



Australian Government
Geoscience Australia

Latest developments in CCS in Australia

Rick Causebrook
Geoscience Australia

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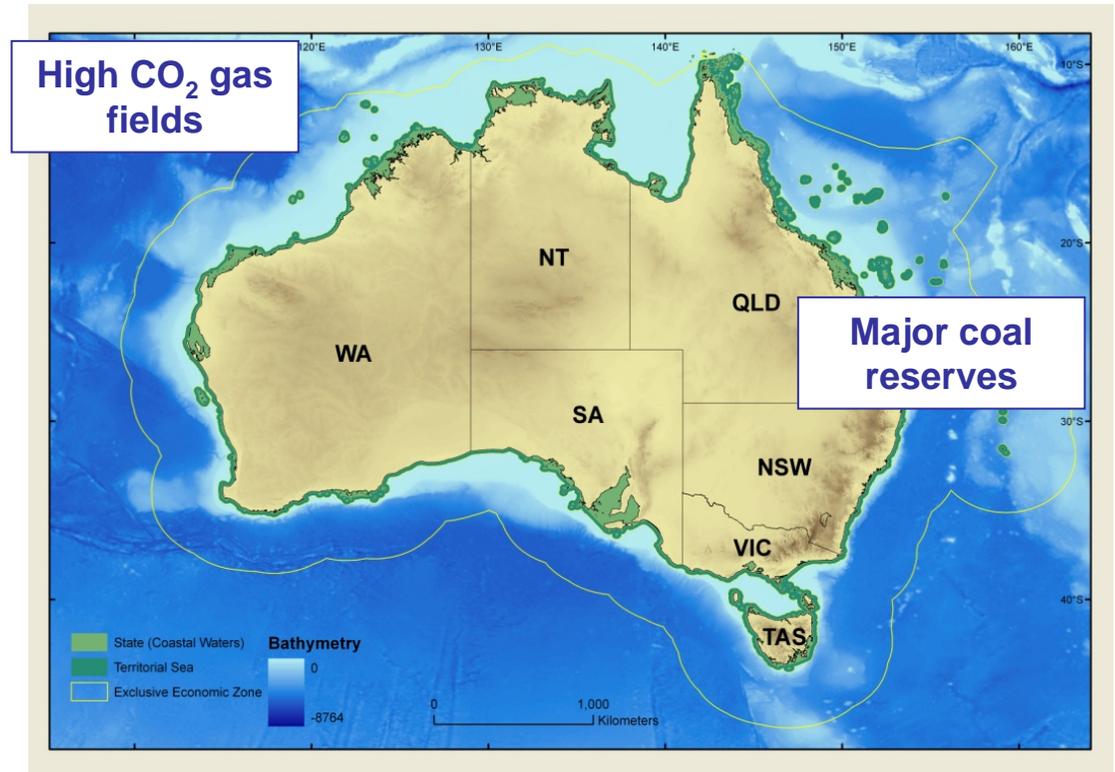
China Australia Geological Storage of CO₂

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The drivers for CCS in Australia

- Australian Government commitment to reducing GHG emissions to atmosphere
- Australian coal reserves on the east coast-
- Australia's leading export worth A\$ 55 billion in 2009
- High CO₂ gas fields on the North West Shelf
- Australia's high per capita emissions



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Government Initiatives To Support CCS

- The Australian Government has introduced a number of initiatives over a number of years to encourage CCS. These include:
 - AU to \$2b flagship projects fund
 - Carbon Storage Task Force
 - National CCS Council
 - Data acquisition program
 - State Government Initiatives



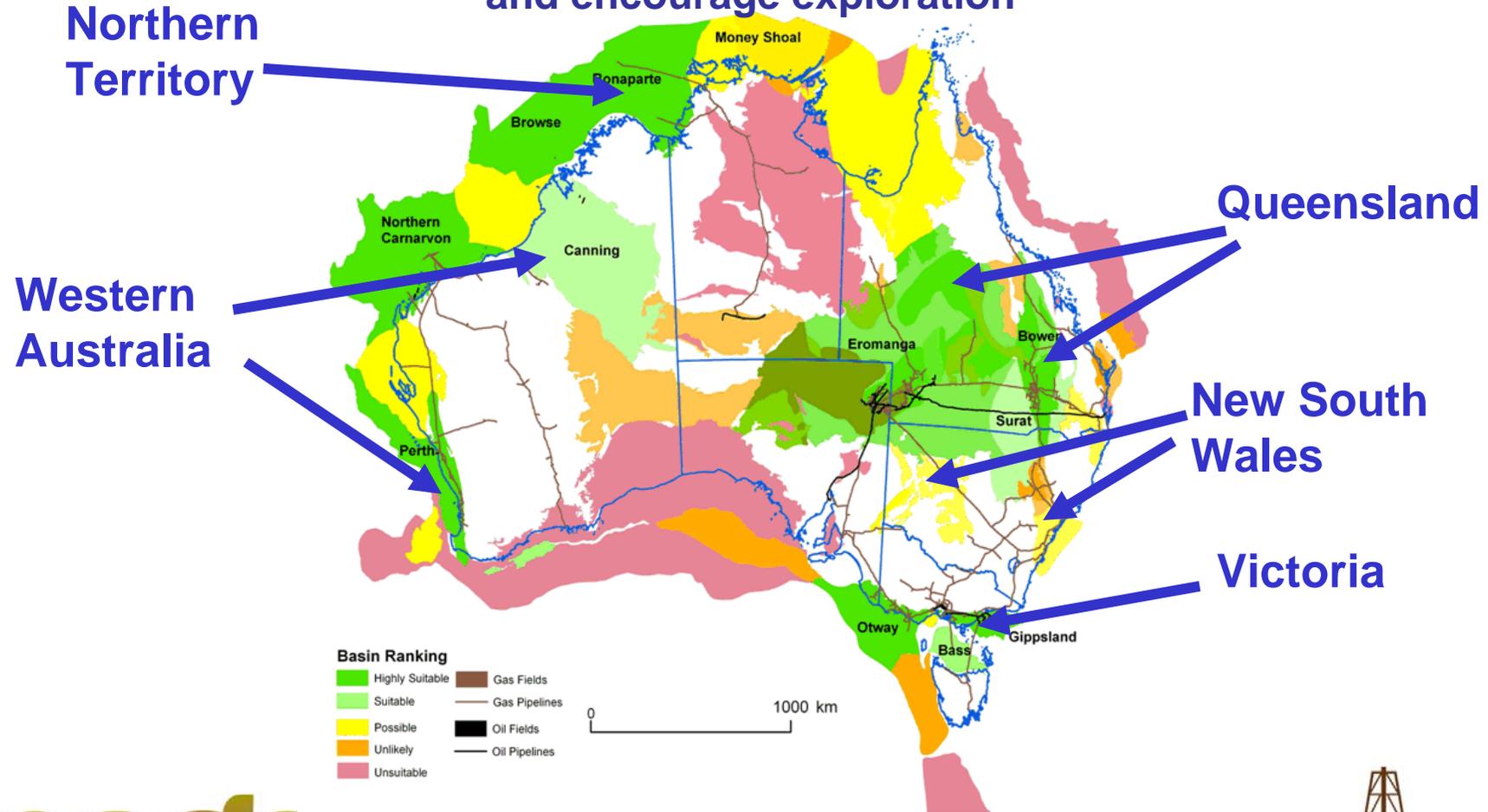
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Government Data Acquisition Programmes

Joint State and Federal Government geological exploration programmes to improve understanding of nation's storage potential and encourage exploration



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CCUS and CCS in Australia

- Australia currently has no CCUS programmes.
- Some commercial production of CO₂ from natural sources.
- Most major Australian oil provinces not suitable for CO₂ EOR.
- Some potential for some future CO₂ EOR in the Cooper Basin in Central Australia.
- CO₂ removed from natural gas streams is currently vented.



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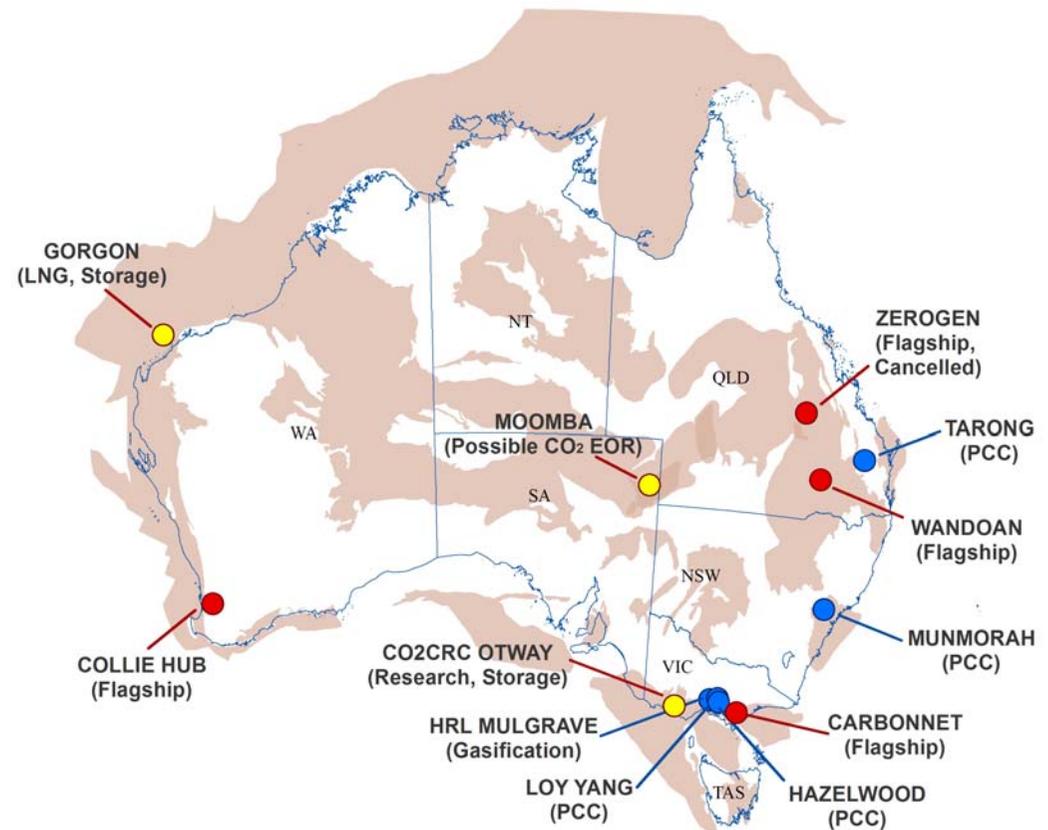


CCS in Australia

- Six experimental /demonstration capture projects underway.
- One demonstration storage programme in progress (OBPP).
- One major LNG / CO₂ storage project under construction (Gorgon).

➤ Three integrated capture / storage projects in planning or early exploration stages under joint Industry/Government funded projects.

➤ One advanced exploration stage project cancelled due to difficulties in establishing storage capacity in chosen location (ZeroGen).



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Storage Research Project- the CO2CRC Otway Basin Test

- A major project involving research teams from Australia and overseas and both industry and research institutions
- Stage 1: 65kt CO₂ injected into a depleted gas field
- Stage 2: researching CO₂ storage in saline aquifers
- Nine major research streams
- Two large field experiments
- 79 researchers across 11 institutions
- 2011-2012 budget of A\$11.9 million



Pictures: ©CO2CRC

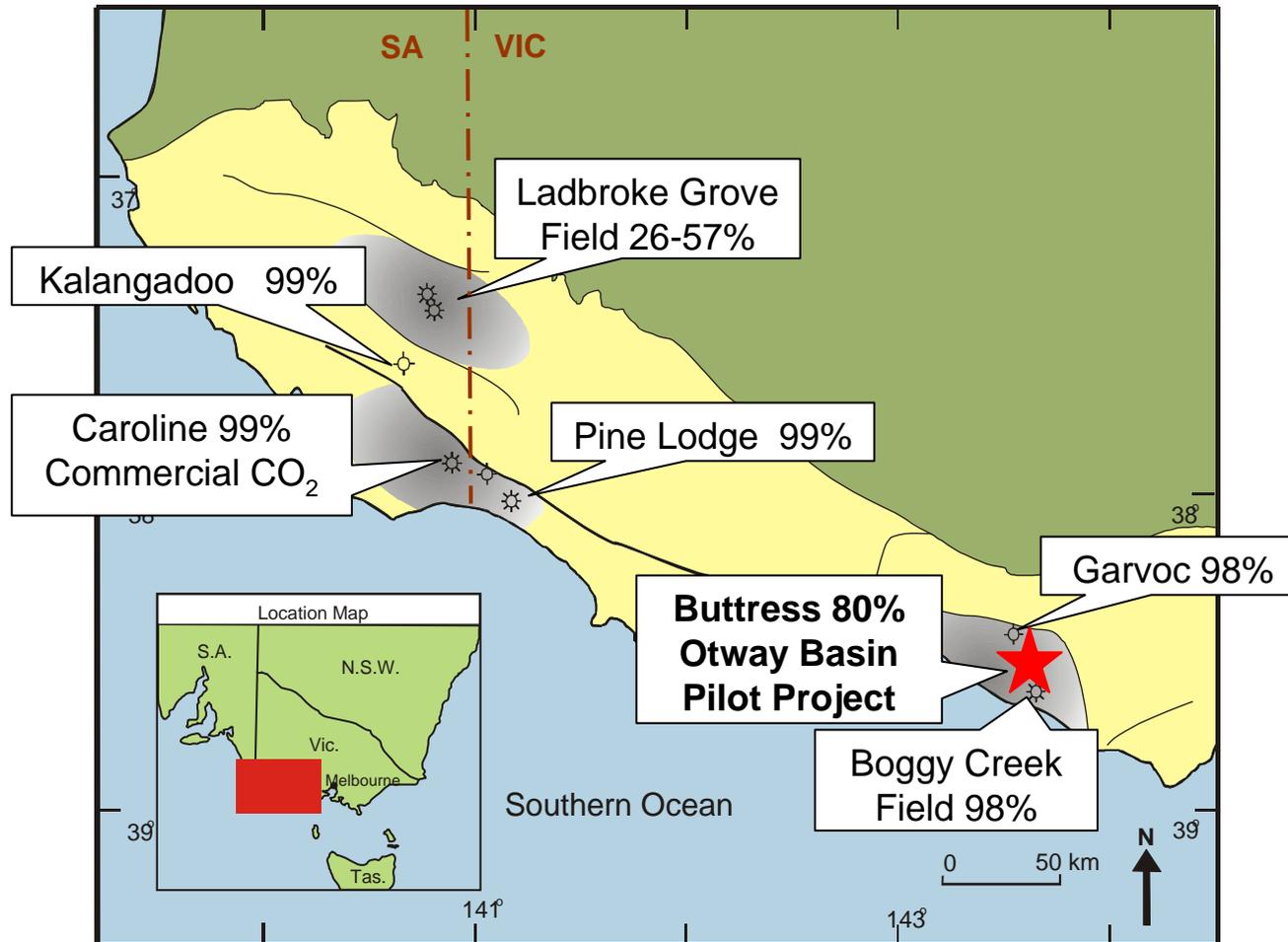
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Located in an area where naturally occurring CO₂ is available



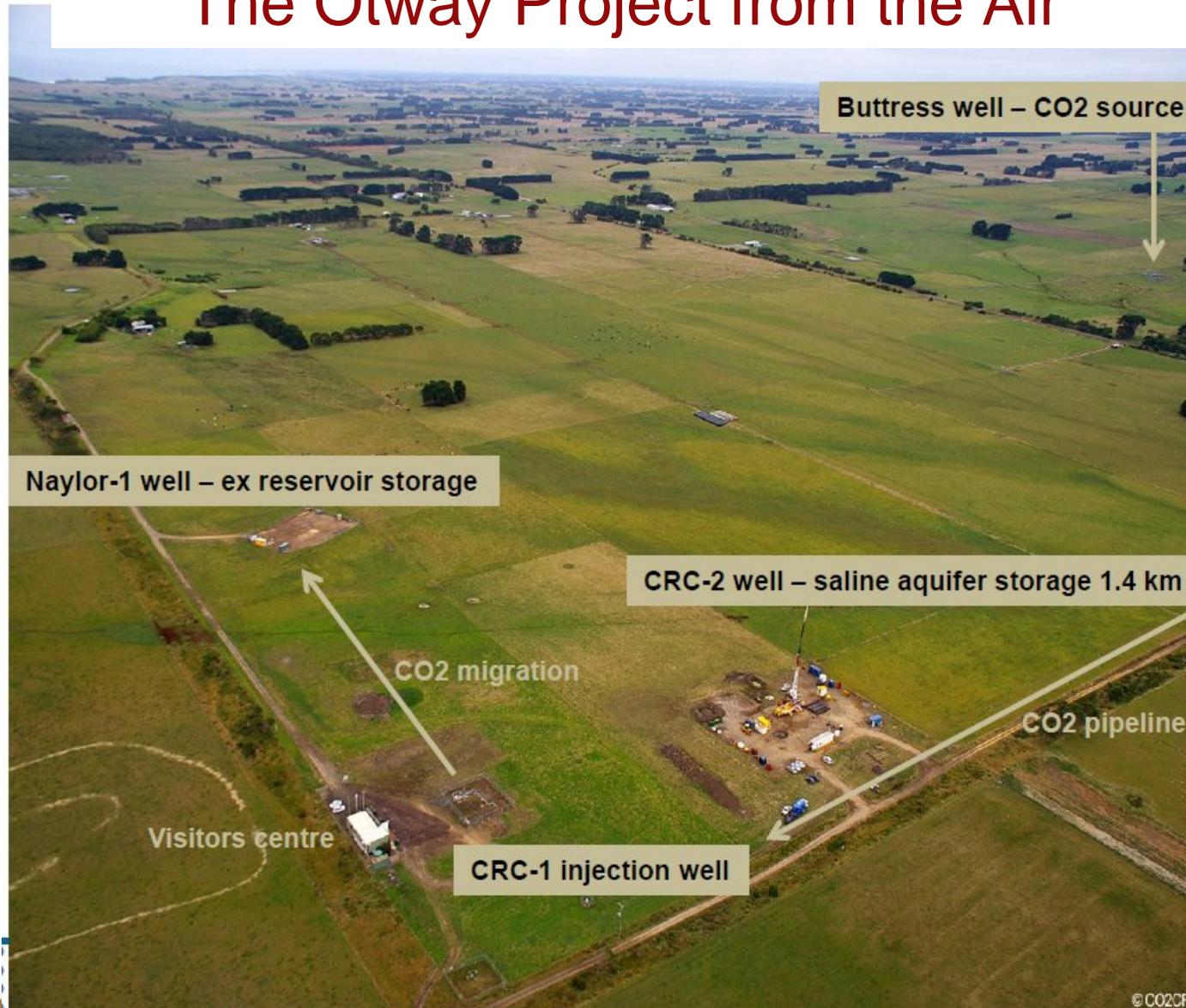
Adapted from CO₂CRC
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The Otway Project from the Air

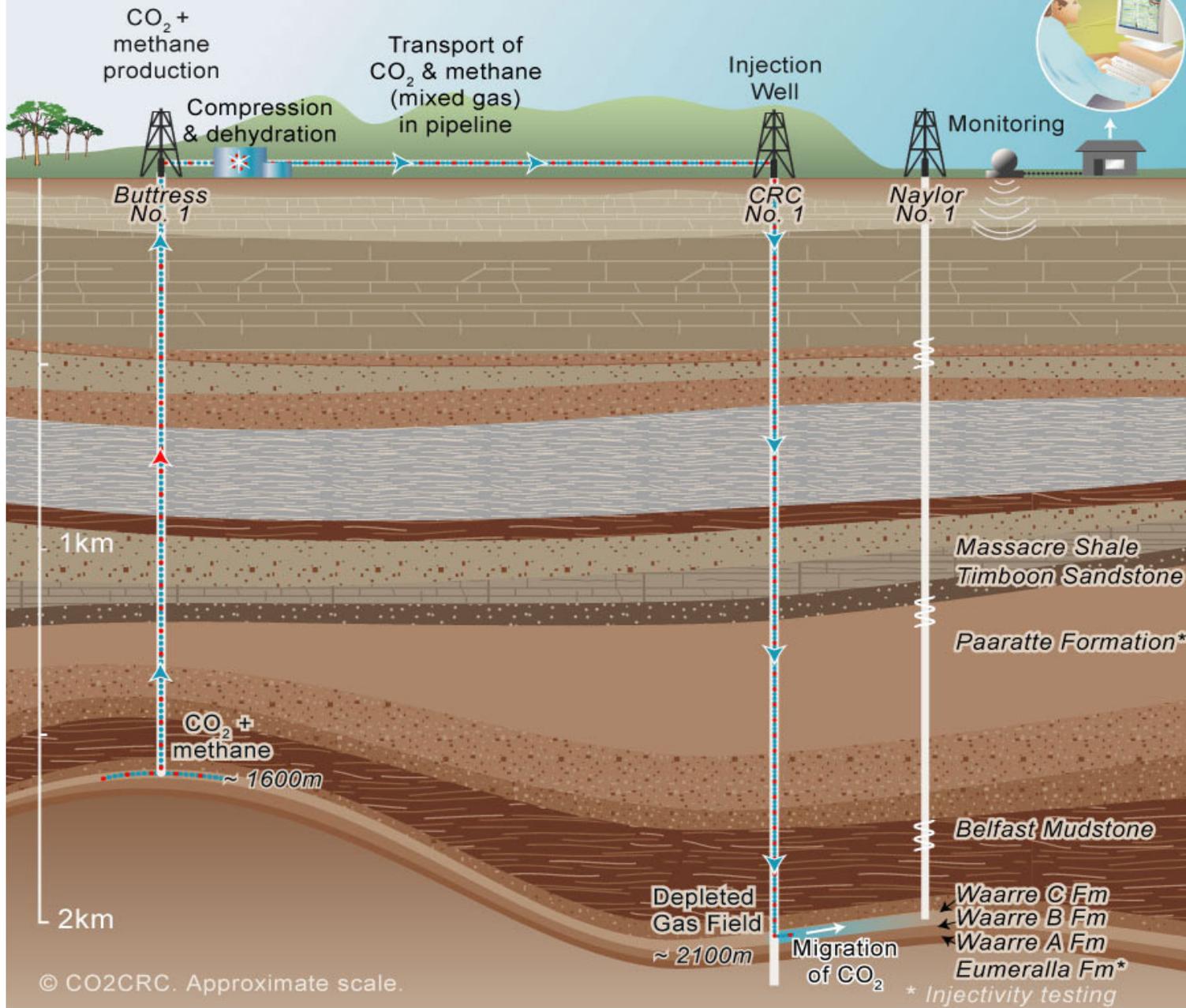


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STAGE 1. Geosequestration Research Project (Otway Basin)



The CO2CRC Otway Project

Stage 1:

- Production of CO₂ rich gas
- Compression
- Injection into Waarre Fm depleted gas field
- Monitoring and verification
- >65,000t injected

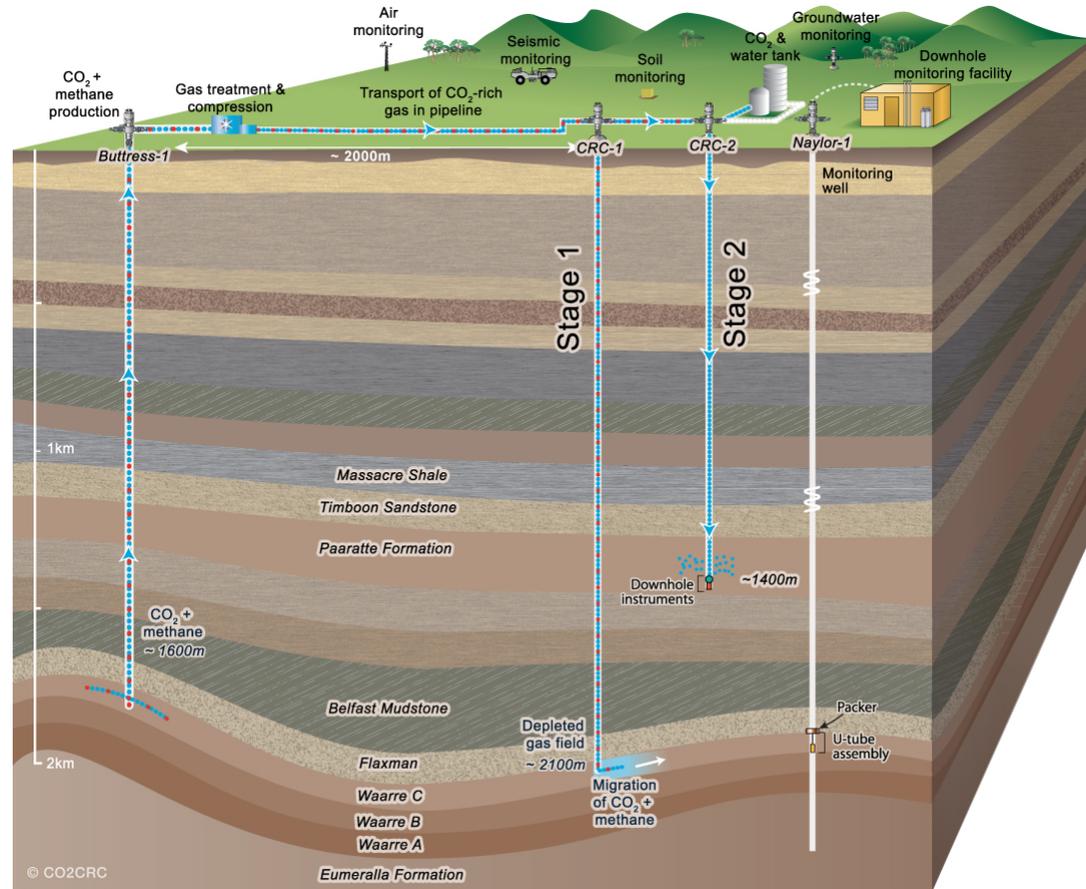
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The CO2CRC Otway Basin Pilot Project

Stage 2:

- “Huff and puff” test to evaluate residual trapping
- Using natural CO₂ rich gas
- Paaratte Fm (~1400m), saline aquifer
- New well CRC-2



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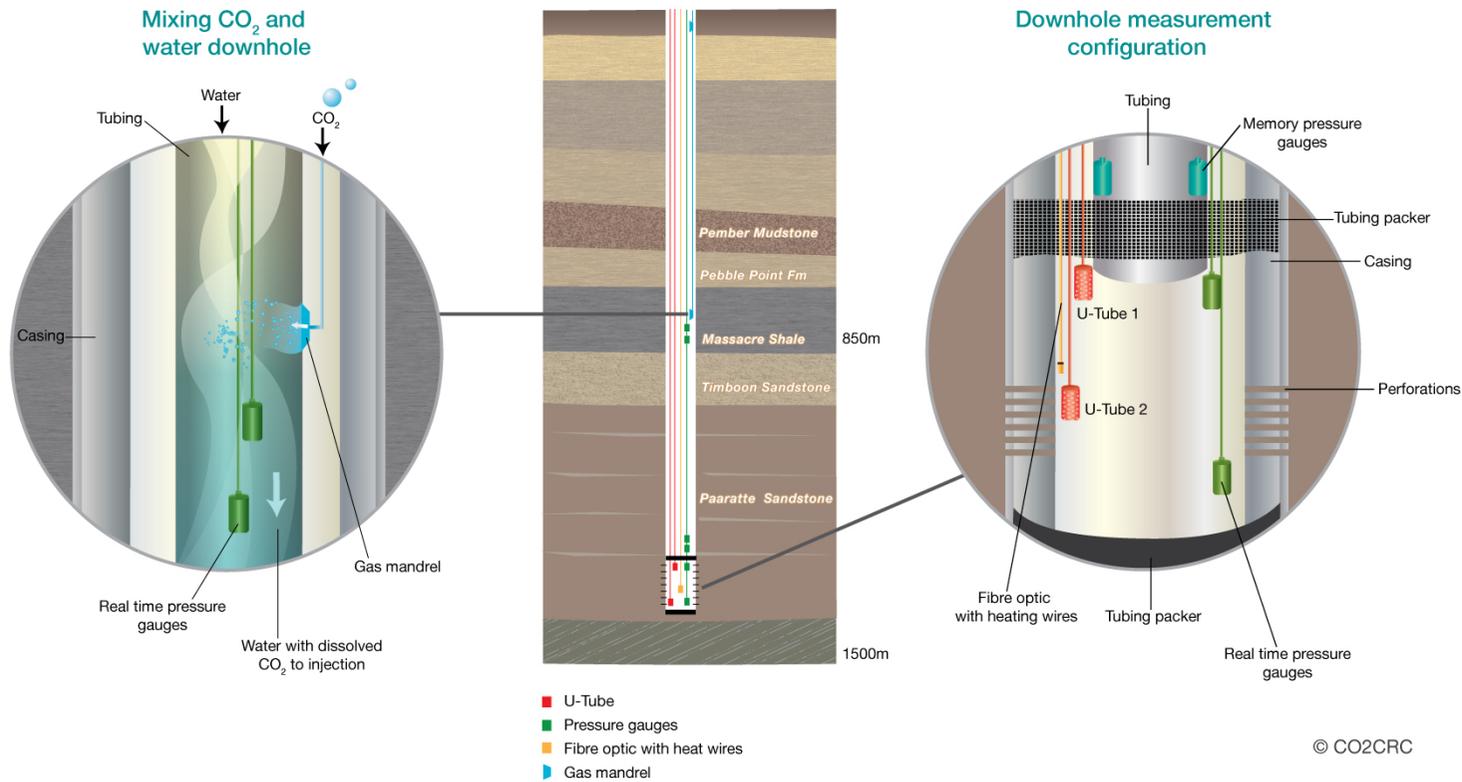
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Saline Aquifer storage Test in Otway Stage 2

Residual gas saturation test (Otway Stage 2B)
CRC-2 Well



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Government Supported Initiatives The Flagship Projects

The \$1.68 billion CCS Flagships programme offers commonwealth Government support to help develop “first of a kind” large scale, integrated, industrial CCS projects in Australia.

These projects are intended to contribute to reaching the G8 goal of “20 by 2020”

Project have to satisfy strict guidelines



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Government Supported Initiatives

The Flagship Projects

- 1) The Southwest Hub Carbon storage Project-Western Australia
 - A\$53 Million in support for detailed feasibility study announced in June 2011
- Slides courtesy of the Southwest Hub Project

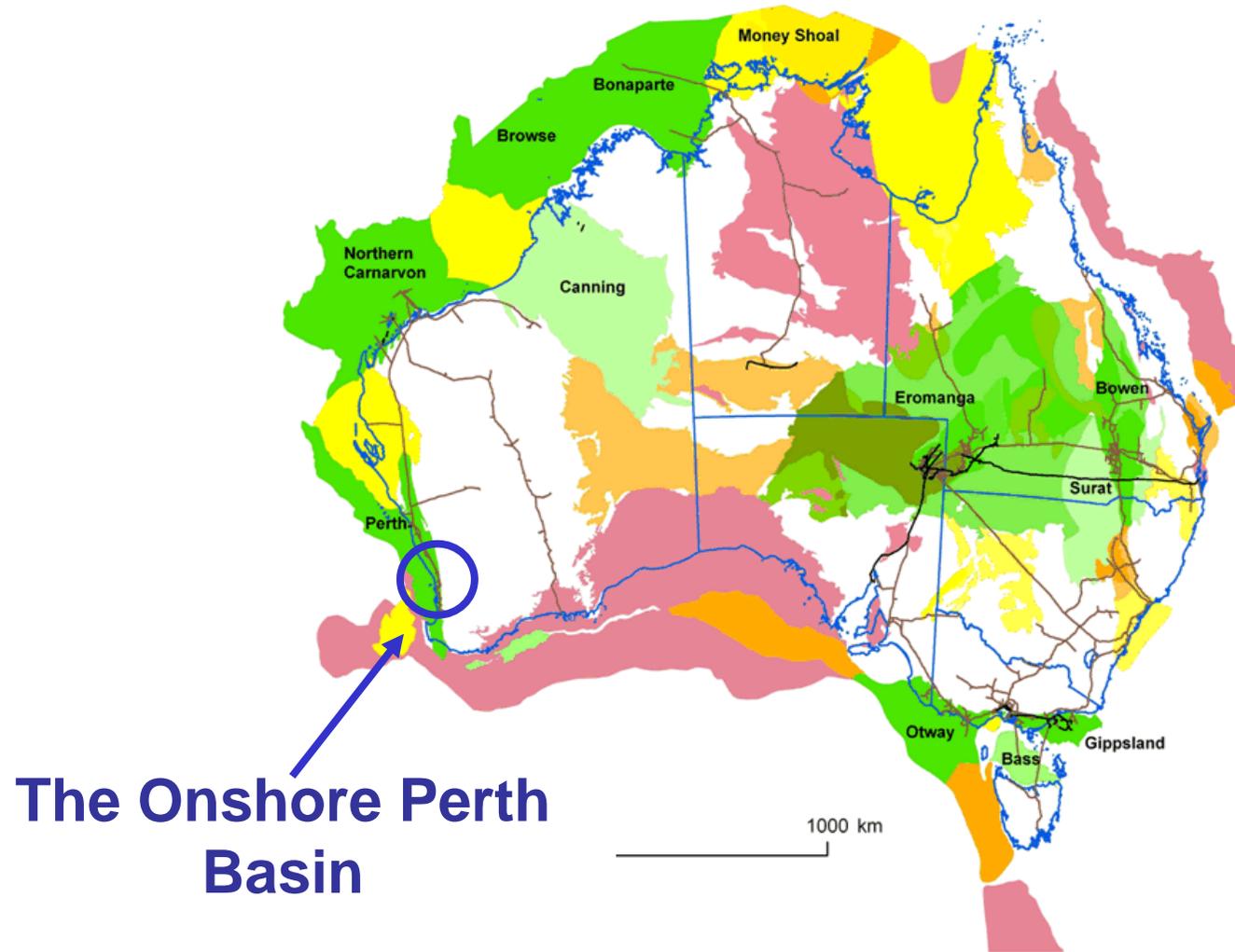


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The Southwest Hub Project in Western Australia



The Onshore Perth Basin



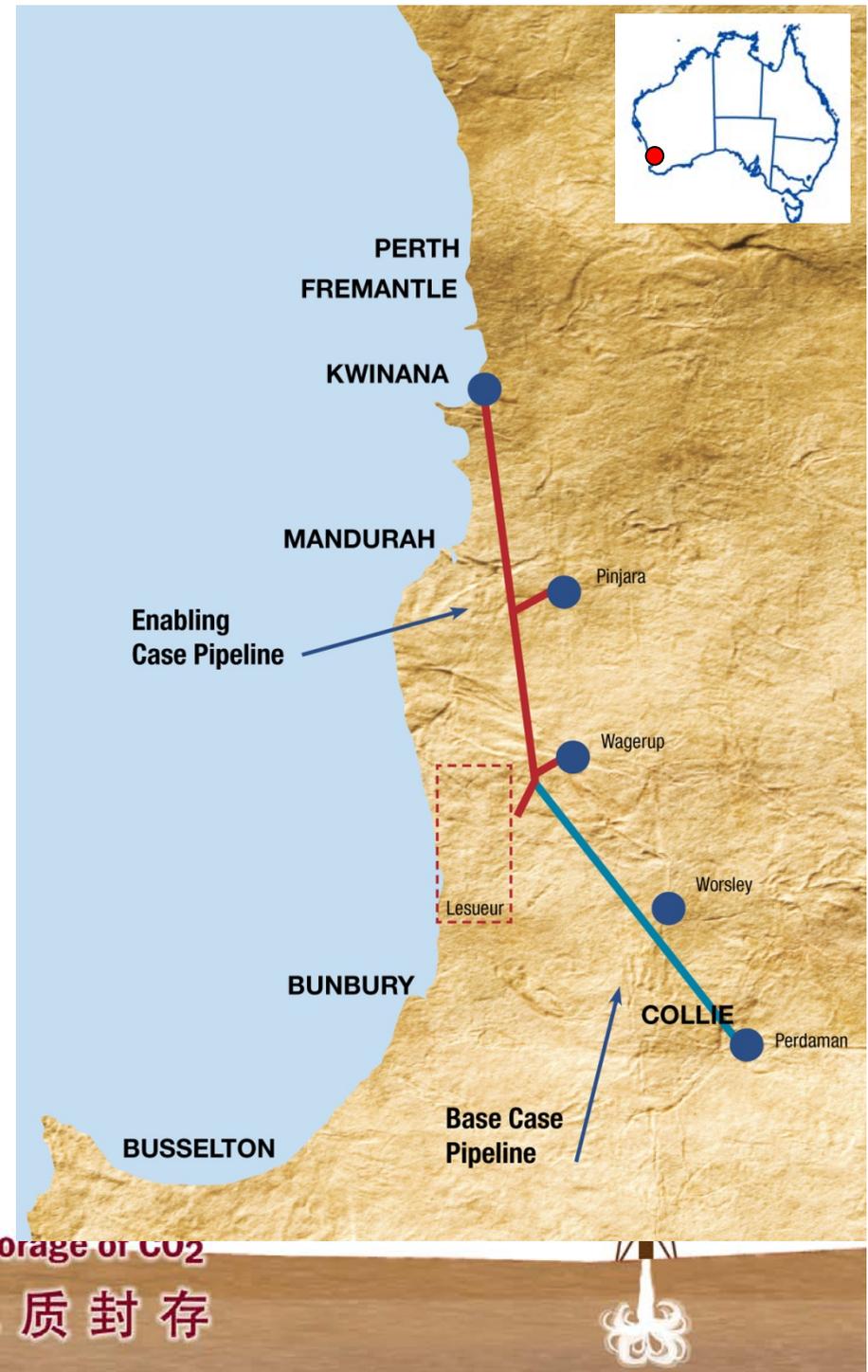
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South West Hub Carbon Storage Project

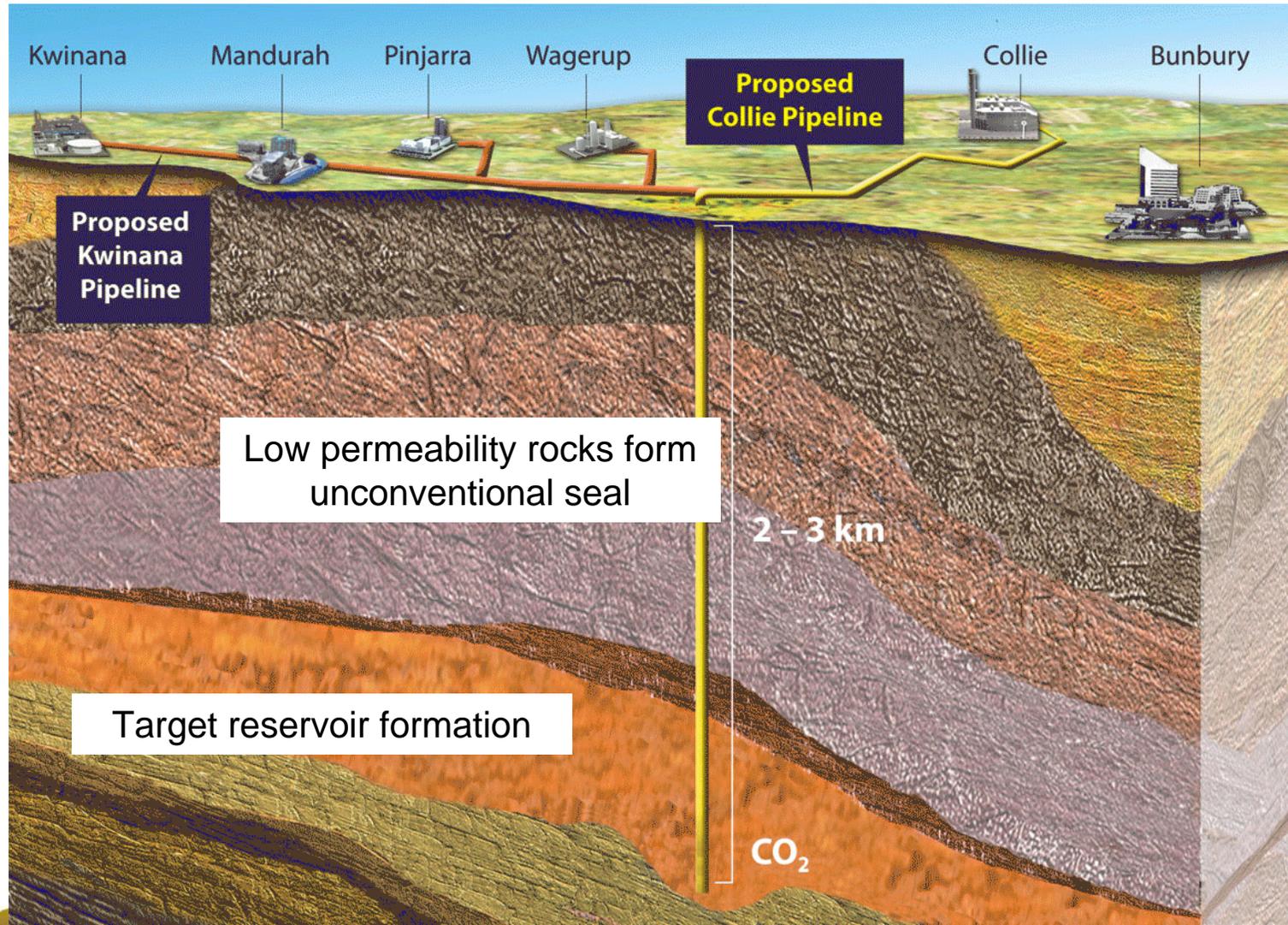
- Integrated industrial CO₂ geosequestration system
- Storage within an identified area
- 2.4 mtpa from fertilizer plant CO₂
- Red mud sequestration 300,000+ tpa (Alcoa)
- Potential for up to 7 mtpa for future power generation



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Collie Hub Carbon Storage Project



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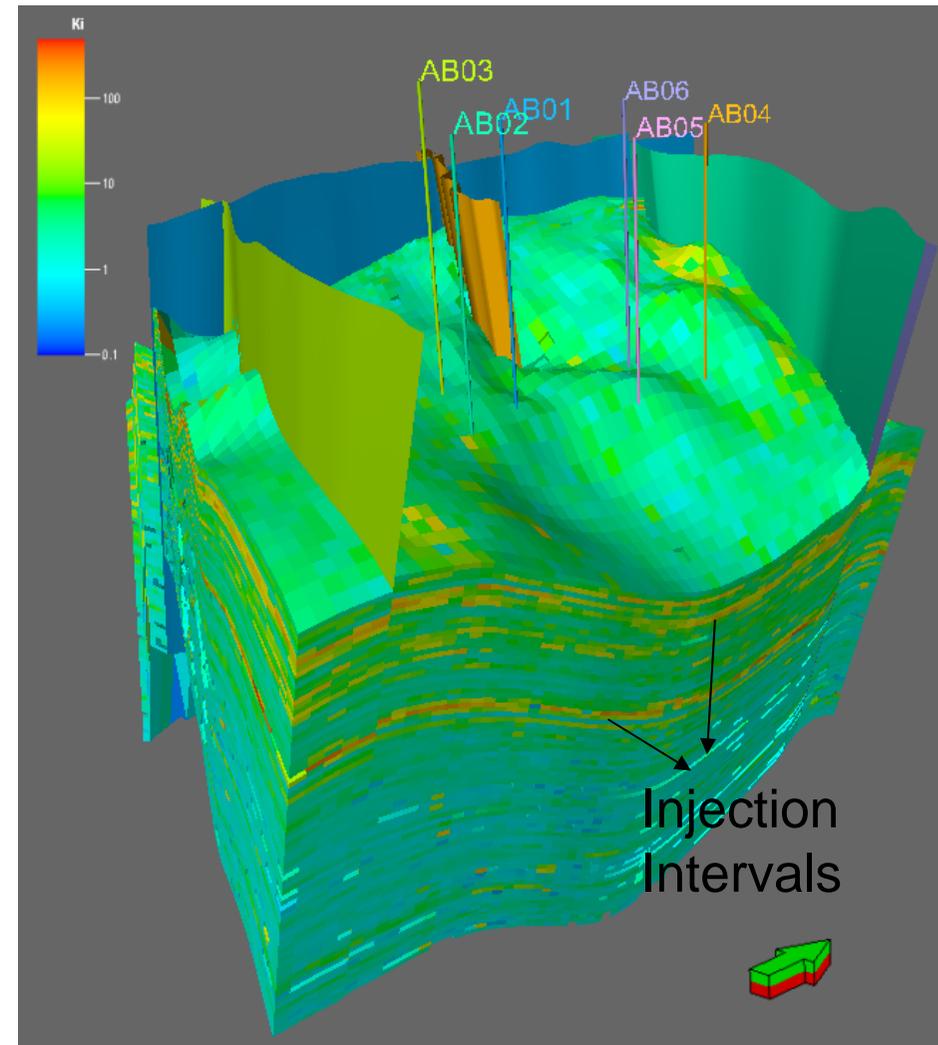
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4. Collie Hub Carbon Storage Project

Development plan:

- Target injection (40 yrs): 6 injectors
- Completion consideration to optimize injection volume and manage containment risk
- Two potential injection zones identified from seismic and modeling



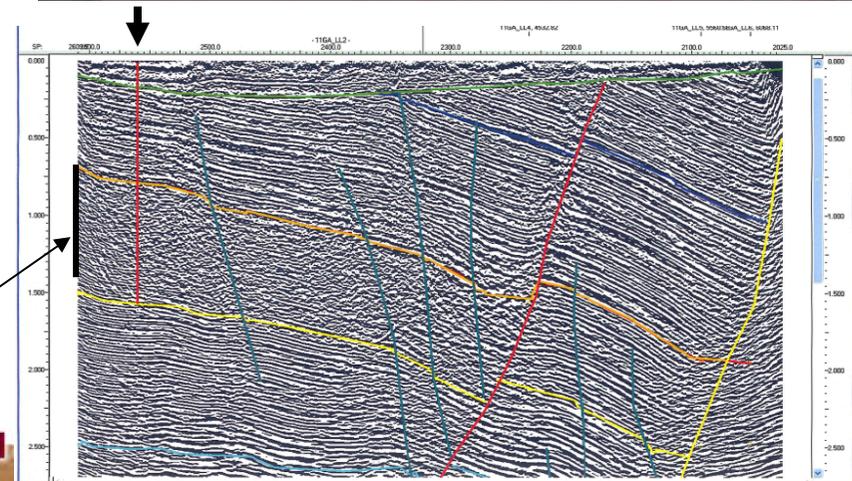
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Harvey -1 Exploration well

- Drilled during February and March 2012 to a total depth of 2945m.
- Target Lesueur Formation (Permian) extensively cored.
- Drilling identified several thick shale bands within the target formation to act as conventional seals to the underlying reservoir
- Initial core tests indicate that the reservoir has promising storage potential



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Government Supported Initiatives

The Flagship Projects

- 2) The CarbonNet Project – Victoria
- A\$100 Million for detailed feasibility study announced in February 2012
- Slides courtesy of CarbonNet

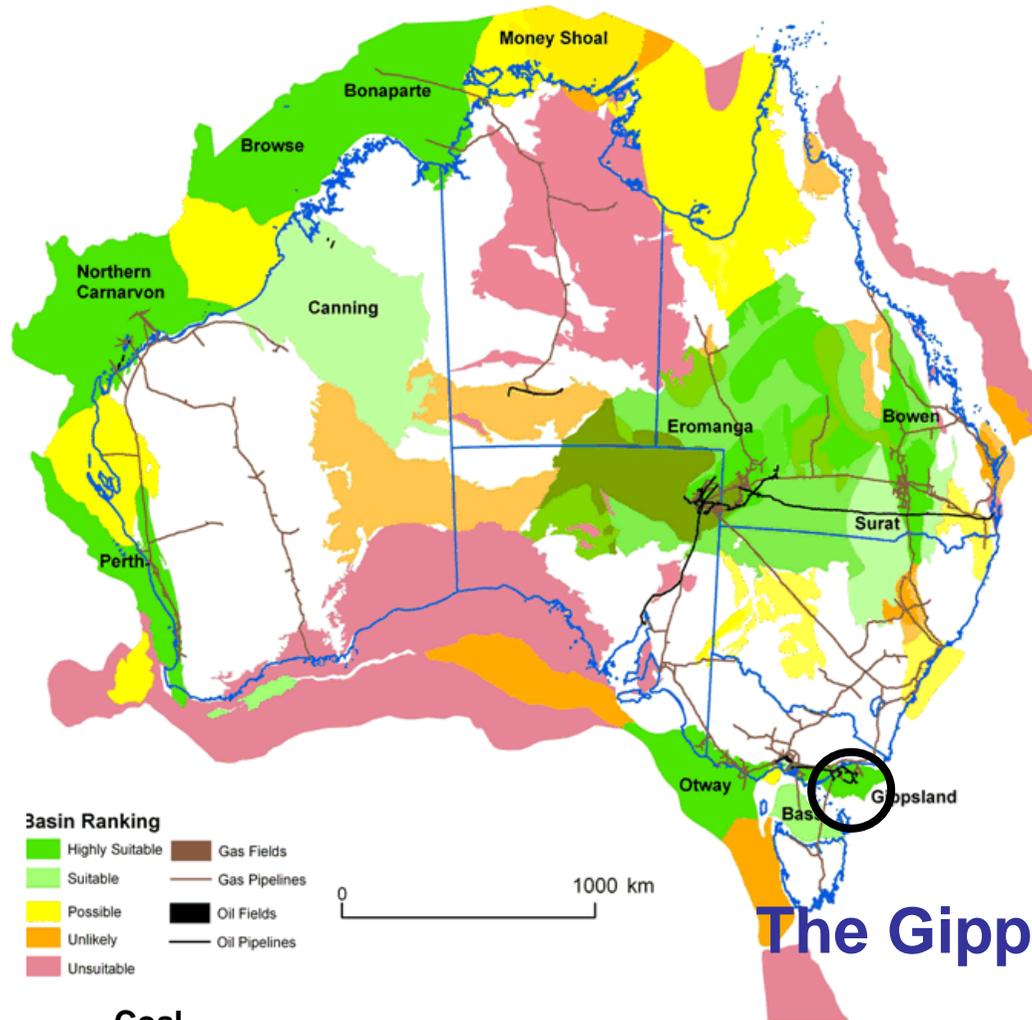


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CarbonNet - A Victorian Project



Coal

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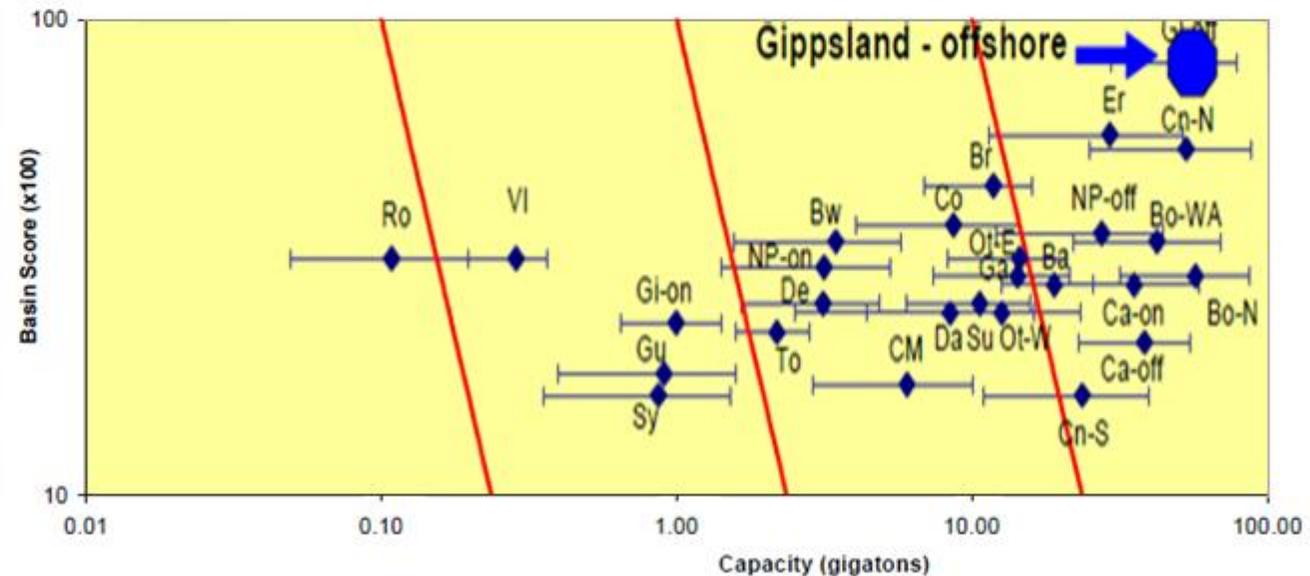
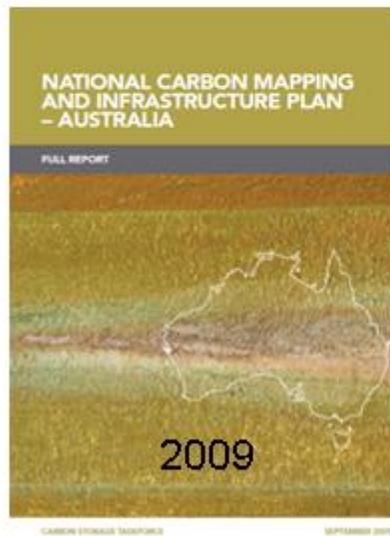
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Project

Why Gippsland?

- The 2009 National Carbon Task Force study found that the offshore Gippsland basin contains both the **best quality** and **largest volume** of CO₂ reservoirs from 25 major basins across Australia



CarbonNet Gippsland Basin



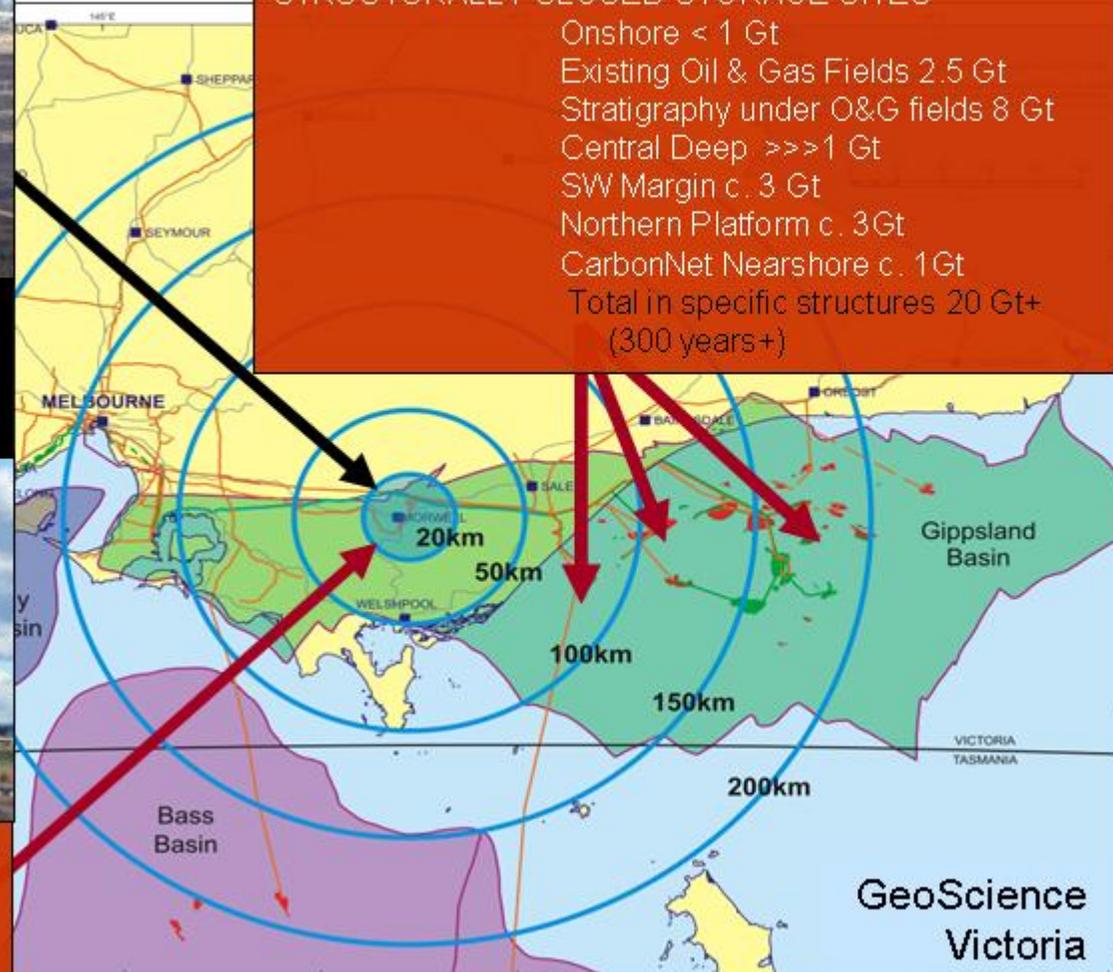
Latrobe Valley Brown Coal
10's of billions of tonnes
300 years+ Electricity Supply



Some of Australia's highest emitting power stations
60 mtpa CO₂

World class Carbon storage potential
STRUCTURALLY CLOSED STORAGE SITES

- Onshore < 1 Gt
- Existing Oil & Gas Fields 2.5 Gt
- Stratigraphy under O&G fields 8 Gt
- Central Deep >>>1 Gt
- SW Margin c. 3 Gt
- Northern Platform c. 3Gt
- CarbonNet Nearshore c. 1Gt
- Total in specific structures 20 Gt+
(300 years+)

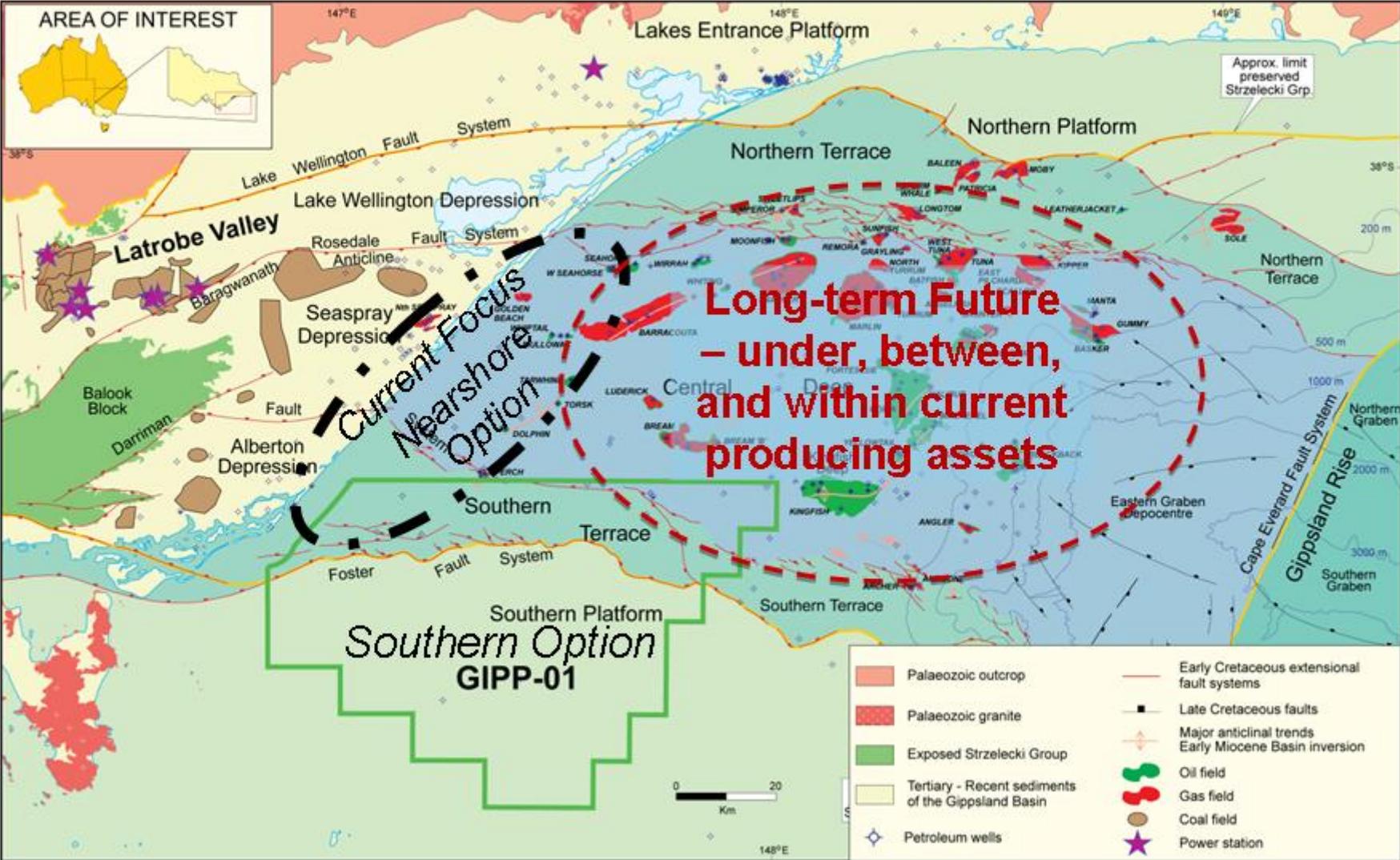


Storage Objectives

- **Confirm** the presence of sites with 20-100 Mt of accessible CO₂ storage within the Latrobe Group in the near shore Gippsland basin
- **Demonstrate** the injectivity properties of the Latrobe Group at the preferred injection sites are adequate
- Establish that the injection of **1 to 5 Mt** of CO₂ per annum can be undertaken in a **sustainable and secure** manner
- Determine that injected CO₂ will have a **minimal and acceptable impact** on other users and resources within the basin
- **Commence monitoring programs** to establish baseline data base(s) for future developments and to provide surveillance procedures to demonstrate that the CO₂ is behaving as modeled and will be constrained over anthropogenic and geological timeframes

CarbonNet

Focus



The Gorgon Project – a Major Industrial Project

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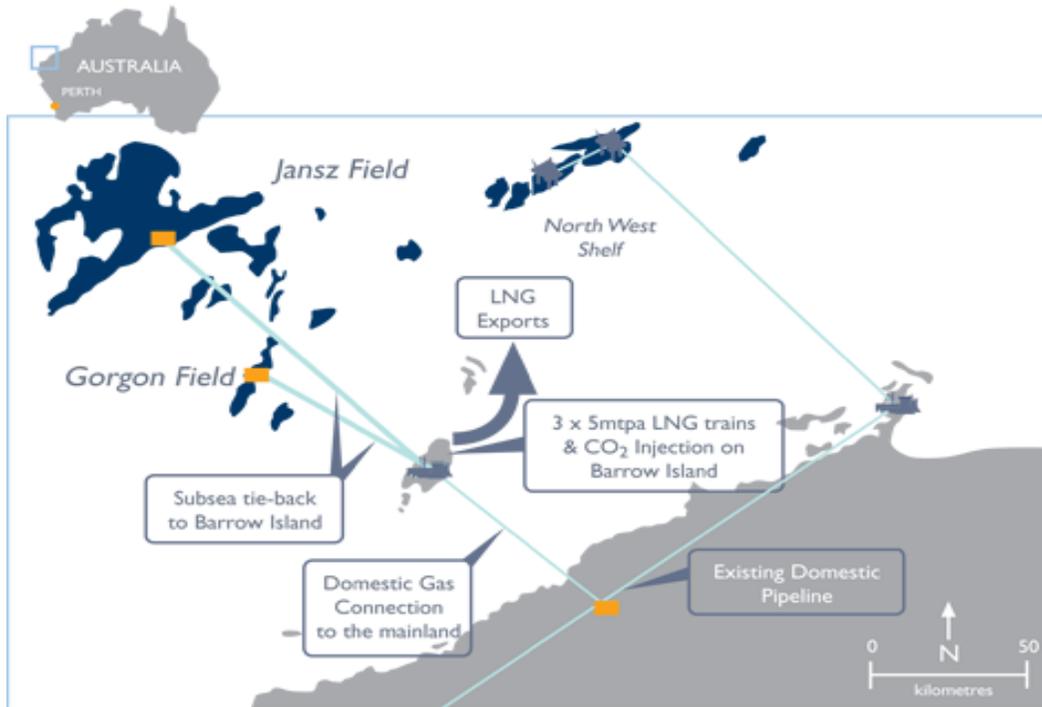
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The Gorgon Project

- Greater Gorgon Gas Fields lie 130-200km offshore and contain about 40 trillion cubic feet of gas
- Water depths, Gorgon 270m Janz 1300m
- CO2 content Gorgon 14%, Janz 0% , overall ~7%
- Processing Facility onshore Barrow Island 3x5Mtpa trains.



Project Joint venture Partners

- Chevron (47.333%)
- Shell (25%)
- ExxonMobil (25%)
- Osaka Gas (1.25%)
- Tokyo Gas (1%)
- Chubu Electric Power (0.417%)

<http://www.gorgon.com.au/index.html>

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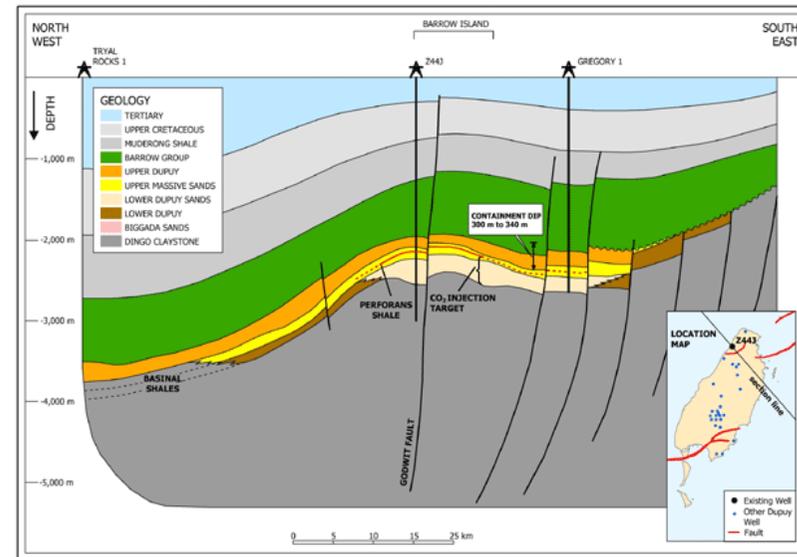
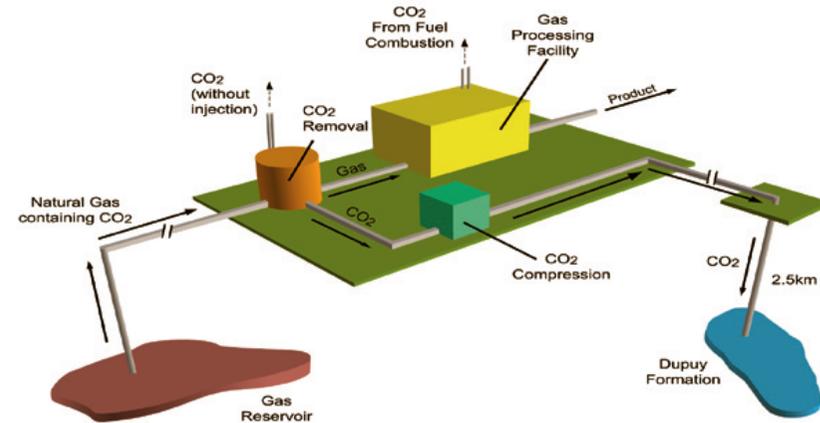
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The Gorgon Project

- Gas piped and separated on Barrow Island
- CO₂ removed for sales gas
- CO₂ compression attached to gas facility
- Up to 3.4Mtpa of CO₂ will be captured, piped and stored in deep formations below Barrow Island



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The Gorgon Project

Status:

- Project construction in progress
- Project on schedule for first LNG in 2014
- First CO₂ injection some months later



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5. ZeroGen Project



Source: ZeroGen



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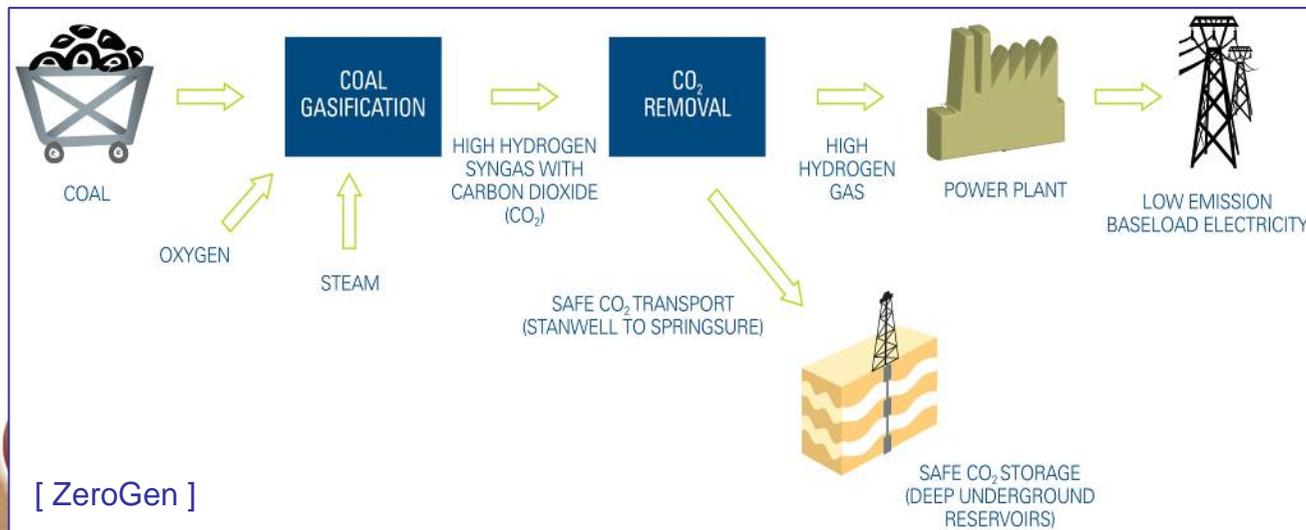
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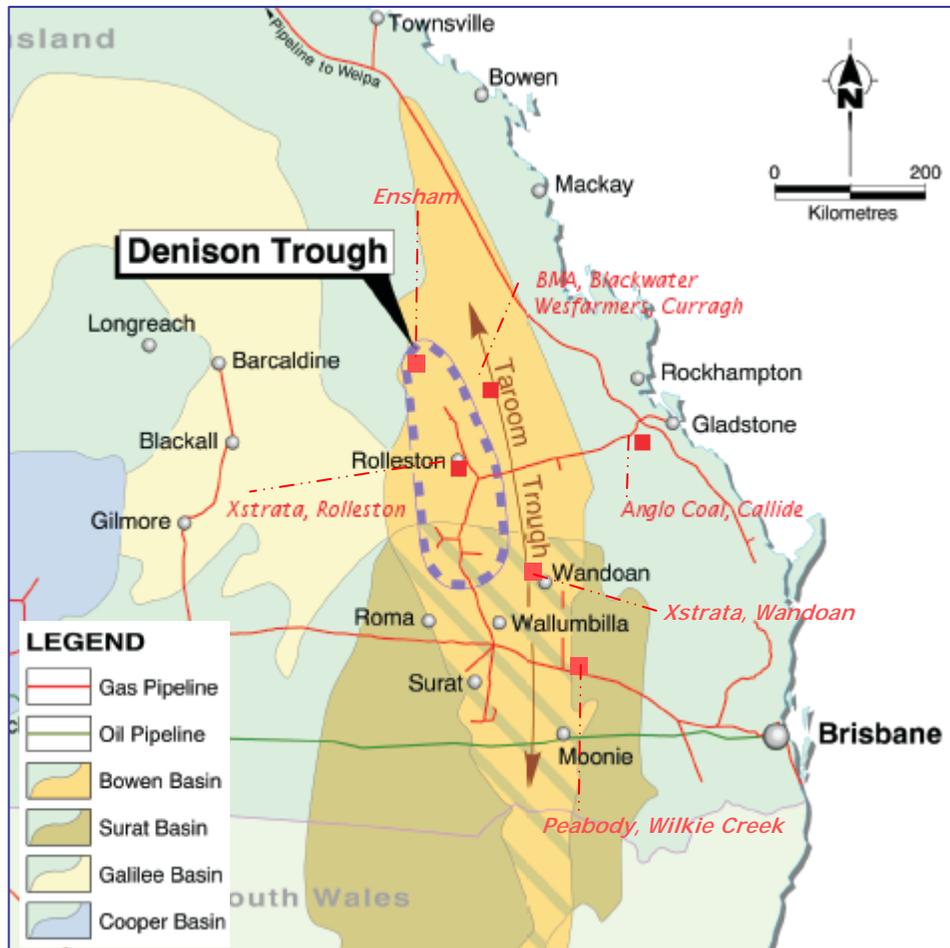


5. ZeroGen Project

- Planned for 530MW coal-fired IGCC plant with 90% CO₂ storage in northern Queensland
- Plant planned to be operational by 2015
- Exploration in the nearest potential storage basin started in 2005
- 12 well drilled following permeability trend in Permian fluvial/delta sandstones



5. ZeroGen Project



- After 5 years of exploration and 12 exploration wells it was recognised that the injectivity of the formation was **too low** to allow:
 - injection of the target volumes of 60 million tonnes of CO₂
 - at 2 MMTPA
 - for 30 years at an economic cost
- The project has produced many valuable learnings on the difficulties of assessing low permeability reservoirs.

Sources: ZeroGen; Marsh & Scott, 2005

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Critical lesson: Without a defined storage reservoir there is no CCS Project

Geologists need to get this message over to Government and Industry, until the reservoir has been characterised properly there is no certainty of storage.

Low permeability fluvial basins will be the biggest challenge to evaluate.



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Questions?

For further information, contact
ghg@ga.gov.au

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