The Australia Institute

Research that matters.

Briefing Note

20 March 2014

Debunking *Solving for 'x'* – The NSW Gas Supply Cliff

Introduction

This week energy company AGL released a research paper entitled Solving for 'x' – the New South Wales Gas Supply Cliff[1]. The paper contains plenty of economic terms and algebra, but these merely serve to provide camouflage for another reiteration of the gas industry's claims – that NSW is running low on gas and the only way around this is the development of coal seam gas (CSG) projects, such as AGL's project in Gloucester.

The Australia Institute's research has shown that these claims are untrue and self-serving.[2] The Australian east coast gas market is experiencing rapid price rises not because there is a shortage of gas, but because the gas is to be exported through new export facilities to world markets. Gas is going to overseas customers prepared to pay more. Development of controversial CSG projects will do almost nothing to change this situation. They cannot change world prices. There is plenty of gas, NSW consumers will just have to pay the world price for it.

CSG projects are facing great resistance from local communities concerned about potential environmental and social impacts on their areas. Partly because of this resistance development of gas supplies has been slower than gas companies expected. This is a problem as they have already contracted to sell gas that they now cannot supply. Rather than addressing community concerns, the gas industry has manufactured a "gas crisis" and now a "supply cliff" which they are hoping will scare the public and policy makers into making decisions which suit the gas industry.

The AGL paper is the latest attempt in this scare campaign. This is obvious if one can understand the jargon which the authors have used. Below is the opening paragraph of the AGL paper and our translation for non-economists.

Original Abstract

On Australia's east coast over the period 2013-2016, we forecast that aggregate demand for natural gas will increase three-fold, from 700 PJ to 2,100 PJ per annum, while our forecast of system coincident peak demand increases 2.4 times, from 2,790 TJ to 6,690 TJ per day. This extraordinary growth is being driven by the

1 http://aglblog.com.au/wp-content/uploads/2014/03/No.40-Solving-for-X-FINAL.pdf

2 http://www.tai.org.au/content/fracking-future

development of three Liquefied Natural Gas plants at Gladstone, Queensland. Almost simultaneously, a non-trivial quantity of existing domestic gas contracts currently supplying NSW will mature. Much of that gas has been recontracted to LNG producers in Queensland – thus creating a gas supply cliff in NSW. Compounding matters, recent policy developments have placed binding constraints over the development of new gas supplies in NSW. In this article, we present our dynamic partial equilibrium model of the interconnected gas system and produce forecasts with daily resolution. We find that absent additional supply-side development, unserved load events will remain more than a theoretical possibility due to inter-temporal spatial constraints…

Translation

On Australia's east coast over the period 2013-2016, we forecast that gas companies will begin to export enormous quantities of gas to Asia. This will triple the demand for gas in the east coast gas market and the gas industry will sell to its new Asian customers at prices three times higher than the historic Australian east coast price. At the same time some industrial gas users in Australia are needing to re-negotiate their gas supply contracts. Unfortunately for them, gas companies have promised to sell more gas to Asia than they have the ability to actually supply. Rather than disappoint their new Asian customers, some gas companies are telling their Australian customers that they can't have the gas they need, using emotive terms like 'gas supply cliff'. Part of the problem for the gas industry is that the NSW government has acted on community concerns about CSG and restricted gas extraction near homes and farms. In this article we present the opinions of the gas industry underneath some algebra that most people find incomprehensible. We make a wide range of assumptions designed to generate findings which will scare the public and policy makers. We talk about things like 'dynamic partial equilibrium' and 'forecasts with daily resolution' to make our assertions seem scientific but we don't discuss why energy industry analysts like us have been so unsuccessful in predicting the demand for energy in Australia in the last five years. We find that there is no prospect of households or small businesses running out of gas, however the idea that some industrial gas users will either have to use less gas or pay a lot for it remains "more than a theoretical possibility". Did we mention the 'supply cliff' yet?...

Overview

The AGL paper uses seemingly complicated economic modelling to conceal a simple truth. The gas industry in Australia has overinvested in liquefaction and export capacity at Gladstone and, as a result, it is desperate to export as much gas as it can, as quickly as it can, especially as the industry fears that if the US begins to export gas the world price will fall and the returns on their investments in Gladstone will be even lower than originally promised. AGL's own economists state "The

relevant results are illustrated in Figures 27 and 28 and show that, with the benefit of hindsight, the potential for unserved load in NSW could have been eliminated"
Further, the AGL paper argues that the short term spike in wholesale gas prices associated with linking the east coast gas market to the world market will be even greater than previously feared. That is, while the Australia Institute has previously argued that linking the east coast market to the world market would see Wholesale prices rise from around $3 Gj to $9 Gj the AGL paper now argues that the price is likely to peak at $11.20.

However, rather than discuss the economic impact of the tripling of the wholesale price of gas that is associated with the plans to export huge quantities of gas the paper focuses instead on the risk that some gas users may experience difficulty buying gas on some days due to the industry's determination to export as much gas as possible.

Further, rather than discuss the impact of gas prices increasing three-fold on the profits of the gas industry, the paper attempts to argue that the boost in gas production of three times current levels is inadequate to meet the demands of NSW gas users. The only way for existing gas customers in NSW to expect secure gas supply, according to the report, is for an even larger volume of gas to be extracted. While the first 1500 petajoules of additional gas production are 'earmarked' for the export market, NSW can only avoid going over the 'gas supply cliff if an additional 60 petajoules can be extracted, then NSW can avoid the 'gas supply cliff'.

Finally, not only is the paper silent on the economic costs to the wider economy of wholesale gas price increasing three-fold, but it tries to emphasis the potential economic benefits of restricting those price rises to a 2.99-fold increase by seeking to focus the reader's attention on the trivial 'downward pressure' that further increases in gas supply may have on the new 300 per cent higher prices.

Assessment and Selected quotes

The authors of the AGL report concede that the industry's massive and rapid expansion is unprecedented:

> P.1 "We are unaware of any mature, large-scale national energy markets experiencing a three-fold increase in aggregate demand in such a short period of time."

The authors confirm that the Gladstone LNG facility will cause a 300 per cent increase in wholesale gas prices – far greater than the carbon price and no compensation is to be given to exporters:

> P.2 “Not only would it result in the rapid expansion of aggregate demand, but would also have the benefit of linking domestic gas prices, historically ca$33 per gigajoule (/GJ), to the north Asian export market price of ca$6-9/GJ equivalent ex-field ‘netback price’ over the medium term”

While the industry denies that the LNG exports are the cause of big price rises the AGL economists gloat about the success of the strategy:

> P.2 “The practical evidence is that this strategy has worked. Forward gas prices have risen beyond the top-end of this range, and aggregate demand is now trending towards 2,100 PJ/a.”

The AGL authors concede that the industry’s inability to meet its desired level of gas exports and required level of domestic demand is the industry’s fault:

> P.2 “The energy industry grossly underestimated community sentiment”

> P.2 “A dispassionate assessment could only conclude that the industry’s initial response to community concern was entirely inadequate.”

The authors’ comments and modelling seem to downplay the role of price in rationing demand:

> P.3 “Our principal focus is not to present forecast gas prices by node, but rather, to examine the issue of energy security.”

A central premise of economic theory is that price is used to ration scarce resources. The model used by AGL however, focuses on supply constraints and downplays the role of price in both reducing demand and allocating gas between users willing to pay the highest price. The following quote highlights that the authors have ‘notionally allocated’ huge volumes of gas to the export market because of the ‘corporate strategic targets’ of gas companies. If we assume that the ‘corporate strategic target’ is profit maximisation then gas companies will sell to the highest bidder not stick to ‘notional allocations’. Italics in original:

> P.5 “A key issue facing the market for natural gas is how these 2P reserves are notionally allocated, that is, with an ‘export-market bias’ or a ‘domestic market bias’. As Figure 4 highlights, *ca*80% of existing 2P reserves are *notionally* allocated for export to North Asian markets in the form of LNG cargoes as they are owned by market participants with financial obligations (or corporate strategic targets) to supply LNG. While price rather than reserve ownership will be the ultimate determinant of how gas flows within the east-

> coast interconnected system, Figure 4 tends to indicate that *ceteris paribus,* the default directional flow for a majority of gas will be to LNG loads."

The authors say they are interested in 'market dynamics' but they have already said they are not interested in modelling price. Again, economists usually think that price has a role to play when scarcity exists:

> P.6 "In this article, our primary interest relates to how the market for natural gas will dynamically adjust during the period in which LNG facilities commence their production run-up and simultaneously various long-dated gas supply contracts in NSW mature."

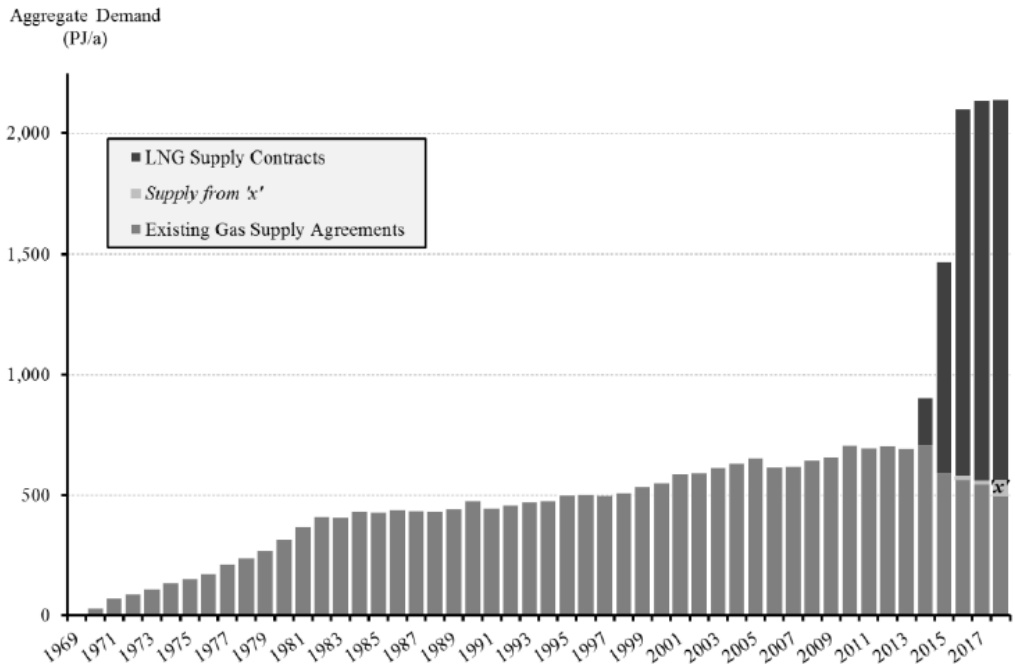
The authors tell us that 'resellers' of gas like AGL are required to recontract their gas supply in the next 4-5 years but that gas fired power stations have locked in the old $3 price and have an average of 11 years to run on those contracts. What that means is that gas fired power stations will be able to onsell their cheap contracted gas to any industrial user in Sydney that is willing to pay a price high enough to convince a gas fired power station to shut down temporarily. This eventuality has already happened in Queensland with Stanwell selling their gas and restarting a coal plant.[3] The ability to do that fundamentally detracts from the 'supply cliff' argument. While the paper seems to assume a reduction in gas used for electricity generation, AGL's authors do not discuss it in much detail.

> P.7 "These supply agreements can be further broken down into 'reseller agreements', 'power station agreements' and 'industrial supply agreements'. Reseller contracts range from 2-20 years in tenor with an average term-to-maturity of 12.1 years. Pricing for this otherwise homogeneous commodity on a unity-load factor basis spans the range of *ca*$3/GJ for contracts written in the mid-2000s all the way through to contemporary oil price-linked contracts with values as high as *ca*$10/GJ. Annual contract quantities vary considerably, from as low as 1 PJ/a to more than 100 PJ/a with an average contract quantity of 18.4 PJ/a. However, while the average contract could be thought of as 12.1 years in tenor with a contract quantity of 18.4 PJ/a and a market value of *ca*$6-9/GJ, the maturity profile of existing contracts is highly congested. The average term-to-maturity for reseller contracts as at 2013 was just 4.7 years on a volume-weighted basis. Our database of gas supply agreements to power stations displays pricing trends reflective of their earlier commencement, with substantially longer tenors and an average term-to-maturity of 11.7 years. This is not entirely surprising given that one of the constraints associated with the development of project financed gas-fired power stations is a secure, long-dated fuel supply contract.

3 http://www.brisbanetimes.com.au/queensland/swanbank-power-station-to-close-for-three-years-20140205-321m6.html

The following graph shows how trivial the 'supply cliff' is in the context of the massive increase in gas supply and, in turn, gas exports. The tiny *X* in the middle of the last column is what the whole paper is about. (Arrow added for clarity)

Figure 7: Aggregate gas demand vs. aggregate gas supply – 1969-2018*f*



Source: AGL 'Solving for 'x' – the NSW Gas Supply Cliff', p8

The AGL paper argues that there are 'physical limits' to the ability to supply NSW with gas (see quote) but these physical limits only bind when the physical infrastructure is being used to ship most of the gas to the LNG plants.

> P.8 "The issue facing policymakers is that even under ideal operating conditions, there is insufficient gas production, pipeline and storage capacity during the height of winter to meet system-wide peak gas demand, particularly during working weekdays when diurnal patterns reach their maximum."

Bizarrely, the paper argues that temporary gas price spikes will be bad for employment when the whole premise of the paper is that gas prices will rise three-fold. They focus on the "short run" impacts of the gas supply 'cliff', but are silent on the long term impact of tripled gas prices:

> P.9-10 “And so gas-intensive industrial users in the NSW region who have supply contracts maturing over the 2016-2017 period will face one of three general options during an episode of scarcity; (1) pay a substantially higher price for natural gas supply; (2) cease trading; or (3) reduce production. Under these general conditions, it is difficult to imagine employment levels associated with NSW manufacturers being completely unaffected in the short run.”

Safe in the knowledge that few policy makers will read more than the press release, the AGL authors stress:

> P.10 “At this point we would caution readers not to draw alarmist conclusions about the likely state of the broader economy. While ABS data reveals that the NSW manufacturing sector has *ca*185,000 employees, not all manufacturers are gas-intensive, and manufacturers that are gas-intensive (and therefore at risk) will invariably represent a small share of total national employment.”

However, having said that they don’t want to be alarmist they then include some alarming numbers about job losses associated with temporary plant closures. Again, no discussion of the impact of long term higher prices for gas. Perhaps that is because only ‘supply cliffs’ generate ‘alarming’ plant closures, closures relating to long run gas profits are far less alarming.

> P. 10 “As Burgan and Spoehr (2013) and Brain (2013) explain in the manufacturing case, during the first quarter after plant closure, job losses stood at around 6,500 but over the four years following swelled to almost 12,000 with much of this occurring in three suburbs.”

In a footnote on page 10 the authors concede that a reviewer of the paper highlighted that:

> “employment impacts in NSW are more likely to be dispersed and transient in nature”

One of the important assumptions is that there will be no new investment in gas in NSW in the next four years. None.

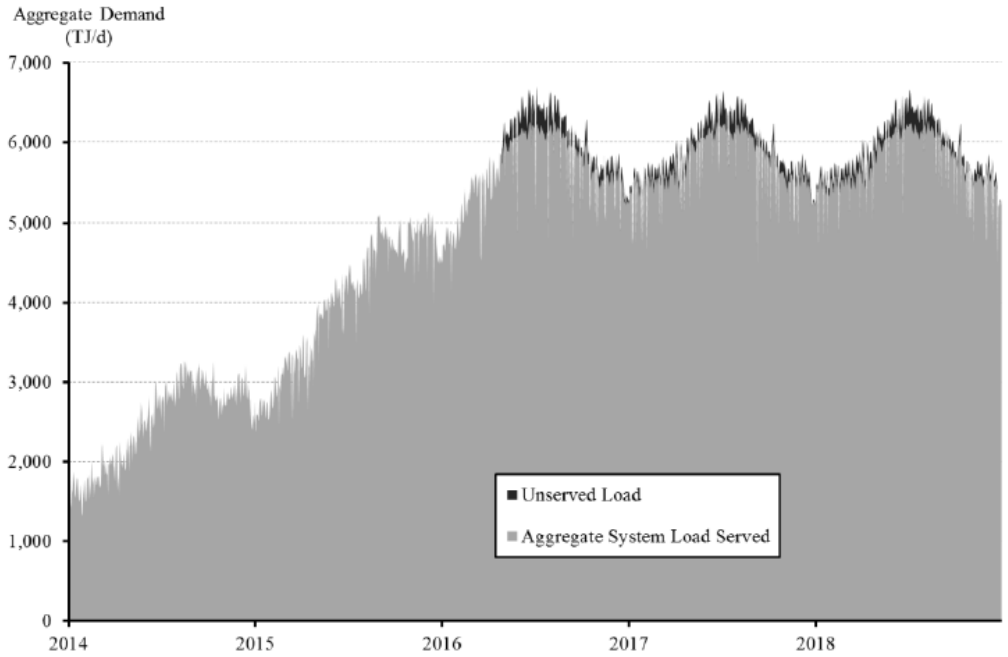
> P.18 “However, we specifically assume no new investment in infrastructure or field development occurs within NSW which enables us to establish a suitable *business as usual* baseline while meeting the objective function set out in equation”

Figure 16 shows that the real problem is that the industry built too much export capacity. In the words of the AGL authors:

> P. 18 “LNG fleet unserved load, which are evident from inspection of Figure 13, occurs from April 2016 and continues to occur most days of the year. These shortages coincide with the commissioning of the sixth and final LNG train”

In other words, as soon as the sixth train comes on, the problems begin.

Figure 13: GPEM base case model results for the five year period 2014-2018



Source: AGL ‘Solving for ‘x’ – the NSW Gas Supply Cliff’, p19

Further:

> P.19 “Based on our aggregate supply assumptions, total LNG fleet demand is unable to be met as Figure 14 clearly illustrates. Shortfalls occur for more than 330 days per annum (i.e. 90% of the year) and by as much as 250 TJ/d with a median shortage of 130 TJ/d.”

The authors concede that the market can, does, and has solved ‘supply cliffs’ before but then dismiss the significance of this by saying that because they can’t predict what the actual form of the market contractual forms would be, we shouldn’t rely on them:

> P.25 "To the extent that any residual shortfall may exist in NSW, we would expect LNG producers, gas-fired power stations, gas shippers and large industrial consumers to initiate a series of transactional swaps and options so that NSW demand and supply clears without the need for emergency intervention by the NSW Minister for Energy. Indeed, gas sales contracts with embedded summer season 'call options' exist between power stations and LNG producers.[33] However, in our opinion predicting participant behaviour under extreme energy market conditions is difficult at best. And so if such transactions are insufficient, or peak demand is higher than the market anticipates due to extreme weather events, coordinated supply curtailment in NSW will be invoked to forcibly solve for *'x'* in 2016 – as occurred in NSW during the winter of 2007."

Footnote 33 in the above tells us:

> "Specifically, certain gas-fired power stations will substantially reduce their output once the LNG terminals commence their ramp-up and on-sell their fuel supplies to the LNG producers. The power station will retain an ability to re-call some component of the fuel during the Q1 Summer period each year (i.e. to meet summer peak loads in the electricity market). Due to the confidentiality of such arrangements, we are uncertain as to whether call options also cover the domestic winter peak loads of industrial gas consumers."

The authors talk of price induced reductions in demand as 'demand destruction'. This is not what most economists would call the rational response to a price increase.

Further evidence the paper's narrow focus on supply not price is on P.26:

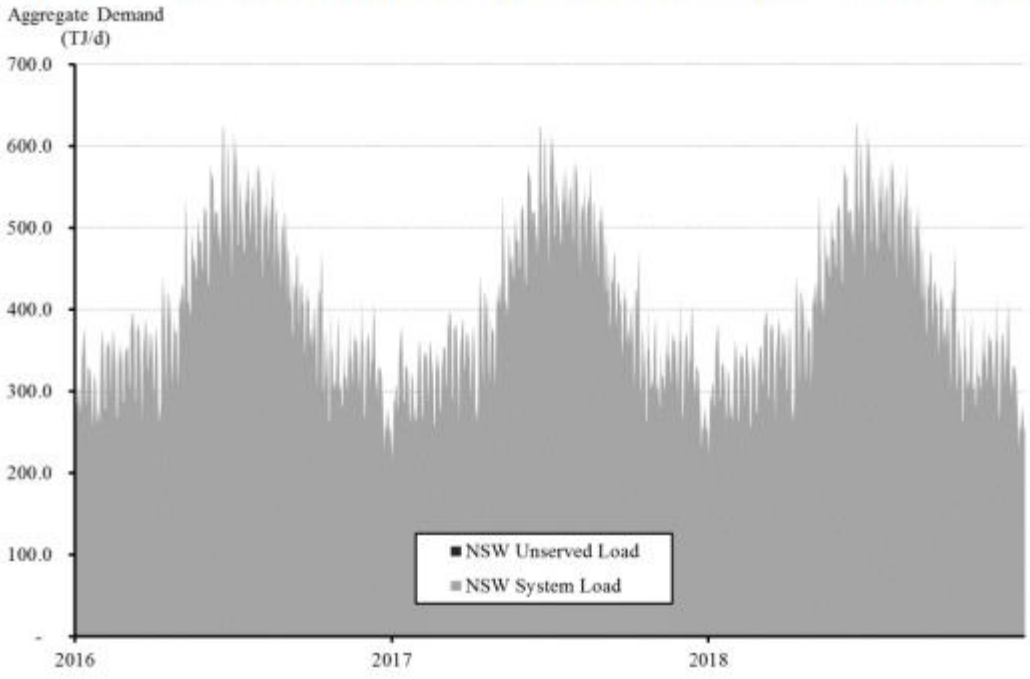
> P.26 "Above all, our GPEM Model cannot solve for *'x'* in NSW in the absence of demand destruction or unserved load,
>
> Our supply-side analysis must therefore turn to what is possible inside our NSW boundary constraint from 2017"

Again the authors are clear that the problem has been caused by excessive investment in LNG capacity:

> P.28 "The relevant results are illustrated in Figures 27 and 28 and show that, with the benefit of hindsight, the potential for unserved load in NSW could have been eliminated."

Figure 28 shows that there is no 'unserved load' if the sixth train does not go ahead:

Figure 28: GPEM model results NSW (with sixth LNG train delayed) - 2016-2018



Source: AGL 'Solving for 'x' – the NSW Gas Supply Cliff', p29

The authors make clear that they have assumed that the profits of the LNG industry should be placed ahead of the manufacturing industry:

> P.30 "In our GPEM model, which seeks to maximise welfare, the burden of unserved load was borne by industrial consumers in NSW and the LNG fleet in Gladstone"
>
> P.30 "Our model results do not envisage households or small businesses experiencing energy shortages in any region at any time. The burden of unserved load events could, in theory, fall entirely on the LNG producers. But in our view this is unlikely. Putting to one side LNG commissioning commitments, LNG plant minimum load constraints, LNG contract obligations, the imperfect substitutability of physical and financial LNG cargo delivery and the fact that two of the three Gladstone producers (GLNG and APLNG) will be keen to establish their credentials37 as reliable LNG suppliers"

Conclusion

The AGL paper, ‘Solving for ‘x’ – the NSW Gas Supply Cliff’, sets about making a simple situation seem complex. You do not need to understand algebra or dynamic partial equilibrium modelling to understand that the new export facilities mean prices are going up. In their rush to cash in, gas companies have forward sold too much gas, promising more than they can deliver. Rather than taking the blame for these price rises and any resulting job losses, gas companies are using the “crisis” to claim the need for “supply-side development”, ie gas projects that communities are opposed to.