COMMON MYTHS OF THE NUCLEAR INDUSTRY

Myth: the new generation of nuclear reactors are designed to recycle nuclear waste

BUST

These reactors don't exist

These reactors often spoken of by advocates of nuclear energy are hypothetical. There are none of these "Generation IV" reactors commercially operating anywhere in the world:

- **Even the demonstration plants are still decades away**
    - Various designs are still under investigation on paper and have been for many years.
    - The first demonstration plants are projected to be in operation by 2030-2040,[1] so they are yet to be tested and still many years away.
- **Problems with earlier models**
    - The specific type of Generation IV reactor that would recycle waste – the Integral Fast Reactor – only exists on paper, but earlier models of fast reactors have been expensive, underperforming, and have had a history of fires and other accidents, with many countries abandoning the technology.[2]
- **These reactors would still produce some waste**
    - The Integral Fast Reactor is called "integral" because it would process used reactor fuel on-site, separating plutonium (a weapons explosive) and other long-lived radioactive isotopes from the used fuel, to be fed back into the reactor. It essentially converts long-lived waste into shorter lived waste. This waste would still remain dangerous for a minimum of 200 years (provided it is not contaminated with high level waste products), so we are still left with a waste problem that spans generations.[3]
- **The theory is that these reactors would eat through global stockpiles of plutonium**
    - When thinking about recycling waste it's important not to confuse recycling *existing* stockpiles of waste with these reactors perpetually running off of *their own* waste, which they could also be operated to do.[4] If they ran off their own waste, they would not consume existing waste beyond the initial fuel load.[5]

Myth: nuclear is the only alternative to coal for baseload power

BUST

We don't need baseload

Baseload describes the minimum amount of electricity required by society at a steady rate. It is argued that renewables cannot provide this constant minimum energy because they are unreliable or variable, because the sun doesn't always shine and the wind doesn't always blow, so we need nuclear energy to replace our coal-fired baseload stations. We don't need baseload because:

- **Geographic dispersion of renewable energy stations, storage of renewable energy, and demand management can address fluctuations in energy availability from renewable sources**
    - Geographic dispersion of renewable energy power stations would address variability. Although one windmill is variable, a system of windfarms in various locations is much less so.
    - Energy storage can also address variability. Solar thermal energy storage is commercially available, not hypothetical, allowing for the dispatch of energy at peak periods or when the sun isn't shining.
    - A transparent "smart" electricity grid could inform consumers of dips in energy availability and facilitate energy use that takes availability into account.
- **Nuclear power stations are too inflexible to operate alongside a renewable energy mix**
    - Baseload stations are designed to operate continuously and cannot be ramped up or down quickly. To accommodate fluctuations in wind and sun, renewables require "back-up" from power stations that can provide energy flexibly, not constantly as traditional baseload does.
    - South Australia is already operating on nearly 40% renewable energy. Nuclear energy is a poor partner for such a high penetration of renewables.[6]

Myth: the nuclear renaissance

BUST

The nuclear industry is in decline

Whilst the Royal Commission into the Nuclear Fuel Cycle is assessing the feasibility of expanding the nuclear industry in SA, the global nuclear industry is stagnating. Rather than a "nuclear renaissance," there are:

- **Fewer reactors**
  - The commonly cited number of reactors currently operating in the world is 437. This includes reactors that have not been operational for over a year. As of October 2015 there are actually 392 *operational* reactors.[7]
  - These 392 reactors are 46 fewer than the 438 operating in 2002.
  - Further reductions are expected as a significant proportion of the world's nuclear reactors are ageing – closure of almost half the world's total is expected by 2040.
- **Fewer reactors being constructed**
  - Nuclear plant construction starts have fallen from fifteen in 2010 to three in 2014.[8]
- **No growth in nuclear share of global power generation**
  - The nuclear share of global power generation has stagnated over the last three years at 10.8%, after a steady decline from its peak of 17.6% in 1996.[9]
- **Overall decline in global nuclear energy generation**
  - Annual global nuclear electricity generation peaked in 2006 at 2660 TWh. In 2014 it was 9.4% lower than 2006 levels.[10]
- **Slow growth compared with renewables**
  - Compared with 1997, in 2014, an additional 185 TWh of electricity was produced from solar photovoltaics, 694 TWh from wind, and just 147 TWh from nuclear.
  - Between 2013 and 2014, electricity generation from solar increased by over 38%, for wind power over 10%, and for nuclear power 2.2%[11]

Myth: expansion of the nuclear industry would be good for the economy

BUST

Expansion of any sector would be good for the economy. Why choose a sector which:

- **Has little potential for growth**
  - The nuclear renaissance is a myth.
  - Uranium prices remain below the average cost of production and supply continues to exceed demand. In 2012 BHP Billiton shelved its plan to expand the Olympic Dam mine and has since sacked hundreds of workers. In October 2015 the Wiluna uranium mine in Western Australia was put on hold due to the ongoing downturn in demand and prices.
  - The global market in uranium conversion, enrichment & fuel fabrication is already oversupplied.
- **Is likely to increase electricity costs**
  - Nuclear energy has very high capital costs and is expensive and heavily subsidised to offset these costs.
  - The UK government has guaranteed the French company EDF AU$173.30 per megawatt-hour generated by the planned Hinckley Point reactors in Somerset, England, for 35 years. This is 2.5 times higher than wholesale electricity prices in Australia.[12]
- **Has serious environmental, health and weapons proliferation risks - comparable employment can be generated in renewable projects, without the associated risks**
  - On return from an overseas visit, Royal Commissioner Kevin Scarce announced at a press conference on 24th July 2015 that the Canadian nuclear industry accounts for 60, 000 jobs – had he gone to Germany to explore alternatives he would have learnt that the renewables industry there has created nearly 400,000 jobs.[13]

Myth: nuclear energy is zero carbon so we need it to mitigate climate change

BUST

Nuclear energy is not zero carbon

- **This ignores life-cycle CO2 emissions**
    - These include emissions from the other stages of nuclear power generation, such as uranium mining, milling, enrichment, transport, reactor construction and decommissioning, and mine site rehabilitation.
    - On average, life cycle emissions from wind and solar thermal are found to be much lower than emissions from nuclear energy, and solar PV comparable or lower (depending on the materials used to make the solar cells).[14]
    - Estimates of the life cycle emissions of nuclear energy vary depending on assumptions made. Assuming no attempt should be made to rehabilitate sites, or that radioactive mine waste will be left above ground rather than buried, pushes emissions estimates for nuclear energy down.

- **Emissions from nuclear energy are set to rise**
    - Emissions from nuclear will increase significantly over the next few decades as high grade ore is depleted, and increasing amounts of fossil fuels are required to access, mine and mill low-grade ore.

- **To stay below the 2 degrees of global warming that climate scientists widely agree is necessary to avert catastrophic consequences for humans and physical systems, we need to significantly reduce our emissions by 2050, and to do this we need to start this decade. Nuclear is a slow technology:**
    - The "Generation IV" demonstration plants projected for 2030-2040 will be too late, and there is no guarantee the pilots will be successful.
    - Nuclear reactors have long lead up times. The global average construction time for existing technology is 9.4 years, with a wide range from 4 to 36 years.[15]
    - Long delays are common - at least three quarters of all reactors currently under construction are delayed.[16] The Flamanville reactor in France began construction in 2007, with commercial operation projected for 2012 – this timeframe has now been pushed back to the fourth quarter of 2018.[17]
    - It has been estimated that it would take 10 to 15 years to build one nuclear power station in Australia. Once accounting for "paying back" the energy from fossil fuels used to construct it – it would take 15 to 20 years for this station to make a contribution to cutting emissions.[18]
    - Renewables are much faster to roll out. The industry standard for wind is 1 year.[19] The first US large scale solar thermal plant with storage, Solanis, took 3 years to build.[20]

Myth: we can isolate high level radioactive waste from the environment for 200,000 years

BUST

There is no operating dump for high level waste anywhere in the world

The Royal Commission is considering the feasibility of establishing a high level nuclear waste dump in South Australia to store other countries nuclear waste.

- **Even countries that actually have stockpiles of high level waste have not been able to solve this problem**
    - There is one deep underground repository for *long-lived intermediate level waste* in New Mexico - the Waste Isolation Pilot Plant. Before it opened it was predicted that it may have one radiation release in 200,0000 years. In February 2014, after 15 years in operation, a waste barrel exploded leading to an aboveground release of airborne radiation. Twenty-two workers tested positive to low-level radiation exposure.[21]

- **Australia can't even manage the waste it has**
    - In the late 1990's the Australian government "cleaned up" the Maralinga nuclear test site, leaving tonnes of plutonium-contaminated debris buried in shallow, unlined pits. In 2011, 19 of the 85 pits containing contaminated debris were found to be subject to erosion or subsidence, including the main Taranaki trench where the radioactive debris from the weapons trials was buried.[22]

Myth: of an empty interior

BUST

The desert isn't empty

- Historically the nuclear industry in Australia has disproportionately impacted Aboriginal communities
    - The uranium mining industry in has a track record of stripping Aboriginal communities of their land rights and heritage protections. For example, the Olympic Dam mine is exempt from the Aboriginal Heritage Act that applies elsewhere in the state.

- Previous attempts to impose nuclear waste dumps on Aboriginal communities in SA and the NT have faced fierce opposition from traditional owners.

Myth: we can import high level waste at a massive profit and turn it into free electricity

BUST

If nuclear waste was such an asset why would other countries pay us to take it?

The idea that nuclear energy can result in free electricity is not a new one. In the 1950's it was claimed that atomic energy would make electricity "too cheap to meter." It hasn't.

- **On what basis have the calculations been made that building the first repository for high level waste in the world and the first Generation IV reactor in the world could be paid for by the money generated from importing nuclear waste?**
    - No repository for high level waste has been built anywhere in the world so we don't know how much this would cost.
    - No Generation IV reactor has been built anywhere in the world so we don't know how much this would cost.
    - There is no existing market for high level nuclear waste so we don't know how much this would make.

- **Pursuing a plan to import high level waste for use in a reactor before such a reactor is built is likely to lead to South Australia being left with stockpiles of waste as these reactors are hypothetical at this stage**

- **If this hypothetical reactor ran off its own waste, then:**
    - It would only alleviate fuel costs not capital costs which would take years to pay off.
    - Very little waste would actually be required as it would not require waste beyond the initial load, potentially leaving SA with stockpiles of high level waste.

- **If this reactor required an ongoing input of waste, then:**
    - This waste would become an asset and countries would stop paying SA to take it, again leaving SA with a high level waste problem, or (if indeed SA managed to do what no other country has) a deep geological repository that cost billions to build with no waste to put in it.
    - Another likely scenario is that instead of the waste being treated as an asset, "recycling" it would be treated as a service, with the operator of the reactor charging a fee to dispose of the nuclear waste. The SA government would then be importing waste from overseas only to pay for its disposal. This "service-model" has been proposed by GE Hitachi for its PRISM fast reactor model for the disposal of stockpiles of plutonium in the UK.[23]

Friends of the Earth Adelaide

ENDNOTES

[1] This is according to the International Atomic Energy Agency. See Jim Green, "South Australia's Nuclear Fuel Cycle Royal Commission Issues," prepared on behalf of the Conservation Council SA, May 2015, p. 41, http://www.conservationsa.org.au/nuclear

[2] Jim Green, "South Australia's Nuclear Fuel Cycle Royal Commission Issues," p. 43;
International Panel on Fissile Materials, "Fast Breeder Reactor Programs: History and Status," Feb 2010, www.ipfmlibrary.org/rr08.pdf

[3] Even GE Hitachi, developer of the PRISM reactor which is designed to run off used reactor fuel, states on their website that the duration of radiotoxicity of the remaining waste would still be hundreds of years. See http://gehitachiprism.com/what-is-prism/;
Beyond Nuclear, "Pandora's False Promises: Integral Fast Reactor: Facts and Myths. A Beyond Nuclear Fact Sheet," Jan 2013, http://static1.1.sqspcdn.com/static/f/356082/21732801/1358994245757/BN_Final_FullFactsheet_IFR_Jan2013.pdf?token=R7Drb%2BsDMMCvd4eVK1hvtrG%2BHPg%3D

[4] Jim Green, "Nuclear Weapons and 'Fourth Generation' Reactors," Friends of the Earth Australia, July 2009, http://www.foe.org.au/anti-nuclear/issues/nfc/power-weapons/g4nw;
Fred Pearce, "Are fast-breeder reactors the answer to our nuclear waste nightmare?" *The Guardian*, Australia Edition, 31st July, 2012, http://www.theguardian.com/environment/2012/jul/30/fast-breeder-reactors-nuclear-waste-nightmare;
Brave New Climate website, http://bravenewclimate.com/2010/09/18/ifr-fad-7/;
Brave New Climate website, http://bravenewclimate.com/2013/08/15/ifr-at-mit/#more-6179

[5] Ben Heard (a proponent of Fourth Generation reactors) is quoted in the Advertiser saying that fast reactors can recycle waste "over and over again," suggesting that they would almost perpetually recycle the waste they produce after the first fuel load. See: Tory Shepherd, "Liberal Senator Sean Edwards unveils radical plan for a booming nuclear industry in South Australia," *The Advertiser*, March 12, 2015.

[6] Mark Diesendorf, "100% Renewable Electricity for South Australia," Conservation Council of South Australia, Adelaide, 2015, p. 15.

[7] In July 2015 the World Nuclear Industry Status Report counted 391 operational reactors, and in August 2015 Japan restarted its first nuclear reactor since Fukushima.
Mycle Schneider & Antony Froggatt et al, "World Nuclear Industry Status Report 2015," July 2015, p. 13, http://www.worldnuclearreport.org/-2015-.html;
Justin McCurry, "Japan restarts first nuclear reactor since Fukushima," *The Guardian*, Australia Edition, 11th August 2015, http://www.theguardian.com/environment/2015/aug/11/japan-restarts-first-nuclear-reactor-fukushima-disaster

[8] Schneider& Froggatt et al, previously cited, p. 14.

[9] Schneider & Froggatt et al, previously cited, p. 13;
Diesendorf, previously cited, p. 34.

[10] Schneider & Froggatt et al, previously cited, p. 13;
Diesendorf, previously cited, p. 34.

[11] Schneider & Froggatt et al, previously cited, p. 18.

[12] Jim Green, "South Australia's Nuclear Fuel Cycle Royal Commission Issues," p. 34.

[13] Naomi Klein, *This Changes Everything*, Penguin Books, UK, 2014, p. 131.

[14] B. Sovacool, "Valuing the greenhouse gas emissions from nuclear power: A critical survey," *Energy Policy*, 36, 2008, pp. 2950 – 2963;
D. Nugent & B. Sovacool, "Assessing the lifecycle greenhouse gas emissions from solar PV and wind energy: A critical meta-survey," *Energy Policy*, 65, 2014, pp. 229 – 244;
D. Arvizu, P. Balaya, L. Cabeza et al, IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Cambridge University Press, Cambridge and New York, 2011, (Chapt. 3 – Direct Solar Energy), p. 371.

[15] Schneider & Froggatt et al, previously cited, p. 14.

[16] Schneider & Froggatt et al, previously cited, p. 14.

[17] EDF, Press Release 3rd Sept. 2015, https://www.edf.fr/en/edf/press_release/Flamanville-EPR-optimised-project-management-and-a-new-timetable

[18] Jim Green, "South Australia's Nuclear Fuel Cycle Royal Commission Issues," p. 39.

[19] Beyond Zero Emissions, *Zero Carbon Australia: Stationary Energy Plan*, The University of Melbourne Energy Research Institute, 2010, p. 161.

[20] Giles Parkinson, "World's largest solar thermal plant with storage comes on-line," Renew economy, 11th October 2013, http://reneweconomy.com.au/2013/worlds-largest-solar-thermal-plant-with-storage-comes-on-line-63533;
Abengoa, News, October 2013, http://www.abengoa.com/web/en/novedades/solana/noticias/

[21] The US Department of Energy website, "WIPP: Waste Isolation Pilot Pant recovery," http://www.wipp.energy.gov/wipprecovery/accident_desc.html

[22] Philip Dorling, "Maralinga sites need more repair work, files show," *The Age*, Nov. 12, 2011, http://www.theage.com.au/national/maralinga-sites-need-more-repair-work-files-show-20111111-1nbpp.html

[23] Duncan Clark, "Nuclear waste-burning reactor moves a step closer to reality," *The Guardian*, Australia Edition, 10th July, 2012, http://www.theguardian.com/environment/2012/jul/09/nuclear-waste-burning-reactor