Climate Action Darwin Submission to Scientific Inquiry into **Hydraulic Fracturing** in the Northern Territory

Submission due April 30 2017

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Thank-you for taking our views into consideration.

It is refreshing and encouraging to see that the NT Government recognises climate change as a crucial threat from conducting hydraulic fracturing in the Northern Territory:

> *There may be a risk that greenhouse gases, including hydrocarbons (methane and ethane) and carbon dioxide, will be released during hydraulic fracturing and the associated activities. Emissions may be from sources such as well heads, pipelines, compression stations and final use. The potential contribution of hydraulic fracturing and the associated activities to the burden of greenhouse gas emissions will be assessed by the Panel. (**Background and Issues Paper**, p. 18).*

As volunteers ourselves, we represent a large and diverse local community group with hundreds of volunteer members called Climate Action Darwin. The breadth and diversity of people concerned by climate change in the Northern Territory was demonstrated during the People's Climate March in November 2015, when over 1000 people representing many thousands of Territorians, including church groups, unions, doctors, scientists and environment groups demonstrated at marches in Darwin and Alice Springs. Our membership in the Darwin region is acutely aware and concerned that the emission of greenhouse gases from fracking and related activities will contribute significantly to the Northern Territory's overall impact on climate change.

In this submission we will show that the greenhouse gas emissions caused by hydraulic fracturing and associated activities entail such deleterious economic, environmental and social consequences for the population and land base of the Northern Territory and elsewhere as to constitute an undesirable and unacceptable risk. Our members also submit that the past record of NT environmental regulators indicates the high likelihood that they are unequipped to successfully monitor or regulate a new resource extraction industry in the NT, particularly one with such diffuse impacts as the shale gas industry.

Climate change is happening now

The world's largest body of independent scientists, the Intergovernmental Panel on Climate Change (IPCC) concurs that human-induced climate warming is occurring faster and more extensively than previously expected. [2013–14 Intergovernmental Panel on Climate Change (IPCC), Fifth Assessment Report.]

Under current global energy policies and non-renewable resource extraction practices, a global temperature increase in excess of 4°C before 2100 is likely, thus risking a substantial reduction in the global population due to heatwaves, floods, cyclones, diseases, starvation of increasing frequency and severity. Australia is not immune to these threats. Even with immediate action, we are currently on trajectory to exceed the 2°C temperature increase limit), with serious consequences.

In the Paris Agreement, 195 nations, including Australia, agreed that we must limit the increase in global average temperature to well below 2°C above pre-industrial levels. To achieve this, Australia committed to implement an economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030. This requires a substantial reduction in the amount of carbon dioxide, methane and other greenhouse gases released into the atmosphere through human activities, including the burning of fossil fuels.

A **Carbon Budget** is the maximum amount of carbon that can be released into the atmosphere while keeping a reasonable chance of staying below a given temperature rise.

In Figure 1, the IPCC - Intergovernmental Panel on Climate Change - shows carbon budgets for 33%, 50% and 66% likelihoods of keeping global warming below 2°C (IPCC, 2013). Higher probabilities of achieving the target were not reported because a 2°C warming target with high probability of success is now unreachable. That budget has already expired. The most stringent target reported - at 66% - has a one-in-three chance of exceeding the 2°C target, and *could see a global temperature increase exceeding 3°C* (with 95% confidence).

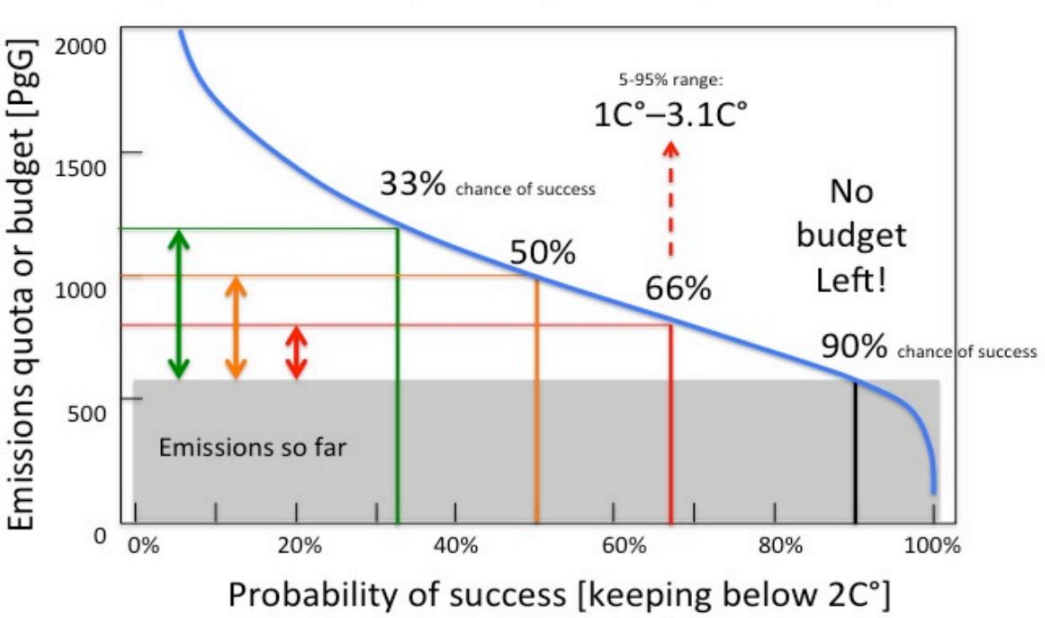


***Figure 1**: **The carbon budget and probability of success.** The budget (vertical axis) is related to the risk of failure (overshooting 2°C) (horizontal axis) along the blue curve. Emissions to date are indicated by the grey box, leaving the available budget as the distance between the blue curve and the grey box. As chance of not exceeding the target increases from 33% (green) to 50% (orange) to 66% (red), the budget decreases. At 90% chance of exceeding the target (black), no carbon budget remains.*

Source: http://takvera.blogspot.com.au/2016/02/global-carbon-budget-reassessed.html

Australians are amongst the biggest climate polluters in the world

Shamefully, Australians produce more climate pollution per person than most other developed countries, see Figure 2. Australia has just 0.3% of the world's population but produces 1.5% of emissions, five times the global average, and one of the world's highest per capita emitters.

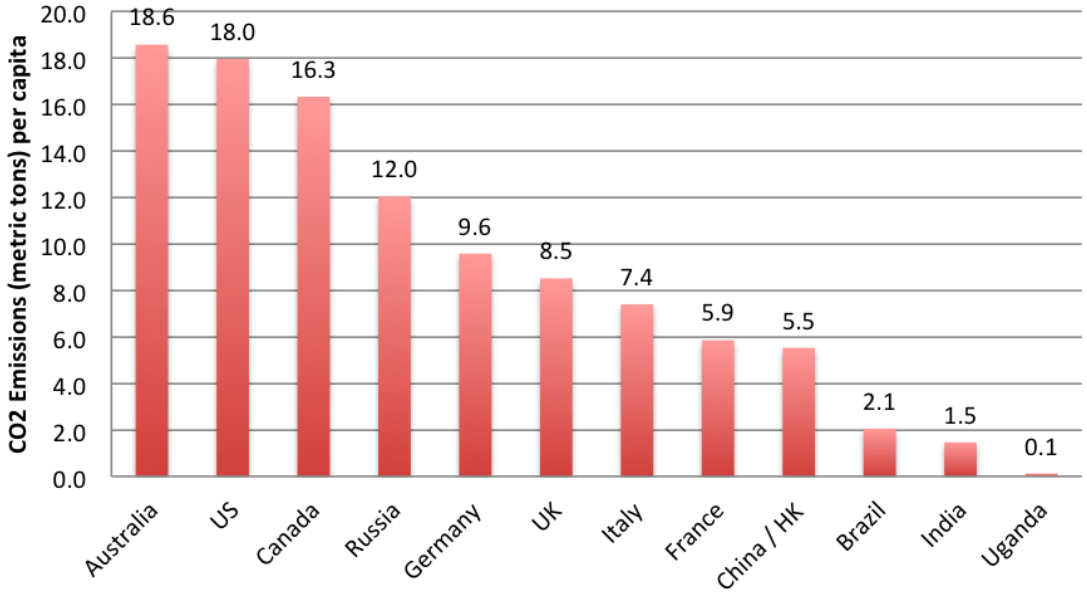


Figure 2. Carbon Dioxide Emissions per Capita.

Source: http://www.economicshelp.org/blog/6131/economics/list-of-co2-emissions-per-capita/

Concerningly, the next graph, Figure 3, shows that by 2030, Australia is expected to *still* be the highest per capita emitter of greenhouse gases for high income countries. Note the horizontal band that depicts the level of emissions needed to reach our Paris obligations. This shows that Australia must *stop* planning new ways to pollute and start cutting back significantly on its emissions.

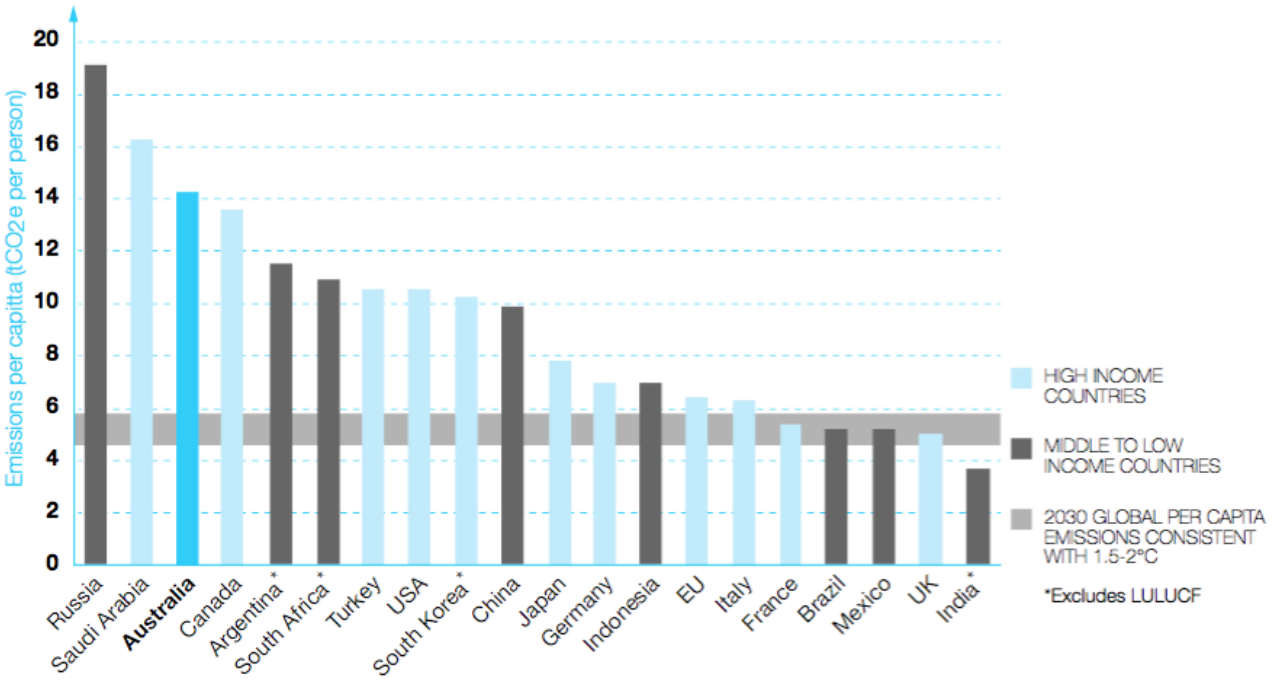


Figure 3. G20 Countries per capita emissions in 2030, compared with their per capita emissions range associated with the Paris Agreement.

Source: *http://reneweconomy.com.au/five-years-zero-emissions-australias-climate-reality-check-86428/*

Over the period 2015 to 2020, Australia's emissions are projected to grow. This is primarily driven by the development of new Liquefied Natural Gas (LNG) facilities in Western Australia, Queensland and the Northern Territory. This expansion of the LNG industry results in increases in emissions for the direct combustion and fugitives sectors. Emissions in 2020 are currently projected to be 559 Mt CO_2-e. *(See http://www.environment.gov.au/system/files/resources/9437fe27-64f4-4d16-b3f1-4e03c2f7b0d7/files/aust-emissions-projections-2016.pdf)*

Meanwhile, Australia's current pledge is to reduce 2030 pollution to a level about 27% below the 2005 level. However, it is widely considered by the Climate Council and others, including CAD, that our contribution should be much higher than has so far been pledged, to make a 'fair' contribution towards a global 'least-cost' 2°C path.
(See: https://www.climatecouncil.org.au/breaking-australia-ratifies-paris-climate-agreement)

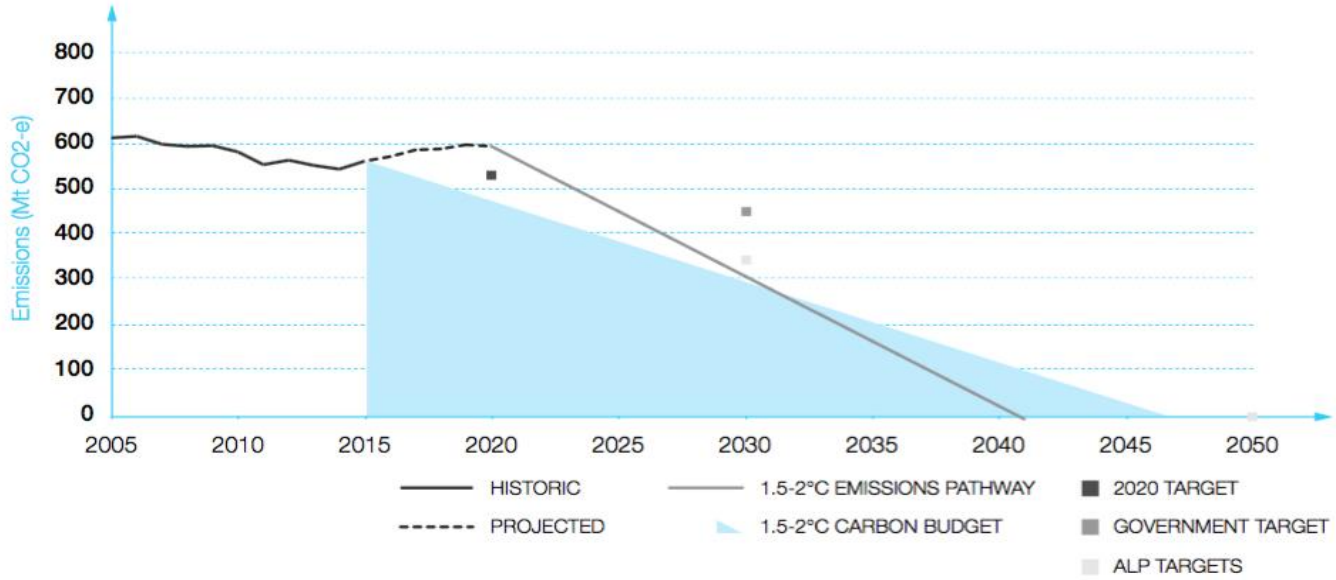


Figure 4. Midrange Australian emissions budget and pathway consistent with limiting warming to 1.5-2°C. Current and proposed emissions targets are also illustrated.
Source: http://reneweconomy.com.au/five-years-zero-emissions-australias-climate-reality-check-86428/

As climate change expert Giles Parkinson of the Renew Economy website wrote recently:
*"The Climate Institute estimates Australia's share of the "carbon budget" is around 9 billion tonnes. At current rates, it will consume 40 per cent of that from 2020 to 2025. If nothing else changes, it will exhaust its budget by 2035, as shown by Figure 4. Australia will need to reduce its emissions to zero well before 2050 – possibly as early as 2040 – if it is to meet those targets. Not even the federal Australian Labor Party's 45 per cent reductions proposal by 2030 is ambitious enough to do so. [*We note that although the NT Government is establishing a Renewable Energy Target of 50% by 2030, it is yet to set a target for reducing climate pollution]. *And so what is Australia's fair share? Well, in the Climate Institute's estimate of "high equity" – i.e. Australia playing its fair share and not counting on "negative emissions" and international offsets – Australia would have to reach pretty close to zero emissions by 2025."*

Adopting the IPCC's [Intergovernmental Panel on Climate Change] optimistic carbon budget whilst allowing *equal global per capita emissions,* **Australia's carbon budget for 2°C runs out in only six years (2023).**

The Northern Territory is Australia's biggest climate polluter

Territorians are well and truly the highest emitters of greenhouses gases per person in Australia, and as noted, Australia is one of the highest emitting nations in the world. Sources of pollution include agriculture, power generation, transport, land clearing, industry, agriculture and bushfires.

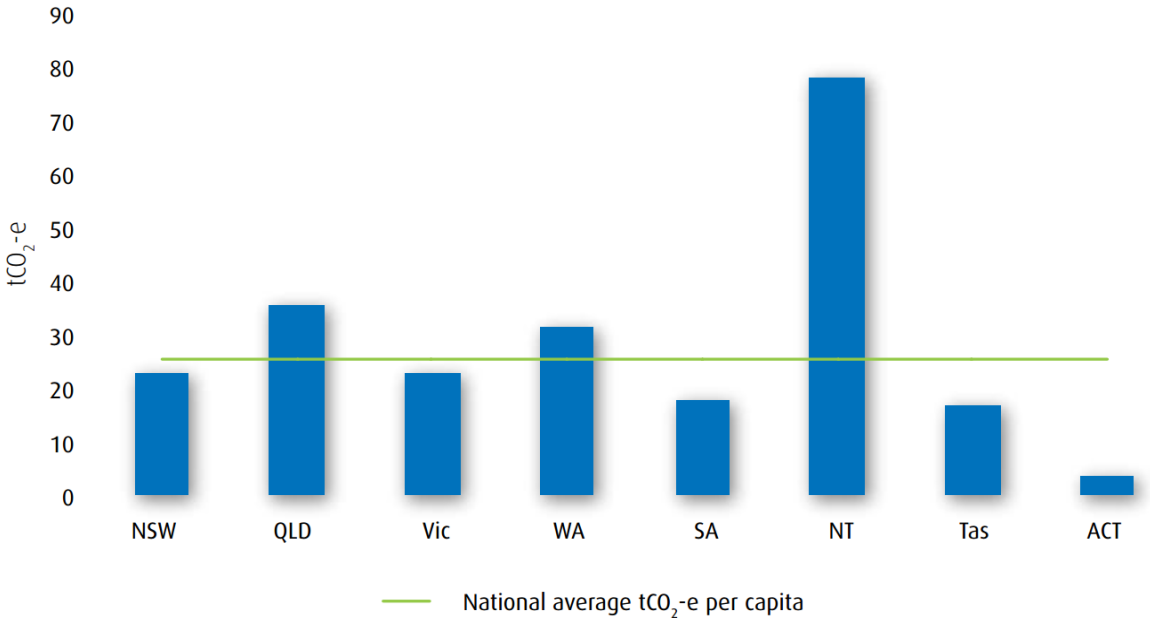


Figure 5. Tonnes of carbon dioxide per capita by State and Territory
Source: http://www.environment.gov.au/climate-change/climate-science/impacts/nt

Tropical Darwin is already getting hotter

There are many expected impacts from climate change in the Northern Territory, none of them pleasant, and some of them already apparent, like sea level rise and the number of hot days in Darwin. According to sustainability and biodiversity experts Professor Stephen Garnett and Professor Andrew Campbell, "Sea-level rise is happening already – 17 cm in the past 20 years in the Darwin region, which makes it one of the highest rates anywhere. Primarily, this is due to thermal expansion of the Timor Sea." *(See: http://theconversation.com/a-wet-warning-from-australias-top-end-on-rising-sea-levels-22934)*

The CSIRO has reported *(page 5*) that in Darwin the number of days over 35°C is expected to increase from long term (historic) average of 11 days per year to up to 69 days by 2030 and up to 308 days by 2070, without global action to reduce greenhouse gas emissions. The Bureau of Meteorology, (BOM) now reports the average of hot days in Darwin has risen to 11.5 days per year. In 2016 however, there were an astonishing 29 days over 35°C in our city. This clearly impacts the 'livability' of our city, in turn affecting population growth, energy consumption, and therefore economic outcomes.

During the last 12 years in Darwin, the average number of excessively hot days (over 35°C) per year was 19, almost double the long term average. This is a rising trend, indicating we are well on the way to the 69 excessively hot days CSIRO predicts by 2030. That's more than 3 months every year of sweltering weather, not including the days that are "only" 34.9°C. This prospect is of great concern to our members. Further, it seems we are on the trajectory to the alarming 308

excessively hot days a year by 2070, as per CSIRO's projections. In this context, it is highly likely that the NT economy will be heavily compromised by internal migration of its population to cooler southern climes, rising cost of living due to cooling, increased illness and work absence from heat stress.

Shale gas is more polluting than any other fossil fuel

Shale gas, the type of gas currently being considered for fracking in the Northern Territory, is promoted by industry groups as a 'transition' fuel so we can continue to use fossil fuels while reducing carbon emissions. This is because it has been considered by the resources sector that less climate pollutants are emitted from natural gas (including shale gas) than from coal and oil, per unit of heat energy.

However, it has been found that **significant quantities of methane are emitted into the atmosphere from shale gas development: an estimated 12% of total production** when considered over the full life cycle from well to delivery to consumers, based on recent satellite data in the USA. *Source:* *http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf*

Methane - an unparalleled greenhouse gas

Methane is an incredibly powerful greenhouse gas that is 100-fold greater in containing heat than carbon dioxide, while both gases are in the atmosphere, and 86-fold greater when averaged over a 20-year period following emission.

Concerningly, the concentration of methane in our Earth's atmosphere has tripled since pre-industrial times and continues to rapidly rise. From 800,000 BC until the year 1750 methane didn't exceed 800 parts per billion. Between 1750 and 2014, rates have tripled and this acceleration has increased again since 2006, as is shown below in Figure Six.

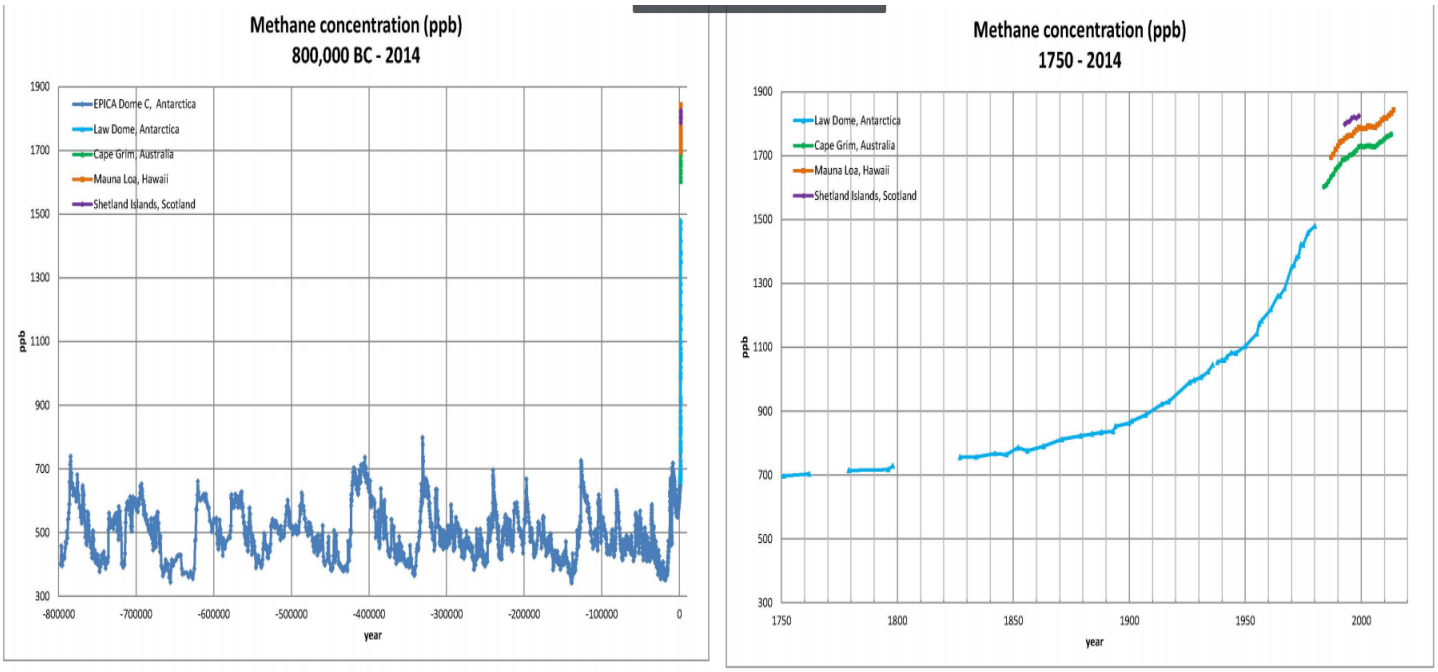


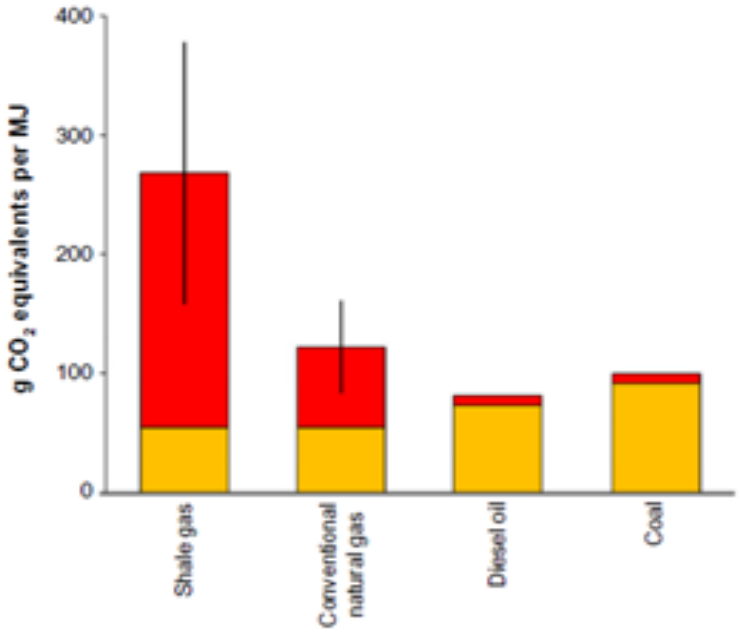
Figure Six: Atmospheric methane concentration shown in parts per billion (ppb), from hundreds of thousands of years ago, through to 2014. *Left: Timeframe 800,000BC to 2014, showing concentrations have not been higher than 800 ppb until very recently. Right: Timeframe 1750 to 2014, showing concentrations have almost tripled since 1750, and the rated of increase has accelerated again since 2016, Data Source: EPA (2016). Data are from historical ice core studies (Loulergue, Schilt et al. (2008), Etheridge, Steele et al. (2002)) and recent air monitoring sites (NOAA (2014), NOAA (2015), Steele, Krummel et al, (2002)).*
Cited:http://www.tai.org.au/sites/defualt/files/MEI%20Review%20of%20Methane%20Emissions%20-%2026%20October%202016.pdf p. 13.

The climate footprint of shale gas is dangerously high

The total greenhouse gas footprint of shale gas is *substantially* greater than that of other fossil fuels when methane emissions from extraction are included (*see Figure 7 below*). The greenhouse gas footprint of conventional natural gas is also higher than that of conventional oil and coal for the mean estimate of methane emissions. It is still greater than or comparable to that of these other fuels even at the low-end estimate for methane emissions.

Consequently, natural gas – particularly shale gas – is not suitable as a 'transition' fuel when methane emissions are considered over an appropriate timescale. Conversely, switching from coal to shale gas is actually *accelerating* rather than slowing global warming.

Figure 7: The greenhouse gas footprints of shale gas, conventional natural gas, oil, and coal expressed as g CO2 equivalents per MJ of heat produced. *Notes: Yellow indicates direct and indirect emissions of carbon dioxide. Red indicates methane emissions expressed as CO2 equivalents using a global warming potential of 86. Vertical lines for shale gas and conventional natural gas indicate the range of likely methane emissions.*



Emissions for carbon dioxide for all fuels and for methane from conventional natural gas, oil, and coal are as in Howarth et al. Mean methane emission estimate of shale gas is taken as 12% based on Schneising et al as discussed in the source text.

Source: http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf , Page 49.

If more than about 3% of fracking-produced methane is emitted to the atmosphere, the climate impact on the 20-year timescale of the emitted methane is more important than the climate impact of the remaining combusted methane *(as Figure 8 below illustrates)*. For example, as shown by the column labelled "20%", if methane emissions are 20% of total gas production, the climate impact of those emissions is eight times greater than climate impact of burning the remaining gas, on the 20-year time-scale (on 100-year time scales it would reduce to about three times).

If natural gas is to provide maximum net climate benefit versus coal, the release of methane to the atmosphere (both intentional and unintentional) must be held to less than about one per cent of total gas production. Reducing methane emissions as soon as possible will provide the largest impact on global peak temperature. Theoretical benefits of switching from coal to gas, could easily be wiped out without controls on methane leakage, limits on total energy use and targets to ensure low-carbon energy sources are not displaced.

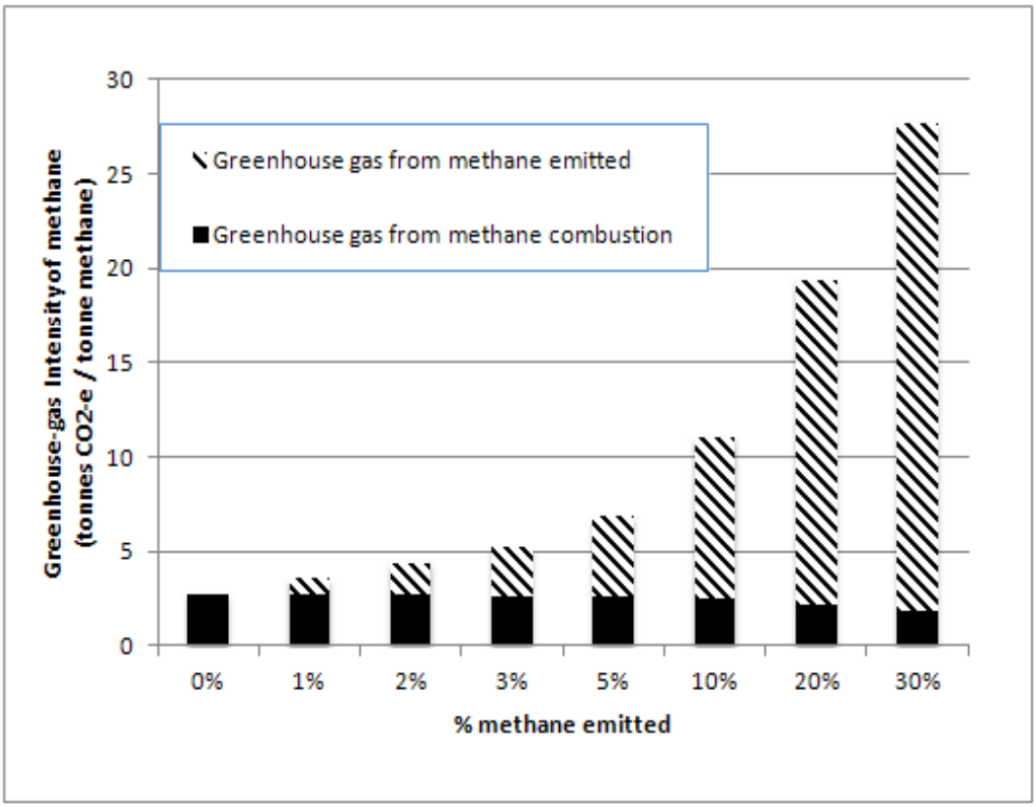


Figure 8: *The climate impact of gas as an energy source greatly depends on what fraction is emitted to the atmosphere, versus what fraction is burned as fuel. Here we assume a global warming potential of 86 (appropriate to the 20 year timescale), with the y-axis showing the tonnes of CO2 emitted for each tonne of methane gas produced.*
Source: http://www.tai.org.au/sites/defualt/files/MEI%20Review%20of%20Methane%20Emissions%20-%2026%20October%202016.pdf, page 19.

Climate footprint of conventional versus unconventional gas

Methane emission risks to the NT are far greater from shale gas than they are from conventional gas due to the Territory's massive reserves of shale. There is an estimated 200 trillion cubic feet of shale gas underlying the NT. *(NT Govt: http://newsroom.nt.gov.au/mediaRelease/14551)*
Based on current industry best practice, extraction of this untapped unconventional gas will lead to far greater methane emissions in the NT. In the shale gas-fields of Texas USA for instance (Eagleford Shale), methane emissions were measured by satellite to equate to 9% of total gas production. *(See: http://onlinelibrary.wiley.com/doi/10.1002/2014EF000265/abstract)*

In the Territory, even if only the shale gas from the Beetaloo Sub Basin were extracted, resource analysts point to about 30 trillion cubic feet being recoverable: *(See: http://www.afr.com/business/energy/gas/beetaloo-emerges-as-beacon-for-east-coast-gas-20170329-gv9add).*

With 9% leak rates comparable to measurements in the shale gas-fields of Texas, this equates to 2.7 trillion cubic feet of methane being inadvertently released into the atmosphere due to the fracking of NT shale gas from the Beetaloo basin.

2.7 trillion cubic feet of methane is a devastating amount of highly potent methane to add into the atmosphere during the key decades where emissions need to be reduced in order for the world to stay below 2 degrees of warming. Beetaloo Sub Basin gas must be left where it is.

Further differences in leak rates between unconventional gas and conventional gas have been measured in the USA. A 2014 peer-reviewed report stated:

> *"Casing and cement impairment in oil and gas wells can lead to methane migration into the atmosphere and/or into underground sources of drinking water. An analysis of 75,505 compliance reports for 41,381 conventional and unconventional oil and gas wells in Pennsylvania drilled from January 1, 2000–December 31, 2012, was performed with the objective of determining complete and accurate statistics of casing and cement impairment. Statewide data show a sixfold higher incidence of cement and/or casing issues for shale gas wells relative to conventional wells."*
> See full report: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4121786/

The technologies for conventional and unconventional gas are not at the same scale. Unconventional gas is trapped in very dense rocks with low permeability that prevents it flowing into wells in commercial volumes. Therefore, greater pressure and a far greater number of well heads are required to extract the gas over a large surface area. This creates **more** points of methane leakage across the gasfield.

University of Waterloo researchers warned that natural gas seeping from 500,000 wellbores in Canada represents *"a threat to environment and public safety"* due to groundwater contamination, greenhouse gas emissions, and explosion risks wherever methane collects in unvented buildings and spaces. The report found that 10 percent of all active and suspended gas wells in British Columbia now leak methane. Additionally, the report found that some hydraulically fractured shale gas wells in that province have become *"super methane emitters"* that spew as much as 2,000 kg of methane each year. *(See:*
http://www.geofirma.com/Links/Wellbore_Leakage_Study%20compressed.pdf)
And regarding Canada's 500,000 leaky energy wells:
http://www.thetyee.ca/News/2014/06/05/Canada-Leaky-Energy-Wells/)

In 2014, following a comprehensive review of evidence, the Council of Canadian Academies identified inherent problems with well integrity as one of its top concerns about unconventional drilling and fracking. According to one expert panel, *"the greatest threat to groundwater is gas leakage from wells from which even existing best practices cannot assure long-term prevention."* Regarding their concerns related to well integrity and cement issues, the panel wrote:

> *"Two issues of particular concern to panel members are water resources, especially groundwater, and GHG emissions. Both relate to well integrity* [....] *Natural gas leakage from improperly formed, damaged, or deteriorated cement seals is a long- recognized yet unresolved problem* [....] *Leaky wells due to improperly placed cement seals, damage from repeated fracturing treatments, or cement deterioration over time, have the potential to create pathways for contamination of groundwater resources and to increase GHG emissions."*

They further explain:

> *"Cement may crack, shrink, or become deformed over time, thereby reducing the tightness of the seal around the well and allowing the fluids and gases ... to escape into the annulus between casing and rock and thus to the surface.* [...] *The challenge of ensuring a tight cement seal [will] be greater for shale gas wells that are subjected to repeated pulses of high pressure during the hydraulic fracturing process than for conventional gas wells. This pressure stresses the casing and therefore the cement that isolates the well from surrounding formations repeatedly."* See: Council of Canadian Academies. (2014, May 1). Environmental Impacts of Shale Gas Extraction in Canada: the Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction. Retrieved from http://bit.ly/1nNicuf

High amounts of methane are inevitably released as 'fugitive emissions' during shale gas fracking

Australia's unconventional fugitive emissions are far higher than reported, and once these emissions exceed 3.3%, gas loses any climate advantage it has over coal.

Business Editor and journalist Paddy Manning estimates that fugitive emissions in Australia already exceed 4%: *(See:https://www.crikey.com.au/2014/08/12/fugitive-csg-emissions-are-no-big-deal-right-wrong/).*

Former chemical engineer and Melbourne Energy Institute Energy Adviser Tim Forcey reports that 'about 3%' of fracked methane in Australia currently escapes in fugitive emissions. *(See http://www.abc.net.au/news/2017-02-28/the-clean-green-image-of-coal-seam-gas-is-under/8312466)*

Similarly, the Australia Institute has pointed out that Australia's fugitive emissions are almost certainly being underreported. *(See:http://www.tai.org.au/content/australia%E2%80%99s-unaccounted-emissions-could-cause-paris-target-failure).*

Given the extensive size of Australia's gas resources, using current extraction and processing methods, our oil and gas industry could be among the world leaders in emitting methane to our Earth's atmosphere. If Australian unconventional gas production expands to twice its present size (to 3000 petajoules per year), with a methane-emission rate of 6%-of-production, the resulting pollution would be equivalent to approximately *half* of Australia's total nation-wide greenhouse-gas emissions, as currently reported across all sectors.
Source: http://energy.unimelb.edu.au/articles/a-review-of-current-and-future-methane-emissions (page 10)

No baseline methane-emission studies yet

Based on current industry extraction practices, fugitive methane emissions in the Territory's proposed hydraulic fracturing industry comprise an unconscionable risk to the world's climate and the NT's population and environment. Since it represents a conflict of interest to its goal to profit from extracting shale gas, the industry cannot be relied on to monitor such emissions, as their reporting record interstate shows. This University of Melbourne report found *no* baseline methane-emission studies were completed prior to the commencement of the Australian CSG-LNG industry. None. As is now well-known, above a heavily fracked coal seam gas deposit underlying the Condamine River in Queensland, methane now escapes into the atmosphere unchecked. Without baseline data it is difficult to prove it's a consequence of nearby fracking.

Clearly, comprehensive baseline data is needed should exploration in the NT go any further, and the NT's waterways are similarly compromised. Due to the industry's conflict of interest, such studies should be performed by an independent regulator.

The NTG has a poor record monitoring mining and enforcing regulations

Based on the Northern Territory Government's inadequate performance to date, CAD has serious concerns about the government's ability to monitor and regulate a new mining industry in the NT. Evidence shows that the NT Department of Primary Industry and Resources (DPIR) struggles to get people on the ground conducting routine inspections of existing big, high profile mining

projects. At large, long-established and well resourced projects including Mt Todd Gold Mine, Ranger Uranium Mine and McArthur River Mine, unplanned incidents and management failures have generated significant contamination of air, water and soil.

To comprehend how few staff monitor the infamous McArthur River Mine, recently the Department had a number of unscheduled inspections due to the ballooning problems with the spontaneously combusting waste rock dump, but previously, they often only visited for monitoring once a year. This fails to take into account seasonal impacts before and after rain events, or evidence of air pollution. View the history of site inspection at: *https://dpir.nt.gov.au/mining-and-energy/public-environmental-reports/mcarthur-river-independent-monitor*

As for the most monitored and best regulated mine in the NT, Ranger Uranium Mine, Routine Periodic Inspections (RPIs) are scheduled monthly, and they do them most months. At the latest Alligator Rivers Region Advisory Council (ARRAC) meeting [April 20 2017] it was suggested Ranger will soon need to additionally monitor shallow water in the wetland surrounding the mine. The NT Department of Resources representative responded stating that this would be difficult as their environmental monitoring resources are stretched and to do so they'd need to abandon other check-monitoring points *(pers comm. Justin Tutty, Environment Centre NT Rep)*.

Even in those well-defined cases the Department's ability to get their staff on-site or to work with industry to promote remediation efforts is limited, often expensive and sometimes impracticable. In contrast, the shale gas industry and its impacts are not localised, but spread out in gasfields and beyond, making it even more impractical to independently regulate.

Without significant new resourcing, the NT Government won't have the ability to test for leaks at all sites along the exploration and production fields. Even then, the NT is vast and much of it has seasonal access challenges deeming it highly likely that the poor levels of monitoring will continue and will not suffice to make us safe.

The NT's reputation in regulating the petroleum industry is no better. In its Inquiry into the August 2009 oil spill disaster, the 2010 Montara Oil Spill Inquiry report found:

> *"For a period of just over 10 weeks, oil and gas continued to flow unabated into the Timor Sea, approximately 250 kilometres off the northwest coast of Australia. Patches of sheen or weathered oil could have affected at various times an area as large as 90,000 square kilometres.*

Ensuring the integrity of oil and/or gas wells (that is, preventing blowouts) is a fundamental responsibility of companies involved in offshore petroleum exploration and production.

Blowouts offshore can have major and long lasting effects - including the loss of human life; the pollution of marine and shoreline ecosystems; and substantial commercial losses by the companies directly involved and third parties affected by the spill.

Well control practices approved by the delegate of the Designated Authority (DA), the Northern Territory Department of Resources (the NT DoR), most likely would have been sufficient to prevent the Blowout if PTTEPAA had adhered to them and to its own Well Construction Standards.

*"However, **the NT DoR was not a sufficiently diligent regulator**: it should not have approved the Phase 1B Drilling Program for the Montara Oilfield in July 2009 as it did not reflect sensible oilfield practice; **it also adopted a minimalist approach to its regulatory responsibilities.** The way the regulator (the NT DoR) conducted its responsibilities gave it little chance of discovering PTTEPAA's poor practices. In this case, **the regulatory dog did not bark.**"*

Source:
https://industry.gov.au/resource/UpstreamPetroleum/MontaraInquiryResponse/Documents/Montara-Report.pdf

Concerned by the NTG's evident inability to monitor and regulate the resources sector within its jurisdiction, then shadow NT Mining Minister, Ken Vowles MLA, described the NT Petroleum Regulations as 'unsatisfactory' in 2016. Now the Minister for Mining, Vowles was informed on the basis that the Regulations omitted the recommendations of energy law expert Dr Tina Hunter, who was commissioned to provide advice on fracking regulations. Specifically, Dr Hunter's review of the draft regulations recommended: *"Well inspection by an independent certified third party inspector should be a mandatory component of the regulatory regime for drilling."* Minister Vowles noted that this recommendation had been ignored by the then CLP Government: *"Dr Tina Hunter has stated that all the draft regulations have to be brought in. That is certainly not the case in this legislation and this is why we can't support this." Source: http://www.abc.net.au/news/2016-05-23/territory-labor-refuses-to-back-fracking-legislation/7438210?pfmredir=sm*

Such statements from Minister Vowles indicate that members of the current NTG share CAD's concerns about the inadequate regulation of the extractive sector in the Territory. Like the Minister, we believe that the current regulatory regime is grossly ill-equipped to monitor the conduct of a

diffuse and multiple impact industry such as hydraulic fracturing. We are hoping plans to rectify the many inadequacies of the NT mining and petroleum regulations do so thoroughly and speedily. If this Inquiry deems the moratorium to be expired, it must reiterate the need for regular inspection of *every* well, and highlight that the existing regulations fall far short of this standard.

The conclusion we draw from the ability of NT regulators to deal with current high profile problems, is that they don't have the extra capacity for this new regulatory challenge created by allowing hydraulic fracturing of shale gas. It is also unlikely such capacity will be granted. But even if somehow it were, monitoring alone cannot sufficiently deal with the vast number of point sources of pollution or take back fugitive emissions once leaks have occurred.

The economic argument for shale gas fracking is false

The argument for increasing NT's shale gas industry is based upon false economics designed to encourage investment in infrastructure which supports fossil fuel resources at the expense of clean and readily available renewable energy source. *(See: https://www.climatecouncil.org.au/price-of-gas)*

Our community has not been presented with any independent economic analysis to show that there is an economic or social case for increasing NT's shale gas industry. Conversely, independent reports by The Australia Institute and others highlight that there is no economic case to extract shale gas in the NT. We remain very cynical about the estimations of both projected jobs and income made by industry bodies. Clearly these industry bodies have a short-term, vested interest in accessing shale gas for their shareholder's profits and therefore cannot be relied upon as a source of information about such projections.

Furthermore, there is no domestic demand for shale gas in the NT. The NT has access to plentiful conventional gas and renewable energy to meet its energy needs for decades to come. False economies driven by the over-contracting of gas to export industries is now driving demand in eastern states, however the economic benefit of supplying shale gas from the NT to the eastern states is likely to be negative when fully costed. *(http://www.tai.org.au/content/passing-gas-economic-myths-around-northern-territorys-north-east-gas-interconnector-pipeline).*

CAD is increasingly concerned that building the North East Gas Interconnector pipeline will send a signal to the world that the NT ignores the wishes of Traditional Custodians, and is about fossil fuels, not renewables. We are concerned that once built, it will be publically subsidised, run at a loss and serve to justify further extraction of shale gas at all costs.

The Institute for Energy Economics and Financial Analysis (IEEFA) found in exploring the economic case for the North East Gas Interconnector (NEGI):

a) Recent downgrades suggest demand for the project is overstated.

b) The project raises questions over ownership, given the proponent Jemena is effectively owned by the Chinese and Singaporean governments

c) The project would most likely be a loss-making enterprise

d) The project is informed by official energy market forecasts that are overestimated

e) The project is being built into a global glut of LNG

f) A breakdown is occurring in how contracts are traditionally priced

g) NT production is very high cost

- *For the NEGI to be built, substantial new fossil fuel subsidies from the Northern Territory government (through the PWC) and the federal government (through the Northern Australia Infrastructure Facility) will be required.*
- *The NEGI has been conceived to compensate for a poor decision by the Power and Water Corporation (PWC) to contract to buy too much gas.*
- *Neither the NEGI nor the larger East Coast onshore gas export market has sufficient customers for their high-priced product.*

Source:http://ieefa.org/wp-content/uploads/2016/05/Pipe-Dream-A-Financial-Analysis-of-the-NEGI-MAY-2016.pdf

A cheaper, cleaner alternative to shale gas is readily available: Solar

CAD is very pleased to note that the NT Government has committed a Renewable Energy Target of **50% of power generated from renewables by 2030** which signals a great shift towards renewable-generated power in the NT from the current paltry figure of just 3%. We look forward to contributing to the Renewable Energy Target expert panel. However we are concerned that an emissions reduction target and accompanying whole of economy climate policy is yet to be put into place and was not included in the NT Government's recently released Draft Economic Framework.

The NT is a global solar hotspot. We have an average of between 8 and 10 average sunshine hours daily across the NT. (http://www.bom.gov.au/jsp/ncc/climate_averages/sunshine-hours/index.jsp**)**

The opportunities for sustainable renewable energy generation and storage here are enormous. The existing large-scale solar plants located at Uterne Alice Springs and Darwin Airport are a model for the future energy supply of Territorians, and export opportunities could be explored.

Uptake of rooftop solar is rapidly increasing in Australia due to plummeting capital costs. As opposed to shale gas extraction the rollout of solar PV technology in NT towns and cities provides a new, independent model of energy delivery with far less infrastructure, environmental and social costs.

As an alternative to existing fossil-fuel power generation in remote communities, solar provides increased energy independence; increased living standards and connections to country (eg. Bushlight Project Evaluation Report (2005) Centre for Appropriate Technology); local remote jobs with long-term benefits rather than boom/bust of extractive industries; reduced cost of diesel haulage, or impact on roads and it is both cheaper and cleaner.
(Source:https://static1.squarespace.com/static/5450868fe4b09b217330bb42/t/5475305ae4b01e93899dc945/1416966234785/BL-evaluationreport-2005.pdf)

The Climate Council estimates that if Australia adopts a 50% Renewable Energy Target, this would create 28,000 jobs nationally *(https://www.climatecouncil.org.au/renewablesreport).* The Australian Institute recently found that the solar industry employs more people than all fossil-fuel generated power industries combined and that solar is the future of jobs in Australia, not fossil fuels. *(http://reneweconomy.com.au/solar-industry-provides-far-more-jobs-in-australia-than-coal-69251)*

Solar vs Shale gas life-cycle analysis

An Australian report from 2012 shows: “When exported for electricity production, LNG was found to be 22 to 36 times more GHG intensive than wind and concentrated solar thermal (CST) power” *http://www.mdpi.com/1996-1073/5/4/872.*

This is important, as all the shale gas extracted in the NT is expected to be destined for LNG export. The report also states: “if methane leakage approaches the elevated levels recently reported in some US gas fields (circa 4% of gas production) and assuming a 20-year methane GWP, the GHG intensity of CSG-LNG generation is on a par with sub-critical coal-fired generation.”

The extent to which reduced-emissions completions will be adopted (or regulated) in the UK is not yet clear; if adoption is low, methane emissions will be higher and the actual GWP of shale gas will be closer to the worst case estimates of 1102 (GWP100) and 1565 (GWP20) g CO_2-eq./kWh shown in Figure 9, making it the worst fuel source considered.

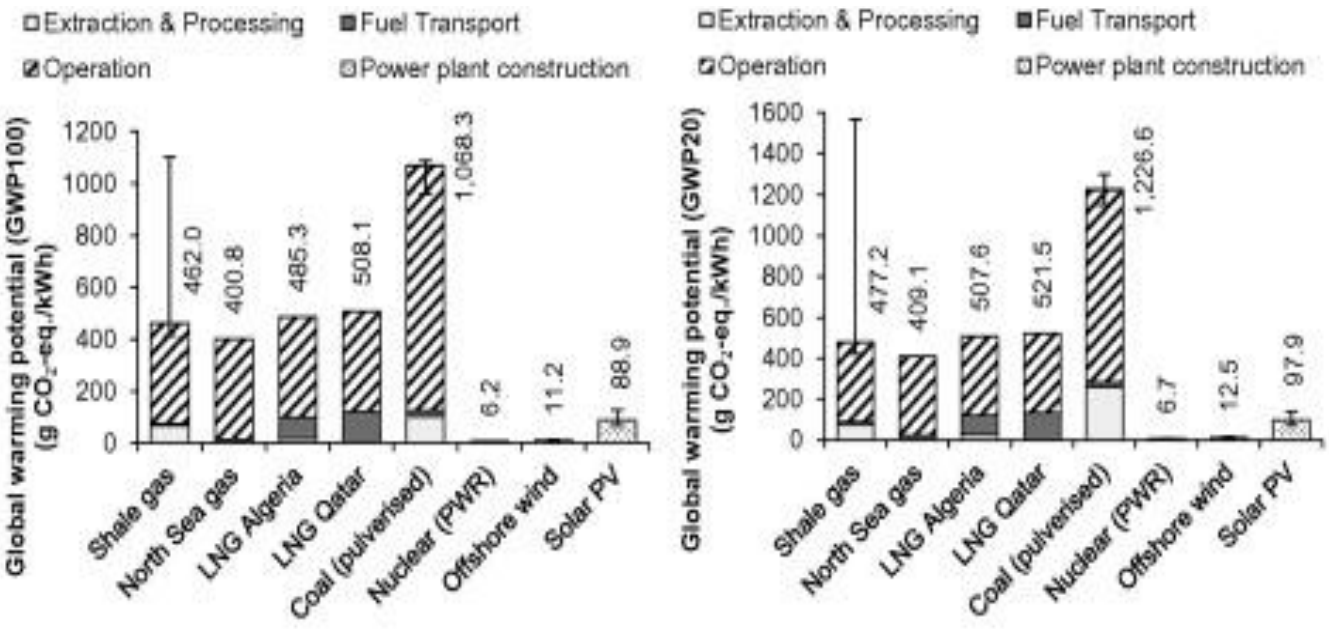


Figure 9. Life cycle environmental impacts of electricity from shale gas, conventional gas, coal, nuclear, offshore wind and PV.
Source: *http://www.sciencedirect.com/science/article/pii/S0306261914008745*

Abatements for climate emissions are expensive and such important tasks comprise one of the many hidden costs of shale gas extraction. Once taken into consideration, shale gas extraction's hidden costs make transitioning to renewable energy utilising solar power the economically sensible choice for the Territory, rather than a short-lived fossil fuel industry.

Future generations have the right to a clean, safe climate

The NTG has a moral imperative to protect its population from potential harm caused by climate change, by cutting greenhouse gas emissions where possible.

The Human Rights Council of the United Nations General Assembly emphasised the following at its 29th meeting on 30 June, 2015:

> *"Emphasizing that the adverse effects of climate change have a range of implications, both direct and indirect, for the effective enjoyment of human rights, including, inter alia, the right to life, the right to adequate food, the right to the enjoyment of highest attainable standard of physical and mental health, the right to adequate housing, the right to self-determination, the right to safe drinking water and sanitation and the right to development…" (p.2),*
> **Source:** http://ap.ohchr.org/documents/E/HRC/d_res_dec/A_HRC_23_L27.doc

The Northern Territory has a global, national and local responsibility to reduce its greenhouse gas emissions and rapidly shift away from energy generated by fossil fuels to a renewable energy economy.

To do this, the NT needs to shift its investment in infrastructure, political efforts and ingenuity away from polluting shale gas toward making the most of clean, free renewable energy sources. A permanent ban on shale gas fracking will help it to get there.

The Universal Declaration of Human Rights (U.N. 1948) in Article 3 states: "*Everyone has the right to life, liberty and security of person*", and in Article 22: "*Everyone, as a member of society, has the right to […] the economic, social and cultural rights indispensable for his dignity and free development of his personality*." In other words, the member states of the United Nations have acknowledged that as part of their solemn oath to protect fundamental human rights, that everyone has the right to live free, safe and secure lives.

Climate Action Darwin's members submit to the Inquiry that future generations have a right to exist in a safe and healthy world. The energy, lifestyle and infrastructure choices we make now will determine whether we live in a world determined by dangerous climate change, or one where these impacts are able to be managed. Banning shale gas fracking is one step the NT must take to protect its population, particularly future generations.

Conclusion: Ban shale gas fracking

Gas has been lauded for its potential role in the transition to lower greenhouse-gas emitting energy sources. This is because it has been considered that burning gas results in less carbon dioxide emissions than that produced when the same amount of energy is produced by burning coal. But this does not account for fugitive methane emissions, which are presently inevitable. To reduce pollution and to meet international commitments to emissions reduction, avoiding preventable methane emissions is an obvious first step. An immediate way to achieve this in the Northern Territory is to ban the fracking of shale gas.

Climate change, with its tipping points and irreversible consequences – such as mass extinctions, destruction of ecosystems, the loss of large ice sheets and the large-scale release of greenhouse gases from carbon stores such as permafrost and methane trapped in ice under sediments on the ocean floors – contains many possibilities for catastrophic failure. World leaders have agreed to act to limit dangerous climate change. Improving the efficiency of energy-use and shifting from fossil to renewable energy sources have been identified as ways to help achieve this vital goal.

2°C of warming is the designated boundary between dangerous and very dangerous climate change. The non-dangerous (safer) zone is well under 1°C, yet the present level of greenhouse gas emissions is sufficient to produce much more than 2°C of warming, indeed, we may have already committed ourselves to a catastrophic rise of 7°C. *(http://www.nature.com/nature/journal/v538/n7624/full/nature19798.html)* Practically speaking there is no carbon budget available for burning more fossil fuels for a chance at the 2°C target.

Given Australia's commitment to a 2°C target, reducing methane emissions as soon as possible will provide the largest impact on global peak temperature, as well as the largest ecosystem benefit. Methane emission reductions are most effective in the near term. So all unconventional gas extraction in the Northern Territory should be permanently halted, not phased out.

The NT now has a short window of great opportunity; to shift away from a polluting fossil-fuel economy towards a clean renewable economy by taking advantage of our enormous solar resources - pollution free. Investing in supporting, monitoring and regulating a shale gas industry now will lock us in for 30 years of more climate pollution, which is simply untenable in a world already suffering a 1 degree rise in average global temperatures. Alternatively, many thousands of jobs and investment could be made in the renewable energy economy.

We are privileged to be the generation with the benefit of this choice, and that the choice is clear: ban shale gas fracking and instead divert all inquiries, research, investment, regulation and efforts toward a burgeoning renewable energy industry.

For taking courage against the powerful fossil fuel lobby and their interests in making this decision, you will be our heroes and this Government will be well remembered for generations to come. The inevitable consequences of the alternative scenario must be avoided at all costs.

Please recommend the moratorium be permanent: ban hydraulic fracturing in the NT.