Emissions from potential gas development, Queensland Lake Eyre Basin

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Summary

This report calculates the likely carbon emissions of two gas development scenarios in Queensland's Lake Eyre Basin. Emissions for a low export gas scenario (400PJ/year) and a high export gas scenario (2,000PJ/year) have been calculated using the most recent edition of the Australian government's guidelines for greenhouse gas emissions, published by the Department of Environment and Energy.

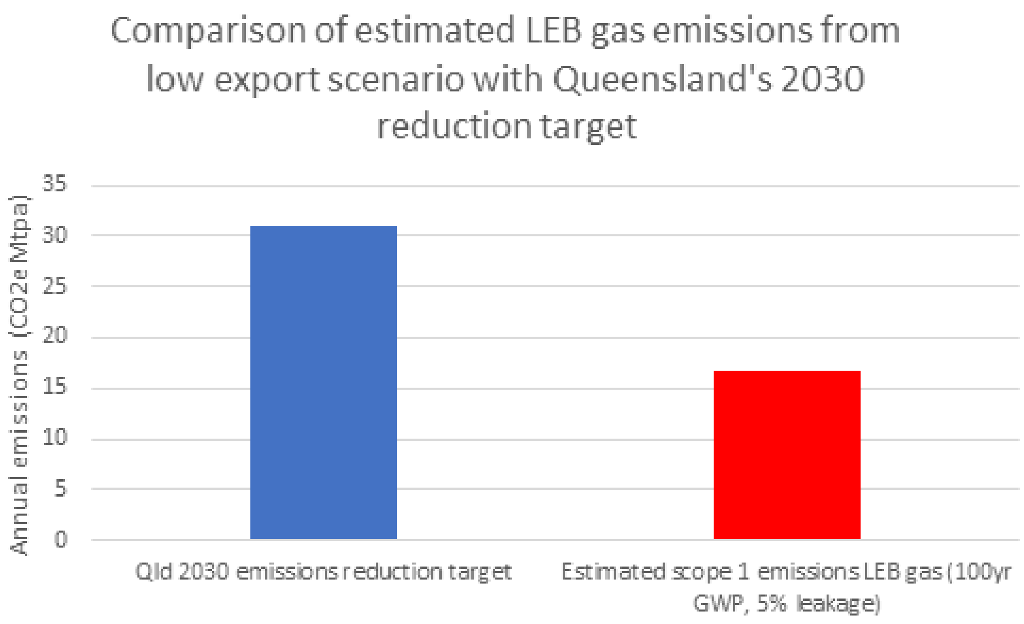
The results are assessed against the Queensland Government's emissions reduction targets to achieve net zero emissions by 2050 and a 2030 target of 133Mt CO2-e, some 31 Mt/year below the 2019 figure.

The results are truly startling. They demonstrate that unconventional gas development in the Lake Eyre Basin would be totally incompatible with Queensland's stated 2030 emissions reduction target.

Using a scientifically precautionary approach to estimating emissions (including using a 20 year global warming potential (GWP) for methane to properly consider near term impacts), the Scope 1 emissions alone of the high export scenario would result in about 190 Mtpa CO2-e, which is almost half of Australia's total annual emissions.

Even using a 100 year global warming potential for methane and medium leakage assumptions, and assuming that none of the fuel is burnt in Australia, the low export scenario would result in Scope 1 emissions alone that are more than 50% of Queensland's proposed reduction of 31 Mt/year from all sources by 2030.

If this development were to go ahead, even at that more modest scale and using generous assumptions, meeting the Queensland target would require a clearly impossible scale of reduction in all other activities: electricity, transport, manufacturing, agriculture and domestic use.



Introduction

The Lake Eyre Basin encompasses three gas basins that are being targeted for possible production of so-called "unconventional gas" – the Cooper, Eromanga and Georgina Basins. Various estimates have been made of the prospective resources in these basins. The most reliable of these estimates add up to about 334 trillion cubic feet of potentially recoverable gas, equivalent to about 362,000 PJ of energy[1]. It has been calculated that about 55 per cent of these resources are in South Australia, meaning that the amount in Queensland is about 163,000 PJ. If it were to happen that 25 per cent of those resources were proven and then extracted over a 20-year period from 2025, the energy content of the gas produced would be more than 2,000 PJ per year. This study calculates the probable rate of release of greenhouse gases if this were to occur and compares it with the climate change targets announced by the Queensland government. This is called the high gas export scenario.

The report also calculates probable emissions if a much lower volume of gas, 400PJ per year, were to be extracted to explore the impacts of a more conservative development scenario. These two scenarios (400PJ/year and 2000PJ/year) effectively represent a low export gas scenario and a high export gas scenario respectively.

Queensland's total greenhouse gas emissions in 2019 were 164 million tonnes of carbon dioxide equivalent, some 14 per cent less than the 2005 baseline[2].

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[1] The resource estimates used here are based on: for the Cooper Basin, the GBA Stage 2 Baseline Analysis Petroleum Prospectivity Technical Appendix (Page 9) of 248.43Tcf; for the Eromanga Basin the GeoScience Australia estimate of of 82Tcf; for the Georgian Basin the CSIRO 2018 estimate of 13Tcf of technically recoverable shale gas.

[2] Queensland Government information on 2030 emission targets

The government's commitments are to achieve net zero emissions by 2050 and to achieve a reduction of 30 per cent below the 2005 level by 2030. That means the 2030 target is about 133 Mt CO2-e, some 31 Mt/year below the 2019 figure.

Methodology

The contributions of proposed developments have been calculated using the most recent edition of the Australian government's guidelines for greenhouse gas emissions, published by the Department of Environment and Energy. This gives values for the direct emissions from various forms of natural gas. However, it is important to recognise that the emissions that are directly produced by the extraction and burning of gas are only part of the contribution to climate change. There are two significant extra impacts. First, the hydrocarbon resources in the Lake Eyre Basin contain high levels of carbon dioxide, which will be released when the gas is extracted. An authoritative report estimated that the target resources in the Cooper Basin contain 30-35 per cent CO2 which would be vented to the atmosphere and add to the greenhouse impact[3]. Secondly, production of gas inevitably results in so-called fugitive emissions, the leaking into the air of methane, a very significant greenhouse gas, contributing much more warming per molecule than carbon dioxide.

The problematic issue in calculating the total impact is estimating the scale of fugitive emissions and deciding what multiplier to use to calculate the Global Warming Potential [GWP] of the leaked methane. In the scientific literature, there are various estimates of life-cycle methane emissions from shale gas. A comparative analysis recently observed that most of these values are based on sparse and poorly documented data (Howarth et al, 2012). The exception is a paper based on measurements from an actual US shale gas field over a year (Petron et al, 2012) which found leakage rates varying between 2.3 and 7.7 per cent, concluding that the best estimate for current practice is 4 per cent. This is significant because the recent NT Fracking Inquiry was urged to accept that best practice could reduce the overall rate of fugitive emissions to as low as 1.7 per cent. While that seems extremely optimistic, for the purpose of this study three calculations were undertaken: the optimistic assumption of only 1.7 per cent leakage, an intermediate figure of 5 per cent based on Forcey's observations in Queensland, (Forcey, 2018) and a worst-case of 7.7 per cent based on the US measurements.

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[3] Cooper Basin Geological and Bioregional Assessment Stage 2, Technical Appendix: Petroleum Prospectivity, p 52

The IPCC have used a GWP of 25 to calculate the impacts over a 100-year time frame, but "more recent research that better accounts for the interaction of methane with other radiatively active materials in the atmosphere suggests a mean value for the global warming potential of 33 for the 100-year integrated time frame" (Shindell et al, 2009)[4]. The same summary suggested that it might be more appropriate to compute the impact of methane over a twenty-year time frame, given that the Paris agreement is based on 2030 emissions. The choice is significant because the relevant figure for the GWP of methane on the shorter time frame is much greater; Shindell suggests a figure of 105, while the IPCC uses the range 84-87. For the purpose of this study, the 100-year time frame with a GWP of 33 and the 20-year time frame with a conservative GWP of 85 were calculated for the three selected scales of fugitive emissions. Probably the most appropriate figures to use are those in bold in the table, assuming the most likely leakage rate of 5 per cent and using a 20-year time frame.

To explain the calculations, a petajoule of natural gas is about 20,000 tonnes of methane, so 400 PJ is 8 million tonnes. Burning that amount of gas would produce 21 million tonnes of carbon dioxide, the figure in the first row of the Table. The additional CO2 released in production, 30-35 per cent of the gas, will be 3.4-4.3 million tonnes, the figure in the second row of the Table. If the leakage rate is 5 per cent, 5% of 8 mt is 0.4 mt. On a 100-year timescale, the GWP of 33 means that the 0.4 mt of methane has a warming potential equivalent to 33 x 0.4, or 13 mt of CO2. On a 20-year timescale, the GWP of 85 means that 0.4 mt of methane has a warming potential of 85 x 0.4, or 34 mt of CO2. Similar calculations have been done for lower (1.7%) and higher (7.7%) rates of leakage. In every case, the figures for a production rate of 2000 PJ/year are simply five times the numbers for 400 PJ/year.

In the absence of a future development such as extracting gas from the Lake Eyre Basin, Queensland faces the challenge of reducing its emissions from 164 mt/yr to 133, an overall reduction of 31 Mt/year by 2030. The results of this analysis below are compared against that emissions reduction target.

Results

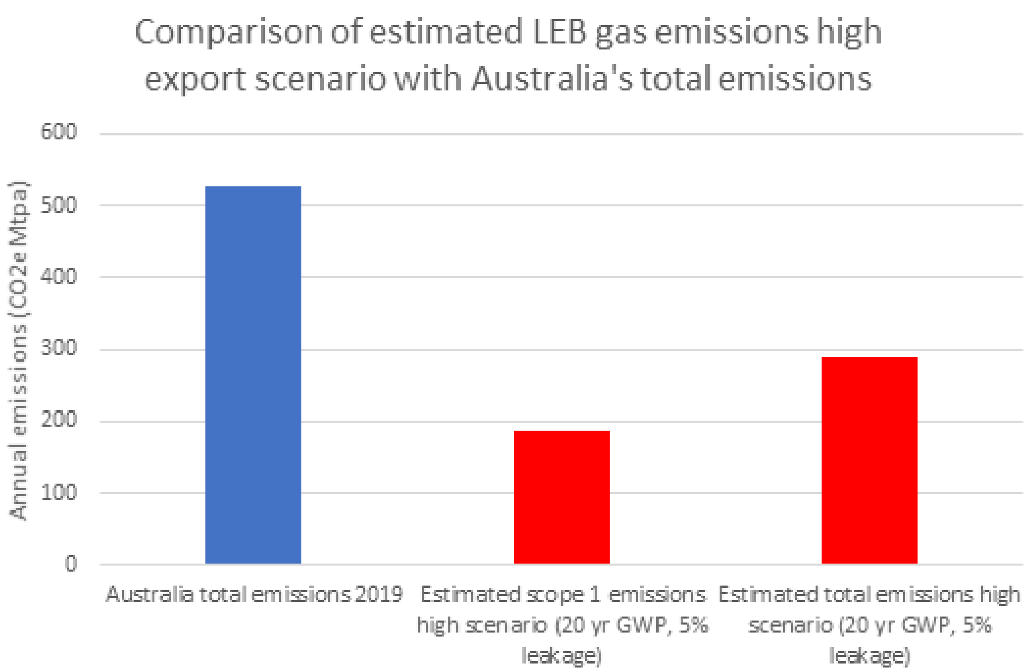
Table 1 below provides estimated emissions from unconventional gas development in the Lake Eyre Basin. For two levels of possible gas production, the table gives three figures. The first row shows the emissions from direct

[4] Note the US EPA attributes methane a GWP of 28–36 over 100 years

combustion of the gas, which would only count toward the Queensland target if the gas were to be burned locally.

The second row is the estimate of additional carbon dioxide which would be vented in production. The following six rows calculate the impact of fugitive emissions for three different leakage rates and two different timescales. So the total contribution would be the sum of the direct combustion, the additional gas vented in production and one of the figures for fugitive emissions.

The figures in the table below are startling. They demonstrate that unconventional gas development in the Lake Eyre Basin would be totally incompatible with Queensland's stated 2030 emissions reduction target. Using a precautionary approach for the high gas export scenario, just the annual Scope 1 emissions would be over 190 million tonnes of carbon dioxide equivalent, while the total would be nearly 300 million tonnes a year. To put that figure in perspective, Australia's total emissions from all causes are about 500 million tonnes a year.



To underline the incompatibility of the proposed development with the Queensland government's target, as the first column in the table shows, even for the low export gas scenario, assuming 5 per cent leakage and using a 100-year GWP, and assuming that all the gas would be burned overseas and not be counted locally, the additional greenhouse gas emissions would be about 16 million tonnes of carbon dioxide equivalent a year, which equates to almost half of the State's proposed reduction of 31Mt/year from all sources by 2030.

Therefore, if this development were to go ahead, even at that more modest scale, meeting the State target would require a clearly impossible scale of reduction in all other activities: electricity, transport, manufacturing, agriculture and domestic use.

It is even worse if the near term impacts are considered. Assuming 5 per cent leakage, the fugitive emissions of the low export scenario using a 20-year GWP would be 34 Mt/year, with an additional 3.4-4.1 Mt/year of carbon dioxide directly vented. If we were to add even that lower figure of nearly 40 Mt/yr from gas production, meeting the 2030 target would require a reduction in other areas of that scale on top of the existing target – i.e. it effectively doubles the state's 2030 target. That is clearly totally unrealistic.

Table 1. Estimated emissions from unconventional gas development in the Lake Eyre Basin
Greenhouse gas emissions, millions of tonnes of carbon dioxide equivalent per year

	400 PJ/year	2000 PJ/year
Direct combustion of gas	21	103
Additional CO2 vented in production	3.4-4.1	17-22
Fugitive emissions, 100 year timescale, 1.7 % leakage	5	23
Fugitive emissions, 100 year timescale, 5 % leakage	**13**	**66**
Fugitive emissions, 100 year timescale, 7.7 % leakage	21	102
Fugitive emissions, 20 year timescale, 1.7 % leakage	12	58
Fugitive emissions, 20 year timescale, 5 % leakage	**34**	**170**
Fugitive emissions, 20 year timescale, 7.7 % leakage	53	284
Total emissions, most realistic assumptions	**58**	**290**
Total emissions, most generous assumptions	29	143
Minimum Scope 1 emissions, most generous assumptions	8	40

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