Submission to Senate Select Committee into Fair Dinkum Power

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Executive Summary

A fundamental premise for policy decision-making must be for Australia to track the lowest cost route to future power generation for industry, commercial and household consumers. Whole of Grid Systems Modelling shows our current investment trajectory is fraught with the risk of embedding higher cost outcomes for long lived power generation assets.

Focus Question: *How do we chart a lowest cost path for electricity generation in a rapidly changing grid/market that has to retain flexibility to respond to emissions reduction?*

There are many different drivers of wholesale and retail prices. Known variables include, technology cost, market behaviour, policy/regulatory intervention and asset ownership (public/private). The integrated effects of these in a rapidly developing/changing national asset portfolio will determine our energy competitiveness.

Conventional and prior analyses that project or predict the evolution of a National Power Generation portfolio, do so on the basis of their levelized cost of electricity at the gate. This is a sub-optimal approach because it ignores how an asset will impact the grid system itself (eg:NEM). A better approach is to minimize the cost of the system as a whole.

Systems Analysis is a proven superior framework when trying to minimise the cost of energy to all stakeholders. Building on this premise, ANLEC R&D commissioned modelling of the "Total Systems Cost" for Australia[1]. Many technologies provide a range of grid services (such as flexibility, reserve and firm capacity) which are increasingly valuable in their own right as increased intermittency from renewables enters the system.

Two new studies[2] [3] assess energy generation assets based on the services they bring to the electricity grid. The results highlight the impact on the Total System Cost and hence reflects outcomes necessary to reduce consumer bills whilst achieving national targets for affordability, competitiveness and carbon abatement.

The executive summaries of these latest studies[2,3] (provided as attachments) suggest the NEM will benefit from:

- A diverse portfolio of power generation assets is the best mitigation for avoiding the risk of high electricity prices into the future
- A transition path to the lowest cost electricity generation system that includes low emissions technologies such as carbon capture and storage (CCS)
- Low emissions coal fired power generation with CCS is essential for the deepest emissions reduction ambitions to 2050 at lowest cost to the consumers[4]
- Review and change to market regulations settings. If not changed, there is risk to over-build renewable asset types and lock in higher curtailment costs into the future. Current settings lock out the adoption/deployment of low emissions technologies like CCS.

These studies and this submission suggest the following recommendations.

[1] Managing Flexibility while Decarbonising Electricity, 2017
[2] Attachment 1: The Effect of Renewable Energy Targets on the NEM
[3] Attachment 2: Renewables and the NEM – What are the limits
[4] https://www.ipcc.ch/sr15/ Special Report on Global Warming of 1.5º

Recommendations for transparent outcomes in a National Energy Strategy

a) *Evidence based policy initiatives should be underpinned by transparent analysis and assessments for minimising "total systems cost" for power generation in Australia. The Energy Security Board, The AMC, The AER and AEMO are best placed to deliver these.*

b) *Further empower the Energy Security Board, The AMC, The AER to:*

- *Implement policies and regulations that seek to minimise the "Total System Costs for power generation on the NEM"*
- *Develop and publish metrics to monitor "Total System Costs for power generation on the NEM"*
- *Develop and publish forecast target ranges for competitive electricity pricing to monitor market performance*
- *Develop and implement measures to maintain Australian energy competitiveness.*

Recommendations for a secure and reliable electricity network

a) *Provide support to the current coal fired power generation fleet. These assets will need substantial investment if they are to be able to operate flexibly - as required in the transition to a low emissions system with high RE penetration.*

b) *Provide on-going investment in power generation with CCS deployment for it to be available when needed.*

   i. *Support for Surat Basin, Queensland – CTSCo Project to target injection before 2025*

   ii. *Support for Gippsland Basin – CarbonNet Project to target injection before 2030*

c) *Support for technologies – like CCS - that bring grid stability services coupled with additional generating capacity. These should be delivered as part of the lowest system cost portfolio of power generation assets by:*

   i. *Developing investment instruments to re-establish investment confidence in large scale low emissions coal fired power generation*

   ii. *Developing rules to guarantee the dispatch for large scale low emissions coal fired power generation on the system.*

Recommendations for net-zero emissions ambitions to 2050

a) *Support CCS deployment in Australia. The lowest cost stable NEM grid system requires CCS as an essential contribution to the national power generation asset portfolio. This is especially true if we are to meet international and deep decarbonisation (net zero emissions) ambitions by 2050.*

b) *Support for commercial CO_2 storage reservoirs and proto-type power generation retro-fits are required immediately.*

c) *Deploy financial investment and regulatory initiatives necessary to encourage and incentivise CCS deployment at commercial scale. A suite of possible approaches are outlined in the University of Queensland CCS Roadmap for Australia[5][6].*

d) *Increased financial support for commercialising CO_2 storage hub development in the Australian geological storage reservoirs of relevance.*

[5] http://anlecrd.com.au/wp-content/uploads/2017/02/Financial-Incentives-for-the-Acceleration-of-CCS-Projects.pdf
[6] http://anlecrd.com.au/projects/a-ccs-roadmap-for-australia/

Introduction

Electricity or Energy pricing is an underpinning pillar of a competitive Australian economy. In the last decade any national advantage has been significantly compromised by a near 70% increase in pricing. As clean energy costs more, meeting our emissions commitments, targets and ambitions will further erode the Australian competitive position.

Australian energy consumers have differing needs. In public discourse, the most attention is paid to household domestic consumption and pricing – but his represents just 25% of electricity demand. Industrial and Commercial businesses, that need competitive energy pricing, accounts for 75% of the demand and does not draw enough attention. Arguably, this is a more important metric that has significant implications for the performance of the Australian economy.

Despite being endowed with some of the best energy resources, Australia now has some of the most expensive electricity prices. This is clear evidence that:

a) Consumers and the economy are paying the price through higher energy costs
b) Replacing privatised power generation assets on the network results in a higher capital financing burden for the grid system that will transfer these higher costs to the consumer
c) An investment hiatus for dispatchable, reliable and competitively priced power is causing a lack of suitable supply resulting in higher cost (70% in real terms) energy price rises over the last decade

The following submission relates to a selected subset of the Committee's Terms of Reference (ToR). Numbering and title headings from the ToR are retained for ease of reference.

a. The potential for empowering energy consumers to play a more important role in the National Electricity Market, through providing diverse services in:

i. Energy generation

All Energy Consumers will benefit from the lowest cost energy generation supply into the future.

Industry and Commercial consumers will pro-actively consider investment in a policy environment, underpinned by a National Energy Strategy that **targets lowest system costs for energy generation**.

The report on Managing Flexibility while De-carbonising Electricity[1]. shows that the lowest cost power generation asset portfolio includes carbon capture and storage (CCS) technologies for fossil fuels. In fact, such technologies become essential for a lowest cost electricity system as renewable generation increases penetration on the NEM grid.

Australia has several proponents for CCS who have commenced commercial scale deployment planning and investment since 2011. They are:

- **CarbonNet**, Victoria in the Gippsland Basin
- **CTSCo**, Queensland in the Surat Basin
- **SWHub**, WA – an exploratory characterisation in the South Perth Basin

These projects already commenced should be encouraged and supported through to deployment.

Figure 1: Cost of De-carbonising the NEM[2]

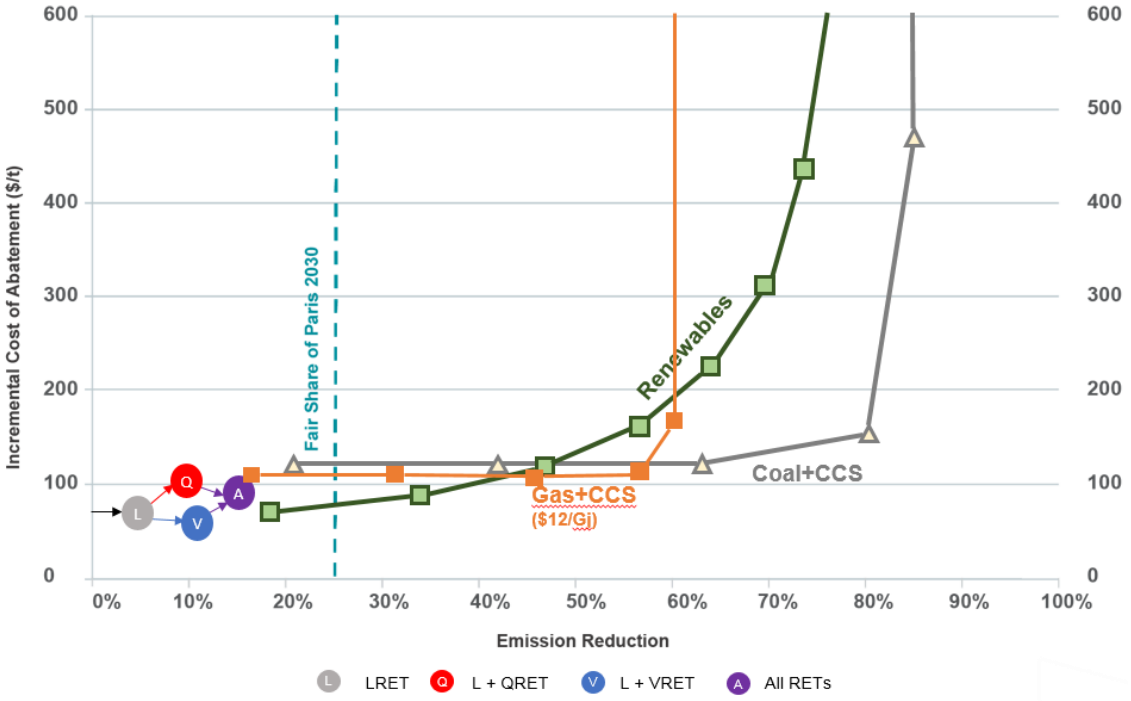


Figure 1 above shows the "cost of CO_2 abatement" that the system pays for emission reduction on the NEM. The lines chart the abatement cost if a single technology is used to decarbonize the NEM (eg: RE, Gas or coal+CCS).

Given the costing accuracies for these types of studies, it is arguable that there is not much difference irrespective of the low emissions generation technologies used to decarbonize the NEM until about 45% emissions reduction. It shows that even today, coal+CCS is an equally valuable and competitive emissions reduction technology to the NEM grid system.

Very importantly, at around 40-50% decarbonization ***CCS is seen as the lowest cost option that delivers the deepest emissions reduction for the NEM***. CCS cannot be suddenly switched on – it needs to be deployed now to ensure it establishes a license-to-operate with regulators and with local communities. On-going investment in CCS deployment is required for it to be available when needed.

Recommendation:

a) *Evidence based policy initiatives should be underpinned by transparent analysis and assessments for minimising "total systems cost" for power generation in Australia. The Energy Security Board, The AMC, The AER and AEMO are best placed to deliver these.*

b) *Provide support to the current coal fired power generation fleet. These assets will need substantial investment if they are to be able to operate flexibly - as required in the transition to a low emissions system with high RE penetration.*

c) *On-going investment in power generation with CCS deployment is required for it to be available when needed.*

   iii. ***Support for Surat Basin, Queensland – CTSCo Project to target injection before 2025***

   iv. ***Support for Gippsland Basin – CarbonNet Project to target injection before 2030***

iii. Grid stability and reliability services,

The Energy Security Board 's Integrated System Action Plan published in December 2018 clearly identifies the gap emerging for grid stability and reliability services. They report:

"[There is] need for some minimum of synchronous generation in the system. This is an effective constraint where insufficient synchronous generation will cause non-synchronous renewable generation to be curtailed."

This is very consistent with our own study on the **path to minimise cost** for Maintaining Flexibility whilst decarbonising the NEM[1]. Existing Coal and Gas fired power generation assets are synchronous generators and have provided the stability and reliability services to the grid for past decades.

Premature exit of these services and power generation capacity from the market is a potential risk. The unlimited introduction of increasing intermittent renewable generation into the NEM changes the economics of participation for these existing synchronous service suppliers. Having a large proportion of these private assets on the grid means that decisions to exit the NEM - as unprofitable - will be made in the interests of the investors – irrespective of the needs of the grid system.

Financial Investment mechanisms are needed to deploy power generation using CCS technology[4]. CCS mitigates the system risk posed to the grid of the pre-mature loss of synchronous capacity.

It has been shown that having coal and gas fired generation with carbon capture and storage provides not only additional clean energy generation, but also is an essential component of a lowest cost stable and reliable electricity generation grid.

Technologies such as synchronous condensers, batteries and other electrical controls can decouple power generation from the supply of stability services. Their integration in the total systems cost to the grid has not been fully assessed – especially that they do not include the added benefit of reliable electricity generation and supply. Importantly, their adoption is likely to be tested but their efficacy (both cost and performance) will not be apparent for at least a decade.

CCS is available today - deployed at suitable scale hedges against a system cost risk where candidate low emissions technologies can be ramped up or down depending on their system performance and demand.

Recommendation:

*Support CCS Deployment in Australia. The **lowest cost stable NEM grid system** requires CCS as an essential contribution to the national power generation asset portfolio. This is especially true if we are to meet international and deep decarbonisation (net zero emissions) ambitions by 2050.*

Support for Commercial CO_2 storage reservoirs and proto-type power generation retro-fits are required immediately if CCS is to assist meet the committed emissions reduction targets to 2030 as well as net-zero emissions ambitions before 2050.

Deploy financial investment and regulatory initiatives are necessary to encourage and incentivise CCS deployment at commercial scale. A suite of possible approaches are outlined in the University of Queensland CCS Roadmap for Australia.

iv. Alternatives to conventional network investment, and

Regional Development from Low Emissions Energy Generation Hubs

Conventional network investment has focussed on poles and wires – ie: transmission. ***Future network investment should be expanded to include access to CO_2 transport and storage hubs***. The planning for and investment in CO_2 storage hubs is continuing to develop for the Surat Basin in Queensland, the Gippsland basin in Victoria and the South Perth Basin in WA. These are major centres of industrial development. Providing a Carbon Capture and Storage services to these regions will boost their credentials as low emissions enabled industrial development zones for attracting, continuing and growing investment.

The NEM is rapidly changing to accommodate various sources of power generation and services. Therefore, the suite of considerations for power generation should not be restricted to conventional and historical resources. In a rapidly changing energy system, it is essential to develop new and enabling low emissions resource options such as "pore-space" for CO_2 storage as well as CO_2 transport corridors. Renewables, Hydrogen and CCS can be synergistic on the Australian grids. Even a clean and robust

Recommendation

a) *Increased financial support for commercialising CO_2 storage hub development in the Australian geological storage reservoirs of relevance.*

v. Peer-to-peer trading between households and businesses

vi. The potential for these services to deliver lower energy costs and increased energy reliability

Renewable Energy supply lends itself to distributed energy systems and peer-to-peer sharing. Solar Energy is particularly suited to domestic, business and residential installation. In its present form however, besides hydro energy, RE does not come with complementary and essential grid services necessary for the networks stability and reliability.

The cost of non-residential energy is an important factor to the Australian economy. The Australian Energy Update for 2017 reports that residential demand accounted for only 8% of total Australian energy consumption. The bulk of the remaining consumption is taken up by electricity supply, transport, manufacturing and mining that have economy wide impacts.

Unreliable electricity supply has a cost. These costs are particularly high if imposed on businesses.

Mechanisms and incentives to extract the benefits of RE should not be pursued to the detriment of the total system reliability. Grid stability and reliability is essential for major industrial processes and should not be compromised.

If ancillary services are to be acquired to support intermittent RE supplies, it should not rule out technologies that provide such grid services coupled with additional electricity generating capacity. Fossil fuel power generation with CCS is precisely such a technology that can deliver the lowest cost system for a stable NEM.

Recommendation:

a) *Support for technologies – like CCS - that bring grid stability services coupled with additional generating capacity should be delivered as part of the lowest system cost portfolio of power generation assets.*

b) *Implement financing mechanisms outlined in the CCS Roadmap for Australia (UQ report) to deploy power generation using carbon capture and storage.*

d. The impacts of privatisation;

Investment confidence in large-scale dispatchable power generation should be restored.

Privatisation and the present regulation ***embeds an unverified premise*** that large scale dispatchable power generation has no benefit to the electricity generation system. ***The ESB Action plan acknowledges the need for a minimum amount of synchronous generation capacity but has no immediate planning actions to support or deliver it***.

Power generation with CCS – the one single technology that can deliver additional power generation capacity, clean energy and grid stabilising services is locked out of any current government initiatives/regulation to secure the power generation system (This compares to 3 Billion dollars in annual RET subsidy in 2016[7] aggregating to about $10 billion over the term of the scheme since 2011).

Power generation for low emissions fossil fuel technologies such as CCS should be allowed to compete in a technology agnostic market framework that delivers system wide benefits.

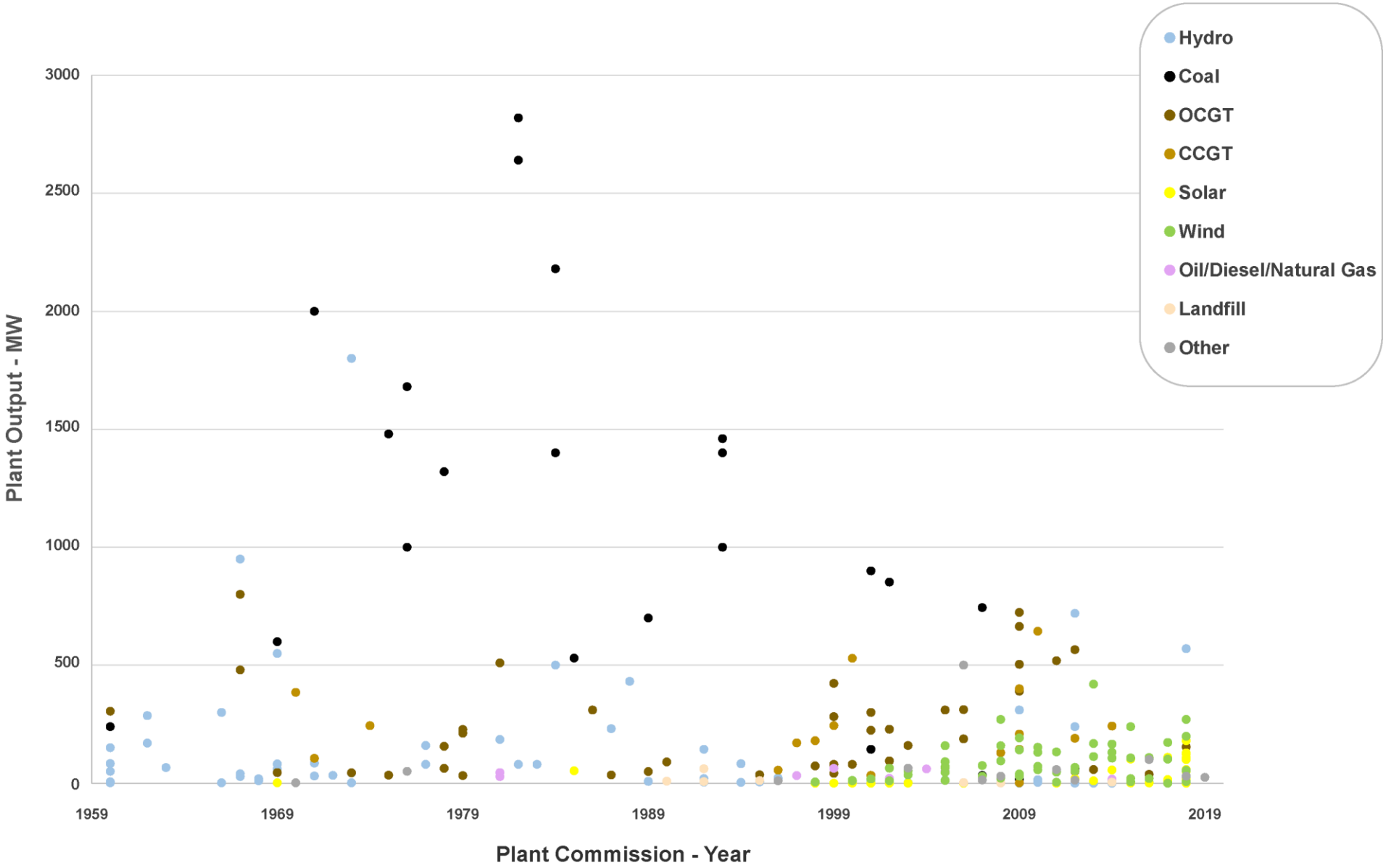
The impact of privatisation on power generation in Australia manifests in many ways including:

Loss of Planned Generation Capacity - Divestment by Government:

In executing sale of power generation assets several state governments first disaggregated and operated them as a host of smaller size assets over more than a decade. In NSW and QLD, these smaller government owned corporations (GOC's) did not have the financial wherewithal to take long-term, large scale decisions due to uncertain futures and policy uncertainties. The result was a hiatus in any new build of large scale (>500MW) coal fired dispatchable capacity. Kogan Creek (700MW) in Queensland was the last Power Station of this size commissioned in 2007 (the decision to build was probably made 5 years prior). There has been commissioning of higher cost, flexible, dispatchable gas fired peaking capacity and smaller scale subsidised intermittent RE projects. ***The economies of scale to the system are being substantively eroded***.

Since 2007 confidence in the investment of billions of dollars credibly underwritten by state governments was lost to coal fired power generation. The figure below shows the size of assets commissioned by year.

[7] http://www.baeconomics.com.au/wp-content/uploads/2017/02/MCA-renewables-subsidies-8Jan2017-2.pdf


Hydro
Coal
OCGT
CCGT
Solar
Wind
Oil/Diesel/Natural Gas
Landfill
Other
3000
2500
2000
1500
1000
500
0
Plant Output - MW
1959
1969
1979
1989
1999
2009
2019
Plant Commission - Year

Private Investment Hiatus and asset deployment distortion

In the absence of government investment, there has been no private investment in large scale power generation. The 600MW Millmeran Power Station in Queensland was the last one commissioned in 2002 – nearly 16 years ago.

Without substantial government co-investment business and policy risks preclude private investors preparedness to build large scale competitively priced dispatchable coal fired power generation assets for the NEM. This especially comes to the fore for decisionmakers dealing with risks of discriminatory regulation (eg: RET) and over-supplied markets.

Therefore privatisation may be allowing the "system cost" can drift higher than necessary without supervised accountability to optimise it.

Sub-optimal schedule of capacity withdrawal

With profit as the motive of privatised assets, decisions are taken based on risks posed to the return on private asset investment. These decisions are independent of the power generation system and therefore made irrespective of grid security. While regulation attempts to protect the system (eg: notices to retire) the decisions are made in Board rooms (often outside the country).

The best solution for additional power generation capacity on the NEM may require a longer time to deploy than the current requirements for notice to withdraw. The power generation system is therefore exposed to the risk of pre-mature capacity withdrawal of privatised assets.

Current fossil fuel power generation assets – with proactive investment - can be adapted to avoid premature withdrawal and maintain lowest system cost outcomes. Adapted to low emissions configurations, they can benefit from privatised Peer-to-Peer trading between households and businesses especially if they are included/allowed as cleaner energy options to consumers.

Longer-term emissions risk posed by fossil fuel generation can be mitigated by technology neutral emissions reduction policy. Clean Energy Initiatives implemented should be made available to all projects that can demonstrate compliance with transparent performance objectives that might include:

- The contribution to a lowest cost national electricity generation system
- A reliable national electricity generation system
- Achievable low emissions performance
- Sound financial basis over the life of the asset

Recommendation:

a) *Develop investment instruments to re-establish investment confidence in low emissions coal fired power generation*
b) *Develop rules to guarantee the dispatch for large scale low emissions coal fired power generation on the system.*

e. Regulatory reforms which would empower energy consumers, including the following key groups:

i. Households, including low income households and renters
ii. Farms
iii. Small businesses, and
iv. Major energy users

Small Business and major energy users need a stable and reliable energy system competitively priced internationally to attract and keep investment growing in the Australian economy.

How do consumers invest in Grid Stability and Reliability? How is the cost of grid stability and reliability managed?

Current mechanisms encourage consumers to invest in "generation" (eg:rooftop PV) and/or "storage capacity" (eg: batteries) as a means of supplementary income or cost reduction. These investment decisions take no account of the system needs for stability and reliability. There is evidence for a large increase in stability interventions called upon from existing coal fired generators.

Current regulation does not value the synergy of multiple grid services offered by a technology such a low emissions coal fired power generation. A technology like CCS brings capacity, scale, cleanliness, reliability or stability. Criteria for informed consumer behaviour must include transparent valuation at all scales, multiple synergies and multiple products. Consumer engagement with the market should be premised on access to this quality of information.

Recommendation:

Empower the Energy Security Board, The AMC, The AER to:

- *Implement policies and regulations that seek to minimise the "Total System Costs for power generation on the NEM"*
- *Develop and publish metrics to monitor "Total System Costs for power generation on the NEM"*
- *Develop and publish forecast target ranges for competitive electricity pricing to monitor market performance*
- *Develop and implement measures to maintain Australian energy competitiveness.*

References

1. Boston, A., Bongers, G., Byrom, S. and Staffell, I. (2017), *Managing Flexibility Whilst Decarbonising Electricity - the Australian NEM is changing*, Gamma Energy Technology P/L, Brisbane Australia
2. Boston, A., Bongers, G., and Byrom, S. (2018), *The Effect of Renewable Energy Targets on the National Energy Market*, Gamma Energy Technology P/L, Brisbane Australia
3. Boston, A., Bongers, G., and Byrom, S. (2018), *Renewables and the NEM: What are the limits and what else is needed to go zero?*, Gamma Energy Technology P/L, Brisbane Australia
4. IPCC Special Report on Global Warming of 1.5º ,
5. Greig, C., Baird, J. and Zervos, T. (2016) *Financial Incentives for the Acceleration of CCS Projects*, The University of Queensland, Brisbane. ISBN 978-1-74272-177-4
6. Greig, C. et al. (2016) *A CCS Roadmap for Australia*, The University of Queensland, Brisbane,
7. Schnittger S, Fisher B S. (2017) *Primer on renewable energy subsidies in Australia*, BAEconomics.