Advanced nuclear power concepts? not advanced and not advancing

DON'T NUKE THE CLIMATE AUSTRALIA

Below is a snapshot of new nuclear technologies - it is clear they are not cleaner, safer, affordable or ready for commercial development. To the limited extent they have been deployed, these 'advanced' nuclear plants have been dangerous, expensive failures. We need urgent action to transition away from fossil fuels and nuclear simply does not meet our needs. Our energy future is renewable not radioactive.

Fast Reactors: Fast breeder or fast neutron reactors and other 'advanced' concepts are sometimes called Generation IV concepts. But fast reactors have been around since the dawn of the nuclear age. They are best described as failed Generation I technology – "demonstrably failed technology" in the words of Allison Macfarlane - former Chairman of the United States Nuclear Regulatory Commission.

The number of operating fast reactors reached double figures in the 1980s but has steadily fallen and will remain in single figures for the foreseeable future. More recently:

- Terrapower abandoned plans for a prototype fast reactor in China
- France abandoned plans for a demonstration fast reactor
- Russia clawed back $4 billion from Rosatom's budget by postponing its fast neutron reactor program
- Both the US and UK have rejected proposals for GE Htachi's PRISM fast reactor technology

Currently, just five fast reactors are operating – all of them described by the World Nuclear Association as experimental or demonstration reactors.

Small Modular Reactors: Most of the handful of small modular reactors (SMRs) under construction are over-budget and behind schedule; there are disturbing connections between SMRs, weapons proliferation and militarism more generally; and about half of the SMRs under construction are intended to be used to facilitate the exploitation of fossil fuel reserves.

SMRs aren't leading to "cleaner, safer and more efficient energy production". And SMRs aren't advancing – projects are falling over left, right and centre:

- Babcock & Wilcox abandoned its mPower SMR project in the US despite receiving government funding of US$111 million.
- Westinghouse sharply reduced its investment in SMRs after failing to secure US government funding.
- China is building a demonstration high-temperature gas-cooled reactor (HTGR) but it is behind schedule and over-budget and plans for additional HTGRs at the same site have been "dropped" according to the World Nuclear Association.
- MidAmerican Energy gave up on its plans for SMRs in Iowa after failing to secure legislation that would force rate-payers to part-pay construction costs.
- Rolls-Royce sharply reduced its SMR investment in the UK to "a handful of salaries" and is threatening to abandon its R&D altogether unless massive subsidies are provided by the British government.

Fusion: At best it is decades away and most likely it will forever remain decades away. Articles in the Bulletin of the Atomic Scientists by Dr. Daniel Jassby explain that many of the same problems with fission would exist with fusion - waste, weapons production and the need for biological shielding.There are also issues with the production of one of the main fuel sources tritium, and overall fusion would consume a huge chunk of the energy produced known as a "parasitic power drain". The reactions in fusion are bigger and so damage inside the 'reaction vessels' is expected to be worse increasing risks of the structures.

It is expected that the overall radioactivity of waste from fusion would be less than fission however, the volume and mass of waste would be many times larger - this is not offset by power gains because of the parasitic power drain. Dr Jassaby also explains that weapons grade material can still be produced at a fusion reactor. He goes on to explain there are problems with high water demands for cooling and the overall operating costs being prohibitive.

Thorium: There are no fundamental differences between thorium and uranium so the idea of replacing the uranium fuel cycle with a thorium fuel cycle is absurd and will never happen. India's interest in thorium is clearly connected to its weapons program. Thorium R&D is minimal and the World Nuclear Association notes that there are "significant hurdles in terms of building an economic case to undertake the necessary development work."

www.dont-nuke-the-climate.org.au/myth-busting
www.nuclear.foe.org.au/power#gen4

Nuclear Power Cannot Solve the Climate Crisis

Slow: The industry does not have the capacity to rapidly expand production. In Australia, it would take 5–10 years of planning before reactor construction could begin, then 10 years to build a reactor, then another 6 or so years to pay back the energy debt from construction. It would take at least 20 years before nuclear power could even begin to help reduce emissions. Globally nuclear reactors new builds are notorious for being behind schedule and over budget.

Dangerous: In addition to the very real danger of a nuclear reactor meltdown - as the world has witnessed at Fukushima, Chernobyl and Three Mile Island there are other dangers. Nuclear power has almost always been linked to a nuclear weapons program. Doubling nuclear output by the middle of the century would require the construction of 800– 900 reactors to replace most of the existing cohort of reactors and to build as many again. These reactors not only become military targets but they would produce over one million tonnes of nuclear waste (in the form of spent fuel) containing enough plutonium to build over one million nuclear weapons. "On top of the perennial challenges of global poverty and injustice, the two biggest threats facing human civilisation in the 21st century are climate change and nuclear war. It would be absurd to respond to one by increasing the risks of the other. Yet that is what nuclear power does." Dr Mark Diesendorf

Ineffective: The 2006 Switkowski report found that building 12 reactors in Australia would reduce emissions by 8% if they replaced coal-fired plants, yet reductions ten times greater are required. Doubling global nuclear power output at the expense of coal would reduce emissions by just 5%. The Switkowski report states that nuclear power is three times more greenhouse intensive than wind power. Nuclear power is far more greenhouse intensive than many energy efficiency measures. Therefore, displacing renewables and energy conservation with nuclear power is not an effective response to climate change, as explained by US physicist Amory Lovins: "If climate is a problem, we need the most solution per dollar and the most solution per year. We can get two to 10 times more coal displaced per dollar buying stuff other than nuclear. Every time I spend a dollar on an expensive solution I forgo a lot more that I could have bought of a cheaper solution."

Dirty: Reactors produce high level radioactive waste in the form of spent nuclear fuel. No country has established a repository for high level nuclear waste from nuclear power. Australia's own battle to store low and intermediate level waste has been ongoing for 30 years and there is still no agreed solution in site. It would be deeply irresponsible to pursue nuclear power without first addressing the long term management of high level inter-generational radioactive waste.

Thirsty: In the face of unpredictable rainfall and drought we cannot afford to go nuclear:

Water consumption of different energy sources	L/kWh
Nuclear	2.5
Coal	1.9
Oil	1.6
Combined Cycle Gas	0.95
Solar PV	0.11
Wind	0.004

Expensive:

According to the World Nuclear Industry Status Report the cost of generating solar power ranges from $36 to $44 per megawatt hour (MWh), onshore wind power comes in at $29 –$56 per MWh. Nuclear energy costs between $112 and $189.