# Senate Environment, Communications and the Arts References Committee

# Reference – Impact of Mining on the Murray Darling Basin

# Santos Submission

## INTRODUCTION

Santos' operations in Queensland, the Cooper Basin and Victoria show that agriculture and gas extraction can co-exist successfully.

Santos' business planning in New South Wales and Queensland is based on a conviction that food security, water security and energy security are inextricably linked, and that this link will become more pronounced in future.

Food security is defined as *...when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life*.[1] It is recognized that Australian agriculture has a major role in providing for the world.

Water security is defined as access to improved water sources for personal and productive use, allowing equitable development across regions and nations.[2]

Energy security is defined as…*adequate, reliable and affordable supply of energy to support the functioning of the economy and social development*.[3] At present some 1 in 2 people around the globe have no access to electricity. Natural gas is one answer to providing that energy while minimising the carbon emissions from generating it.

Just as Australia can be a major supplier in achieving global food security, natural gas means Australia potentially can be an energy powerhouse, providing safe and cleaner energy security to the Asia Pacific region.

Energy security has been a major competitive advantage for Australia, and a key to our economic development and prosperity.

Using natural gas to generate electricity is a key transition strategy that can deliver significant reductions in Australia's CO2 emissions from stationary energy whilst ensuring energy security for Australian's economic well being. Gas can fuel peak, shoulder and baseload capacity. A proven and established technology, closed cycle generating turbine (CCGT) plants emit some 60% less CO2 emissions and uses less than one third of the water needed by coal fired baseload generators while generating competitively priced energy.

Like water, affordable and sustainable energy is a key input to food production in Australia, and both are essential considerations when investigating issues relating to environmental values in the Murray Darling Basin, the location of some of Australia's richest farming land.

Santos understands that this Inquiry's focus is on the impact of current and projected mining operations (including gas extraction) on environmental values of land in the Murray Darling Basin, focussing on surficial water and groundwater.

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[1] http://www.ausaid.gov.au/keyaid/food_security.cfm, accessed 30 August 2009

[2] http://www.unescap.org/esd/water/WaterSecurity/Socio-economic%20policy%20brief_draft_2%20_format2_.pdf, pg 1

[3] http://www.ret.gov.au/energy/Documents/Energy%20Security/National-Energy-Security-Assessment-2009.pdf, pg 5

These impacts on environmental values and water will then be evaluated in the context of the Murray-Darling Basin Plan with particular regard to agricultural productivity. The Murray-Darling Basin Plan is a strategic plan for the integrated and sustainable management of water resources in the Murray–Darling Basin, to be prepared by the Murray-Darling Basin Authority as required by the *Water Act 2007* (Cwlth), and implementation will commence in 2011.[4]

This submission consists of the following sections

1. Santos' submissions in regard to the Impact of Mining in the Murray Darling Basin
2. Response to Questions on Notice from Senators
3. Comments on claims made in Submission 29 - Impacts of Coal Seam Methane Extraction in the Murray-Darling Basin.
4. Attachment One: Factsheet Exploration Drilling and Core Hole Design
5. Attachment Two: Factsheet Gunnedah Basin – Frequently Asked Questions
6. Attachment Three: Factsheet Introduction to Coal Seam Gas
7. Attachment Four: Media Release *Santos forestry project a ground-breaking solution to CSG water management*

## 1. GAS EXTRACTION AND ENVIRONMENTAL VALUES IN THE MURRAY DARLING BASIN

### *GAS EXTRACTION AND SURFICIAL WATER*

Santos' proposed surface water management systems for associated water (as described in the EIS for our Gladstone LNG [GLNG®] project) have been designed to:

- Contain all associated water and prevent escape of salts to any surface water by any route
- Provide water for beneficial uses back to the community with a priority on the supply of water for the irrigation of crops, including leucaena, lucerne, grain crops

Santos will provide assistance packages to farmers to develop and use the water that will be provided as a result of its activities for production. This extends to our appraisal activities as well.

### *GAS EXTRACTION AND GROUNDWATER*

The production of coal seam gas (CSG) involves the extraction and treatment of large quantities of water from deep coal seams (between 200 and 1000m below the surface). Santos is committed to ensuring that the water produced is put to safe and productive use, just as Santos is committed to ensuring groundwater resources are protected.

As outlined in the EIS for the GLNG project[5], Santos will comply with the requirements of the Environment Protection Act, Integrated Planning Act, and the Petroleum Act (Queensland) to manage and protect the groundwater resources in the following ways:

[4] http://www.mdba.gov.au/basin_plan
[5] GLNG EIS documents available at www.santos.com

- Alluvial aquifers are protected by Santos' well design, which ensures that they are isolated behind a single or double layer of pressure cemented steel casing, preventing cross-flow between aquifers. Refer to the attached factsheet *Exploration Drilling and Core Hole Design* for a basic well design, which is adapted to suit the geological features of individual core holes.

- Aquifers below the alluvial levels are protected during drilling by well-control techniques - the use of biodegradable drilling additives and loss-control materials. At the completion of drilling, the well is pressure cemented from base to surface, ensuring that no communication between geological formations is possible.

Groundwater management

- Santos' approach to groundwater impact assessment and management is to understand the nature and potential magnitude of groundwater impacts first, then develop monitoring programmes that enhance our understanding and improve our management approach
- Whereas groundwater models are typically used to provide advance estimates of impacts, it is well designed and managed monitoring that should be used to ensure the correct management and protection of the groundwater resource (see below)
- For example, Santos has committed in the EIS for the GLNG project, to provide adaptive groundwater management based on close monitoring that, among other objectives, will ensure Santos and the regulators are informed about potential impacts long before they occur.

Groundwater monitoring

- As part of its exploration activities, Santos is conducting comprehensive groundwater and surface water monitoring.
- For the GLNG project in Queensland, a project-wide water monitoring strategy has been developed that guides the development of detailed water monitoring plans for each of the fields
- Monitoring and sampling is performed by trained environmental scientists, dedicated to this role
- An environmental data management plan has been developed for all CSG environmental monitoring activities
- Santos has committed to providing public access to key monitoring data, in particular regional trends of water levels and water quality
- All Santos' Australian soil and water sampling is done by ALS Laboratory Group (a National Association of Testing Authorities [NATA] certified laboratory company).

**GAS EXTRACTION, THE MURRAY DARLING PLAN AND AGRICULTURAL PRODUCTIVITY**

The production of CSG involves the extraction and treatment of large quantities of water from deep coal seams (between 200 and 1000m below the surface), which is not

included in current water accounting. Santos is committed to treating CSG water to a standard where it is useful to landholders and the community. While not a permanent supply, treated CSG water could be used as an addition to scarce water supplies and to establish perennial plantations during the period the water is available.

Santos is committed to ensuring that the water produced is put to safe and productive use.

For example, at Santos' Fairview operations in Queensland, four new water treatment plants and a desalination plant will treat around 24 megalitres of CSG water a day. It will be used for drip irrigation onto a native hardwood gum plantation, and irrigation of agricultural crops. Santos will also use CSG water to establish forage crops for cattle.

Santos has also installed state of the art water and soil monitoring facilities at locations throughout the plantation and on local rivers and adjoining properties. Santos is committed to the sustainable management of the plantation within strict guidelines that have been agreed with the regulators. The project will create several new jobs as well as major research opportunities for the Australian agroforestry and water industries, and educational opportunities for schools and universities around beneficial water use and carbon emission reduction. The Fairview project provides compelling evidence of the benefits of multiple land use.

The smaller footprint of gas exploration, pilot testing and production comparative to other resource exploration means that it can co-exist with other primary industries such as agriculture.

Since arriving in the Gunnedah Basin, Santos has committed to being available to farmers to answer questions and address concerns raised. There has been active engagement through information sessions, briefings and updates including:

- Agquip (1500+ inquiries)
- Thirteen community briefings
- Presented to a range of community groups
- Participating in Namoi Water Study
- Regular engagement with landholders

**CONCLUSION**

Santos' operations in Queensland, the Cooper Basin and Victoria show that agriculture and gas extraction can co-exist successfully. As the global population increases, multiple uses of land, rather than quarantining, are the best response to increased demand for food and energy. This is particularly true when both can be provided from the same land.

## 2. RESPONSE TO SENATORS' QUESTIONS ON NOTICE

With regard to the specific information asked of Santos at the committee hearing in Oakey, Santos provides the following information:

**Senator WILLIAMS**—If you could take on notice how many tonnes of salt are produced and forward the answer to the Secretary of the committee, that would be great.

**Santos Response:** The upper estimate of salt produced from treatment processes from the entire GLNG project in Queensland over the life of the project (approx. twenty years) is estimated to be around 600,000 Tonnes which is estimated to occupy around 500,000 m3

## 3. COMMENTS ON CLAIMS MADE IN SUBMISSION 29 - IMPACTS OF COAL SEAM METHANE EXTRACTION IN THE MURRAY-DARLING BASIN.

**CHAIR**—We are running over time, so I am not going to hold the committee and everyone else up with another round of questions. I will, however, set a little bit of homework for Santos—or you might like to outsource it to APIA. My colleagues have raised a number of issues about coal seam gas, the processes that are used and some of the concerns that have been raised with this committee over the last couple of days. One of the submissions we have received, the submission from the coal seam methane subcommittee of the Caroona Coal Action Group, contains just about every risk that I have heard presented over the last couple of days. A few more are outlined, many of which I suspect come from the issues that Senator McEwen raised about historical problems. I would like to see the industry's response to each of those issues. If that could be provided to us at some stage over the next few weeks, that would be greatly appreciated.

**The Importance of the Namoi Catchment to the Liverpool Plains and the Murray-Darling Basin.**

**Santos Response:** Santos is fully aware that some agricultural producers within its exploration area rely on irrigation from alluvial aquifers in the Gunnedah and Narrabri formations (which are within 200m of the surface), and that others rely on the same aquifers for stock and domestic bore water.

Alluvial aquifers are protected by Santos' well design, which ensures that they are isolated behind pressure cemented steel casing, preventing cross-flow between aquifers. Refer to the attached factsheet *Exploration Drilling and Core hole Design* for a basic well design, which is adapted to suit the geological features of individual core holes.

Aquifers below the alluvial levels are protected during drilling by well-control techniques - the use of biodegradable drilling additives and loss-control materials. At the completion of drilling, the well is pressure cemented from base to surface, ensuring that no communication between geological formations is possible.

Santos would like to correct the following claims:

- Claims that CSG production will lead to pollution of waterways by toxic metals, fine silica dusts and carcinogenic petroleum hydrocarbons are unsubstantiated.
- Claims that Santos will build evaporation ponds are incorrect. Since May 2009, Santos has been very clear with the community that this is Santos' least preferred option for handling produced water, and that Santos' intention is to treat the water to a point where it is useful to landholders and the community. Refer to the attached factsheet Gunnedah Basin – Frequently Asked Questions (bottom page 1).
- Claims that CSG extraction is associated with acid mine drainage are incorrect. It is an extractive, not a mining process.
- Claims that CSG production will irreparably damage the purity and capacity of the surficial and aquifer water supplying the Liverpool Plains, and the Plains' ability to produce food, are incorrect. The integrity of Santos' well design has been proven over decades of use in the petroleum industry and is intended to protect aquifers.

**The CSM Extraction process – impacts of an unproven technology.**

**Santos Response:** While the extraction of CSG is a relatively new industry in Australia, it relies on standard technology which has been proven in the petroleum industry over a number of decades. For an explanation of the exploration and production processes that Santos intends to use, refer to the attached factsheet *Introduction to Coal Seam Gas.*

Santos would like to correct the following:

- CSG becomes sub-economic to extract at depths greater than 1 000m, therefore Santos will not be drilling to depths of over 3 500 metres.
- Coal seams function as aquifers, in that they are subsurface structures containing water. They are not completely dewatered. Water is removed until the pressure drops sufficiently to allow gas to detach from the surfaces of the coal seam.
- Fracture stimulation (fraccing) is extremely expensive and is only used when necessary. It is used to liberate gas, not water, and is performed after dewatering has been carried out.

Santos has many years of experience in exploring and producing gas. The first gas was extracted from Moomba in 1969.

**Disposal of Waste Water – the industry is still searching for a solution**.

**Santos Response:** Exploration drilling for CSG requires approximately 30 000L of locally sourced water per core hole. Production of CSG also produces water, although water production decreases with time. The amount of water produced depends on the:

- depth of the relevant coal seam;
- permeability of the coal seam;
- porosity of the coal seam;
- extent of interference from aquifers overlying the coal seam differences in the location of the gas fields themselves; and

- gas extraction technique.[6]

The nature of the water CSG water quality typically varies from region to region and from well to well. CSG water presents in the form of salty brine.[7]

Santos would like to correct the following:

- Disposal of water produced from coal seams in Santos' Queensland CSG fields has not been a huge problem. Santos has devised a way to treat CSG water to the point where it can be used to grow hardwood trees and forage crops for cattle. Refer to the attached media release *Santos forestry project a ground-breaking solution to CSG water management.*
- Claims that CSG water usually has an extremely high salt content are incorrect. The volume and quality of water extracted from coal seams varies and can only be quantified after exploration and appraisal testing. However, associated water with salinity above >15,000 mg/l dissolved salt is unlikely, with water below 3,500 mg/l typically accounting for the majority of associated water.
- Claims that CSG water usually has extremely high heavy metal content are incorrect. Santos' operational experience shows that negligible quantities of heavy metals are present in produced water.
- Incorrect claims that Santos will build evaporation ponds have been addressed above, therefore all claims associated with evaporation ponds are not relevant to this discussion.
- Santos is aware that reverse osmosis is extremely expensive and highly energy intensive, and for this reason has always been clear with the community that it is accepted as part of the cost of doing business.
- Claims that reinjection would result in widespread contamination of aquifers are incorrect. Reinjection has only been proposed if CSG water can be reinjected into a subsurface formation of the same or greater salinity. The process of reinjection would be controlled by the IINSW's Aquifer Interference Guidelines (as yet unreleased).

**Increased Seismic Activity**

**Santos Response:** Santos would like to correct the following:

- Claims presented by a single scientist (Dr Christian Klose from the Lamont Doherty Earth Observatory at a meeting of the American Geophysical Union in San Francisco, California in December 2006[8]) are an opinion, and do not constitute a body of evidence from which the conclusion can be drawn that the tragic 1989 Newcastle earthquake was caused by coal mining in the Hunter Valley.
- Santos was not the technological lead on the Brantas Production Sharing Contract.

[6] http://www.tresscox.com.au/resources/resource.asp?id=405

[7] http://www.tresscox.com.au/resources/resource.asp?id=405

[8] http://news.nationalgeographic.com/news/2007/01/070103-mine-quake.html

- Santos held an 18% minority non operating interest in the Brantas Production Sharing Contract (PSC) when the mudflow incident occurred at the Banjar-Panji exploration well in Sidoarjo, East Java.
- It is important to remember that while the cause of the Banjar Panji incident in Indonesia has not been determined, the geology of East Java is very different to that of the Gunnedah Basin and the two situations cannot be compared. There is no possibility of any form of mud volcano occurring in the Gunnedah Basin.
- Landowners have drilled hundreds of water bores in the Gunnedah Basin – and coal miners thousands of coal bore holes – and there is no evidence of over pressuring in these wells.[9]

Anecdotal evidence linking gas exploration and seismic activity has been quoted in a misleading way:

- Claims that earthquakes in Ohio may have been caused by waste reinjection were published in *Geotimes*, where geologist Michael Hansen was quoted as saying, *There are a number of injection wells in Ohio. And elsewhere companies are injecting hazardous waste as deep as they can get it in the sedimentary rock, into the basement and away from drinking water sources. In most cases it's never a problem. Indeed, I haven't seen it in any other injection well in Ohio.*[10]
- An article widely circulated by the Associated Press agency claimed *Drilling might be culprit behind Texas earthquakes*. The article speculated that small earthquakes were caused by fraccing associated with natural gas (not CSG) exploration, and went on to say *There is no consensus among scientists about whether the practice (fracking) is contributing to the quakes*. Two scientists were quoted in the article - one ruled out any association between fraccing and earthquakes, and the other stated *I would be surprised if a seriously damaging earthquake came out of this*.[11]
- Seismic activity in Basel, Switzerland, was associated with a pioneering hot fractured rock geothermal project which bears no similarity to any Santos CSG operations.[12]
- Seismic activity in the Gazli gas fields in Uzbekistan occurred between 1976 and 1984[13], however the link between gas extraction and seismic activity is unproven. The mass of gas extracted from the Gazli field (300 million metric tonnes) is exceeded by the 1200 million metric tonnes of water that infiltrated the gas field, adding to the mass of the local crustal load.[14]

**Irreparable damage and destruction of aquifers.**

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[9] http://www.santos.com/library/Gunnedah_Basin_FAQs.pdf, pg 4
[10] http://www.agiweb.org/geotimes/mar02/NN_quakes.html
[11] http://www.madville.com/out/news/308503_oil_and_gas_drilling_might_be_culprit_behind_texas_earthquakes
[12] http://www.treehugger.com/files/2007/01/geothermal_powe.php
[13] http://news.nationalgeographic.com/news/2007/01/070103-mine-quake_2.html
[14] http://books.google.com.au/books?id=aFNKqnC2E-sC&pg=PA657&dq=Uzbekistan+Gazli+natural+gas+field#v=onepage&q=Uzbekistan%20Gazli%20natural%20gas%20field&f=false

**Santos Response:** Claims that Santos intends to use an explosive fraccing process, and that there is …*no control over the extent of the fracture…* are incorrect. In the event that fraccing is absolutely necessary, the intention is to fracture the coal seam only, allowing gas to travel to the well and the surface. The fracture stimulation is designed to ensure that neighbouring rock is left intact.

**Methane migration**

**Santos Response:** It is correct that in September 2004, Molopo's LMG03 well was shut down because boreholes nearby produced methane gas. In fact, gas was produced from three nearby coal exploration holes that had not been grout sealed by previous coal license holders[15]. This reinforces the importance of applying petroleum industry standards with which Santos complies for core hole abandonment.

**Contamination from Drilling and Fraccing Fluids**

**Santos Response:** Claims that Santos' CSG operations will cause contamination are unfounded. The Review of Environmental Factors (REF) submitted to IINSW (formerly NSW Department of Primary Industries) commits Santos to using biodegradable drilling fluids. See attached REF by way of example. Materials Safety Data Sheets for all products used are attached. Misting of drilling fluids is not a disposal technique that is used on Santos sites.

Meat and Livestock Australia (MLA) guidelines relating to stock and coal mine wastes apply to pollution from old coal mines and washeries, are taken from the *On-farm risk assessment for persistent chemicals*[16] and make no mention of CSG.

**Gas Extraction and the lowering of water tables and creation of voids leading to subsidence.**

**Santos Response:** Claims that extraction of one unit of gas results in thirteen and half units of waste water are unproven. The volume and quality of water extracted from coal seams in the Gunnedah Basin will only be quantified after exploration and appraisal testing.[17]

Claims that *Dewatering coal seams will allow for groundwater migration towards coal seam voids. This has significant potential to effectively dewater sections of the study area. Dewatering of the coal seams will adversely affect the groundwater system and will have a flow on effect of reduced or lost stream flow* are taken from a report referred to by the Minister at the time as ..*not the best available scientific evidence...*[18] after three months analysis by staff at the former NSW Department of Mineral Resources.

Senator Wong's comments regarding water moving between different levels of an aquifer referred specifically to the increased pumping from highly-developed aquifers in

[15] ASX Release, 18 February 2005, http://molopo.com.au/asx_april_05.html#18feb
[16] http://www.mla.com.au/NR/rdonlyres/A33C69AD-16A4-4333-A350-F51DFCF45922/0/RiskAssessmentLivestockProductionAssuranceMarch2005.pdf
[17] http://www.santos.com/library/Gunnedah_Basin_FAQs.pdf. pg 3
[18] http://www.parliament.nsw.gov.au/prod/parlment/hanstrans.nsf/V3ByKey/LA20050503

NSW due to drought and climate change[19] and made no mention of undeveloped aquifers many hundreds of metres below the surface.

**Environmental Damage from Establishment of Gas Fields.**

**Santos Response:** drawing conclusions between the Gloucester CSG Project and Santos' Gunnedah Basin project are misleading and have no basis in fact. The current exploration process is intended to reveal the facts needed to understand the density of development required to produce.

Assumptions that loss of food producing land, noise pollution, erosion, loss of native habitat, environmental damage, erosion and noxious weeds will result from CSG production have no basis in fact and ignore stringent planning protocols relating to development in NSW which Santos will be required to comply with

**Methane and CO2 liberation.**

**Santos Response:** Methane, as a greenhouse gas, is twenty two times more damaging than carbon dioxide (C02) only when allowed to escape into the atmosphere, not when burned to provide electrical energy. Claims that gas escapes during capture, storage and handling processes ignores environmental and safety regulations that required operators to conduct these processes to minimize fugitive emissions. Having spent many millions of dollars discovering and capturing coal-seam gas (CSG), Santos has no intention of wasting it. And Santos would be liable for any such furtive emissions under any Emissions Trading Scheme (ETS) such as the proposed Carbon Pollution Reduction Scheme (CPRS).

Using natural gas to generate electricity is a key transition strategy that can deliver significant reductions in Australia's CO2 emissions from stationary energy whilst ensuring energy security for Australian's economic well being. Gas can fuel peak, shoulder and baseload capacity. A proven and established technology, closed cycle generating turbine (CCGT) plants emit some 60% less CO2 emissions and use up to one third of the water needed by coal fired baseload generators while generating competitively priced energy.

**Attachment One: Factsheet Exploration Drilling and Core Hole Design**

**Attachment Two: Factsheet Gunnedah Basin – Frequently Asked Questions**

**Attachment Three: Factsheet Introduction to Coal Seam Gas**

**Attachment Four: media release *Santos forestry project a ground-breaking solution to CSG water management***

[19] http://www.environment.gov.au/minister/wong/2009/mr20090303.html