

**From:** [Andrew Grogan \(Hotmail\)](#)  
**To:** [IPCN Enquiries Mailbox](#)  
**Cc:** [Casey Joshua](#)  
**Subject:** Narrabri Gas Project - Written Supplemental Submission in response to DPIE statements 1st August 2020  
**Date:** Saturday, 8 August 2020 7:59:30 PM  
**Attachments:** [image001.png](#)  
[image002.png](#)  
[image003.png](#)  
[image004.png](#)  
[Written Submission NGP - Response to DPIE Comments on Submission.pdf](#)

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Can you please also enter the attached document as a submission to the IPCN; it can be appended to my existing material if that is appropriate, or treated as a separate supplementary submission

As it specifically deals with new material (the DPIE's response on 1st August 2020 to the technical issues that were raised on 25th July 2020) and contains a number of clear recommendations on conditions that should be added to any project approvals to deal with these issues, I would be most grateful if you can ensure that the Commissioners see this attached document and in particular the recommended conditions that should be attached to any project approval.

I was, as the attached content details, concerned about DPIE's confusion with respect on how to manage the potential production of high CO2 gas that is encountered in the NGP area, and the attached analysis of DPIE's response to my raising the CO2 issue also contains some clear and practical recommendations on how to manage the issue and ensure low emissions from the project.

I would be grateful, again, if you could acknowledge receipt of the attached document.

Dr Andrew Grogan  
0422 277 600

----- Original Message -----

From: "IPCN Enquiries Mailbox" <[ipcn@ipcn.nsw.gov.au](mailto:ipcn@ipcn.nsw.gov.au)>  
To: "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>  
Cc: "Casey Joshua" <[Casey.Joshua@planning.nsw.gov.au](mailto:Casey.Joshua@planning.nsw.gov.au)>  
Sent: 29-Jul-20 9:37:03 AM  
Subject: RE: Narrabri Gas Project - Written Submission

Dear Andrew

Thank you for your email, I can confirm receipt of your submission and supporting documents.

Regards

**Nina Harrison | Project Support Officer**

Office of the Independent Planning Commission NSW  
Level 3, 201 Elizabeth Street Sydney NSW 2000

E: [nina.harrison@ipcn.nsw.gov.au](mailto:nina.harrison@ipcn.nsw.gov.au) P: +61 2 9383 2141 | F: 9383 2133 | [www.ipcn.nsw.gov.au](http://www.ipcn.nsw.gov.au)



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**Independent Planning Commission**

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**From:** Andrew Grogan (Hotmail) <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>

**Sent:** Tuesday, 28 July 2020 2:44 PM

**To:** IPCN Enquiries Mailbox <[ipcn@ipcn.nsw.gov.au](mailto:ipcn@ipcn.nsw.gov.au)>

**Cc:** Casey Joshua <[Casey.Joshua@planning.nsw.gov.au](mailto:Casey.Joshua@planning.nsw.gov.au)>

**Subject:** Narrabri Gas Project - Written Submission

Please find attached a Written Submissions to the Independent Planning Commission for the Narrabri Gas Project

I would be grateful if you could acknowledge receipt the Submission and supporting documents as per list below

- 00 - IPCN Covering Letter - Written Submission NGP.pdf
- 01 - IPCN ATG 2020-07-25 2\_05 PM Final - Out.pdf
- 02 - IPCN Submission - NGP and East Coast Gas Prices.pdf
- 03 - IPCN Submission - Will an LNG Import Terminal Solve the Problem.pdf
- 04 - The High Cost to Produce Narrabri Gas (AEMO Data, 2019).pdf
- 05 - NGP - Independent Engineer CO2 Review, July 2020 Updated.pdf
- 06 - Emissions Summary - Independent Engineer CO2 Review, July 2020 Updated.pdf
- 07 - IPCN Submission - Santos states at 2020 AGM that the NGP will not produce from the Hoskissons Formations.pdf
- 08 - IPCN CO2 content graphic Final.pdf
- 08a - IPCN Dewhurst 8A CO2 Samples.pdf
- 08b - IPCN Bibblewindi\_North\_1C\_Gas\_Composition.pdf
- 08c - IPCN Dewhurst\_19\_Gas\_Composition.pdf
- 09 - IPCN Submission - High CO2 in Narrabri Gas.pdf

I remain at the Commission's disposal to provide further information or assistance on these matters and can be contacted via the NGP Economics site at:

<https://ngpeconomics.org/contact/>

Sincerely

NGP Economics

Dr Andrew Grogan, PhD, BE (Hons)

----- Original Message -----

From: "Casey Joshua" <[Casey.Joshua@planning.nsw.gov.au](mailto:Casey.Joshua@planning.nsw.gov.au)>

To: "Kym Statham" <[Kym.Statham@ipcn.nsw.gov.au](mailto:Kym.Statham@ipcn.nsw.gov.au)>; "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>

Cc: "IPCN Enquiries Mailbox" <[ipcn@ipcn.nsw.gov.au](mailto:ipcn@ipcn.nsw.gov.au)>

Sent: 25-Jul-20 4:04:59 PM

Subject: RE: Fw: Re[2]: IPCN - Material for Commissioners and

Dear Andrew,

We will endeavour to upload the transcript within 3 business days.

Regards,

**Casey Joshua | Principal Case Manager**

Office of the Independent Planning Commission NSW

Level 3, 201 Elizabeth Street Sydney NSW 2000

e: [casey.joshua@ipcn.nsw.gov.au](mailto:casey.joshua@ipcn.nsw.gov.au) | p: +61 2 8289 6913 | [www.ipcn.nsw.gov.au](http://www.ipcn.nsw.gov.au)



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**From:** Kym Statham <[Kym.Statham@ipcn.nsw.gov.au](mailto:Kym.Statham@ipcn.nsw.gov.au)>

**Sent:** Saturday, 25 July 2020 4:01 PM  
**To:** Casey Joshua <[Casey.Joshua@planning.nsw.gov.au](mailto:Casey.Joshua@planning.nsw.gov.au)>  
**Cc:** IPCN Enquiries Mailbox <[ipcn@ipcn.nsw.gov.au](mailto:ipcn@ipcn.nsw.gov.au)>  
**Subject:** FW: Fw: Re[2]: IPCN - Material for Commissioners and

Hi Casey,

Could you reply to Andrew's email.

Many thanks

Kym

---

**From:** Andrew Grogan (Hotmail) <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>  
**Sent:** Saturday, 25 July 2020 2:28 PM  
**To:** Kym Statham <[Kym.Statham@ipcn.nsw.gov.au](mailto:Kym.Statham@ipcn.nsw.gov.au)>  
**Subject:** Re: Fw: Re[2]: IPCN - Material for Commissioners and

Kym,

When may I get a copy of the transcript?

I had a lot of questions and the Commission (and following speakers) are to be thanked for extra time.

Andrew  
0422 277 600

----- Original Message -----

From: "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>  
To: [kym.statham@ipcn.nsw.gov.au](mailto:kym.statham@ipcn.nsw.gov.au)  
Sent: 25-Jul-20 11:43:40 AM  
Subject: Fw: Re[2]: IPCN - Material for Commissioners and

Kym

Can you advise how I can record (on video+sound) or obtain a recording (video+sound) of my appearance at IPCN later today?

Thanks

Andrew Grogan  
0422 277 600

----- Forwarded Message -----

From: "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>  
To: "Jason Fieramosca" <[jfieramosca@gmail.com](mailto:jfieramosca@gmail.com)>  
Sent: 25-Jul-20 10:52:31 AM  
Subject: Re[2]: IPCN - Material for Commissioners and

And a question, I'd like to record the session (video plus sound) - how would I do that?

Or can IPCN give me a copy of video and a transcript?

Sorry to bother

Andrew Grogan  
0422 277 600

----- Original Message -----

From: "Jason Fieramosca" <[jfieramosca@gmail.com](mailto:jfieramosca@gmail.com)>

To: "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>

Sent: 25-Jul-20 6:45:43 AM

Subject: Re: IPCN - Material for Commissioners and

Thank you

Sent from my phone

On Fri, 24 Jul. 2020, 22:29 Andrew Grogan (Hotmail),  
<[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)> wrote:

PPT

- (a) to be shown on AV to Commissioners while I am presenting
- (b) paper copies for all commissioners to make notes

Please let them know the detail behind the short PPT can be found at:

<https://ngpeconomics.org>  
Google]

[NB - no www, and you can't find it on

thank you

Andrew  
0422 277 600

----- Original Message -----

From: "Andrew Grogan (Hotmail)" <[andrewgrogan@hotmail.com](mailto:andrewgrogan@hotmail.com)>

To: [jfieramosca@gmail.com](mailto:jfieramosca@gmail.com)

Sent: 24-Jul-20 5:26:59 PM

Subject: Test

NGP Economics

Please use contact Form at

<https://ngpeconomics.org/contact/>

Office of the Independent Planning Commission NSW  
Level 3, 201 Elizabeth Street  
SYDNEY NSW 2000

8<sup>th</sup> August 2020

### **Written Submission : Narrabri Gas Project, Commission Public Hearing Response to DPIE's position on CO2 levels, 1<sup>st</sup> August 2020**

Further to NGP Economics material presented to the Commission at the Public Hearing at 2:05 pm on 25<sup>th</sup> Jul 2020, and for which quite a number of questions were asked by Commissioners, I subsequently observed the DPIE's response to the issue of high carbon dioxide CO<sub>2</sub> in the NGP gas area on 1<sup>st</sup> August 2020.

There a number of serious concerns which arise when considering the DPIE's 1<sup>st</sup> August response to this issue. A marked-up transcript of the Commission exchange with DPIE is attached to this letter, with comments on the misunderstandings, knowledge gaps and impractical suggestions by the DPIE.

When the established uncertainty on the level of carbon dioxide (CO<sub>2</sub>) in the NGP gas is considered, there are a number of recommendations on the project approval which can simply and cleanly address the CO<sub>2</sub> and emissions issue and range of other project problems stemming from a lack of useful and applicable data provided to date; notwithstanding that the data for 40 wells and over a thousand gas samples with CO<sub>2</sub> gas composition have been available during the entire Assessment process on the DPIE's DIGS (Digital Geological Survey) website.

#### **The recommended additional conditions on the NGP Approval should include:**

1. **That any project approval be limited to Phase 1 (Appraisal and further Assessment) activities.**

Phase 1 would involve carrying out further exploration and appraisal activities, including:

- seismic surveys;
- core and chip holes;
- drilling up to 25 pilot wells; and
- installing ancillary infrastructure to support these activities (access tracks, gas and water gathering lines, flaring infrastructure).

Santos (or the NGP Operator) can then provide in the interest of its commitment to transparency, during Phase 1, actual data on gas compositions in 2014 and 2015 (as required by law) and a full independent CO<sub>2</sub> content study could be completed by an independent panel using the significant amount of available publicly available data on the CO<sub>2</sub> content of NGP CSG. It would also provide time for Santos to meet data requests associated with other environmental issues with audited and actual non-industry (independent) data for actual methane emissions and safe disposal of salt; and time to conduct a market study by a competent and independent panel to assess whether there would be any downward pressure on gas prices in NSW (NB : DPIE has now admitted there will not be any positive impact on NSW gas prices from the NGP)

2. **For any Phase 2 activities, that aggregate vented CO<sub>2</sub> production in any year from the NGP wells may not exceed 5% of the produced gas volume (on a mole basis) or 500,000 tonnes CO<sub>2</sub> whichever is the lower amount (of CO<sub>2</sub>). As Santos maintains that the level of CO<sub>2</sub> is approximately 5%, they should not have any resistance to imposing a 5% limit as a hard approval condition.**
  - a. Santos, with its subsurface expertise can then work to target the lowest CO<sub>2</sub> areas - as the “hard” approval CO<sub>2</sub> limit of 5% will be an effective and enforceable condition. (NB - Independent and qualified and empowered professionals would need to be engaged by DPIE / EPA to ensure compliance)
  - b. This would obviate the unworkable proposal from DPIE on directing Santos where to drill and produce CSG in the NGP area.

In addition to the above recommended Approval conditions, there are a numbers of other activities that would benefit NSW in respect of any Approval for Phase 2 of the NGP:

1. Any consideration of the Project’s claimed economic benefits and any Phase 2 Approval should include transparent evaluation by the Independent Planning Commission of gas market modelling, which includes the price setting effect in the Eastern States gas market of the Queensland LNG facilities, by a panel of competent and independent experts. Any “security of supply” assertions should be backed up by independent analysis. The price that Santos would pay for any grid electricity also needs to be transparent, to avoid any hidden subsidy of the project by other NSW electricity users.
2. That there be a full, transparent and documented analysis of the thousands of gas samples taken during the appraisal of the NGP area by an independent panel of experts; and a requirement for Santos to provide the samples which it claims show a low (5%) level of CO<sub>2</sub> in the CSG (coal seam gas) at Narrabri.

I refer the Commission to the last page of this document, which sets out estimates for the DPIE that have been made, in order to assist them, of CO<sub>2</sub> and fugitive emissions for the CO<sub>2</sub> content of 10% (EIS); 15% (David Kitto number mentioned on 1<sup>st</sup> August 2020); and 25% (analysis of 40 wells and 1000 samples). The table on the final page indicates that the NGP would result in 2 million tonnes p.a. or more of total GHG emissions.

This would be a 30% increase in Santos Scope 1 emissions from its current corporate total emissions of 5,819,284 tonnes CO<sub>2</sub> p.a. (AER 2018-2019 Data<sup>1</sup>), which is not compatible with a clean transitional fuel claim by Santos. See the emissions calculations on the last page of this document.

I remain at the Commission’s disposal to provide further information or assistance on these matters and can be contacted via the NGP Economics site at: <https://ngpeconomics.org/contact/>

Sincerely

Dr Andrew Grogan, PhD, BE (Hons)

---

<sup>1</sup> [www.cleanenergyregulator.gov.au/NGER/National greenhouse and energy reporting data/Corporate emissions and energy data/corporate-emission-and-energy-data-2018-19](http://www.cleanenergyregulator.gov.au/NGER/National_greenhouse_and_energy_reporting_data/Corporate_emissions_and_energy_data/corporate-emission-and-energy-data-2018-19)

## NGP Economics Response to DPIE Comments on CO<sub>2</sub> levels in NGP CSG, 1<sup>st</sup> August 2020

The DPIE position taken on the CO<sub>2</sub> issue when questioned by the Commission was quite unusual in that David Kitto of the DPIE effectively told the IPC Commissioners that the DPIE has the power, and the subsurface technical ability and knowledge, to tell Santos where to drill and from which wells it can produce, and could use those powers to stop “too much” CO<sub>2</sub> being produced.

Such an approach is impractical for a number of reasons; one of them being that it is rarely possible to be certain what will actually be encountered whenever a well is drilled; another is that there do not appear to be any obvious relevant conditions in the DPIE Assessment recommendation that would actually enable this control on Santos CO<sub>2</sub> emissions.

The quantitative limit associated with Mr Kitto's “CO<sub>2</sub> levels are very high” [see text in **yellow** in attached marked-up Transcript) limit is undefined, which means the position has no valid CO<sub>2</sub> limit defined and is a vague and qualitative assurance of no applicability. However, the insertion of a hard limit on NGP CO<sub>2</sub> emissions, enforced by the EPA and DPIE, and with independent oversight would achieve the necessary goal of limiting production from high CO<sub>2</sub> areas.

The question also remains as to why this DPIE ability and subsurface knowledge about CHS and CO<sub>2</sub> was not used to analyse the data on well CO<sub>2</sub> levels on the DPIE's own public domain Geoscience data base website (DIGS) during the Assessment of the project.

The refusal of Santos to provide any information on the high carbon dioxide level in many wells in the NGP area as detailed on page 25 of the Narrabri Gas Project - Water Expert Panel Report (excerpt below) indicates that the GHG commitment by Santos in Chapter 24 of its EIS (also reproduced below) does not reflect the reality of the assessment process for the NGP. It is notable that Santos as the drilling Operator actually provided to Geoscience NSW much of the public domain data for wells drilled prior to 214 in the NGP area that could have been used during the Assessment process by the EPA and DPIE, and the silence of Santos on the existence of this data is difficult to reconcile with “reporting transparency”.

Santos, NGP EIS, Chapter 24, page 24-8:

*“The proponent has a strong track record of working cooperatively with government, industry and the community to address greenhouse gas emissions with specific focus on addressing energy efficiency, the transition to low emission technologies and reporting transparency. The proponent is committed to implementing reasonable and practicable measures to reduce, monitor and disclose its greenhouse gas emissions throughout the life of the project.” [Author's underline]*

Page 25 of the ' Narrabri Gas Project - Water Expert Panel'

*“The WEP (Water Expert Panel) sought information about gas composition, especially carbon dioxide, from Santos but the company has declined to provide such information on the grounds that “detailed spatial information of gas is commercial in confidence”.*

## NSW DPIE - High CO<sub>2</sub> in Narrabri Gas

### NSW Independent Planning Commission : Transcript with Observations

1 August 2020, Day 7 of the Narrabri Gas Project Public Hearing

At the DPIE's final submission session to the IPC on 1<sup>st</sup> August 2020, Professor Snow Barlow, IPC Commissioner, referred to evidence provided to the IPC including analysis showing that the CO<sub>2</sub> content of Narrabri Gas is in the region of 25-30%. This was the evidence was provided to the IPC by NGP Economics during a presentation to the Commission on Saturday, 25<sup>th</sup> July 2020.

The Commissioner (Professor Snow) stated that, in relation to greenhouse gas emissions, that the IPC is aware that Santos hasn't released any well or gas sample data post-2014 and that this unreleased information appears to be the gas composition data that Santos relies on for its new "5% CO<sub>2</sub>" claim.

However, Professor Barlow pointed out that accredited analysis of those wells on the public record prior to 2015 by an experienced subsurface engineer indicated that CO<sub>2</sub> content is in the region of 20%-30%.

Professor Barlow observed that some commercial-in-confidence information is claimed by Santos to support an estimate that the CO<sub>2</sub> content of the gas would be "probably about 5%".

The ongoing exchange on the issue has been transcribed below, and is presented together with relevant observations on the DPIE responses.

#### **David Kitto, Executive Director, NSW Department of Planning, Industry and Environment:**

*"... from a greenhouse gas emissions point of view, certainly in terms of the emissions generated on-site, the flaring of CO - or venting of CO<sub>2</sub> is the key - is the key emission. Now, there's two prongs to this. There's obviously an economic side to CO<sub>2</sub> levels and there's an environmental side to CO<sub>2</sub> levels.*

*So from an economic point of view, Santos would want as little CO<sub>2</sub> as possible because that's, you know, they don't make any money from CO<sub>2</sub>. It's - you know, they'd really want the methane<sup>2</sup>.*

*From an environmental point of view, obviously you're wanting to minimise that as much as possible".*

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<sup>2</sup> As long as Santos is producing enough methane to sell economically after the costs of extracting and venting the CO<sub>2</sub>, high CO<sub>2</sub> is not in itself an economic deterrent, and claims that it should be discounted by the Commissioners. The assertion has no market or economic foundation, and there is no disincentive for Santos to not produce high CO<sub>2</sub> CSG and remove and vent the CO<sub>2</sub> to make it saleable gas. This statement by the DPIE reveals a lack of understanding of CSG production economics.

### Box 1

Author's Note : Any incentive for Santos to not produce high CO<sub>2</sub> gas will only occur if there is a realistic price on carbon of \$20/tonne or more; and/or there is a very high cost to Santos to removing the CO<sub>2</sub> and venting it to the atmosphere. Scrubbing CO<sub>2</sub> from gas is expensive but Santos will have to do this even at the unsubstantiated "5% CO<sub>2</sub>" level.

As long as Santos is producing enough methane to sell economically after the costs of extracting and venting the CO<sub>2</sub>, high CO<sub>2</sub> is not an economic deterrent, and claims that it should be discounted by the Commissioners. The assertion has no market or economic foundation.

The DPIE did not address how the 'second prong' of emissions minimisation would be actually addressed by any conditions. As outlined in this submission, a "hard" approval limited of vented CO<sub>2</sub> emissions of 5% of gas (by produced volume) or 500,000 tonnes CO<sub>2</sub> p.a. [whichever is the lower] would be a simple and effective mechanism to achieve emissions control

**Kitto :** *"Now, I think ... what everyone has said is the CO<sub>2</sub> levels will vary across that project area. So in some levels CO<sub>2</sub> levels might be low within the target coal seams and in others they may be higher. So certainly I think on some of the eastern boundary of the project area, you would expect - I think some of the work has shown that you would expect areas of higher CO<sub>2</sub> levels. And so I guess in developing field development plans, we would expect Santos to focus on the most prospective areas within the project area and certainly to avoid areas with high CO<sub>2</sub> content."*

### Box 2

Author's Note : The comments in Box 1 above apply equally to this assertion. Santos may attempt to start with wells in lower CO<sub>2</sub> areas, noting that researchers such as Gurba et al (2009)<sup>3</sup> observe that the occurrence of high CO<sub>2</sub> levels in the Gunnedah Basin is extremely hard to predict. It is possible that Santos may begin production with lower CO<sub>2</sub> production wells, but there is no defined control mechanism over Santos drilling or production decisions in the future, perhaps when Santos feels that they can produce higher CO<sub>2</sub> without limits and/or Santos doesn't intersect low CO<sub>2</sub> areas when they drill and is forced to produce the documented high CO<sub>2</sub> gas.

**Kitto :** *"So that's one of the key drivers.*

*I think what Santos is saying is, you know, through the chief scientist and engineer, there was also some work done by Professor Cook which assumed, you know, 10 per cent for, you know, of CO<sub>2</sub> levels in coal seam gas. And so Santos has used that number in its greenhouse gas assessment and that's what the - you know, the 12 - you know, their calculations are based on.*

*Now, what they likely are aware that some of the appraisal wells, you know, like, the data coming out of that is that the CO<sub>2</sub> levels will be five per cent but we would assume that in some it may be slightly higher. I don't think - you know, I don't think we're assuming it would be up in the 25 to 30 because - but, you know, that may be the case. "*

---

<sup>3</sup> Lila W. Gurba, Alexandra Golab and James Douglass et al, February 2009, CO2CRC Report No: RPT09-1456\_NB - see [Table on page 9 from this reference](#)

### Box 3

Author's Note : Santos may try to target low CO<sub>2</sub> areas but it will also need to maintain an economic production rate and so future drilling and production decisions will depend on how the reservoir performs. Also, as well drainage increases, pressure on the coal drops and CO<sub>2</sub> gas desorption from the coal occur at a greater rate and the proportion of CO<sub>2</sub> in the production gas will increase with time - even more reasons for a hard annual 5% limited on vented CO<sub>2</sub> emissions.

Note that there is no need to "assume" any level of CO<sub>2</sub> - there is ample data to provide specific information on the level of CO<sub>2</sub>, and that is an average of 25%-30%. Some wells have over 80% CO<sub>2</sub>.

**Kitto :** *"But I guess the issue - all that we can say at this stage is there will be a variation across the area. We would expect the focus certainly through the greenhouse gas management plan and the field development plan, to minimise, you know, the CO<sub>2</sub> - you know, to focus on the areas with minimal CO<sub>2</sub> so that the CO<sub>2</sub> venting is kept to a minimum.*

*But from an economic point of view, Santos has an incentive to do that anyway, but we do have, you know, the power in the conditions to say, "Well, the CO<sub>2</sub> levels are very high in those areas and you should be focusing on that area.*

*So the power does exist and certainly, you know, we would be focused heavily on that."*

### Box 4

Author's Note : The way in which DPIE or EPA or another Government agency would be able to direct Santos to limit any CO<sub>2</sub> production would need to be clearly defined and independent and qualified and empowered professionals would need to be engaged by DPIE to ensure compliance. It would be unique worldwide for a Government oil and gas regulator to tell a publicly listed field Operating company where, when and how to drill and produce.

But there must be serious questions to answer on how any agency could practically enforce well content or production CO<sub>2</sub> limits in the future when the Santos claims that performance is poorer than "assumed" (i.e. CO<sub>2</sub> levels are higher than the "5%" CO<sub>2</sub> figure recently proposed by Santos) and the NGP would seek to maintain production, possibly citing "royalties and jobs" as a justification for venting more and more CO<sub>2</sub> into the atmosphere. *However, a hard project approval limit on CO<sub>2</sub> venting amount would achieve the desired goal with minimal complications.*

**In view of this, my recommendation would be that aggregate CO<sub>2</sub> production in any year from the NGP wells could not exceed 5%. As Santos insists that is the level of CO<sub>2</sub>, they should not have any resistance to imposing that as a hard approval condition. Santos, with its subsurface expertise can then target the low OC2 areas - the hard CO<sub>2</sub> limit of 5% will be an effective and enforceable condition.**

Note : At this stage Mike Young, Executive Director, Resource Assessments NSW Government, stepped in after the above comments by David Kitto, who has effectively told the IPC Commissioners that the DPIE (NSW Department of Planning, Industry and Environment) has the power, and the subsurface technical ability and knowledge, to tell Santos where to drill and from which wells it can produce. *Ironically, this ability of DPIE could have been used to analyse the publicly available information to determine the NGP gas area CO<sub>2</sub> content during the Assessment phase.* Mike Young asks Stephen O'Donoghue, Director of Resource Assessments, to comment.

### Mike Young, Executive Director, Resource Assessments

*"It's Mike Young here, Steve. I'm just wondering - Steve O'Donoghue, that is. Just wondering whether you had any comments on the concentrations of CO<sub>2</sub>. I mean, I would have thought at levels like that you're starting to get into issues of, you know, economic issues in terms of those sorts of levels.*

### Stephen O'Donoghue:

*"Well, that's right and Santos has discussed that at CCC meetings along the way. You know, there's acknowledgement that there is variability in CO<sub>2</sub> levels.*

*Certainly as David said, further to the east where the coal seams, you know, start dipping up and shallower and you're getting into those volcanics in closer proximity that you're getting, you know, higher CO<sub>2</sub> levels. So that's - I mean, that's something that has been acknowledged through the CCC meeting and it would put constraints in on viability for going, you know, after the high CO<sub>2</sub> level sources\*.*

#### Box 5

Author's Note : Given that the volcanics do not control or have direct relationship to the variability in CO<sub>2</sub> distribution in the NGP area this comment simply does not recognise the complexity of CO<sub>2</sub> distribution in the NGP the area by making it appear to be a risk that is easily avoided. It is often easier to brush off an issue if it sounds simple to avoid. Specifically, it should be noted that there are also high CO<sub>2</sub> wells in the west, north, middle and south of the PEL 238 tenement (NGP area) which contradict this claim.

Also, the response did not answer Mike Young's question on the impact of high levels of CO<sub>2</sub> on the economics of gas production - the answer is that higher CO<sub>2</sub> materially increases the cost of production of saleable gas.

### Mr Young:

*"But, presumably from an economic and investment point of view, Steve, that - and my assumption would be that Santos would, obviously, be targeting the most prospective areas let alone what the department does through the conditions. But, clearly, from an economic point of view it would be the majority of the area is in those deeper seams and therefore, I guess, the indication they've put on record with the IPC is that typically it's more like five per cent, is my understanding. "*

### Mr O'Donoghue:

*No, that's right, yes. Yes, I agree."*

### Prof Barlow:

*“But, can I ask a supplementary there? But I think what you’re saying EIS despite the - you know, some ... analytical data being available, just use the Peter Cook assumption of 10 per cent<sup>4</sup>. So do you think that is a reasonable assumption with what the ultimate, you know, estimation of emissions from CO<sub>2</sub> in this project might be? “*

#### Box 6

Author’s Note : The document that Professor Barlow appears to be referring to is the Water Expert Panel (WEP) report as Professor Peter Cook was on the WEP that stated that Santos was requested to provide information on the CSG gas composition data and Santos refused to provide any data. There is no documentation that attributes the “10%” number to the WEP or Peter Cook. The 10% “assumption” only appears in the NGP EIS submitted by Santos.

The WEP Review Committee geotechnical (subsurface) expert did not appear to be aware that the required CO<sub>2</sub> and gas composition data were freely available on the NSW Government Geoscience website (DIGS, maintained by DPIE). As there was never any focus on carbon dioxide emissions and/or CSG CO<sub>2</sub> content by the DPIE or EPA during the assessment process, it appears that any CO<sub>2</sub> numbers used by the DPIE are based solely on the “assumptions” used by Santos in the EIS.

Prior to the Independent Planning Commission hearings, CO<sub>2</sub> issues (CSG CO<sub>2</sub> content and project emissions) were not addressed in any way by the EPA or DPIE. The only group that attempted to do so was the WEP, and Santos declined to point out that the data was publicly available.

### Mr Kitto:

*“So, Snow, I think the answer to that is yes, but it’s not difficult to do some sensitivity testing and say, well it’s 15 per cent and so on\*\*. You could work out quite quickly what the emissions are and I don’t think that’s - you know, materially changes what the Scope 1 emissions of the project would be. So I think, you know, it wouldn’t change it in a determinative way, but certainly, you know, through the greenhouse gas management plan and through the fuel development plans, you know, consistent with what the mining sect and other things are saying is we were guiding minimisation of greenhouse gas emissions which would be really pushing Santos to target those areas with low CO<sub>2</sub> - low CO<sub>2</sub> levels and really focusing on the most prospective part of the resource.”*

#### Box 7

Normally, it would be required that an observer on geological and engineering quantitative issues has the relevant qualifications in sub-surface evaluation and assessment in order to provide any informed opinion on whether a particular level of CO<sub>2</sub> is a reasonable assumption, notwithstanding that “assumptions” can be used to deflect the importance of data-based conclusions.

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<sup>4</sup> Peter Cook and the WEP were not involved in assessing any level of CO<sub>2</sub>. The 10% figure comes from the Santos EIS (Chapter 24 and Appendix R)

\*Further Note 1: There was no unfortunately no further discussion on the impact of the high CO<sub>2</sub> on the actual volume of clean and saleable gas which might be associated with the resource (after removal of CO<sub>2</sub>), noting that Santos does not currently carry any firm reserves for the Gunnedah Basin (NGP) gas.

The removal of NGP reserves by Santos occurred after reducing the NGP reserves by 30% (i.e. 30% of the acquired Eastern Star Gas and Gastar volumes) from its firm reserves in 2014, subsequent to a Gunnedah Basin CO<sub>2</sub> and coal seam mapping exercise it reported as having conducted in 2013-2014

Subsequently, Santos reported reclassification as lower certainty the remaining 70% of firm Gunnedah Basin reserves in its 2015 Annual Report. There was no discussion by Santos of the CO<sub>2</sub> levels on the cost of gas production.

**Table 2: Coal seam gas composition in selected wells in the Gunnedah Basin (from well completion reports).**

Well	Location	Interval	Coal Seam	Total Gas content	CH <sub>4</sub>	CO <sub>2</sub>	N <sub>2</sub>
		[m]		[m <sup>3</sup> /t]	[%]	[%]	[%]
ACM North Mullaley-1	Bando Trough- (Structural High)	463.8-467.16	HS	4.66	11.3	88.6	0
		772.97-776.79	MCF	4.09	14.4	86.5	0
		786.04-789.24	MCF	5.73	24.7	75.5	0
ACM Bando-1	Bando Trough- (Structural Low)	484.5-487.7	HS	4.4	61.7	27.6	10.2
		910.0-915.9	MCF	9.2	66.0	32.0	
		934.0-941.5	MCF	8.9	67.0	32.0	
Jacks Creek-1	Bohena Trough (Structural High)	486.7-494.4	HS	7.09	42.7	55.30	1.69
		726.55-740.43	BS	18.89	0.91	97.45	1.62
		756.17-761.06	BS	17.32	0.61	82.05	17.34
Burrawarna-1	Bohena Trough	554.10-559.65	HS	11.18	33.19	61.73	5.0
		777.25-788.40	BS	16.32	5.11	93.36	1.53

*HS-Hoskissons Seam (Late Permian); MCF-Maules Creek Formation (Early Permian); BS-Bohena Seam (Early Permian Maules Creek Formation).*

*(Source : Gurba et al, 2009, op cit)*

\*\* Further Note 2 : This analysis is shown below. The emissions that would be caused by using NSW electricity instead of NGP gas for energy are also shown; it is misleading to consider only Scope 1 (NGP site) emissions if the project also caused significant emissions at other sites producing electricity for the NGP (Scope 2).

Carbon Dioxide from Produced Gas and Power for CO <sub>2</sub> removal with 70 PJ p.a. of sales gas						
	Santos EIS CO <sub>2</sub> content (10.8%) (Table 5-3) Own Fuel	Santos EIS CO <sub>2</sub> content (10.8%) (Table 5-3) with NSW high emissions electricity used	15% average well CO <sub>2</sub> content from DGIS data	15% CO <sub>2</sub> content from DGIS data and counting external NSW power emissions	Using average well CO <sub>2</sub> content from DGIS data	Using average well CO <sub>2</sub> content from DGIS data and counting external NSW power emissions
CO <sub>2</sub> fraction of produced gas	10.8%	10.8%	15.00%	15.00%	24.50%	24.50%
Million tonnes CO <sub>2</sub> e fuel (own use)	0.470	0.080	0.512	0.122	0.605	0.215
Million tonnes CO <sub>2</sub> e fuel (grid power from NSW)	-	0.720	-	0.720	-	0.720
Million tonnes CO <sub>2</sub> e vented	0.493	0.493	0.685	0.685	1.120	1.120
Million tonnes CO <sub>2</sub> flared	0.005	0.004	0.007	0.007	0.011	0.011
<b>Million Tonnes CO<sub>2</sub>e p.a. (operations, excluding fugitive methane) (a)</b>	<b>0.968</b>	<b>1.297</b>	<b>1.204</b>	<b>1.534</b>	<b>1.736</b>	<b>2.066</b>

### Fugitive (Methane) Venting Emissions Estimation (CO<sub>2</sub>e) - 70 PJ

Applied Leakage Factor (USA EPA 2013 (Factor))	1.20%	1.20%	1.20%	1.20%	1.20%	1.20%
Tonnes fugitive methane	16,451	16,451	16,451	16,451	16,451	16,451
Methane Global Warming Potential relative to CO <sub>2</sub>	28	28	28	28	28	28
<b>Million Tonnes CO<sub>2</sub>e (Fugitive Methane) (b)</b>	<b>0.461</b>	<b>0.461</b>	<b>0.461</b>	<b>0.461</b>	<b>0.461</b>	<b>0.461</b>

### Total Project Associated Emissions Estimation (CO<sub>2</sub>e) - 70 PJ

<b>CO<sub>2</sub> Emissions (production activities) (million tonnes p.a.) [(a)+(b)]</b>	<b>1.428</b>	<b>1.757</b>	<b>1.665</b>	<b>1.995</b>	<b>2.197</b>	<b>2.527</b>
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