Climate Council of Australia

Submission to: The Scientific Inquiry Into Hydraulic Fracturing in The Northern Territory

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About the Climate Council

The Climate Council is an independent non-profit organisation that provides authoritative, expert advice to the Australian public on climate change.

To find out more about the Climate Council's work, visit www.climatecouncil.org.au

Executive Summary

Human activities, such as the burning of coal, oil and gas for electricity, are driving up greenhouse gas emissions and a long-term warming trend. Consequently, climate change is cranking up the intensity of extreme weather events in the Northern Territory and elsewhere in Australia, such as heatwaves, bushfires and coastal flooding. The impacts of extreme weather events will likely become much worse unless global greenhouse gas emissions are reduced rapidly and deeply.

In ratifying the Paris Agreement, Australia committed to rapidly reduce our carbon emissions, transitioning to zero emissions before 2050. Despite this pledge to tackle climate change, Australia's emissions continue to rise, particularly from its largest source – the electricity sector. Furthermore, while some have argued that additional gas resource development is essential to transition to a low carbon electricity generation system, this will not be possible within the 2^{o}C carbon budget - because tackling climate change requires that most of the world's (including Australia's) fossil fuels be left in the ground, unburned. Additionally, building new gas power plants and infrastructure based on policy schemes which foster new gas development, risk "locking-in" expanded gas use for decades into the future, and dramatic expansion of new unconventional gas resource exploration and development, and associated fossil fuel delivery infrastructure.

To protect Australians from worsening climate impacts (eg more destructive storms, intense heatwaves and worsening bushfire conditions) and in line with our Paris Agreement commitments and carbon budget constraints, Australia needs pathways to transition as rapidly as possible away from coal, oil and gas to reach net zero emissions by 2050. Developing new gas projects, including hydraulic fracturing of onshore unconventional reservoirs and associated activities (and other fossil fuel projects) is fundamentally at odds with attaining this goal. Today, the cheapest new electricity sources are renewables, so for new power generation, it makes sense to limit reliance on gas for cost and climate reasons.

For more details on how investing in more gas will lock in high electricity prices and pollution for decades to come, see the Climate Council's report, "Pollution and Price: The Cost of Investing in Gas" (Climate Council 2017a).

Delivering Australia's emission reduction commitments

2016 was the hottest year on record globally for the third year in a row. The record global warmth of 2016 is part of a long-term trend. All of the world's 10 warmest years have occurred since 1998. 2016 is the 40th consecutive year with above-average global temperatures (NOAA 2017). Human activities, such as the burning of coal, oil and gas for electricity, are driving up greenhouse gas emissions and fuelling the long term warming trend.

In 2016, Australia sweltered through its warmest autumn on record. Highest temperatures on record were experienced throughout much of eastern and northern Australia including Northern Territory, Queensland, New South Wales, and Victoria. From late February through March 2016, the sea surface temperatures over the northern, most pristine part of the Great Barrier Reef were around 1 to 1.5°C above the recent long-term average (2002-2011). Warm waters caused devastating bleaching and the death of 67% of coral in the northern section. Western Australian and other reefs throughout the world were also badly affected by this mass global bleaching event, the worst in recorded history, driven by climate change and a recent El Niño event.

Climate change is influencing all extreme weather events in Australia. Heatwaves are becoming hotter, lasting longer and occurring more often. Marine heatwaves that cause severe coral bleaching and mortality are becoming more intense and occurring more often. Extreme fire weather and the length of the fire season is increasing, leading to an increase in bushfire risk. Sea level has already risen and continues to rise, driving more devastating coastal flooding during storm surges. The impacts of extreme weather events will likely become much worse unless global greenhouse gas emissions are reduced rapidly and deeply. For more details, see the Climate Council's report, "Cranking up the Intensity: Climate Change and Extreme Weather Events" (Climate Council 2017b).

Under the Paris Agreement, world leaders have agreed to limit global temperature rise to well below 2 degrees Celsius (°C) above pre-industrial levels, and to pursue efforts to limit temperature rise to only 1.5°C. This near universal agreement - signed by 197 parties, ratified by 129 parties and covering 97% of emissions - entered into force on 4 November 2016. Australia ratified the Paris Agreement on 9 November 2016 (UNFCCC 2016).

In order to meet the 1.5-2°C target, the Paris Agreement sets a goal to reach net zero greenhouse gas emissions globally in the second half of this century (UNFCCC 2016).

In ratifying the Paris Agreement, Australia has committed therefore to rapidly reduce our carbon emissions, transitioning to zero emissions before 2050.

Today, Australia's electricity sector accounts for 35% (189 $MtCO_2e$ in 2016) (Australian Government 2016) of our greenhouse gas emissions - the single largest source. When emissions from extraction, processing and transporting

coal, gas and diesel are added, electricity generation is clearly the dominant contributor to Australia's emissions (Climate Council 2014).

The Federal Government has set a 26-28% emissions reduction target. Yet in 2015, leading up to the Paris climate talks, the Climate Change Authority (CCA) recommended - based on climate science, international actors and economic factors - that Australia should reduce its emissions 40 to 60% below 2000 levels by 2030 (or a range of approximately 45 to 65% below 2005 levels). It is important to note that the CCA's recommendations are based on a two-thirds chance of avoiding 2°C warming. For a stronger chance, the target should be higher. Therefore, if global average temperature is to stay below 2°C then the CCA recommendations should be seen as a bare minimum for Australia's contribution to tackling climate change in concert with the rest of the world.

Gas and the global carbon budget, staying under 2°C

The carbon budget is one method of tracking progress against the Paris Agreement 1.5-2°C target. The carbon budget is a simple, scientifically based method used to determine how much carbon humanity can "spend" (IPCC 2013).

Most of the world's fossil fuel reserves must be left in the ground, unburned, to keep global temperature rise to no more than 2°C in accordance with the Paris Agreement.

McGlade and Ekins (2015) analysed the unburnable fossil fuels globally and for the OECD Pacific group (which consists mainly of Australia reserves, see Table 1):

- To have a 50% chance of meeting the 2°C warming limit, at least 52% of known global reserves of gas are unburnable, i.e. they must be left in the ground.
- To have a 75% chance of meeting the 2°C warming limit, at least 71% of known global reserves of gas are unburnable.

Table 1: Percentage of fossil fuel reserves that can be burned, based on a carbon budget approach for the OECD Pacific group (largely Australian reserves) for emissions from 2011 through 2050.

Probability of meeting 2°C target	**50%**	**75%**
Oil	54	32
Gas	49	29
Coal	5	3

Source: Meinshausen et al. 2009; IPCC 2013; McGlade and Ekins 2015.

This analysis is based on a carbon budget from 2011 to 2050. Thus, results from this analysis will need to be reduced somewhat to account for the emissions from gas burned over the 2011-2016 period.

The analysis by McGlade and Ekins (2015) also finds that no amount of unconventional gas reserves (coal-seam gas, shale gas, etc.) are exploitable (unless they are cheaper than, and thus displace, production from existing conventional gas reserves, which is highly unlikely).

While some have argued that additional gas resource development (conventional and unconventional) is essential to transition to a low carbon electricity generation system, this will not be possible within the 2°C carbon budget - because tackling climate change requires that most of the world's (including Australia's) fossil fuels be left in the ground, unburned (for more details see the Climate Council's report, "Unburnable Carbon: Why we need to leave fossil fuels in the ground".

Recommendation:

- Most of the world's (including Australia's) fossil fuel reserves must be left in the ground, unburned, to keep global temperature rise to no more than 2°C in accordance with the Paris Agreement.

Australia's emission reduction challenge and the electricity sector, reaching zero emissions before 2050

To protect Australians from worsening climate impacts (eg more destructive storms, intense heatwaves and worsening bushfire conditions) and in line with our Paris Agreement commitments and carbon budget constraints, Australia needs pathways to transition as rapidly as possible away from coal, oil and gas to reach net zero emissions by 2050.

Using existing gas-fired generators to complement wind and solar power while scaling up a range of renewable energy technologies, energy storage, and energy efficiency measures can deliver a limited benefit, provided the end goal is phasing out the use of all fossil fuels as quickly as possible.

However, building new gas power plants and infrastructure based on policy schemes which foster new gas development, such as an Emissions Intensity Scheme, risk "locking-in" expanded gas use for decades into the future, and dramatic expansion of new unconventional gas resource exploration and development, and associated fossil fuel delivery infrastructure.

Two recent studies by consultants evaluated alternative policy mechanisms to deliver the 26-28% reduction target for the electricity sector (Frontier Economics (2016) and Jacobs (2016). Both modelled alternative renewable policy mechanisms (feed in tariffs using reverse auctions, and expansion of the Renewable Energy Target) and other economic mechanisms such as emissions

intensity and emissions trading schemes. Under an emissions intensity scheme, to achieve the 26% to 28% emissions reduction by 2030, between 70,000 GWh/yr (Frontier Economics 2016) and 110,000 GWh/yr (Jacobs 2016) of additional gas fuelled power production (by around an extra 8000MW of new power plant by 2030) would be needed to displace coal.

To put this in context, this would require the development of gas reserves and production equivalent to that needed to supply between 2 to 5 additional LNG trains of the capacity of those at Gladstone. In circumstances where experienced industry consultants are already anticipating a shortfall against existing east coast demand, and companies like Santos are already impairing their results because they are unable to economically develop sufficient gas to fill out their existing GLNG plant, it would be economically (as well as environmentally) negligent to base future emission reduction policy for the sector around any policy measure which would require a dramatic expansion of gas exploration and development.

This new gas development would "lock in" over a billion tonnes of additional carbon dioxide emissions over the lifetime of the new gas power plants, and the operating lives of the plants would extend well beyond 2050, when electricity sector emissions need to drop to zero.

Investing well over $10 billion in gas power generation assets, and probably the same amount or more in upstream gas development, is very risky economically. With gas costs linked to volatile international oil prices, new open cycle or combined cycle gas power stations would be uncompetitive relative to renewables, as the latter have zero fuel costs. Once storage technologies reduce in cost, they will also be able to dispatch renewable sourced power extremely competitively, again undermining gas plant economics.

Further, while gas power plants emit fewer greenhouse gas emissions than coal-fired power plants, there is a significant added carbon emissions risk associated with methane "fugitive emissions" released through unconventional gas extraction and transport. It is critical to note that the carbon budget approach includes only carbon emitted as carbon dioxide from combustion processes, and does not include the warming effects of methane, a much more potent greenhouse gas than carbon dioxide, from fugitive emissions. Including the warming effects of fugitive emissions of methane would require an even more stringent carbon budget.

Currently in national greenhouse gas accounts, Australia applies default emissions factors for fugitive emissions largely based on conventional (offshore) gas, rather than direct measurement. Published emissions data based on field studies and direct measurement from Australia's unconventional gas industry is extremely limited. Emissions from all gas produced in Australia is reported as 0.5% of gas production (Melbourne Energy Institute 2016).

However, satellite and aircraft-based measurements of methane from unconventional gas production in the United States finds fugitive emissions are

substantially higher than the default factors applied currently by industry and government in Australia. Studies have found fugitive emissions from unconventional gas production in the United States range from 2 to 17% of production (Melbourne Energy Institute 2016). Infrared satellite imagery of unconventional shale and coal seam gas developed areas in the United States shows a very dramatic fugitive emissions "hot spot" over the San Juan coal seam gas development region (the biggest developed CSG region in the United States). Coal seam gas, in particular, is typically developed in shallower geological horizons than shale gas and hence the risks of fugitives escaping from dewatered coals through heterogeneous rock strata is much greater.

There are insufficient field studies, and no base line studies to quantify the impact of fugitive emissions associated with unconventional gas development and extraction in Australia. However, if methane emissions in Australia are equivalent to levels in the United States, any emissions benefit of choosing gas over coal may be cancelled out (Melbourne Energy Institute 2016).

Underreporting of methane emissions is not limited to Australia. Globally, methane emissions from fossil fuels have been significantly underestimated, potentially by as much as 60% (Schwietzke et al 2016).

This lack of data on fugitive emissions from coal seam gas presents a significant carbon risk associated with underestimated fugitive emissions, particularly given the potency of methane as a greenhouse gas, the rapid and continuing scale-up of gas production and the growing proportion of coal seam gas.

Recommendations:

- To protect Australians from worsening climate impacts, Australia needs pathways to transition as rapidly as possible away from coal, oil and gas to reach net zero emissions by 2050.
- No new gas power plants and infrastructure to be built because they risk "locking-in" expanded gas use for decades into the future.
- Field measurement of baseline and fugitive emissions from the coal, gas and oil supply chains to accurately record emissions from all onshore and offshore fossil fuel infrastructure.

Gas is expensive

As Australian gas is now mostly exported as LNG, Australian gas prices are now inextricably linked to world market prices for oil. At current oil prices (around US$60/bbl), LNG netback prices are equivalent to around A$9-10/GJ (e.g. see ACIL Allen 2014; Climate Change Authority 2014; Lewis Grey Advisory 2016). If oil prices were to reach US$100/bbl or more again, domestic gas prices would double to around A$20/GJ.

However, gas prices are much higher than this on occasions even now. LNG export supply contracts have dramatically increased the demand for gas to

export, and led to scarcity pricing for gas available for domestic power production in Australia (Sandiford 2016). The developing shortfall in supplies and deliverability sees gas prices routinely reach two to four times more than this now, driving up local gas and power prices greatly. A gas price of $20/GJ gas needs a power price of between $A140 to $200/MWh, just to cover fuel costs alone.

Reliance on gas power is also driving extreme price spikes due to lack of competition among gas power companies, particularly in South Australia and Queensland (Climate Council 2016; RenewEconomy 2017).

Today, the cheapest new electricity sources are renewables (Bloomberg New Energy Finance 2016), so for new power generation, it makes sense to limit reliance on gas for cost reasons (as well as climate reasons).

Energy affordability is a critical issue for the estimated 12.8% of Australians living in poverty (ACOSS 2014). There are ways to transition the electricity sector to low emissions power while also protecting the most vulnerable households and businesses from further electricity cost increases.

The Australian Capital Territory (2017) has demonstrated one approach to addressing this issue by establishing an energy efficiency improvement scheme in conjunction with its 100% renewable energy target. This approach specifically targets low-income households to receive energy efficiency upgrades with the objective of offsetting any increased power costs (by reducing electricity use).

To keep electricity affordable, the regulatory framework also needs to keep pace behind new developments enabling households and businesses greater control over their electricity bills through technologies such as solar power and battery storage as well as digital information for monitoring and controlling electricity use and generation.

Recommendation:

- Limit reliance on gas for cost reasons – renewables are cheaper.

The cheapest approach is to transition directly to renewable energy

Gas power generation is both polluting and expensive – it does not achieve two of the stated energy policy criteria.

Numerous modelling studies of Australia's National Electricity Market (eg Jacobs 2016) show that accelerated renewable uptake, paired with storage, a smart grid and energy efficiency, best achieves lowest consumer prices, acceptable reliability and meets Australia's emissions reduction commitments, not only for 2030, but importantly also positions electricity infrastructure for a continued trajectory to zero emissions by 2050, with minimal economic stranding of assets newly built to achieve the 2030 target (e.g. gas powered generation under an emissions intensity policy alternative).

For example, Jacobs (2016) modelled a series of policy options to achieve Australia's 2030 commitment under the Paris Agreement and also to achieve the near zero emissions by 2050, consistent with the longer term 2°C guardrail Paris Agreement obligations, these were: carbon tax; an emissions intensity scheme; an extended renewable energy target; a low emissions target (with wider eligibility than the renewable energy target); renewable energy feed in tariffs with contracts for difference (reverse auctions for renewable energy similar to the Australian Capital Territory's approach for reaching its 100% target); regulated coal closures; and absolute emissions baselines.

This modelling (Jacobs 2016) found that a policy of reverse auctions driving investment in new renewable energy results in by far the lowest costs for all classes of retail consumers; and resulted in the second lowest economic costs overall (after a carbon tax) for meeting Australia's emissions reduction commitments. This approach also results in one of the lowest levels of gas generation over the modelling period 2020 - 2050.

The modelling results reflect the fact that new renewable energy power generation, such as wind and solar, are now cheaper than new gas or coal and avoid the asset stranding risks inherent in new fossil fuelled generation. There is a range of renewable energy and storage technologies that can provide power on demand to complement variable renewables (at times of low wind or sunshine), such as hydro, pumped storage, solar thermal, both large and small scale battery storage, smart grids as well as demand management.

Renewable and battery technologies are serving large scale global markets that are growing dramatically. For example, the Tesla "gigafactory" is now making lithium ion batteries and it will double current global production, dramatically reducing costs. It is one of many such "mega" factories now operating or being built making solar PV panels and batteries at giga-scale.

Transitioning directly to renewable energy is a policy for significant job creation nationwide. Moving to 50% renewables by 2030 would create more than 28,000 jobs nationally (EY and Climate Council 2016).

This direct transition approach avoids the additional emissions, stranded gas and power assets, and high power prices for years to come.

Recommendations:

- Invest in new renewable energy power generation rather than new gas or coal in order to avoid the asset stranding risks inherent in new fossil fuelled generation.
- Transition directly to renewable energy to stimulate significant job creation nationwide.

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