

Introduction

According to the draft agenda this public session will incorporate a series of presentations on the socio-economic analyses being undertaken to estimate the costs and benefits of establishing new nuclear activities in South Australia. Each contractor will present:

- the methodology being applied in undertaking the assessments;
- the key inputs to the assessments;
- the types of outputs which are anticipated.

Quantitative analyses will be undertaken to determine engineering, procurement, construction and lifecycle operating and maintenance costs associated with the possible development of facilities in South Australia for the processing of uranium oxide into fuel for use in nuclear reactors. Case studies to be considered are the establishment of conversion, enrichment and fuel fabrication processes for a light water reactor [LWR] and conversion and fuel fabrication processes for a pressurised heavy water reactor [PHWR].

Also relevant to fuel fabrication processes is this statement on page 8 of Issues Paper Two: *“South Australia’s decision to establish facilities for the conversion, enrichment, fuel fabrication or reprocessing of uranium could also be influenced by developments in prospective technologies, such as pyroprocessing and the development and production of high-performance materials for the thorium fuel cycle or other new reactor technologies.”* It is unclear how pyroprocessing, which is not new technology, and other new reactor technologies got excluded from tendered analyses.

Quantifying lifecycle costs to include disposal of radioactive “waste”

Not explicitly stated in lifecycle operating and maintenance costs, but required by international conventions and agreements overseen by the International Atomic Energy Agency [IAEA] are provisions for disposal of radioactive, and particularly high level radioactive “waste”. The map and data in the GE-Hitachi [GEH] submission are evidence of how LWR, PHWR and all Generation III & III+ reactors lifecycle costs have been and are being funded. By contrast Generation IV reactors are fuelled by high level radioactive “waste” and dispose of all but a tiny part of LWR and PHWR “waste” they use. Evidence of this is documented in *‘Managing Spent Fuel from Nuclear Power Reactors: Experience and Lessons from Around the World’*. It is a 2013 research report by the International Panel on Fissile Materials [IPFM]. [See: <http://fissilematerials.org/library/rr10.pdf>]

Given the above, estimating lifecycle costs and benefits to South Australia [SA] of establishing further nuclear activities also requires quantifying [lifecycle]:

- national [NEM plus WA] and international markets for electricity, spent uranium and competing energy fuels and “renewable” energy sources, like solar in SA
- international responses of all levels of governments particularly those largely discredited locally on their handling of nuclear power generation **plus** spent fuel and waste disposal
- responses of other parties with clear and immediate conflicting interests, such as thermal coal miners plus rail, shipping and coal trading organisations who supply that coal

- responses of yet other parties with interests in management and applications of the various national and international funds established to pay for final disposal of spent fuel that could be more safely, and probably more economically, recycled to recover energy sufficient for hundreds of years of world electricity, or other heat demands at steam temperatures

In the international markets for electricity and spent uranium is GEH with their Advanced Recycling Center [ARC], explained in the GEH submission. Evident there, but not explained is the failure, since before 2009, to agree even on a site where GEH could build a commercial scale demonstration ARC. This prompts questions such as did GEH assess in 2009 the prospect that by 2015 no site would be agreed, and why not? More on ARC is below.

GEH submission & Donald Hoffman's assessment of ARC

The GEH submission on management, storage and disposal of "waste", summarised the opportunity to reduce world, not just Australian including SA waste volumes, in its opening paragraph:

GE Hitachi Nuclear Energy's (GEH) response will focus on the storage/disposal of used nuclear fuel. The environmental risks associated with storage/disposal of used nuclear fuel at a purpose built facility will depend on the technology used. One strategy for minimizing the environmental risks of used nuclear fuel is to recycle its most problematic constituents thereby reducing the risks at the storage/disposal facility, using technology having a minimum environmental footprint itself. This can be accomplished by GEH's PRISM Advanced Recycling Center (ARC).

That last sentence is an unqualified statement that GEH can minimize the environmental risks of used nuclear fuel by recycling its most problematic constituents, thereby reducing the risks at the storage/disposal facility, using technology having a minimum environmental footprint. Its authors could be called by the RC to answer questions in its public session on present, practical, and **international**, environmental impact lessons, as well as those from past South Australian practices.

This article '*The case for a near-term commercial demonstration of the Integral Fast Reactor*' [see: <http://www.sciencedirect.com/science/article/pii/S2214993714000086>] advocated last November "*for an accelerated timetable for commercial demonstration of Generation IV nuclear technology, via construction of a prototype metal-fueled fast neutron reactor and associated 100 t/year pyroprocessing facility to convert and recycle spent fuel (routinely mischaracterized as "nuclear waste") that has accumulated from decades of lightwater reactor use.*" That parenthetical *routinely mischaracterized as "nuclear waste"* is the final disposal alternative "*wastes from reprocessing of spent fuel*" stated on page 4 of Issues Paper Four. Also the pyroprocessing facility referred to is one excluded from tendered analyses and the corresponding author of the article is Barry Brook, a member of the Royal Commission's [RC's] **Expert Advisory Committee**. Independent factual background on PRISM is published here: <http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Power-Reactors/Small-Nuclear-Power-Reactors/>

On 29 September Donald Hoffman, appeared as an expert RC witness. He answered questions on the topic of: "*nuclear reactor designs under development – potential advantages and key challenges to deployment*". The RC's video record and transcript include this relevant question and answer: *MR JACOBI: No. Sorry, I think we're at cross-purposes. I'm just interested to understand has there been a demonstration or prototype built of the PRISM? MR HOFFMAN: No. No, there has not. Well, look I*

want to say that there has, there's parts and pieces that are built but is one integrated reactor core capable of doing what PRISM does, no. But what they've done is they built it in parts and pieces to demonstrate the unique capabilities of those portions of the overall system to demonstrate their capability to function as expected. Unfortunately there was not time to question Mr Hoffman on "key challenges to deployment" of even a demonstration of GEH ARC technology to dispose of spent fuel. His answer would have been relevant to estimating [lifecycle] international market for spent uranium.

Given the above this topic's witnesses should ask Mr Hoffman about the "key challenges to deployment" of even a demonstration of GEH ARC technology or any competing technologies to dispose of spent fuel. However even if Mr Hoffman has compelling evidence that a demonstration of GEH ARC technology is, despite the "case for a near-term commercial demonstration of" ARC, unlikely in the foreseeable future, many more questions remain.

More questions for witnesses at session on estimating costs & benefits

The ultimate question for Tuesday's witnesses is whether their report is likely to be overtaken by facts that emerge during the time they take to complete their tasks?

As an example of particular relevance to South Australians, what if enough of them expressed interest in starting [by say 2019] an ARC demonstration to replace, for an ARC fuel cycle, Alinta's coal fuelled Port Augusta steam boilers? Given local awareness of evidence such as timely commencement of negotiations with GEH and [this](#), published here last month in the New York Times, even this is foreseeable. It comes down to media coverage, particularly locally of the RC's work, such as its very public and transparent reporting, until it report [next May?].

Even if enough [how many?] informed South Australians do not express interest a Port Augusta ARC demonstration it is also foreseeable that Roxby Downs landowners, residents and workers, plus BHP Billiton, could express enough interest in an ARC demonstration and timely commencement of negotiations with GEH.

At present the probability that either of the above near-term, and closely correlated, examples emerge before the RC gets reports from Tuesday's witnesses may be low. It could be much higher by the time their reports are due.

A final question is would it be worth suspending the witnesses work if either of the above local possibilities emerge, or to retender the work to include pyroprocessing plus the international issues in still unanswered questions on "key challenges to deployment" of even a demonstration of ARC?