Capital for kilowatts

The (non)-inflationary impacts of the green transition

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CENTRE FOR POLICY DEVELOPMENT

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Executive summary

Australia needs to make significant investments in electricity infrastructure and export industries. Some economic commentators and analysts view a renewable transition as inflationary, in large part because of the high levels of investment required. This ignores the fact that there will be high levels of investment over the coming decades regardless of whether it is "green" or not. To the extent that green investment may cost more, it is unlikely to have significant impacts on inflation.

A significant portion of Australia's electricity infrastructure will reach the end of its life over the coming years. This turnover of coal and gas assets provides a natural impetus to decarbonise the electricity system. Around 12 GW of coal and gas power will be retired by 2030, and 38 GW by 2050. In addition, AEMO modelling predicts maximum demand will increase by 20 GW by 2050. Put together: there is a gap of almost 60 GW that needs to be filled by 2050.

Investing in renewable energy to fill this gap is likely to cost more than replacing coal and gas assets like-for-like. The best estimates available suggest a coordinated green transition will cost $625 billion, whereas it will cost around $400 billion to reinvest in existing fossil fuel generation classes. However this difference – roughly $225 billion – is small from a macroeconomic perspective. Spread over several decades, the inflationary effects of this investment will be small in any given year.

And even these estimates overstate the impact of a green transition for three reasons. First, we expect the actual cost of a green transition to be lower as technologies move down the cost curve. Second, an effectively implemented green transition will avoid a significant inflationary risk: constrained electricity supply as coal plants retire. Third, decarbonising the grid will reduce the economy's exposure to one of the biggest sources of price volatility: fossil fuels. Of course, macroeconomic stability is not the only reason to prefer renewables – they also contribute to a more stable climate and planet.

A fast and effective transition to renewable electricity generation will deliver significant macrostability benefits over the long term, and any inflationary impacts are likely to be small and manageable.

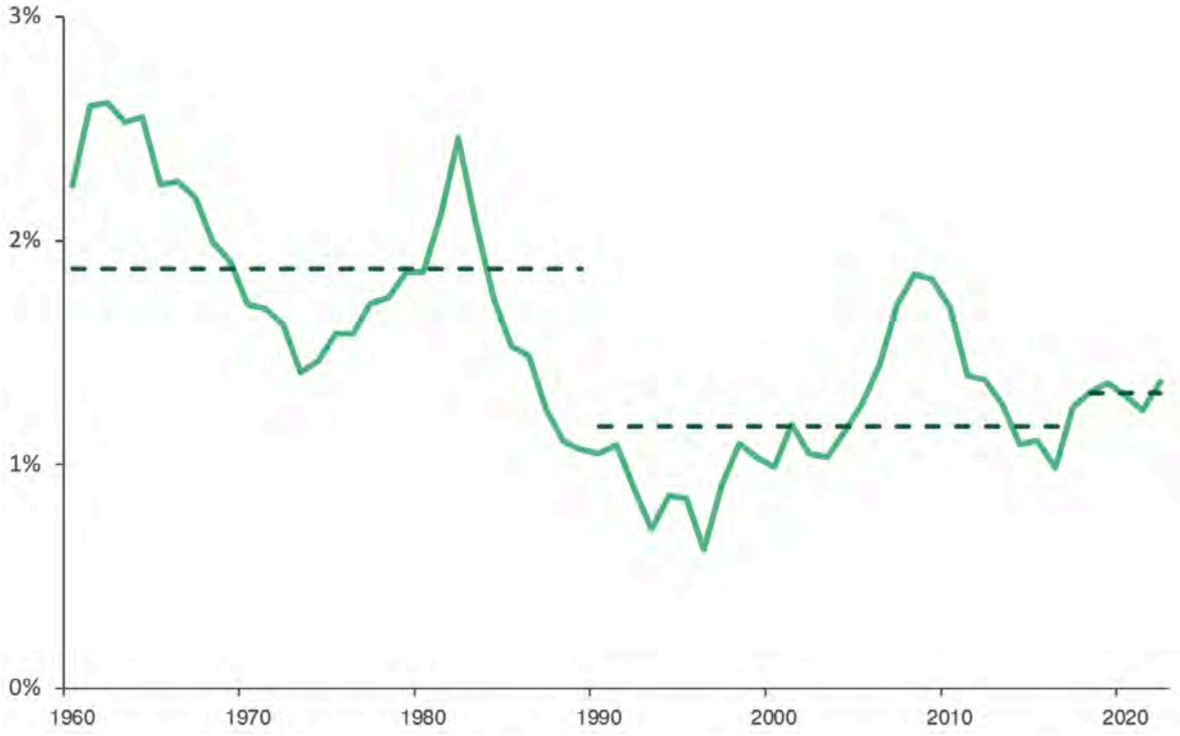
Much of Australia's electricity infrastructure is reaching its retirement date

A lot of Australian electricity generation infrastructure was built in the 1960s, 1970s and early 1980s (see Figure 1). This investment facilitated extensive productivity gains and growth across the economy, but now much of this infrastructure is reaching the end of its life. Australia has to grapple with the unspoken rule of infrastructure: one day it will need to be replaced. But a period of sustained high investment in infrastructure will have implications many decades later when the assets reach end-of-life. For coal and gas electricity generation, there is approximately 38 GW of generation capacity approaching the end of its life.

This loss of 38 GW of generation capacity will create a gap that demands capital investment just to keep the lights on. In reality, keeping the lights on requires more than just replacing retired capacity; it also requires building 20 GW more generation to deal with growing demand according to AEMO's central scenario.[1] There also needs to be parallel investments in transmission infrastructure and storage (this need for storage is not isolated to renewable energy: more gas generation capacity would also require storage too).

Fig. 1 Energy sector investment has never been as high as during the 1960s-80s

Capital investment in energy sector as per cent of GDP



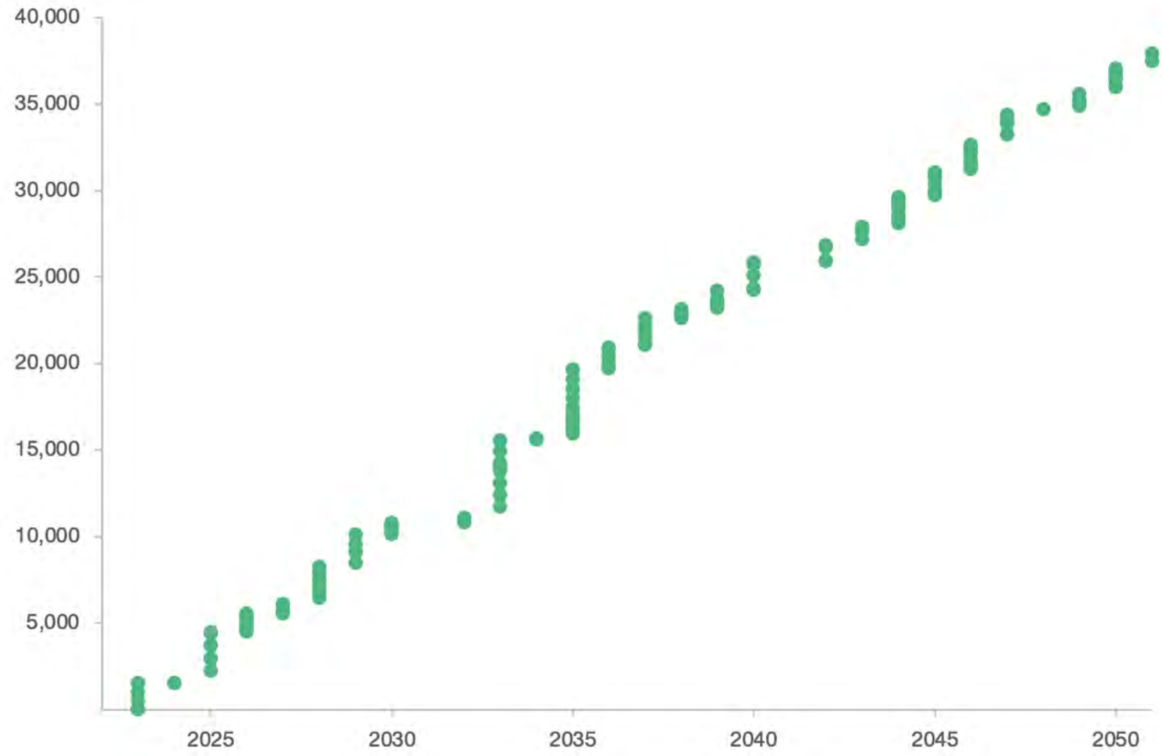
Source: OECD (2024) *National accounts*
Notes: the data refers to gross fixed capital formation in electricity, gas, steam and air conditioning supply

Coal and gas electricity generation plants are particularly affected by this approaching wave of infrastructure retirement. The coal and gas assets that will reach retirement in the coming decades represent a significant proportion of Australia's generation capacity: roughly 27 GW of coal generation capacity and 11 GW of gas capacity will reach the natural end of its life by 2050 (see Figure 2). These assets need to be replaced with something new, even in the absence of any decarbonisation goal.

In the medium-term to 2030, Figure 2 shows a retirement of approximately 12 GW coal and gas generation capacity across the country by 2030.[2] And these planned retirement timeframes may even be brought forward as the operating environment changes. Concerningly, AEMO reports only 10 GW of "committed" projects due to come online on the NEM between now and 2030.[3] These committed projects will not cover retiring coal and gas assets this decade, let alone supply enough electricity to a growing country.[4] To address this, investment decisions need to be made now in 2024 for new capacity to come online by 2030.

Fig. 2 The grid will lose 38 GW of generation capacity from retiring coal and gas facilities over the coming decades

Cumulative MW of retiring coal and gas generation



Source: authors' analysis of data from AEMO (2024) *February 2024 NEM Generation Information*, and various sources of data from Western Australia[5]

Notes: each dot represents a plant that is scheduled for retirement

The inflationary impacts of decarbonising Australia's current grid

The Commonwealth government has an ambitious plan to see 82% of electricity on the National Electricity Market come from renewable sources.[6] Modelling of different transition scenarios finds that coordinated action to decarbonise Australia's electricity sector will cost $625 billion through to 2050 (inclusive of associated transmission infrastructure and other costs).[7] This has led some people to argue that decarbonising the grid will add to inflationary pressures.[8]

Regardless of whether or not Australia decarbonises its electricity generation, there is a gap of almost 60 GW of generation capacity that needs to be filled by 2050 (38 GW of retiring coal and gas assets and 20 GW of new demand). Modelling by the Australian Industry Energy Transitions Initiative found that under a business-as-usual "incremental" scenario without coordinated decarbonisation there would still need to be $400 billion of new capital investment in electricity infrastructure (roughly split half-half between generation and transmission) just to keep the grid running to 2050.[9] Our own analysis reaches a similar conclusion: it would cost over $200 billion just to maintain generation capacity on a like-for-like basis (replacing coal with coal, and gas with gas), plus significant additional expenditure of around $200 billion for transmission and other costs.[10]

So while a green transition will cost $625 billion, we are still looking at $400 billion of expenditure to replace depreciated power generation and transmission. Put differently: the counterfactual to a scenario of significant green investment is not "spend nothing", but rather spending hundreds of billions on another 38 GW of coal and gas generation, and hundreds of billions more to meet new demand and replace transmission lines. The inflationary impacts of green investment (as opposed to fossil fuel investment) are only relevant with regards to the additional expenditure above the amount that would occur anyway: $225 billion.

The annual increment to demand from this spending of $225 billion over three decades is small from a macroeconomic perspective. Given it is spread over several decades, the inflationary effects of this capital investment will be small in any given year. A renewable energy transition may have other downstream costs – such as electrifying household appliances or household heating – but even still, we expect that this $225 billion estimate overstates the impact for three reasons.

First, we expect the actual cost of a green transition to be lower as technologies move down the cost curve. And because costs decline as a function of deployment (not time), rapidly front-loading these investments will lead to cheaper costs overall.[11] This has already happened for solar generation, but there are still opportunities for significant cost reductions in storage and other technologies. Achieving this requires government intervention: the benefits of front-loaded investment are large and shared across society, whereas the costs are borne primarily by the first movers.[12] Interventions like the Capacity Investment Scheme and Hydrogen Headstart are designed to encourage first movers to make these important investments, bringing lower costs for everyone else.[13]

Second, an effectively implemented green transition will avoid a significant inflationary risk: not enough electricity. As described above, the current pipeline of electricity projects is insufficient to replace retiring capacity, let alone meet new demand. If electricity supply fails to keep up with the demand, the inflationary impacts of constrained electricity supply would likely be much worse than the impact of the high aggregate demand from capital investments in infrastructure.

Third, replacing fossil fuel generation with renewable generation will remove one of the most significant sources of price volatility in the economy, and lead to cheaper electricity overall (as we discuss in the final section below). As global markets transition away from fossil fuels, it is likely that the supply of coal and gas will become even more volatile; affecting prices in a dynamic dubbed "fossilflation" by the European Central Bank and others.[14] Moving to greater levels of renewable energy generation will be a source of stability in the economy.

Of course, macroeconomic stability is not the only reason to prefer renewables – they also contribute to a more stable climate and planet.

The inflationary impacts of building green export industries

The Commonwealth Government has announced an ambition for the country to be a "green export superpower". Taken seriously, this would require hundreds of billions of additional investment. Forecast scenarios where Australia has large green export sectors require at least double the volume of renewable energy generation – sometimes much more.[15] However, as with the domestic infrastructure investment, the inflationary impact of this capital expenditure should be assessed against a relevant counterfactual.

In this case, the relevant counterfactual is once again not "no investment" but rather "investment in the next-best new export industry". With projected decline in global demand for fossil fuels, Australia faces an existential need to develop new export industries. Failure to do so risks a steep decline in export revenue, which will compound inflation in a disadvantageous cycle: falling export revenue leads to a depreciating exchange rate, which makes imports more expensive, which creates inflationary pressure.

Whether capital is invested in a new lithium mine or a new bauxite mine, a new green iron factory or a new biotechnology lab, the end result is the same: Australia will need to make significant investments over the coming decades in non-fossil fuel export industries.

At the same time, there will be some automatic moderation of inflationary impacts from investment in export industries through the exchange rate channel. In previous investment booms – such as the 2000s mining boom – growth in investment flows led to higher returns to capital, itself leading to currency appreciation. A higher currency has the effect of making imports cheaper, easing pressure on prices and inflation across the economy.

To the extent that there are legitimate concerns about promoting green export industries, the concerns should be less about inflation and more about efficient capital allocation to the best industrial opportunities.

It all comes down to demand management

The inflationary impact of the investment in the green transition is no different from any other source of aggregate demand. The tools of standard tools of governments and central banks can be deployed as required.

Throughout Australia's economic history there have been challenges in managing large investment cycles in the resources sector (although as mentioned above, exchange rate appreciation can help with this). This is not a new problem; we can apply the same lessons from those cycles to this one. And whether the investment is in renewable infrastructure or not, the bottom line is that Australia will need to make significant investments in electricity infrastructure over the coming decades.

In this context, it is also important to reiterate that it is the *increment* to investment in any period which is the potential impulse to inflation. A *sustained* higher level of investment is not inflationary over the medium-term – if the level of investment is truly sustained then the economy will adjust and allocate resources to meet this demand.

Indeed, it is somewhat ironic that after nearly a decade of anxiety about too low levels of private investment contributing to too low levels of inflation, we have now shifted to anxiety about the converse. It is a more straightforward challenge to moderate too much aggregate demand and investment than it is to stimulate subdued aggregate demand.

The long-term vision: low cost energy

In this paper we have focussed primarily on the immediate effects of spending on new infrastructure: the expected impact that these dollars will have on inflation. However, it is also worth considering the long-term impact of dramatically increasing the supply of renewable energy.

Decarbonising the grid will remove one of the biggest sources of price volatility from the economy. The global inflationary "cost-of-living crisis" over 2022-23 was in part due to fossil fuel supply shocks that arose from the Ukraine war. Even over long time periods, analysis in the United States found that oil and gas prices are more volatile than 95% of other goods.[16]

Our own analysis of ABS price data shows that electricity and petrol prices are more volatile than 90% of other goods and services.[17] By contrast, renewable energy generation has stable prices – once a facility is built there is no ongoing need to buy fuel at prices set by global commodity markets. Renewable energy can also lead to lower wholesale prices across the electricity network, as lower cost generation (like solar) is deployed first and higher cost generation (like gas peakers) is only used when needed.[18]

This is an opportunity to improve the sustainable, stable, supply capacity of the economy, using energy resources that are quite literally "renewable". At the same time as we are presented with this opportunity, the economy also faces worsening risks and instability from the physical effects of climate change. Climate impacts will likely make CPI more volatile in the short term with inflationary spikes from damage to food systems, destruction of capital stock, and disruption of key infrastructure.[19] The risks from a changing climate are many and varied; and will in themselves be a source of significant macroeconomic volatility.

Australia needs to make significant investments in electricity infrastructure over the coming decades. Using this as the basis for an ambitious renewable grid transition may present a small impulse to aggregate demand in the short term. But it will deliver significant macrostability benefits over the long term, and any inflationary impacts are likely to small and manageable.

Endnotes

[1] This estimate of additional demand by 2050 is based on the central "step change" scenario in AEMO's *draft 2024 ISP consultation*, published in December 2023.
[2] AEMO (2023), *NEM Electricity Statement of Opportunities (ESOO)*.
[3] The situation is less bleak if we count ~7 GW of projects that AEMO counts as "anticipated" by 2030, which meet 3 out of 5 project commitment criteria. Project status as "committed" or "anticipated" is drawn from AEMO (2024) *Generation Information*.
[4] There is some further nuance to understanding these numbers, depending on whether or not they include WA. The 12 GW of retiring capacity by 2030 is comprised of around 2 GW in WA and 10 GW across the NEM jurisdictions. But the 10 GW of "committed" projects is only for NEM states, the data does not include committed projects in WA.
[5] The AEMO dataset does not include a closure date for Callide C in Queensland, but we have assumed a 2050 closure date which is a common assumption used by coal companies (see for instance: Waratah Coal (2022) *Response to Ministerial Information Request*). AEMO does not publish a dataset of expected closure dates for generation capacity in WA. The state government has announced plans to retire all coal generation by 2030, which we have factored in for four coal power stations. For gas stations, for simplicity, we ignore smaller facilities (under 100 MW) in this analysis. For three gas facilities owned by TransAlta, the company refers to expiry dates in 2026, 2038, and 2042 (see: Parkston, Kambalda Southern Cross, and South Hedland). For 11 other West Australian gas facilities (making up 2.8 GW of capacity) we have assumed generous 40 year lifespans (Cockburn, Pinjar, Port Hedland, Newman, Neerabup, Kwinana, Pinjarra, Kemerton, Worsley Alumina, Telfer Gold Mine, and Mungarra).
[6] Chris Bowen (2022) *Climate change – a shared economic plan, a shared challenge*, speech at the AFR Energy & Climate Summit, Sydney.
[7] $625 billion is the level of capital investment required in the "coordinated action" scenario that is consistent with 1.5 degrees of warming from the *Australian Industry Energy Transitions Initiative* (2023) *Pathways to industrial decarbonisation – Phase 3 technical report*.
[8] One recent line of this commentary appeared in the Australian Financial Review last year (John Kehoe (2023) *How the renewables rush could push up interest rates*, Australian Financial Review), and more generally was given the moniker "greenflation" in a 2022 speech at the European Central Bank (Isabel Schnabel (2022), *A new age of energy inflation: climateflation, fossilflation and greenflation*, speech at "Monetary Policy and Climate Change" panel, European Central Bank).
[9] *Australian Industry Energy Transitions Initiative* (2023) *Pathways to industrial decarbonisation – Phase 3 technical report*.
[10] This assumes the 38 GW coal and gas facilities are replaced with like-for-like facilities, and the 20 GW of capacity for new demand comes from the cheapest possibly source, with costs from table B.1 of Paul Graham, Jenny Hayward, and James Foster (2023) *GenCost 2023-24: Consultation draft*, CSIRO, Australia.
[11] Recent econometric analysis has shown that the lowest whole-of-economy cost for a green transition can be achieved by front-load as much investment as possible to "bank" early technological improvements, for more see: Rupert Wey, Matthew C. Ives, Penny Mealy & J. Doyne Farmer (2022) *Empirically grounded technology forecasts and the energy transition*, Joule, vol 6, issue 9.
[12] Toby Phillips (2023) *Green gold: a strategy to kickstart Australia's renewable industry future*, Centre for Policy Development.
[13] Chris Bowen (2023) *Delivering more reliable energy for all Australians* [announcement of CIS expansion], Minister for Climate Change and Energy.
[14] For more on "fossiflation" see: Tom Arup and Fraser Simpson (2022) *Interactions between inflation, energy, economic policy and climate change*, CPD discussion paper, Centre for Policy Development, as well as Isabel Schnabel (2022), *A new age of energy inflation: climateflation, fossilflation and greenflation*, speech at "Monetary Policy and Climate Change" panel, European Central Bank.
[15] Toby Phillips (2023) *Green gold: a strategy to kickstart Australia's renewable industry future*, Centre for Policy Development.
[16] Eva Regnier (2007), *Oil and energy price volatility*, Energy Economics, vol 29, issue 3.
[17] This is based on rolling 2 year standard deviations over the entire history of ABS price data (Australian Bureau of Statistics (2024), *Consumer Price Index (cat 6401.0)*, "Table 13. CPI: Group, Expenditure Class and Selected Analytical Series Index Numbers, Seasonally adjusted, Weighted Average of Eight Capital Cities"). The categories "electricity" and "automotive fuel" are in the top 10% of price volatility. "Gas and other household fuels" is in the top 25% of most volatile categories.
[18] Werner Antweiler and Felix Muesgens (2021) *On the long-term merit order effect of renewable energies*, Energy Economics, vol 99.
[19] Michele Bullock (2023) *Climate Change and Central Banks*, Sir Leslie Melville Lecture, ANU Research School of Economics.

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