IES INSIDER

ISSUE 33- October 2018

Examining the Entrails of the Failed NEM: How Did It Fail and How to Fix It?

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Has the NEM Failed?

Many with access to loud megaphones assert that the NEM has failed by pointing to high electricity prices and to less than perfect reliability; all the fault, some say, of misguided policies on emissions and renewable energy. Irreconcilable opinion fuels the debate on these issues.

But there can be no doubt that the NEM has failed. It was supposed to be an open and competitive arrangement, subject to the lightest of light regulation and free of oppressive government intervention. What we have now, or have proposed and discarded, is intervention on a grand scale via the RET, Finkel, the NEG, enthusiasm for Snowy II, sponsoring of Tesla batteries and government support for renewables on the one hand and urging for coal fired power stations on the other. At the time of publication, a brand new raft of government intervention had been announced.

History can put these arguments into perspective and I will relate some in this article. I can do this because I have lived and worked through the period of interest, with personal recollections from as far back as the early '50s.

Were Prices Low when Coal was King?

How can a country blessed with so much and such good quality energy resources, which we dig up and export profitably on a grand scale, manage to have some of the highest retail electricity prices in the world? And wasn't there are time when Australian manufacturing thrived using the cheap energy we used to produce?

Let's take that in parts, first by looking for that golden era of cheap electricity. When was that golden era? Certainly before the renewable fad took hold (as some argue) and certainly before privatisation replaced the "essential service" model of public electricity supply (as others would argue). So I looked for data on a period when large coal fired power stations were the unchallenged base load supply sources and the system was run by a state utility.

Looking back into my archives, I found a report I did with Travers Morgan in 1994 for the NSW IPART on the NSW Bulk Supply Tariff, which includes the wholesale energy and transmission prices proposed to be charged to retailers. A summary of the proposed BST is given in the top half of Table 1 below. The bottom half contains the same data inflated to 2018 values, using a standard inflator of 1.80 in this case. The report is now 25 years old, so I am assuming the confidentiality requirement has lapsed!

Table 1: NSW Bulk Supply Tariff - Then and Now

	Peak	Shoulder	Off peak	Total/Avg
Hours	25.00	50.00	93.00	168.00
Fraction	0.15	0.30	0.55	1.00
Gen 1994 ($/kWh)	6.56	5.70	2.82	4.23
Trans 1994 ($/kWh)	1.43	1.23	0.00	0.58
Total 1994	**7.99**	**6.93**	**2.82**	**4.81**
Inflator to 2018*	1.80	1.80	1.80	1.80
Gen 2018 ($/kWh)	11.80	10.25	5.07	7.62
Trans 2018 ($/kWh)	2.57	2.21	0.00	1.04
Total 2018	**14.37**	**12.46**	**5.07**	**8.66**

Source: Travers Morgan – IES Report, page 3[1]

[1] Travers Morgan – IES, "Review of Pacific Power's Marginal C0st Calculations: Volume 1: Summary Report", A Report prepared for the Government Pricing Tribunal of New South Wales, 1994, available *here*.

The inflator data were estimate from the RBA's inflation calculator at https://www.rba.gov.au/calculator/annualDecimal.html

Note that the peak, shoulder and off-peak times differ from those used today. The last column shows time-weighted figures, suitable when comparing prices for base load energy.

If I look at the 2018 equivalent figure for generation (suitable for analysing base load), at 7.62c/kWh I can't see much difference to the forward prices now showing on the ASX, forward prices are lower if anything. Of course network and retail costs add to all of that, in both cases.

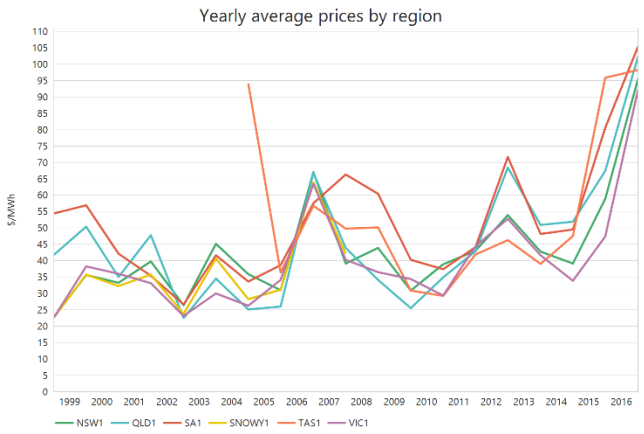
In both cases, of course, there is ample scope for improvement. This is clear from the 1994 the report when there was, ironically, a bias much too much in favour of base load power. It's also very true today, both in the wholesale market and in retail, as noted in the recent ACCC report.

The Golden Age of Low Prices – and Why

So when was this golden age of low prices when coal was king? There was one in most regions, and that was the decade and a half immediately after the introduction of the National Electricity Market in 1998, together with interconnections between the states added over that time.

Figure 2 below, shows regional prices averaged over the year since 1998. The general pattern is very low average prices in the larger, interconnected regions, persisted for a decade or more, only recently rising to value now considered by many to be at price gouging levels. Improved interconnection has tended to drive pricing in the summer regions down and towards a common price.

Figure 2: NEM Yearly Time Average Spot Prices



Source: NEM market data

To all parties of the time, the very low wholesale prices that persisted for a decade or more were the outcome of ***too much*** coal fired plant in the system. Prior to the NEM, the cost of this was sustained by centralised pricing at levels which were not particularly low, as previously outlined.

After the NEM began (from 1998), this level was competed away in most regions, to a level that private owners found discomforting. Competition greatly improved availability, in NSW from values around 70% to closer to 95%, so the system nearly overnight gained thousands of MW of new capacity, all at low marginal cost.

With this huge base load plant imbalance, the system was able to remain low cost and reliable largely with the addition of some gas plant around the system, with little impact on market outcomes given that gas prices were relatively low at the time.

To put this in perspective, the modelling we did in Victoria in 1993 actually assumed that two Hazelwood units would remain mothballed. Why? Because from the modelling we though they were "not needed"! In fact, the buyer refurbished them immediately and keep them running until recently –a 20-year life extension!

Of course, such "out of equilibrium" low prices could not last as the old plant fleet aged and demand grew. The history of wholesale and retail prices over the last decade has been complicated and much less happy for customers. But before reviewing that, let's look at system reliability.

A Quick Gallop over System Reliability

There a few home truths about system reliability that are worth listing, but without detailed discussion:

- For domestic consumers and most commercial consumers, by far the most frequent cause of blackouts is failure of the local distribution system, ***not a lack of generation***.
- The NEM has a required generation reliability level that amounts to less than 2 hours per year of outage. In practice, this can occur at random, sometimes bunched, sometimes separated by many years and usually confined to a local area or region.
- Blackouts driven by generation failure often look like stuff-ups rather than a simple run of bad luck.

Most readers will not remember the blackouts of the 1950s in NSW. For a period, these occurred every night in winter for about half an hour on a rotating basis, as the system struggled to keep up with the post war boom. We always had our kerosene lamp handy and primed to go. It was only when Liddell and other coalfield based plant were commissioned did this pattern recede.

Many readers may also not remember the 1982 electricity crises, either. The root cause was that three of Liddell's four coal fire units blew up through a common fault. The recently completed Snowy Scheme could not keep up. Eventually, industry got into a regular load shedding routine[2] until the Liddell repair was completed, which took many months. So much for the reliability of coal-fired plant; there is no escape from stuff-ups.

The NEM has been quite reliable despite the input of renewables, until the episodes of the last few years which largely focussed on South Australia. But there were many factors at work in those cases including mothballing of gas plant (because of high gas prices), interconnector capacity reduction and transmission outages due to storms. However, the killer blow in the worst case were settings on wind farm protection systems which had the effect of tripping the whole system prematurely. This problem was not endemic to wind farms; more an indication that the connection requirements were not specified rigorously enough; in short – a stuff-up.

This is not to say that wind and other renewables have not and do not present a reliability challenge, especially, if one seeks to go beyond the current RET levels. But the real and legitimate gripe that most people have about electricity is its price, and that story has culprits well beyond a perceived surfeit of renewables.

The Sorry Story of Recent NEM Prices

Let's look at how well we have dealt with the electricity market. By "we" I mean we as a collective, represented by our governments as well as the other movers and shakers in the industry.

Networks as Milch Cows

Let's look first at networks. When the electricity sector was "liberalised" over the last 25 years, beginning in Victoria, networks were recognised as monopolies requiring regulation. We could have then established a well-resourced, strong regulator that was robust in chasing down and eliminating over-investment, that offered a modest but fair rate of return in exchange for very low investment risk, and which had lowering the cost to the customer in mind at all times.

But, no, we didn't do that. We quickly saw that network were "safe" businesses. We persuaded the regulators to allow generous rates of return, despite the low risk. Under government direction, our friendly regulators waved though investments targeting ridiculously high levels of reliability, at least in some states. In government ownership, networks became prized milch cows. Dressed up and sold at premium prices, they topped up government coffers, allowing bragging rights of superior fiscal management. If a regulator sought to interfere with this flow of value, governments appealed, against the interests of customers and in favour of higher monopoly income and a higher value sale.

Gas Market Plunder

Now let's look upstream, at the gas market. For much of the period of the NEM, gas prices were modest and supported ongoing investment in gas plant as opportunities arose. This was a Good Thing as, historically, the east coast electricity system was over-invested in coal-fired base load plant. Gas turbines and gas combined cycle allowed new load to be met at low cost, by allowing coal plant to run closer to capacity.

When electricity demand growth stalled about 10 years ago, gas plant become even more valuable as a lower cost, lower risk investment than long load time coal. Gas plant could also fill the supply gaps as renewables started to penetrate the system. Given its centrality to the future development of the NEM, whether that future be dominated by coal, renewables or even nuclear, you would

[2] An interesting load management scheme implemented between the James Hardie Industries group of companies in response to this supply constraint is described in "Operations of a Large Industrial Firm during the NSW Electricity Supply Crises of 1982" available ***here***.

think that the east coast domestic gas supply would have been nurtured carefully.

But we didn't do that. Excited by the potential of recently proved up fracking technology, we approved and even cajoled a phalanx of new LNG export facilities in Queensland. Then, when the resource set aside for export proved less productive than hoped, we didn't let those speculative investors wear the problem, as capitalism theoretically requires. Of course not! Instead. we simply allowed exporters to raid domestic gas supplies.

Gas-fired generation plants in South Australia and elsewhere on-sold their gas contracts to exporters, causing reliability problems. Domestic gas customers both industrial and domestic suffered. Worse, gas disappeared as a credible electricity fuel supply option for the future.

Supply Side "Consolidation"

When Victoria reformed and sold off it industry, it broke up power stations into separate businesses and legislation prevented ownership of more than 20% of the Victorian market. Everything worked fine, although generators didn't earn what they hoped for. Break up was less enthusiastically pursued in the other states, but increased interconnection kept competition workable and prices at reasonable levels, at least for a time.

But states remained keen to sell their electricity assets at premium prices, or at least to draw premium revenues from them, so mergers became the order of the day, and then sale in some states. In the spirit that big business is good, we believed that bigger business is even better; that scale economies trump competition, every time.

While in acquisition mode, these businesses behaved themselves to keep the regulator off-guard and amenable to arguments about economies of scale. Eventually, though, when no more acquisitions appeared possible, they switched to money-making mode. In essence, the game was to get the wholesale price up and keep it up, and to let boofhead commentators blame it all on renewables.

To analyse this, one only needs to ask the obvious questions. Would Engie have closed Hazelwood if it didn't own Loy Yang A and gas fired generation in South Australia? Would AGL be shutting down Liddell if it was the only plant that it owned, when in fact it owns Bayswater next door and a raft of other generation assets that would benefit from Liddell closure? The logic is simple and the analysis is easily done.

Why did we let this degree of consolidation happen? The outcome was inevitable. These businesses chase profits just as lions chase down wildebeest on the African veldt, and crocodiles consume stray tourists in Kakadu; it's what they do! It's no use calling them greedy and threatening a big stick. They should never have been allowed to consolidate to that degree. Clearly, policymakers think of competition as a theoretical concept only, useful more as camouflage than practical policy. Consolidation or the prospect of consolidation acted to increase sale value.

Climate Policy Chaos

This topic has been written about at length but I will discuss it again from an historical, somewhat personal, level. The late 60s and early 70s was an era of environmental agitation I had a small part in that. Older types like me will recall the work of the Club of Rome and Paul Ehrlich, who foresaw a chaotic, resource constrained world just over the horizon. The counter argument was to promote liberal economics, expounded elegantly as I recall by our very own Australian Treasury and Industries Assistance Commission, whereby market forces would allocate resources in the economy wherever possible.

Where externalities were present such as pollution, we could devise a pricing mechanism to deal with them. Further, with a growing economy we could deal with all these environmental issues at very low cost; I recall Treasury being bold enough to estimate something like a 3-5% burden on the economy only. So we could easily resolve environmental issues using these tools.

Although bearing a green tinge, I absorbed this liberal argument. By the late 70s I was following the electricity spot pricing work of Fred Schweppe and his colleagues in the US, while working on promoting energy R&D for the Commonwealth after the oil crisis. On the environmental side I began to notice that, in many real situations, the relatively minor cost of achieving some environment goal was often resisted with extreme arguments. Outcomes were portrayed as economic devastation if the environmental course was taken; not at all the gentle nudge

in favour of the environment that Treasury had so eloquently argued!

One example was the route to be taken by the Moomba-Sydney Gas Pipeline. The planned route was through the middle of sensitive natural areas in the Blue Mountains. The original proponent, AGL in this case, argued initially that if this specific project was rejected, the benefits of natural gas wold be denied to the Sydney region. Of course, the reality was that an alternative, southern route that would cost $6 million extra and could do the same job. Eventually, this route was used (hence the bend) and gas became a competitive fuel in Sydney. Was it worth it? Opinions may differ, but we do have gas in Sydney and that part of the Blue Mountains remains pristine and a tourist drawcard.

We have seen the same scenario play out, but with a much, much worse result, with climate policy. John Howard was sceptical about climate change, but was persuaded that a "no regrets" policy could be prudent (and politically palatable at the time). He considered a carbon trading scheme – a carbon price. Eventually, this was implemented by the Gillard government, amid great controversy. The carbon price was painted as a tax and a dead weight on the economy, (the political message was much more crudely portrayed). This led to the downfall of the government and the eventual removal of the tax. Energy and climate policy has been in chaos ever since.

In my view, Gillard/Swan made a single, fatal mistake. Instead of applying the proceeds of the tax to keep down retail prices, for example by reducing network charges, they disbursed the proceeds elsewhere. This allowed the tax to be portrayed as a dead weight on the economy through higher electricity prices. It should have been set up and portrayed as a minor tweak to the relative prices of fuels seen by different generators. This change would have slightly advantaged gas and renewables and disadvantaged brown coal, with black coal essentially neutral. The size of the adjustment would not in itself have been enough to shut anything down, but it would have nudged new investment in favour of renewables and gas. It would have provided a strong argument not to continue renewable schemes, and left the door open for base load plant of any type going forward, including nuclear. Renewables would not be economic under this arrangement unless they could be supported by cost effective firming options.

Of course, we didn't do carbon pricing of any sort. We have instead big sticks and a pervading sense of aimlessness and confusion.

Technology Decay

This one is hard to describe. As an industry observer and contributor from the conception of the NEM through to implementation and to the present time, I have noticed a gradual attrition within AEMO, AEMC and the industry generally of the hard engineering and mathematical skills which are central to how the NEM operates. Whereas in 1998 one was most likely to meet people trained in Engineering, Maths, Physics and Statistics, in 2018 we are now much more likely to find Lawyers, Economists, PR Consultants, and PhDs in Renewable Energy.

While all these are good people no doubt, there appear to be gaps in the skill base. For example, in a matter I have been following recently, frequency control, AEMO does not have confidence in its understanding of how the AGC works and how it should be tuned, so its parameters haven't been adjusted for a long time, which affects the performance and security of the system. In this field it is also noticeable that Consultation Group discussion and thinking is restricted to minor tweaks of existing systems, when it is clear that whole procedures, in this case causer pays, are well past their use-by dates and need a complete re-think. In its recent Frequency Control Report. AEMC does not seem to have progressed the issue very far on the ground, despite a long period of work on the topic.

The cause is probably institutional. After the creativity required to establish the NEM, operations became more routine and less challenging in many respects. Further, there is pressure from industry and governments to cut costs and a philosophy of "if it works, don't fix it" settles in. In such an environment, many skilled and creative people will eventually move on and an organisation like AEMO loses memory of the basis of many of its systems and practices.

This process of decay is even evident in the Rules. In Version 01 of the original NEM rules, we have:

3.8.1 Central Dispatch

…..(f) *NEMMCO **must*** investigate from time to time:

(1) the scope for further development of the *dispatch algorithm* beyond the minimum requirements specified in clause 3.8.1(b); and

(2) the sufficiency of the *dispatch algorithm* in meeting the minimum requirements specified in clause 3.8.1(b),

and following compliance with the *Code consultation procedures*, submit its recommendations in a report to *NECA* no later than 2 years after *market commencement.*

NECA was the original NEM Code Administrator. By Version 89 and no doubt long before, the ***must*** above had been changed to ***may*** and such reports were no longer required.

Where To From Here?

The history of the NEM over past 20 years has been one of a bright and successful, even miraculous beginning, followed by a long period of decay and abuse that has delivered the current bedraggled NEM carcass. Worse, the public discourse is now focussed on peripheral matters such as whether or not we should remain in the Paris Agreement, which has nothing to do with the shambles we find ourselves in.

So much money had been wrung out of the sector by governments (and gas exporters) over the period that Angus Taylor has no hope of getting real results from his big stick. OK, he could devalue all the network assets to their true value, intervene big time in the gas sector to ensure cost effective local supply, bust up the gentailers and revitalise the technology base in AEMO and AEMC. But, hey! Is he really going to do those things? I think not. There will instead be smoke and mirrors and claims of superior price management, all delivered with astonishing chutzpah.

Longer term, when superficial short term measures are seen for what they are, governments will have to invest back into the industry quite a large part of what they have unscrupulously sucked out, or let be sucked out, over the past 20 years. With this in mind, I offer the following ***Nine Point Plan***. It has borrowed widely and will not be to the taste of all, but there aren't too many other options if a competitive electricity sector is the ultimate aim.

1. Implement a carbon price where the proceeds are used to reduce network charges. This approach ought to end the "big tax on everything" argument.
2. Do not renew the RET or RET-like policies and persuade the states to do likewise, or at least make them more market sensitive, given the carbon price now implemented.
3. Dynamic distribution network pricing to promote efficient local load management and storage technology trials should be designed and implemented as a priority. This option has been grossly neglected.
4. Government should intervene in the gas sector to ensure adequate supply for intermediate and peak gas generation over the next 10 years, say. Failing this, governments to subsidise gas prices to a practical level for intermediate and peak usage.
5. Governments should underwrite or build, own and operate marginal gas plants and storage plant (Snowy II may not stack up against local storage and GTs), pre-empting where possible any builds from existing large gentailers who own too many generator assets already. (These could be sold later to new generator firms if the market is competitive, which it isn't now – see point 9). Market operating rules should be at efficient market levels where practical.
6. Government(s) should set up and operate a not-for-profit retail business offering simple, low cost tariffs with minimal marketing and no gotchas.
7. If base load plant is required, ensure that it is either government owned and operated at cost, or underwritten by government for the benefit of a credible generator business that can increase competition. The choice and mix of baseload technologies (coal, nuclear, gas, renewables) should be deferred as long as possible.
8. Rebuild the technical capability of AEMO and AEMC and promote independent research into advanced market arrangements and system control.
9. Over time, the potentially competitive assets could be sold off in a way that maintains competition. This approach should be legislated to ensure efficiency objectives are not corrupted.

These measures should eventually lead to a more competitive sector with an appropriate plant mix for efficient, reliable and climate-friendly operation.

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