To the Environment and Planning Committee,

> "The looming choice may be either stranding those [fossil fuel] assets or stranding the planet."
>
> - OECD Secretary-General Angel Gurría states

> "…business-as-usual' is not a viable option for the fossil fuel industry in the long term."
>
> - Paul Spedding, Oil & Gas Sector Analyst HSBC

**Re Inquiry into Unconventional Gas in Victoria**

My name is Tony Goodfellow, I have a Bachelor of Natural Environment and Wilderness Studies and Honours in Sociology from the University of Tasmania. I also have a background in agriculture working as an apiarist. I live and work in Victoria with my family and would like to state, from the onset, that Victoria should ban all unconventional gas drilling permanently. I do not support any form of unconventional gas mining (including coal seam gas, tight gas, shale gas & underground coal gasification) and would like to explain my reasons for this position.

Unconventioal gas is not a step in the right direction it threatens investment in future renewable energy technology, it is polluting, it is unpopular, coal seam gas carries evidence-based risks for the environment and health and contributes to climate change. There is existent renewable energy technology that could be used to transition to a 100% renewables clean economy.

A ban on unconventional gas mining would give certainty to existing industry such as agriculture and tourism and also give certainty to renewable energy industry. A ban would send the message that the state takes the risks to environment and health seriously.

Unconventional gas poses unacceptable risks to water, community health, food security and jobs for a moribund industry built on an asset that will be soon stranded.

As Dr Alex St John writes in the Parliamentary Library Briefing Book *the coal seam gas debate*:

"….some communities feel that CSG development does not fit with the character or objectives of the area, such as wine or tourist regions. Some communities are also concerned that CSG development may have an impact on their health."

A draft report by the Environmental Protection Agency (EPA) with the title 'Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources' completed June 2015 found that hydraulic fracturing for oil and gas can lead, and has led, to the contamination of drinking water.

Major Findings:

From our assessment, we conclude there are above and below ground mechanisms by which hydraulic fracturing activities have the potential to impact drinking water resources. These mechanisms include water withdrawals in times of, or in areas with, low water availability; spills of hydraulic fracturing fluids and produced water; fracturing directly into underground drinking water resources; below ground migration of liquids and gases; and inadequate treatment and discharge of wastewater.

….we found specific instances where one or more mechanisms led to impacts on drinking water resources, including contamination of drinking water wells.

Hydraulic fracturing wastewaters contain other constituents such as barium, boron, and heavy metals. Barium in particular has been documented in some shale gas produced waters. Little data exist on metal and organic compound concentrations in untreated and treated wastewaters in order to evaluate whether treatment is effective, and whether there are potential downstream effects on drinking water resources when wastewater is treated and discharged.

Produced water varies in quality from fresh to highly saline, and can contain high levels of major anions and cations, metals, organics, and naturally occurring radionuclides. Produced water from shale and tight gas formations typically contains high levels of total dissolved solids (TDS) and ionic constituents (e.g., bromide, calcium, chloride, iron, potassium, manganese, magnesium, and sodium). Produced water also may contain metals (e.g., barium, cadmium, chromium, lead, and mercury), and organic compounds such as benzene. Produced water from coalbed methane typically has much lower TDS levels compared to other produced water types, particularly if the coalbed was deposited under fresh water conditions.

We identified 134 chemicals that have been detected in hydraulic fracturing produced water. These include chemicals added during the chemical mixing stage, as well as naturally occurring organic chemicals and radionuclides, metals, and other constituents of subsurface rock formations mobilized by the hydraulic fracturing process. Data on measured chemical concentrations in produced water were available for 75 of these 134 chemicals.

The EPA characterization of hydraulic fracturing-related spills found that 8% of the 225 produced water spills included in the study reached surface water or ground water. These spills tended to be of greater volume than spills that did not reach a water body. A well blowout in Bradford County, Pennsylvania spilled an estimated 10,000 gal (38,000 L) of produced water into a tributary of Towanda Creek, a state-designated trout fishery. The largest volume spill identified in this assessment occurred in North Dakota, where approximately 2.9 million gal (11 million L) of produced water spilled from a broken pipeline and impacted surface and ground water.

Potential impacts to drinking water resources may occur if hydraulic fracturing wastewater is inadequately treated and discharged to surface water. Inadequately treated hydraulic fracturing wastewater may increase concentrations of TDS, bromide, chloride, and iodide in receiving waters. In particular, bromide and iodide are precursors of disinfection byproducts (DBPs) that can form in the

> presence of organic carbon in drinking water treatment plants or wastewater treatment plants. Drinking water treatment plants are required to monitor for certain types of DBPs, because some are toxic and can cause cancer.
>
> Water is a major component of nearly all hydraulic fracturing operations. It typically makes up almost 90% or more of the fluid injected into a well, and each hydraulically fractured well requires thousands to millions of gallons of water. Cumulatively, hydraulic fracturing activities in the United States used on average 44 billion gal of water a year in 2011 and 2012, according to the EPA's analysis of FracFocus 1.0 disclosures. Although this represents less than 1% of total annual water use and consumption at this scale, water withdrawals could potentially impact the quantity and quality of drinking water resources at more local scales.

DEPI states in the region overview that "Cropping, livestock and horticulture comprise the major primary industries in the Central Highlands." Through competition for water and land the primary industries of the area would threatened if Unconventioal gas mining occurred in the area.

Relating to 4 (c) *carbon dioxide emissions from these sources* a recent a journal article in Earth's Future in Volume 2, Issue 10 titled 'Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations' has the stark conclusion that there is an "unlikely" benefit when the "methane loss" is considered, with the leaks "calling immediate climate benefit into question."

"In conclusion," they write, "at the current methane loss rates, a net climate benefit on all time frames owing to tapping unconventional resources in the analyzed tight formations is unlikely."

The abstract states:

> In the past decade, there has been a massive growth in the horizontal drilling and hydraulic fracturing of shale gas and tight oil reservoirs to exploit formerly inaccessible or unprofitable energy resources in rock formations with low permeability. In North America, these unconventional domestic sources of natural gas and oil provide an opportunity to achieve energy self-sufficiency and to reduce greenhouse gas emissions when displacing coal as a source of energy in power plants. However, fugitive methane emissions in the production process may counter the benefit over coal with respect to climate change and therefore need to be well quantified. Here we demonstrate that positive methane anomalies associated with the oil and gas industries can be detected from space and that corresponding regional emissions can be constrained using satellite observations. On the basis of a mass-balance approach, we estimate that methane emissions for two of the fastest growing production regions in the United States, the Bakken and Eagle Ford formations, have increased by 990 ± 650 ktCH4 yr−1 and 530 ± 330 ktCH4 yr−1 between the periods 2006–2008 and 2009–2011. Relative to the respective increases in oil and gas production, these emission estimates correspond to leakages of 10.1% ± 7.3% and 9.1% ± 6.2% in terms of energy content, calling immediate climate benefit into question and indicating that current inventories likely underestimate the fugitive emissions from Bakken and Eagle Ford.

Victorian communities don't want unconventional gas. At least 30 communities have already declared themselves gasfield-free, and the number continues to grow. Renewable energy is wanted by over 80% of Australians. Giving the green light to unconventional gas gives the red light to renewable energy. Renewable energy would provide jobs and new manufacturing opportunities.

Due to the shifting nature of policy unconvential gas assets may become stranded assets. THE Climate Council in Australia has recently released a report *Unburnable Carbon: Why we need to leave fossil fuels in the ground* argues that ""new investment in fossil fuels…needs to be reduced to zero as soon as possible." The Climate Council argues that Austrlais "dash for Gas" needs to be questioned,"it is important to understand the likely greenhouse gas (GHG) contribution of this emerging fuel in the future."

*Unburnable Carbon* outlines the shifting sands of the fossil fuel boom time:

> ## High probability of stranded assets
>
> These numbers bring a stark new reality – all stakeholders need to start thinking about which of those assets are more likely to get burnt within the next few decades. This has led to a new debate about the potential for stranded assets. From a climate change point of view it makes sense to switch to less carbon intensive options, which results in a hierarchy of renewables over gas and over coal. Within the coal sector it is clear that if demand is reduced and prices fall then the most expensive sources of coal will suffer first. Given Australia's current position as a high-cost producer, this should be of concern to the sector and those who invest init. Some companies have already scaled back plans for expansion. Although, gas and coal companies are investigating the potential for carbon capture and storage to mitigate emissions from combustion, it is not yet clear that this is within a timeframe and costbase which gives investors any certainty.
>
> ## Revenues at risk
>
> As margins are squeezed over the next few years, this could impact revenues which are the basis for calculating discounted cash flows used in valuation models. Analysts have calculated that up to 44% of coal revenues could be at risk if the IEA's 450ppm pathway – the 2°C scenario - is followed. This raises questions about the assumptions underlying the valuation models used by these analysts. This is not just about whether there is a carbon price. There are far wider implications of achieving emissions targets. The fundamentals of the demand for and price of fossil fuels are also likely to be impacted in a low-carbon future.

In sum, it is for these reasons, environmentally, socially, ethically and financially why Victoria should **ban** all unconventional gas drilling permanently. Unconventional gas poses financial risks of being a stranded asset it is not a renewable source of energy - it is polluting, contributes to climate change, and is not required as a fuel to transition between fossil fuels and renewables. We can make a planned transition to 100% renewables in Victoria without the need for gas as a 'bridging' fuel, but we need to start investing in real renewables like solar and wind power now.

Tony Goodfellow

END