
# Submission to the Victorian Legislative Council's Inquiry into Unconventional Gas

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| *Term of reference* | (2) the environmental, land productivity and public health risks, risk mitigations and residual risks of onshore unconventional gas activities; |
| *Summary position* | **Climate change is a great risk to both public health and land productivity. Gas, especially from unconventional sources, has a greater contribution to climate change than is often generally realised.** |
| *Detailed position* | ***Public health.*** There is a strong connection between climate change and public health as recently described in the report from The Lancet commission [1] and other reports [2,3]. The Lancet report also illustrates that measures that are good for climate are also generally both affordable and good for public health.<br>***Land productivity.*** There is a strong connection between climate change and land productivity, including in Victoria. This is well described by the Climate Commission [4] and by the IPCC [5]. Specific medium-term risks to Victoria include increased frequency of extreme weather and drought, with attendant effects on land productivity.<br>***Climate change and gas***. There is a widespread but mistaken view that gas is a low-emission fuel with a useful role to play in the transition to a clean-energy future [6]. The greenhouse emissions arising from production, processing and use of fossil methane are significant, rising, and higher than is generally acknowledged because of a) the levels of fugitive emissions, and b) misunderstanding gas' global warming potential.<br>***Combustion emissions***. Emissions from clean and complete burning of methane gas, while only about half that for coal, are still significant at 51.3 kg-$CO_2$e/GJ [7]. This should not be considered a 'low' level for any practical purpose.<br>***Global warming potential (GWP)***. The standard Federal Government emission factors use a GWP of 21[8], for methane released into the air. This factor (21) is based on an old estimate for the 100-year GWP. Scientists recognise that methane has a much shorter residence time in the atmosphere than $CO_2$ by using both 100-year and 20-year measures of GWP. It is appropriate to use the 20-year time horizon because it better aligns to the timescales in which action might reasonably be expected to occur [9]. We do not have the luxury of 100 years to fix the climate crisis. The currently accepted value for the 20-year GWP of methane is 84 according to the IPCC [10]. The higher value should be used when estimating the effect of leaking methane.<br>***Fugitive emissions***. The end-to-end system of gas production, processing, distribution and consumption is complex and inevitably leaky. Leakage levels from production of unconventional gas are innevitably much higher than from conventional petroleum gas. Using a GWP of 84 it only takes 3.4% of methane to escape [11] for the net emissive effect of the methane to double (relative to no leakage and complete combustion). BZE is of the view that the end-to-end leakage in the current Victorian gas system is probably in the range of 3% - 5% [12], and that widespread use of CSG will cause that to increase considerably. In other words, it is likely that the emissions situation for gas is actually no better than for coal when the GWP and leakage of gas are properly allowed for. |

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| *Term of reference* | (4) the ability of potential onshore unconventional gas resources contributing to the State's overall energy sources including (a) an ability to provide a competitive source of energy and non energy inputs for Victorian industries;(b) an affordable energy source for domestic consumers; and (c) carbon dioxide emissions from these sources; |
| *Summary position* | **Gas as a mass-market fuel is less important to Victoria than is generally supposed. Replacing gas devices with efficient electrical alternatives can mostly deliver equivalent, or better, function at lower cost. Gas-free homes represent a viable alternative to the current ubiquitous Victorian gas service.** |
| *Detailed position* | ***The 'cheap gas' myth***. The current domestic gas tariff is ~2c/MJ, which equals 7.2c/kWh of thermal energy. On a straight joule-for-joule basis, this appears less than domestic electricity. However, when compared with what can be achieved with electricity because of the performance of modern split system heating and cooling systems, then gas no longer looks as economical. The comparison between a common gas ducted system and a good split system is illustrative.<br><br>***Gas system performance***. A typical well-maintained legacy ducted gas heating system in Victoria would have an end-to-end efficiency of about 30% [20]. Large amounts of energy are lost in the ducts and flue, and because of poor air mixing.<br><br>***Heat pump performance***. Modern split systems are based on a vapour-compression heat pump capable of extracting useful heat or coolness from the outside air in a way that gives functional efficiencies of well over 300% [21]. A good-quality, affordable and, readily available modern split system has a typical coefficient of performance (CoP) of 400% and some have a CoP as high as 600% or more. Heat pumps are available for all climate zones and are suitable for heating, cooling and hot water [22].<br><br>***Gas vs electricity***. With an electricity tariff of 28 c/kWh and a CoP of 400%, then the cost per kWh of heat delivered is 7c, equalling the cost of a perfectly efficient gas system. In the case of a comparison with a typical gas ducted system the cost of heating using gas is about 3x that of using a good split system [23].<br><br>*Hot water*. A home's hot water can also come from a heat pump [24] and give great energy savings compared to gas. Good heat pump systems are readily available and use, at most, one third the energy of a comparable gas system, even in a cold climate.<br><br>***Cooking***. Gas cooktops are common in Victoria. We suggest that efficient induction electric cooktops are at least as good and are much more efficient[25].<br><br>***No gas needed***. Far from needing gas, we suggest that Victorian homes would benefit greatly from not using gas at all. This is supported by our own case studies[26] and by research from the ATA [27]. The perceived need for unconventional gas is tied intrinsically to the idea that Victorians can't do without gas. We have shown that, far from being essential, our homes will be cheaper to run without gas. Homes that are exemplars of climate safety and efficiency should not use gas [26].<br><br>***Solar implications***. Premises with Solar PV, can save further if they don't use gas by making better use of solar generation which can increase the self-consumption rate relative to those with gas [28]. In other words, premises with solar PV have extra incentive to disconnect from gas.<br><br>***Unconventional gas costs***. Onshore Gippsland gas production costs are estimated by the Australian Energy Market Operator (AEMO) to be around $9/GJ – more than double the current gas market price[29]. Any further price inflation will only amplify the cost advantage of modern electrical system solutions.<br><br>***Energy infrastructure streamlining***. In addition to wholesale price inflation, the downstream costs to consumers are even greater – as is the case with electricity[30]. This includes transmission and distribution pipelines as well as any retail costs. These costs have increased by 60% for Victorian consumers over the past decade (in real terms)[31] as the network is expanded and renewed – evidently uneconomically. The availability of highly efficient modern electrical appliances renders this duplicate energy service redundant, providing opportunity to streamline Victoria's energy supply infrastructure.<br><br>As it relates to greenhouse gas emissions, the vast distribution network of pipelines to household consumers are a source of substantial methane leakage. Any curtailment of this pipeline network would diminish the opportunities for leakage of this potent greenhouse gas. |

# References and notes

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3. Armstrong, F., 2015, “Coal and health in the Hunter: lessons from one valley for the world”, http://caha.org.au/wp-content/uploads/2015/02/CAHA.CoalHunterValley.Report.FINAL_.Approvedforprint.pdf

4. Climate Commission, 2014, “Science and the impacts of climate change”, http://www.climatechangeauthority.gov.au/files/files/Target-Progress-Review/Targets%20and%20Progress%20Review%20Final%20Report_Chapter%202.pdf

5. IPCC, 2014, “Climate Change 2014: Impacts, adaptation, and vulnerability”, http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf

6. Victorian Government, “Low Emissions Coal and Gas”, http://www.energyandresources.vic.gov.au/energy/low-emissions-coal-and-gas

7. National Greenhouse Accounts, December 2014, http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/national-greenhouse-accounts-factors-dec-2014, Table 2.

8. GWP of methane is 21, according to National Greenhouse Accounts [7], Table 26.

9. Lomardi, E, Mangione, K, 2008, “Beyond Kyoto: Why Climate Policy Needs to Adopt the 20-Year Impact of Methane”, http://www.esrl.noaa.gov/gmd/publications/annual_meetings/2008/abstracts/Poster_Final%209.pdf

10. Romm, J., 2013-10-02, More Bad News For Fracking: IPCC Warns Methane Traps Much More Heat Than We Thought, http://thinkprogress.org/climate/2013/10/02/2708911/fracking-ipcc-methane/

11. Richard Keech, 2015, Methane Emission Calculations (spreadsheet), Beyond Zero Emissions, http://media.bze.org.au/Methane_emission_calcs.ods

12. Keech, R., 2013, “What role for gas in future HVAC?”, procedings of conference 'The Future of HVAC 2013”, AIRAH.

20. Keech, R., 2014, “Supporting information on Sankey diagram for residential HVAC”, Appendix 9 to Zero Carbon Australia Buildings Plan (2013), http://media.bze.org.au/bp/bp_appendix_9.pdf

21. See [20].

22. Beyond Zero Emissions, 2013, Zero Carbon Australia Buldings Plan, http://bze.org.au/buildings, Part 3.

23. The cost of heating using gas is about three times that of using a good split system. This is based on:

- Cost per delivered kWh(thermal) from a heat pump is 7 cents (as described in the text);
- Cost per raw kWh(thermal) from gas is 7.2 cents (as described in the text); and
- End-to-end efficiency of a ducted gas system is about 30% [20].

24. See [22], page 106

25. See [22], page 97

26. Beyond Zero Emissions, September 2015, “The Energy Freedom Home”, Scribe.

27. Alternative Technology Association, November 2014, “Are we still cooking with gas?”, http://www.ata.org.au/ata-research/new-report-on-economics-of-gaselectric-appliances

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29. Australian Energy Market Operator, Gas Production Cost, 2012, http://www.aemo.com.au/Gas/Planning/Gas-Statement-of-Opportunities/Previous-GSOO-reports/2012-Gas-Statement-of-Opportunities/Production-Costs

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