Ernst & Young (2016), Computational General Equilibrium Modelling Assessment

OBJECTIVE

To assess the potential economic impacts on the South Australian and broader Australian economy that would result from additional investment in the nuclear fuel cycle.

BACKGROUND

The computational general equilibrium (CGE) modelling was undertaken by Ernst & Young[1] in conjunction with the Victoria University Centre of Policy Studies.

Nuclear fuel cycle facilities were assessed against defined investment scenarios representing various levels of reduction in carbon emissions for the 2030 and 2050 time scales. These opportunities are not dependent on a specific Australian carbon abatement policy.

The CGE model calculates the change, with and without an investment in the nuclear fuel cycle, in:

- gross national or state income (GNI/GSI)
- gross domestic or state product (GDP/GSP)
- the impact on the labour market.

The exploration and mining of uranium is currently allowed in South Australia; however, the development of nuclear power, uranium processing facilities, and the importation and storage of used nuclear fuel and radioactive waste in South Australia would require state and federal legislation to be repealed.

URANIUM MINING AND MILLING

There may be substantial growth in global demand for uranium ore driven by an increase in global nuclear electricity generation, which is estimated to double by 2040 under the International Energy Agency's (IEA) 450 parts per million (ppm) carbon emissions abatement scenario.[2]

South Australia is well positioned to benefit from this growth in demand for uranium concentrate, with exports potentially increasing by a factor of three by 2040, assuming the maintenance of current market share.[3]

Growth in the value of the uranium mining industry of 32 per cent by 2029–30 in South Australia would represent significant growth in activity in regional areas. However, on an economy-wide basis the impacts on real GSP and GSI are small and these mask the effect of growth at the industry level. Despite this, this would represent a significant increase in activity in regional areas with consequent regional impacts on growth and jobs.[4]

An increase in uranium mining and milling of this order would add more than $300 million to state GSP (or 0.23 per cent[5]) and enable the employment (direct and indirect) of approximately 800 persons on a full-time basis by 2030.[6]

URANIUM PROCESSING

There are economic benefits associated with the further processing of uranium for conversion, enrichment or fabrication into fuel assemblies for South Australia, although this is likely to be of a smaller magnitude than opportunities in other parts of the nuclear fuel cycle.[7]

Relative to the outcomes under a business-as-usual scenario that represents a carbon-constrained world, the development of a further processing industry, comprising investment in conversion and enrichment facilities together, would add more than $670 million to GSP (or 0.47 per cent) and enable the employment of approximately 1000 persons on a full-time basis by 2030.[8]

The economic benefits of the further processing of nuclear fuel reflect modest commercial returns generated to South Australia.[9]

WASTE STORAGE AND DISPOSAL

The growth in global nuclear electricity generation and the ongoing need for long-term storage and disposal solutions for multiple countries, presents a significant economic opportunity to provide a waste storage and disposal facility in South Australia.[10]

The radioactive waste storage and disposal business case[11] was estimated to improve GSI and GSP by about 5 per cent (or $6.8 billion) by 2030 and 3.6 per cent by 2050, relative to a scenario without this investment.[12] Similarly, GSI per person in today's dollars was estimated to be about $3500 higher by 2030 and about $3300 higher by 2050. A future radioactive storage and disposal industry is estimated to be as big as the utilities (electricity, gas and water services) industry in South Australia by 2030.[13]

This new industry was also estimated to employ (direct and indirect) up to 9600 persons by 2030 and 7500 persons by 2050. This has the effect of reducing underemployment and unemployment in South Australia and Australia more widely.[14]

The significant economic benefits of developing radioactive waste storage and disposal facilities reflect the impact of substantial revenue flows to South Australia from the acceptance of used nuclear fuel. The terms of trade gains associated with this income flow and the reinvestment of profits in South Australian infrastructure further increases incomes to residents of the state.[15]

NUCLEAR ELECTRICITY GENERATION

The case for South Australia entering into nuclear electricity generation is not strong. This reflects the relative economics of nuclear electricity generation, even under high carbon prices, and the changing mix of generation assets in the national electricity market that undermines the economics of less flexible sources of electricity generation.[16]

However, it is important to note that this scenario is contingent on assumptions made in relation to private investment in residential battery storage systems to which the wholesale price of electricity is very sensitive. No assessment of the profitability of private investment in these battery storage systems was made as part of the modelling.[17]

The estimated wholesale price trajectory is also sensitive to the assumed level of carbon permit imports.[18] Although the Australian economy is assumed to be decarbonised by 2050, a quarter of this objective is met through imported international carbon permits rather than through local emission reductions.[19]

Given these caveats, there are plausible scenarios in which nuclear electricity generation has a role in Australia's electricity market. For example, if deeper reductions in carbon emissions are required sooner while maintaining electricity supply reliability, or if the expected increase in globally installed nuclear electricity generation capacity leads to material capital cost reductions. In these circumstances, the viability of nuclear electricity generation may be improved.[20]

In the event that a single, large, gigawatt-scale nuclear power plant were developed in South Australia by 2030 it would have the effect of reducing wholesale electricity prices in the state by 24 per cent relative to a case with no nuclear power plant[21], and is estimated to employ approximately 575 persons.[22] However, GSP would decrease by approximately 3 per cent if a subsidy to a nuclear power plant in South Australia is made at the expense of other state government services.[23]

NUCLEAR FUEL LEASING

Fuel leasing is based on a concept of the sale of uranium concentrate (or a value-added form of uranium) from Australia to international nuclear power utilities before its eventual return to South Australia for storage and disposal.[24]

The synergistic benefits from a fuel leasing arrangement have not been specifically considered in this analysis. However, potential economic benefit from combining the single elements of front-end processing and waste management was estimated to enable significant economic benefits.[25]

A fuel leasing arrangement comprising a combination of conversion, enrichment and waste management services is estimated to:[26]

- lead to a 5.6 per cent increase in gross income by South Australia (or $7.7bn) by 2030
- an increase of $4000 per capita by 2030
- a significant increase in full-time employment in South Australia of about 11,000 by 2030, with the component of full-time employment for conversion and enrichment contributing just over 1000 jobs to this total.[27]

REFERENCES

[1] Ernst & Young, *CGE modelling assessment*, report prepared for the Nuclear Fuel Cycle Royal Commission, Adelaide, February 2016, available at <http://nuclearrc.sa.gov.au/tentative-findings/>.

[2] ibid., p. 5 and p. 11.

[3] ibid., p. 5 and p. 11.

[4] ibid., p. 11.

[5] ibid.

[6] ibid., p. 11, Table 2.

[7] ibid., p. 5.

[8] ibid., p. 12, Table 3.

[9] ibid., p. 13.

[10] ibid., p. 5.

[11] Jacobs and MCM, *Radioactive waste storage and disposal facilities in SA—Quantitative cost analysis and business case*, report prepared for the Nuclear Fuel Cycle Royal Commission, Adelaide, 2016, available at <http://nuclearrc.sa.gov.au/tentative-findings/>.

[12] Ernst & Young, op. cit., p. 14, Table 4.

[13] ibid, p. 14.

[14] ibid, p. 14, Table 4.

[15] ibid, p. 14.

[16] ibid, p. 5.

[17] ibid., p. 15, 1.5.8

[18] ibid, p. 16

[19] ibid, p. 27, section 3.2.

[20] ibid, p. 5.

[21] ibid, p. 16.

[22] ibid, p. 16 Table 5.

[23] ibid, p. 17, Table 5.

[24] ibid, p. 14.

[25] ibid, p. 15.

[26] ibid, p. 15.

[27] ibid., p. 12 Table 3.