Australian Government
Geoscience Australia

Geoscience Australia's Geological Storage Activities

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Australian energy resources - coal

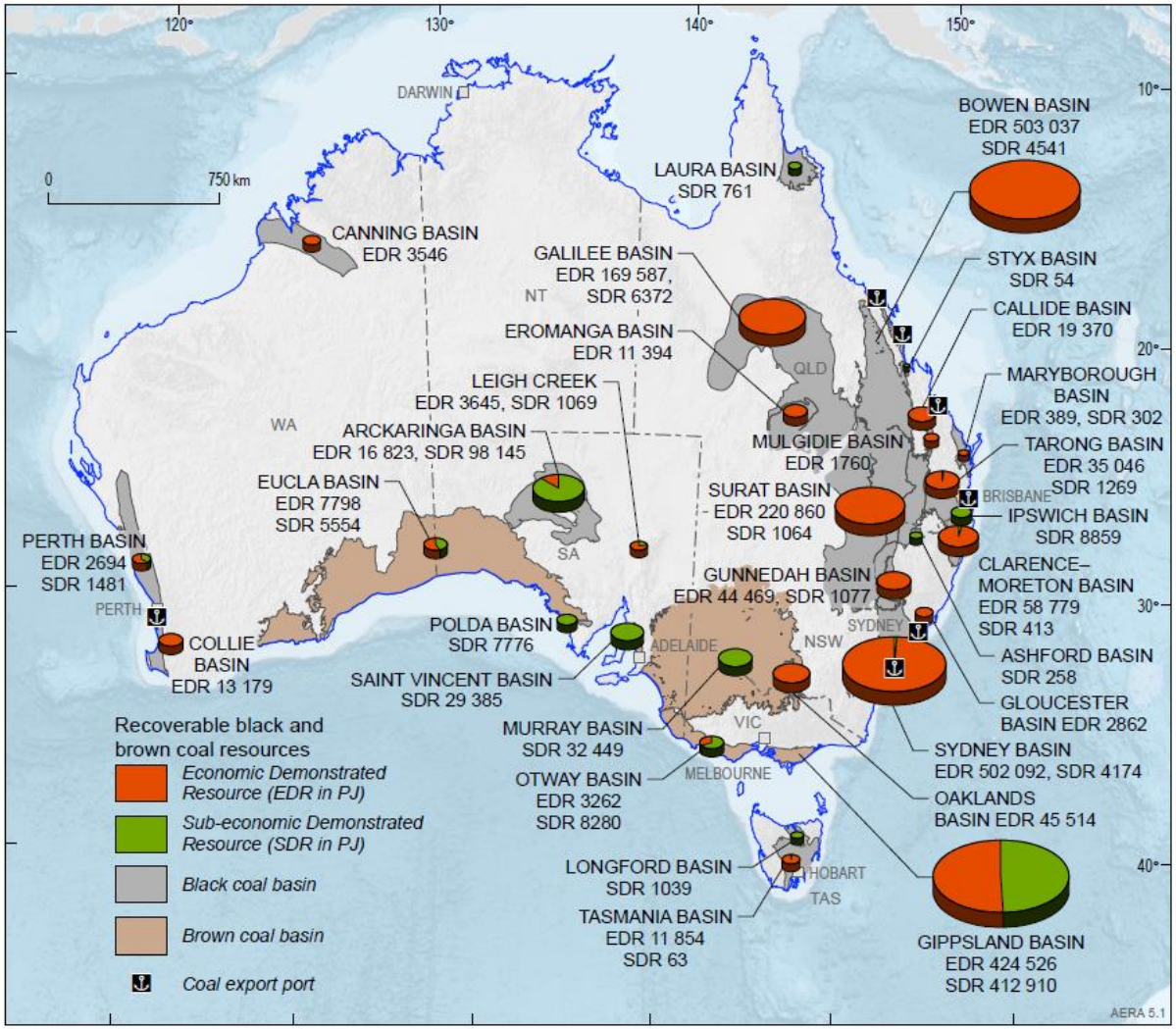
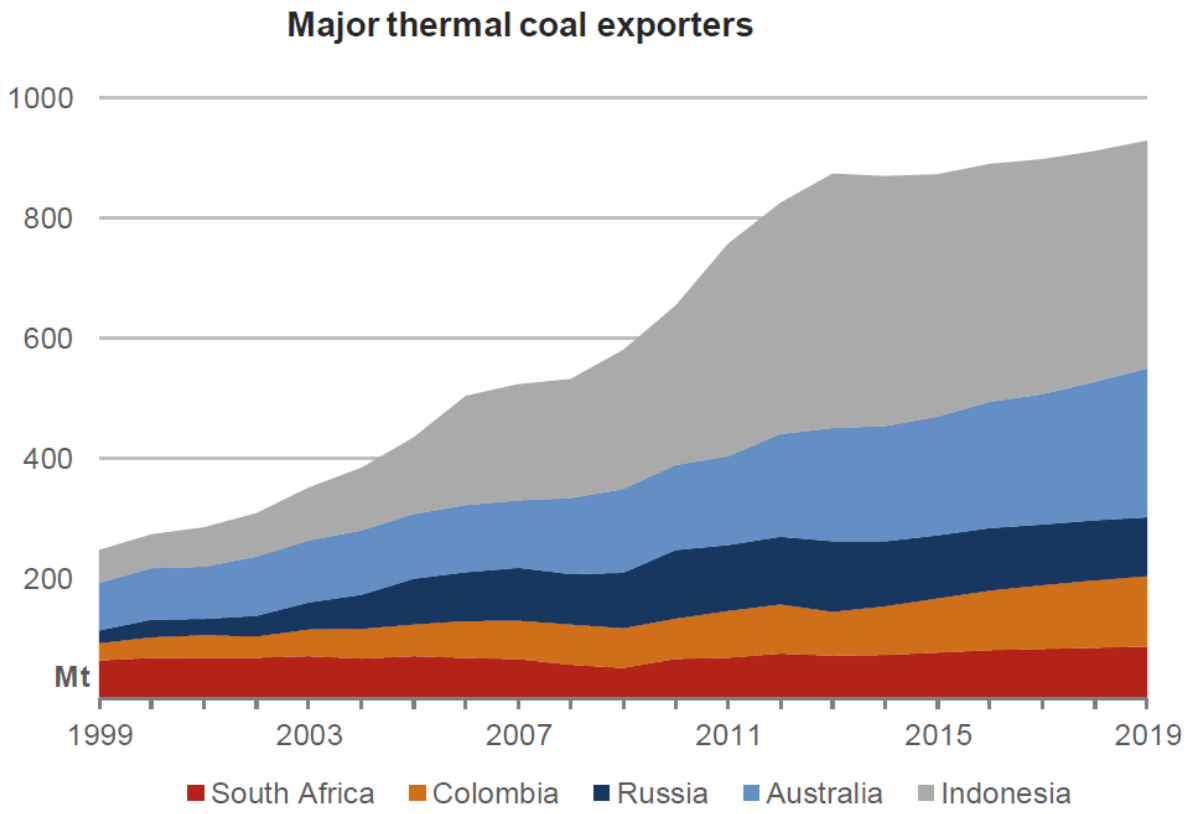


Figure 5.1 Australia's total recoverable resources of black and brown coal as at 31 December 2012

Source: Geoscience Australian and BREE (2014)

Forecast energy production - coal

- 100+ years of coal reserves



Sources: BREE; IEA.

Source: BREE (2014)

Australian energy resources - gas

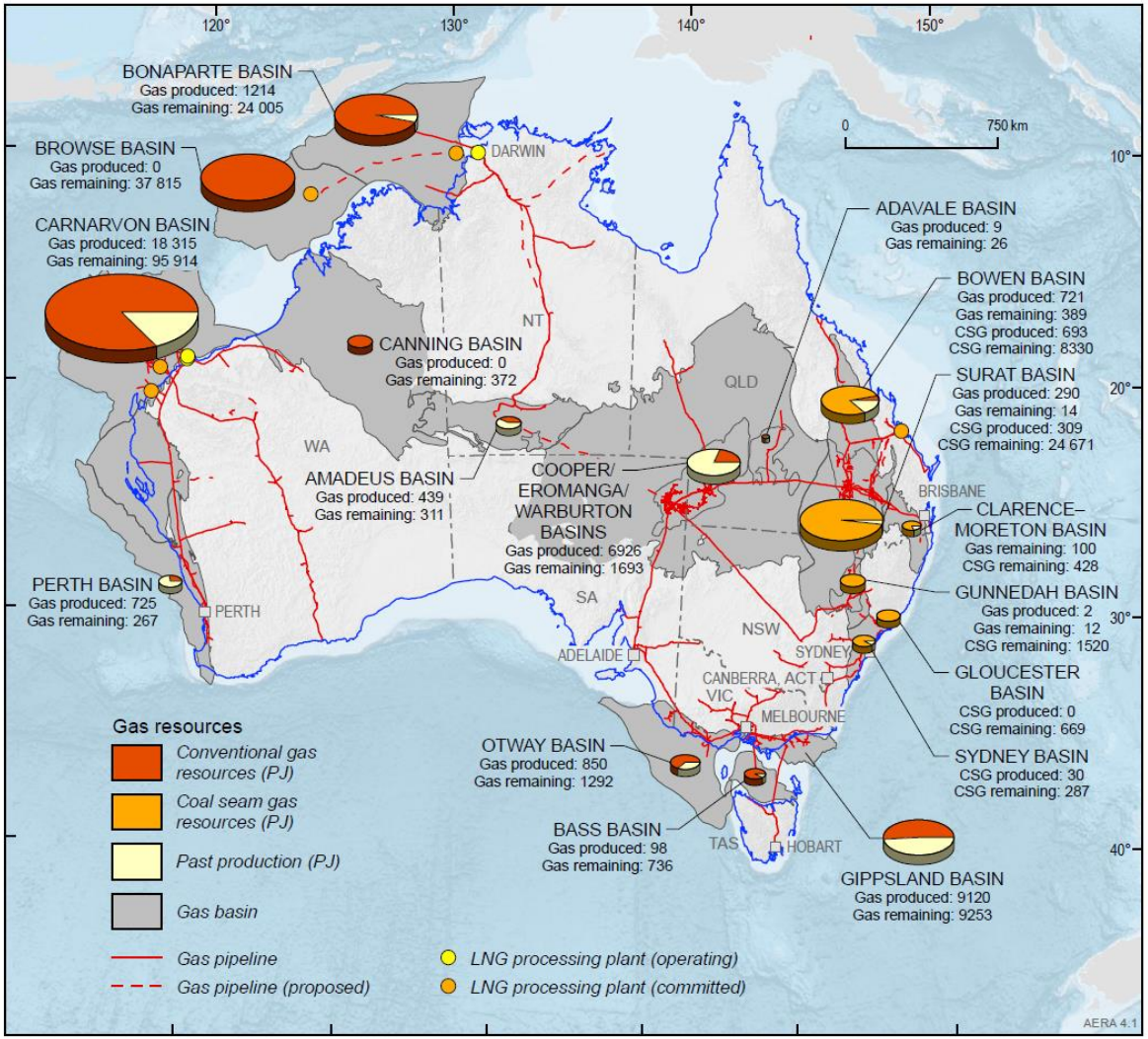
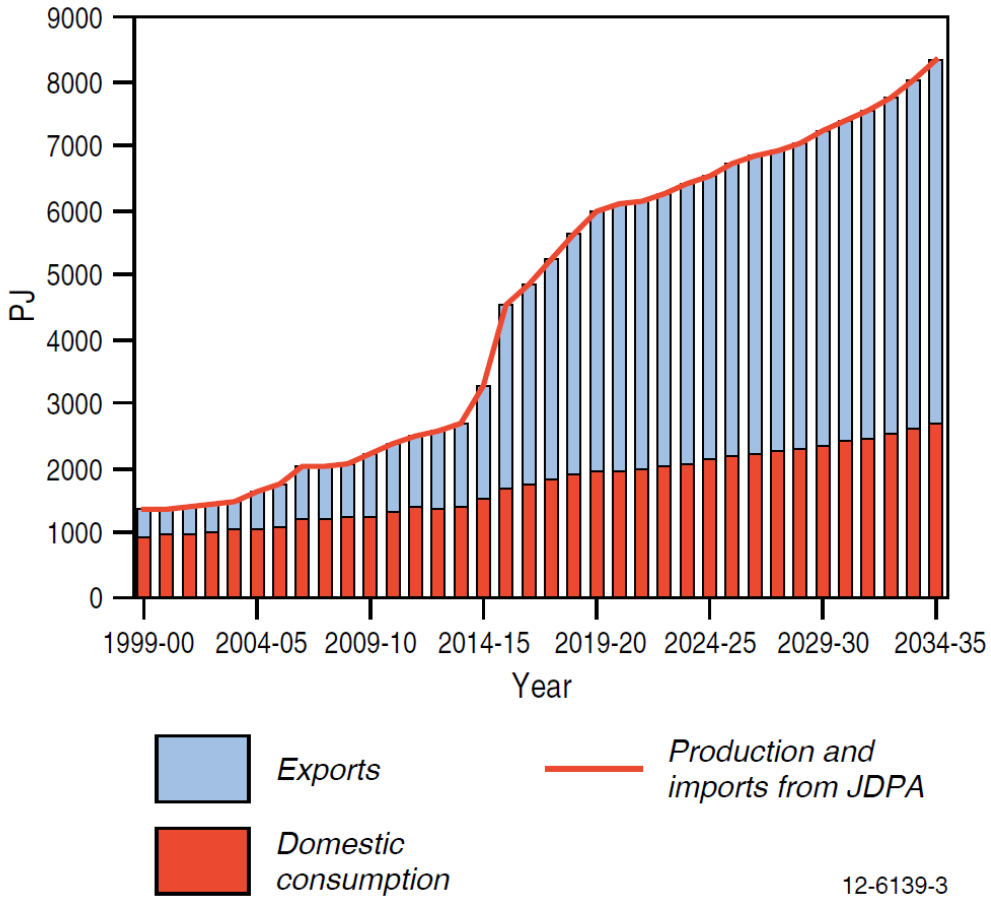


Figure 4.1 Location of Australia's gas resources and infrastructure

Source: Geoscience Australian and BREE (2014)

Forecast energy production - gas

- on track to be the largest gas exporter in the world

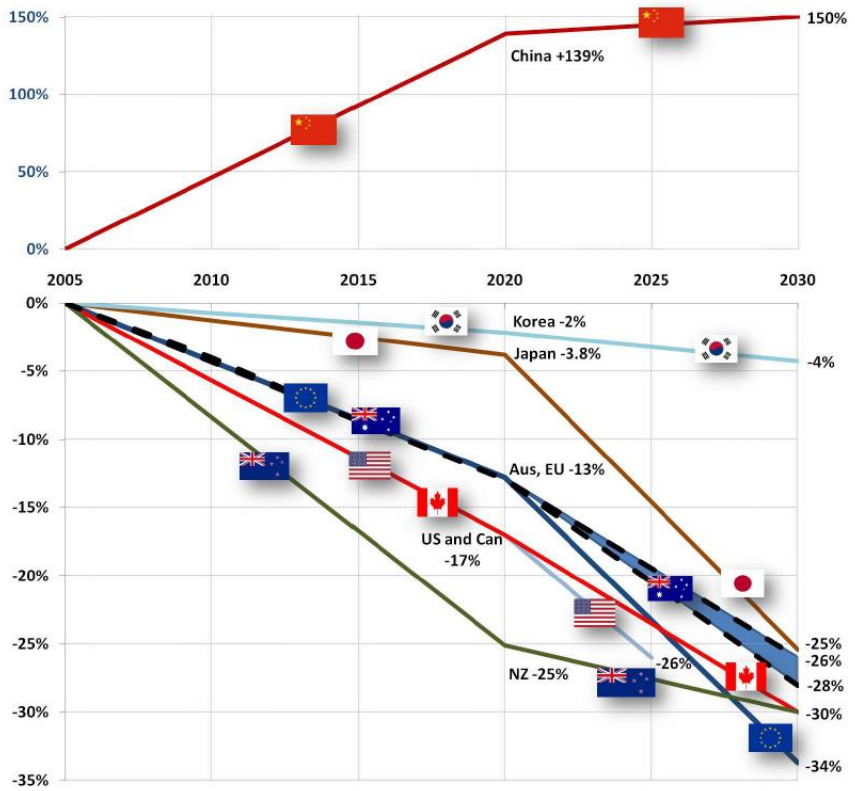


Source: Geoscience Australian and BREE (2014)

Drivers for CCS in Australia

Greenhouse gas reduction **26-28% lower** than 2005 levels by 2030

Low emissions technology (incl. CCS) a key mechanism to achieve long term reductions



Source: DPMC (2015)

National Carbon Mapping and Infrastructure Plan: 2009

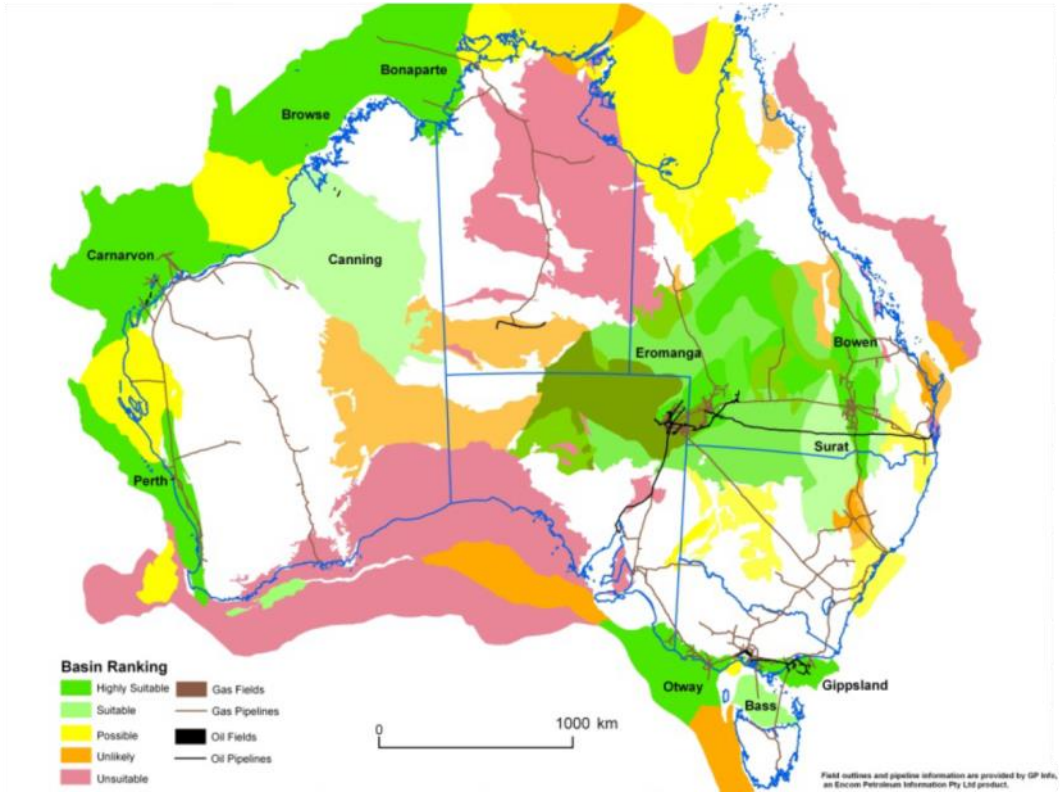
High level capacity estimates:

Eastern Australia

- 200 Mtpa for 70-450yrs

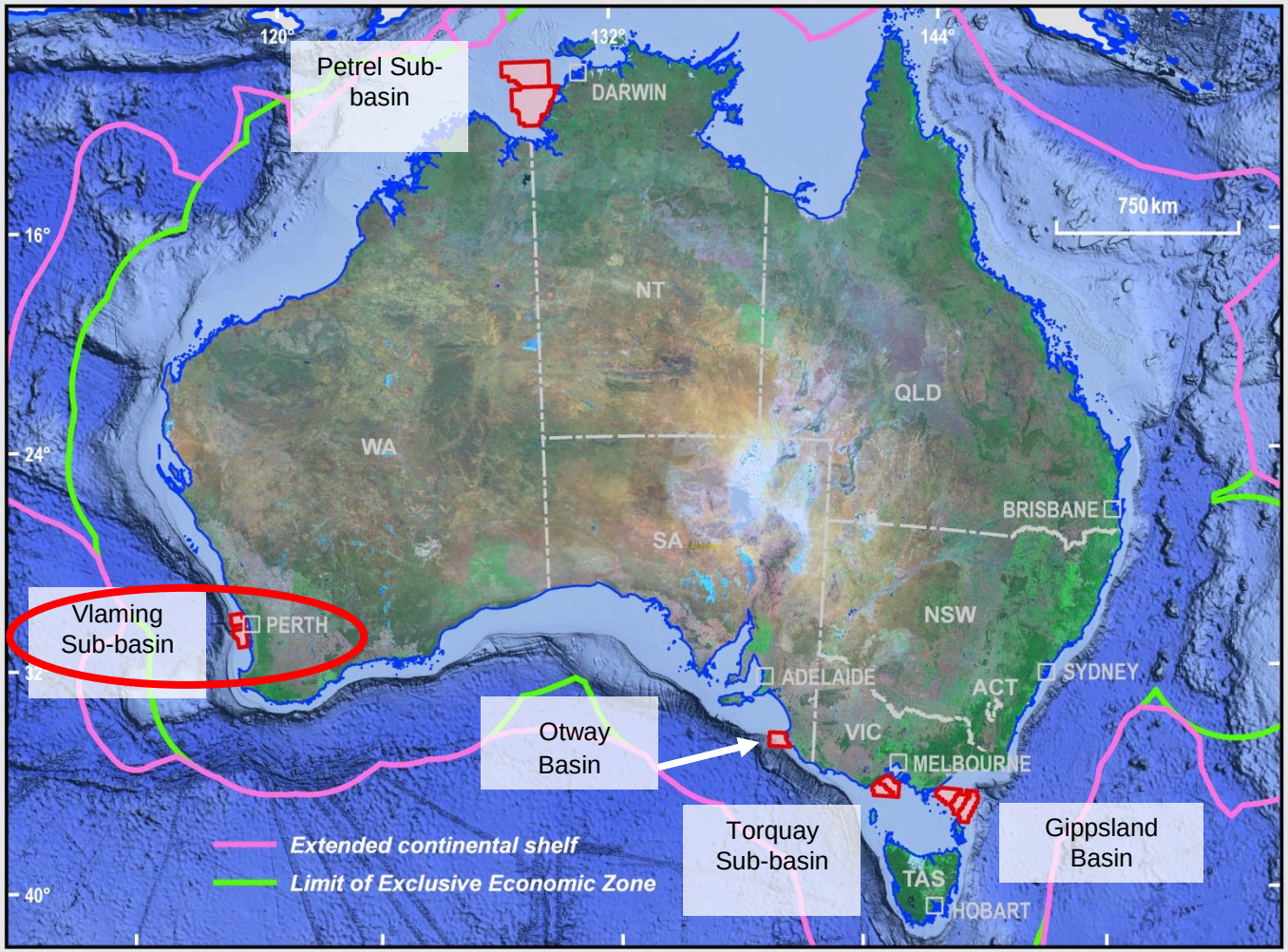
Western Australia

- 100 Mtpa for 260–1000+yrs



How realistic are these numbers?

Australian Government Offshore GHG Acreage Release March 2009

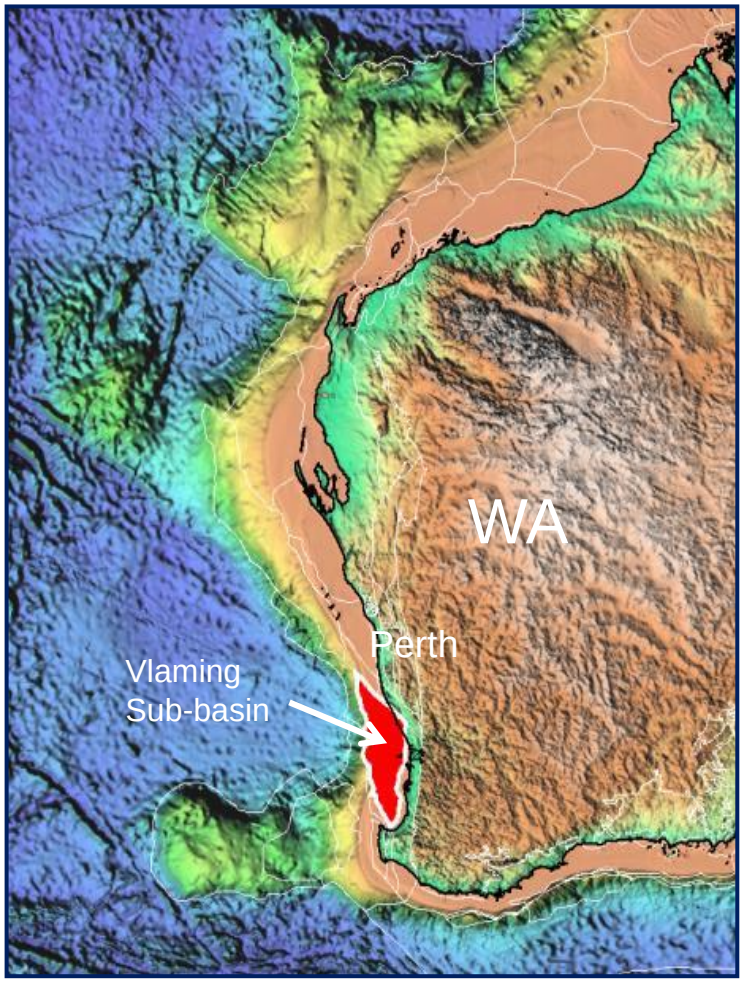


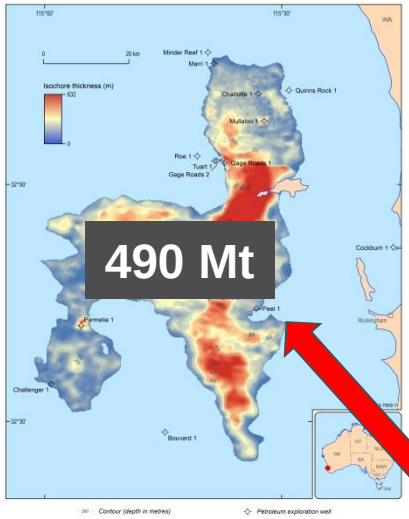
10 areas –
5 basins

National Carbon Infrastructure Plan

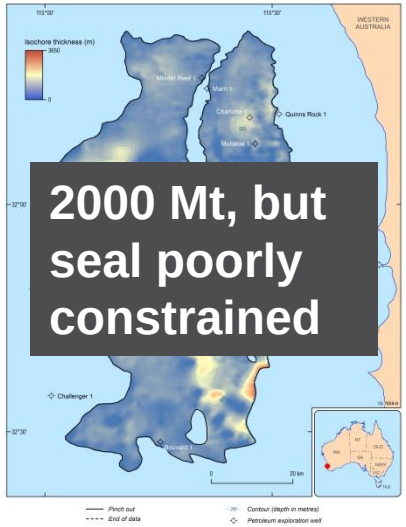
- GA led project
- $60m over 4 years (2011/2012)
- Accelerate the identification and development of suitable long term CO_2 storage sites
  - Onshore – worked with WA and NSW State Governments to undertake drilling/seismic
  - Offshore – GA undertook marine surveys to obtain precompetitive data on basin suitability
- Presently wrapping up project

Example: Vlaming Sub-basin CO_2 storage assessment (2015)





Gage Sandstone



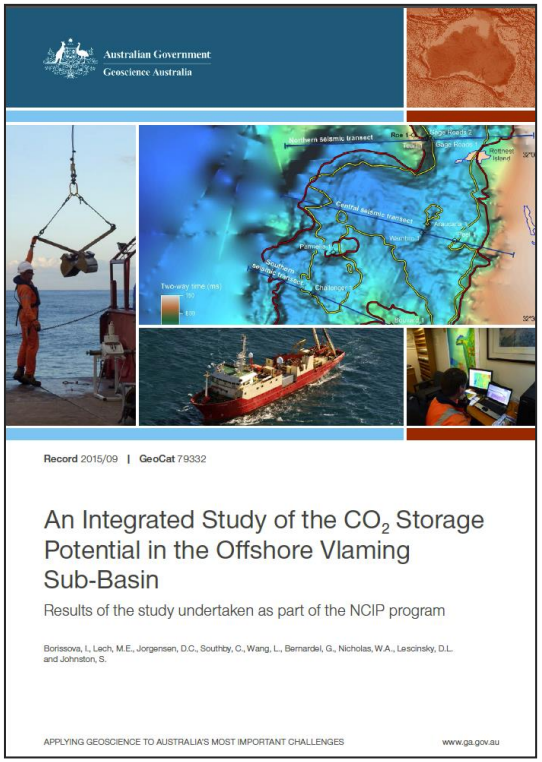
Charlotte Sandstone

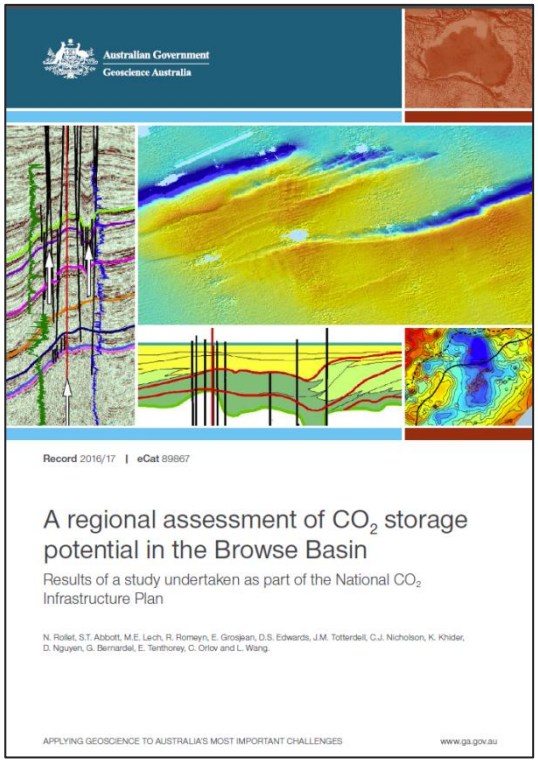
Old capacity estimate (multiple reservoirs):

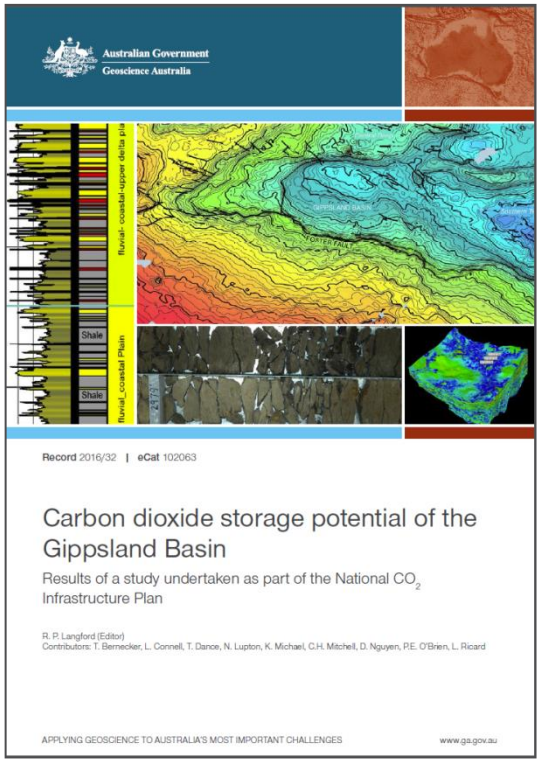
1300 Mt

- Storage capacity estimates likely to change with more information

NCIP Reports publicly available



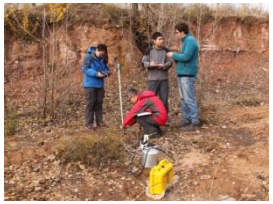




GA’s near surface monitoring research

GA-CO2CRC Ginninderra shallow controlled release facility (2012-2015)

GA-CSIRO Arcturus atmospheric monitoring project (2010 – 2014)

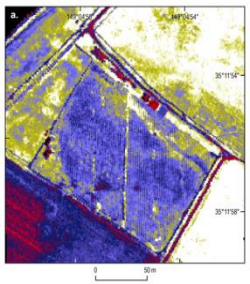
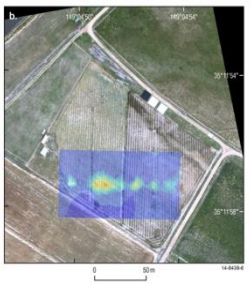


GA-China Geological Survey natural seep and Ordos surveys (2014)

Great Artesian Basin Hydrogeology Atlas (published in August 2015)

Ginninderra –techniques trialled to date

- Soil gas
- Soil flux
- Soil analysis
- Atmospheric tomography
- Scanning laser
- Eddy covariance
- Tracer studies (soil gas and atmospheric analysis)
- Ground penetrating radar
- Airborne CO_2 detection using a rotorcraft UAV
- Electromagnetic surveys
- Airborne hyperspectral and thermal imaging
- In-field phenotyping (hyperspectral, thermal, 3D imaging)
- Microbial soil genomics
- Plant biochemistry and physiology



Ginninderra Data

- Data from 3 sub-surface releases publicly available
- 2GB data from over 20 monitoring techniques
- Comprehensive metadata
- Can be downloaded from www.ga.gov.au/Ginninderra

CO_2 and methane emissions quantification study

- “Blind Release”
- Methane, CO_2 and N_2O release
- 8 weeks in 2015

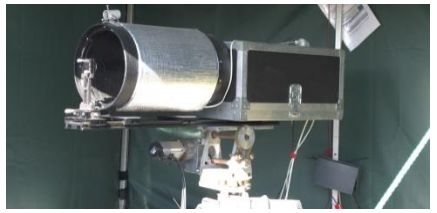
Experimental aim

- Simultaneously evaluate 6 different approaches for quantifying emissions
  - Tracer ratio technique (e.g. N_2O, ethylene)
  - Backwards Lagrangian stochastic modelling
  - Atmospheric tomography using point sensors
  - Atmospheric tomography using line sensors
  - Eddy covariance
  - Plume traverse techniques
- Test new CH_4 and CO_2 mobile detection platforms

Technologies trialled

- 2 scanning Open path FTIRs
- 2 Boreal tunable diode lasers
- 2 Picarro CRDS
- 5 eddy covariance towers
- Los Gatos CDRS on trolley
- Unmanned aerial vehicle
- 2 ground robots
- 1 Picarro in vehicle
- Vertical scanning laser





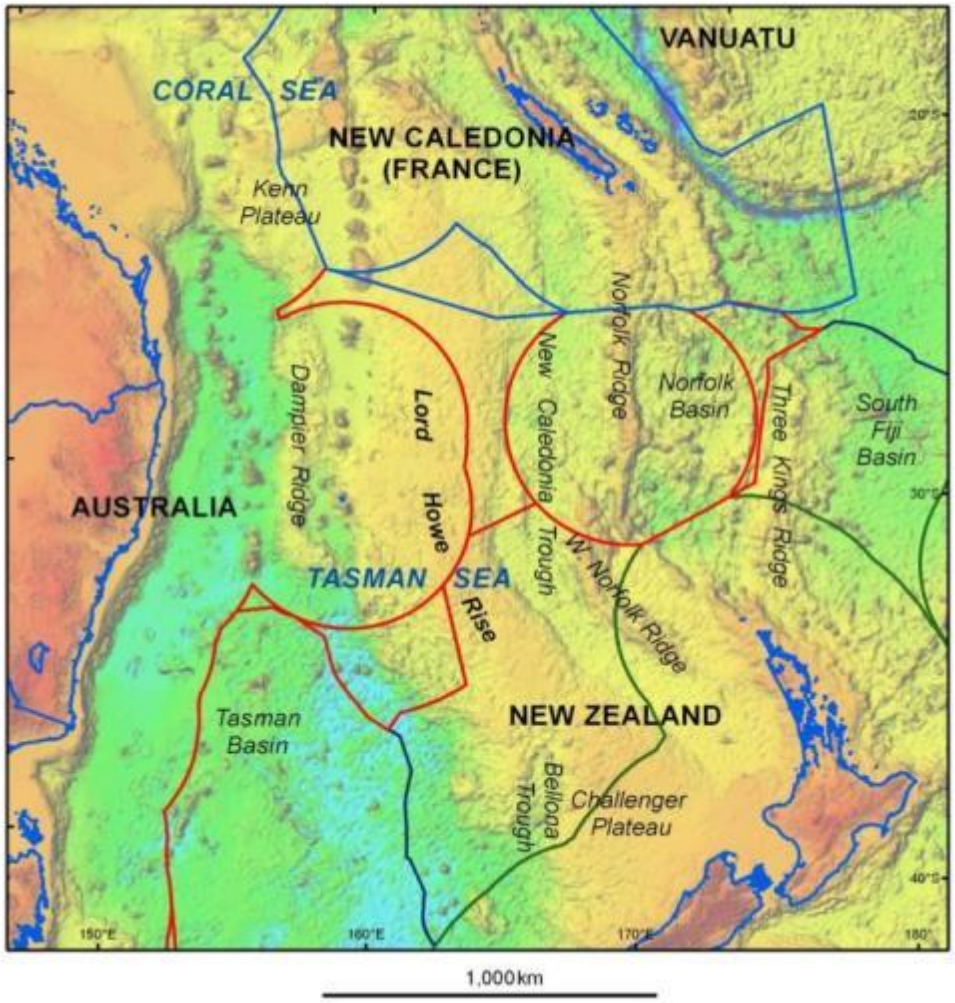
Results

- Majority of blind estimates within 20% of true release rate
- Majority of revised estimates within 10%
- Tracer ratio technique the `winner´
- How realistic are 5% legal or market requirements for emissions accuracy?

GA's basin prospectivity and CCS program 2015-2018

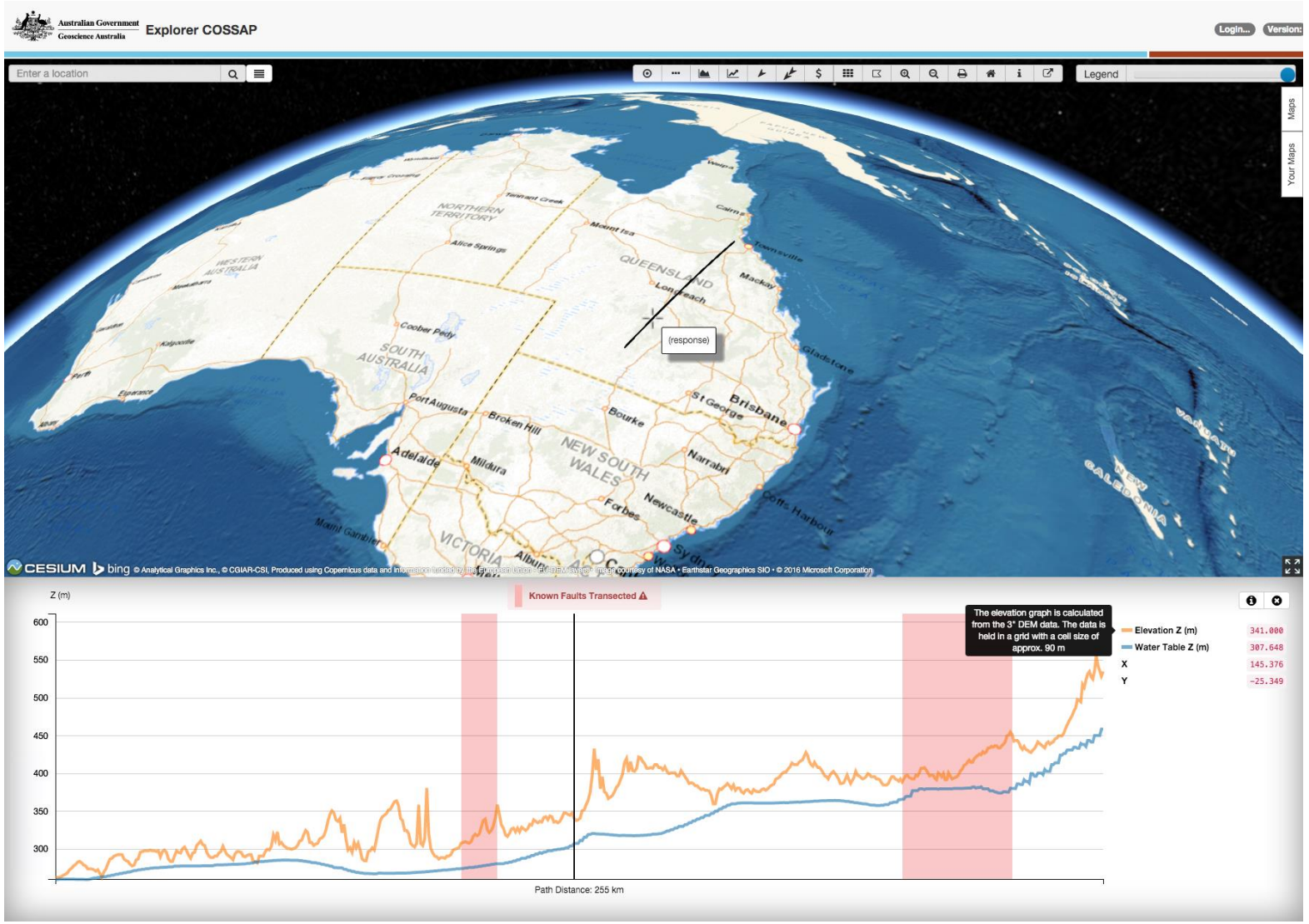
- **Lord Howe Rise project**
  - exploring an offshore basin
- **China-Australia Geological storage of CO_2 project – Phase 3 (CAGS3)**
  - further develop geological storage research capacity in Australia and China through scientific exchanges and joint research
- **CCS Subsurface Assessment Project (COSSAP)**
  - web-based capability to support the evaluation of CO_2 geological storage potential
- **CO2CRC Projects**

Lord Howe Rise: Sparse scientific knowledge



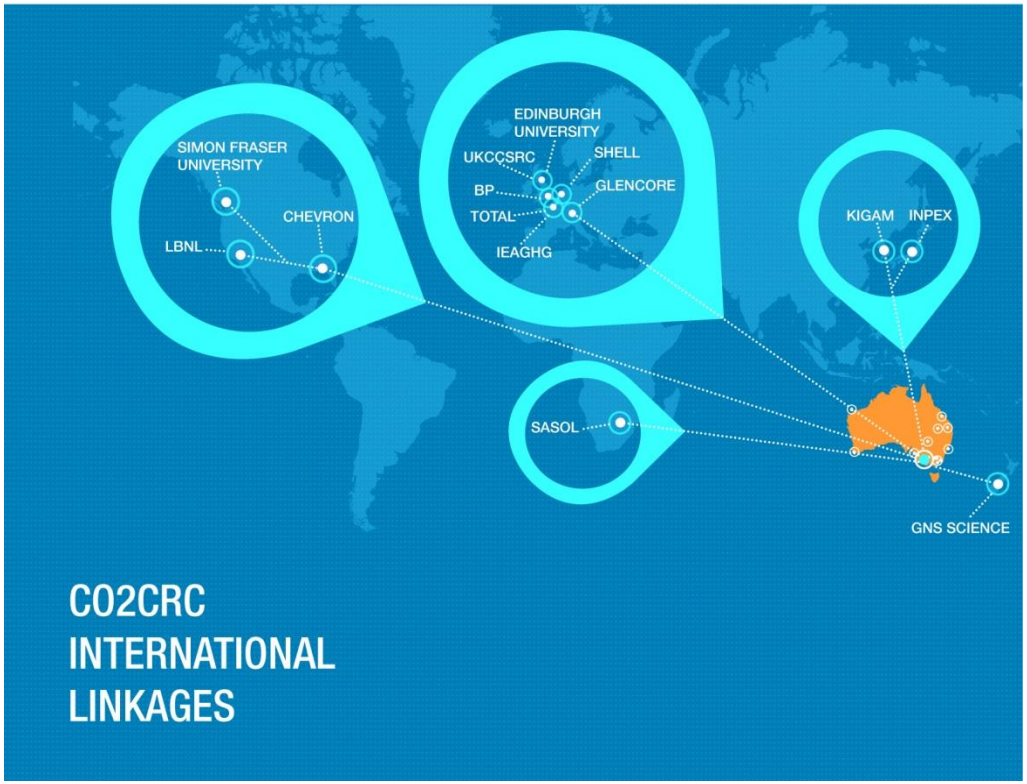
- 3,000,000 sq.km
- Covers marine jurisdictions of three countries
- Very large geologic frontiers
- Multiple basins
- Many fundamental science questions + CO_2 storage potential?
- Prep. survey work for a deep stratigraphic well

COSSAP



GA and the CO2CRC

- CO2CRC leading organisation for CCS research worldwide
- GA is a member of the CO2CRC Ltd, a not for profit company
- GA leading two projects at Otway site:
  - Geomechanics
  - CO_2 migration and monitoring



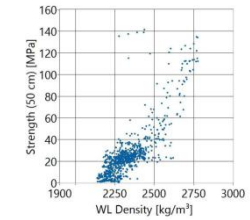
SRD 1.1 Fault Seal Integrity Characterisation

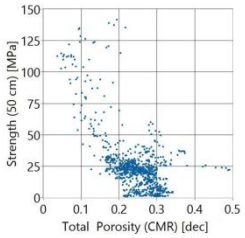
- Workflows to predict various fault properties (ie. strength, hydraulic properties)

Methodology

Scratch, triaxial testing

Correlation to wireline data, drilling data

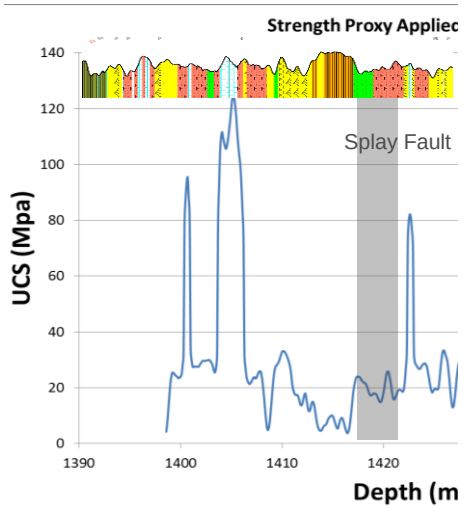




Proxies for fault properties

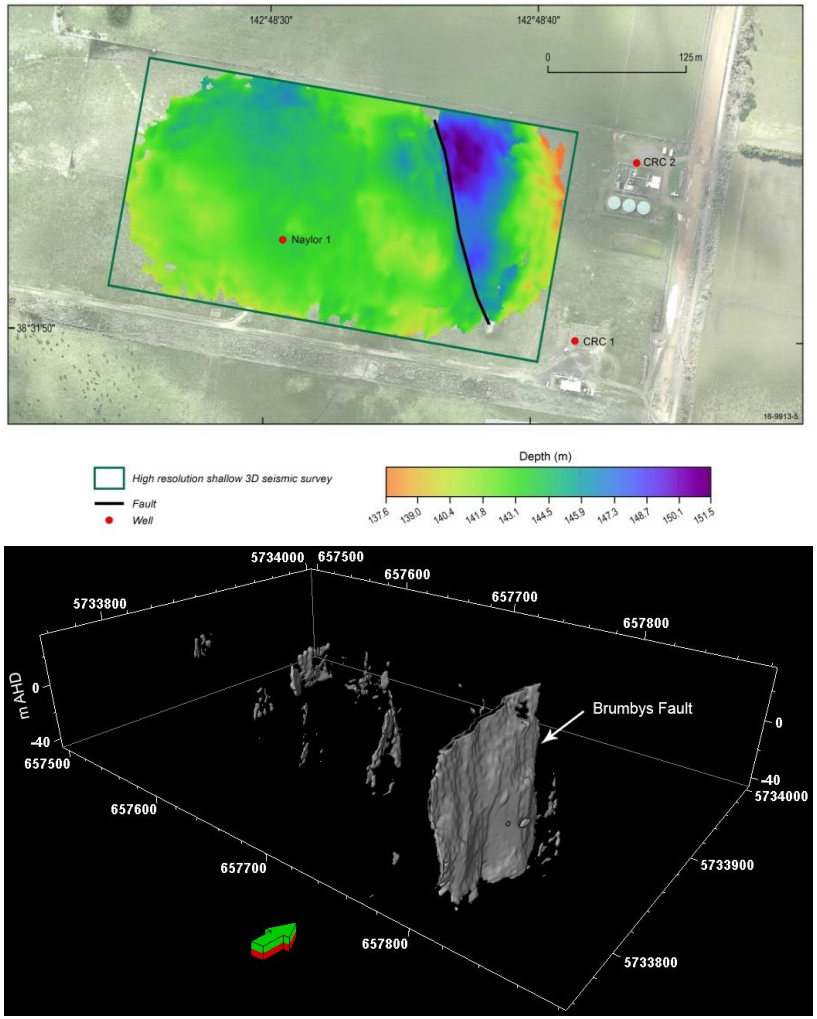
Strength= -320-(1.42 PEF)+ (0.15 ρ)-(13 ϕ)

Better fault models!



SRD 3.3 Prediction and verification of shallow CO_2 migration

- Identified shallow fault at CO2CRC Otway site
- Planning a shallow fault injection experiment in 2019
- Image CO_2 migration up a fault
- Generate data to test fluid flow models
- Test shallow CO_2 monitoring strategies



Summary

- Australia has a fossil fuel intensive economy
- Pursuing low emissions technology, including CCS
- GA's NCIP storage prospectivity programme complete
- GA's CO_2 monitoring research programme complete
- Good storage potential offshore, especially in the Gippsland Basin
- Monitoring methods ready for quantifying leakage, in unlikely event it should occur
- Ongoing CCS research through partnership with CO2CRC