



Australia's National  
Science Agency

**GISERA** | Gas Industry Social and Environmental Research Alliance

# Progress report

Offsets for Life Cycle Greenhouse Gas Emissions of Onshore  
Gas in the Northern Territory



Australian Government  
Department of Industry, Science,  
Energy and Resources



Supported by  
Government of  
South Australia



# Progress against project milestones

Progress against milestones/tasks are approved by the GISERA Director, acting with authority in accordance with the GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic light reports and descriptive Project schedule reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:

- **Green:**

- Milestone fully met according to schedule.
- Project is expected to continue to deliver according to plan.
- Milestone payment is approved.

- **Amber:**

- Milestone largely met according to schedule.
- Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
- Milestone payment is withheld.
- Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.

- **Red:**

- Milestone not met according to schedule.
- Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
- Milestone payment is withheld.
- Project review initiated by GISERA Director.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

## Project schedule table

| TASK NUMBER | TASK DESCRIPTION  | SCHEDULED START | SCHEDULED FINISH | COMMENT   |
|-------------|---|-----------------|------------------|-----------|
| 1.1         | Review of reports and literature and consultation with stakeholders | 13/07/2020      | 31/08/2020       | Completed |
| 1.2         | Define physical and conceptual scope and report                     | 13/07/2020      | 31/08/2020       | Completed |
| 2           | Develop production scenarios  | 14/08/2020      | 30/09/2020       | Completed |
| 3           | LCA of production scenarios   | 01/10/2020      | 01/05/2021       | Completed |
| 4           | Identify, quantify offset options                                   | 05/01/2021      | 31/08/2021       | Completed |
| 5           | Synthesize Production Scenarios and Offsets                         | 05/01/2021      | 31/08/2021       | Completed |
| 6           | Report writing, review, Final Report                                | 01/07/2021      | 10/12/2021       | Completed |

## Project schedule report

### TASK 1.1: Review of reports and literature and consultation with stakeholders

#### BACKGROUND

It is important to consult with government, industry and other stakeholders to obtain perspective and understand the material issues of the onshore gas proposal in the Northern Territory. There will also be a review of the recent (last 5 years) peer-reviewed literature regarding onshore gas and GHG emissions.

#### TASK OBJECTIVES

A knowledge base from peer-reviewed literature, expert submissions and industry to inform the scoping of the project and development of production scenarios

#### TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Series of workshops or online meetings with stakeholders and a literature review.

#### PROGRESS REPORT

This milestone is 100% complete.

A literature review has been completed and forms the Background section to the scoping report. Desktop review completed of: carbon capture and storage (CCS) experience, globally; current practice in Australia and; identified maps of suitable storage basins close to potential NT onshore gas extraction.

Material is also available through shared files and notes on the project MS Teams site set up expressly for interactions and sharing information.

We have reviewed submissions to the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory (2018), specifically from: Origin Ltd.; Santos Ltd; Pangaea Resources Pty Ltd; Geoscience Australia; The Australia Institute; and Climate Council.

An initial consultation with senior officers from the Northern Territory Government (NTG) on the 31st July 2020 led to contact information for the Northern Land Council and high-level representatives of other Land Council, and the Indigenous Carbon Industry Network (ICIN). Before we could contact these and other stakeholders (especially Indigenous stakeholders), the project was required to obtain ethics clearance – this was obtained on 28th August 2020 (see also Task 1.2).

Among the stakeholders and experts consulted for this Task were representatives from:

- Senior Officers from NT Government
- Indigenous Carbon Industry Network
- Tiwi Land Council
- Northern Land Council
- Fenner School of Environment and Society, ANU
- Origin Energy Ltd
- Chair in Chemical Engineering at the University of Texas and author of a series of resources on best practice for onshore shale gas (<https://methaneguidingprinciples.org/>)
- Watson Institute for International & Public Affairs, Brown University, Providence, Rhode Island.
- CSIRO Hydrogen Mission
- CSIRO – land-based carbon sequestration
- CSIRO and Science Director National Geosequestration Laboratory
- CSIRO Land and Water principal economist – advice on offset markets

Further consultations are planned as the scoping of the project (see Task 1.2) is ongoing although there is enough technical definition to commence discussions (and sub-contracting) on Task 2 and 3.

## **TASK 1.2: Define physical and conceptual scope and report**

### **BACKGROUND**

This task includes scoping of the scale and duration of upstream and downstream activity and likely logistics regarding the particular geology and geography of the NT onshore gas project.

### **TASK OBJECTIVES**

Having consensus on the bounds of the project distributes ownership of the scope (and implications) beyond the research team to include multiple stakeholders

## TASK OUTPUTS AND SPECIFIC DELIVERABLES

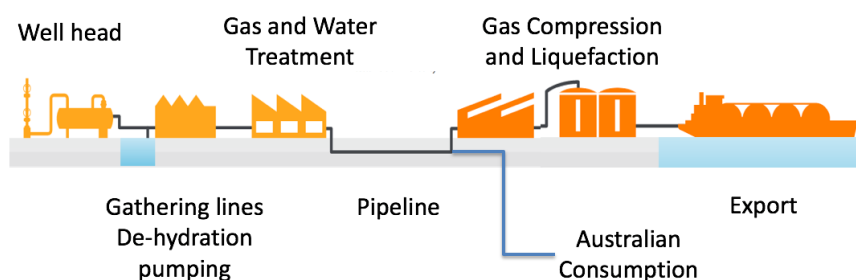
A scoping report outlining agreed terms of reference and parameters of the study in the context of local and international knowledge on GHG emissions from onshore gas.

## PROGRESS REPORT

This milestone is 100% complete.

- Scope defined
- Report draft circulated
- Verbal agreement on scope of LCA

The scope of the research has been defined: including the upstream extraction of dry gas and any processing; the downstream compression and liquefaction stages; other stages leading up to export; and shipping. Explicitly excluded are the stages of re-gasification, distribution and consumption overseas – see figure below. The duration of the gas development has been set at 25-30 years.



A draft scoping report has been circulated to some stakeholders and, responding to the initial delays of the project, the scenarios of scale of gas production (Task 3) are being discussed concurrently. We are awaiting feedback from industry.

The outcome we are seeking in these two early milestones are awareness and consensus on: the purpose of the project; terms of reference and any priority research questions for stakeholders. We have contacted ICIN and NLC and are sharing the draft Scoping Report. This is necessarily not the final scoping report as it awaits feedback from these stakeholders in an intentionally iterative process.

This part of the project is intended to be finalised well before a proposed 1st TRG meeting on the 21st October 2020. Since the commencement of the project one member of the NT Senior Officers group and one member of the TRG have discontinued participation. We are actively seeking to backfill these positions, and this includes seeking expert advice on shale gas from academics in North America.

## TASK 2: Develop production scenarios

### BACKGROUND

Working with industry, government and using the knowledge base of Task 1.1, these production scenarios are the main input assumptions that set the scope and scale of GHG emissions

## TASK OBJECTIVES

Credible production scenarios that represent the specific conditions of the Beetaloo Sub-basin and industry commitments to mitigation practices over the life time of the hypothetical development

## TASK OUTPUTS AND SPECIFIC DELIVERABLES

A dataset of technical scenarios that quantify levels of production from the Beetaloo Sub-basin, and any mitigation actions or practices that industry can reasonably commit to.

## PROGRESS REPORT

We have talked to industry about an initial appraisal of scale and features of gas development in the Beetaloo Basin. Subsequent to the Scoping Report, and the background information it contains, we proceeded with a set of indicative development scenarios formulated around assumptions available in earlier work by ACIL Allen <https://frackinginquiry.nt.gov.au/inquiry-reports?a=456790>. These were also the scenarios used in the Scientific Inquiry into Fracking in the Northern Territory (2018).

A core group of Northern Territory Government Senior Officers were invited to review these production scenarios and we also contacted Aboriginal and Torres Strait Islander Land Councils that manage land-based offsets in Northern Australia, and the Indigenous Carbon Industry Network. On 24th November 2020, all stakeholders had the opportunity to review the scoping and provide feedback on all details including the production scenarios in a face-to-face roundtable held in Darwin. Further review was obtained from: the NT Department of Business Trade and Innovation; the project Technical Reference Group and; CSIRO Colleagues in Bio-regional Assessment <https://www.bioregionalassessments.gov.au/assessments/geological-and-bioregional-assessment-program/beetaloo-gba-region>. From CSIRO's Bio-regional Assessment we will also make use of common assumptions about the well pad land use/ servicing needs of infrastructure.

The consensus of industry, government and CSIRO researchers was that the "Gale Scenario" defined in the ACIL Allen submission with ~645 wells and 365PJ/year be chosen as the Baseline (minimum) scenario in this project. We will explore a few scenarios that diverge from that possibly up to 4,000 TJ/day but the main outcome of those will likely be the increase in emissions, and subsequently offsets, for LNG production for export. That is, we would be expecting < 200PJ/year domestic consumption in almost every production scenario. Otherwise, the cost of offsetting Australian emissions from consumption of NT gas would be prohibitive.

We understand there is potential for industrial chemical consumption of shale gas methane in the plans for industrial development in Darwin's Middle Arm. This suggests accompanying consumption scenarios for the non-combustion consumption of methane and/or industrial use coupled with geological CCS in the Petrel Basin. This was also raised as a genuine interest by industry attending the roundtable.

We have commenced Task 3 with the acknowledgement that there may be some variation to the scenarios if more information, or more reviews of our scope and assumptions come to hand.

## **TASK 3: LCA of production scenarios**

### **BACKGROUND**

This task is the key link between the production scenarios developed in Task 2 and the objective of surveying potential GHG offset options in Task 4

### **TASK OBJECTIVES**

Adding to and updating data on life cycle assessment of GHG emissions from onshore gas production scenarios cognisant of potential mitigation actions by industry

### **TASK OUTPUTS AND SPECIFIC DELIVERABLES**

Report and data detailing the life cycle GHG emissions of production scenarios from Beetaloo Sub-basin.

### **PROGRESS REPORT**

This milestone is 100% complete.

- An LCA model was constructed, and a draft technical report was circulated by LifeCycles for review of assumptions by industry and the project team. Further feedback was sought on the core assumptions from the Technical Reference Group and the final deliverable incorporates that feedback.
- Although this task was delayed more than a month it was critical to have input assumptions that can be used consistently across the project and ones that will withstand a critical appraisal of the work.
- The LCA report is finished. To adhere to the ISO standards for Life Cycle Assessment, 3 independent reviewers are needed to review the work for sufficiency in scope, rigour and data transparency. As the delivery of the report (not its review) is the remaining milestone in the contract with LifeCycles, the final payment may be processed. We do not expect substantial revision to the main assumptions, modelling and results.
- The LCA modelling and analysis is now complete and the technical output feeds directly into Task 5 while we await any further refinements from the review process

## TASK 4: Identify, quantify offset options

### BACKGROUND

Key to the credibility of responding to the environmental impacts of gas development and Recommendation 9.8 from the Scientific Inquiry.

### TASK OBJECTIVES

GHG Offset options, including indigenous fire management, will be developed and assessed based on technical feasibility considering: maturity of technology; demonstrated effectiveness; application at scale; continuity over lifetime of onshore gas project; quality of governance and; indicative cost.

### TASK OUTPUTS AND SPECIFIC DELIVERABLES

A quantitative and qualitative appraisal of offset options available to the production scenarios of Task 2 that can effectively accommodate the GHG emissions impact identified in Task 3.

### PROGRESS REPORT

This milestone is 100% complete.

Due to availability of staff, the land-based offset component of this analysis has been conducted after the start of the financial year 2021/22.

The assessment of *physically* available land-based offsets is based on a comprehensive review of by a senior CSIRO representative. This already provides a great deal of the analysis envisaged for this task, and we have spoken to the senior CSIRO representative about using his data. The assessment emphasised that what is physically available is moderated by socio-economic and environmental considerations e.g. that more carbon farming could provide additional offsets, but this might compromise e.g. food production or ecological values. This sort of trade-off is exactly the question posed to CSIRO's Land Use Trade Off Model. We have contacted a LUTO specialist to investigate if there is a contemporary analysis that we can use.

The results of this task merge with Task 5, to synthesise the information with other literature and data, and to understand the existing and future market saturation of land-based offsets.

Essentially, we have a picture of what is physically possible, but the question of what Australian land-based offsets would *actually* be available is yet to be resolved.

This is concurrently being written up as part of Task 6

Regarding carbon capture and storage – see report on Task 5 as this is synthesized with scenarios of hydrogen production.



## **TASK 5: Synthesize Production Scenarios and Offsets**

### **BACKGROUND**

This penultimate task matches the production scenarios with feasible carbon offsets and it is anticipated that in that matching exercise there may be some need for iteration between the tasks – hence this Task overlaps with its predecessors: Task 3 and 4.

### **TASK OBJECTIVES**

A techno-economic pathway to resolving the concurrent strategic aspirations of developing gas from the Beetaloo Sub-basin and neutralizing GHG emissions impacts through improved industry practices

### **TASK OUTPUTS AND SPECIFIC DELIVERABLES**

A dataset combining the input assumptions of the production scenarios with the life cycle GHG impacts and the emissions offset options. Presentation of interim results to stakeholders in webinars or in person.

### **PROGRESS REPORT**

This task is complete and will be incorporated into the writing and internal review process of Task 6.

The land-based offsets analysis is complete. We understand from the initial interactions and information gathered that the quantity of emissions from the LCA would not be matched even with the physically possible Australian land-based offsets. Thus, we have included mitigation of emissions in production, non-combustion end-uses of natural gas, hydrogen production with carbon capture and storage and other forms of offsetting emissions.

Scenarios have been developed for these elements and the emissions effects have been calculated in the LCA. Literature, industry, and scientific reports have been reviewed, and we have spoken with industry proponents of CCS about the likely location, capacity, and connection with our scenarios of non-combustion gas products in the NT.

We have presented interim results to the NT Government and other stakeholders in an online seminar and separately presented the same results to the Technical Reference Group, useful feedback was provided which is part of the iterative process of refining this work.

## TASK 6: Report writing, review, Final Report

### BACKGROUND

Subsequent to the presentation of initial results in Task 5 and stakeholders' responses, this Task combines the output from different components of the project to a coherent final report. This task also includes preparation of a scientific paper for an international journal.

### TASK OBJECTIVES

Communication of results and conclusions to immediate stakeholders, peers and the wider community

### TASK OUTPUTS AND SPECIFIC DELIVERABLES

Draft report for internal peer-review and stakeholders. In view of the likely public interest in this work the Final Report will be accompanied by knowledge transfer sessions and factsheets. Preparation of scientific manuscript to international journal.

### PROGRESS REPORT

This task is complete.




The final report "Mitigation and Offsets of Australian Life Cycle Greenhouse Gas Emissions of Onshore Shale Gas in the Northern Territory" is now publicly available via this [link](#).


## Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority, in accordance with the [GISERA Alliance Agreement](#). Any variations above the GISERA Director's delegation require the approval of the relevant GISERA Research Advisory Committee.

The table below details variations to research Project Order.

Register of changes to Research Project Order

| DATE       | ISSUE  | ACTION  | AUTHORISATION   |
|------------|--|---|---|
| 11/06/2021 | Delays incurred as the analysis required feedback and checking   | Milestone 3 extended from 1 Feb to 1 May 2021       |  |
| 11/06/2021 | Consequential delays from earlier task   | Milestone 4 extended from 31 March to 31 May        |  |
| 16/07/2021 | Due to availability of staff, the land-based offset component of the analysis required for task 4, will be | Milestone 4 extended from 31 May to end August 2021 |  |

|                   |   |   |   |
|-------------------|---|---|---|
|                   | conducted after the start of the financial year 2021/22 |   |   |
| <b>16/07/2021</b> | Delay in task 4 therefore impacts task 5.               | Milestone 5 extended from end June to end August 2021 |  |

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GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.