

Stop the Santos Narrabri coal seam gas project now and require effective remediation of Pilliga country already poisoned by Santos and its predecessors in interest in coal seam gas mining.

Liquefied natural gas (LNG) is not a cleaner greener energy. It is all methane, CH<sub>4</sub>. Methane can be mined conventionally from reservoirs in sandstone or limestone, or more recently, unconventionally.

Conventional gas in Australia is mined in Central Australia, Cooper Basin/Eromanga Basin; offshore Victoria in Bass Strait/Gippsland Basin; and, offshore in northwest Western Australia. The 2016 eruption in Aliso Canyon, Los Angeles, USA illustrates the complexities and dangers of conventional gas mining.

It is mostly coal seam gas (CSG) mined in Australia and mostly shale rock seams mined in the US and begun to be mined in the UK. Methane occurs within the pores and cheats of the coal matrix itself or within shale rock. Mining unconventional gas is complicated and methods vary between coal and shale gas and depending upon many other variables, such as how porous the coal or shale is and how permeable the coal or shale seam is, how deep the seam is, how much water if any is also held in the seam.

Methane burns cleaner, producing less carbon, than most other fossil fuels, at its final energy consumption point. As with all energy systems, to understand the value, uses and impacts of unconventional gas, one must examine the whole of production from exploration and construction of infrastructure, to by-products and waste streams left behind, and every step in the distribution process.

Coal seam gas extraction has a proven devastating track record in the Darling Downs, Queensland, in Camden, New South Wales; in North America and wherever else it has been imposed.

In order to efficiently extract methane from a coal or shale seam many hundreds and thousands of wells connected by pipelines are required. The more wells in close proximity, the faster the gas flows. Whole landscapes are transformed from vast stretches of farmland and wilderness into industrial zones. Each well drills down through different geological layers, basins and groundwater catchments inserting vertical steel pipe, at least partially encased in concrete. Most wells are now also drilled horizontally along the seam underground.

The methane is not alone in the coal or shale seam. Each region and well may have a different mix, but there will be other hydrocarbons, lead and other heavy metals and radioactive elements, which will also be activated, released from the target seams, migrate horizontally and vertically underground and be brought to the surface with the methane, the fracking fluid and produced water.

Hydraulic fracturing, fracking (spelt fraccing in industry papers) is required to separate methane from shale rock. Fracking injects sand, various chemicals and a many millions of litres of water into a well under pressure, fracturing the seam to stimulate gas migration. Some fracking fluid stays underground, some returns to the surface with the gas. Highly corrosive water is held in 'evaporation' ponds, injected back into wells underground, treated using different water purification systems removing some,

but not all salts and toxins are released into ground water systems, sprayed on roads and used to irrigate crops.

There is no cheap and easy way to handle these dangerous by-products of unconventional gas production. Yet those are the only systems used by industry.

Coal is more porous than shale rock and some seams of high permeability are not fracked, or not fracked initially, but fracking is regularly used for CSG mining. The methane in coal seams is usually locked in by water pressure. In order to mine the gas, the coal seam must first be dewatered and depressurized.

CSG mining extracts many millions of litres of water from deep underground. This massive volume of water is also laden with salts, hydrocarbons, lead and other heavy metals, radioactive elements, etc; in other words, elements that must be left alone, deep underground. The water purification system has yet to be invented to successfully treat CSG produced water to levels safe for crop irrigation, stock watering and human consumption.

After dewatering and depressurising coal seams, water will flow back into these underground cavities from surrounding aquifers, requiring more or even constant dewatering over the commercial life of a well.

I have noted the 7000 page Santos report, which seems to say all is well, nothing to worry about, underground aquifers will not cross contaminate, ground water sources for farms will be impacted only negligibly, i.e. 0.5 metre lowering of ground water. I read the summary in the Land news online. It is irrational in the extreme to think that there is any truth to the Santos position.

Scientists are working toward a better understanding the impacts of unconventional gas extraction on the environment, damage to soil, air and water; climate change and greenhouse gas emissions; and human, domestic and wild animal and plant health. Organizations of scientists are working to concentrate knowledge and understanding in the field, PSE Healthy Energy (Physicians, Scientists & Engineers) and the Concerned Health Professionals of New York examples. They have both noted that the data is quite new. Peer-reviewed studies showing negative impacts of unconventional gas began appearing in significant numbers from January 2014. Collating and articulating the data, allowing it to gain wider exposure are these sources: <http://www.psehealthyenergy.org> and <http://concernedhealthny.org/compendium>.

One example of the strength of reliable data expressing the dangers of unconventional gas, is the US state of New York banning, in December 2014, hydraulic fracturing on the grounds of public health and harm to the environment. This was done over the objections of the powerful petroleum lobby. <http://www.wsws.org/en/articles/2014/12/23/frac-d23.html>

If it were not such a regular occurrence under capitalism (e.g. tobacco, asbestos, DDT), it would defy understanding how an industry aggressively rolling out from the 1990s in the US and from 2000 in Australia can exist, pass various so-called environmental protection agencies 'rigorous' regulatory processes and be declared safe on the basis of almost no data. It's as if a magical incantation was saying, "Look

away, there is nothing to see here,” and everyone, except those living and working in the gas fields, looked away.

Whistleblower Simone Marsh, was an analyst with the Queensland government, whose role included authoring a report on the environmental effects of the proposed LNG industry in 2010, including specifically two of the now three Gladstone/Curtis Island LNG processing plants, one by British Gas/Queensland Gas Company \$20 billion project and the other Santos. Both projects were approved and have since been built, going online in 2015. Marsh gave evidence to a federal Senate Select Committee in November 2015 that they were approved ‘under pressure’ from the companies and with Environmental Impact Statements missing essential information.

Marsh quotes a letter sent from Queensland Coordinator General’s office to Santos, on 31 March 2010. “We need gas field development plans, including operational plans showing locations of petroleum activities and infrastructure, disturbance to regional ecosystems, environmental management plans for the gas field development in accordance with the Environmental Protection Act 1994, and a regional groundwater model.”

Marsh told the Senate that she used Santos’ figures on quantities of water produced to calculate volume of waste to be created. “A lot of the cumulative volumes that we had calculated, like 45 million tonnes of solids, were deleted from the final report.... salts, the hydrocarbons, heavy metals, anything that is in that water once evaporated—that is those solids.” The numbers upon which this calculation was based were underestimated, Marsh was later told.

As an example of the ‘pressure,’ Marsh produced an email sent to Queensland treasurer Andrew Fraser on 12 May 2010, saying the project had to be approved in ‘one or two weeks.’ The one-page email came from Ian Fletcher, the 2010-2011 director-general of the Queensland Department of Employment, Economic Development and Innovation (DEEDI) the department responsible for issuing and monitoring petroleum permits.

(Ian Fletcher was a New Zealand diplomat who began working in the British civil service in 1989 in Kosovo, later he was principal private secretary to Sir Andrew Turnbull, head of the Home Civil Service. He was chief executive of the UK Patent Office in 2009, before moving to Queensland in time to usher the LNG industry through the regulatory process. In February 2012 he became head of New Zealand Government Communications Security Bureau (GCSB—New Zealand’s ASIO or CIA). Fletcher resigned as head of the GCSB in January 2015.)

The projects were approved on 28 May 2010.

The Queensland governments says, “Growth in coal seam gas ... in Queensland has been rapid over the past 15 years with the annual number of wells drilled increasing to over 1,371 in 2012-13. This growth will support the more than \$70 billion worth of investment in 3 liquefied natural gas (LNG) projects that will produce approximately 26 million tonnes per year of LNG from 2015 onwards. This represents a quarter of the global LNG supply coming from Central Queensland and places Australia as a leading supplier of LNG.”

Tara and nearby Chinchilla in the Western Darling Downs area, are over the coal seams of the Surat Basin, has been the site of much of the CSG expansion in Queensland as well as the Bowen Basin further north. The Surat Basin and the southern half of the Bowen Basin are deep underground below the Great Artesian Basin, perhaps the world's largest underground aquifer, under 22% of Australia. Above the Great Artesian Basin are shallower groundwater aquifers and the headwaters of the Darling River, part of the catchment of the Murray-Darling River system.

Contaminating the Great Artesian Basin and compromising the flow of the Murray-Darling are catastrophes that cannot be overstated. Mining industry insists in public relations statements that are aquifers are impermeable and discreet, able to remain uncontaminated and secure from ill effects of unconventional oil and gas mining. Dewatering and depressurization of coal seams will not deplete the deep water aquifers or shallower groundwater sources, they say while farmers' bore water disappears, water tables drop, water flows in rivers fail.

The US EPA repeats the lie that water is not harmed by unconventional gas mining in a recent report: <https://www.wsws.org/en/articles/2015/07/13/epaf-j13.html>

As this US EPA report also says, their conclusion is based upon almost no data. Companies are allowed to begin mining with no baseline data on water tables, chemical and mineral composition of water, stream flows and levels and many other variables. The same is true for air quality. They are also allowed to continue their business without adequate monitoring of changes in the water and air after they begin construction and fracking. Thus, 'there is no evidence of harm.'

There is evidence of the propensity of well casings to fail, allowing methane and other constituents to escape into the ground, water and/or air. In a study based upon publically available data from the Pennsylvania Department of Environmental Protection, the statewide failure rate to date for unconventional (Marcellus Shale) wells is at least 6.2%, 60% fail over 20 years, they all fail over time. Dr. Anthony Ingraffea, Distinguished Professor of Engineering, Cornell University. <http://www.pnas.org/content/111/30/10955.short>

The potential for fracking to pierce through the 'impermeable' aquitards contaminating water sources is quietly studied. "New models are being developed to predict the growth of complex fractures as well as improved calculations of fluid loss from stress and permeability interactions around fractures." CSIRO. <http://research.csiro.au/oilandgas/wp-content/uploads/sites/49/2015/10/Coal-seam-gas-2015.pdf>

On a 2011 Australian ABC "Four Corners" program, John Hillier, former principal hydrologist for Queensland said, "We may not even know that we've got leakage down there for 20, 30, 40 years. So we can have a lot of damage to a big resource that we don't even know about." <http://www.abc.net.au/4corners/content/2011/s3144806.htm>

Queensland Gas Company (QGC) fracked its Myrtle 3 well near Tara in mid 2009. In mid 2010, after 13 months, QGC reported the incident that eventually resulted in confirmation the Walloon Coal Measures had leaked through to the Springbok Aquifer. Reportedly the interconnection causing the leak was sealed 21 months later.

Questions that remain unanswered are, was the company aware of the potential for this well to breach if fracked, and did it proceed with the fracking recklessly or intentionally?

In late 2013 UNSW Water Research Laboratory researchers reported to Office of the NSW Chief Scientist and Engineer as part of the Independent Review of coal seam gas activities that this was an incidence of CSG contaminating another aquifer and that, "No technical information could be found about this incident ..."

[http://www.chiefscientist.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0007/38158/WRL-2013-09-Final-November-2013.pdf](http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0007/38158/WRL-2013-09-Final-November-2013.pdf)

The 2011 "Four Corners" program also reported on this incident, interviewing Robert and Anne Brindle who have the 30,000-acre Talbingo Station, cattle farming property in the area of the Tara CSG wells. Anne Brindle said that eventually the Queensland government provided her with a list of the fracking chemicals that had been injected into the leaking well. 130 litres of THPS (hydroxymethylsulfate, also known by its brand name Tocide, a biocide used to kill bacteria in the well) and other highly toxic chemicals went down the well under pressure and if anyone knows where it all ended up, they are not telling.

In June 2011, an Arrow Energy well head blew near Dalby, Queensland. Methane and water spewed up to 90 metres in the air for two days before being capped.

From early 2012 gas began bubbling to the surface on a five-kilometre stretch of the Condamine River near Chinchilla on the Western Downs. The Condamine is a tributary to the Darling River. Origin Energy engages in CSG mining, including fracking in the area and claims that the methane bubbling from the river has nothing to do with them. Four years later the bubbling continues and has intensified and expanded. The official line is that surface and sub surface data must be collected and analysed and this will take a very long time.

<http://www.abc.net.au/news/2016-02-14/condamine-river-mysterious-bubbling-intensifying-landholders-say/7139676>

A 31 March 2015 email, sent by mistake to the online journal *Independent Australia*, from the Queensland Department of Energy and Water Supply says any investigation is in the hands of Origin Energy and "we may never determine the cause."

<https://independentaustralia.net/business/business-display/queensland-bureaucrat-string-puller-one-day-csg-mining-big-shot-the-next,7561>

In another incident concerning the Great Artesian Basin and the Murray-Darling River catchment, a New South Wales Environmental Protection Agency report published in May 2014 confirmed deep and shallow aquifer contamination caused by CSG produced water leaking from ponds that are part of the Santos Narrabri Gas Project in the Pilliga forest in northern NSW. Lead, aluminium, arsenic, barium, boron, nickel and uranium were detected in the aquifers at elevated levels.

[http://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/1160/attachments/original/1399238109/Santos\\_Bibblewindi\\_Investigation\\_Report\\_-\\_Final\\_-\\_To\\_be\\_released.PDF?1399238109](http://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/1160/attachments/original/1399238109/Santos_Bibblewindi_Investigation_Report_-_Final_-_To_be_released.PDF?1399238109)

Water, water everywhere; nor any drop to drink... Coleridge's deeply passionate poem of a crime committed against nature is prophetic. Air quality around unconventional gas mines is also laden with highly toxic substances, including methane.

Dr Isaac Santos and Dr Damien Maher from Southern Cross University did conduct measurements of air quality. They conclude that methane concentrations in the area of the coal seam gas wells around Tara are 3 to 3.5 times higher levels than the surrounding area. <http://scu.edu.au/coastal-biogeochemistry/index.php/70/>

Dr Geralyn McCarron, a medical practitioner conducted her own study in February and March 2013 on 113 people from the 38 households in the Tara area. Dr McCarron's conclusion: "The pattern reported was outside the scope of what would be expected for a small rural community. In all age groups there were reported increases in cough, chest tightness, rashes, difficulty sleeping, joint pains, muscle pains and spasms, nausea and vomiting. Approximately one third of the people over 6 years of age were reported to have spontaneous nose bleeds, and almost three quarters were reported to have skin irritation. Over half of children were reported to have eye irritation."

Submission No 12: Select Committee on Unconventional Gas Mining  
(Bender Inquiry) 31st January 2016

[http://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Gasmining/Gasmining/Submissions](http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Gasmining/Gasmining/Submissions)

Still there is no environmental testing of air or water in the Queensland coal seam gas industrial zones.

An Australian federal government inquiry chaired by then Queensland independent senator Glenn Lazarus (formerly of the Palmer United Party): with former Labor agriculture minister and Queensland senator Joe Ludwig, Australian Greens Queensland senator Larissa Waters, Queensland LNP senator Matthew Canavan; Queensland Liberal senator Joanna Lindgren; and SA Labor senator Anne McEwen.

Testimony from people affected by CSG mining, including Helen Bender, the daughter of George Bender, whose death provided motivation for the Senate inquiry. George Bender had been publically fighting CSG mining on his property and in the area and killed himself in October 2015. Just like in the US and Canada where unconventional gas extraction occurs, groundwater tables sink, well water becomes unusable for farming and domestic use. People and animals sicken and die.

Stop the Santos Narrabri coal seam gas project now and require effective remediation of Pilliga country already poisoned by Santos and its predecessors in interest in coal seam gas mining.

\*Methanogenesis occurs when microbes, often describes as bacteria, but which are in a distinct group called Achaea, produce methane from decomposing biomass. These methanogens do their work both deep underground in coal seams over many millions of years and in the gut of ruminants everyday. Confusing the two related but different methanogenesis systems has led to assertions that CSG is a renewable resource.

Reesa Ryan, Bellbird, NSW