

## Is nuclear 'the most expensive form of energy'?

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The nuclear power debate in Australia heated up on 9 June, ironically in the middle of an east coast energy crisis brought on by a cold snap. New Labor Energy Minister Chris Bowen shot down a suggestion that in the context of the debate about reducing CO2 emissions, Australia should explore

nuclear power: "Nuclear is the most expensive form of energy", Bowen insisted.

By contrast, he repeatedly claims that so-called renewable - solar and wind power - are the cheapest !

**Is Bowen right?** The short answer is **NO !**

The cost of power is not the same as the current price. In Australia, the price of electricity is set by the chaotic National Electricity Market, which can fluctuate wildly from negative wholesale prices, to up to \$14,200 per megawatt hour (MWh). The cost of power is the cost of building, operating, and maintaining electricity generation and transmission infrastructure.

### Energy density

The main cost advantage of nuclear power comes from its extraordinary energy density. While sunshine and wind are essentially free, they are diffuse sources of energy: solar is fundamentally limited by the maximum energy of the sun shining on the earth, which at the equator is around 0.001 megajoules (MJ) per square metre per second; while the global average wind kinetic energy per square metre is about 1.5 MJ (**these figures are compiled by Nuclear Now Alliance**). Coal has a much greater energy density, of about 24 MJ/kilogram, and oil is even greater, at around 44 MJ/kg.

Nuclear blows them all away: in a typical light water reactor, uranium has an energy density of about 500,000 MJ/kg; in a fast reactor, the energy conversion jumps by a factor of 56, to a staggering 28,000,000 (28 million!) MJ/kg.

**Click here for a series of charts** that illustrate this difference in energy density, in the quantities of physical materials to build and fuel various forms of power generation.

Fuel - 10 grams of uranium oxide is equivalent to 1 ton of coal, or 454 litres of oil, or 481,000 litres of natural gas;

Scale—a 1GW nuclear power plant (93 per cent capacity factor) produces the same power as 939 wind turbines (3MW turbine, 33 per cent capacity factor), or 11 million solar panels (320 watt panel, 27 per cent capacity factor);

Construction materials by source (tons per MWh)—nuclear uses less than 10,000 tons of construction material (cement, concrete, glass, steel, other) per MWh of energy produced, compared with more than 100,000 tons for wind, and more than 160,000 tons for solar;

Land use intensity - nuclear requires 30 times less land than wind power and 15 times less than solar.

Another advantage of nuclear power is its useful by-products, including process heat, which is the heat from the power plant that can be diverted for heating homes and offices, for high-heat industrial applications, and for cheap desalination of seawater; and nuclear isotopes, which have widespread application in nuclear science, medicine, and industry.

Offsetting the clear cost advantages, nuclear power plants are complex, involving high upfront capital costs and long construction periods, typically five years. However, countries such as South Korea and China have shown that these costs can reduce significantly as more nuclear plants are built. If Australia embarked on developing a nuclear power industry, it would have the advantage of having the world's largest reserves of uranium, and abundant thorium.

## **An Accounting Trick**

The most authoritative examination of the expense of nuclear power in Australia was the South Australia Nuclear Fuel Cycle Royal Commission, conducted by retired Rear Admiral Kevin Scarce. In his May 2016 report, Commissioner Scarce made positive findings about nuclear power, but concluded "nuclear power would not be commercially viable to supply baseload electricity" to South Australia. **(Emphasis added.)**

This finding, however, was essentially based on an accounting trick, as it assumed "a commercial cost of capital of 10 per cent". According to the World Nuclear Association, "the cost of financing is a key determinant of the cost of electricity generated". By assuming nuclear power could only be developed under Australia's private electricity market as a commercial project, Scarce effectively loaded on enormous financing costs. Yet until electricity privatisation and deregulation started in the 1990S, none of Australia's electricity infrastructure was developed commercially - electricity infrastructure was always government-owned, and financed at interest rates much lower than the "commercial cost of capital".

At the time Scarce assumed a 10 per cent cost of capital, the Australian government bond rate, which is the cost of capital if the government funded the project, was below 2 per cent!

Compare this to the accounting assumptions behind Chris Bowen's claim that renewables are the cheapest form of power. This is a claim made by the International Renewable Energy Agency (IRENA) in its **"Renewable Power Generation Costs in 2020" report**. IRENA averaged the market price of the electricity technologies in use all over the world, and highlighted the super cheap wholesale contract prices from solar installations in Qatar, UAE, and Saudi Arabia, - all lower than 2 US cents per kilowatt.

IRENA'S report, however, made the following admission on page 88: "What is required to achieve these exceptionally low prices is the convergence of all of the factors that could drive costs to their lowest levels." Aside from the optimal conditions for solar power generation in the Arabian desert, these factors included, crucially, that these solar installations are supplying government-owned electricity utilities, and that, because the government-owned utilities are "at low risk of default", the weighted average cost of capital is therefore cheap, namely 3 per cent.

These factors are the opposite of the assumptions behind the South Australia Royal Commission 's conclusions that nuclear power is not commercially viable!

What if the costs of nuclear power were assessed on the same assumptions as IRENA'S renewable claims? It has been, in a 2020 report by the OECD'S Nuclear Energy Agency, **"projected Costs of Generating Electricity"**. That report assessed the cost of nuclear power projects at various discount rates (a measure calculated similarly to the weighted average cost of capital). It concluded: "At a 3 per cent discount rate, nuclear is the lowest cost option for all countries ." **(Emphasis added.)**

Nuclear power stacks up as superior to all other energy source due to its amazing energy density. The only two concerns -safety and waste - have been well and truly solved technologically. In terms of the debate about reducing CO2 emissions, which is Chris Bowen's declared priority for energy production,

A new report by the International Energy Agency (IEA) released June 2022, **Nuclear Power and Secure Energy Transitions: From today's challenges to tomorrow's clean energy systems**, also contradicts him, stating unequivocally: "Achieving net zero globally will be harder without nuclear", and "Less nuclear power would make net zero ambitions harder and more expensive." **(Emphasis added.)**

Chris Bowen can only continue to deny this if he is more committed to the discredited free market ideology that dictates that infrastructure must be provided by the private sector commercially—and not more cheaply by governments - than he is to his party's net zero agenda.

**... > ALL open to ANY counter arguments to the tune of a \$\$\$Trillion for the Establishment "consensus" !**

## **REFERENCES**

- these figures are compiled by Nuclear Now Alliance
- Click here for a series of charts
- In Commissioner Scarce May 2016 report
- According to the World Nuclear Association
- Renewable Power Generation Costs
- "projected Costs of Generating Electricity
- Nuclear Power and Secure Energy Transitions: From today's challenges to tomorrow's clean energy systems