.

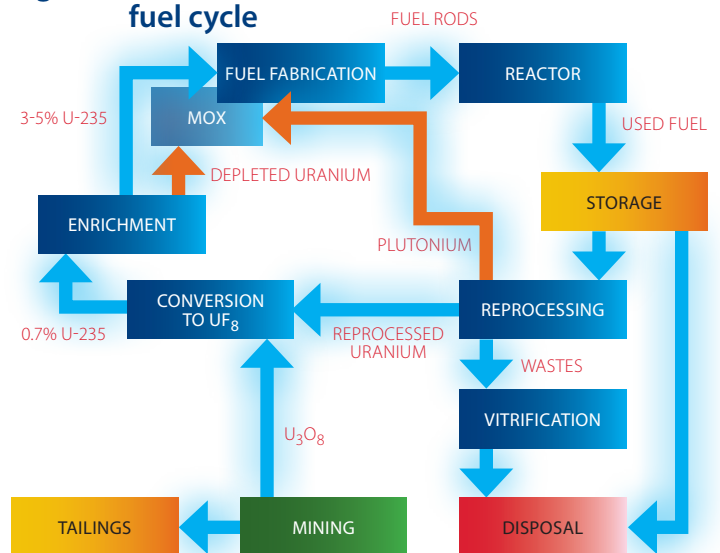
Australia, through its established regulators, ASNO and ARPANSA, has an important international role in global nuclear safeguards and safety through "the expertise that has derived from implementing safeguards and security at the Australian Nuclear Science and Technology Organisation (ANSTO), universities, research and development institutes and companies, and uranium mines, and in designing, implementing and administering the controls on Australian nuclear material through the network of 22 bilateral nuclear cooperation agreements under which Australian uranium is exported." (ASNO)

AUSTRALIA'S ROLE

The civilian nuclear fuel cycle is depicted in Figure 1.

Worldwide, uranium mining currently provides about 85 per cent of global industry requirements, with the balance coming, up to the end of 2013, from down-blending of excess weapons material and stockpiles.

Figure 1 The nuclear fuel cycle



Conceptually, Australia has good geological potential for a disposal industry to service national requirements. However, there is a need for a wide-ranging assessment of disposal technologies and security issues, training researchers and future workers, as well as addressing and overcoming public and political concerns.

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Coal-fired thermal power plants provide nearly all Australia's present base-load generation capacity. However many of these coal plants will reach the end of their commercial lives within the next 20 to 30 years – during which time international and national policy interventions and investments to limit anthropogenic greenhouse gas (GHG) emissions are expected to increase markedly.

Nuclear energy offers near-zero GHG emissions for base-load power supply. Levelised cost of energy (LCOE) modelling by the Bureau of Resource and Energy Economics suggests that nuclear power, in the 2030 to 2050 timeframe, is economically competitive with a broad range of other low-or zero-emission base-load technologies.

Apart from ANSTO's OPAL nuclear reactor for medical and science applications, Australia has not utilised its uranium resources for domestic power generation. However, on economic, social and environmental considerations in an international carbon-constrained policy environment, nuclear power should be included as an option for base-load power supply in Australia. Should Australia proceed towards adoption of nuclear power it must do so within the International Atomic Energy Agency (IAEA)

full scope safeguards. The management of interim and long-term storage of nuclear waste will also need to be based on established international best practice.

Australia's participation in global nuclear fuel cycles and the maintenance of capabilities that will enable an ongoing contribution to global nuclear safeguards and safety will be important for any potential careful development in this area.

THE CHALLENGE

Nuclear power in Australia does not yet have a social licence to operate or wide public support. For decades it has been actively opposed by Australian governments at all levels. Should Australia consider deploying nuclear power the need to first address community concerns is paramount. Open public engagement is essential and the process should begin now. The long-term nature of the issue highlights the need to ensure the involvement of the younger generation in the engagement process.

THE WAY FORWARD

ATSE provides the following key recommendations to government, industry and universities, to progress nuclear as an energy option for Australia:

1. Undertake a comprehensive business/economic analysis.
2. Compare the nuclear option with alternative scenarios to the 2030-2050 timeframe.
3. Commence active and open community engagement.
4. Review current policies that preclude its consideration.
5. Build on current education and training activities, including through secondment and increasing and supporting university courses.
6. Examine the regulatory requirements and determine the actions needed.
7. Build on current overseas R&D program linkages, for example in fusion or the Generation IV program.

More specifically, within the four key themes set out in ATSE's Energy Position Statement, the three that provide actions to progress nuclear energy as an option for Australia are:

THEME 2: Supply systems and market measures that deliver reliable, competitive, low emissions electricity.

A long-term, stable, bipartisan Australian energy policy and associated regulatory environment, covering all viable energy sources and conversion technologies including nuclear energy, is required to:

- Attract from national and international markets the massive capital needs for transformation of our electricity system, including large-scale base-load plant replacement, regardless of technology; and
- Meet Australia's national objectives of reliability, security, minimum cost and emissions abatement.

Current policies that preclude consideration of nuclear energy should be reconsidered. Australia's adoption of nuclear power generation will require a significantly enhanced regulatory regime – a process that will take several years. An early start is needed to examine thoroughly the relevant issues to ensure readiness. This includes studies of nuclear power plant siting options,

legal and regulatory frameworks, projected skills needs and appropriate educational and training facilities and regimes, including seconding qualified Australians for training in overseas nuclear power plants.

An extensive and openly transparent community engagement process should begin to build understanding of the benefits and safety of nuclear energy including gathering a deeper understanding of the attitudes of Australians.

An independent study of the related business opportunities and potential job creation arising from Australia's adoption of nuclear power would benefit this engagement process.

THEME 3: Supply systems and market measures that deliver reliable supply of competitively priced, low emissions fuels for transport

Market uptake of electric passenger and light commercial vehicles will require widespread deployment of low-emission electricity supplies, including nuclear as an option, for deep GHG and other emission reductions. Long-term alternative technology scenarios need to be rigorously evaluated, using for example CSIRO's eFuture modelling tool or similar, to provide high quality forecasts of Australia's future power demands and their economic, social and environmental impacts, including demands from the transport sector.

THEME 4: Strategic investments in innovation of low- emissions energy technologies

There is significant ongoing international private and public sector investment in next generation nuclear power plant technologies, including consideration of thorium in fission reactors and nuclear fusion-based energy technologies.

Australia should enhance its international collaborations to link its national research, education and training activities to recognised overseas programs and projects.

SOURCES: International Atomic Energy Agency, Australian Radiation Protection and Nuclear Safety Agency, Bureau of Resources and Energy Economics, World Nuclear Association and Australian Safeguards and Non-Proliferation Office.

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