Climate Change and Energy

Unrealistic Unreliable Unaffordable

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The big plan that Australia can build enough wind farms, transmission lines, and back-up storage to power a renewable energy future is deluded and *unachievable at any realistic cost, argues IPA Executive Director Scott Hargreaves.*

As a modern industrial economy with a growing population, affordable and reliable electricity is central to everything Australia does. It allows our cities to work, keeps our homes habitable and safe, and powers the machinery and computer centres that underpin modern business. It seems it will soon also be powering more vehicles. Electricity is an essential good, the true value of which is only appreciated when it is not available. Unlike any other good, it needs to be used at the same time it is produced. While battery technology can provide some storage, it is incapable of meeting any more than a few minutes of actual demand. But during the federal election campaign, Labor doubled down on net zero policies that will destroy our energy system. On the basis of 'modelling', it boasted that renewable energy's share in the National Electricity Market will reach 82 per cent by 2030. Its $20 billion *Rewiring the Nation* policy promises lower power prices *and* more renewables.

Renewable energy currently makes up around 39 per cent of total NEM capacity, yet Labor is suggesting Australia could more than double this in just over seven years. Following the lead from Canberra, the Australian Energy Market Operator (AEMO, the organisation charged with keeping the lights on) released its 2022 Integrated System Plan (ISP) on 30 June 2022. Effectively saying the same thing as the Federal Government, AEMO upped the hubris by claiming the energy transition was irreversible and represented a 'once-in-a-century opportunity'.

The Albanese government's energy policy and AEMO's latest plan achieves that rare feat of being both unrealistic and unaffordable. In the past 20 years the focus has been on renewable energy sources, especially wind and solar. Government schemes to promote their use started with the Howard government's introduction of the renewable energy target in 2001 that mandated a specific market share. This has been supplemented by various State-based schemes that underwrite the cost of developing new renewable energy projects. It is time to face reality. We must, because of the impacts of current and future energy plans on consumers and the economy, and because it is imperative that we as a nation remain competitive and capable in a deteriorating global security environment.

Back-up and transmission systems drive up the costs of wind and solar power.

But in order to succeed why does the cheapest energy source require more subsidies and government investment? Wind and solar are intermittent—they only work when the wind blows and the sun shines. In the case of wind, over a year it only produces about 35 per cent of the electricity a reliable generator could deliver if it ran non-stop all year.

For solar, this is even lower—about 30 per cent for large solar farms and only 20 per cent for the solar panels on top of homes around Australia. What is more, the best locations for large renewable projects are often some distance from where the demand is, requiring large new transmission systems.

So while wind and solar have low operating costs (when they are producing electricity) but high set-up costs, the cost of all the back-up and transmission systems is driving up costs. According to AEMO's Step Change scenario (which it says is most likely), onshore wind capacity will need to increase from 11,525MW in 2023/24 to 34,415MW in 2030/31. That is roughly a tripling of capacity, which means about another 7,000 new wind turbines cluttering the landscape. In particular, the New England Renewable Energy Zone is forecast to see an additional 3,500MW of new wind capacity installed by 2030. This represents a seven-fold increase in the number of wind turbines in the New England region, about 1,000 in total. Likewise, solar power increases from 30,000MW in 2023/24 to 51,000MW in 2030/31. This will mean another 100 million solar panels (depending on size), overwhelmingly from China, and all without any programs to recycle these panels in place (more on this in a later section).

MICHAEL SHELLENBERGER.
PHOTO: SHELLENBERGER.ORG

ELECTRIFICATION OF TRANSPORT

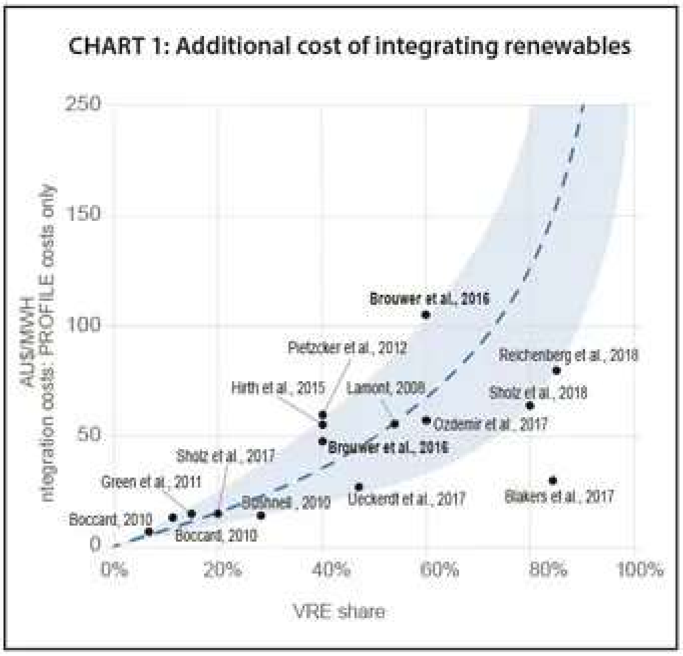
If AEMO is to be believed, Australia should be looking to increase the level of renewable energy six to tenfold over the next 20 to 30 years just to meet *existing* demand, which is about 265 terawatt-hours (1TWh = 1 trillion watts of energy being produced for one hour). If also—as proponents claim—we will all be driving electric vehicles, then transport-related electricity demand will be around 634TWh. This means if Australia was to electrify transport, then its total electricity demand would be 906TWh, which is more than 3.4 times the current demand. It is a ridiculous scenario.

And if Australia were to produce this all from renewable energy, there would have to be an elevenfold increase (notwithstanding all the difficulties just described).

For at least a decade, it has been well understood that even if technology-level costs of wind and solar power are low and decreasing (which they were, for a time), increasing the *share* of these forms of variable renewable energy drives up the total system costs.

Chart 1 provides an overview of various academic studies that consider the additional costs of integrating renewables. The key point is the higher the level of variable renewable energy sources (wind and solar), the higher the integration cost. This cost does not include the actual cost of new transmission or the cost of the renewable energy itself.

The NEM currently has just over 26 per cent variable renewable energy. Based on Chart 1, the additional cost of integration is around $20–$25MWh. However, this cost will more than double as the level of variable renewable energy increases to 50 per cent, and once it hits 75 per cent, the costs will likely quadruple.



This stands in contrast to the increasingly discredited claims made by renewable energy proponents that energy costs will come down.

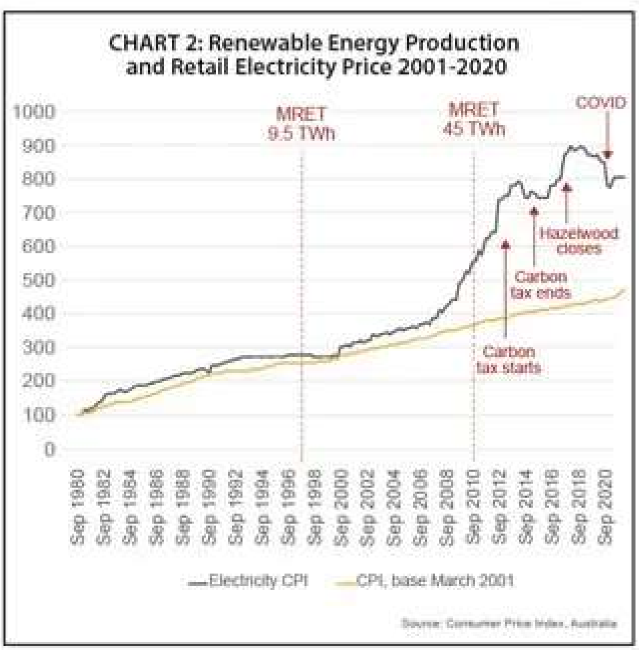


Chart 2 tracks the Consumer Price Index and Retail Energy Price index from 2000 to 2020. It shows that retail electricity costs have continued to increase as more renewables are put into the system. The data series ends in 2020 and does not capture the double-digit price increases seen recently. However, the trend is clear: the more renewables that are brought into the power system, the higher the cost. This reflects the increasing cost of integration seen in Chart 1.

RENEWABLES DECREASE ENERGY SYSTEM RELIABILITY

The recent energy market events in eastern Australia have highlighted the basic problem of reliability. There is not enough reliable on-demand power supply to meet our needs, and the result is seen in rising power bills. While politicians and renewable lobbyists seek to blame coal power stations for this situation, the opposite is the case: the increased level of subsidised renewables have led to ageing coal assets being forced to operate in ways for which they were not designed, by increasing and decreasing output (which also destroys their financial viability).

The demand for electricity naturally has peaks and troughs, during each day and during the year. During the day, for instance, there is typically a peak as people return from work and turn on appliances and/or heating or cooling systems. Very hot days in summer drive the peaks even higher as air conditioners are switched on.

In a well-designed power system the bulk of the power will be provided by base-load generators, so called because they run pretty much 24/7 and supply the base or minimum requirements (with peaks occurring above that level). Globally, this is typically supplied by coal or nuclear plants or—in regions lucky enough to have large rivers with large and predicable flows—hydro. Gas is too scarce and expensive to serve this purpose, so it tends to be used to supply the difference between the minimum requirements and the peaks (which is why they are called 'peak-load' generators). Base-load generators are expensive to build but can run for decades. Financially, they make sense when there is confidence that they will indeed run nearly all of the time, and this is also how they are engineered. This confidence also enables writing long-term contracts for coal supply, insulating them to some extent against the vagaries of the international market for black coal (Victorian brown coal does not even have to manage that risk, as it cannot be exported).

The standard peak-load generator being installed today is more or less a gas turbine similar to that found on an aeroplane, turning a generator (e.g. Origin Energy's gas-fired power station at Mortlake in Victoria). In a 'normal' energy system these are only called upon during times when the peaks are very high—sometimes for a few hours a few days a year, when wholesale prices 'spike' along with the demand. They earn money mostly by providing 'insurance' for retailers—so that the latter are not out of pocket during the spikes.

Australia's baseload power stations are now closing more rapidly than expected (when maintenance and refurbishment could extend their operating lives for years if not decades) because the companies cannot commercially operate power stations that need to run for 70–80 per cent of the time when wholesale power prices are so often negative. And the reason prices are negative is because of the levels of subsidised renewables being forced into the system (when producing, they bid into the market at close to zero to ensure the energy is used).

Consumers do not benefit from these short periods of negative prices because renewable energy is underwritten by costly supply contracts. More than a few stories in the media about how renewables are delivering lower prices are deliberately designed to mislead readers, as the complex relationship between wholesale and retail prices (and the short and the longer term) is not explained.

But worse for consumers, these periods of negative prices create a situation where renewables may be cheaper (for short periods) today, but when they force out large baseload plants over the longer term, the average price will be set at a new and higher level (as it did following Hazelwood’s closure). This situation is exacerbated whenever large baseload plants close—something that will occur more often on the Albanese Government's proposed policy settings.

In 2017 the 1,600MW Hazelwood power station in Victoria closed with six months' notice. This led to wholesale electricity price increases of 85 per cent, and serious concerns about the reliability of power supplies.

The only reason renewables are in the power system is subsidies.

The 1,680MW Liddell power station is due to close later this year. Some have argued that Hazelwood and Liddell are older plants and their closure was/is inevitable, but the headlong rush to renewables is now hitting some of our newer and more efficient plants.

Origin Energy has announced its intention to close in 2025 Australia's largest power station, Eraring, with the generating capacity of 2,922MW. This alone provides around 20 per cent of electricity for NSW.

It should be noted that NSW is already the largest importer of electricity in the NEM—it is already heavily reliant on coal power imported from Queensland after allowing plant closures in recent years and failing to invest in its own generators.

The proposed takeover of AGL by Australian IT billionaire Mike Cannon-Brookes showcased the proposed early closure of Australia's other two large baseload power stations: 2,640MW Bayswater (NSW) and 2,210MW Loy Yang A (VIC) before 2030. In 2020–21, Liddell, Yallourn, Eraring, Bayswater and Loy Yang A power stations provided 31 per cent of all electricity produced in the NEM.

But the situation is more acute at the State level. The closure of these power stations would see around 50 per cent of NSW and Victoria's baseload capacity closed before 2030, with little like-for-like replacement capacity.

Australian governments are pushing to shutter Australia's baseload power stations before there is sufficient replacement capacity. This also impacts reliability, because managing every peak and trough caused by weather-related surges and energy droughts associated with solar and wind becomes even harder.

To manage periods of shortage the system operators selectively will first cut back industrial users, then they will cause ‘brown-outs’ (power being cut off to particular users), and then if they lose control entirely blackouts will occur (as happened in South Australia in 2016). All these scenarios will become more frequent.

In June 2022, IPA Deputy Executive Director Daniel Wild and IPA Research Fellow Dr Kevin You published a landmark report forecasting what will happen to power prices as net zero policies force our coal-fired power stations out of business (while gas development is strangled and nuclear energy prohibited.) They focused on the costs to households.

Six coal-fired power stations are set to close in Australia by 2030. The capacities of these six facilities account for close to half of the total coal-based capacity of the NEM. They also account for more than 20 per cent of the total energy capacity of the NEM. The coal-fired power stations due to close are Yallourn W, Eraring, Bayswater, Liddell, Vales Point B, and Callide B.

The report estimated the impacts the closures of these six coal-fired power stations could have on wholesale and retail electricity prices by 2030.

The report found:

- Queensland families face the prospect of a 110 per cent increase in retail electricity bills, rising from $1,200 to around $2,500 p.a.
- NSW families face the prospect of a 100 per cent increase in retail electricity bills, rising from $1,300 to around $2,600 p.a.
- Victorian families face the prospect of a 95 per cent increase in retail electricity bills, rising from $1,300 to around $2,500 p.a.
- South Australian families face the prospect of a 90 per cent increase in retail electricity bills, rising from $1,700 to around $3,200 p.a.
- Tasmanian families face the prospect of a 125 per cent increase in retail electricity bills, rising from

$2,000 to around $4,500 p.a.

SOLAR: NOT SO BRIGHT WHEN THE REAL COSTS ARE CALCULATED

Around 90 per cent of solar panels installed in Australia come from China. Polysilicon is a critical part of solar panels, with 45 per cent of global polysilicon production from the Uyghur region in China. According to a 2021 report by a team at Sheffield Hallam University, *In Broad Daylight: Uyghur Forced Labor and Global Solar Supply Chains*, all manufacturers of polysilicon in the Uyghur region have either used forced labour (euphemistically called 'labour transfer programs') or been supplied raw materials by companies that have. But the real challenge for Chinese-produced solar panels is that the cost of inputs are rising, particularly the cost of the (mostly coal-fired) energy that goes into making polysilicon and solar PV. Ironically, rising fossil fuel costs are making the production of renewable energy more expensive.

Despite this, renewable energy advocates persist with the view that solar energy's cost will continue to decrease. AEMO's cost projections are that large-scale solar PV costs will decrease by 38 per cent by 2030, and then by a further 15 per cent by 2040. This is unrealistic.

The cost of new solar installations will increase, especially for the massive solar farms in remote areas that will bring similar issues with transmission costs and environmental (and community) permissions to those faced by wind farms.

In addition, panel degradation will become a significant problem. While solar businesses claim panel lives of 25 to 30 years, this is only for quality products. And even then, this claimed longevity is only based on the manufacturers' warranties.

Recycling old solar panels and wind turbine blades has become a problem.

However, for many of the cheaper imports (such as those from China), Australia's harsh conditions of high UV, high levels of thermal cycling (the difference between night and daytime temperature), and high humidity can play havoc with lesser-quality panels, leading to severe degradation in less than 10 years.

This leads to a further challenge, the emerging waste problem of how to dispose of old solar panels. A 2021 article in *Harvard Business Review* highlighted this issue, noting the rising amounts of discarded solar panel and the associated costs:

By 2035, discarded panels would outweigh new units sold by 2.56 times. In turn, this would catapult the LCOE (levelized cost of energy, a measure of the overall cost of an energy-producing asset over its lifetime) to four times the current projection. The economics of solar—so bright-seeming from the vantage point of 2021—would darken quickly as the industry sinks under the weight of its own trash.

Similarly, there has been no serious discussion about the recycling of wind turbine blades—an issue the *HBR* article also notes is likely to become a problem.

PROTEST IN NEW YORK IN SEPTEMBER 2021
AGAINST FORCED LABOUR IN CHINA.
PHOTO: SOMEOFUS/FLICKR

WIND POWER: NOT WORKING AS ADVERTISED

Wind power, while more efficient than solar, is increasingly challenged in Australia. Onshore wind farms are more difficult to build. They are divisive in local communities. The North American experience shows local communities are increasingly opposed to wind, just as those in Europe. Moreover, the actual performance of onshore wind farms does not seem to meet initial expectations. For example, Macarthur wind farm—the largest in Victoria—was expected to produce electricity 35 per cent of the time, yet it has struggled to reach 30 per cent. This reflects that wind turbine performance degrades over time.

While the CSIRO in its 'GenCost' study assumes a capacity factor of 44 per cent, the average capacity factor for Australian wind farms in 2020–21 was 32.5 per cent. This has then led to the latest focus: offshore wind farms. Even as Victoria has re-announced the 2,200MW Star of the South offshore project, there has been little scrutiny of offshore wind's costs and reliability. Europe's experience shows these are more expensive than predicted. Analysis by University of Edinburgh's Professor Gordon Hughes shows that while the capital cost of on and offshore wind farms had decreased, this trend had stopped by 2018. But the operating cost of wind farms have continued to increase at a greater rate. For offshore wind farms this is even a bigger issue, with the operating costs being considerably higher than predicted, in large part because the offshore environment is more challenging, as explained by

University of Edinburgh economics professor Gordon Hughes in *Wind Power Economics: Rhetoric & Reality* (2020).

WIND FARM IN WESTERN VICTORIA.
PHOTO: ED DUNENS/FLICKR

TRANSMISSION WILL BE A POLITICAL ISSUE

In the recently released 2022 Integrated System Plan (ISP), AEMO states "our energy system transformation is accelerating and irreversible, and ever more comprehensive and challenging". It then notes the need to "engage with landholders and regional communities to co-design solutions that will earn a lasting social licence". This is because the ISP calls for

$12.7 billion to be spent on 10,000km of new transmission networks by 2050. It identifies a number of transmission projects that need to be completed by 2030, including:

- Western Renewables Link, 2026
- Hume Link, 2026
- Sydney Ring, 2027
- New England REZ Transmission Link, 2027
- Marinus Link, 2029
- VNI West, 2031

Transmission sounds easy and simple compared with generation projects, which may be contentious. However, transmission projects can be more vulnerable to delays in planning and approvals, and more vulnerable to local opposition, because major transmission projects span hundreds of kilometres of private and public land, requiring wide safety corridors.

To take but two examples: The Western Renewables Link has encountered serious opposition from local communities, and the new interconnector between

South Australia and New South Wales is having to deal with the land access issues where farmers are opposed.

I can personally attest to the difficulties, from my own experience as a consultant to the organisation which built Basslink, linking Victoria's Loy Yang to Bell Bay in Tasmania. The Victorian overhead transmission lines were vehemently opposed by the local communities, leading to delays and increased costs. If Australia cannot deal with the required build-out of new transmission lines, then achieving the headline renewable targets will be impossible. Transmission cannot be taken for granted.

STORAGE — CAN'T SUPPORT MODERN INDUSTRIAL ECONOMIES

Renewable supporters suggest batteries and pumped hydro can be the source of back-up power, yet grid-scale batteries remain small. If it ran at maximum capacity, the vaunted 150MW battery in South Australia could supply five per cent of the State's peak demand for just one hour. (Snowy 2.0 is not the answer, either).

Commercially available battery storage technologies have not changed much in the past 10 years. Lithium-ion based technologies continue to dominate. For genuine storage, there needs to be a step change in battery technologies, but proposals for alternatives like grid-scale chemical storage such as flow battery technologies remain uncommercial. And they are not actually sources of energy.

Pumped hydro has been talked-up as potential salvation. But while Snowy 2.0 will nominally provide the effective capacity of a single 2,000MW baseload power station (for a time), it is still very capital intensive. Latest estimates put the cost (including transmission) at $12 billion.

Small modular reactors offer real potential.

In 2017 investment bank Morgan Stanley predicted that by 2020 there would be one million household batteries installed in Australia. According to the Clean Energy Council, the actual number of installed household batteries between 2015 and 2020 was 94,792—that is less than 10 per cent of the predicted figure.

AIN'T GOING TO HAPPEN WITHOUT NUCLEAR

The countries with the lowest emission intensity power grids are those with established nuclear power generator fleets: France, Finland, Sweden, Canada, and Switzerland. Nuclear energy is the largest provider of zero emission 24/7 power, producing around 10 per cent of all electricity globally. In its various scenarios of how to achieve net zero emissions, the International Energy Agency has a prominent role for nuclear. Yet in Australia there is a legislated ban on nuclear in the *Environment Protection and Biodiversity Conservation Act* 1999. If Australia is serious about meeting net zero goals—

especially in a world where everything is being electrified—there is no way this can occur without nuclear power.

Small modular reactors offer real potential for deployment in Australia. They are designed to operate in conjunction with intermittent renewable energy sources and can be sited next to existing power stations, utilising much of the same transmission and network infrastructure. Ontario Power Generation in Canada is currently developing a 300MW plant at Darlington.

The renewables lobby commonly raises the objection that nuclear will take too long and will require government to effectively underwrite their construction through power purchase agreements. That is, nuclear energy is demonised for requiring governments to take the same supportive and long-term approach the renewables lobby has been demanding (and enjoying) for decades. With all the adverse outcomes we have described.

Its common rhetorical trick is to say that bringing nuclear energy into the mix would require departing from the principles of an energy market. This from the lobby whose efforts have taken the 'market' out of the NEM, to the point that it was suspended—subject to centralised command and control by government—in the midst of our winter 2022 energy crisis.

A key factor here is that a nuclear reactor operates for 60 years. At best, wind and solar last around 20 years. This means replacing the wind and solar facilities at least twice just to keep a site running for the same period as a nuclear plant. Without nuclear energy, Australia cannot decarbonise its electricity supply. This is just one aspect of the realities of energy that the Albanese Government and all enthusiasts for the 'net zero by 2050' mantra (including those within the Coalition parties) refuse to face.

Unless they do, the modern grid which has been developed over the last century and provides a remarkably high level of reliable supply, is about to get a whole lot less reliable. This is not a transition; it is a regression.

Scott Hargreaves

Scott Hargreaves is the Executive Director at the Institute of Public Affairs

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The author gratefully acknowledges contributions to this article from a number of experts still working in the energy industry, who are desperately trying to inject common sense into the mix.

This article from the [Winter 2022 edition] of the [IPA Review] is written by IPA Executive Director Scott Hargreaves.

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