The CarbonNet Project

Overview and Update

June 2017

IEAGHG Monitoring Research Network Meeting, Traverse City
CARBON CAPTURE AND OFFSHORE STORAGE

- Potential Source of CO₂
- Secondary Seal
- Primary Containment Seal
- Monitoring
- Injection Well Head
- Stored CO₂

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MONITORING IN THE OFFSHORE/NEARSHORE THE CARBONNET EXPERIENCE

• Commercial projects rely on proven technology
  Technology must be proven and cost-effective to be of value

• 3D seismic offshore
  The “Gold Standard” e.g. Sleipner.

• Targeted Well Monitoring
  Full instrumentation of the injection/monitor well cluster (offshore) and an onshore sentinel – water well (eg CO2CRC Otway Stage 3)

• AZMI
  Checking pressure across seals

• Research programme (GipNet)
  Investigating whether other technologies might work in this complex nearshore zone
CCS IN AUSTRALIA

Australia is “bigger than Texas”

GORGON LNG PROJECT (WA)

• Liquefied Natural Gas project currently being commissioned;
• 3.4 - 4 million tonnes per annum of CO₂ injected and stored in a deep saline formation;
• The world’s largest dedicated geological storage.

CO2CRC OTWAY DEMONSTRATION PROJECT

• The world’s largest carbon capture and storage demonstration project with over 80,000 tonnes of CO₂ injected and stored in a variety of geological formations;
• The most comprehensive, internationally renowned, monitoring program that tests advanced technologies and techniques with the aim of reducing cost.
THE CARBONNET PROJECT

- Investigating the feasibility for a commercial-scale, multi-user CCS network in Gippsland, Victoria, Australia
- Jointly funded by the Australian and Victorian Governments to 2020, also supported by GCCSI
- Governments have made significant research investment to support CarbonNet
- CO2CRC is CarbonNet’s lead research organisation
- Working collaboratively with industry to secure customers and investors in a CCS service
A GATED APPROACH

We are here

Risks and uncertainty decreases as project progresses

Funding Commitments increase as project certainty increases

Concept

Feasibility

Project Development

Procurement

Financing

Construction

Commissioning

High

Risk & Uncertainty

Low

We are here

Time

Funding Committed

100%

10%

10%
COMMERCIAL VIABILITY

- CCS is not a homogenous product
- The costs are directly related to source industry users
STORAGE CERTAINTY - A MAJOR FOCUS

- Two-stage process
  - regional
  - site specific
- Technical and non-technical assessment - criteria developed to identify prioritised storage sites
- Independent Scientific Peer Reviews
- Independent assurance certification by Det Norske Veritas:
  - Statement of Feasibility
  - Certificate of Verification
There are three subsurface requirements for commercial success:

- Injectivity
- Injectivity
- Injectivity

High-porosity offshore reservoirs are also easy to monitor with 3D seismic.

High-porosity open aquifers avoid long-term pressure problems.
CARBONNET PORTFOLIO

Diverse Portfolio
Structural and Aquifer traps
Multiple topseal options
Depleted and Greenfield
State and Commonwealth
50-500 MT Capacity
The reference corridor is coloured yellow and the grey routes are alternative options.

The reference corridor avoids important cultural and topographic elements.
Two existing wells + 2D and 3D seismic data define the structure

Site Screening
Existing Wells and seismic
Multiple topseal options
Greenfield
State and Commonwealth
Capacity (SPE definition)
1C: 125 MT
2C: 250 MT
3C: 500 MT
Advance to 1P/2P/3P with Declaration of Storage & Injection Licence

The Storage Complex is a catchment area and containment volume for buoyant CO2

Eastern Downdip limit wide enough to include plume in east flank injection scenario
MODELLING OF INJECTION SCENARIOS

25 Years

300 Years

1000 Years
MODELLING FOR UNCERTAINTY AND SENSITIVITY

We have modelled the probability distributions for potential plume paths.

Conclusion:

We know enough for the next regulatory approval step-

Declaration of Identified Storage Formation

When combined with DNV’s certification this would represent a **bankable asset in resource development terms.**
CarbonNet is planning to conduct the 3D marine seismic survey in Bass Strait during the summer of 2017-18. This will be the baseline for future timelapse 4D Covers plume P90 to 1000 years

Survey indicative parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Vessel size</td>
<td>4,000 – 7,000 tonnes</td>
</tr>
<tr>
<td>Number of streamers</td>
<td>Up to 6</td>
</tr>
<tr>
<td>Streamer length</td>
<td>4 km</td>
</tr>
<tr>
<td>Survey area</td>
<td>166 km²</td>
</tr>
<tr>
<td>Duration</td>
<td>Up to 15 days</td>
</tr>
</tbody>
</table>
3D MARINE SEISMIC SURVEY - LOCATION

LEGEND
- Oil and Gas facility
- Seismic Survey Acquisition Area
- Seismic Survey Operational Area
- CarbonNet Greenhouse Gas Assessment Permits
- 3 Nautical Mile Limit

This map shows the expected recording and operational area of the seismic vessel during normal operations, including turn areas. Support vessels will operate both inside and outside this area.

Proposed CarbonNet
3D Marine Seismic Survey
CarbonNet Project

Economic Development,
Jobs, Transport
and Resources.
Stakeholder engagement is a fundamental requirement to inform the Environment Plan (EP) to be submitted to regulators for approval:

– Commercial fishing industry
– Oil and gas industry
– Local councils
– Local groups

CarbonNet also undertaking environmental impact assessments: field observations and modelling
Stakeholder engagement will be ongoing throughout the planning and operation of the activity:

- Fact sheet/notification
- Collate and assess
- Response to stakeholders
- Submit EP
- Ongoing consultation and operation notifications

**Timeline:**
- Seismic Survey window: June 2017
- Seismic Survey window: Summer 2017-18
PUBLIC PERCEPTION

• Public perception critical
  - Understanding local issues and interests

• Access to information
  – Fact sheets
  – Website and e-newsletter
  – Presentations

• GCCSI / CarbonNet partnership:
  - Publication of 9 Knowledge Share Reports
  - Technical Papers in peer reviewed journals

• CO2CRC / CSIRO / UoM partnership:
  - GipNet environmental baseline validation
  - Building community confidence in CCS
Commonwealth Education Investment Fund

- secured by CO2CRC as CarbonNet’s lead research organisation
- approx $6M for GipNet research assets
- co investment (assets and research) by proponents.
  - CSIRO
  - University of Melbourne
  - ANLEC R&D (ACALET & Commonwealth)
- technologies to be validated at CarbonNet’s offshore storage sites
- important to build community awareness and regulatory confidence
- knowledge share report available on GCCSI website
Microseismic

• validate monitoring protocols in ‘noisy’ nearshore environment

Marine MMV

• builds on precursor ANLEC scoping study (7-0314-0230)
• Validate monitoring methods in shallow waters, including autonomous vehicles

Atmospheric MMV

• Applies proven open path technology but across the onshore and offshore environment over longer distances
GIPNET TIMELINE

2016

GipNet Coordination – CO2CRC

CSIRO

Sea Bed Processes CN2015-02 Part 1 Desktop

2017

Sea Bed Processes CN2015-02 Part 2 In Field (Gipp)

Marine MMV Stage 2 Sea Trials (Tas)

Marine MMV Stage 3 (Bass Strait)

UoM

Atmospheric Local Area Network Onshore (Woll)

Deploy Atmospheric On/Offshore (Gipp)

Analysis

CarbonNet Baseline MMV Commences

2018

Seismic Stage 1 Deploy Onshore & Island based Local Area Network (Gipp)

Seismic Stage 2 Deploy Offshore OBS (Gipp)

Analysis

2019

2020
Feasibility Stage key outcomes (2012-2016):

- Secure full access to portfolio of prioritised storage sites
- Prepare Application for Declaration for prioritised storage site
- Finalise a business case for next stage outlining:
  - a vision of what a CCS network in Gippsland and its estimated costs
  - what is the level of commitment from industry
  - what next steps government should take

Project Development Stage (2017-2020):

- **Storage Site Appraisal** and GipNet environmental baseline validation
- Progressing industry collaboration – investment facilitation activities
- Transitioning CarbonNet to the private sector around 2020
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