

Project Order

Proforma 2016

1. Short Project Title (less than 15 words)

Analysing economic and demographic trajectories in NSW regions experiencing CSG development and operations

Long Project Title Baseline assessment, analysis and projections of the economic and sociodemographic characteristics in regions with existing and emerging CSG industry in NSW

GISERA Project Number S8

Proposed Start Date 1 July 2016

Proposed End Date 30 June 2017

Project Leader David A. Fleming

2. GISERA Region

Queensland New South Wales Northern Territory

3. GISERA Research Program

Water Research GHG Research Social & Economic Research
 Biodiversity Research Agricultural Land Management Research

4. Research Leader, Title and Organisation

David A. Fleming, Research Scientist, CSIRO Land & Water
Time committed to project: 0.25 FTE

5. Project Description

The local socioeconomic impacts produced by resource development activity have been widely debated and researched in recent years. This interest has come from a lack of empirical evidence to better understand how resource activity affect income and employment in hosting regions, and the consequent socioeconomic changes likely to arise as product of this changes. Thus, locals in resource extractive regions generally wary about the potential impacts and outcomes that the expansion or contraction of resource activity can bring to regional economies. This is important as a better understanding of these issues can be linked to a social license to operate.

The socio-economic impacts of resource extraction activity can be categorized in a hierarchical order given by its occurrence after the development or expansion of extractive industries such as unconventional gas. Thus, it is possible to define primary, secondary and tertiary impacts, as shown in figure 1. However, in order to estimate impacts, it is very important to assess the initial conditions of local economies.

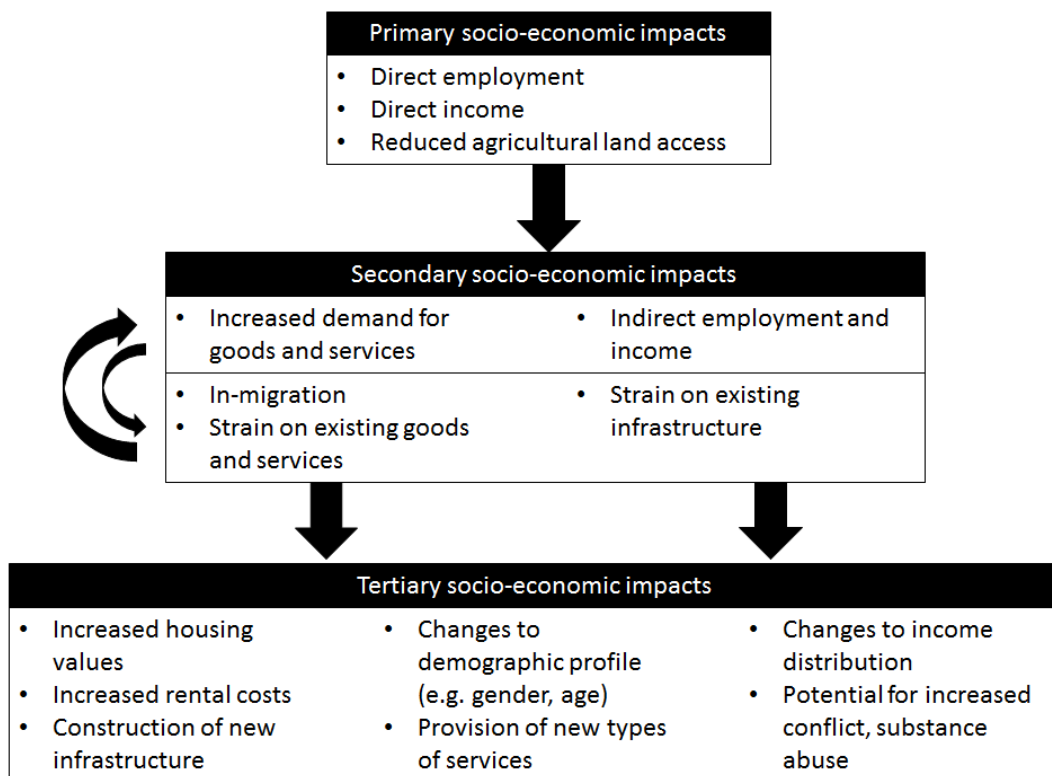


Figure 1. Primary, secondary and tertiary effects of resource development on host communities. *Reference:* Extracted from “Measham, T; Fleming, D. and Schandl, H. (2016). A conceptual model of the socioeconomic impacts of unconventional fossil fuel extraction. *Global Environmental Change* 36, pp. 101-110”.

This project provides a comprehensive baseline assessment of the economic, social and demographic levels and trajectories of NSW CSG regions and then analyses how these trajectories can be affected by the existing and emerging CSG industry by comparing them to other NSW regional areas and CSG regions in Queensland. A systematic set of economic, social and

demographic variables will be assessed to build a robust baseline of CSG regions and analyse them by comparing their trajectories to a set of non-CSG regions with similar characteristics (a counterfactual group) to be chosen using statistical techniques. The comparison of NSW CSG regions to counterfactual regions in NSW, as well as CSG regions in Queensland, will be conducted using econometric models that allow the identification of impacts coming from CSG development, from those generated by other (external and internal) factors such as drought, so it can be evaluated whether or not CSG development could affect the trajectory of economic and sociodemographic variables in NSW. Projections of potential impacts of CSG, especially given by impacts in the 'primary' and 'secondary' categories, will also be done considering three to four scenarios of CSG expansion based on external conditions such as gas price and state regulation. All the regional analyses will be conducted using available secondary data provided by industry, state and federal governments at statistical area (SA1 and SA2) and local government area (LGA) levels.

Research context

This project considers a regional economic analysis of CSG regions in NSW. Analysis of regional economies in NSW have been conducted in several occasions, which can be observed in different federal and state government documents (e.g., the Regional Development Australia 'Regional Plan 2013-16' for different areas of NSW)¹, consultancy reports and fact sheets.² However, this project for GISERA goes beyond the economic profiling of particular shires as done generally in consulting reports. This project, differently from previous work, comprehensively assesses the baseline of several development indicators across the different CSG regions in NSW and builds an economic analysis by comparing economic trajectories and projections to a set of counterfactual regions to be chosen using state of the art statistical techniques and econometric models. This project also moves beyond classical economic studies that rely on input-output (I-O) table modeling or multi-regional CGE models, to provide a more detailed analysis of a large set of development indicators that are not possible to track and analyse overtime using I-O or CGE.

In summary, the project will systematically assess a baseline of economic and demographic conditions for CSG regions in NSW and identify existing and emerging effects of CSG development in the state, along with providing projections of potential impacts of four to five different scenarios of CSG expansion into regional economic and demographic changes.

¹ The plan for the 'Northern Inland' region of NSW, which includes the Narrabri shire, can be found here:
http://www.rdani.org.au/files/pages/our-region/regional-plan/RDANI_Regional_Plan_V3_October_2013_web.pdf

² As an example, the Narrabri Shire economic profile is available at:
http://www.narrabri.nsw.gov.au/files/uploaded/file/Economic%20Development/Narrabri_Shire_Economic_Profile.pdf

6. Budget Summary

Expenditure	2015/16	2016/17	2017/18	2018/19	Total
Labour		101,167			101,167
Operating		12,000			12,000
Subcontractors					
Total Expenditure		113,167			113,167

Expenditure per Task	2015/16	2016/17	2017/18	2018/19	Total
Task 1		10,000			10,000
Task 2		30,000			30,000
Task 3		40,000			40,000
Task 4		33,167			33,167
Total Expenditure		113,167			113,167

Source of Cash	2015/16	2016/17	2017/18	2018/19	Total
Contributions					
GISERA Industry Partners (25%)		28,292			28,292
- Santos (12.5%)		14,146			14,146
- AGL (12.5%)		14,146			14,146
NSW Government (25%)		28,292			28,292
Federal Government (25%)		28,292			28,292
Total Cash Contributions		84,876			84,876

In-Kind Contribution from	2015/16	2016/17	2017/18	2018/19	Total
Partners					
CSIRO (25%)		28,291			28,291
Total In-Kind Contribution from Partners		28,291			28,291

	Total funding over all years	Percentage of Total Budget
GISERA Investment	28,292	25%
NSW Government Investment	28,292	25%
Federal Government Investment	28,292	25%
CSIRO Investment	28,291	25%
Total Other Investment		
TOTAL	113,167	

Task	Milestone Number	Milestone Description	Funded by	Start Date	Delivery Date	Fiscal Year	Fiscal Quarter	Payment \$
Task 1	1.1	Data collection and synthesis completed	GISERA	July 2016	October 2016	2016-17	1	10,000
Task 2	2.1	Report of economic and sociodemographic baseline assessment of the CSG regions	GISERA	October 2016	December 2016	2016-17	2	30,000
Task 3	3.1	Report of analysis and benchmarking of assessed variables and potential CSG impacts	GISERA	January 2017	May 2017	2016-17	3-4	40,000
Task 4	4.1	Final report and working paper detailing methods, results of analyses and projections of economic and demographic trends under four different CSG expansion scenarios	GISERA	April 2017	June 2017	2016-17	4	33,167

7. Other Researchers (include organisations)

(State time commitment to project by each Researcher listed)

Researcher	Time Commitment (project as a whole)	Principal area of expertise	Years of experience	Organisation
David A. Fleming	0.25 FTE	Applied economics	10	CSIRO
Thomas G. Measham	0.10 FTE	Geography	20	CSIRO
Research assistant	0.08 FTE	Economics/Statistics	4	CSIRO

8. Subcontractors

N.A.

9. Project Objectives and Outputs

Project Objectives

The objectives of this project can be defined as the following:

- a) To provide a comprehensive baseline of the current levels and trajectories of economic, social and demographic variables in NSW CSG regions
- b) To analyse whether or not the CSG industry could change the trajectory of economic and sociodemographic variables across regions in NSW
- c) To provide a statistically robust group of control regions (counterfactuals) of non-CSG regions that could be used in future comparison to CSG regions for impact evaluation

Output s

The main outputs of this project can be summarised as follows:

- i) A detailed report providing a comprehensive baseline assessment and analysis of economic and sociodemographic characteristics of the NSW CSG regions, compared to others, and the potential impacts of CSG on their economic functioning and sociodemographic changes
- ii) A working paper summarising the main methodological procedures and findings of the assessment and analysis of secondary data

The information to be reported in the outputs of this project will provide important evidence-based insights and empirical projections of CSG economic and demographic impacts that could be used by decision makers and stakeholders across NSW regions, as well as for researchers interested in investigate impacts with future data.

10. GISERA Objectives Addressed

To provide knowledge that enables communities in this and other regions to maximise benefits and manage costs from future resource developments, and to enhance regional economic benefit from CSG developments.

11. Project Development (1 page max.)

Debate around economic and social impacts and benefits associated with resource extractive industries in regional areas is often conducted in the absence of empirical data or based on economic models that produce poor or misleading information. Past research conducted by GISERA addressed these issues by providing empirical evidence, derived from economic models, of how key economic and social variables had changed as consequence of the CSG development in Queensland. Results of this previous research have been used by different stakeholders to support their arguments towards the development of the CSG industry in Queensland. Considering this previous GISERA research in the Queensland case, this project will expand robust empirical evidence for NSW regions experiencing CSG development. Thus, after speaking to stakeholders in NSW and consulting other social scientists at CSIRO, this proposal has been shaped with the main aim of expanding the successful economic research experience in the Queensland CSG context, to provide a robust baseline assessment and detailed analysis of different scenarios for economic and sociodemographic trends in CSG regions in NSW, compared to other regions.

As shown in Figure 2, most of the CSG development happening in NSW, to November 2015, has been concentrated in four river basins (from north to south): the Richmond, Namoi, Hunter and Hawkesbury river basins. Given its history, it will be very important to learn from the economic context of existing

CSG industry in the MacArthur region (in the Hawkesbury river basins). By contrast, most prospecting for future development in the state is likely to happen in the Namoi basin region, a very distinctive region in Australia featuring a large cotton industry that has historically shaped the economy and culture of the region. The NSW regions' exposure to CSG has been different to the Queensland experience: while in the Bowen and Surat basins in Queensland the CSG industry grew exponentially in just a couple of years (translating into the drilling of thousands of wells across regions), in NSW the development of the industry has been slower with only 639 (mainly exploratory) wells drilled, to November 2015, across the state (see Figure 2). Although the causes of these differences in CSG expansion are various (including reservoirs and state legislation), these are beyond the scope of this research project. However, similar to Queensland, the CSG industry is also likely to produce changes in the economy and demography of regional NSW. Hence, this project will provide a robust and comprehensive assessment and analysis of what is happening (especially in the Macarthur region), and what could happen in the future economy and demography of the Namoi river basin, and other NSW river basins located over CSG reservoirs, given the developing CSG industry across regions.

This research project includes a baseline assessment, comparative analysis to counterfactual non-CSG regions and projections of potential future impacts of the CSG industry on economic, social and demographic characteristics in regions of NSW. In particular, initially a comprehensive economic and demographic baseline assessment will be conducted for all regions affected by CSG in NSW, which will be contrasted to state and national trends. Secondly, after the baseline assessment is completed, the research team will create a counterfactual group in order to have a set of relevant non-CSG regions in NSW that could be directly compared to CSG regions in the state, so any potential impact of the industry can be isolated in empirical terms. In other words, a set of counterfactuals will be chosen to compare economic and demographic levels, trends and projections across regional economies, so all effects coming from CSG could be identified. To attain this, all counterfactuals will be selected based on empirical/theoretical grounds (for instance using 'propensity score matching') and econometric models developed to estimate the potential effects of CSG expansion on local economic and demographic growth after controlling for other external and internal factors such as drought and non-mining industry activity. CSG regions in Queensland will also be used to compare trends and estimate potential projections of economic and demographic variables in NSW CSG regions. All projections will be discussed using four to five possible scenarios of CSG expansion and sensitive analysis. A discussion will also be provided to explore the potential use of gas for local business and industries in the extractive and surrounding regions.

Thus, by addressing the objectives of this project (detailed in section 9), this project will provide important insights to better understand how CSG regions have changed in recent years (baseline) and how these regions could see their economic and sociodemographic trajectories affected by CSG activity, in contrast to regions not facing this industry. All projections will be discussed using four to five scenarios of CSG expansion in the state, so results could be compared and discussed. Finally the project will provide the empirical grounds for future economic and social studies of CSG activity in NSW by constructing a set of reliable counterfactuals, so changes over time could be tracked consistently across regions.

12. Project Plan

The project will analyse a comprehensive set of economic, social, and demographic variables, including:

- family income
- personal salary and wages
- income distribution

- regional domestic product
- mining and non-mining employment
- job spillovers
- firms enter/exit
- migration
- fly-in fly-out
- migration
- educational attainment
- housing
- population and age distribution
- community development/urbanization

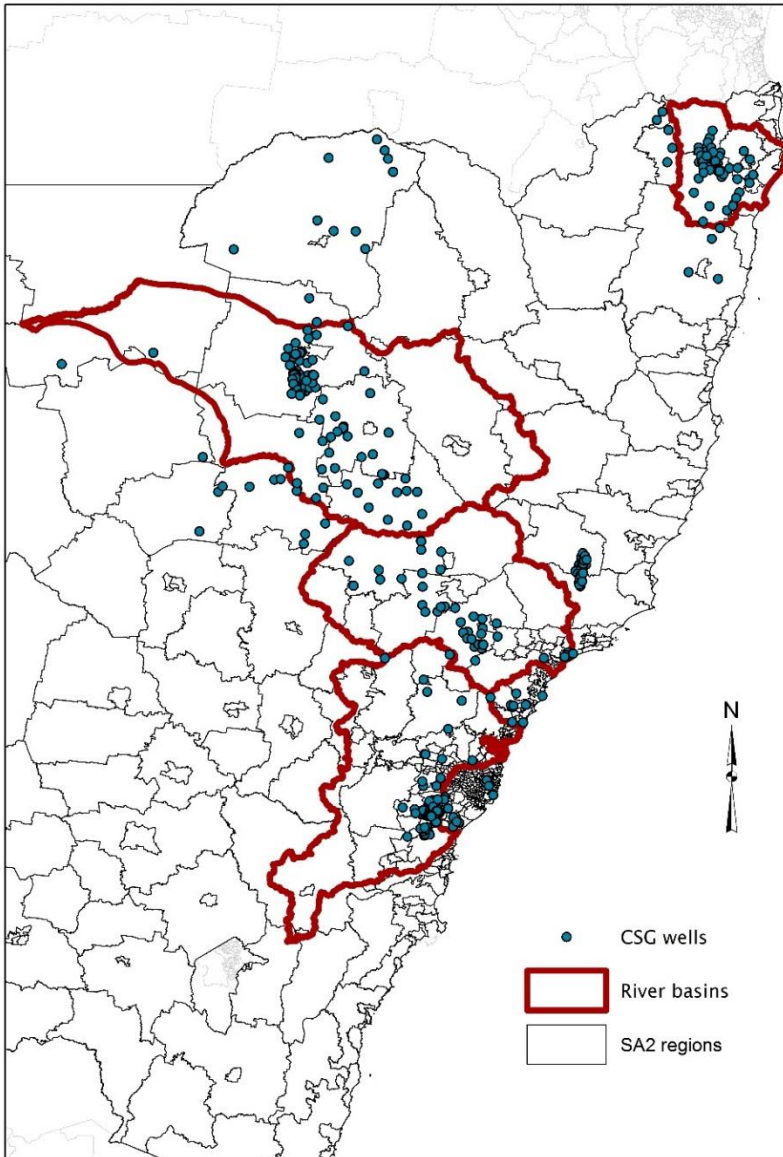


Figure 2. Northeast SA2 regions of NSW and the location of CSG wells to November 2015.
Note: The red borders show river basin regions where most of the wells drilled are concentrated.
 River basins shown (north to south): Richmond, Namoi, Hunter and Hawkesbury.
Reference: Authors' elaboration with data from NSW Division of Resources and Energy
 (available at: <http://dwh.minerals.nsw.gov.au/CI/warehouse>)

Beyond the construction of a comprehensive baseline assessment of the variables to be studied in CSG NSW regions, an empirical analysis will be conducted by comparing the variables' levels and trends to other resource and non-resource regions in NSW. These counterfactual regions will be selected based on empirical/theoretical grounds using statistical tools such as 'propensity score matching'. Once the counterfactual group is defined, a set of econometric models will be created to evaluate the trajectories of the different variables across regions and analyze whether or not CSG is causing effects on these

trajectories, as well as to obtain parameters to simulate potential future changes in the variables given four to five different scenarios of CSG expansion. Thus, by using counterfactuals and econometric models, the empirical analysis will identify CSG effects over economic and demographic changes across regions from other external and internal factors such as drought. In addition, the economic and sociodemographic trajectory of the NSW CSG regions will also be contrasted to the CSG regions in Queensland to analyze potential impacts of the CSG industry in NSW and the resilience of these regions.

Both the baseline assessment and the analysis of variables' trajectories and projections across CSG and non-CSG regions in NSW (and Queensland) will be conducted using secondary data at SA1, SA2 and LGA levels.

In particular, the planning of this project has been subdivided into four main tasks, which are scheduled and described in the following.

12.1 Project Schedule

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Collection and synthesis of data	David Fleming	July 2016	October 2016	N.A.
Task 2	Baseline assessment	Tom Measham	October 2016	December 2016	Task 1
Task 3	Analysis of trajectories and projections	David Fleming	January 2017	May 2017	Task 2
Task 4	Final report and dissemination of findings through GISERA Communications and Engagement Strategy	David Fleming	April 2017	June 2017	Tasks 2 and task 3

Task 1

TASK NAME: Collection and synthesis of data

TASK LEADER: David Fleming

OVERALL TIMEFRAME: 3 months

BACKGROUND: In order to provide a comprehensive baseline assessment and analysis of economic and sociodemographic variables across regions, the study will collect and map data at SA1, SA2 and LGA levels. The main reason to capture data at three different levels of aggregation is the lack of consistent time series across cases (for instance SA1 Census data is only available for 2011, while SA2 Census data is available for 2001, 2006 and 2011). Therefore, data at different levels of aggregation will need to be considered to consistently assess and analyse particular variables across regions and over time.

TASK OBJECTIVE: To collect and map data at different levels of aggregation in order to prepare time series for further baseline assessments and analyses (including the creation of counterfactuals).

TASK OUTPUTS: Data collection and synthesis completed.

SPECIFIC DELIVERABLES: Dataset and maps.

Task 2

TASK NAME: Baseline assessment

TASK LEADER: Tom Measham

OVERALL TIMEFRAME: 3 months

BACKGROUND: Before the economic comparative analysis and projections can be conducted, it is important to fully assess the baseline levels and trajectories of key variables across regions. This task will ensure that all variables to be studied are comprehensively assessed and portrayed for all CSG regions in NSW and compared to state and national figures.

TASK OBJECTIVE: To provide a comprehensive baseline of the current levels and trajectories of economic, social and demographic variables in CSG NSW regions.

TASK OUTPUTS: Economic and sociodemographic baseline assessment of the CSG regions.

SPECIFIC DELIVERABLES: Report of economic and sociodemographic baseline assessment of the CSG regions.

The report to deliver in this task will serve as interim project progress report, so besides the indications of socioeconomic indicators across regions it will also include a detailed commentary on the methods being used and to be implemented in task 3.

Task 3

TASK NAME: Analysis of trajectories and projections

TASK LEADER: David Fleming

OVERALL TIMEFRAME: 5 months

BACKGROUND: After the construction of the baseline for the variables to be studied in NSW CSG regions, it is important to perform a sound empirical analysis of what is happening and what could happen in CSG regions. Thus, a robust statistical and econometric analysis will consider whether or not the CSG industry could affect the trajectory of economic and demographic variables in future years and set the empirical grounds, based on the creation of a counterfactual group, to future research and impact evaluation of CSG development across regions. The potential use of gas in local business and industries will also be explored.

TASK OBJECTIVE: To analyse whether or not the CSG industry in NSW could affect the trajectory of economic and sociodemographic variables across regions and to provide insights into potential projections of future benefits and impacts considering four to five scenarios of CSG expansion in the region.

TASK OUTPUTS: Analysis of assessed variables and projections of potential CSG impacts.

SPECIFIC DELIVERABLES: Report of analysis and projections of economic and demographic variables given four to five different scenarios of CSG activity.

Task 4

TASK NAME: Final report and dissemination of findings through GISERA Communications and Engagement Strategy

TASK LEADER: David Fleming

OVERALL TIMEFRAME: 3 months

BACKGROUND: The project will disseminate findings to stakeholders in the region in order to share the information and insights with people related to the potential CSG development in NSW. It will also address wider audiences in academic outlets (national and internationally relevant conferences) and public audiences (popular press).

TASK OBJECTIVE: Present baseline results and methods to GISERA stakeholders and scientific audiences through workshops and conferences.

TASK OUTPUTS: Report and working paper detailing methods for calculating future benefits and impacts. Factsheet summarising main findings and implications for regional development.

SPECIFIC DELIVERABLES: Final report and working paper detailing methods for calculating future benefits and impacts, and factsheet.

13. Communications Plan

The project will establish a Technical Advisory Committee (TAC) aimed at seeking advice on contextual matters and to discuss research needs as well as outputs as the project progresses. The TAC will include the project leader and a group of different stakeholders, as appropriate.

The TAC will meet quarterly starting in term of the research project inception to discuss: (i) the progress of the approved research; (ii) any significant difficulties encountered during the research process; and (iii) key findings and potential future applications for the research results. These gatherings will be held in person, telecommunication, or via consultation by formal emails.

Following the advice of the TAC, the project team will communicate directly to groups of people that would have direct interest in the research, such as federal and state government officials, community representatives, NGOs, land holders and similar. All research formal communications will be first sent to GISERA communications for assessment and advice.

The following stakeholder groups will be contacted at a minimum:

Government and policy:

Department of Agriculture (Australian Government)

Department of Industry and Science (Australian Government)

Rural Industries Research & Development Corporation (Australian Government)

NSW Trade & Investment

Narrabri Shire Council

Business associations:

- Cotton Growers Association
- Lower Namoi Cotton Growers Association
- National Farmers' Federation
- Minerals Council of Australia
- Australian Petroleum Production and Exploration Association
- NSW Farmers
- Narrabri Chamber of Commerce
- Local Aboriginal Land Council

14. Intellectual Property and Confidentiality

Background IP (clause 11.1, 11.2)	Party	Description of Background IP	Restrictions on use (if any)	Value
				\$
				\$
Ownership of Non-Derivative IP (clause 12.3)	CSIRO			
Confidentiality of Project Results (clause 15.6)	Project results are not confidential.			
Additional Commercialisation requirements (clause 13.1)	Not Applicable			
Distribution of Commercialisation Income (clause 13.4)	Not applicable			
Commercialisation Interest (clause 1.1)	Party		Commercialisation Interest	
	Santos		NA	
	AGL		NA	
	CSIRO		NA	

15. Approval from Project Parties

In signing this document you are committing your organisation to provide the specified funds, personnel and the required in-kind contributions.

Santos Limited

SIGNED for and on behalf of Santos Limited,

by

.....
Signature of delegate

.....
Name of delegate

in the presence of

.....
Signature of witness

.....
Name of witness

.....
Date

AGL Energy Limited

SIGNED for and on behalf of AGL Energy Limited,

by

.....
Signature of delegate

.....
Name of delegate

in the presence of

.....
Signature of witness

.....
Name of witness

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Date

CSIRO

SIGNED for and on behalf of CSIRO

by

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Signature of delegate

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Name of delegate

in the presence of

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Signature of witness

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Name of witness

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Date