NARRABRI GAS PROJECT AND HUMAN RIGHTS ABUSE

- **a submission to the Permanent Peoples' Tribunal**

  from People for the Plains, Narrabri*

Backgound

Narrabri Gas Project (NGP) is proposed by gas company Santos for the extraction of coal seam gas (CSG or methane) from coal seams which lie below the Pilliga State Forest and adjacent areas to the south of Narrabri in north-western New South Wales (NSW), Australia (see Map 1 below). The project is proposed to consist of 850 new gas wells on 425 well pads. More than 50 wells already have been drilled for exploration and are to be converted to production in the future. Additional infrastructure includes:

- access tracks, water and gas pipelines, communication lines, and supporting infrastructure
- Leewood central gas processing facility for compression, dehydration and treatment of gas
- an adjacent reverse-osmosis water treatment plant, to separate salt from the water removed from the coal seams during gas extraction
- storage and use of this water for irrigation adjacent to this site
- an in-field gas compression and water management facility at the Bibblewindi site
- workers' accommodation.

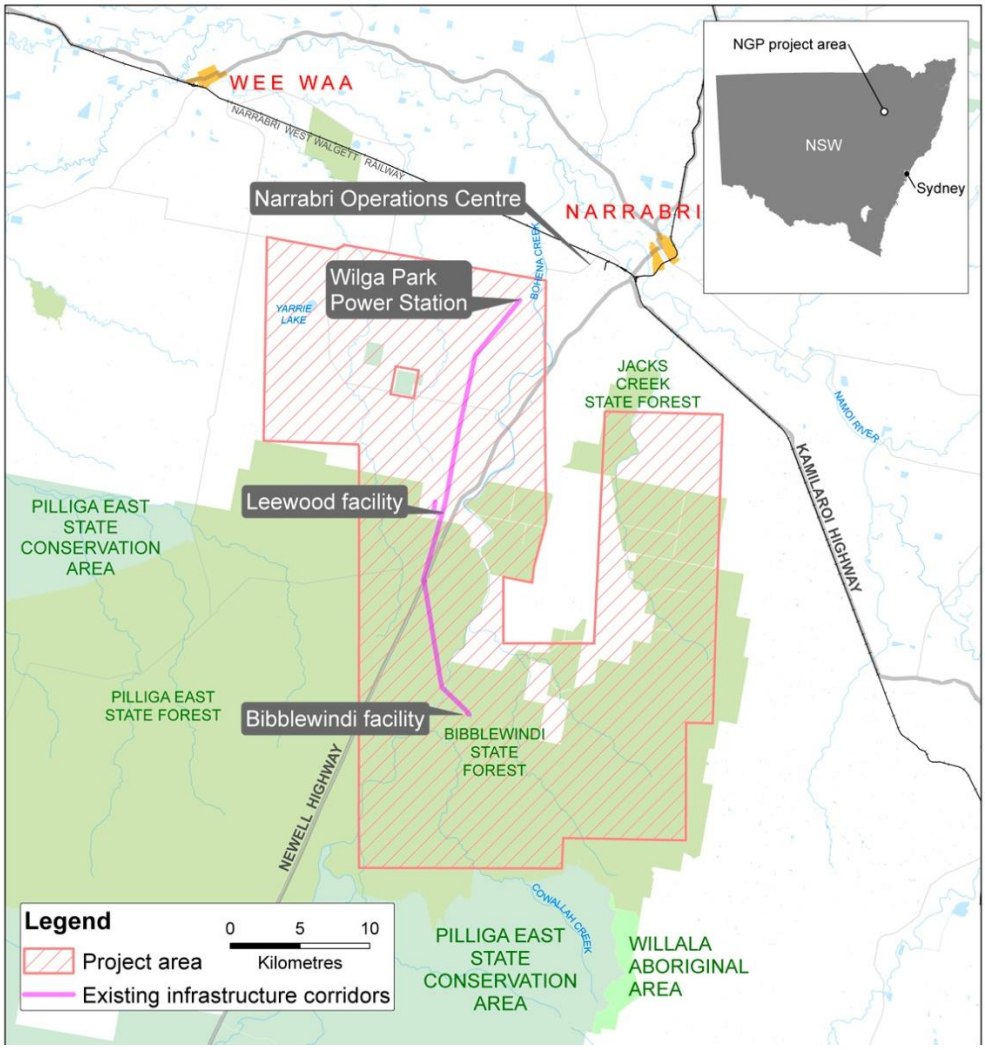
The project is anticipated to have a 20 to 25 year life.

The 900 gas wells are to be spread over 95,000 hectares, with the majority in the Pilliga Forest and the remainder on private land. The gas is to be conveyed in the proposed Western Slopes Pipeline (WSP) to be constructed by infrastructure company APA, to the join the Sydney-Moomba pipeline to the west of Condobolin in central-western NSW. From here, gas could be sent to Sydney for consumption or to Gladstone in Queensland for export.

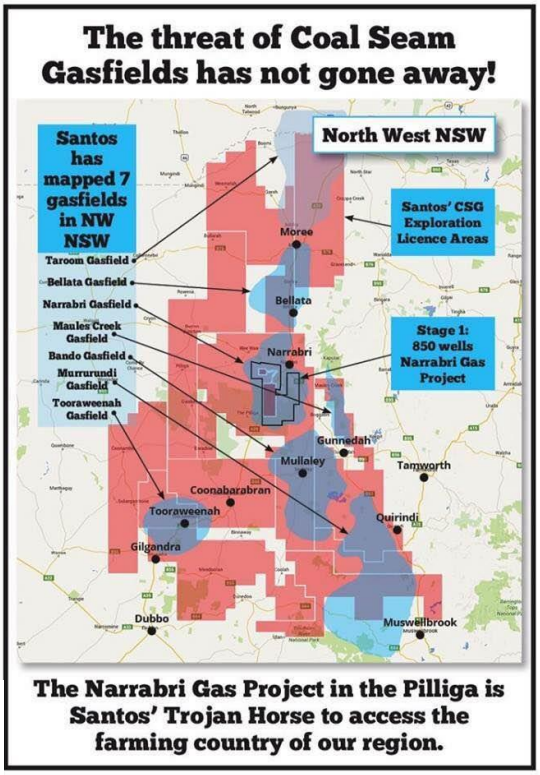
The project developer, Santos, has lodged a State Significant Development Application, including an Environmental Impact Statement (EIS) for the project, with the NSW State Government. The application was advertised and nearly 23,000 submissions were received, all but 1.3% of these objected to the project. The government has summarised the objections and referred these to Santos for a response, which is pending. Meanwhile Santos is continuing with exploration and appraisal activities in the project area.

Santos claims to have "no plans" for development of other gas fields in the region, despite having undertaken extensive exploration and opened an office in adjacent areas and having high-lighted to their shareholders six additional areas for future development in the region (see Map 2 below).

***People for the Plains** is a group of Narrabri Shire residents who have sought to gain a comprehensive understanding of the processes surrounding coal and coal seam gas developments, and the impacts of those processes. Its charter is to educate and advocate on these issues affecting North Western New South Wales.



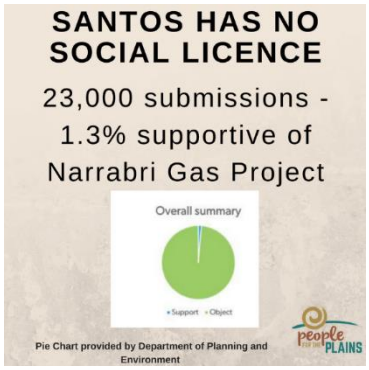
Map 1. Narrabri Gas Project Area



Map 2. Additional gasfields proposed by Santos in North-Western NSW

The Community does not accept the Narrabri Gas Project

The Narrabri Gas Project and its complementary pipeline have been comprehensively rejected by the North Western (NW) NSW residents and have no social licence.



Nearly 23,000 submissions were received responding to Santos' Environmental Impact Statement (EIS), smashing all previous records for development projects in Australia. Submitters had to state at the outset of their submission whether they supported or opposed the project. Only 300 (1.3 per cent) supported the project, with 98.7 per cent opposed. Even in the local area (Narrabri, Wee Waa and Boggabri postcodes), 319 opposed the project, versus 180 supportive.

People from a range of diverse backgrounds, including farmers, have gone to, and have committed to going to, whatever lengths are necessary to protect the region from CSG and halt Santos' NGP and APA's pipeline.

There is wide-scale community rejection of the CSG industry in NW NSW, and of the NGP in particular. Comprehensive community-run door-to-door surveys have been undertaken by 87 communities completely surrounding the Pilliga Forest, spanning an area of over 3 million hectares to date. These communities have unilaterally declared their districts Gasfield Free with an average of 96% rejecting plans for gasfields in NW NSW, making it clear that Santos has no social licence to operate here.[i]

In addition, door knocking of the project area itself has identified families who have never been contacted by Santos. This door-knocking found that the majority of the residents are distrusting of Santos and do not want to be part of a gasfield. Many residents reported that they either already have their properties on the market, or are considering putting them on the market and would like to leave, if they could sell.

ReachTEL polling, commissioned for the Independent candidate in the March 2015 State election, showed 87% of people across the broad NW NSW region encompassing Santos PEL areas are concerned about CSG mining; 63% "very concerned" and 24% "concerned".

Local communities are resolute in their opposition to Santos' plans to turn our region into a gasfield.[ii] APA's heavy-handed approaches to the landholders along the WSP route has already been met with extensive community opposition. Signs are being erected on front gates at a rapid rate and farmers are banding together to work out how they can convey their non-negotiable stance.

Whole communities and their local governments have voiced their opposition to the project, from Moree Plains Shire in the north to Coonamble Shire

to the south of the NGP, from the west across the cotton belt, to the east across the Liverpool Plains and beyond.

Claims by Santos of "working together with host communities" are completely rejected. Santos has "bought" the support of some community organisations through sponsorship. This sponsorship can come at a heavy price as discovered by the local golf club, which was to provide the venue for a meeting involving Senator Glenn Lazarus (undertaking an Australian Government Senate Inquiry into Coal Seam Gas). Coercion from Santos resulted in the club cancelling the booking two days before the meeting, provoked outrage from many in the community and beyond[iii].

Members of the North West Alliance, an umbrella organisation for community groups in NW NSW, have repeatedly asked for a meeting with the Premier of NSW to discuss coal and coal seam gas developments in the region. The Premier was further petitioned by personal letter and by a full page letter inserted in a major regional newspaper in late 2017, signed by 600 respected leaders and companies in the region. All of these invitations have been declined, on the basis that the Premier is too busy to meet. However, over the same period, she has met with at least a dozen major businesses and lobby groups, including a CSG producer and retailer and a coal mining company. In February 2018 the local State Member of Parliament, in reference to the project, has avowed that they should just "get on with it".

Human Rights Abuse:

It is unacceptable that community opposition is ignored by the NSW State Government, Santos and APA. All have legal and moral obligations to listen to the concerns of the community and to act appropriately. The community has the right to participate in the decisions of Government.

The Right to Peaceful Enjoyment and Privacy

Members of the local community in general and Narrabri Bushwalking Club in particular routinely enjoyed the quiet beauty of the Pilliga State Forest, especially in the Spring when it abounds in wildflowers. This pleasure is now denied over a considerable portion of the forest, in which the majority of the NGP is located. The forested area is already subdivided by roads, well pads and gas processing infrastructure, with most areas off limits to the public.

Anyone venturing near the gas infrastructure is followed and filmed by gas industry personnel. Santos staff or contractors follow visitors around the perimeter fences, filming as they go. Video cameras are routinely brought within a metre of the "intruders" face.

During one bushwalking excursion, Santos staff resolutely tailed the bushwalkers' vehicles as they drove to different parts of the forest, noting their number plates when they stopped. Children on this excursion were filmed, in spite of the objections of their parents. Although this was reported to Narrabri Police, no action was taken.

In late August 2017, a local resident was driving past the Leewood water treatment facility with a friend, a well known journalist, when they noticed that the treated water was being used for sprinkler irrigation. After they stopped to observe the centre pivot irrigator make its slow revolutions around the paddock, they were amazed to see a drone being flown directly towards them. The drone hovered directly in front of them, not more than ten metres away, before flying over them and on to their car parked in the tree line adjacent to the highway, capturing the registration plates on their car. The drone then flew back to a vehicle just visible at the other end of the irrigation lateral. This incident was reported to the Civil Aviation Safety Authority.

Human Rights Abuse:

The local community has been denied the right to its peaceful enjoyment of public lands and the right to privacy - not to be filmed without permission.

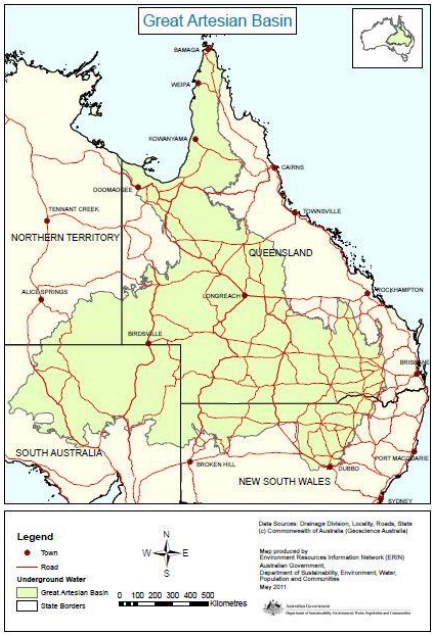
The NGP will impact flows of the Great Artesian Basin

Water from the Great Artesian Basin (GAB) currently sustains the lives of more than 180,000 people and 7600 enterprises.[iv] It is a vital resource for a significant portion of Australia (23% of the landmass). If these lives and businesses are negatively impacted by contamination and/or drawdown of the GAB, Australia will see its greatest environmental disaster in its history and Santos and the NSW Government will be responsible.

The people living in the North West are highly reliant on groundwater: they drink, bathe, water stock and irrigate with it. More than 20 years of policy reform, utilising the precautionary principle, has improved our understanding of the importance of recharge and what is required to ensure sustainability. Presently the community views the system as sustainable and are highly protective of allocations. Long-standing water licence holders extract groundwater in the Gunnedah-Oxley Basin, but at different depths to the coal seams.

The NGP would abstract groundwater which is under a very high pressure head, high enough to absorb the coal seam gas into the coal cleats. Any change to the equilibrium due to abstraction in the deeper systems will result in the resource changing and finding a new state of equilibrium. How much that impacts other groundwater users and those living in the region depends on the degree of connectedness of the many geological layers between the coal seams, where the groundwater is being pumped from, and the ground/surface water connection.

Having reviewed the "Bibblewindi EIS (July 2013)" and the "Water Resources Assessment" (June 2013), both prepared for Santos, Senior Petroleum Geologist Peter Lane[v] concludes that "no basic hydrogeological or geological data has been provided and therefore it is not possible for any expert in these fields to make any meaningful comment as to whether the conclusions reached in the above mentioned reports are justifiable or not". The Independent Expert Scientific Committee (IESC - an Australian Government body) in reviewing the NGP EIS in fact recommended more monitoring.



The Great Artesian Basin covers an extensive area of Australia

We are concerned that Santos is relying on reports of convenience rather than those of substance which ultimately prevents the company from undertaking appropriate risk assessment and mitigation strategies.

CSG extraction in the Pilliga State Forest has the potential to impact the groundwater quality and quantity within the GAB Pilliga Sandstone aquifers and the Quaternary (recent) unconsolidated alluvial aquifers. Connectivity has already been established between the GAB and many of its underlying petrochemical rich basins[vi] confirming the likelihood of both contamination and drawdown from CSG produced water removal.

The project is located above the Pilliga Sandstone recharge beds to the GAB. Santos' own Referral of Proposed Action to the Federal Department of Sustainability, Environment, Water, Population and Communities in 2014 states "that the duration and wider geographic extent of depressurisation of groundwater head within the coal seams and adjacent strata **will impact** the groundwater and surface waters of the Gunnedah-

Oxley Basin"[vii]. This excessive drawdown of pressure heads in the recharge zone of the GAB associated with gas extraction has the potential to reduce pressure heads in artesian waters across a large part of the GAB, and may completely stop the free flow of water to the surface at springs and bores[viii].

Original pressure of GAB in Blackall, Queensland

In its 2017 review of the NGP EIS, the IESC identifies groundwater depressurisation and drawdown of aquifers as a key risk of the project and noted the impact on, amongst others, other groundwater users and changes to water flow and quality as a result of discharges to Bohena Creek.[ix] The IESC identified impacts on groundwater dependent ecosystems (GDE), including at Hardys and Eather Springs, as a key risk of the project and recommended that more work be carried out to identify further GDEs at risk.

Santos does not have the information to say categorically it will not affect other groundwater systems or contaminate surface water systems. Furthermore, it is unable to provide concrete assurances the impact can be confined to the deeper systems as the current interconnectedness between the GAB and the deeper coal seams is unknown.

The location of the Santos NGP and its connection with Bohena Creek also poses a surface water risk. Bohena Creek connects directly with the Namoi River both above and below ground. The proximity of the intersecting Bohena Creek and Namoi River to the starting point of the Lower Namoi groundwater paleochannel means that any surface water contamination of Bohena Creek could contaminate one of the Namoi Valley's most extensive irrigation resources.

University of NSW Professor Bryce Kelly stated that in Queensland "gas production from the Walloon Coal Measures will eventually result in hundreds of thousands of megalitres of groundwater being extracted each year, depressurising the groundwater systems in the Walloon Coal Measures and adjacent geological formations. The full extent of the impacts due to this volume of groundwater extraction will take multiple decades to be transmitted throughout the aquifers of the Great Artesian Basin and the Condamine Alluvium."[x]

The GAB is a national icon, a vital lifeblood and part of an intricate and critical underground water network that sustains life, agriculture and communities that rely on it. Contamination of GAB water by produced water through well failures, unpredicted geological anomalies, or through surface water migration will cause devastation on a national scale.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has rejected the claim made in an Australian Petroleum Production & Exploration Association (APPEA – "the voice of the Australia's oil and gas industry") television commercial aired in 2012 that 'CSIRO (and government studies) have shown that groundwater is safe with coal seam gas'. They reiterated on 4 September 2015 "At no time has CSIRO made such a statement, and nor do the results of CSIRO research support such a statement."[xi]

Human Rights Abuse:

The NGP poses an existential threat to the water supply of people and environmental communities dependant on the Great Artesian Basin.

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Great Artesian Basin bore used to grow food and fibre

The NGP will contaminate GAB water

It is highly concerning that well integrity cannot be assured during and beyond the life of the NGP. There is substantial evidence that well integrity can be compromised at any stage of a well's existence. With questionable well integrity come a number of risks; even if it takes 20 - 30 years for negative impacts to occur, it is negligent to accept CSG within the GAB, especially in the area of recharge.

Using figures supplied by industry in the USA, Professor Tony Ingraffea found that 7% of wells leak immediately, 30% leak within 20 years, and 50% within 30 years.[xiii] Concrete deterioration cannot be prevented: a gas well is an engineered structure, which will crumble and corrode with age.

Corroding well Infrastructure

Santos will be liable for ongoing costs, as these deteriorating wells will require rehabilitation.

Where the deterioration causes farmers' bores to fail, the community is concerned that it will be impossible to compensate farmers adequately. Even if Santos could afford to replace lost or contaminated groundwater with "make good" water, experience elsewhere shows this to be entirely inadequate to serve farmers' purposes.

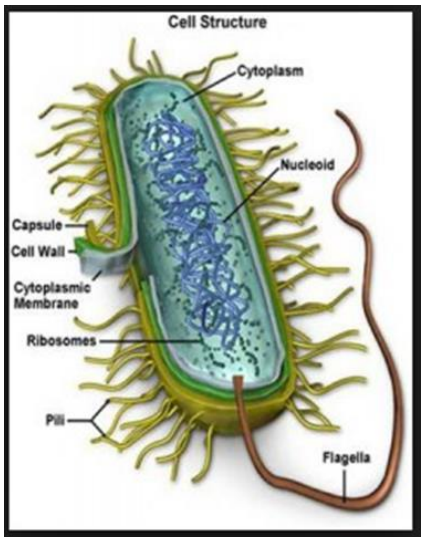
Professor Ingraffea (who heads the Cornell Fracture Group and who has undertaken numerous research and development projects for both public and private institutions, including Schlumberger and the Gas Research Institute) asserts that "Cementing and completion practices in the basins are the main risks to the downhole environment. Many mechanisms are present to cause the cement to deteriorate. As a result, sufficient zonal isolation cannot be guaranteed for any amount of time. The major risk associated with cement failure is cement carbonation."[xiv] He said that methane and other chemicals cannot be prevented from getting into the water and the atmosphere. Without ongoing treatment with biocides into the distant future, which is impractical, many of these wells will eventually corrode to create connections between aquifers and coal seams.

Brian Bender's bore bubbling with gases

Associate Professor Bryce Kelly from the University of NSW says "Results from coal bed and shale gas production regions in the US show that if a gas production well is poorly constructed then there is a risk of groundwater contamination at a local scale".[xv]

Hydrogeologist Andrea Broughton has warned that well integrity is one of the greatest threats to our clean aquifers.[xvi]

Another major threat to well integrity is sulphate reducing bacteria (SRB), one of the oldest and most widespread bacteria on the planet. SRB inhabit nearly every conceivable location where there is no oxygen (anaerobic conditions), including the depths of the ocean, the human stomach, moist soil, hot water services, and sewage pipeworks. They also inhabit aquifer systems, coal seams, gas well drill rigs and associated infrastructure, including drill strings and mud tanks.



In most cases the population of naturally occuring SRB is controlled by the restricted availablity of a food source. However, if a food source is introduced via drilling fluids and concrete casings, for example, the SRB population increases and with it problems for gas wells.

SRB can act fast or slowly and are non-selective with regards to the source of their "food", creating problems well into the future for gas well infrastructure and any other non-related underground infrastructure, such as town water bores and pipelines. The issue is therefore not confined to gas companies and government approving bodies, but extends to anyone with underground infrastructure, such as Councils and the farming community.

Well drillers have long known of the damage caused by SRB. These anaerobic bacteria grow on organic compounds found in water contaminated with hydrocarbons and organic material. The bacteria convert sulphate into hydrogen sulphide (rotten egg gas). The presence of hydrogen sulphide not only reduces the commercial value of natural gas, but also rapidly corrodes pipes, tanks and other iron and steel structures.[xvii] Hydrogen sulphide from SRB also plays a role in the biogenic sulphide corrosion of concrete.

While SRB can be controlled to some extent in the produced water from the coal seams by the use of biocides[xviii], they cannot be controlled in the natural aquifer system. Once in the aquifer, SRB become a very real threat to the longevity of the outer concrete casing of a gas well, as the SRB convert sulphides in the cement to food. The effectiveness of the concrete outer casing to prevent cross contamination of groundwater is thereby severely compromised. That is, low quality water from one aquifer could contaminate high quality water in another. The loss of this concrete seal can also result in the residual gas from the coal seam escaping to the surface.

When a gas well is drilled there is a certain amount of aquifer/drilling fluid (mud) interchange, as mentioned in all of the Eastern Star Gas (ESG0) Reviews of Environmental Factors and in the earlier Santos REFs for PEL 238. (ESG undertook the earlier development work on the NGP and was bought out by Santos in 2011). As the drilling fluid pressure is always greater than the pressure in the aquifer, drilling fluid is lost to the aquifer. The organic lignite, lignin, tannins, cellulose, starches, and fatty acids found in many mud systems are carbon food sources for SRB. These muds can also harbour SRB.

Biocides are almost ineffectual in controlling SRB in aquifers because the water/biocide dilution rate is too high. By introducing drilling muds to the aquifers, the gas industry is in fact actively encouraging SRB. While this is well known in drilling circles, it is an issue which the CSG industry and government regulators never mention, as it one reason why rehabilitated well integrity can never be guaranteed.

Human Rights Abuse:

The Narrabri Gas Project risks groundwater contamination of the Great Artesian Basin, putting at risk the lives and livelihood of those who rely on aquifers for their water supplies. The community has a right to clean water.

Impact on Existing Sustainable Industries

Santos' Narrabri Gas Project poses direct and indirect threats to agriculture, the main industry that has sustained this part of NSW since white settlement. The local agricultural industry also supports a multitude of diverse secondary industries such as research stations, cotton ginning, oil seed crushing, grain handling, livestock selling, freight, machinery dealers, and many other rural supply and service businesses, which together employ 21% (1,124 jobs) of all the jobs in Narrabri Shire. The next highest employer is retail trade with 10% and health care with 9%. Furthermore, 45% of all businesses within the shire are farming, fishing or forestry related[xix]. The Total Gross Farmgate Value of agriculture in Narrabri Shire was $394.6 million (2010/2011) with cotton the largest contributor, at $223.5 million. Agriculture is by far the single largest contributor to Narrabri Shire revenues and stands to be the biggest loser from the CSG industry.

Local wheat production demonstrating a long term beneficial industry

Much of the region's agriculture is highly reliant on stock water from aquifers and/or irrigation water from surface or bore supplies. Based on the work of the IESC and many other experienced and professional scientists, the NGP represents a long term threat to both the quantity and quality of agricultural and domestic water supplies in the NSW section of the Surat Basin and elsewhere.

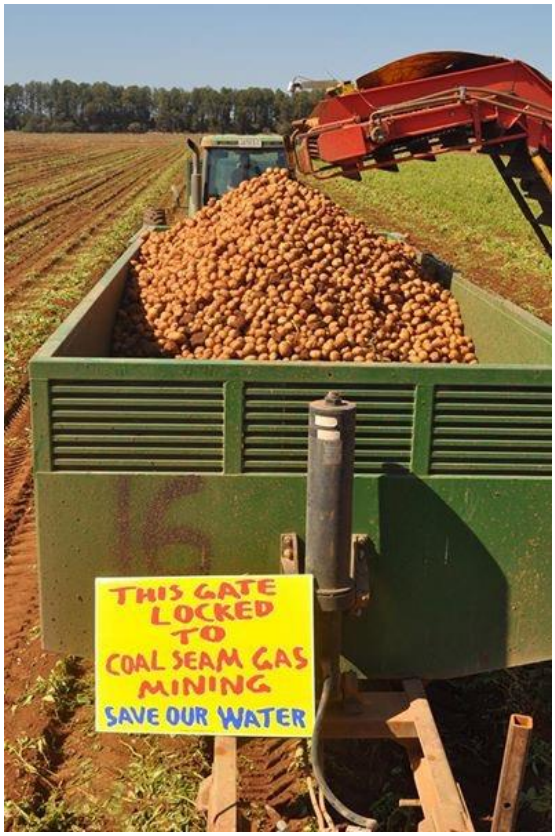
This threat sits squarely on the shoulders of Santos, but it is the farmers who will suffer.

CSG exploration and production is incompatible with many types of agricultural production, particularly irrigated cropping. Centre pivot and travelling laterals are not able to manoeuvre over or around fences or wellheads. Dissecting fields with CSG infrastructure is totally incompatible with precision laser graded surface irrigated fields and disruptive of dryland cropping patterns. CSG and viticulture do not mix. All of these agricultural enterprises are common in the Namoi Valley and other areas surrounding the NGP.

The Productivity Commission Report[xx] acknowledged that one area where landholders will be impacted by the CSG industry is the reduction in land values, and there is no mechanism for setting compensation for this. A reduction in property values has also been acknowledged by the Queensland State Valuation Services which applies a reduction of up to 20% in valuations for grazing lands with CSG wells located on them.

Landholders may also experience difficulties in borrowing and securing insurance. Rabobank, a major rural lender, is opposed to CSG because of the potential to adversely affect rural property values, reducing farm equity and hence the ability of farmers to borrow.

Landholders have been advised by their insurers that their farm businesses, the associated water resources and/or farm produce are considered "uninsurable" against CSG contamination. Therefore both the likelihood of the risk manifesting, and the severity of the risk, are unacceptably high for an insurer to cover. The insurers are suggesting that a significant adverse impact as a result of CSG operations in the region is considered almost inevitable.



CSG extraction risks existing agricultural production

Furthermore, Meat and Livestock Australia states that "the landholder may still have primary liability in the event of contamination of the soil, pasture or groundwater, neighbouring properties, as well as livestock which, if then processed and consumed, could breach Australian food standards or importing country requirements for meat."[xxi] This is particularly pertinent for landholders who sign a National Vendor Declaration or similar document for their produce. Signing such a document provides the buyer with a guarantee of the food safety status of the animals or crops they are purchasing and puts responsibility of any potential contamination in the hands of the landowner.

Being unable to obtain insurance leaves landholders at grave risk, questioning what consequences there may be for food products sold into the future, and whether they may ultimately incur a legal or financial liability. This is precisely why landholders have sought to insure against such an eventuality, and for which cover is not available. Neither Santos, nor its insurance company, nor a NSW Government Bank Guarantee (to an undisclosed amount), can provide certainty of cover for, or remedy, the inability to obtain insurance privately.

Human Rights Abuse:

Gas companies should not be allowed to undertake the systematic dismantling of existing sustainable industries that represents core Australian values. Santos and the NSW Government are abusing the right to a safe, healthy and sustainable environment.

Health Impacts Have Not Been Properly Considered

We believe Santos has a corporate responsibility towards the health of its staff and the communities in which it operates. As the number of CSG wells under the operation of Santos increases exponentially, the health impacts from these wells and associated infrastructure begin to mount up.

Particularly concerning are impacts to the environment and people from fugitive methane emissions. Santos uses a CSIRO report[xxii] on just 43 wells to declare that methane emissions are much lower than in the USA, but ignores the facts that:

- the wells were hand-picked by the company for testing
- they were only tested at the well head
- they were all new and no account was taken of the aging of wells and equipment, and that
- fugitive emissions escape from many other places between the wells and point of use.

A peer reviewed study by Southern Cross University showed that emissions in the Tara, Queensland gasfields are much higher than expected and that methane is also seeping through the soil.[xxiii] The nearby Condamine River bubbles with escaping methane (which can be viewed on YouTube).

It is imperative that the company uses the best possible information, not the most convenient to the outcome it desires.

Along with CO_2, methane levels are now at their highest atmospheric concentrations in about 800,000 years, with their increase about 2.5-fold since pre-industrial times. Atmospheric methane is generally considered to be non-toxic unless in concentrations dense enough to displace oxygen and cause asphyxiation, which is unlikely except in enclosed spaces. However, when exposed to sunlight, atmospheric methane can form formaldehyde. Any methane only partially burnt in flares or motors can also result in formaldehyde emissions.[xxiv]

NSW Chief Scientist Professor Mary O'Kane outlined health impacts as missing from the debate

The severity of symptoms from formaldehyde exposure depends upon the concentration (how much) and duration (how long) and the individual sensitivity, but even short term exposure may result in immediate symptoms. These symptoms are the same as those experienced by people in the Tara and Chinchilla gasfields and those evacuated from the Porter Ranch natural gas leak in California in 2015.[xxv]

While there is a lot of anecdotal evidence from people living and working near these industries, there are still no comprehensive studies on the long term health effects of CSG as recommended in the NSW Chief Scientist's Report.[xxvi] Santos has not taken a proactive position on these concerns and is failing its moral responsibility in its concern for impacted people. [xxvii]

Brisbane GP Dr Geralyn McCarron has been studying the health effects of CSG on people in Queensland gasfields and has documented evidence of dozens of side effects.[xxviii] American studies have shown that the rates of childhood diseases increase when living within a 10km radius of natural gas wells.[xxix] Studies of chemicals used in and produced (brought to the surface) as a result of CSG have identified many health risks that will likely increase with time, well numbers and exposure.[xxx]

A community-based exploratory study found increased levels of volatile compounds in and around gasfields, individual wells and associated infrastructure at a number of locations in the USA. These included levels that exceeded American federal guidelines for eight volatile compounds, most commonly benzene, formaldehyde and hydrogen sulphide.[xxxi]

Many residents anywhere near CSG facilities are inevitably stressed by the consequences of the development on their family, community and business, and the strain of dealing with CSG companies.

The public record shows at least two incidents in Queensland over the last couple of years where farmers have taken their own lives have been due to the stresses CSG places on their families and enterprises. Similar stresses have already been witnessed in the local Narrabri community, with at least one person hospitalised.

Human Rights Abuse:

Health impacts of CSG have been poorly addressed to date, causing growing community concern about the documented impacts on physical and mental health.

Spills and Leaks pose Risks to People and the Environment

The NGP has been responsible for a succession of spills, leaks and unapproved releases of produced water from sources which include water treatment plants, drill rigs, well sites, cuttings ponds, storage reservoirs, tankers, poor operating practices and poor container cleanout practices by contractors. Santos' internal records show that many have not been reported as required by the Conditions of Operating and many of these events have been recorded and communicated to the regulators only by community members.

The spill at Bibblewindi created a 2 ha kill site

Santos is not being proactive in its monitoring and/or not being honest in its reporting of incidents. Either way this is an unacceptable way for a reputable company to operate.

More than 20 occurrences of spills, leakages and failures are known to date, some of which happened long after Santos purchased the field from Eastern Star Gas (ESG).

In late 2011 a member of the public discovered a large spill which had not been reported to the regulator. The spill allegedly occurred in mid-2011 and allegedly consisted of produced water from the Bibblewindi water treatment facility. The spill occurred over a five hour period and decimated approximately two hectares of vegetation. Santos declared that "the spill was only 10,000 litres of water, some of which was recovered", which would equate to only two cups of water per square metre. Obviously far more water than this was spilt as most of the vegetation on the two hectare site was killed and significant soil pH changes were measured (and reported by Santos' consultants CH2M Hill and Golder Associates) 277 metres from the spill site, to the depth of measurement (pH 10.0, 8.5 and 8.2 at depths of 0-50, 50-150 and 500-600 mm respectively, compared to a background level of 5.6).

This response by Santos destroyed its credibility in the eyes of the community. All vegetation in the area has died or remained severely retarded for the past seven years, resulting in further ridicule of Santos' response.

In 2012, the NSW EPA issued Santos with fines for two separate discharges into a local waterway of polluted waste water from CSG activities at Bibblewindi by ESG over the period 2010-11-12. Then, despite being formally warned by the EPA for a water discharge incident in 2011, in 2013 Santos itself was fined for a pollution incident which involved a leak from a CSG waste water storage pond.

Santos has also been fined more than $50,000 by the NSW Land and Environment Court for four separate breaches of the conditions of its petroleum title.

In 2014, Santos was fined for contaminating an aquifer at the Bibblewindi water storage site, the first proven case of its type in Australia. A suite of heavy metals was found, including uranium at levels 20 times higher than safe drinking water guidelines. A run-off incident at Leewood in early 2016 prompted the EPA to investigate the adequacy of Santos' erosion controls on site.

Santos employees and contractors appear derelict in their duties. Santos has been issued with warning letters for storing environmentally damaging material at the Narrabri Operations Centre, while a long-term contractor was issued with warning letters and penalty notices for breaches of the Protection of the Environment Operations Act.

In spite of these notices, Santos has continued with sub-standard practices. In March 2016, an employee was observed and filmed leaving a high point vent and its security cage open while he left the site. This is a clear breach of the Conditions of Operation for all water/gas line vents, imposed by the EPA in 2015 after an automatic vent failed and released water and gas into the environment.

While it was clear that the infrastructure Santos acquired with its $924m takeover of ESG was poorly constructed, it is also clear that it is now poorly operated.

It is highly embarrassing that the community is usually the one to identify, document and communicate first about these spills and leaks. It is also disheartening that Santos doesn't seem to be able to prevent these types of incidences from happening time and again.

To date Santos has spent over $17 million on attempted rehabilitation, with limited success. The areas of forest decimated by spills of produced water are still virtual dead zones devoid of almost any new self-regenerated native vegetation. Of the predominant Pilliga species, the cypress pine is dead, bull-oak is heavily impacted and both are yet to re-establish naturally. Wattles are growing but most of the sennas would appear to have been introduced with the mulch and wood chips.

Unsuccessful remediation works can still be easily seen

The Bibblewindi Water and Gas Gathering Facility is an environmental fiasco, where after three years of intensive rehabilitation work, including soil removal and replacement, and amendment with gypsum and sulphur, very few native species have regenerated. The area within the facility has since been refilled and gravelled over. The bulk of the "kill zone", however, is outside the fence and has finally reached a semi-rehabilitated state only because Santos is now planting tree species in an attempt to speed up the rehabilitation process.

There are seven such major spill areas in the project area. However, the current lead regulator was not aware of all the approval requirements around rehabilitation. It was left to members of the community to make the regulator aware of these requirements as per the original approval documents and State Forest leasing agreements. Santos has started rehabilitating many of the legacy sites with mixed success, with some of the older sites now removed from the Santos lease.

Human Rights Abuse:

The community cannot trust Santos to operate in a manner which protects the environment and the community. The right to a safe, healthy and sustainable environment has been abused.

Water Treatment and Salts Disposal

The Leewood Produced Water Treatment and Beneficial Reuse Project has caused deep concern within the community. There are concerns about the remaining toxins and chemical makeup of the reverse osmosis treated produced water, the amount of salts deposited during irrigation and the method for disposing of the toxic salts that are removed.

Although the reverse osmosis plant will be able to remove much of the salts from produced water, it can never remove all the toxins, heavy metals and chemicals, nor can it change the chemical balance.[xxxii] Hydrogeologist and geochemist John Polglase has commented on an informal water test result of produced water in one evaporation pond in the Pilliga. "The major element ratios in this water are completely unlike freshwater," according to Mr Polglase. "This water cannot be remediated to agricultural or human consumption without intense treatment followed by further element supplementation to produce a more natural balance of elements. For instance, the potassium concentration and the sodium concentration are so high and the calcium concentration and magnesium concentration are so low, that a process like desalination cannot rectify this major element imbalance". The water in this pond is the same as will be drawn up from the coal seams and used in the reverse osmosis plant.

In addition, information supplied by Santos about the use of the treated water for irrigation has caused considerable concern. Based on the proposed salt concentration, the treated water would deposit 2.2 tonnes of salts per hectare per year on the unsuited duplex soils Santos proposes to irrigate during the exploration stage[xxxiii]. If the production stage were approved, this extra treated water is proposed to be sold to local farmers for irrigation use, adding even larger quantities of salts to the area. Again, these soils are in the southern recharge area of the GAB. Water from this area also contributes to the recharge of the Lower Namoi Alluvium Aquifer, which currently provides high quality water for irrigators.

And this is before the issue of brine disposal is considered. Based on current indicated production levels, the EIS states that 42,000 tonnes of solid salts per year will need to be disposed of. Previous information suggests this figure could peak at about 63,000 tonnes per year. From the time Santos took over from ESG, the method of disposal has been questioned. The answer has changed successively as each option proposed by Santos has been shown to be flawed. The current answer (in the EIS): "In a Government-approved waste disposal facility" has been met with incredulity within the local, regulatory and scientific community, as no such facility has been identified. Santos has told the NGP Community Consultative Committee, to its astonishment, that the company will not be responding to questions on salt disposal raised in submissions to the EIS.

Human Rights Abuse:

The poor track record of Santos in controlling and managing toxic components extracted from coal seams during the exploration phase of the Narrabri Gas Project is a portent for how a fully-developed Santos gasfield would place the community and environment at risk.

Light Pollution will Ruin Siding Spring Observatory

Siding Spring Observatory is a unique scientific research facility neighbouring the Pilliga Forest. This historic site has been working for over 50 years, and houses currently more than 50 of Australia's largest optical telescopes which conduct both national and international research in astronomy and astrophysics.

This is Australia's premier research facility of this type and is located in the Warrumbungles expressly to take advantage of the requisite dark skies. The facility is one of only 55 internationally recognised certified Dark Sky Parks in the world. These parks have "exceptional or distinguished quality of starry nights and a nocturnal environment that is specifically protected"[xxxiv]. It is also one of the three observatories in the southern hemisphere which together provide the required 24hour night sky coverage.

The Australian National University co-ordinates work at the facility, alongside other universities, government industries and private enterprise from around the world. More than $100 million worth of research equipment is located at the observatory, with extra funds allocated annually to maintain and upgrade facilities to keep abreast of innovations in science and research.

Siding Spring Mountain hosts the world class Siding Spring Observatory

This research hub is Coonabarabran's largest employer, with 50 people employed onsite and a further 150 supported in Canberra and Sydney. The facility is credited with discovering the oldest known star and is currently undertaking the largest survey of dark matter ever attempted[xxxv], maintaining Australia's reputation as a leading astrophysics player. [xxxvi] [xxxvii]

The observatory also gives Coonabarabran its identity and provides core tourism opportunities, with 30,000 visitors annually.

The Bibblewindi flare, which is 90 kilometres away, can be seen in direct line of sight from these telescopes. This flare creates more light pollution than the entire neighbouring town of Coonabarabran, with a population of 3000. Sky meter readings show all exploration flares currently affect the sky darkness for the observatory. Furthermore, the red coloured light caused by flaring is worse than white light in astronomical research, as a lot of the science, including astronomy and astrophysics, is undertaken with red spectrum light, and flaring will blind this out.

[xxxviii]Light pollution and light spills may cause this unique Australian asset to be shut down. Every little bit of unshielded light makes it harder to conduct cutting edge research. Even light pollution from Sydney, over 400 kilometres away, can have an impact. The Federal Government highlighted the protection of the observatory as one of the key areas it would be looking at in the EIS for the NGP, because of its importance to the regional economy and the national astronomy sector.

Santos' future gasfield expansions include Coonabarabran itself, Tooraweenah, Gilgandra, Gunnedah, Mullaley, Dubbo and more. Some of these gasfields would be much closer to Siding Spring and there would be increased flaring, causing an even greater impact on the observatory than the NGP. The only outcome would be the shutdown of Siding Spring permanently.

The loss of Sidings Spring would result in the removal of Australia from the global astrophysics landscape. This site would not be rebuilt to the same scale anywhere in Australia again. No further developments or discoveries would be made in Australia and Coonabarabran would be stripped of its key employer, its major tourist attraction, and its identity.

Siding Spring boasts a 4 metre telescope

Mitigation is not possible. Santos could shield some lights on new building facilities but not the light pollution from 900 gas wells, many of which propose flare stacks 10 times higher than currently in use, being 50 metres high with flames up to 30 metres higher. These flares would cause an insurmountable problem for the observatory, with the result that Australia's contribution to all future scientific discoveries in astrophysics and astronomy would be vastly diminished.

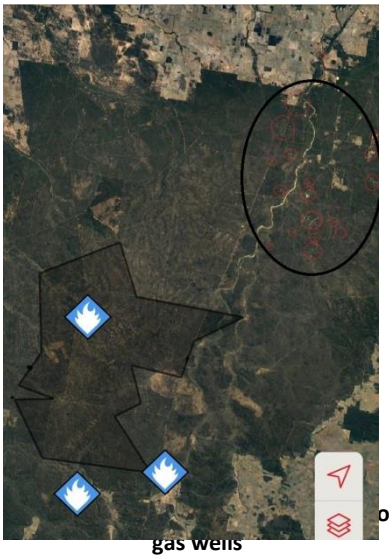
Human Rights Abuse:

It is apparent that the impact of the NGP on Siding Spring Observatory cannot be overcome and the community cannot accept the loss of knowledge and education that would result.

Bushfire Risks are Too Great

The Pilliga Forest is well known for its low humidity, high fuel load and hot summers creating catastrophic fire conditions. Massive bushfires break out every few years, often started by lightning strikes.

On January 24th 2018, a massive fire burnt out 58,000 hectares and came perilously close to some homes[xxxix]. Rural Fire Service (RFS) resources involved 10 bomber planes, 4 helicopters, more than 40 trucks, up to 150 personnel per shift for ten days, and an estimated 7,200 volunteer hours[xl]. These fires not only put the lives of fire fighting personnel at risk, they damage the forest, animals and can risk homes and livelihoods.



o gas wells

This fire was about 30km south of Santos' proposed Narrabri coal seam gasfield.

Santos' EIS Appendix S determined there was a "medium risk" and "major consequence" of bushfire from the operation and construction of the gasfield, confirming that Santos would not be able to mitigate the consequences of a runaway bushfire, which could be deadly[xli].

The RFS made a scathing response to the EIS including "the EIS is considered to be short on detail with respect to bush fire impacts on the various components of the development proposal."

Santos' Operations Bushfire Management Plan states "Santos personnel and contractors are advised that leaving an area early is the safest option in the event of an active bushfire in proximity to operational areas."[xlii] This leaves RFS staff and volunteers dangerously exposed to highly unsafe conditions.

During this disastrous fire week in 2018, the nearby Tamworth Country Music Festival goers were not allowed to use their gas BBQs for cooking, yet in the Pilliga Forest, Santos was permitted to continue to burn at least three open flares for their exploration wells.[xliii]

The EIS states "flammable gases are present above threshold levels" at their infrastructure [xliv], these gases would ignite if embers from a bushfire were to enter the project area.

Open flares are used to burn off excess gas. Open flares in a tinder dry environment drastically increase the chances of igniting a fire. Stray leaves or grasses, blown through by willy-willies (mini-tornadoes) could be ignited and blown off into surrounding forest with devastating outcomes.

Human Rights Abuse:

A gasfield, along with its associated infrastructure including pipelines, will exacerbate the risks of bushfires in the region, with ruinous effects on the environment and putting human lives at risk. These risks are far too great for our community.

The Narrabri Gas Project and Climate Impacts

The days of denying anthropogenic climate change are over, with 2014, 2015 and 2016 being the hottest years on record globally. Temperature records are being smashed monthly, with 10,883 out of 10,885 peer-reviewed climate articles agreeing with the International Panel on Climate Change report of 2013 that "It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century"[xlv]; and with all of the world's scientific societies (such as the National Academy of Sciences, American Geophysical Union, the Royal Society, etc) agreeing with them. How long is it going to take the Australian and NSW Governments and Santos to realise that fossil fuel production and world climate stability are incompatible?

The majority of greenhouse gases come from burning fossil fuels to produce energy[xlvi]. While natural gas emits 50 to 60 percent less CO_2 when combusted in a new, efficient natural gas power plant and emits 15 to 20 percent less heat-trapping gases than petrol when burned in today's typical vehicle[xlvii]; we know that when fugitive emissions are factored in, CSG is no more "greenhouse friendly" than coal[xlviii].

This is because methane is such a powerful greenhouse gas, 86 times more powerful than carbon dioxide when its atmospheric impacts are considered over a 20 year period, and 34 times more powerful over a 100 year period. Consequently, a loss of only a few per cent of methane from the system easily overcomes the advantage of methane over coal (e.g. 2% x say 35 times the potency = 70% + 50% from combustion = 120% compared to coal). It is therefore unlikely that CSG will ever be better placed to limit global warming. As outlined below, emissions are likely to be much more than 2 per cent, so replacing coal with gas makes no sense in limiting global warming.

Fugitive emissions in the gas industry comprise the gas lost from:

- Field production, from valves, flanges and other connections, and also from around the well casing
- Processing, from leaks from many items of equipment such as seals in compressors and the valves, flanges and associated pipeworks. Gas is also lost through deliberate venting and flaring, and equipment malfunction or failures. Some pneumatic equipment is operated with compressed gas rather than air, another source of loss
- Transmission and storage, from booster compression stations, and from
- Distribution, with losses from the low pressure distribution network, accidents, and the initial gas losses when lighting appliances.[xlix]

Some of these losses are difficult to measure while some, such as venting and flaring, are more straightforward. In the U.S., new technologies including satellite and aircraft-based systems have been used to detect methane emissions and quantify emission rates. Some of these technologies are currently being deployed in Australia but Santos has chosen to ignore them.

Instead, Santos claims in its EIS that "Fugitive emissions (excluding venting and flaring) are minor losses of gas that are **assumed to occur** (emphasis added) from equipment and infrastructure. They are **measured by applying legislative emission factors**" (emphasis added). In other words, Santos has used industry estimates for all of its figures on gas losses from the production, transport and processing system of the NGP.

Fugitive emissions are NOT "assumed to occur" – they are known to occur. They are NOT a "minor loss", but a significant portion of the produced gas and a major contributor to greenhouse gases, as borne out in recent observations in the United States. Where measured, emissions from

unconventional gas developments in the United States range from 2 to 17% of production, with 6% being a typical figure across some gas fields.[i]

For example, high point vents (HPVs) are located on all of the water collection flow lines wherever the pipes pass over a rise in the ground. Accumulated gas that comes out of solution needs to be released from the vents periodically; otherwise it forms a gas pocket which blocks the flow.

High point vent in Narrabri Gas Project flow line

Gas releases from HPVs in the Pilliga have been observed and photographed by community members. Given that the gas must be released at regular intervals as it accumulates at the HPVs, and given that the gas comprises mostly methane and carbon dioxide, this could represent a major emissions source, but it was completely ignored in the Santos EIS.

As a result of observations, the United States Environment Protection Authority recently (2016) increased its estimates of emissions emanating from gas field production and gathering systems by 134 per cent. These estimates have not been increased in Australia.

The largest coal seam gas (as opposed to shale gas) producing area in the United States is the San Juan Basin, in Colorado and New Mexico. Satellite data shows that this area now sits under a methane emissions "hot-spot", a 6500km^2 cloud of methane pooling above the natural gas fields, where methane has escaped from infrastructure.[ii] These emissions are 1.8 times greater than reported emissions for the region.

Residents of the farms, towns and villages in and around the Pilliga Forest would prefer not to sit within a methane "hot-spot", with its health and global warming impacts.

The NGP will also release carbon dioxide directly to the atmosphere, as some is inevitably mixed with the methane in the coal seams. Again, however, "The assumed carbon dioxide content of gas was based on industry experience" and "The estimates were based on the extracted gas containing 10 mol% carbon dioxide", which is equivalent to the volume percentage[iii]. That is, the extracted gas is assumed to contain 10 per cent carbon dioxide by volume.

There is absolutely no reason to **assume** the carbon dioxide content of the Pilliga gas, as it has been measured during the exploration phase. Data from GeoGas Pty Ltd show CO_2 levels ranging from 17 per cent in the Upper Maules Creek seam to 78 per cent in the Hoskissons seam, with an average across the four seams being accessed approaching 50 percent. However, most of the CSG is proposed to be accessed from the Maules Creek seam, which averages 18 per cent CO_2, well in excess of the assumed 10 per cent.

This $C0_2$ would be released directly to the atmosphere after separating from the methane.

And finally there is no requirement to pay royalties until the gas is sold. Any leakage costs will not be borne by the proponent.

Many astute business leaders are acutely aware of the problems we face due to global warming. As former National Australia Bank CEO Cameron Clyne said "… climate change is real, human beings are causing it, and the threat is existential…" He adds "… we know from history what happens when a business or government sets its face against a change that is coming anyway."[liii] The CEO of AGL (an Australian gas supplier) Andrew Vesey has recognised this and is rapidly transitioning his company to a renewable energy company[liv], to take advantage of "the change that is coming anyway". Fire chiefs, wineries, banks, insurance companies, etc are factoring climate change into their forward planning. It would appear that Santos and the Australian and NSW Governments choose to put their heads in the sand.

The Paris Summit affirmed that to avert catastrophic global warming, we need to keep nearly all the world's known reserves of fossil fuels in the ground[lv].

As outlined by a number of Australia's leading CEOs on the Santos website (until recently): "Climate change is affecting our businesses and the communities in which we operate…. The longer we wait, the harder it will be and the more it will cost us… We are also vulnerable to climate impacts and we have a strategic interest in managing climate change"[lvi].

Human Rights Abuse:

Far from being "clean and green", methane is a particularly potent greenhouse gas which inevitably finds its way into the atmosphere when coal seams are disturbed. The NSW Government and Santos are violating the basic human right to an uncontaminated environment. The consequences are a dead planet.

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