

Economics.

The Nuclear Fuel Cycle Royal Commission found that there is a significant economic opportunity for South Australia to pursue the storage and disposal of nuclear waste from overseas countries (known as intermediate and high level waste).

Over a 120 year project timeline, the potential benefits and costs that could be realised by securing a partnership with a client nation were modelled and identified as:

FINDINGS
FROM THE
NUCLEAR FUEL
CYCLE ROYAL
COMMISSION
REPORT.

\$257 BILLION
REVENUE.

\$145 BILLION
EXPENDITURE.

\$445 BILLION
STATE WEALTH FUND.

9,600
JOBS.

How was the economic analysis and modelling undertaken?

- By a partnership between Jacobs and MCM who bring specific experience in engineering and constructing large public and private infrastructure.
- Key assumptions and methodologies were scrutinised by two separate groups of independent experts.
- Assessment was independently verified and peer reviewed.

Is there demand for the storage of used fuel?

The Nuclear Fuel Cycle Royal Commission assessed the potential market for a South Australian geological disposal facility for international used fuel. It identified that the current global inventory of used fuel is estimated to be in the order of 390,000 tonnes and by 2090 this inventory is anticipated to grow to over 1 million tonnes. The amount of revenue, expenditure, benefits and jobs depend on the agreements reached with partner countries. The revenue and expenditure figures identified above are based on South Australia accepting 138,000 tonnes of used fuel.

What are customers willing to pay?

While an international market does not currently exist a number of countries have expressed an interest in having their used fuel disposed of overseas. The Royal Commission prepared a conservative estimate of what potential customer countries may be willing to pay for this service that was based on:

- The costs that the customer might avoid in receiving the service.
- The costs of disposal estimated in countries intending to dispose of their used fuel domestically.
- The costs associated with reprocessing, being the only alternative long-term used fuel management strategy.
- The savings in capital costs for new nuclear power plants that might be achieved where access to permanent used fuel disposal reduces project risk and therefore lowers the cost of finance.
- Distress costs, being the costs a nuclear power plant operator may be willing to pay to avoid plant shutdown due to a lack of used fuel management options.

Key elements of the modelling undertaken by the Royal Commission.

The amount of revenue, expenditure and benefits would ultimately be determined by how much used fuel South Australia chooses to accept for disposal and how much any partner countries are willing to pay. The following volumes and prices were used to estimate the revenue and flow on potential benefits:

- 138,000 tonnes high level waste that is mostly used fuel, at \$1.75 million per tonne; and
- 390,000m³ intermediate level waste, at \$40,000 per cubic metre.

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REVENUE



\$257 billion revenue from contracts with overseas customer countries.

This could be generated by a state-owned corporation accepting used fuel from countries with existing stockpiles and no local solution.

The Royal Commission modelling estimated that approximately 276,000 tonnes of used fuel from such countries will be available between now and 2090, based on existing nuclear power plants or those in advance stages of development.

The total revenue of \$257 billion was estimated based on accepting half of the accessible market.

JOBS AND SKILLS



Investment and development on this scale could create more than 9,600 full time equivalent direct and indirect jobs by 2030, coinciding with peak construction.

Were South Australia to embark on a nuclear development, further education and training of our existing workforce would be required. This would build on the up skilling of existing trades (concreting, electrical, carpentry and welding), broad engineering capabilities (from the mining sector), regulatory and project management expertise.

There could also be opportunities in specialised manufacturing of casks and canisters for transport of used fuel or the design and construction of specialised double hulled ships.

EXPENDITURE



\$145 billion expenditure is estimated for construction, operating, decommissioning and closure and remediation costs for a used fuel storage and disposal facility.

The Royal Commission found that through pre-commitments from client countries (up front payments) the state would not need to assume significant commercial risks associated with capital costs.

The concept relies upon the development of an interim storage facility where shielded dry casks holding used fuel will be stored for around two decades as the geological disposal facility is developed and licensed for safe operation.

SHARING THE BENEFITS



The Royal Commission proposed a State Wealth Fund to protect future use of profits received, into which all project dividends are deposited. By investing profits into such a fund to accrue interest, a \$445 billion State Wealth Fund could accumulate.

The Fund could grow by more than \$6 billion a year for 70 years to reach around \$445 billion (assuming interest accruing at 4%). Legislation would ensure a proportion of the revenue ensures future generations benefit.

South Australian Citizens' Jury.

In June and July, a Citizens' Jury of 50 randomly selected South Australians examined the Royal Commission's Report. They identified key themes for further discussion including economics and the benefits/risks for our state. The Jury proposed questions for consideration as part of community consultation underway. To support the community conversation, further information about these issues is provided. Your feedback on these questions is important and further work is underway to investigate these topics more in the lead up to a second Citizens Jury later this year.



What benefits can be made available to South Australians now and in future generations? How will the benefits be realised and how will the wealth be distributed?

The Royal Commission proposed a State Wealth Fund to protect any future profits supported by specific legislation to ensure future generations benefit.

Dependent on the outcomes of community consultation, government decision making and future negotiations, a robust legislative regime could be developed further to put in place the necessary arrangements to support wealth distribution, investment and intergenerational benefit.

Community benefit models in Belgium, Finland and France involved working with the community to invest in local infrastructure such as schools, roads and community facilities.

How can we be sure that the economic analysis completed by the Royal Commission is robust?

The modelling undertaken for the Royal Commission by Jacobs MCM included multiple stages of peer review and independent evaluation. This was undertaken by the Royal Commission's Economic Modelling Steering Committee comprising eminent resource and labour economists from across Australia and separately by Ernst and Young who peer reviewed all of the Royal Commission's business case assessments.

Further steps to pursue the opportunity set out in the Royal Commission's Report would involve careful planning as well as state, federal and international cooperation to support South Australia to demonstrate readiness to meet potential demand of customer countries (i.e. those countries that cannot establish their own solution or who have expressed interest in an international solution).

How will the South Australian brand or external reputation be affected and how will this have an effect on tourism and trade?

South Australia's economic priorities support diversification of our economy away from traditional manufacturing to new and high tech industries. They also prioritise growth of our tourism and food and wine sectors with our clean and green reputation providing a competitive advantage.

Should further steps be taken towards South Australia expanding its role in the nuclear fuel cycle, it will be important for government to work in partnership with the community and key stakeholders to explore these potential impacts further.

The Royal Commission found that a number of countries with established nuclear industries, such as France, Finland, Sweden and Switzerland, also have high-value tourism, food and wine industries.

For example, in France, ANDRA's Cigeo deep geological repository project is located in the world famous Champagne producing region. In Switzerland, the Lindt chocolate factory is located 4 km from Goesgen nuclear power plant.

What reliance is there on other countries to pre-commit to storing high level waste at a fixed price?

The Royal Commission found that the development of the proposed concept would require the establishment of partnerships with customer countries and financial pre-commitments to minimise the commercial risk to South Australia.

Pre-commitments and financial partnerships have been crucial to reducing the commercial risk of pursuing high capital cost projects across a number of industries. For example, the development of high capital cost (>\$10 billion) projects in the oil and gas industry require combinations of equity partnerships and long-term purchase agreements before large expenditures can be made.

Such arrangements have been made to secure finance for a range of oil and gas projects across Australia this decade – including the Chevron Wheatstone and Gorgon LNG projects in WA, the Santos Gladstone LNG project and the Ichtys LNG project in the Northern Territory.

Close cooperation between the South Australian and Federal Government is important to continue were South Australia to pursue the opportunity to store and dispose nuclear waste from overseas countries. Given the Federal Government's international responsibilities with respect to non-proliferation, nuclear safety and nuclear security such support would be important to South Australians and the international community.

How do we incorporate rapid change in future technologies such as nuclear fuel recycling in the next generation of nuclear fuel reactors?

The Royal Commission acknowledged the potential for future advancements in nuclear power technology, including for used fuel to be a valuable resource that can power a new generation of nuclear reactors.

It also found that, based on current expectations in nuclear power technology, the Generation IV reactors would still produce a substantial quantity of waste that would eventually require disposal.

What are the workforce opportunities, skills, training and research?

South Australia is well positioned to take advantage of emerging technologies and opportunities associated with the nuclear fuel cycle. Existing partnerships with Australian Nuclear Science and Technology Organisation, research agencies, universities and industry ensures South Australia is already actively engaged with innovative, highly skilled specialist fields.

Research capabilities to support the nuclear waste disposal industry would need to be developed in parallel with an education and skills building program. This could involve the establishment of an associated Centre of Excellence within SA to undertake research on the long-term characteristics and behaviour of used fuel and high level waste, and its disposal.



Every South Australian has an opportunity to learn more about the nuclear fuel cycle by discovering the facts, understanding the choices, and providing their views on the Royal Commission's Report. This is a discussion about the state's future that all South Australians can have, and will help guide the Government's decision making on the next steps.

Visit nuclear.sa.gov.au to find out more.