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10th August 2020

Narrabri Gas Project

We object to this project, and would like to provide detailed comments to the Independent Planning Commission.

Recommendations

- The global warming impact over a twenty-year time period of methane should be used when deciding to approve new methane projects
- Methane leakage rates from mining, transmission, and distribution should also be considered
- Improvements in electric heat pumps and induction cooking mean that gas is no longer necessary within residential buildings and many commercial and industrial buildings.
- The expected extremely low cost of wind and PV will likely outcompete most gas options in the near future – decisions should be made with this fact in mind.

Please do not hesitate to contact us to discuss any of the information contained within this report.

Global warming impact of gas

Methane has 34 times the global warming impact of carbon dioxide over a century. If the time frame is shortened to just 20 years, it has **86 times the impact of carbon dioxide** [1]. This is because methane is converted to carbon dioxide via oxidation, generally within 12 years [2].

However, in an article published in May 2016, the National Greenhouse and Energy Reporting website explains that the Global Warming Potential (GWP) used in Australia for methane is 25, based on the findings of the Intergovernmental Panel on Climate Change's Fourth Assessment report [3], shown in Table 1 below [4]. These are for a 100-year period (denoted below by GWP_{100}).

Table 1: Global Warming Potentials for 100 years from the National Greenhouse Accounts Factors – August 2019 [4]

Gas	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

This GWP is specified in the National Greenhouse and Energy Reporting Regulations 2008 legislation in Regulation 2.02. It is currently being reviewed, and the GWP_{100} is likely to be increased to 28, in line with the IPCC's Fifth Assessment report (although it should be noted that this report lists the GWP_{100} for fossil methane as 30) [5][1].

Australia, along with 188 other countries, has ratified the Paris Agreement [6]. We are bound to mitigate "the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius" [7]. A widely recognised goal is to reach zero net emissions in 2050, if not before. If we are to limit warming to these levels, the **shorter-term impacts of pollutants should be given more weight** [8].

Fugitive emissions

Estimated fugitive emissions account for 11% of Australia's total greenhouse gas emissions. They "occur during the production, processing, transport, storage, transmission and distribution of fossil fuels. These include coal, crude oil and natural gas". Estimated fugitive emissions grew by 6.1% in the year to September 2019, and represented the biggest sectoral change in greenhouse gas emissions [9].

[1] For more information on inconsistencies in GWP reporting and classification please see page 14 of [1].

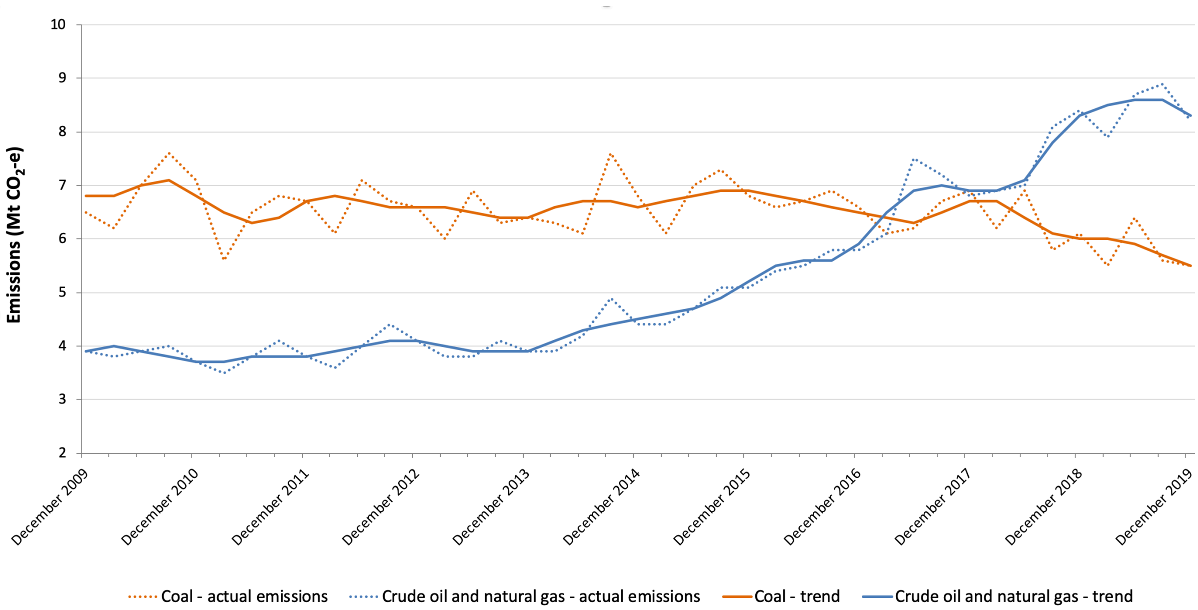

Figure 1: Fugitive emissions, actual and trend, by sub-sector, by quarter from September 2009 to September 2019 [9]

Recent research published in the journal Nature showed that anthropogenic emissions of methane are 25-40% higher than previously assumed [10]. Methane leaks from oil and gas operations can be difficult to control and monitor [11]. Satellite monitoring of methane is a relatively new tool that has already come to some startling conclusions: for examples, an accident at a fracking site in Ohio "released more methane than the reported emissions of the oil and gas industries of countries like Norway and France", and substantially more than was estimated by the site's owner [12].

Rather than require the measurement of fugitive emissions from mining projects, our system simply estimates them using a leakage rate factor:

> *Current greenhouse gas inventory estimates for fugitive emissions in Australia assume a much lower leakage rate of 0.48% (without venting or flaring) and 0.59% (with venting and flaring) than current international estimates. The Northern Territory Scientific Inquiry into Hydraulic Fracturing has expressed concern that present inventory estimates appear too low, stating "These values underestimate field based measurements, which range from 1.6 - 1.9%. Further research is required to better understand the differences between these inventory and field based estimates". The International Energy Agency estimate a global average methane leakage rate of 1.7%* [13]

Regulation of methane leakage in the gas sector must be well managed to ensure the industry has a low global warming impact. Methane can only be considered a low emissions technology if leakage rates are low. Above a certain threshold, there is no climate benefit in replacing a coal-fired power station with gas. Researchers in the US and Australia have pegged this figure at 3% leakage [1] [14] [15].

To the best of our knowledge, thus far ***there has been no "comprehensive, rigorous, independently-verifiable audit of gas emissions"*** [1]. There has also been no requirement for baseline testing for Australian gas mining sites. Methane can migrate from a coal seam gas without human intervention, but also due to the seam being dewatered. Without baseline monitoring we cannot attribute the emissions to the mining activity [1].

Methane leaks during transmission – the factors used to determine emissions from transmission pipelines in Australia can be seen in the Table below:

Table 2: Natural gas transmission emission factors from the National Greenhouse Accounts Factors – August 2019 [4]

Operation or process source	Emission factor (tonnes CO_2-e/km pipeline length)	
	CO_2	CH_4
Natural gas transmission	0.02	10.4

Source: National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Section 3.76).

Methane leakage is also a problem for distributional infrastructure. For example, a study investigating major cities in the United States (in total comprising 12% of the country's population) found that human activities resulted in the release of more than double the mass expected by the US EPA [16]. The factors used for each State in Australia are shown below.

Table 3: Natural gas distribution infrastructure leakage factors from the National Greenhouse Accounts Factors – August 2019 [4]

State	Unaccounted for gas *(%UAG)*	Natural gas composition factor (tonnes CO_2-e/TJ) *(C)*	
	UAG	CO_2	CH_4
NSW and ACT	2.2	0.8	390
VIC	3.0	0.9	388
QLD	1.7	0.8	377
WA	2.9	1.1	364
SA	4.9	0.8	390
TAS	0.2	0.9	388
NT	2.2	0.0	314

Source: National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Section 3.80).

Methane leaks from transmission and distributional equipment should be carefully considered before deciding to continue to use this fuel and infrastructure. As will be shown in the section below, new all-electric appliances and resilient local electricity networks can outcompete methane on cost for consumers, on resilience, and on global warming potential.

We don't need gas

Cities around the world are beginning to switch off the gas:

> *Around 30 cities in California have passed building codes that reduce their reliance on gas… the most recent being Santa Cruz, which in March passed an ordinance to "eliminate natural gas infrastructure and associated greenhouse gas emissions in new buildings where all-electric infrastructure can be most practicably integrated."* [17]

> *The United Kingdom Committee on Climate Change recommends that by 2025, no new homes should be connected to the gas grid. The Netherlands, which is situated over one of the largest gas fields in the world (now depleted), recognises the need to decarbonise 1100 homes (on average) every working day from now until 2050.* [18]

The ACT is also moving to phase out gas connections to households [19]. Electricity is cheaper for heating water and air and for cooking in residential buildings and even with a higher purchase price, electric appliances have a lower total cost of ownership than gas [20] [17]. If a new home is all-electric instead of connected to the gas network, the owners save between $9-16,000 over the first decade [21]. (Energy security in areas with higher rates of black outs does need to managed, for example with community microgrids.)

In response to the AEMO 2019 Gas Statement of Opportunities, which suggested that a severe shortfall in the supply of gas to Victoria would occur from 2024, the consultancy Northmore Gordon was commissioned by Environment Victoria to determine whether gas demand could be reduced. The forecast shortfall is expected to be 26 to 85 PJ annually – demand-side savings of 98 to 113 PJ annually were found. Reverse cycle air conditioners can be used to effectively warm houses. Hot water heat pump technology has progressed to the point that previous issues with low temperatures are no longer a problem. Induction cooktops are now just as responsive as gas, and twice as efficient. Households are now far better off in an all-electric house. The modelling was quite conservative, in that only the ducted gas systems that are older than 20 years were replaced with air conditioners [22]. With the right policies, Australia could have a decarbonised housing fleet by 2050.

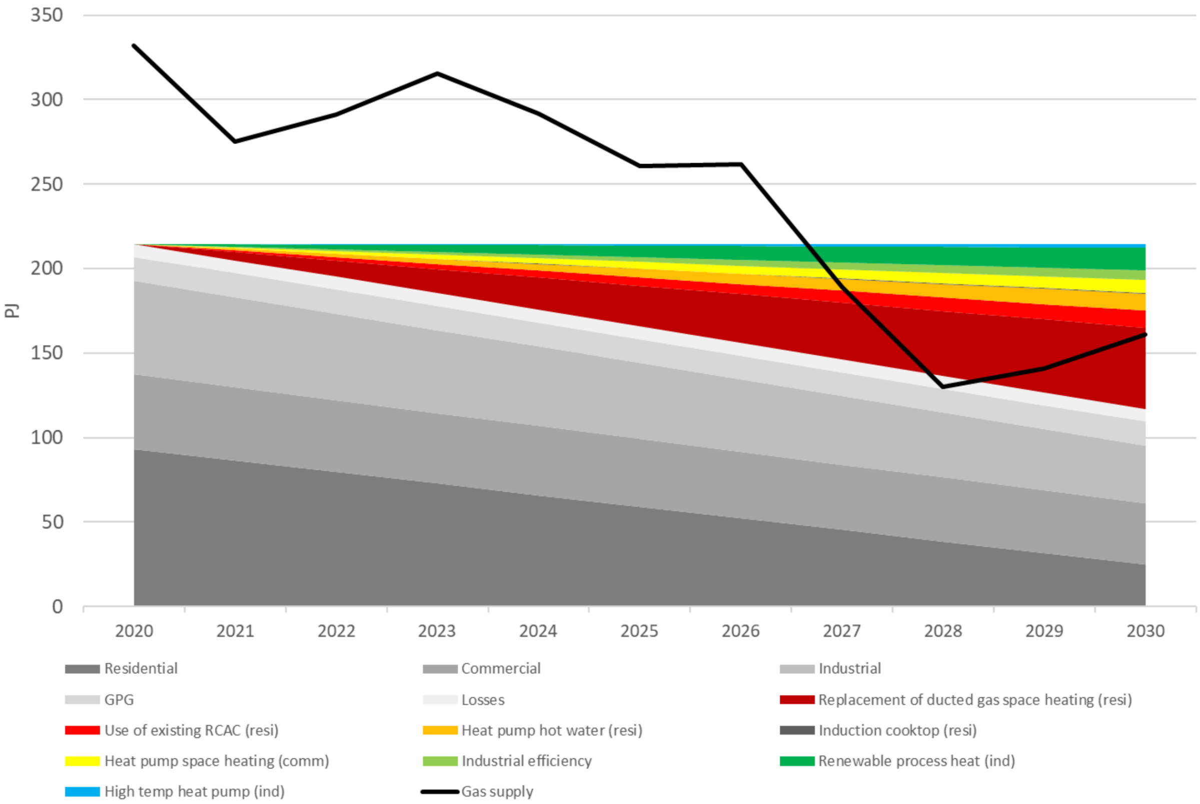

Figure 2: Gas demand reduction by sector and reduction means [22]

The Beyond Zero Emissions *Electrifying Industry* report [23], the WWF and EY reports *Delivery economic stimulus through renewables* [24] and *Australian renewable export COVID-19 recovery package* [25], the ClimateWorks *Decarbonisation Futures* [26], and many more provide roadmaps on rapidly reducing our dependence upon methane and other fossil fuels.

Gas appliances also impact indoor air quality. According to Asthma Australia, “Scientists have found that around 12 per cent of childhood asthma in Australia can be attributed to the use of gas stoves for cooking” [27].

Future solar will likely cost $30/MWh

The following is a quote from the recently published article *Technology leaps driving cost of solar PV electricity in Australia to just A$30/MWh:*

> *The cost of solar photovoltaics (PV) electricity in Australia in 2030 is on track to be about A$30 per Megawatt-hour (MWh). This conclusion arises from current trends in PV module efficiency and cost. Importantly, $30/MWh is below the operational cost of most coal and gas fired power stations. ... This price is also competitive with industrial gas heating.*
>
> *The use of gas for industrial heat is under threat because $30/MWh is equivalent to $7 per Gigajoule assuming a gas burning efficiency of 85%. Access to cheap energy changes economic drivers.* [28]

This projected fall in the cost of solar photovoltaics has serious implications for the bankability of the Narrabri gas project.

Gas in the National Electricity Market

Renewable electricity (wind, solar and hydro) has increased from 16% in 2017 to 26% today in the National Electricity Market, which covers three quarters of Australian electricity generation. Brown coal declined after the retirement of the Hazelwood power station, and black coal is in long-term decline. Already-committed projects (CER) mean that renewables will pass black coal in 2022-23 when Liddell closes.

Gas is used during peaking periods, and its generation share is unchanged at about 9% (Figure below).

Plainly gas is not being ramped up to balance the rapidly rising fraction of renewables.

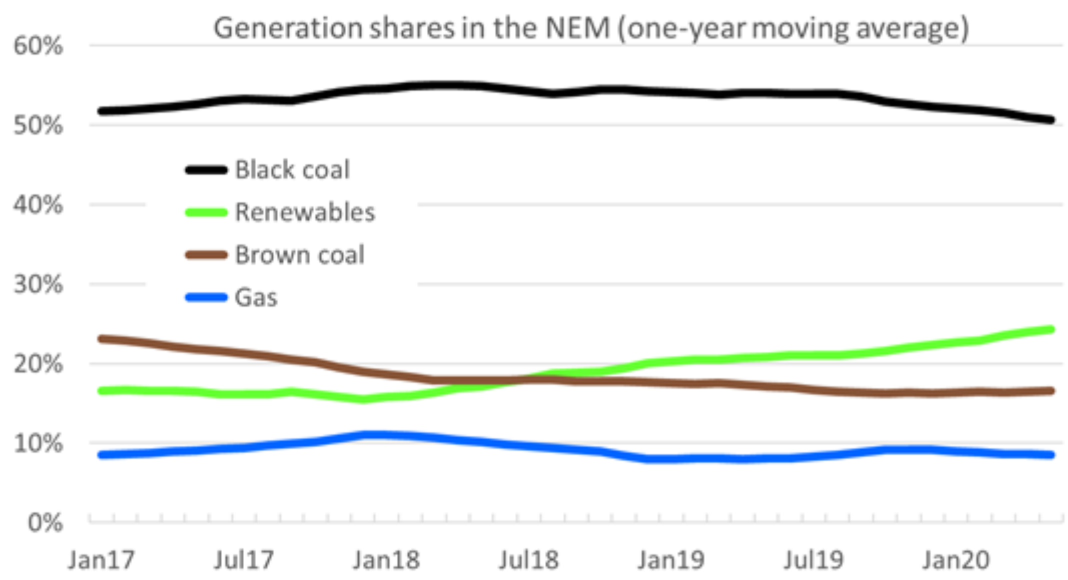

Figure 3: One-year moving average generation shares in the National Electricity Market

Gas is merely one of 8 methods available to balance higher levels of variable solar PV and wind:

1. Stronger interstate transmission to smooth out local weather

A new interconnector will soon be constructed between South Australia and New South Wales. This will allow increase renewable build in South Australia with greater ability to trade electricity with other states rather than use expensive gas for generation. Stronger transmission connection between the states is key to both our 100% studies and the ISP. This is a more important investment direction.

The Tas Hydro whitepaper shows that electricity in Victoria will be cheaper with a good connection to Tasmania through the Marinus Link build (Bass Link 2.0) and access to Tasmanian hydro rather than to use gas to replace coal, even with lower gas prices.

2. Installation of BOTH PV and wind to take advantage of counter-correlated output
3. Demand management
   Shifting energy use to times of excess energy – e.g. water heating in the middle of the day. This is a lower cost approach
   ARENA has been supporting many projects developing these opportunities.
   Powershop has run demand management activities for residential customers in Victoria and rewarded them for cutting consumption during crucial times. Amber Electric charges wholesale rates and provides information on renewable generation so that customers can avoid periods of higher coal and gas generation. They are also working towards a program called SmartShift, which will shift customer demand from pool pumps, hot water systems, EVs and more to charge during periods of low wholesale cost, and high renewables penetration.
4. Utility and community batteries
   In the short term, the primary storage needed to support increased renewable energy is to manage frequency and short term power deficits. The Hornsdale Power Reserve (Big Tesla Battery) has been extremely successful in providing rapid response to variations in supply and demand.
5. Pumped hydro energy storage including Snowy 2.0 and Tasmania Battery of the Nation
6. Electric vehicle batteries
7. Load-following black coal
   Black coal is regularly used for load following. Existing coal will provide significant flexibility in the system, until they retire, at much lower cost than gas.
8. Gas peaking plant

It would be unwise to pick gas as a winner. The best approach is to let the market sort it out.

Flexible demand

In order to ensure stability, the electricity grid needs new, flexible load. The chart below shows the new normal in South Australia during Spring and Autumn, when demand is low. Rooftop solar generation is plentiful and has reduced total midday demand [29]. Without management, this could create problems. New load that can be deployed flexibly could soak up this generation. Demand management through electric vehicle charging is an ideal candidate. Where possible, charging should be performed during the hours around midday, but at any time it can be controlled and interrupted in order to support grid stability. This is important as more wind and solar PV come online.

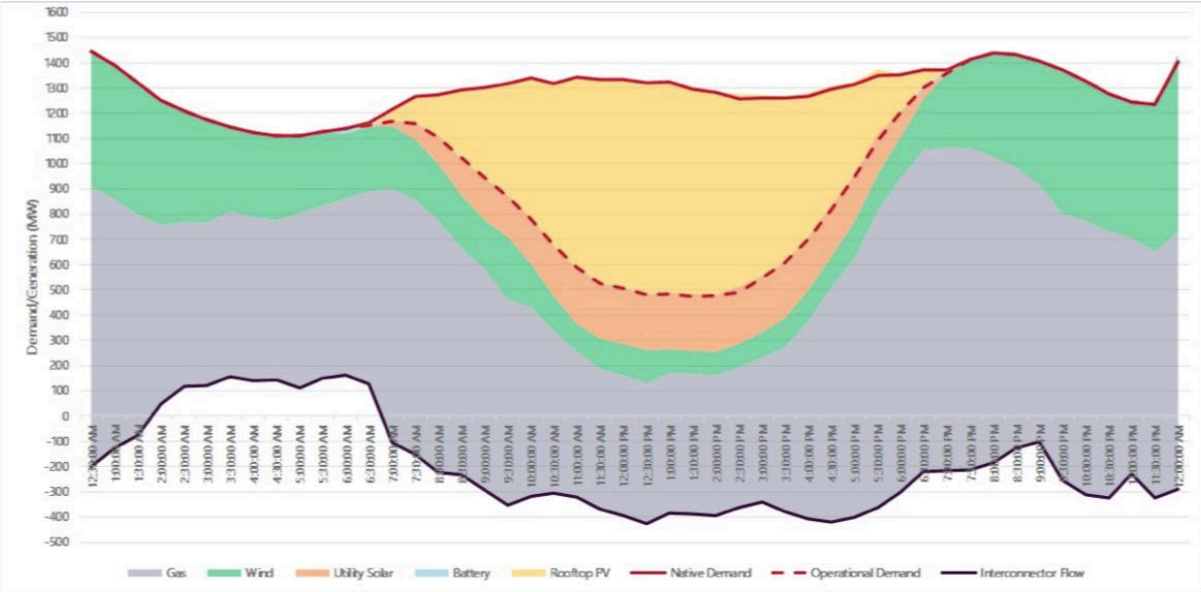

Figure 4: South Australian grid generation for Sunday 20th October 2019 – showing the operational demand (red dotted line) which represents a new low on the system [29]

As an example, consider that 66 066 GWh was generated in NSW in 2014 [30]. In order to use batteries to electrify all of the buses in the State, just 900 GWh would be needed each year – which represents 1.4% of current electricity consumption. (This calculation was performed using data from the Australian Bureau of Statistics [31], which includes those buses which travel longer distances. These would probably need to be electrified using hydrogen fuel cells rather than battery technology). Electrifying transport would remove local air pollution, and provide the grid with more flexible demand.

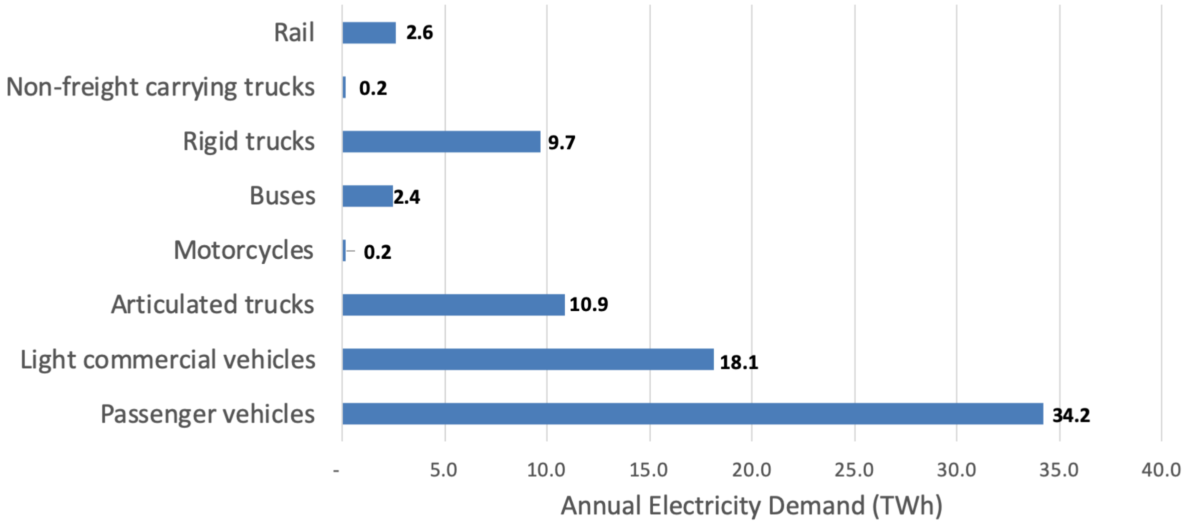

Figure 5: Additional electric load added by each mode of transport within the National Electricity Market

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