



## EXPOSING SMR ECONOMIC MISINFORMATION FROM BEN HEARD AND OTHERS

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From: Friends of the Earth Australia

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Please accept this as a formal submission from Friends of the Earth Australia responding to the draft GenCost 2019-20 report.<sup>1</sup> It draws on detailed information in a 2019 report.<sup>2</sup>

Nuclear propagandists – including Ben Heard, whose lobby group 'Bright New World' accepts secret corporate donations from the nuclear industry<sup>3</sup> – have attacked the CSIRO/AEMO/GHD construction cost estimate of \$16,000/kW for small modular reactors (SMRs).

A logical starting point would be the cost of operational SMRs. There is just one operational plant, Russia's floating plant. Its estimated cost is A\$1,200 million (US\$740 million) / 70 MW<sup>4</sup>, which equates to A\$17,100/kW, which is higher than the CSIRO/AEMO/GHD figure.

A 2016 OECD Nuclear Energy Agency report said that electricity produced by the Russian floating plant is expected to cost about A\$324/MWh (US\$200/MWh), with the high cost due

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<sup>1</sup> [https://aemo.com.au/-/media/files/electricity/nem/planning\\_and\\_forecasting/inputs-assumptions-methodologies/2019/csiro-gencost2019-20\\_draftforreview.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/inputs-assumptions-methodologies/2019/csiro-gencost2019-20_draftforreview.pdf?la=en)

<sup>2</sup> <https://wiseinternational.org/nuclear-monitor/872-873/nuclear-monitor-872-873-7-march-2019>

<sup>3</sup> <https://nuclear.foe.org.au/ben-heard-secret-corporate-donations/>

<sup>4</sup> Charles Digges, 25 May 2015, 'New documents show cost of Russian floating nuclear power plant skyrockets', <http://bellona.org/news/nuclear-issues/2015-05-new-documents-show-cost-russian-nuclear-power-plant-skyrockets>

to large staffing requirements, high fuel costs, and resources required to maintain the barge and coastal infrastructure.<sup>5</sup>

Figures on costs of SMRs under construction should also be used – they are far more useful than guesstimates based on moonshine and self-interest including those from Heard.

The World Nuclear Association states that the cost of China's demonstration HTGR is US\$6,000/kW (A\$9,700/kW).<sup>6</sup> Costs are reported to have nearly doubled, with increases arising from higher material and component costs, increases in labour costs, and increased costs associated with project delays.<sup>7</sup>

The CAREM (Central Argentina de Elementos Modulares) SMR under construction in Argentina illustrates the gap between SMR rhetoric and reality. Cost estimates have ballooned:

— In 2004, when the CAREM reactor was in the planning stage, Argentina's Bariloche Atomic Center estimated an overnight cost of A\$1.62 billion (US\$1 billion) / GW for an integrated 300-MW plant (while acknowledging that to achieve such a cost would be a "very difficult task").<sup>8</sup>

— By April 2017, the cost estimate had increased to A\$35.4 billion (US\$21.9 billion) / GW (A\$1,130 million / US\$700 million with the capacity uprated from 25 MW to 32 MW).<sup>9</sup>

It was reported in Nov. 2019 that work on CAREM had been temporarily suspended, with Techint Engineering & Construction asking Argentina's National Atomic Energy Commission to take urgent measures to mitigate the project's serious financial breakdown.<sup>10</sup>

To the best of my knowledge, no other figures on SMR construction costs are publicly available. So the reality-based figures are

A\$17,100/kW (Russia / LWR SMR)

A\$9,700/kW (China / HTGR SMR)

A\$35,400/kW (Argentina / LWR SMR)

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<sup>5</sup> OECD Nuclear Energy Agency, 2016, 'Small Modular Reactors: Nuclear Energy Market Potential for Near-term Deployment', <https://www.oecd-nea.org/ndd/pubs/2016/7213-smrs.pdf>

<sup>6</sup> World Nuclear Association, Feb 2019, 'Nuclear Power in China', <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx>

<sup>7</sup> 1 Dec 2016, 'China's plans to begin converting coal plants to walk away safe pebble bed nuclear starting in the 2020s', <http://www.nextbigfuture.com/2016/12/chinas-plans-to-begin-converting-coal.html>

<sup>8</sup> Darío Delmastro, Marcelo Oscar Giménez et al., January 2004, 'CAREM concept: A competitive SMR', Conference Paper, Argentina's Bariloche Atomic Center, [https://www.researchgate.net/publication/267579277\\_CAREM\\_concept\\_A\\_competitive\\_SMR](https://www.researchgate.net/publication/267579277_CAREM_concept_A_competitive_SMR)

<sup>9</sup> Andrew Baker, 17 April, 'Argentine nuclear reactor due to start up in 2020', <https://www.bnamericas.com/en/news/electricpower/argentine-nuclear-reactor-due-to-start-up-in-2020/>

<sup>10</sup> 18 Nov 2019, 'Construction Work Stops at Carem 25 SMR at Atucha Nuclear Power Plant in Argentina', <https://steelguru.com/power/construction-work-stops-at-carem-25-smr-at-atucha-nuclear-power-plant-in-argentina/552591>

And the average of those figures is A\$20,700/kW, which is considerably higher than the AEMO/CSIRO/GHD figure of A\$16,000/kW.

And the average cost of the LWR SMRs is A\$26,250/kW. Heard wants CSIRO/AEMO to focus on LWR SMR costs. Fine: the only publicly available data for LWR SMRs averages A\$26,250/kW.

### **Ben Heard's misinformation**

Why does Heard ignore real-world data that he surely has some awareness of – or at least ought to be aware of? Why does he instead propose using a self-interested guesstimate from NuScale, a company that hopes to build a massively-subsidised SMR?

Heard proposes using a figure 50% greater than NuScale's figure. But SMRs in China, Russia and Argentina have increased in cost by factors of, respectively, 2, 4 and 22. So why not use a figure double NuScale's self-interested estimate as the lowest, best-case scenario?

Heard claims the proposed 50% loading is based on "conservatism". However real-world examples clearly demonstrate the need for a far higher loading.

Heard says that even with a loading of 100%, the figure (A\$12,175/kW) is still lower than the AEMO/CSIRO/GHD figure. But as noted above, the figure is lower than real-world construction costs, and as noted below, the WSP / Parsons Brinckerhoff levelised cost estimate prepared for the SA Nuclear Fuel Cycle Royal Commission is more than double the NuScale estimate.

Why not make some allowance for the cost increases for large reactors:

— The cost estimate for the Vogtle project in US state of Georgia (two AP1000 reactors) has doubled to more than A\$20 billion per reactor and will increase further.<sup>11</sup> In 2006, Westinghouse said it could build an AP1000 reactor for as little as A\$2.0 billion<sup>12</sup> – 10 times lower than the current estimate for Vogtle!

— The estimated combined cost of the two EPR reactors at Hinkley Point, including finance costs, is A\$53.0 billion (£26.7 billion – the EU's 2014 estimate of £24.5 billion<sup>13</sup> plus a £2.2 billion increase announced in July 2017<sup>14</sup>). In the mid-2000s, the estimated construction cost for one EPR reactor in the UK was almost seven times lower at £2 billion.<sup>15</sup>

Clearly, vendor estimates need to be increased by far more than 50%, even in a best-case scenario. Indeed a study by WSP / Parsons Brinckerhoff prepared for the SA Nuclear Fuel Cycle Royal Commission recommended a cost estimate of A\$225/MWh based on NuScale

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<sup>11</sup> <https://www.wiseinternational.org/nuclear-monitor/867/vogtles-reprieve-snatching-defeat-jaws-defeat>

<sup>12</sup> <https://www.nytimes.com/2006/07/16/magazine/16nuclear.html>

<sup>13</sup> [http://europa.eu/rapid/press-release\\_IP-14-1093\\_en.htm](http://europa.eu/rapid/press-release_IP-14-1093_en.htm)

<sup>14</sup> <https://www.theguardian.com/uk-news/2017/jul/03/hinkley-point-c-is-22bn-over-budget-and-a-year-behind-schedule-edf-admits>

<sup>15</sup> <https://energypost.eu/saga-hinkley-point-c-europes-key-nuclear-decision/>

Power's design<sup>16</sup> – more than double NuScale's figure of US\$65/MWh (A\$105/MWh) for its first SMR plant.<sup>17</sup>

Heard's lobby group says that the CSIRO/AEMO figure of A\$251–330/MWh is an "extreme overestimate". But the WSP / Parsons Brinckerhoff estimate is A\$225/MWh and power from the Russian floating plant – the only operational SMR in the world – costs about A\$324/MWh.<sup>18</sup> Clearly the CSIRO/AEMO figure of A\$251–\$330/MWh is perfectly reasonable while Heard's figure is an extreme underestimate reflecting his ideological and/or economic interests.

NuScale's cost estimates should be regarded as promotional and will continue to drop – unless and until the company actually builds an SMR plant. A 2015 NuScale report estimated a levelized cost of US\$98–\$108/MWh.<sup>19</sup> By June 2018, the company said it is targeting a cost of just US\$65/MWh for its first plant. The company announced with some fanfare in 2018 that it had worked out how to make its SMRs almost 20% cheaper – by making them almost 20% bigger!

Lazard estimates costs of US\$118–192/MWh for electricity from large nuclear plants.<sup>20</sup> NuScale's claim that its electricity will be 2–3 times cheaper than that from large nuclear plants is implausible. And even if NuScale achieved costs of US\$65/MWh, that would still be higher than Lazard's figures for wind power (US\$28–54) and utility-scale solar (US\$32–44).

Likewise, NuScale's construction cost estimate of US\$4.2 billion / GW is implausible.<sup>21</sup> The latest cost estimate for the two AP1000 reactors under construction in the US state of Georgia (the only reactors under construction in the US) is US\$12.3–13.6 billion / GW.<sup>22</sup> NuScale's target is just one-third of that cost – despite the unavoidable diseconomies of scale and despite the fact that every independent assessment concludes that SMRs will be more expensive to build (per GW) than large reactors.<sup>23</sup> Further, modular factory-line

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<sup>16</sup> WSP / Parsons Brinckerhoff, Feb 2016, 'Quantitative analysis and initial business case – establishing a nuclear power plant and systems in South Australia', <http://nuclearc.sa.gov.au/app/uploads/2016/05/WSP-Parsons-Brinckerhoff-Report.pdf>

<sup>17</sup> <https://www.powermag.com/nuscale-boosts-smr-capacity-making-it-cost-competitive-with-other-technologies/?printmode=1>

<sup>18</sup> OECD Nuclear Energy Agency, 2016, 'Small Modular Reactors: Nuclear Energy Market Potential for Near-term Deployment', <https://www.oecd-neo.org/ndd/pubs/2016/7213-smrs.pdf>

<sup>19</sup> Jay Surina (NuScale Chief Financial Officer), 20-21 August 2015, 'NuScale Plant Market: Competitiveness & Financeability',

[https://newsroom.nuscalepower.com/sites/nuscalepower.newshq.businesswire.com/files/press\\_release/additional/Jay\\_Surina\\_-\\_NuScale\\_Financial\\_Breakout\\_Session\\_0.pdf](https://newsroom.nuscalepower.com/sites/nuscalepower.newshq.businesswire.com/files/press_release/additional/Jay_Surina_-_NuScale_Financial_Breakout_Session_0.pdf)

<sup>20</sup> Lazard, Nov. 2019, 'Lazard's Levelized Cost of Energy Analysis – Version 13.0',

<https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf>

<sup>21</sup> <https://www.powermag.com/nuscale-boosts-smr-capacity-making-it-cost-competitive-with-other-technologies/?printmode=1>

<sup>22</sup> <https://www.wiseinternational.org/nuclear-monitor/867/vogtles-reprieve-snatching-defeat-jaws-defeat>

<sup>23</sup> <https://wiseinternational.org/nuclear-monitor/872-873/smr-cost-estimates-and-costs-smrs-under-construction>

production techniques were trialled with the AP1000 reactor project in South Carolina – a project that was abandoned after the expenditure of at least US\$9 billion.

### **Learning curve**

There is no empirical basis, nor any logical basis, for the learning rate assumed in the draft GenCost 2019-20 report. For large reactors, nuclear's negative learning curve is well documented (even if the reasons are the subject of ongoing debate).

For small reactors, there is no evidence of a learning curve driving down costs. Nor is there any logical reason to anticipate a learning curve. It ignores the experience with large reactors. It assumes that large numbers of SMRs will be built but clearly that has not been the case to date. A wave of enthusiasm for SMRs in the 1990s came and went without one SMR being built. Currently only a handful of SMRs are being built – about half of them designed to power fossil fuel mining operations in the Arctic, South China Sea and elsewhere.<sup>24</sup>

The OECD's Nuclear Energy Agency anticipates <1 GW to 21 GW of installed SMR capacity by 2035.<sup>25</sup>

### **Timing**

*"Nuclear construction on-time and on-budget? It's essentially never happened."*  
– Andrew J. Wittmann, financial analyst with Robert W. Baird & Co., 2017.<sup>26</sup>

Heard wants CSIRO/AEMO to assume that the NuScale project will be completed on schedule!

Most or all SMRs under construction are behind schedule.

For large reactors, the latest World Nuclear Industry Status Report notes that at least 27 of the 46 reactors under construction are behind schedule, mostly by several years.<sup>27</sup>

### **Why the nuclear lobby makes stuff up about the cost of wind and solar**

A recent article by Giles Parkinson – an energy expert and former business and deputy editor of the *Australian Financial Review* – is particularly helpful in debunking propaganda from the nuclear industry and industry-funded lobbyists. An excerpt is reproduced below

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<sup>24</sup> <https://wiseinternational.org/nuclear-monitor/872-873/small-modular-reactors-introduction-and-obituary>

<sup>25</sup> OECD Nuclear Energy Agency, 2016, 'Small Modular Reactors: Nuclear Energy Market Potential for Near-term Deployment', <https://www.oecd-neo.org/ndd/pubs/2016/7213-smrs.pdf>

<sup>26</sup> <https://www.bloomberg.com/news/articles/2017-02-13/toshiba-s-nuclear-reactor-mess-winds-back-to-a-louisiana-swamp>

<sup>27</sup> <https://www.worldnuclearreport.org/The-World-Nuclear-Industry-Status-Report-2019-HTML.html>

and the full, referenced article is online. The article is focused on submissions to the 2019 federal nuclear inquiry.<sup>28</sup>

*Giles Parkinson, 23 Oct 2019, 'Why the nuclear lobby makes stuff up about the cost of wind and solar', <https://reneweconomy.com.au/why-the-nuclear-lobby-makes-stuff-up-about-cost-of-wind-and-solar-46538/>*

*It is generally accepted in the energy industry that the cost of new nuclear is several times that of wind and solar, even when the latter are backed up by storage. The GenCost 2018 report from the CSIRO and the Australian Energy Market Operator (AEMO) puts the cost of nuclear at two to three times the cost of "firmed renewables".*

*The nuclear lobby, however, has been insisting to the parliamentary inquiry that wind and solar are four to seven times the cost of nuclear, and to try and prove the point the lobby has been making such extraordinary and outrageous claims that it makes you wonder if anything else they say about nuclear – its costs and safety – can be taken seriously.*

*RenewEconomy has been going through the 290-something submissions and reading the public hearing transcripts, and has been struck by one consistent theme from the pro-nuclear organisations and ginger groups: When it comes to wind, solar and batteries, they just make stuff up.*

*A typical example is the company SMR Nuclear Technology – backed by the coal baron Trevor St Baker – which borrows some highly questionable analysis to justify its claim that going 100 per cent renewables would cost "four times" that of replacing coal with nuclear.*

*It bases this on modelling by a consultancy called EPC, based on the south coast of NSW, apparently a husband and wife team, Robert and Linda Barr, who are also co-authors of "The essential veterinarian's phone book", a guide to vets on how to set up telephone systems.*

*The EPC report admits to deliberately ignoring the anticipated cost reductions of wind and solar from AEMO's 2018 integrated system plan. Even worse, the report dials in a completely absurd current cost of wind at A\$157/MWh (before transmission costs), which is about three times the current cost in Australia, and A\$117/MWh for solar, which is more than double.*

*The costs of wind and solar are not hard to verify. They are included in the GenCost report, in numerous pieces of analysis, and even in public announcements from companies involved, both buyers and sellers. St Baker could have helped out, as his company has signed two big solar contracts (for the Darlington and Vales Point solar farms) and we can bet he won't be paying A\$117/MWh.*

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[https://www.aph.gov.au/Parliamentary\\_Business/Committees/House/Environment\\_and\\_Energy/Nuclearenergy](https://www.aph.gov.au/Parliamentary_Business/Committees/House/Environment_and_Energy/Nuclearenergy)

*Apart from costs, the EPC scenarios for 100 per cent renewables are also, at best, imaginative. For some reason they think there will only be 10GW of solar in a 100% renewables grid and just 100MW of battery storage. Big hint: There is already 12GW of solar in the system and about 300MW of battery storage. But we discovered that assuming wind and solar do not or won't exist, and completely ignoring distributed energy, are common themes of the nuclear playbook.*

*The delivered cost of energy from wind and solar in the EPC modelling of a 100 per cent renewables grid? A hilariously outrageous sum of A\$477/MWh (US\$330/MWh).*

*Contrast this with SMR Nuclear Technology's claims about the cost of a modern small modular reactor – US\$65/MWh – even though it admits the technology "has not been constructed", and which leading nuclear expert Ziggy Switkowski points out won't likely be seen for at least another decade. ...*

*The EPC report also forms the basis of the analysis from the Nuclear Now Alliance, which describes itself as a not-for profit group of Australian scientists and engineers that are passionate about the benefits of nuclear "but have no connection to the industry."*

*Moltex, which says it is "developing" some sort of fission technology (it says it has a design but hasn't actually built anything) uses the same trick as EPC to paint a daunting picture of renewable and storage costs, in this case by multiplying the cost of batteries by the total amount of electricity consumed in a single day. "Australia consumes 627 Gigawatt hours of electricity per day, and so the battery storage required to cover just one 24 hour period would cost A\$138 billion," it proclaims. It is such an incredibly stupid and misleading claim that it simply takes the breath away. ...*

*But that's what the nuclear industry feels it needs to do to make its yet-to-be invented technology sound feasible and competitive.*

*Let's go to StarCore, a Canadian company that says it, too, wants to manufacture small modular reactors, and claims renewables are "seven times" the cost of nuclear, and which also has a fascination with the Nyngan solar farm. It uses the cost of Nyngan to make the bizarre claim that to build 405 of them would cost A\$68 billion, and then compares this to what it claimed to be the "zero upfront capital costs" of one of StarCore's plants.*

*Say what? Does the nuclear plant appear just like that? Solar and wind farms also usually have long-term power purchase agreements, but they still have to be built and someone has to provide the capital to do so. Nuclear with a zero capital cost? Really, you couldn't make this stuff up.*

*Down Under Nuclear Energy, headed by a former oil and gas guy and a former professor at the University of Western Australia who specialises in mathematical social science and economics, also bases its solar costs on the Nyngan solar farm and makes this bizarre claim about battery storage: "The precipitous decline in solar technology is highly unlikely to be replicated in batteries, a technology already approaching 150 yrs of maturity," it says.*

*Hey, here's some breaking news. Costs of battery storage have already mirrored solar's fall, down 80 per cent in last decade and utilities like Transgrid predict another 60 per cent fall over next 10-15 years.*

*And most large-scale storage batteries use lithium, an abundant resource, and this is battery technology that was actually invented just over 40 years ago by the winners of this year's Nobel Prize for Chemistry. As the Nobel citation says: "(Co-winner Stanley) Wittingham developed the first fully functional lithium battery in the 1970s." Not 1870.*

*Women in Nuclear and the Australian Workers Union both quote the Industry Super report on nuclear, which we debunked a while back, which puts the cost estimates of wind and solar plants at 10 times their actual cost.*

*The "capital cost" of the Dundonnell wind farm in Victoria, for instance, is put at A\$4.2 billion (try A\$400 million) according to their bizarre calculations, while the Darlington solar farm is put at \$5.8 billion (try A\$350 million). It's pure garbage and the fact that it is being quoted really does beggar belief. ...*

*But all the nuclear submissions have one common trait. They assume that the deployment of renewables is stopped in its tracks, either now or sometime soon. It's more wish than analysis, but in that they will have found a willing fellow traveller in federal energy minister, Angus "there is already too much wind and solar on the grid" Taylor, who thought it a good idea to have the inquiry.*

*But the reality is that the rest of the energy industry wants to move on. They know that the grid can be largely decarbonised within the next two decades from a combination of renewables and storage. That's a simple truth that the nuclear lobby cannot accept, and they've passed up the opportunity to have an open and honest debate by promoting utter garbage about renewables, to the point where it would be difficult to believe much of anything else they say.*

### **Big claims and corporate spin about small nuclear reactor costs**

The following article may be of use.

*Big claims and corporate spin about small nuclear reactor costs*

*Jim Green, 19 September 2019, RenewEconomy*

*<https://reneweconomy.com.au/big-claims-and-corporate-spin-about-small-nuclear-reactor-costs-65726/>*

*The 'inquiry into the prerequisites for nuclear energy in Australia' being run by Federal Parliament's Environment and Energy Committee has finished receiving submissions and is gradually making them [publicly available](#).*

*The inquiry is particularly interested in 'small modular reactors' (SMRs) and thus one point of interest is how enthusiasts spin the economic debate given that previous [history](#) with small reactors has shown them to be expensive; the cost of the handful of SMRs under construction is [exorbitant](#); and both the private sector and governments around the world*



have been [unwilling to invest](#) the billions of dollars required to get high-risk SMR demonstration reactors built.

To provide a reality-check before we get to the corporate spin, a [submission](#) to the inquiry by the Institute for Energy Economics and Financial Analysis notes that SMRs have been as successful as cold fusion – i.e., not at all. The submission states:

*"The construction of nuclear power plants globally has proven to be an ongoing financial disaster for private industry and governments alike, with extraordinary cost and construction time blow-outs, while being a massive waste of public monies due to the ongoing reliance on government financial subsidies. ... Governments have repeatedly failed to comprehend that nuclear construction timelines and cost estimates put forward by many corporates (with vested interests) have proven disastrously flawed and wrong."*

The Institute is equally scathing about SMRs:

*"For all the hype in certain quarters, commercial deployment of small modular reactors (SMRs) have to-date been as successful as hypothesized cold fusion – that is, not at all. Even assuming massive ongoing taxpayer subsidies, SMR proponents do not expect to make a commercial deployment at scale any time soon, if at all, and more likely in a decade from now if historic delays to proposed timetables are acknowledged."*

Thus the Institute adds its voice to the [chorus of informed scepticism about SMRs](#), such as the 2017 Lloyd's Register survey of 600 industry professionals and experts who predicted that SMRs have a ["low likelihood of eventual take-up, and will have a minimal impact when they do arrive"](#).

#### **Corporate spin: Minerals Council of Australia**

The Minerals Council of Australia [claims](#) in its submission to the federal inquiry that SMRs could generate electricity for as little as \$60 per megawatt-hour (MWh). That claim is based on a [report](#) by the Economic and Finance Working Group (EFWG) of the Canadian government-industry 'SMR Roadmap' initiative.

The Canadian EFWG gives lots of possible SMR costs and the Minerals Council's use of its lowest figure is nothing if not selective. The figure cited by the Minerals Council assumes near-term deployment from a standing start (with no-one offering to risk billions of dollars to build demonstration reactors), plus extraordinary learning rates in an industry notorious for its negative learning rates.

Dr. Ziggy Switkowski [noted](#) in his evidence to the federal inquiry that "nuclear power has got more expensive, rather than less expensive". Yet the EFWG paper takes a made-up, ridiculously-high learning rate and subjects SMR cost estimates to eight 'cumulative doublings' based on the learning rate. That's creative accounting and one can only wonder why the Minerals Council would present it as a credible estimate.

Here are the first-of-a-kind SMR cost estimates from the EFWG paper, all of them far higher than the figure cited by the Minerals Council:

300-megawatt (MW) on-grid SMR: C\$162.67 (A\$179) / MWh

125-MW off-grid heavy industry: C\$178.01 (A\$196) / MWh

20-MW off-grid remote mining: C\$344.62 (A\$380) / MWh

3-MW off-grid remote community: C\$894.05 (A\$986) / MWh

The government and industry members on the Canadian EFWG are in no doubt that SMRs won't be built without public subsidies:

*"The federal and provincial governments should, in partnership with industry, investigate ways to best risk-share through policy mechanisms to reduce the cost of capital. This is*

especially true for the first units deployed, which would likely have a substantially higher cost of capital than a commercially mature SMR."

The EFWG paper used a range of estimates from the literature and vendors. It notes problems with its inputs, such as the fact that many of the vendor estimates have not been independently vetted, and "the wide variation in costs provided by expert analysts". Thus, the EFWG qualifies its findings by noting that "actual costs could be higher or lower depending on a number of eventualities".

#### **Corporate spin: Australian company SMR Nuclear Technology**

In support of its claim that "it is likely that SMRs will be Australia's lowest-cost generation source", Australian company SMR Nuclear Technology Pty Ltd cites in its [submission](#) to the federal nuclear inquiry a 2017 [report](#) by the US Energy Innovation Reform Project (EIRP). According to SMR Nuclear Technology, the EIRP study "found that the average levelised cost of electricity (LCOE) from advanced reactors was US\$60/MWh."

However the cost figures used in the EIRP [report](#) are nothing more than the optimistic estimates of companies hoping to get 'advanced' reactor designs off the ground. Therefore the EIRP authors heavily qualified the report's findings:

"There is inherent and significant uncertainty in projecting NOAK [nth-of-a-kind] costs from a group of companies that have not yet built a single commercial-scale demonstration reactor, let alone a first commercial plant. Without a commercial-scale plant as a reference, it is difficult to reliably estimate the costs of building out the manufacturing capacity needed to achieve the NOAK costs being reported; many questions still remain unanswered – what scale of investments will be needed to launch the supply chain; what type of capacity building will be needed for the supply chain, and so forth."

SMR Nuclear Technology's conclusions – that "it is likely that SMRs will be Australia's lowest-cost generation source" and that low costs are "likely to make them a game-changer in Australia" – have no more credibility than the company estimates used in the EIRP paper.

SMR Nuclear Technology's submission does not note that the EIRP inputs were merely company estimates and that the EIRP authors heavily qualified the report's findings.

The US\$60/MWh figure cited by SMR Nuclear Technology is far lower than all independent estimates for SMRs:

- The 2015/16 South Australian Nuclear Fuel Cycle Royal Commission [estimated](#) costs of A\$180-184/MWh for large light-water reactors, compared to A\$225 for an SMR based on the NuScale design (and a slightly lower figure for the 'mPower' SMR design that was abandoned in 2017 by Bechtel and Babcock & Wilcox).
- A December 2018 report by CSIRO and the Australian Energy Market Operator found that electricity from SMRs would be more than twice as expensive as that from wind or solar power with storage costs included (two hours of battery storage or six hours of pumped hydro storage).
- A [report](#) by the consultancy firm Atkins for the UK Department for Business, Energy and Industrial Strategy found that electricity from the first SMR in the UK would be 30% more expensive than that from large reactors, because of diseconomies of scale and the costs of deploying first-of-a-kind technology. Its optimistic SMR cost estimate is US\$107-155 (A\$157-226) / MWh.
- A 2015 [report](#) by the International Energy Agency and the OECD Nuclear Energy Agency predicted that electricity from SMRs will be 50–100% more expensive than that from large reactors, although it holds out some hope that large-volume factory production could reduce costs.

- An [article](#) by four pro-nuclear researchers from Carnegie Mellon University's Department of Engineering and Public Policy, published in 2018 in the Proceedings of the National Academy of Science, concluded that an SMR industry would only be viable in the US if it received "several hundred billion dollars of direct and indirect subsidies" over the next several decades.

SMR Nuclear Technology's assertion that "nuclear costs are coming down due to simpler and standardised design; factory-based manufacturing; modularisation; shorter construction time and enhanced financing techniques" is at odds with [all available evidence](#) and it is at odds with Dr. Ziggy Switkowski's [observation](#) in a public hearing of the federal inquiry that nuclear "costs per kilowatt hour appear to grow with each new generation of technology". SMR Nuclear Technology claims that failing to repeal federal legislative bans against nuclear power would come at "great cost to the economy". However the introduction of nuclear power to Australia would most likely have resulted in the extraordinary cost overruns and delays that have [crippled](#) every reactor construction project in the US and western Europe over the past decade – blowouts amounting to A\$10 billion or more per reactor. Nor would the outcome have been positive if Australia had instead pursued non-existent SMR '[vaporware](#)'.

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