

Regulation Economics

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The Finkel Report's Recommendations on the Future Security of the National Electricity Market:

Impacts on the Australian Economy and Australian Consumers

30 June 2017

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Preface

About the author

Dr Alan Moran is a noted economist who has analysed and written extensively from a free market perspective. He has published extensively on regulatory issues, particularly focusing on environmental issues, housing, network industries, and electricity and gas market matters. Dr Moran is the author of a number of books including his latest: Climate Change: Treaties and Policies in the Trump Era.

He was previously the Director of the Deregulation Unit at the Institute of Public Affairs from 1996 until 2014. Dr Moran was also a senior official in Australia's Productivity Commission and Director of the Commonwealth's Office of Regulation Review as well as playing a leading role in the development of energy policy and competition policy review as the Deputy Secretary (Energy) in the Victorian Government. He was educated in the UK and has a PhD in transport economics from the University of Liverpool and degrees from the University of Salford and the London School of Economics.

About the client

Dr Moran was engaged by Senator Malcolm Roberts on 19 June 2017 to critically assess the Finkel Final Report by 30 June 2017. Senator Roberts represents the people of Queensland as a member of the Pauline Hanson's One Nation (PHON) Party. He has considerable business experience in coal mining, processing and transport and has developed a key expertise in climate change data and facts. Senator Roberts has an honours degree in engineering from the University of Queensland and also holds a masters degree in business administration from the University of Chicago Graduate School of Business.

The Finkel Report: Impacts on the Australian Economy and Australian Consumers

Contents

Summary and Recommendations.....	4
Introduction.....	5
Electricity prices this century	5
Price trends.....	9
Australian emissions compared with those of other developed countries	9
The Finkel review and the Jacobs modeling.....	10
The Finkel report.....	10
The Jacobs modelling.....	11
The future according to Finkel	13
Modelling of different electricity technologies' costs	14
Jacobs model outcomes 2014-17.....	14
Renewables.....	16
Overall costs assumed.....	16
State based renewable programs	19
Solar Panels.....	20
Coal	22
Addressing the cost estimates for new plant	22
Realistic estimates of new coal generator costs	25
Three years Notice of Closure	28
Carbon Capture and Storage (CCS)	29
Costs and Composition of Electricity in a Deregulated Generation Market.	29
Wholesale price projections with a deregulated market	30
Network and retail costs.....	32
Electricity and the economy's wealth and structure.....	35

Figures and Tables

Figure 1	Electricity prices	5
Figure 2	Finkel estimated future coal plant closures	6
Figure 3	Wholesale price levels	7
Figure 4	Victoria’s forward prices	7
Figure 5	Comparative Australian electricity prices 2000-2015	8
Figure 6	Wholesale electricity prices by state and over time	9
Table 1	June future prices for the following year	9
Figure 7	Different countries’ carbon dioxide emissions	10
Table 3	Jacobs price forecasts in 2014	15
Table 4	Jacobs price forecasts in February 2014	15
Table 5	Jacobs price forecasts for the Finkel report	16
Table 2	The Jacobs report’s scenarios	12
Figure 8	Jacobs price modelling by state	13
Figure 9	New generating capacity	14
Figure 10	Jacobs renewable cost assumptions	16
Figure 11	Renewable energy generator payments for reliability	18
Figure 12	National wind capacity available	18
Table 6	Subsidies to renewables	20
Figure 13	AEMO projections of PV growth	21
Table 7	German estimates of different generator costs	21
Table 8	State based PV subsidy schemes	22
Table 9	Australian Research Council estimates of coal generating plant costs	23
Figure 14	Australian Research Council estimates of generator costs	23
Figure 15	Recently built coal generators’ efficiency levels	24
Figure 16	Coal Costs FOB Newcastle/Port Kembla, US Dollars per Metric Ton	25
Figure 17	Structural steel costs	25
Table 10	Jacobs (2014) estimates of new coal and gas plant	26
Figure 18	Jacobs (Finkel report) cost estimates of new generation	27
Table 11	Costs of new black coal plant in Australia	28
Figure 19	Electricity generation plant shares with subsidies removed	30
Figure 20	Future wholesale prices under different scenarios	31
Figure 21	Wholesale deregulated market prices by state	32
Figure 22	AEMC estimated network charges	33
Figure 23	AEMC household cost estimates	33
Table 12	Price increases announced June 2017	34
Figure 24	Future electricity prices following June 2017 price announcements	34
Figure 25	Future household electricity prices	35
Figure 26	Industries particularly vulnerable to electricity price increases	37

Summary

- Governments are subsidising the building of intermittent renewable energy that are reducing reliability and security while increasing prices. The Finkel recommendations entail an amplification of these subsidies, the outcome of which has been a doubling of wholesale electricity prices and a degradation of supply reliability. Compared with wholesale electricity prices of around \$40 per MWh prevailing during the first 15 years of the present century, prices now exceed \$80 per MWh.
- The Finkel review accepts that its policy proposals will not return wholesale electricity to their historical levels but mistakenly argues that this would be impossible. Moreover, its over-optimist assumptions on future costs of renewables mean that its proposals would make even its \$80 per MWh price goal unattainable.
- Implementation of the Finkel recommendations would bring a further deterioration of system reliability and lift wholesale prices to at least \$100 per MWh. This is already evident in prices of electricity on futures markets. Returning to the previous market-based electricity supply system that has been gradually undermined by regulations over the past 15 years would result in new coal plants, wholesale electricity costs at around \$50 per MWh and the restoration of a more reliable system.
- Household energy bills, even under an optimistic view of the Finkel proposals, would be between \$588 and \$768 per year more than would be the case under an outcome that removed market distortions by eliminating all subsidies.
- More injurious to households than the lift in their direct electricity costs, the Finkel recommendations would vastly increase the costs of electricity to commercial users. By more than doubling electricity costs, the Finkel proposals would force the virtual cessation of production in energy intensive, trade-exposed industries; these account for one fifth of manufacturing and include some of the nation's most productive activities including metals and smelting, pulp and paper, sugar and confectionery. Competitiveness and future growth would also be adversely impacted across most agricultural and mining sectors.
- A regulatory-induced elimination of the industries able to take advantage of Australia's natural advantage in low cost energy supplies and the forced increase in all other industries' electricity costs would severely reduce Australia's living standards.

Recommendations

- In general, the Finkel proposals should be rejected and regulatory distortions on energy supply should be removed. In particular, the Commonwealth should:
 - Abolish the Commonwealth's Renewable Energy Target (RET) and the subsidies, presently about \$75 per MWh, it creates for wind and large scale solar; and
 - Eliminate the Small-Scale Renewable Energy Scheme (SRES) under which electricity users in general are forced to provide a subsidy of \$40 per MWh to roof-top photovoltaic installations.
 - Cease all government subsidies through the budget including guarantees to bodies like the Clean Energy Regulator and the Clean Energy Finance Corporation (CEFC).
- The electricity market management should require, in line with the Finkel proposals, that all generators pay to ensure they operate reliably and require new generators to pay costs of transmission that their grid connection entails.
- State government should remove subsidies like the Queensland Solar Bonus scheme and preferential Feed-in-Tariffs for PV generated electricity.

1. Introduction

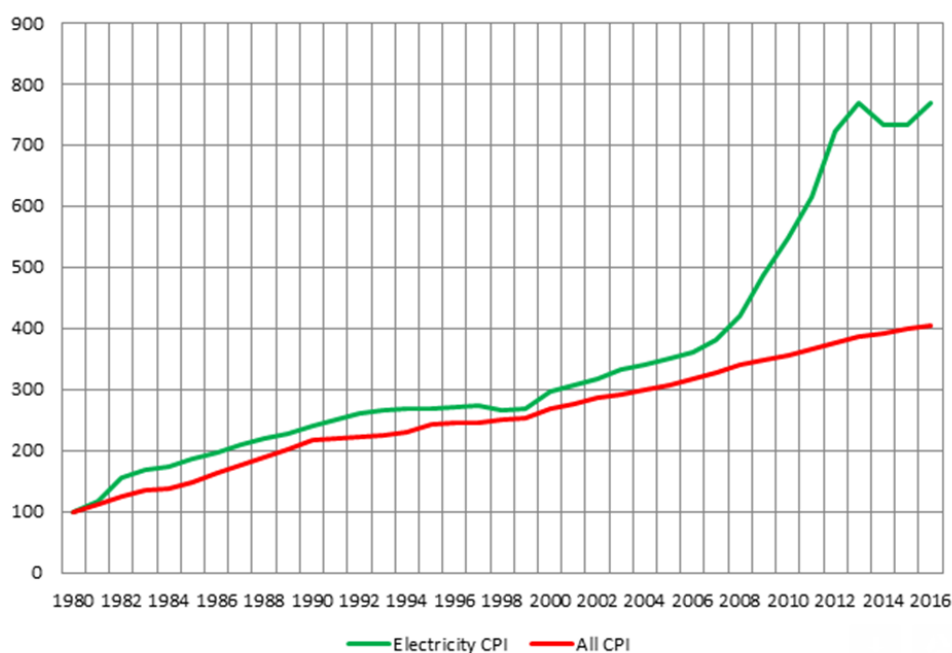
Government actions have brought about vast increases in Australia's electricity prices. They have done so by distorting the market through subsidies to wind and solar and by introducing measures prejudicial to cheaper and more reliable coal and gas based electricity.

Electricity prices this century

Over recent years Australia has witnessed a massive increase in its electricity prices. In terms of the consumer this can be seen from the following.

Figure 1 Electricity prices

CPI All & Electricity | Dec-on-Dec Accumulation | Source ABS: 1980=100

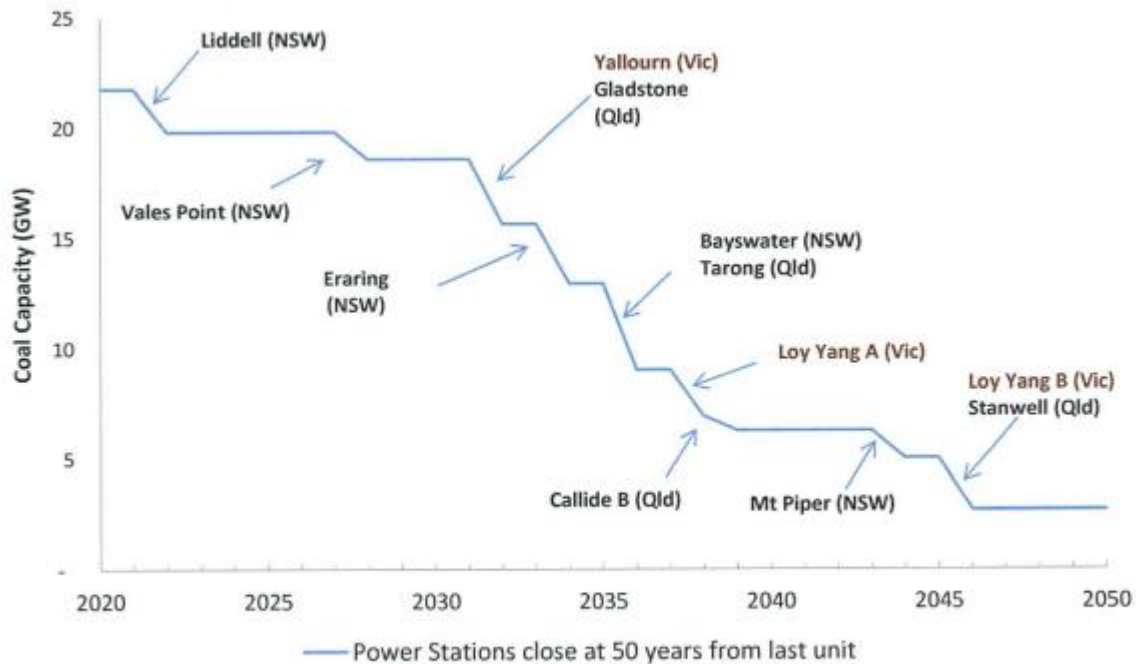


Around 2006 Australia's electricity prices, having previously increased at about the same rate as inflation in general, started increasing at a much faster rate and electricity is now relatively twice as expensive as it was in 1980. Initially, this price upsurge was largely caused by increased regulated network charges, partly due to a need to renew investment and partly as a result of "gold plating" by businesses whose incentives are to boost costs knowing that these will be recouped by higher regulated prices.

More recently, we have seen a politically-driven increased share of intermittent renewable energy. This depends upon subsidies and squeezes out commercial electricity supplies both as a direct result of its subsidy and by imposing costs on coal generators which have to operate in a higher cost, accommodative manner due to renewable energy's intermittent nature.

As a result, 6024 MW of generation capacity (2710 MW brown coal and 3314 MW black coal) has been forced to close since 2010. This comprised over 20 per cent of the 2010 capacity. The Finkel Report envisaged other closures falling due, as in Figure 2, leaving only 3000 MW by 2050.

**Figure 2 Finkel estimated future coal plant closures
NEM coal capacity and closures**



Source: Jacobs Modelling for Finkel Review 2017

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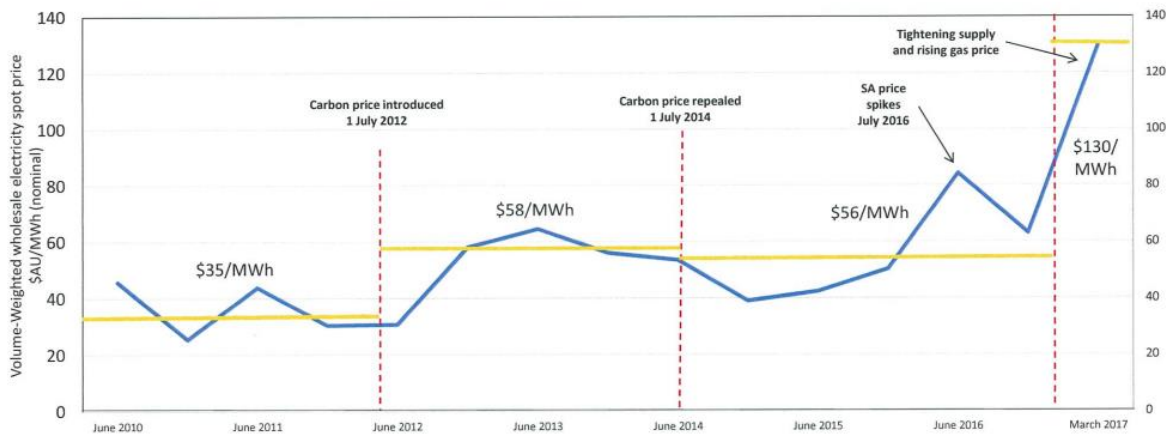
Some argue that many of these power stations are old, and the Finkel report contemplated a forced closure of power stations over 50 years old. The absurdity of such notions should be clear: US global military power is dependent on its 10 Nimitz class aircraft carriers which were first launched in 1972, and many rail lines and ports are over 100 years old. Even most of Australia's commercial hydro power stations are over 50 years old. In all cases, older established plant has been renewed and revitalised over the years. While totally new facilities can be lower cost, it is wasteful to scrap facilities which continue to be competitive.

Minister Frydenberg provided the following synopsis of the wholesale power price¹ increase in his June 2017 presentation to the Liberal Party Room. This, as Figure 3 below shows, came to a crescendo, probably a new plateau, at the end of 2016. Prices rose with the carbon tax, then declined and have risen since due to the renewable energy distortions biting.

¹ <http://www.smh.com.au/cgstatic/gwqsn5/Finkel-slideshow.pdf>

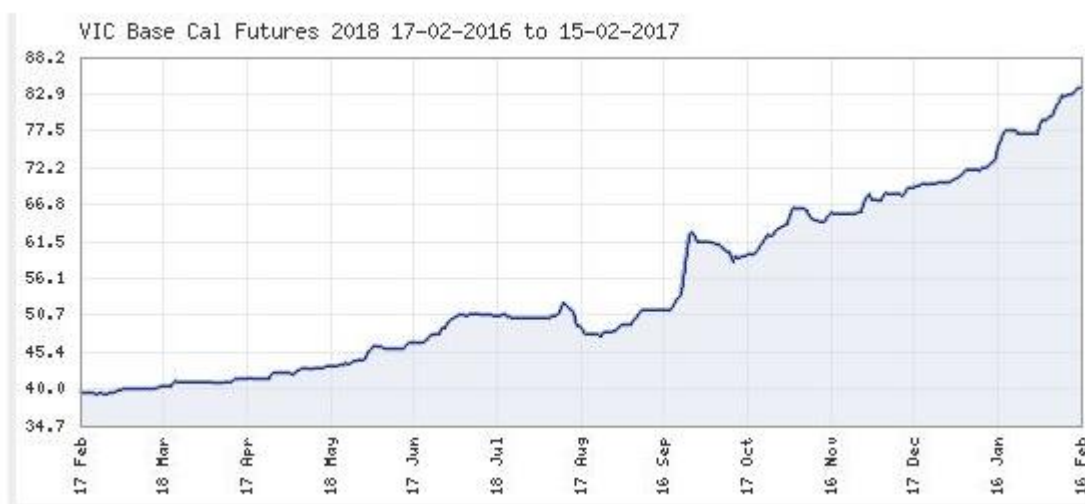
Figure 3 Wholesale price levels

Wholesale prices at record levels



A more graphic picture of the cost surge is provided by the forward price curves (most electricity is contracted well ahead of its production so these prices have actually been paid). This surge started to rise in early 2016 and rose more steeply as the Hazelwood closure was confirmed. Prices ended the year at double those prevailing at the beginning of the year. Figure 4 covers Victoria; other linked states showed a similar though less marked pattern.

Figure 4 Victoria's forward prices

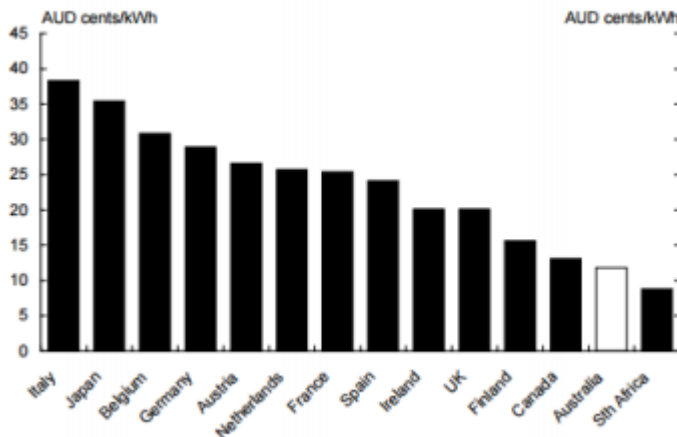


Source ASX

Over the period since the beginning of the current century, regulatory measures have moved Australia from perhaps the cheapest energy supply source to among the dearest as Figure 5 illustrates.

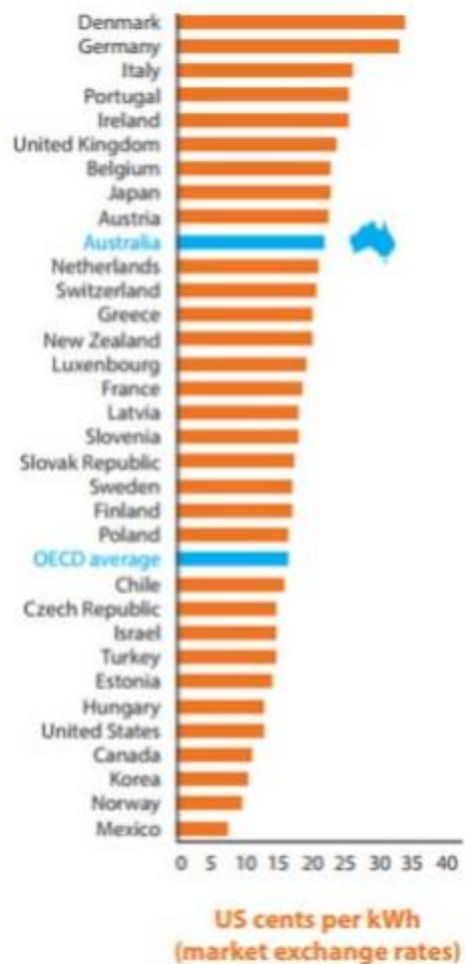
Figure 5 Comparative Australian electricity prices 2000-2015

Electricity prices to households



Source: ESAA, Electricity Australia 1999.

OECD household electricity prices

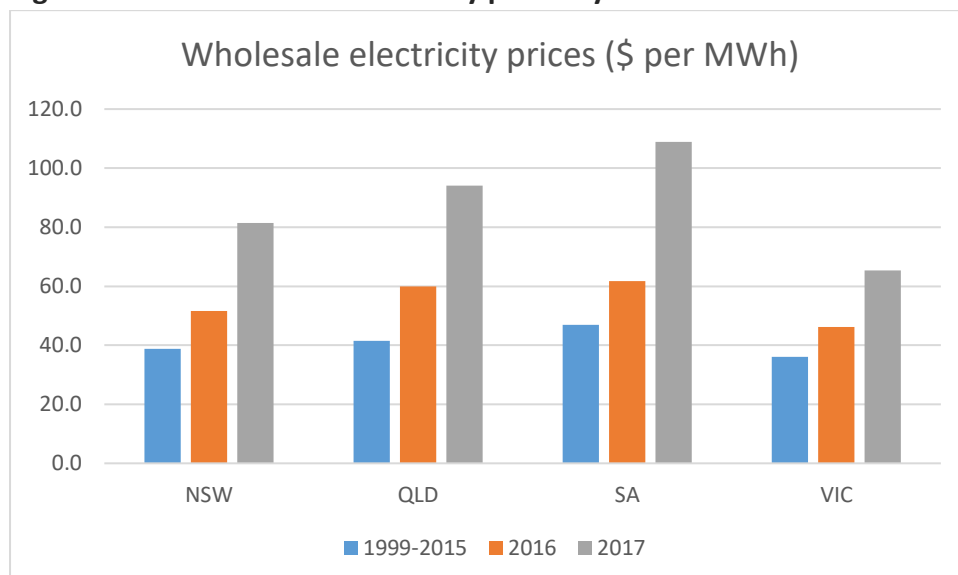


Prices since the national energy market commenced had varied between 1999 and 2015 but showed no trend. By 2017, prices had doubled in Queensland and NSW, and trebled in South Australia.

This catastrophic increase resulted from government market distortions causing the closure of the Northern Power Station in South Australia and Hazelwood in Victoria. Those power stations were unable to continue operating profitably in the face of subsidised wind's priority dispatch of irregularly produced power. The countervailing irregularity forced upon coal power stations creates strains on the key capital components and, though they may be able to continue operating for some time because their variable costs are covered, once fixed cost replacement becomes necessary they are forced to close.

Gas shortages and consequent high costs, stemming from state government actions preventing new exploration, have exacerbated the price trends illustrated in Figure 6.

Figure 6 Wholesale electricity prices by state and over time



Source AEMO

Price trends

The pattern illustrated in Figure 6 is set to continue as a review of forward prices demonstrates. In June 2015, Australian Energy Regulator (AER) base future contract prices for Victoria covering 2017 and 2018 were in the \$30-38 per MWh range. In June 2016, the forward prices were edging up to a then stratospheric level of \$46-58 per MWh as the imminent closure of Hazelwood became widely anticipated. As shown in Table 1, once that closure was confirmed, prices shot up in Victoria and across the National Market, rising to between \$113 and \$133 per MWh.

Table 1 June future prices in Victoria for the following year

Quarterly Base Futures Prices (\$ per MWh)			
Quarter	Jun-15	Jun-16	Jun-17
Q3 2016	32.76	57.99	
Q4 2016	30.55	46.8	
Q1 2017	37.52	56.8	116
Q2 2017	32.83	49.75	133
Q3 2017	34	50.17	132
Q4 2017	31.57	46.4	113
Q1 2018	38.65	54.08	114.3
Q2 2018	33.25	49.32	118.3

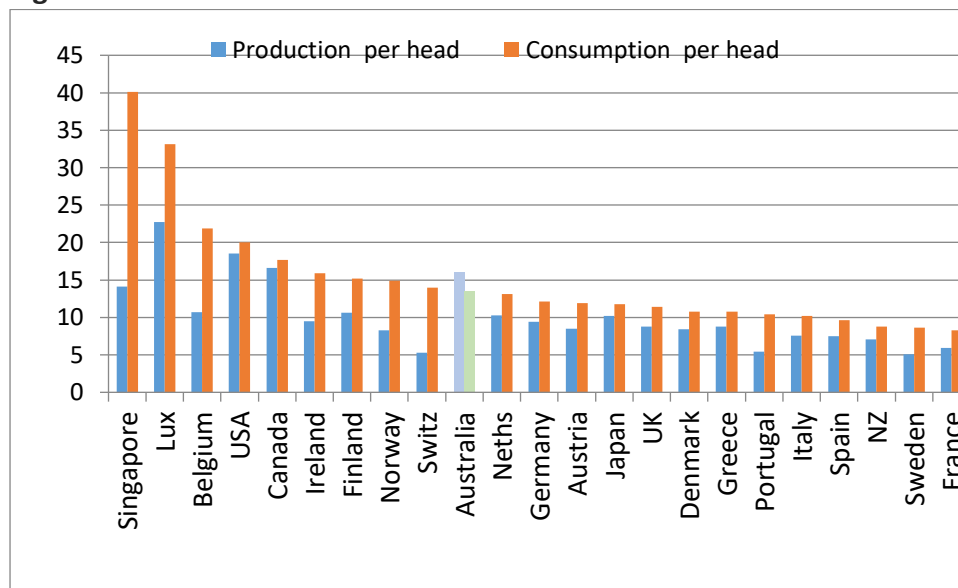
Australian emissions compared with those of other developed countries

One outcome of the historically low prices of electricity in Australia is that the nation, in contrast to other developed countries, has been a net exporter of energy incorporated within the goods and services we produce.

Many politicians and green activists castigated Australia for its relatively high carbon emissions per capita. But, as the following shows, Australia's relatively high emissions are a function of the nation's industry structure. In terms of emissions from domestic consumption, Australia is close to

the average of developed nations, some of which like France, Sweden and New Zealand have ample supplies of hydro and nuclear, but Australia produces more than average levels of CO2 because it is (or was), competitive in energy intensive industries. The chart is based on 2009 data.

Figure 7 Different countries' carbon dioxide emissions



Based on Davis and Caldeira

2. The Finkel review and the Jacobs modelling

The Finkel review misleadingly suggests its policies will bring lower prices than today, when in reality the review's recommendations would exacerbate the higher price trend. The recommendations would force a further replacement of coal, the cheapest form of electricity generation, by (subsidised) intermittent renewables that are both higher cost and less reliable. Increased distortion and regulation of markets have caused catastrophic energy price increases and reduced reliability, yet the review proposes more distortions and regulation.

Underpinning the Finkel review's proposals is modelling by Jacobs. In spite of unrealistic cost reductions assumed for renewables, this projects prices well above those prevailing until recently.

The Finkel report

In October 2016 the COAG Energy Ministers agreed to the *Independent Review into the Future Security of the National Electricity Market* to take stock of its current security and reliability and to provide advice to federal and state governments on a Blueprint for the Future. This has been dubbed the Finkel Review, as the five-person Review Panel was chaired by Australia's Chief Scientist Dr Alan Finkel.

The Final Report claims to seek increased security; future reliability; rewarding consumers; lower emissions. Underpinning its goals is the achievement of an "emissions reduction target of 28 per cent on 2005 levels by 2030 with a linear trajectory to zero emissions by 2070". The number one key recommendation is a federal "technology neutral" Clean Energy Target (CET), which is aimed at

better facilitating increased wind and solar largely at the expense of coal while attempting to mitigate the effects of this on price and reliability, including through “demand management”.

The CET includes a new, higher Renewable Energy Target (RET) of 42 per cent in 2030 and electricity generated with emissions less than 600 grams per kWh (roughly the level that gas is capable of achieving) would be rewarded with a subsidy. The recommended CET is simply a rebranded RET, heavily favouring wind and solar whilst giving ‘lip service’ to technology neutrality regarding coal, gas, hydro and nuclear. According to the report, its proposals would result in “lower residential and industrial electricity prices” as a “result of the stability and reduction in risk for the electricity sector that commitment to a credible mechanism would bring”.

Oblivious to the disastrous outcomes of previous government actions creating market failure, the report urges an even more interventionist approach to the electricity market than that which has evolved. It discusses a “strengthened governance, system planning and an orderly transition” supported by “better funded regulator with enhanced market monitoring capabilities” as we “increase our reliance on variable renewable electricity generators” and do so while planning “responses to shortages”.

Within days of its release in June 2017, the report’s shortcomings were obvious; the Finkel forecast of a 3 per cent increase in 2017 electricity prices were overshadowed by announced price increases of 15-20 per cent as a result of the forced closure of coal power stations, outcomes that the report welcomes but seeks to have better managed.

The Jacobs modelling

The Jacobs report, which was commissioned to assist the Finkel review says, “In all scenarios, the level of coal-fired generation diminishes over the modelling period. The extent and pace of the fall in generation depends on the extent of restrictions on lifespan and the interaction of the policy measure with wholesale prices.”

The key assumptions are:

“The level of renewable generation increases under all scenarios. Even without additional policy support under the Business-as-Usual (BAU) scenario, declining costs means that it is least cost for some level of renewable generation to enter the market.”

The main drivers are

- An envisaged declining cost of renewable energy especially compared with fossil fuel energy.
- A cost of capital for new coal plant under business-as-usual is assumed to be 14.9 per cent; for new gas plant 8.1 per cent; and for new renewable plant 7.1 per cent. Under the other scenarios costs are put at 9.9 per cent for coal and 6.1 per cent for gas and renewables
- Coal plant is assumed to cease operating rather than incur major refurbishment costs

There are six scenarios provided but the three key ones are “business-as-usual” the continuation of existing market interventions to favour renewables, primarily through the RET scheme; the Clean Energy Target, under which the RET is retained and additional variable subsidies are given to all energy that has outputs which cause less than 600 grams of CO₂ to be emitted per MWh; and an Emissions Intensity Scheme which taxes suppliers that emit at above 600 grams per MWh and provides additional rewards for those producing with lower emission than 600 grams per MWh. Table 2 summarizes the Jacobs report’s scenarios.

Table 2 The Jacobs report's scenarios

Description	Business-as-usual	Clean Energy Target (28% below 2005)	Emissions Intensity Scheme (28 % below 2005)
	Status quo (RET), no additional emissions abatement initiatives	0.6 t CO _{2-e} /MWh target for low emissions generation to achieve annual emissions reductions Annual target increases from 2,900 GWh in 2020 to 90,000 GWh in 2050 Certificate prices from \$27/MWh in 2020 to around \$75/MWh in 2050	Certificate prices increase over time to achieve required emissions intensity. Average is just over 0.70 t CO _{2-e} /MWh in 2020, falling to 0.3 t CO _{2-e} /MWh in 2050 Certificate prices from \$15/t CO _{2-e} in 2020 to \$80/t CO _{2-e} in 2050
NPV of resource costs 2017-50, \$billions	\$132 billion	\$137 billion (+ \$4.9 billion relative to BAU)	\$135 billion (+ \$3.5 billion relative to BAU)
Approx Wholesale prices (\$/MWh)	\$70-80/MWh to 2028, \$80-90/MWh to 2050	\$50-60 /MWh in 2030, \$30-40 /MWh in 2050	\$60-70 /MWh in 2030, \$70-80/MWh in 2050
Retail prices, 2020-2030	30 ¢/kWh	28 ¢/kWh	29 ¢/kWh
Retail prices, 2020-50	31 ¢/kWh	28 ¢/kWh	29 ¢/kWh
Coal generation	Declines sharply after 2041 19 GWh retired by 2050	137 TWh 2020 to 57 TWh 2050 12 GWh retired by 2050	136 TWh 2020 to 61 TWh 2050 12 GWh retired by 2050
Gas generation	Gas generation increases to compensate for the decline in coal generation	Gas generation declines along with coal generation	Gas generation declines along with coal generation
Renewables	N/a	70 per cent share by 2050	66 per cent share by 2050
Cost of emissions reductions	N/a	10.5 \$/t CO _{2-e}	7.5 \$/t CO _{2-e}

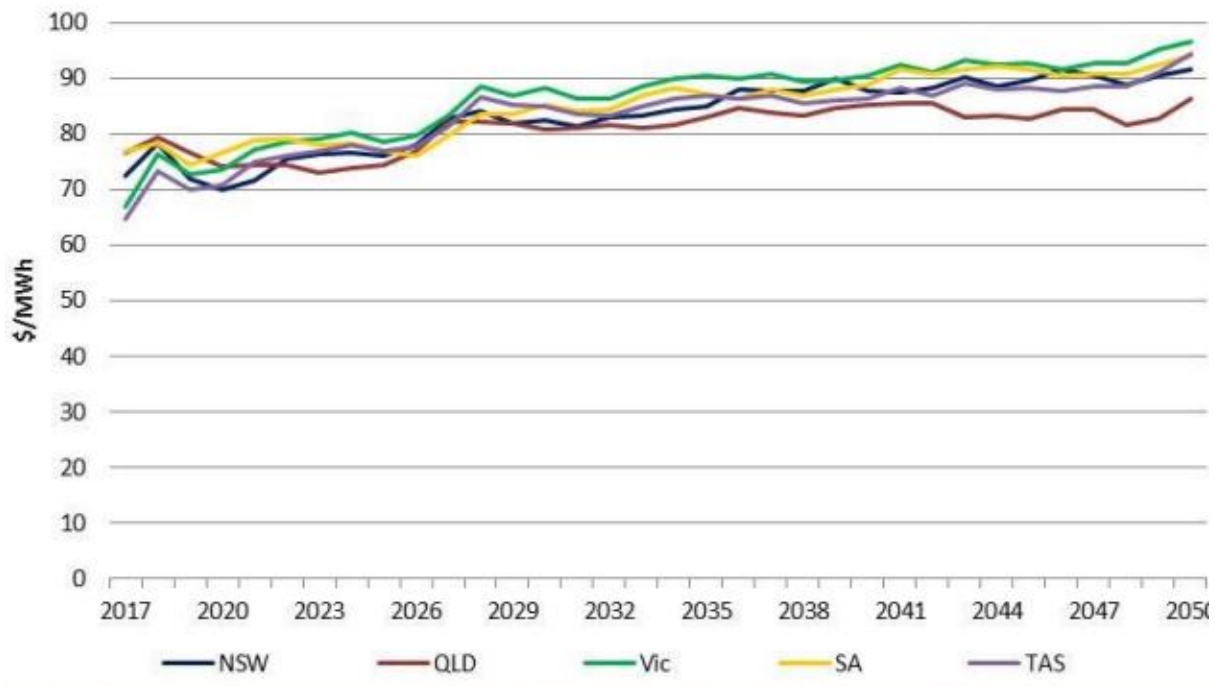
Wholesale prices under the CET and EIS scenarios are deemed to be lower than under what the report describes as business-as-usual (the existing level of renewable subsidies), since the additional incentives provided to low emissions plants are meant to place downward pressure on wholesale prices. The modelling also produces retail prices which are lower under the CET and EIS than under the designated business-as-usual; the CET scenario had lower retail prices than the EIS scenario.

By design, the CET and EIS schemes meet the required annual targets across the entire period to 2030. However, combining these policies with the stated limited lifetime for generating plant means from around 2032, due to assumptions about relative prices of wind and coal these schemes may be unnecessary for the emissions target (and the renewable certificate prices eventually fall to zero).

Jacobs Figure 32 (Figure 8 below) provides a pictorial of the model's wholesale prices by state.

Figure 8 Jacobs price modelling by state

Figure 32: Wholesale electricity prices by region, BAU



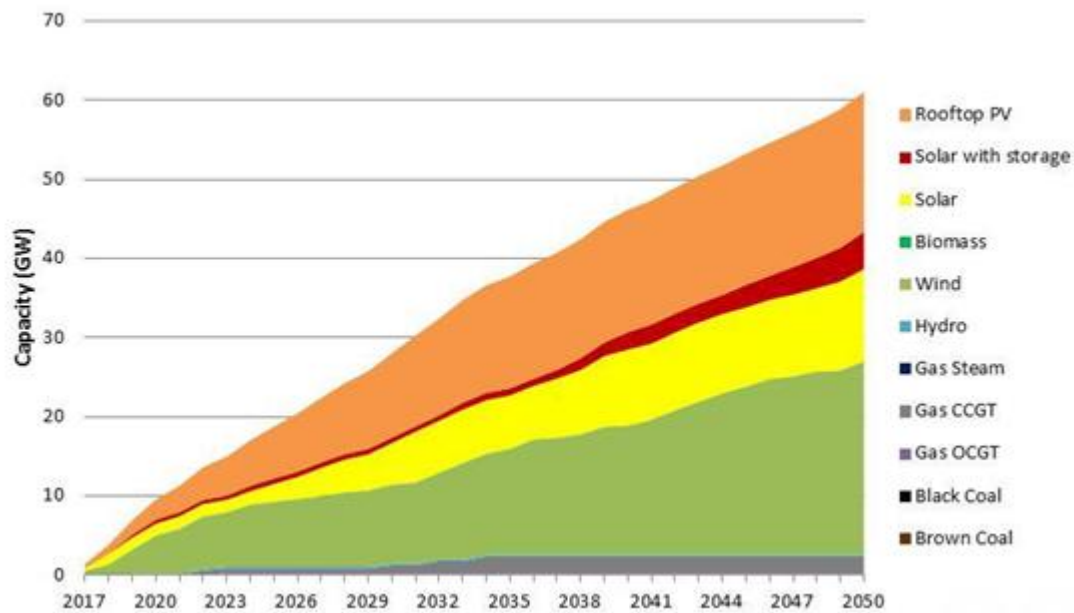
The above pictorial does not show the price immediately prior to the period in 2017, when it was under \$40 per MWh.

Business-as-usual, which the Jacobs modelling calls the “reference case” is actually the existing RET scheme and in the report is the norm against which outcomes from other subsidies and government interventions are measured. By assuming that unprofitable coal will exit the market in an orderly manner and that renewables will fall in cost, the report offers the canard, “There are many people who think that business as usual is the key to lower prices but there is no evidence of that. In fact, the evidence is to the contrary.”

[The future according to Finkel](#)

It is envisaged that all but a sliver of new plant will be biomass, wind and solar, technologies that offer poor reliability and very high costs. The following describes the trajectory.

Figure 9 New generating capacity



Shoring all this up is storage through batteries, a technology which according to earlier work by Dr Finkel would be very costly. He said:

“Assuming that the price per kilowatt-hour of battery falls to below US\$100, US\$5 trillion is the dollar value of batteries that we would need to manufacture each year for 10 years in order to ensure 10 days of battery backup for the global electricity grid.”²

This is considerably in excess of 6 per cent of global GDP and would, presumably, come on top of other energy subsidies which Dr Finkel, citing IMF data, suggested is 6.5 per cent of GDP.

3. Modelling of different electricity technologies’ costs

Jacob’s three recent modelling reports have delivered vastly different price forecasts. The models themselves build on optimistic assumptions about future intermittent renewable generation costs plus pessimistic views of future coal generation costs. Over a thousand coal generators are being built across the world and new builds in Australia would not be markedly more costly than the latest one commissioned ten years ago. Coal generation would also avoid higher poles and wire costs needed with dispersed wind and solar supply.

Jacobs model outcomes 2014-17

Essentially, for Australia the future generating technologies are either coal or renewables - wind/large scale solar. Gas is also a future candidate but its low cost sources from coal seam or shale are likely to remain more expensive than coal.

² <https://cosmosmagazine.com/technology/scale-and-a-new-favourite-number>

Moreover gas has a world price, though Australian users would benefit from lower transport costs for gas used domestically. In Australia, prices of both black and brown coal used in domestic electricity generation are lower than those overseas; this is because most of that used locally (all in the case of brown coal) does not have the premium price possibilities of export grade coal and, being abundant, its price closely approximates its cost of retrieval.

Jacobs has been commissioned to provide electricity price and composition forecasts (or modelled scenarios) for many clients over the years. In addition to the work for Finkel, Jacobs has undertaken recent work for the Climate Change Authority³, the final report of which was published in February 2017, and groups that included the Climate Institute which was published in 2014⁴.

For the purposes of its modelling for the 2014 report, Jacobs assumed there is no carbon price enforced sometime in the future but that the potential threat that carbon pricing may be enacted means that investors will be unwilling to invest in new coal plant. Table 3 shows wholesale price forecasts based on the large scale renewables target (LRET) at 41, 27 and 16 Terawatt hours. The forecasts were driven by optimistic projected prices for intermittent wind and solar (causing forecast prices to be lower where regulations forced increased renewable quantities) and a view that existing coal plant would stay on line in spite of being made unprofitable.

Table 3 Jacobs price forecasts in their 2014 report

	2015 - 2020	2020 – 2025	2025 - 2030
Prices, \$/MWh			
LRET 41 TWh	38.0	46.8	51.0
LRET 27 TWh	43.8	56.5	61.7
LRET 16 TWh	44.0	58.7	63.1

In fact these estimates have proved to be hopelessly optimistic. Jacobs now has the future price at over \$80 per MWh from now until 2050 – 60 per cent higher than its 2014 forecast for 2020-2025.

In its report for the Climate Change Authority in February 2017, Jacobs made the following modelled wholesale price forecasts. These quantify a “reference” price band based on existing policies, an “emissions intensity” scheme with higher emitting facilities paying a tax that is distributed to lower emitting ones, and a “low emissions technology” (LET) scenario under which highly optimistic forecasts of the cost of wind drive down future prices.

Table 4 Jacobs price forecasts in their February 2017 report

Prices \$/MWh	2020-2025	2025-2030
Reference	55	63
Emissions intensity	90	105
LET	35	33

By May 2017, estimates including the Clean Energy Target (CET) were as shown in Table 5.

³

<http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/170217%20Jacobs%20Final%20Report%28revised%29.pdf>

⁴

http://www.climateinstitute.org.au/verve/_resources/Jacobs_ImpactsChangingRETonElectricityMarketParticipants_FINAL_140814.pdf

Table 5 Jacobs price forecasts for their June 2017 Finkel report

Prices \$/MWh	2020-2025	2025-2030
BAU	78	85
Emissions intensity	78	70
CET	74	60

In 2014, Jacobs 2025-30 prices corresponding to business-as-usual were \$51 per MWh; these rose to \$63 in February of this year and \$85 in May. In June 2017, actual average prices across the NEM ranged between \$77 and \$109 per MWh.

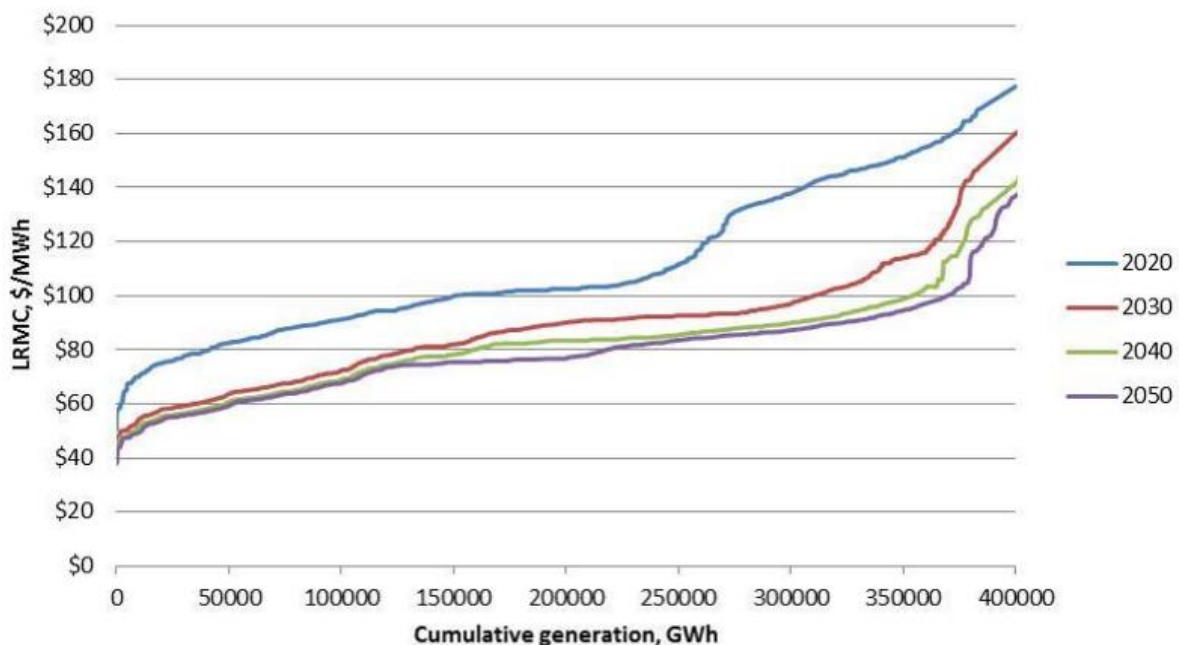
The marked difference in outcomes of these scenario forecasts over a relatively recent period is doubtless explained by the model assumptions. But in all three cases, the client and Jacobs must have considered the assumptions to be plausible. The vastly different modelled outcomes underline the fact that modelling results are critically determined by assumptions rather than by the interactions of the many variables within the model itself.

Renewables

Overall costs assumed

Although not fully specified, the Jacobs modelling (Table 15) has cost assumptions for what it calls renewable energy, (presumably wind, the cheapest renewable source) depicted in the following curves.

Figure 10 Jacobs renewable cost assumptions
Renewable energy supply curves for years 2017, 2020, 2025 and 2030 (\$ June 2016)



This assumes a steady fall in the costs of renewables. Thus the cheapest generation cost in 2020 is put at just under \$60 per GWh with the cumulative generation at 150,000GWh being \$100 per GWh; in 2030 the cheapest plant is estimated to be producing at under \$50 per GWh with the cumulative 150,000 GWh of falling to about \$80 per GWh; by 2050 the cheapest plant is at \$45 per GWh and the cumulative 150,000 GWh has fallen to about \$75 per GWh.

While further cost reductions are likely, wind is now a relatively mature technology and, contrary to the Jacobs assumptions, incremental gains will be much lower than in the past, though more rapid gains are likely for large scale solar. The Climate Council⁵ claims large scale solar costs have fallen by 58 per cent over the past five years and that new additions can offer power at \$110 per MWh presumably in addition to the Renewable subsidy (currently ~\$70 per MWh). It identifies some 460 MW of planned new capacity and maintains that, “In 2017 over 20 new large-scale solar projects will come online. A further 3,700 MW of large-scale solar is in the development pipeline (roughly equivalent to three coal fire power stations)”.

That said, wind is likely to remain the least expensive exotic renewable source over the foreseeable future. One benchmark cost is the Stockyard Hill deal between Origin and Goldwind⁶ under which Origin take all the power of a 530 MW facility at a “bundled” price of under \$60 per MWh. But this leaves open the treatment of the RET (presently \$75 per MWh and on the ASX futures market, notionally at \$47 in 2022)⁷.

There may have been some unique characteristics of the Origin/Goldwind deal but it seems unlikely that wind will finally attain the parity with coal, which for the past 35 years its supporters have been claiming is imminent. Indeed, the Jacobs modelling, notwithstanding heroic assumptions about future cost reductions has modelled wind to be receiving a certificate price in 2030 \$35 under CET and \$20 under EIS. In both cases this would provide wind with remuneration of around \$90 per MWh. Even though some promoting wind and other renewables argue that it will shortly be competitive with coal, none of their representatives are saying that we should abandon the subsidies – indeed they are calling for their increases and extension.

Finkel wisely recommended that intermittent energy suppliers should have storage back-up. According to Minister Frydenberg⁸, this raises the cost of wind (and large scale solar) by 14 per cent for 4 hours storage for (a totally inadequate) 25 per cent of capacity. The cost of sufficient back-up is clearly prohibitive. The Minister’s cost assessment is shown in Figure 11.

⁵ <https://www.climatecouncil.org.au/solar-report>

⁶ <https://www.originenergy.com.au/content/origin-ui/en/about/investors-media/media-centre/origin-adds-530mw-of-renewable-energy-to-its-portfolio.html>

⁷ There are three alternatives ways to assess this contract

- If, as is inferred from the Origin report to the ASX, Origin obtains the value of the RET, it is receiving the electricity at a net \$13 per MWh at the 2022 forward price (at the present RET price, Origin is obtaining the energy free and gaining a benefit of \$13 per MWh!)
- If Goldwind obtains the RET, its deal is worth \$113 per MWh at current prices or \$107 per MWh at the 2022 forward price.
- If, as some commentators maintain, the surge in new wind investment will mean that, unless the renewable total is increased post 2020, the RET price will decline steeply to zero, this begs the question why do we need a subsidy to wind as it has, on these assumptions become competitive with fossil fuels.

⁸ <http://www.smh.com.au/cqstatic/gwqsn5/Finkel-slideshow.pdf> Slide 19

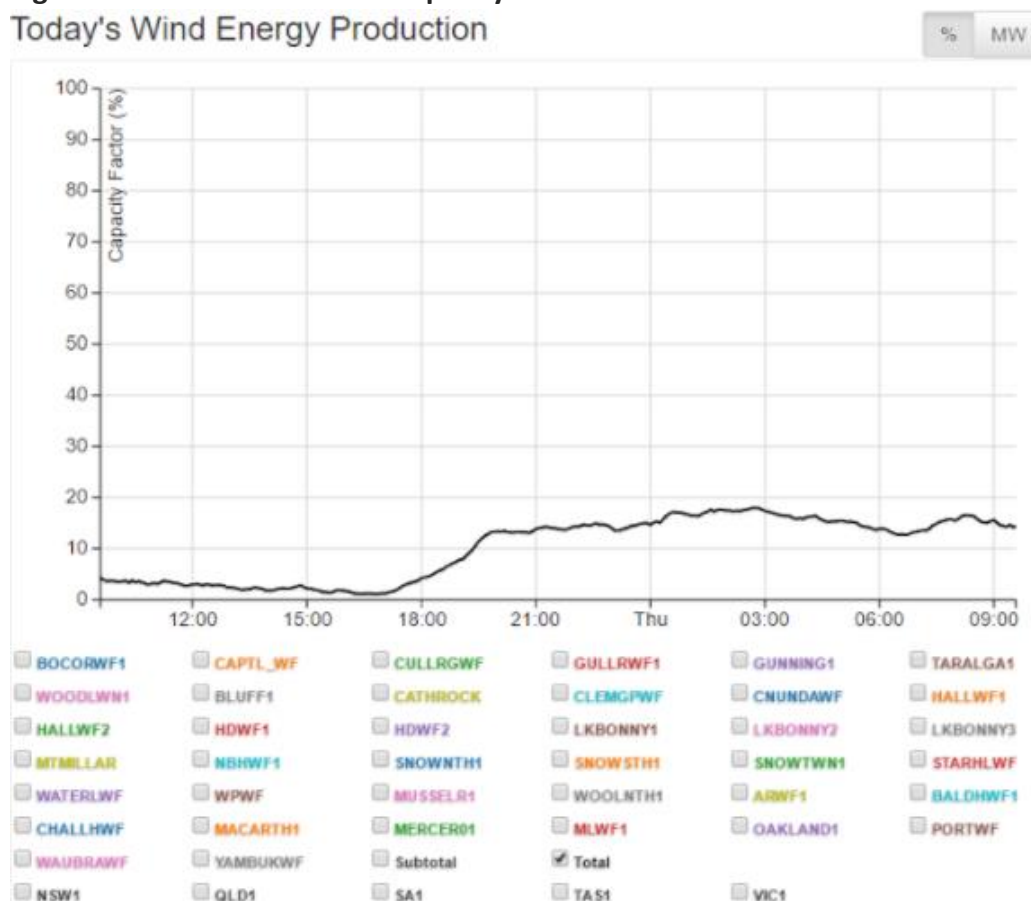
Figure 11 Renewable energy generator payments for reliability Finkel package – Generator reliability obligation

- Wind generates around 40% of the time and solar generates 20-30% of the time
- Finkel recommends mandatory storage and backup for new intermittent renewables
- This levels the playing field – renewables now required to pay for intermittency



These storage costs do not appear to have been included in the Jacobs modelling. But the need for them is critical, not only as evidenced by the South Australian travails but by the frequent windless occurrences like that which was experienced on 21 June 2017 when, as illustrated in Figure 12, the national fleet of windfarms generated at just 3 per cent of their capacity.

Figure 12 National wind capacity available Today's Wind Energy Production



State based renewable programs

The South Australian government has been criticised by the Commonwealth for getting itself into an unreliable electricity situation by having 47 per cent of its generation produced by wind. However, South Australia has actually fewer state incentives for renewable generators than other states – its “success” was in tapping Commonwealth subsidies and having a more useful wind supply than most other jurisdictions.

The report commissioned by the Queensland Government⁹, ‘Credible pathways to a 50% renewable energy target for Queensland’ concludes that, if Queensland jettisons half its coal derived electricity and replaces the output with wind at three times the cost and with greatly inferior reliability the state is \$6 billion or so better off. It argued, and the Queensland Energy Minister concurred, that this would cost \$6 billion in new renewable investment, a sum that was disputed by Commonwealth Environment Minister, Josh Frydenberg who said the investment needed would be \$27 billion¹⁰.

The report’s magic pudding is the outcome of arcane economic modelling. About 20 per cent of the estimated beneficial effects are due to an assumption that all the coal generators will keep operating unprofitably in the face of having half of their output taken off them by subsidised wind and solar. But, even without this unrealistic notion, Queensland makes gains according to the modelled outcome. The main driver is from diverting national government supplied renewable regulation subsidies from other states into Queensland. This is explained on page 108 with the statement,

“These results are consistent with expectations as the subsidisation of renewable energy into Queensland in effect diverts more efficient investments (from both the electricity and other sectors) from other states and territories to Queensland resulting in a gain in Queensland GSP but a loss of economic activity across the rest of Australia. Under the modelling outcomes, these subsidised investments in effect reduce capital and labour productivity over time, leading to lower incomes, investment and GDP.”

What this convoluted language says is that base case has the national measures already incorporated (though it vastly understates the damage that replacing reliable fossil fuel generators with subsidised intermittent supplies). The base case assumes a \$40 per tonne national carbon tax, that wind/solar increase their efficiency and other technologies don’t. These suppositions lift commercially supplied electricity costs up to their renewables level (assuming also that the tricky business of reliability can be solved).

The Queensland panel’s report shifts the inherent reduction in GDP that the carbon tax causes around the nation in ways that are thought to be less costly for Queensland (and marginally more costly for the nation as a whole). The economics is smoke and mirrors to show that, given economic amputation is coming at a national level, Queensland can reduce its own in-state costs. But economic amputation is economic amputation even if politicians support it to pander to green mysticism and donation-rich renewable energy businesses.

In Victoria, the Andrews government has set a 40 per cent renewables goal by 2025. That is up from the existing 14 per cent and represents a doubling of the target set only last year. Victoria’s target would require over 2,000 giant wind turbines in addition to the 600 presently operating. The

⁹ <http://www.qldrepanel.com.au/draft-report>

¹⁰ <http://www.afr.com/news/politics/queensland-needs-6b-in-renewable-investment-to-meet-50-per-cent-target-20161012-gs0bnd>

Andrews government is seeking to replace the highly reliable low cost electricity supply system based on four giant coal plants in the La Trobe Valley.

One indicator of the expense this entails comes from Germany, where a renewables goal of only 30 per cent is estimated to cost \$37,000 per household.

Annual spending on renewable programs (which actually reduce the electricity system’s reliability) by the Commonwealth in Australia is \$3.7 billion. In addition state governments spend \$1.2 billion. This is set to rise. Commonwealth programs aim to get a 23 per cent renewables share of electricity supply by 2020. Additional hydro is prohibited so this means raising the current share of wind and solar to about 15 per cent from the present level of 9 per cent. Table 6 identifies present levels of government subsidy.

Table 6 Subsidies to renewables

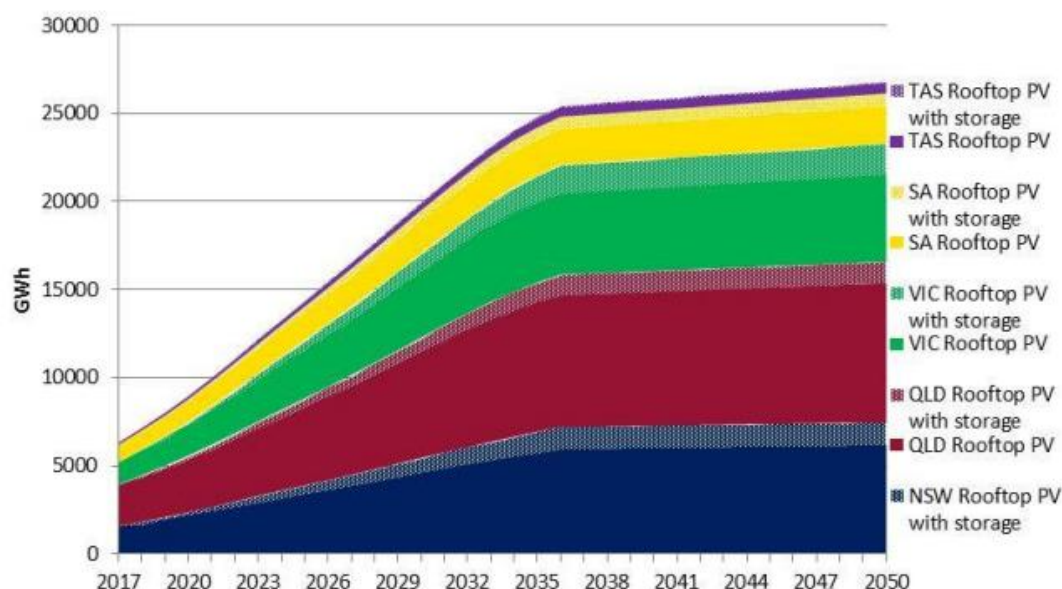
Commonwealth Costs 2016 (\$M)	
LRET (wind and large solar subsidies) costs 21,431,000 MWh at \$85 per MWh	1822
SRES (roof top solar subsidies) costs 6,000,000 MWh at \$40 per MWh	240
Environment Departmental budget costs	
ARENA	154
CEFC	239
Clean Energy regulator	674
Other	69
Other Agencies (CSIRO, BoM, other depts.)	~500
Total Commonwealth	3698
State Costs	
Queensland Solar Bonus (\$276 per customer in 2015/6)	350
NSW Climate Change Fund/Energy Savings	317
ACT	6
Victoria (schemes twice cost per customer of NSW)	439
SA (schemes three times cost per customer of NSW)	62
State Schemes Total	1172
NATIONAL TOTAL	4870

Energy minister Josh Frydenberg estimated that if the states (primarily Victoria and Queensland) were to achieve the additional goals they have set, this would add another \$41 billion in worthless capital expenditure.

Solar Panels

The AEMO report on renewables is taken as the basis for photovoltaics (PV) rooftop electricity generation by the Finkel report. This amounts to about 3 per cent of total supply in 2017 rising to around 14 per cent in 2035 and continuing a slow rise thereafter.

Figure 13 AEMO projections of PV growth



Source: AEMO, NEFR 2016

The AEMO estimates in Figure 13 appear to be somewhat at odds with the view of the AEMO chief Audrey Zibelman. At a recent conference Ms Zibelman said distributed energy and demand response will play a bigger role in electricity supply and suggested estimates that up to 45 per cent of Australian capacity could be "behind the meter" PVs by 2040 didn't look "far off"¹¹. If that means the capacity would be operating at 30 per cent efficiency, it is a major increase from the 18 per cent¹² said to be at the high end of today's systems.

In Germany, Fraunhofer¹³ put the costs of solar as much higher with different plant costs as follows.

**Table 7 German estimates of different generator costs
German LCOE in €/MWh (2013)**

Technology		Low cost	High cost
Coal-fired power plants	brown coal	38	53
	hard coal	63	80
CCGT power plants		75	98
Wind Power	Onshore wind farms	45	107
	Offshore wind farms	119	194
Solar	PV systems	78	142
Biogas power plant		135	250

¹¹ <http://www.afr.com/business/energy/electricity/aemo-chief-audrey-zibelman-sees-a-bigger-role-for-household-solar-20170621-gwvtuh>

¹² <https://www.fool.com/investing/2016/10/15/why-efficiency-is-now-king-in-rooftop-solar-energy.aspx>

¹³ https://www.ise.fraunhofer.de/content/dam/ise/en/documents/publications/studies/Fraunhofer-ISE_LCOE_Renewable_Energy_technologies.pdf

Solar PV roof top collectors, though the price is hidden by subsidies, are among the most expensive forms of electricity generation. Solar tariffs in addition to the Commonwealth’s SRES at \$40 per MWh vary by state as follows¹⁴.

Table 8 State based PV subsidy schemes

State	Current Rate
QLD	6-10c/kWh
VIC	min of 8c/kWh
SA	min of 6c/kWh
TAS	5.5c/kWh
ACT	7.5c/kWh
NSW	up to 8c/kWh
WA	7.135c/kWh or 10-50c/kWh
NT	27.13c/kWh

In Queensland the Queensland Productivity Commission¹⁵ estimated that the solar bonus scheme adds 8.4 per cent to Queensland retail prices and will have entailed a subsidy/charge on consumers of \$4.4 billion by 2034. And it did not even think that rooftop solar was a cost-effective way of preventing carbon dioxide emissions. It found, “Under the most likely scenario, the cost of reducing emissions is \$268–\$327 per tonne of abatement or \$363–\$422 per tonne including the SRES”. It may be recalled that the Gillard Government’s carbon tax was about \$23 per tonne.

Coal

Addressing the cost estimates for new plant

It is argued, (see for example Woods¹⁶) that coal plant, which was once able to offer long term electricity baseload contracts at below \$40 per MWh, would now require \$80. Similarly the Australian Research Council’s ARC CO2 report¹⁷ had new coal at \$80 per MWh – its Table 46 summarises this as follows.

¹⁴ <https://www.solarmarket.com.au/learn/tariffs/>

¹⁵ <http://www.qpc.qld.gov.au/files/uploads/2016/12/DOC16-2388-Solar-Final-Report-FINAL2.pdf> p.11

¹⁶ <http://www.afr.com/news/policy/climate/finkel-is-not-about-forecasts-it-is-about-making-informed-choices-20170615-gws45l>

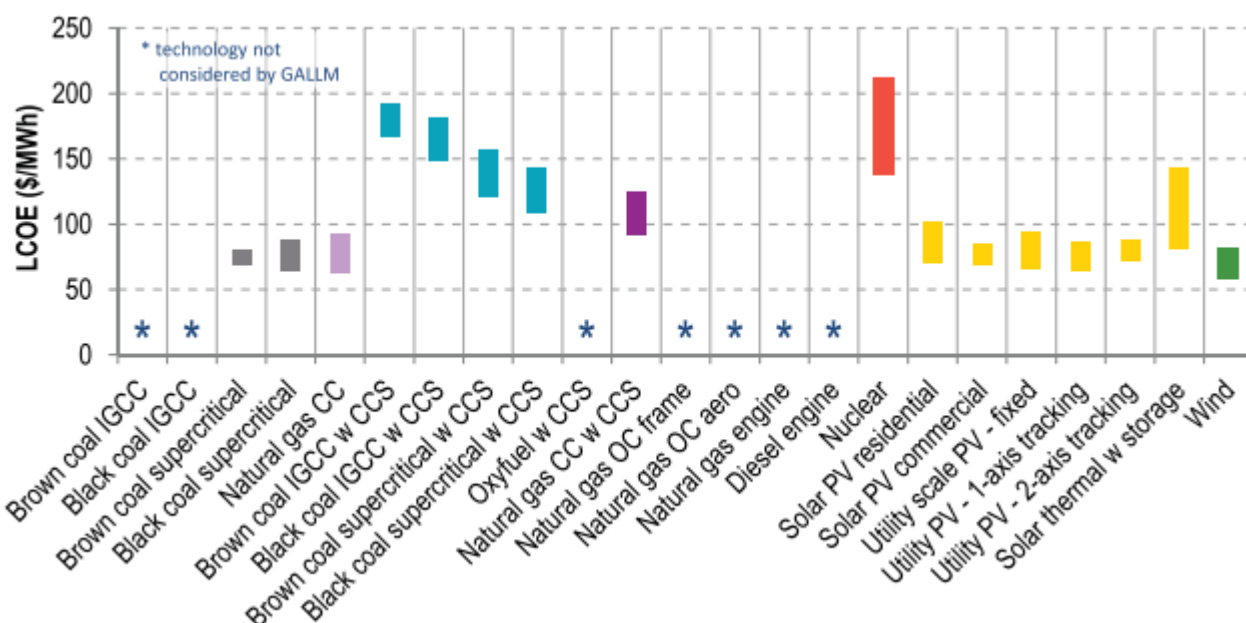
¹⁷ AUSTRALIAN POWER GENERATION TECHNOLOGY REPORT ARC CO2 2015

Table 9 Australian Research Council estimates of coal generating plant costs

	Brown coal		Black coal		Oxyfuel
	No CCS	With CCS	No CCS	With CCS	
Finance charges	56	120	44	98	98
Fixed O&M	7	9	6	7	7
Variable O&M	3	12	3	10	12
Fuel costs	14	20	27	37	36
Cost of CO ₂ T&S	0	19	0	15	15
Cost of carbon	0	0	0	0	0
Average LCOE (\$/MWh)	80	179	79	168	169

The ARC CO₂ assessment placed coal as gradually diminishing in competitiveness as illustrated in Figure 14 (Figure E3, in the ARC’s forecast levelised costs in 2030) but driving this was an assumed reduction in wind and solar (as well as Carbon Capture and Storage costs), no change in coal power station efficiencies and an unjustifiably stiff premium for new build.

Figure 14 Australian Research Council estimates of generator costs



Driving these high costs were very high capital costs. Similar such costs are also estimated in other appraisals. For example, AEMO’s data¹⁸ has a new black coal power station on the Queensland Sunshine Coast requiring a capital cost of \$3131 per kw. (Latrobe Valley brown coal capital costs are put at \$4004 per kw).

These sums are in excess of those incurred elsewhere. Thus Power Engineering¹⁹ addresses three black coal plants in Vietnam with Australian dollar costs of between 4 and 40 per cent cheaper (\$2240 - \$3020 per kw). Such plant would be more expensive to build than that in the established

¹⁸ <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Transmission-Network-Development-Plan/NTNDP-database>

¹⁹ <http://www.powerengineeringint.com/articles/2017/05/7-5bn-worth-of-coal-fired-power-plants-planned-for-vietnam.html>

areas found in Australia in Queensland south of Rockhampton, New South Wales Central and South Coast, in the Victorian Latrobe Valley, and in South Australia’s Port Augusta.

The most recent major generator built in Australia, Kogan Creek, was commissioned in 2007 and was offering long term contracts at under \$40 per MWh. Although built 10 years ago, Kogan Creek’s efficiency rate (a key determinant of emissions per kWh as well as fuel costs) is 40 per cent compared with some 30 per cent for traditional generators. A depiction of the station next to others is offered by the Minerals Council²⁰.

Figure 15 Recently built coal generators’ efficiency levels



Morgan Stanley is cited by the Minerals Council as estimating some comparative costs of high efficiency low emissions (HELE) plant. Among these estimates is one that puts the supercritical or ultrasupercritical design as bringing about a saving of emissions compared to less ambitious plant design at a cost of US\$10/tonne of carbon dioxide. This suggests that further costs could be saved (for example in avoiding the expense of coal drying plant) if new generators were not to push the envelope chasing emission reductions.

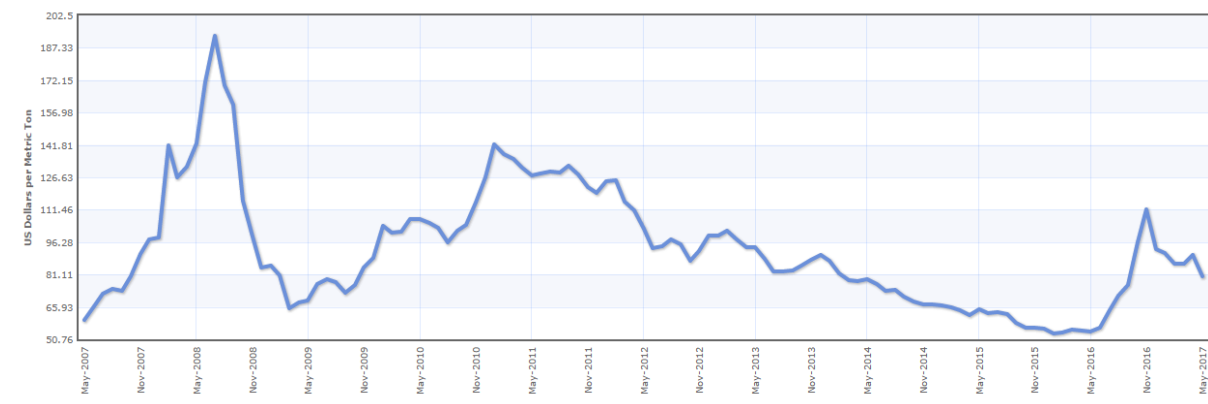
It is implausible that new brownfield coal generators in Australia could have doubled in cost since Kogan Creek was commissioned in 2007. Since 2005 we have seen labour costs for operations and construction increase by 50 per cent. Labour costs might account for some 30 per cent of the construction outlays.

²⁰

http://www.minerals.org.au/file_upload/files/publications/Why_HELE_is_part_of_Australias_energy_solution_FINAL.pdf

Other costs have shown no such increase. Coal costs in US dollars are similar to 2007 levels (and the Australian dollar was about 7 per cent lower in 2017). And, as previously noted, coal used in domestic power stations is of different quality (mainly ash content) than that used for export and is bought at a steep discount, and has few transport costs, especially as is often the case, when the station is built on a coal field.

Figure 16 Coal Costs FOB Newcastle/Port Kembla, US Dollars per Metric Ton



<http://www.indexmundi.com/Commodities/?commodity=coal-australian&months=120>

And most input costs have fallen – the structural steel price in US dollars actually halved.

Figure 17 Structural steel costs



<https://tradingeconomics.com/commodity/steel>

Realistic estimates of new coal generator costs

Compared with other estimates of coal generator costs, the Jacobs 2014 data was rather more realistic, putting costs of new entry coal ranging from around \$60 per MWh. Jacobs in 2014 put the black coal costs in NSW and Queensland respectively at \$6.3 and \$5.2 per MWh; (Jacobs Table 4 of that report is reproduced below).

Table 10 Jacobs (2014) estimates of new coal and gas plant costs

State	Type of Plant	Capital Cost \$/kW	Available Capacity Factor	Fuel Cost* \$/GJ	Weighted Cost of Capital % real	Interest Rate % nominal	Debt Level	LRMC \$/MWh
SA	CCGT	1,327	89.7%	\$ 7.26	10.02%	8.00%	60%	\$ 81.96
Vic	CCGT	1,191	89.7%	\$ 6.69	10.02%	8.00%	60%	\$ 71.53
NSW	CCGT	1,191	89.7%	\$ 7.03	10.02%	8.00%	60%	\$ 72.60
NSW	Black Coal	2,719	90.6%	\$ 1.76	10.02%	8.00%	60%	\$ 64.41
Qld	CCGT	1,191	89.7%	\$ 8.39	10.02%	8.00%	60%	\$ 81.00
Qld	Black Coal (Tarong)	2,719	90.6%	\$ 1.50	10.02%	8.00%	60%	\$ 59.90
Qld	Black Coal (Central)	2,719	90.6%	\$ 1.45	10.02%	8.00%	60%	\$ 59.75

Source:

http://www.climateinstitute.org.au/verve/_resources/Jacobs_ImpactsChangingRETonElectricityMarketParticipants_FINAL_140814.pdf

A report (jointly authored by the former CEO of the Loy Yang A power station, Ian Nethercote) from a visit to examine German new brown coal developments concluded that a comparable station to that being built in Germany would be providing power at \$55-65 per MWh²¹ even if it incorporated expensive supercritical emission abatement features.

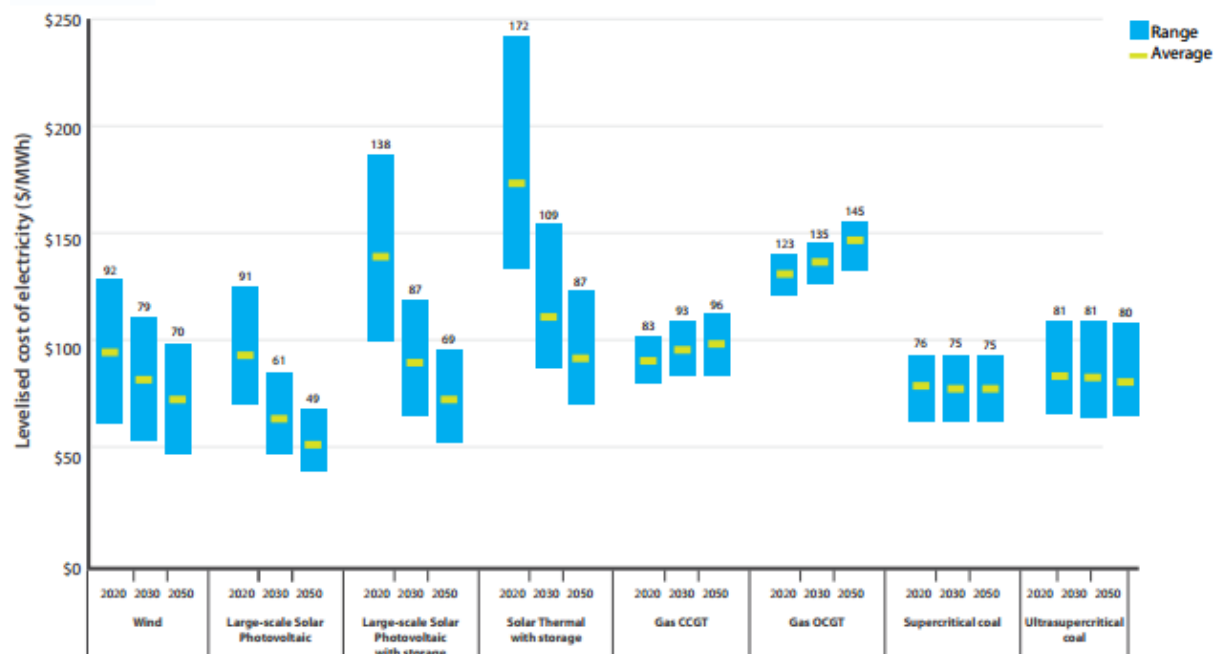
This is a conservative estimate since the coal costs of a brown coal plant in a Victorian location where mining infrastructure is in place and coal reserves are almost infinite would be lower than in Germany. The ARC put these fuel costs at \$14 per MWh though costs would be less on an existing site and Finkel put the variable costs at \$7-10 per MWh for brown coal and as low as \$9 per MWh for black coal in Queensland; German coal costs would be in excess of \$20 per MWh. It seems likely therefore that new Australian coal plant could be built to offer power at \$50 per MWh or perhaps less. Costs of building on a previously cleared site like that of Hazelwood or the Northern Power Station might be considerably less.

However, the Jacobs work for the Finkel report offers the following levelised costs.

21

http://www.minerals.org.au/file_upload/files/publications/Latrobe_Valley_Securing_energy_and_jobs_and_Australias_export_advantage_June_2017.pdf

Figure 18 Jacobs (Finkel report) cost estimates of new generation



This modelling assumes a pariah nature of coal generation would require a weighted cost of capital (WACC) at 14.9 percent compared with 7.1 per cent for wind (AEMO puts the WACC at 12.9 per cent for coal and 7.1 per cent for wind). Bankers are not immune from prejudice and virtue signalling statements and may, in present circumstances, see a PR upside in vocally rejecting coal investment. Thus statements like that of Westpac refusing to participate in future investment in coal are not uncommon²². But Australian banks are not involved in long-lived capital financing projects; such funding, whether for iron ore mines, private highways, rail or other developments is basically raised on New York capital markets and local bankers may see themselves denied no new business by making populist noises. Like all commercial operators, bankers need to stay grounded in pursuit of the best opportunities for profit. This involves carefully weighing risk in committing to an investment project. The alternative is business failure.

It is argued on the one hand (see for example the head of the Energy Council in the AFR²³) that it is now extremely difficult to build a 50 year asset with a high emissions profile. Similarly it is argued that coal “cannot compete on the investment fundamentals”²⁴ and (according to Dr Finkel), that wind is now cheaper than coal²⁵ (although those making that case never also argue its corollary that the now unnecessary renewable subsidies should be terminated).

Impediments to building new coal are twofold. First, there are now many radicalised people bent on opposing any form of coal use and willing to aggressively picket new projects, thereby imposing

²²

<https://www.westpac.com.au/content/dam/public/wbc/documents/pdf/aw/sustainability/WestpacCCEActionPlan.pdf>

²³ <http://www.afr.com/opinion/columnists/the-national-electricity-market-itself-could-collapse-if-we-fail-to-act-on-finkel-20170622-gwwa7d>

²⁴ <http://www.afr.com/news/forget-coal-follow-the-money-to-wind-and-solar-20170620-gwungt>

²⁵ <http://www.afr.com/news/politics/alan-finkel-says-his-modelling-was-conservative-on-wind-solar-20170621-gwvcro#ixzz4khtMWWY6>

costs on them. We have seen this going to the extent of endangering life of those working on such activities (those seeking to prevent forestry activities have even “spiked” trees knowing that this could easily kill a worker involved in felling). If governments are unwilling to combat this and to allow peaceful, legal activities to proceed unhindered then there is little hope of the economy achieving its potential in creating prosperity. Pusillanimity by government in upholding the law should not be an option but that is a choice democratic elections may sanction.

The second problem is that government activity in energy policy has created “sovereign risk”. Coal generators started, with commencement of the “two per cent renewable” target introduced by the Howard Government to find they were competing against a rival source of power which was subsidised. Although not significant in the early days, by around 2007 this discriminatory treatment was severely reducing the prospective profitability of new plant. This occurred because the subsidies to rivals were not only forcing a contraction in the available market to commercial producers but were forcing stop-start reciprocal modes of operation that increased production costs.

In addition, governments have often raised royalty rates once a major investment was locked-in; such actions may have been a factor in the closure of Hazelwood.

Government induced uncertainties on policy actions have reached a point where any new generator would need to have a contractual indemnification against government measures that introduced specific forms of tax or subsidised rival forms of power generation. The increasingly arbitrary nature of political decisions means that such indemnifications are no longer uncommon. They are widely used in the construction of long-lived assets like roads (and, as Victoria’s Andrews Government discovered, these are real guarantees) and rail, where for example, iron ore dedicated lines in Western Australia have effectively been made free from regulatory impositions requiring they carry third party products.

As testified by the thousands of new coal plants under construction around the world, there is no shortage of investment capital for financing these assets. It is simply, as always, a matter of risk and reward.

If, on the data Jacobs used in its 2014 report, the financing costs were put at 7 per cent (Finkel used 7.1 per cent for renewables financing costs under his BAU - the existing RET regime - and 6.2 per cent under his policy scenarios) the new entry coal costs would be as follows.

Table 11 Costs of new black coal plant in Australia

Black Coal New Plant				
	Capital Cost \$/kW	Fuel Cost \$/MWh	Finance costs \$/MWh	LRMC \$/MWh
NSW	2719	6.336	41.07	47.406
Old Central	2719	5.22	40	45.22

(Fuel costs conversion 1 GJ =3.6 MWh)

Three years Notice of Closure

The Finkel requirement that major coal plants provide three years notice of closure emerged from the claim that the two plants, Northern and Hazelwood closed with, at best, a few months’ notice. That is a confabulation on the part of politicians borne of the panic that set in with the South Australian state-wide blackout in September 2016.

Requiring the plant to keep operating unprofitably is totally unrealistic. Plant faced by a growing market share of intermittent electricity supplies that need not be scheduled (nor face some of the costs they impose on the network) will be unprofitable if confronted by a sudden change in its costs. Such a change may occur when a major piece of plant needs replacement or, as occurred with Hazelwood, where Worksafe declared the plant unsafe in its contemporary operational state and the Notice required considerable expenditure to rectify the safety issue.

Where owners are declared to be in breach of safety regulations, they must either operate illegally or to incur costs. Neither is practicable. Would the government then take over the plant? Have governments in supporting this notion thought through these implications?

Carbon Capture and Storage (CCS)

The selection of 600 kg/MWh in the Finkel report as the cut-off for clean energy removes coal fired stations unless they use carbon capture and storage. This is prohibitively expensive involving reservoir selection deeper than about 800m (similar to proving an oil and gas reservoir), conversion of CO₂ to liquid form for injection, and “proof” that there will be no leakage in the future (very low rock permeability and careful monitoring).

CCS is a concept that is widely boosted as an imminent low cost solution to abatement of carbon dioxide. Involving the extraction of the gas and its piping and storage in stable structures, its performance has disappointed. The green left Canadian Desmogblog commented on projects including SaskPower in Canada²⁶

“In recent years 43 CCS projects worldwide have been cancelled, put on hold or simply gone dormant.

“SaskPower’s carbon capture and storage project at the Boundary Dam coal power plant, which the province promised would provide “clean” coal-powered electricity, cost nearly \$1.5 billion to build, effectively doubling the cost of power from \$0.06 per kilowatt hour (kWh) to \$0.12 per kWh from the facility.”

In another case, that of Mississippi Power’s Kemper County CCS plant (which can use either natural or coal derived gas) the owner has spent \$7.5 billion so far. The plant was originally to cost \$3 billion and is still not operational²⁷.

The analysis of CO₂ emissions for coal fired power stations on a whole of project basis is about 1100kg/MWh for brown coal, about 850 kg/MWh for the best black coal, and a claimed 450kg/MWh for natural gas. There is however some argument that for gas plants this takes no account of emissions of CO₂ at the gas recovery wells, or the methane loss in long gas pipelines. One study from WA suggests that if these are taken into account, gas fired stations can emit more carbon dioxide than a coal fired station.

Costs and composition of electricity in an undistorted generation market.

Since the introduction of the subsidised Renewable Energy Target at the initially low level of “two per cent additional energy” its level has risen to its present market share of 9 per cent with its 2020 target at 15 per cent.

None of this would have been built without the subsidy.

²⁶ <https://www.desmog.ca/2017/01/04/how-saskatchewan-driving-small-wind-producers-out-market>

²⁷ . <http://www.foxbusiness.com/features/2017/06/05/clean-coal-plant-suffers-new-setback.html>

The way forward is to terminate with immediate effect all subsidies. In the case of existing rooftop suppliers. Households are less effected as the Commonwealth subsidy, the Small-scale Renewable Energy Scheme (SRES) has already been paid up-front and used by the installer to help defray costs. Households with installations would lose from the Feed-in-Tariffs that remain over-generous but those losses are, of course, gains to households without such installations.

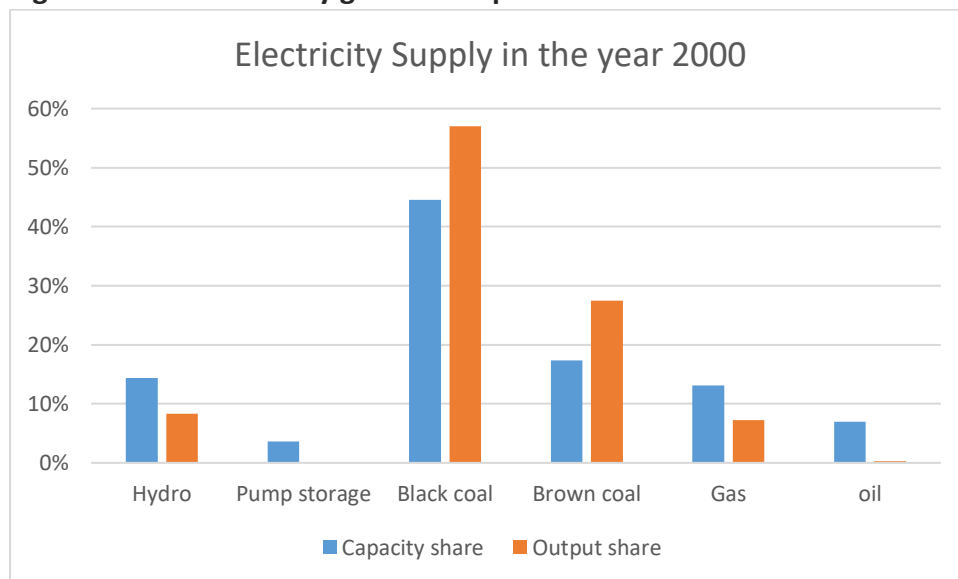
It might be argued that the elimination of subsidies that were promised for 5-15 years into the future amounts to a form of “sovereign risk” imposed on the producers. So it does but, sadly, the energy market is rife with such actions – they include the recent determination by the Commonwealth Government that gas producers must satisfy some level of domestic supply before honouring the contracts they have made for exports.

More pertinently, sovereign risk was introduced once the Commonwealth and state governments started requiring consumers to cross-subsidise renewable energy by forcing retailers to accept a growing proportion of this within the total supply. Such actions deprived coal generators of market share and forced on them an operational regime that was less economic as a result of wind obtaining priority and avoiding costs, like reactive power provision and new transmission.

If subsidies were to be removed, we would have an electricity supply profile not dissimilar to that prevailing in the year 2000. At that time coal, then as now the cheapest form of power, comprised 62 per cent of capacity and 84 per cent of power output. The then newer power stations like Loy Yang A and B could achieve high ramp rates of up to 50 MW per minute which means a ready ability to cover an unexpected drop in generation (In September 2016, South Australia with no coal had no such capability except through the distressed interconnect with Victoria). To cover peak demand, and contingencies fast start hydro, supplemented to some degree by gas and oil, was available.

The earlier pattern of supply is illustrated in Figure 19 below.

Figure 19 Electricity generation plant shares with subsidies removed



Wholesale price projections with an undistorted market

The foregoing illustrates that we have policy choices ranging from restoration of the status quo prior to renewables programs to an intensification of the subsidy regime that has created the high costs

and unreliable electricity market we now experience. The following shows illustrative price projections under four scenarios.

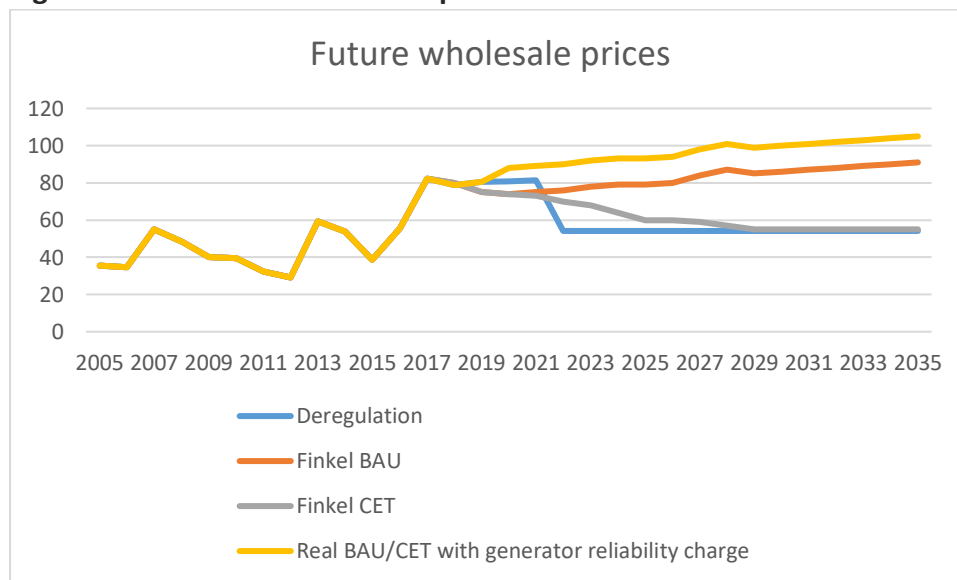
The first, deregulation, based on eliminating distortions, or market reform, sees a return of coal generation being phased in over the next 5-6 years with hydro and some gas acting as peakers. Coal is now very much more flexible with its ramp rates than in previous years and new build is available at less than \$50 per MWh.

The second and third scenarios are the Business-as-usual and Clean Energy Target price trends as inferred from the Jacobs graphing. These are unrealistic since they include very optimistic views on the reduction in the price of wind resulting in the Finkel preferred model showing prices declining with the progressive replacement of coal by wind assumed to cost around \$55 per MWh in 2035.

The fourth scenario is based on the estimates of the true cost of wind with its reliability charge. That source of electricity is benefitting from a regulatory induced forcing out coal from the market. It is modelled on the Finkel BAU price plus the cost of the reliability charge. This has electricity rising steadily to over \$100 per MWh.

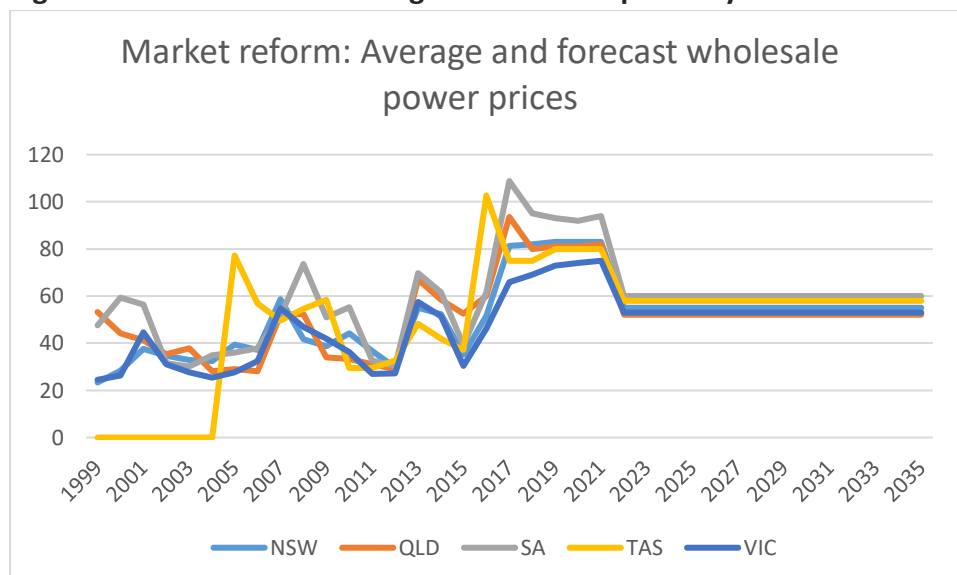
Figure 20 illustrates the outcomes.

Figure 20 Future wholesale prices under different scenarios



On the basis of a return to a deregulated market where coal would naturally become the mainstay of supply, existing and planned transmission lines mean wholesale prices would tend to differ little between the states. Wholesale prices vary between \$52 per MWh (Queensland) and \$60 per MWh (SA).

Figure 21 Wholesale deregulated market prices by state



Under a regime that allowed the energy supply to comprise the cheapest form of generation, Australia would have a system dominated by coal with a wholesale price of the order of \$55 per MWh. Sadly, under its present policy it is heading for prices over twice that.

4. Network and retail costs

Compared to the Finkel proposals, a removal of subsidies and regulations will bring an average household cost saving of at least \$650 per year in electricity bills.

For household consumers, network and retail costs comprise some 65 per cent of the electricity bill. For industrial consumers the level is closer to 45 per cent and much lower than this for the very energy intensive businesses like smelters.

Renewable energy requires much higher charges for networks for a number of reasons. These include the augmentation necessary to carry energy from the intrinsically more dispersed locations that are a feature of wind. More robust transmission is also needed to ensure the lack of reactive power by renewables does not compromise reliability.

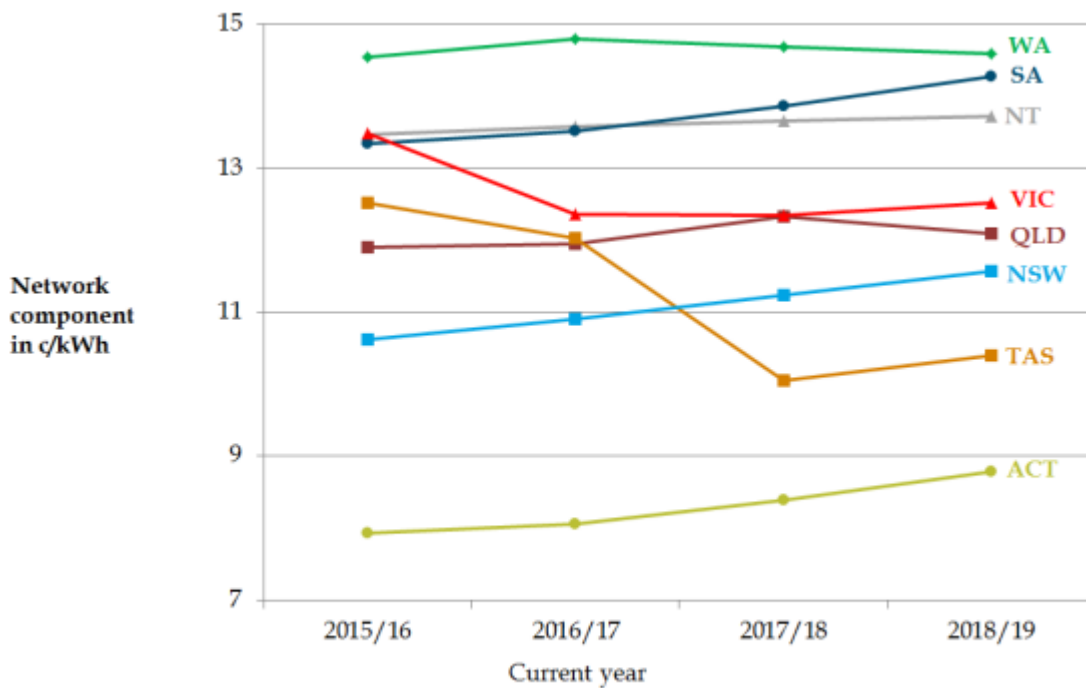
AEMO head Audrey Zibelman has called for a rethink of the networks to cater for increased levels of renewables²⁸. Such an approach would require considerable expenditure. Among the projects mentioned were:

²⁸ http://www.theaustralian.com.au/business/markets/aemo-chief-audrey-zibelman-to-push-for-power-grid-spending/news-story/7af1be26f6526a027ff9dc3806e415e8?utm_source=The%20Australian&utm_medium=email&utm_campaign=editorial&utm_content=BusinessReviewAM

- A second Basslink at \$1.5 billion to transfer wind generated electricity from Tasmania to the mainland
- Increased spending of \$1-3 billion on the grid in Victoria to meet the needs of the Victorian Renewable Energy Target
- Another link with South Australia
- Additional links between Queensland and New South Wales.

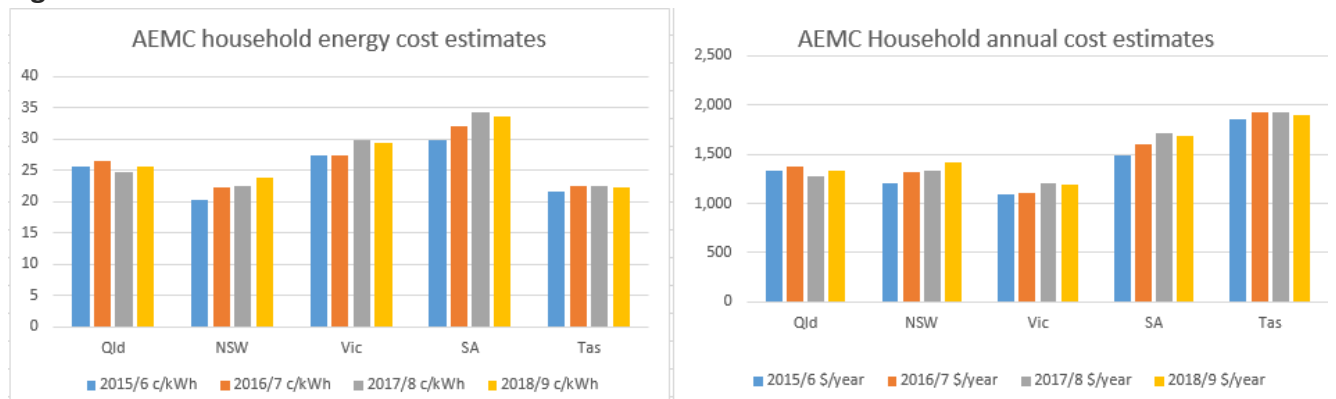
The Australian Energy Market Commission (AEMC) undertakes annual analyses of consumer bills²⁹. Its latest assessment of network charges by jurisdiction is as follows.

Figure 22 AEMC estimated network charges



Last year, AEMC projected relatively modest cost increases over the next few years.

Figure 23 AEMC household cost estimates



²⁹ <http://www.aemc.gov.au/getattachment/be91ba47-45df-48ee-9dde-e67d68d2e4d4/2016-Electricity-Price-Trends-Report.aspx>

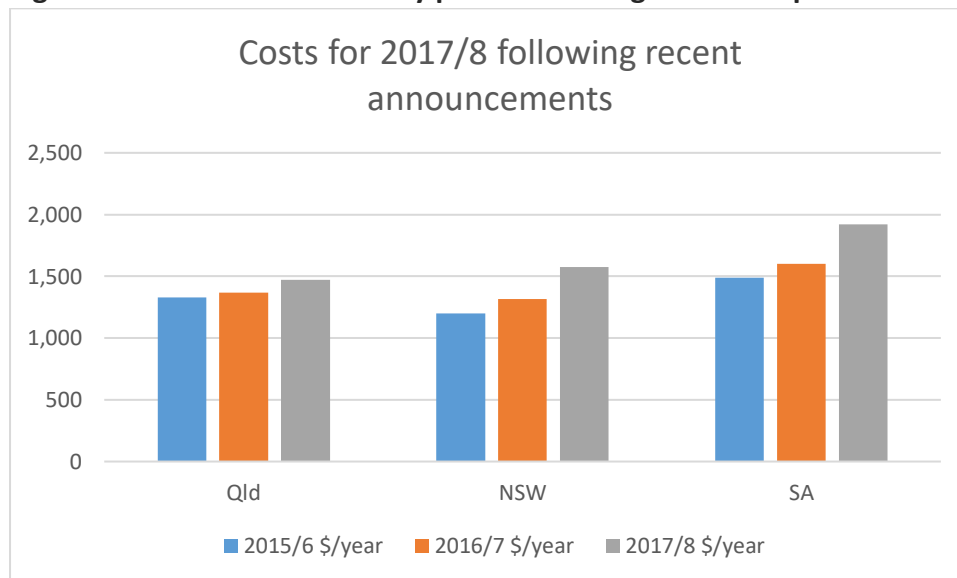
These estimates have been overtaken by the reality of the cost impositions caused by renewables. In June 2017, AGL and other large national electricity providers announced price hikes of up to \$600 a year. Energy Australia's cost increases are as below³⁰.

Table 12 Price increases announced June 2017

	Electricity increase	Cost per week	Yearly	Business increase	Business cost per week	Yearly
NSW	19.6%	\$6.15	\$319.80	19.9%	\$17.60	\$915.20
Queensland	7.3%	\$2.50	\$130	11.3%	\$10.75	\$559
South Australia	19.9%	\$7.50	\$390	19.9%	\$18.60	\$967.20

Costs are now as shown below and it is difficult to imagine that these cost increases will abate in future years under present policies, either with the RET or its CET variation. Average 2015/6 household costs having been \$1329 in Queensland and \$1199 in NSW are now respectively \$1420 and \$1575 in the two states. In South Australia costs rose from \$1487 to \$1921 over this same period. (New Victorian prices were not available at the time of writing).

Figure 24 Future electricity prices following June 2017 price announcements

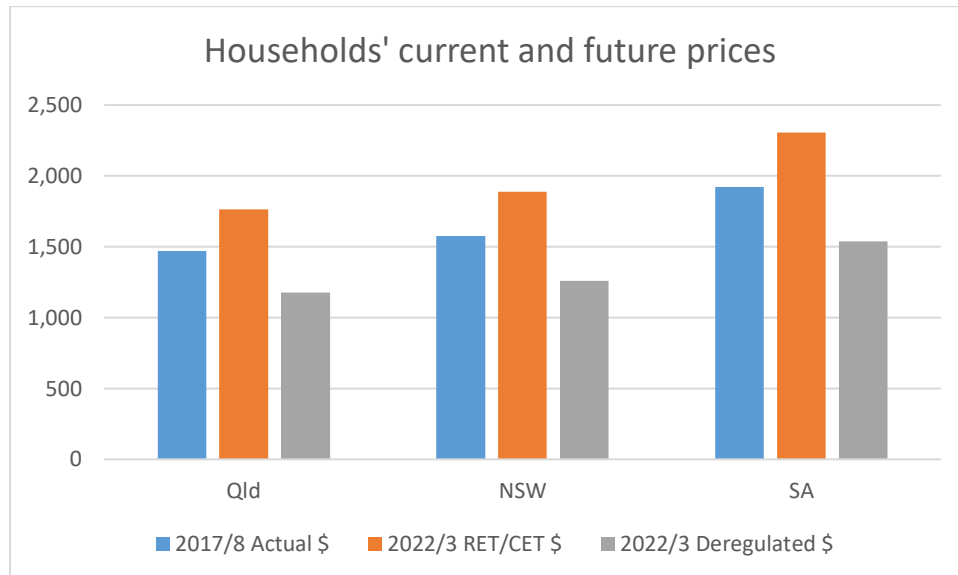


The full extent of the price rise both presently observable in forward markets and anticipated is yet to be felt. Based on the costs of the energy being substituted a further real 30 per cent increase in wholesale prices is likely between now and 2023 under the RET Business-as Usual or the Clean Energy Target. In addition there would be further costs as a result of renewables having to factor in reliability expenses and additional costs stemming from transmission expenditures.

A scenario contrasting the Finkel BAU and the regulatory distortion-free option, shown in Figure 25 below, shifts prices to the basis on which they rested prior to the renewable induced crisis now evident. It shows household annual savings of \$588, \$630 and \$768 in electricity costs alone.

³⁰ <http://www.news.com.au/finance/small-business/electricity-price-rises-locked-in-from-july-1-2017/news-story/0bad2dcddc1a3040c4abbf07d25cb7fc>

Figure 25 Future household electricity prices



5. Electricity and the economy's wealth and structure

The impact of massive future price rises will hit Australia most strongly through its effect on industry competitiveness. The price effects of the regulations would bring a dismantling of some of the nation's most productive enterprises in areas like smelting and food processing while reducing income levels in all trade exposed industries including farming and mining.

On top of the cost increases direct to household electricity bills will come many others as a result of the deindustrialisation the higher costs are inducing. These are very difficult to quantify but are likely to be considerably more serious than the direct costs of higher electricity bills.

Although electricity contributes only some three per cent of national value added, its role is far greater than this since it is a vital component of all production and indeed all personal consumption. Industries with a high share of electricity in their value-added are vulnerable to price increases, especially where they are in competition with imports or their products are exported.

It might be said that even if electricity comprises 20 per cent of costs, a price rise that brings as much as a 50 per cent increase in these costs might be affordable. After all this would be an arithmetic increase in overall costs of a mere 10 per cent.

Such logic however overlooks the drivers of industry location in a market economy. One sees global brands like Adidas and Puma relocating their manufacturing source in response to two or three percentage points of costs. The reason behind this is the amplification effect of costs on profits, the driver of firms' decision making. Profits are the residual benefit to the owner and decision maker after all other costs are covered. If profit comprises 15 per cent of the overall cost, a 10 per cent increase in costs eliminates two thirds of the income of the owner.

This amplification is the key to the creation of efficient economies the world over. Firms strive for seemingly tiny cost savings because of the effect of these in the income of the firm's owner and decision maker. Even a two per cent cost increase would, where profit is 15 per cent of total cost bring a 13.5 per cent reduction in profits. Such a loss of income to the owners would, where the loss was being experienced in only one location, cause a shift away from that location.

A key competitive strength of Australian industry has been the cheap energy endowment that its mining and energy utility businesses have successfully tapped.

The 2014/15 input output data³¹ released by the ABS in June 2017, allow some analysis of the industries likely to be heavily affected by electricity prices. For industrial users, generation is a larger component of electricity prices than it is for households. As a foretaste of the looming problems, there are reports of very substantial energy increases, with one firm in Victoria claiming its bill will rise 83 per cent and pointing out "We can't change our prices because we are an import-export competing business so it's just straight off the bottom line"³².

Industries that are especially exposed from rising prices include "basic metal products" "pulp and paper" and "sugar and confectionery" where electricity comprises respectively 46, 26 and 22 per cent of the gross value added. Other trade exposed industries where electricity comprises over 10 per cent of gross value added include "knitted products", "stationary" "synthetic rubber" and "iron and steel".

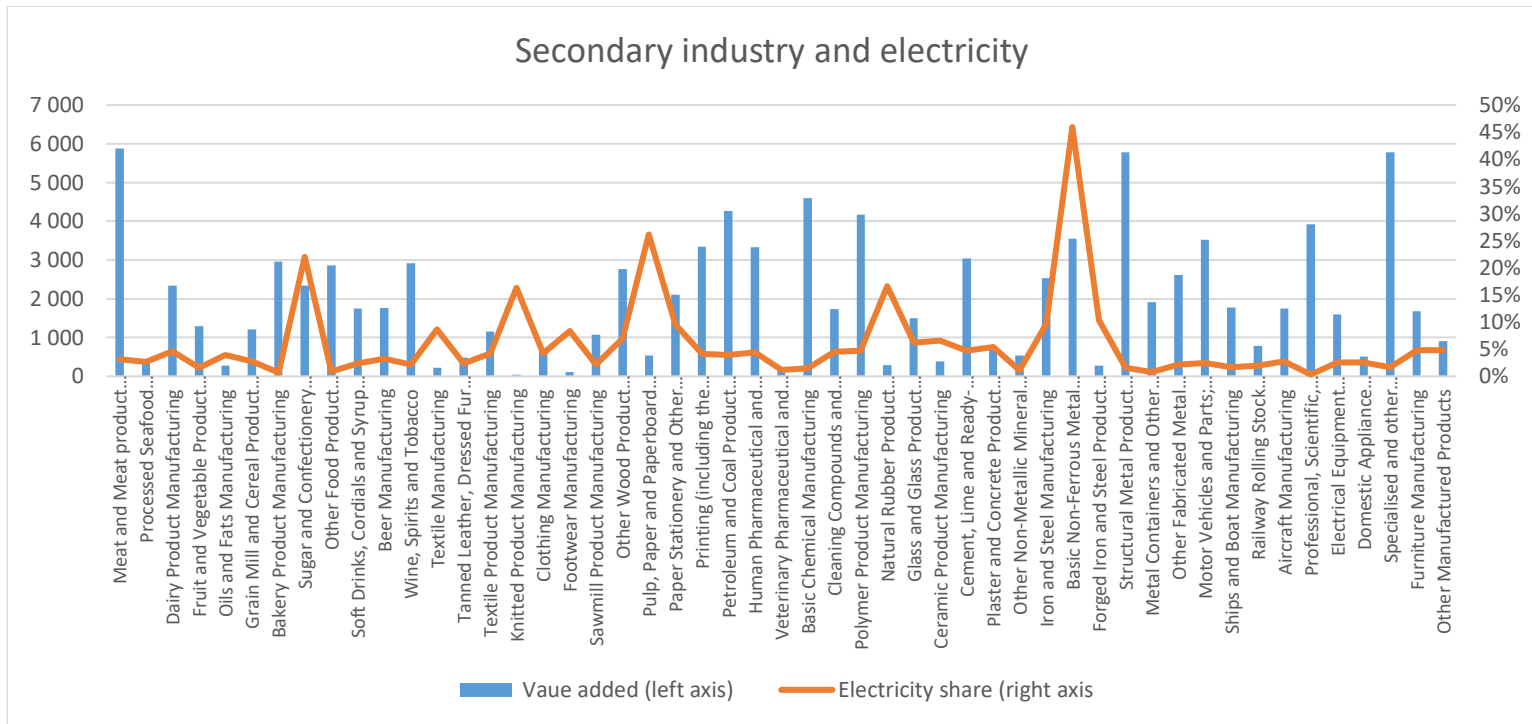
These industries account for almost 20 per cent of secondary industry output and it is difficult to see any of them maintaining a substantial presence facing the 150 per cent increase in wholesale electricity prices that is now underway. Not only is that energy important for the energy intensive industries but it is also vital to many others in the trade exposed areas, even where it comprises only 3-5 per cent of costs as is the case with many agricultural value adding like dairy products, beer, cereal products and edible oils. Many of these products are homogenous where price is the key sales factor.

Figure 26 and Attachment 1 identify the more vulnerable sectors.

³¹ <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5209.0.55.0012014-15?OpenDocument>

³² <http://www.afr.com/business/energy/electricity/destructive-wave-of-energy-price-hikes-about-to-hit-20170629-gx1bol>

Figure 26 Industries particularly vulnerable to electricity price increases



Prominent geologist, Ian Plimer put the case lucidly in a recent article in the Spectator³³ when he said, *“Neither smelting nor refining of the metals for other countries could take place without burning fossil fuels. For example, a steel mill uses coal to reduce iron oxide into iron metal and the carbon in coal is oxidised to CO2. A modern economy cannot rely on sea breezes and sunbeams to generate base load electricity for industry and a decarbonised economy would be a deindustrialised economy.”*

It is hard to engineer a situation where the nation with among the world’s most abundant supplies of energy has achieved energy prices that are among the world’s highest and where reliability of supply approaches third world levels. The cause is government policy, interference and successively tighter levels of political control.

³³ <https://spectator.com.au/2017/06/climate-notes/>

Attachment 1

Industries where electricity accounts for more than five per cent of gross value added

	Non Ferrous Metal Ore Mining	Non Metallic Mineral Mining	Dairy Product Manufacturing	Sugar and Confectionery Manufacturing	Textile Manufacturing	Knitted Product Manufacturing	Footwear Manufacturing	Other Wood Product Manufacturing	Pulp, Paper and Paperboard Manufacturing	Paper Stationery and Other Converted Paper Product Manufacturing	Cleaning Compounds and Toiletry Preparation Manufacturing
% Share of Gross Value Added	6	9	5	22	9	16	8	7	26	10	5
	Polymer Product Manufacturing	Natural Rubber Product Manufacturing	Glass and Glass Product Manufacturing	Ceramic Product Manufacturing	Cement, Lime and Ready-Mixed Concrete Manufacturing	Plaster and Concrete Product Manufacturing	Iron and Steel Manufacturing	Basic Non-Ferrous Metal Manufacturing	Forged Iron and Steel Product Manufacturing	Furniture Manufacturing	Rental and Hiring Services (except Real Estate)
% Share of Gross Value Added	5	17	6	7	5	5	10	46	10	5	12

5209.0.55.001 Australian National Accounts: Input-Output Tables - 2014-15