

Australian Government
Geoscience Australia

Australia overview

emerging energy projects and precompetitive data



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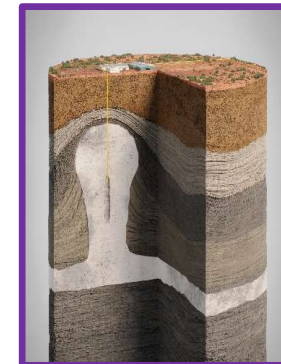
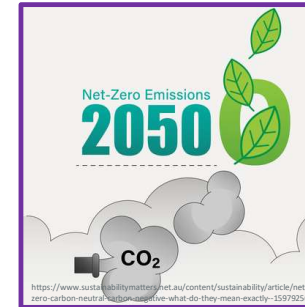


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Australia's energy transition

- ❑ **Commitment to reach net-zero by 2050**
- ❑ **To accelerate energy transition, 43% reduction in emissions by 2030 now legislated**
- ❑ **Support for rapid expansion of renewable energy sources (wind, solar, CCS, hydrogen, geothermal)**
- ❑ **Natural gas flagged as important enabler to meet energy transition targets**
- ❑ **Research that investigates feasibility of hydrogen production/storage, CCUS and geothermal energy ramping up**



2021 offshore acreage release for Greenhouse Gas (GHG) storage

- Five offshore areas released in December 2021 for assessment of greenhouse gas storage potential
- Work program bidding round closed March 2022
- Release areas are supported by a wealth of geological data
- Multiple bids received for each area
- Five new permits awarded in August 2022

BONAPARTE BASIN

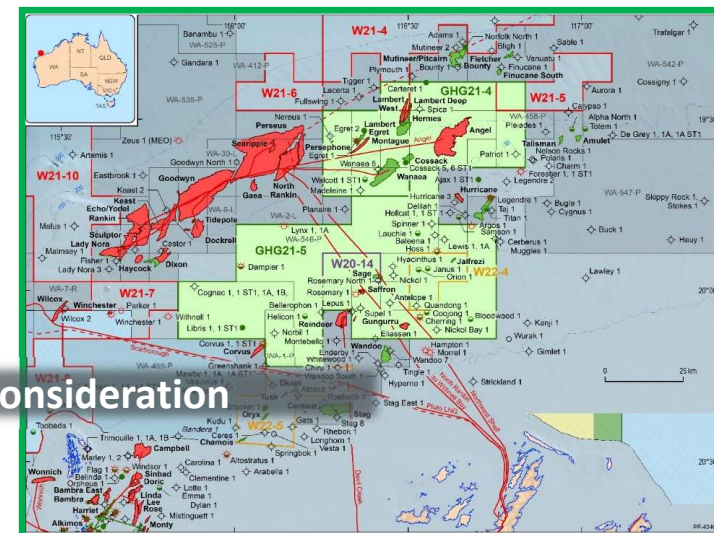
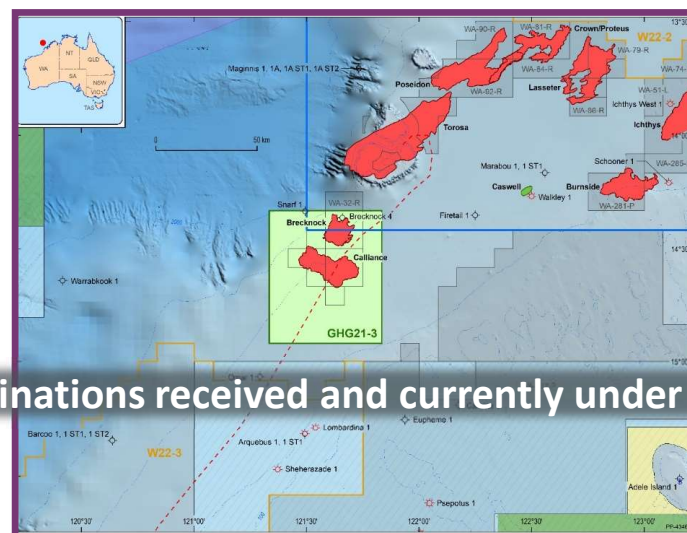
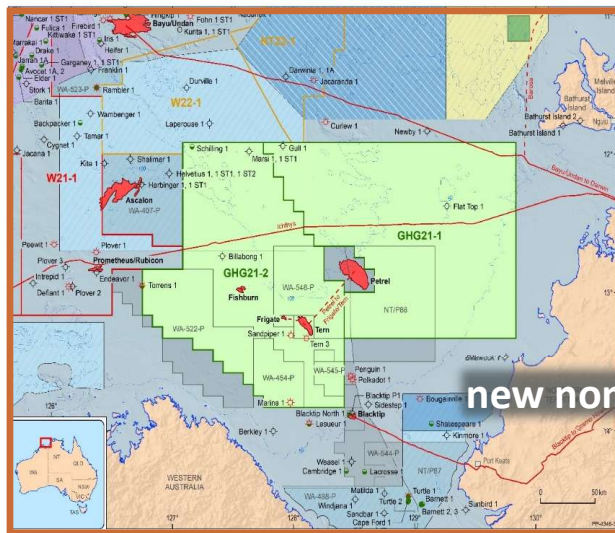
- GHG21-1: G-7-AP (INPEX, Total, Woodside)
- GHG21-2: G-11-AP (SANTOS, Chevron)

BROWSE BASIN

- GHG21-3: G-8-AP (WOODSIDE)

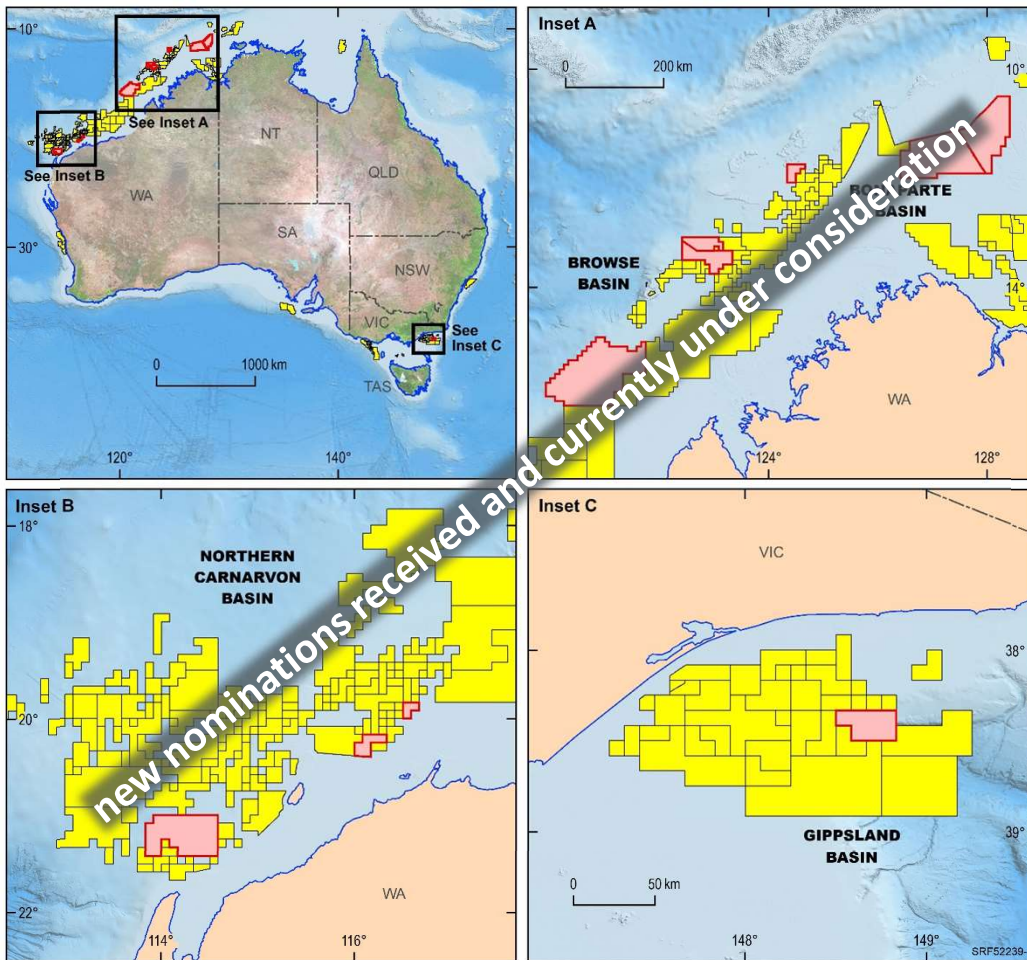
NORTHERN CARNARVON BASIN

- GHG21-4: G-10-AP (SANTOS, Woodside, BP, Chevron, Shell)
- GHG21-5: G-9-AP (SANTOS, Chevron)



new nominations received and currently under consideration

Current offshore petroleum permits and 2022 release areas



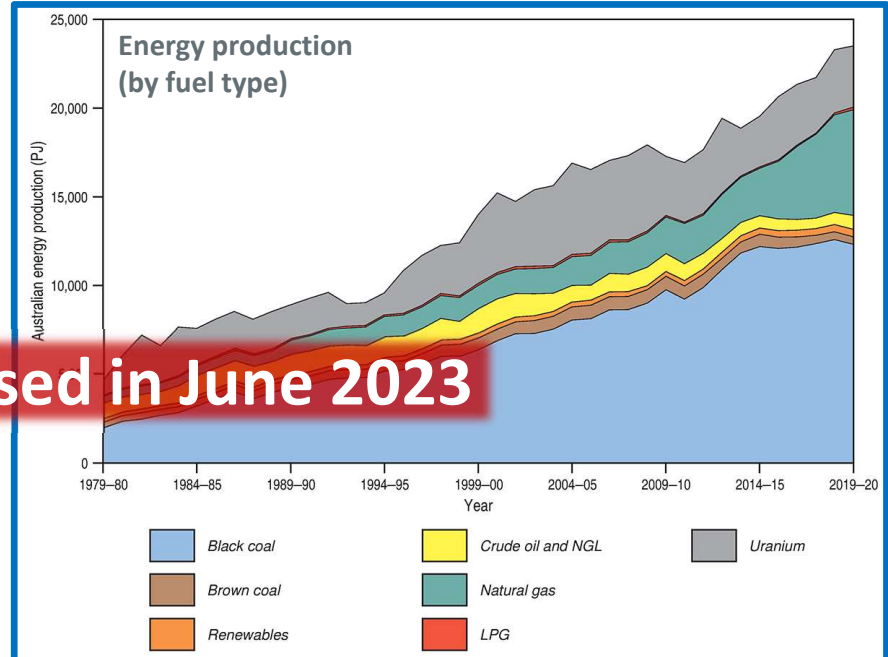
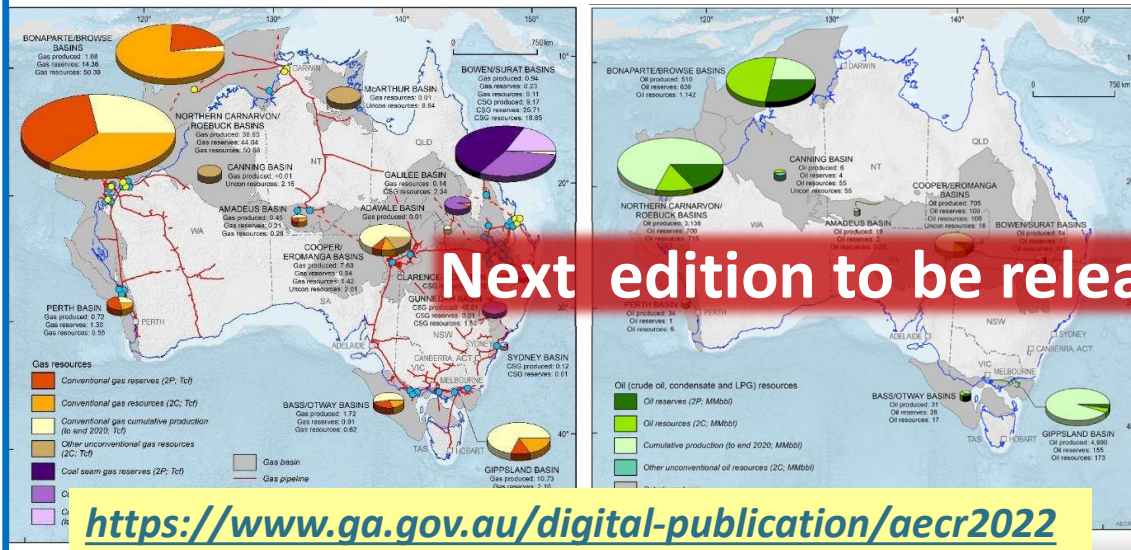
- 31 nominations received, 10 areas submitted for public consultation, 10 areas released
- In 2022, majority of areas located in the Bonaparte and Browse basins
- Underexplored areas in Bonaparte Basin (Malita Graben) and Browse Basin (Barcoo Sub-basin)
- Only one area released outside NW Shelf: eastern Gippsland Basin

**Closing date for bid submission:
Thursday, 2 March 2023**

Australia's Energy Commodity Resources (AECR)

Remaining gas reserves (2P) and contingent resources (2C)

Remaining oil reserves (2P) and contingent resources (2C)



- **AECR provides volumetric estimates of the nation's energy commodity resources**
- **Resource estimates are grouped according to commodity type, reserves and annual production**
- **Includes data on H₂ and CCS**

Australia's Future Energy Resources (AFER) one of eight “Exploring for the Future” (EFTF) projects

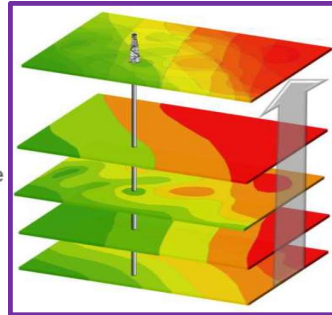
www.eftf.ga.gov.au

Evaluating the energy resource potential for Australia's transition to a low carbon economy

Module 1: Resource Assessments

- Gap analysis
- Play fairway mapping
- Prospective energy resource commodities

Module Leader: Barry Bradshaw



Module 2: Hydrogen

- Natural hydrogen occurrence
- Hydrogen storage
- Hydrogen Economic Fairways Tool

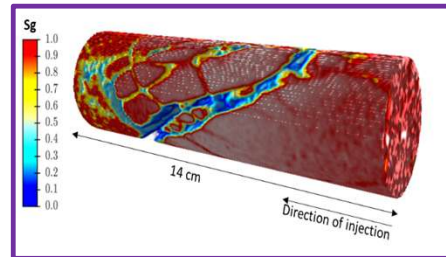
Module Leader: Andrew Feitz



Module 3: CO₂-enhanced oil recovery in residual oil zones

- Evaluation of depleted oil fields
- Identification of palaeo-oil columns
- Assessment of CO₂ storage potential

Module Leader: Aleks Kalinowski



Module 4: Basin Inventory

- Gap analysis – geological knowledge
- Recommendations for future work
- Evaluation of petroleum systems, including source rock characteristics

Module Leader: Lidena Carr



**AFER project is carried out in collaboration with
South Australia Department of Energy & Mining (SA DEM) and the Northern Territory Geological Survey (NTGS)**



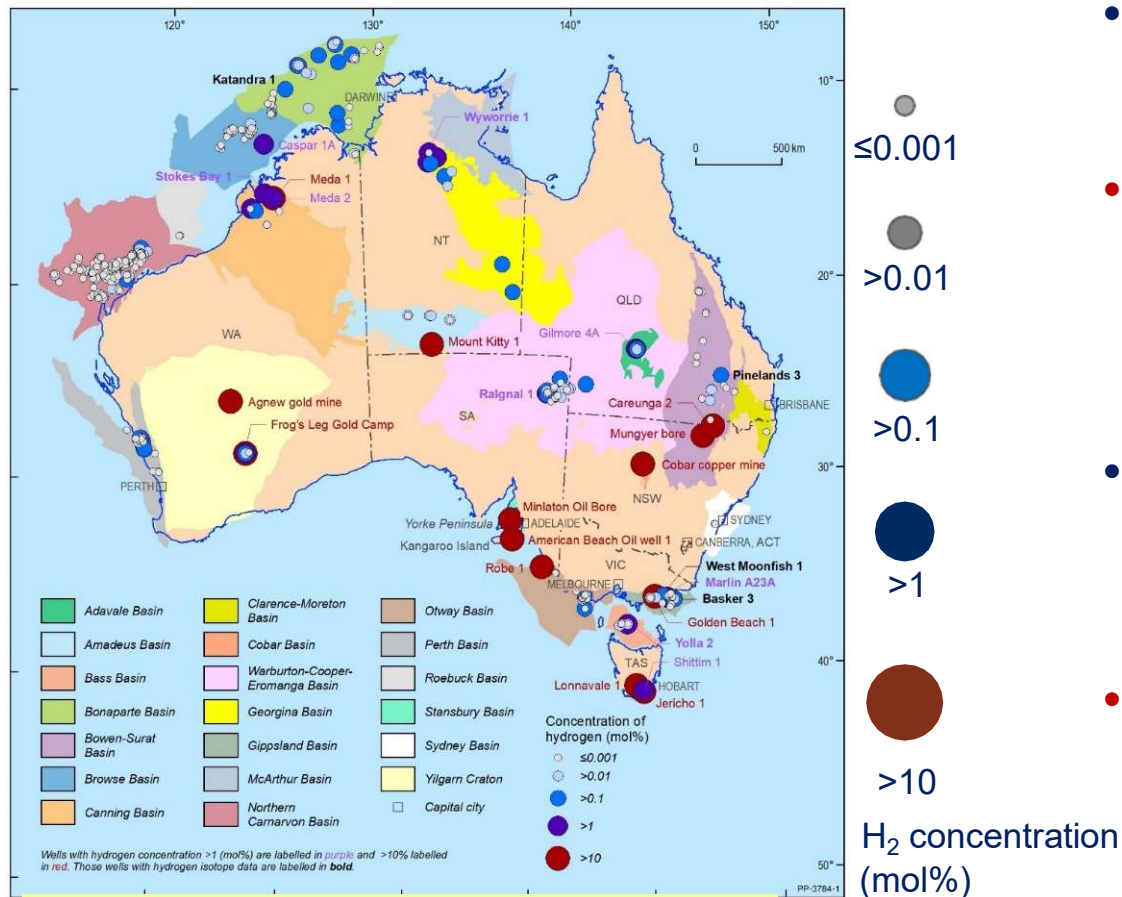
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AFER Module 2: Hydrogen

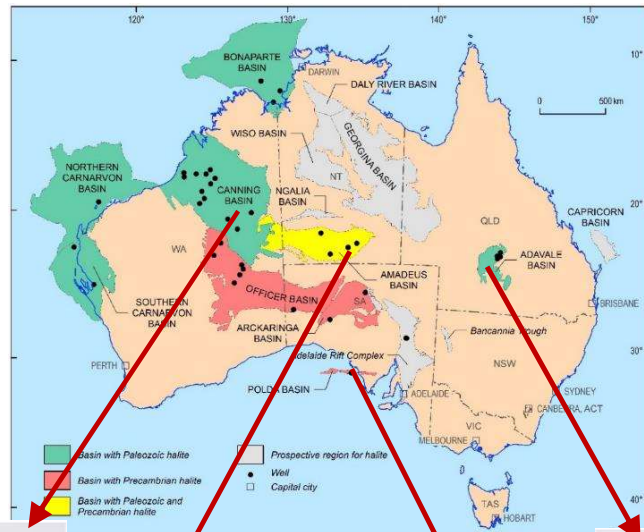
Location map showing exploration well, mine and groundwater samples with measurable concentrations of H₂ (mol%)



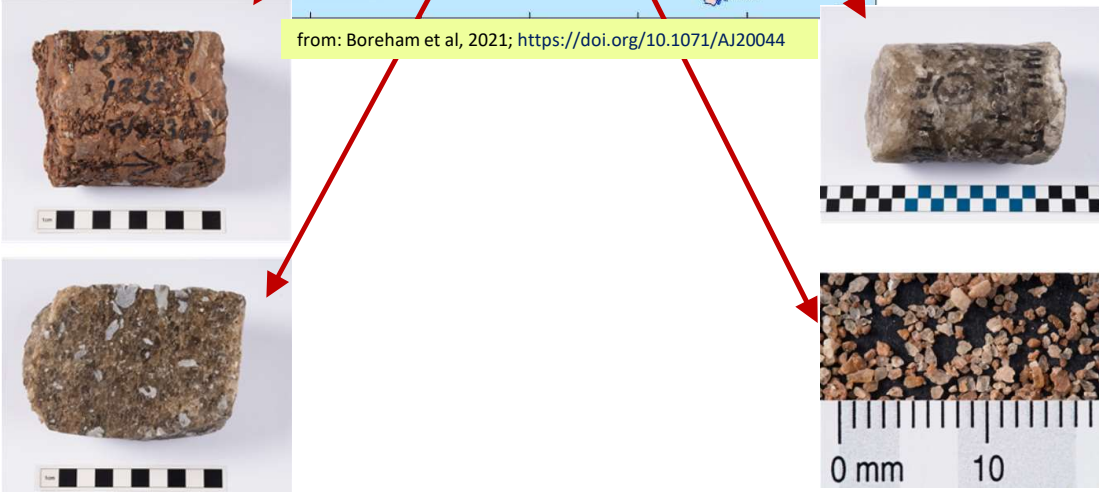
from: Boreham et al, 2021; <https://doi.org/10.1071/AJ20044>

- H₂-rich natural gases identified as early as 1917 (Yorke Peninsula; Kangaroo Island, SA)
- Geoscience Australia's laboratory identified ~1000 natural gases from 470 wells that penetrated Neoproterozoic to Cenozoic reservoir rocks with detectable H₂ levels of up to 91.9 mol%
- Gases with elevated H₂ contents a mixture of deep inorganic sources and decomposed organic matter at high maturities.
- Opportunity to discover natural H₂ in areas previously not targeted by petroleum exploration

Hydrogen: salt and salt storage



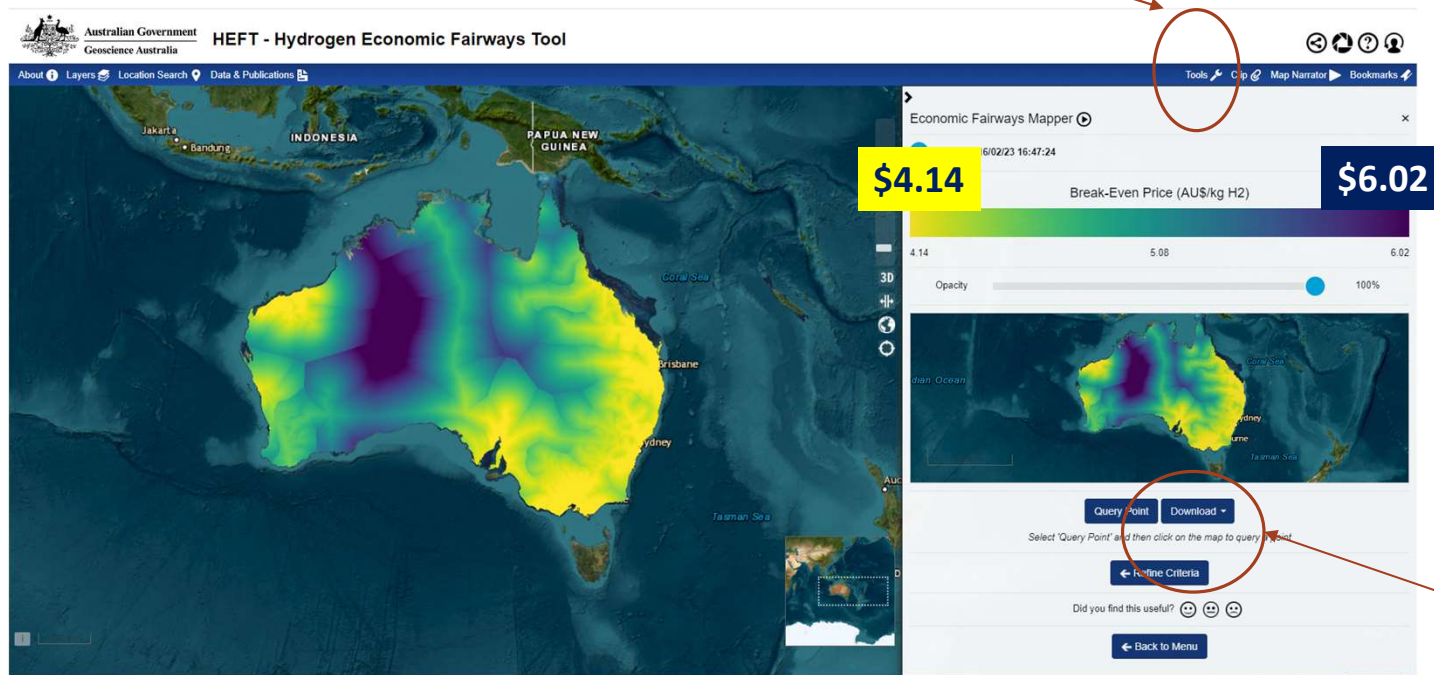
from: Boreham et al, 2021; <https://doi.org/10.1071/AJ20044>



- Naturally occurring hydrogen can be trapped within or below evaporite accumulations (perfect seal)
- Salt can act as buffer preventing reservoir breaching during prolonged tectonic activity
- Evaporites widely distributed across many sedimentary basins in Australia
- Salt accumulations provide excellent hydrogen storage potential (caverns)
- Important consideration for establishing hydrogen production centres
- AFER Module 2 activities include mapping of salt occurrences and assessment of suitability for H₂-storage (*work in progress*)

Hydrogen Economic Fairway Tool (HEFT) – gas + CCS example (break even analysis)

Access HEFT



Customisable inputs:

- AU\$12/GJ natural gas price
- Desalinated water
- 500 t H₂/day
- 25 year operating life
- Hydrogen sent to export port
- 5% company discount rate

Download GeoTIFF or PNG

ga.gov.au/heft

- *Target of \$2.00/kg H₂ not achievable at this point in time.*
- *Requires rapid expansion of renewable energy commodities and is forecast to be achievable by 2030.*

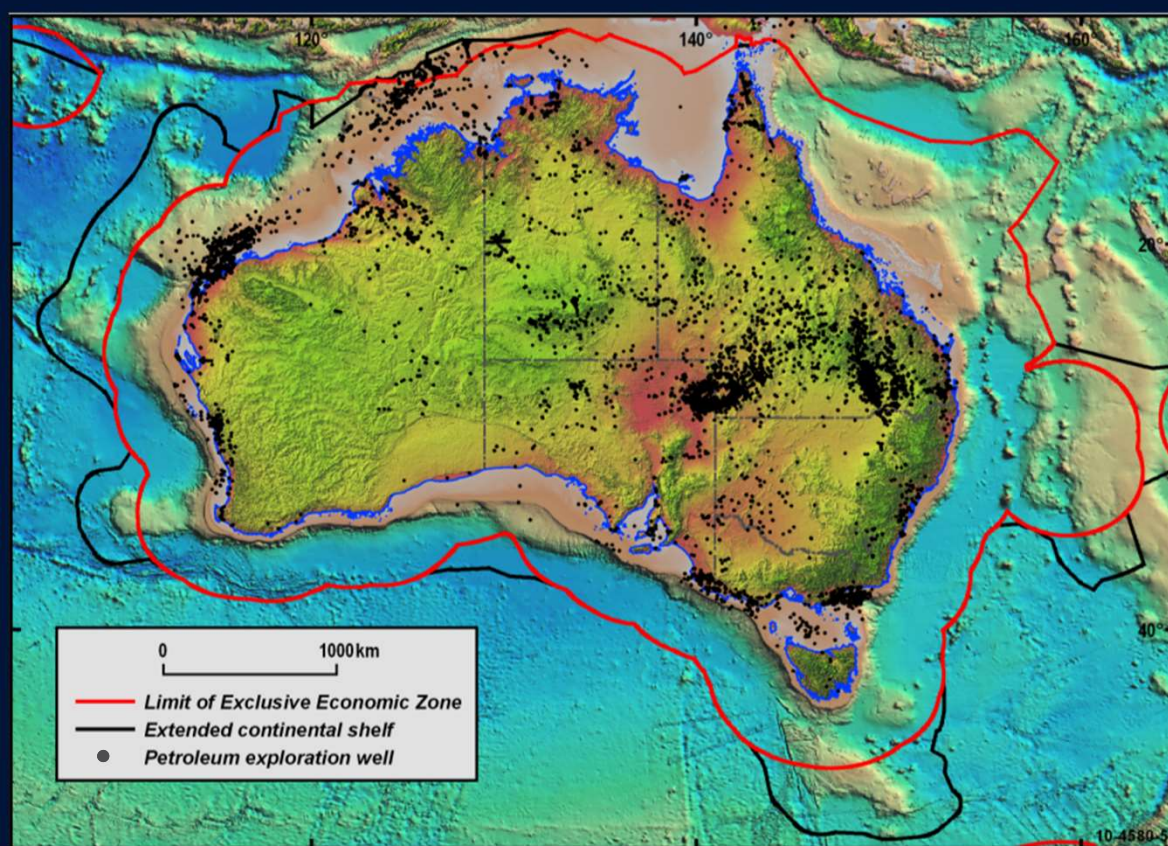
AUSTRALIA Energy Resources: *promoting investment opportunities*



AUSTRALIA Energy Resources is a collaboration, coordinated by Geoscience Australia, between government geologists and regulators across the nation's Commonwealth and State/Territory jurisdictions.

Its main purpose is to promote, domestically and internationally, emerging investment opportunities in Australia's energy projects, especially in those addressing the changing energy mix

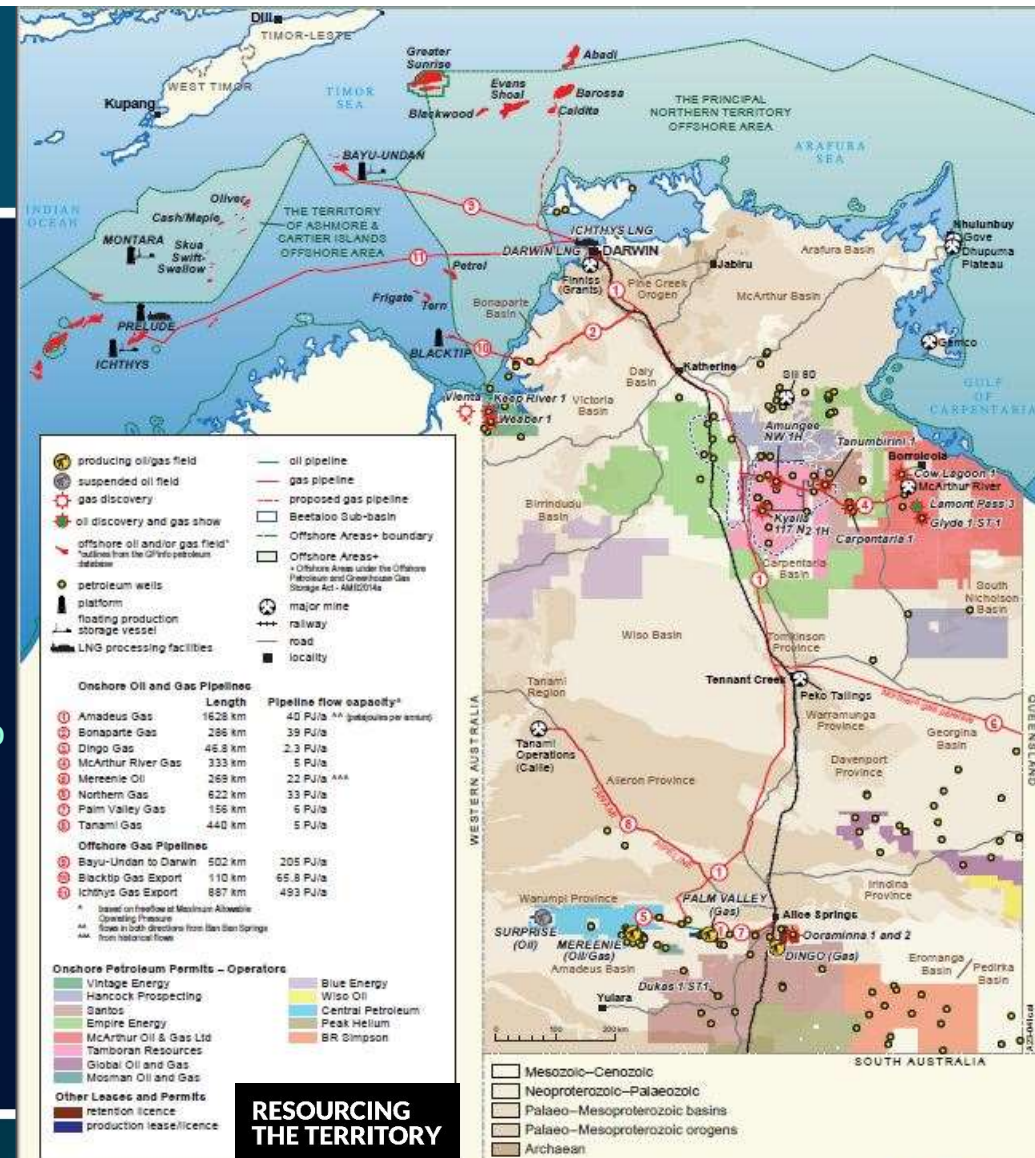
AUSTRALIA Energy Resources strongly supports the exploration for and development of those energy commodity resources that enable Australia's transition to a low emission economy.



AUSTRALIA Energy Resources: Northern Territory

Applying geoscience to support a low emissions future

- Resourcing the Territory program - \$9.5 million (Aus) ongoing funding from the NT government
- Provide pre-competitive geoscience, investment attraction and exploration stimulus programs designed to increase exploration activity and success rates, and open up new areas of the Territory for exploration
- Targeting the Territory's onshore basins for gas, hydrogen and CCS storage potential



AUSTRALIA Energy Resources: *Western Australia*

Oil & gas activities

Perth Basin - Large deep Permian sandstone gas discoveries continue:

- West Erregulla 2 and Beharra Springs Deep in 2019, followed by Lockyer Deep in 2021 (flowed gas at up to 117 MMSCFD in March 2022).
- In 2022 South Erregulla 1 gas discovery in Kingia sandstone and Wagina Formation sandstone.

Exploration acreage awards in 2022:

- EP503, 504 & 506 (Strike Energy) and EP507 (Energy Resources)
- Geothermal SPA AOs granted: GSPA 2 AO (Mid West Power) and GSPA 3 AO (Good Water Energy) in Perth Basin.
- EP 510 (Buru Energy & Energy Resources) in Northern Carnarvon Basin.

Canning Basin

- In 2022, Rafael 1 flowed ~4 to 5 million cubic feet per day gas from Ungani Dolomite, with ~ 20 to 30 barrels of condensate per million cubic feet of gas.

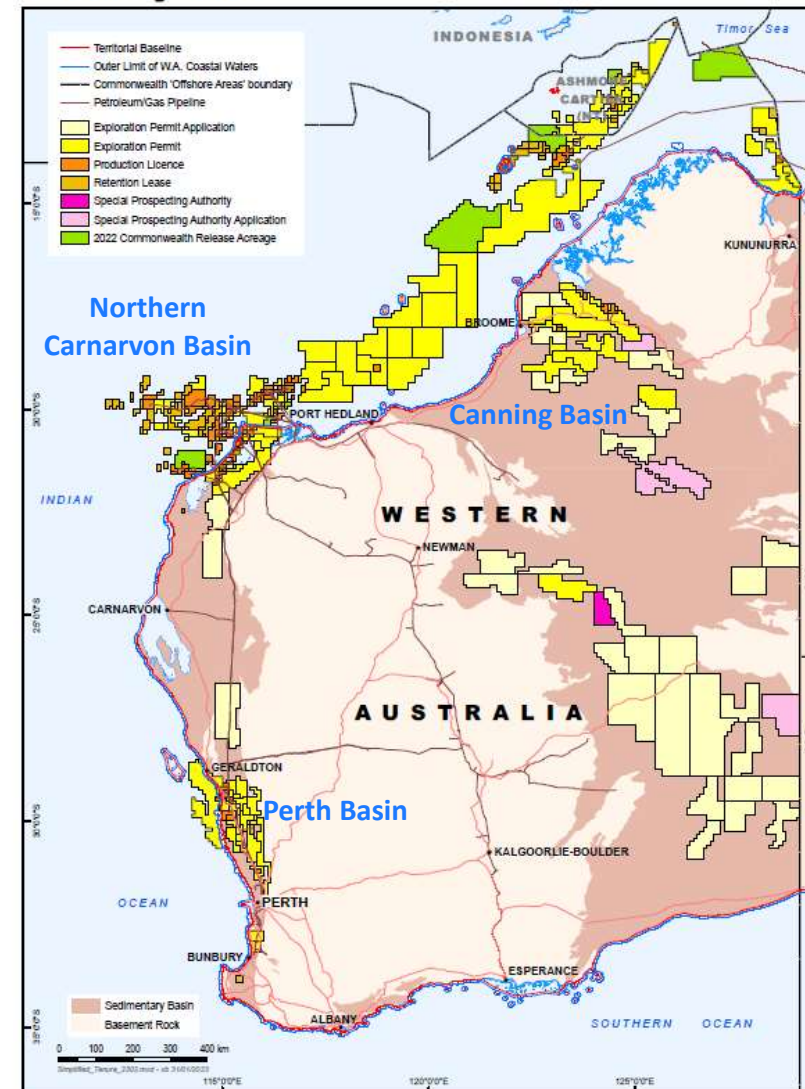
Draft Petroleum Legislation Amendment Bill

(Greenhouse Gas Storage and Transport) – released for consultation.

WA PETROLEUM TENURE

February 2023

Government of Western Australia
Department of Mines, Industry Regulation and Safety

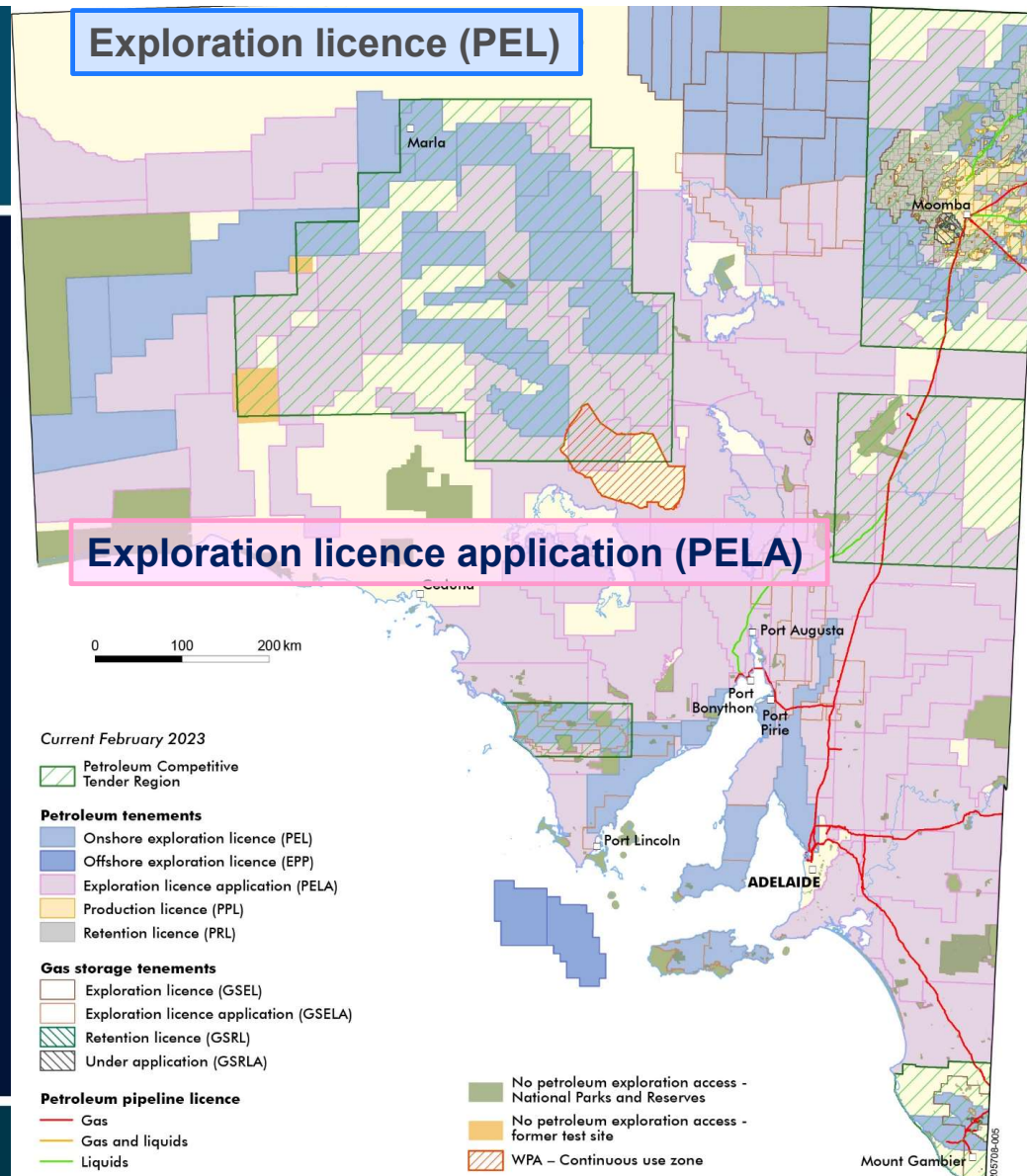


AUSTRALIA Energy Resources:

South Australia

Natural hydrogen exploration

- **South Australia offers explorers:**
 - Acreage positions up to 10,000 km²
 - Easy access to well and seismic data
 - Blue sky opportunities in frontier basins with oil and gas shows
 - Neoproterozoic-Cretaceous marine and non-marine plays
 - Effective natural hydrogen, gas storage and CCS licensing regimes are in place
- **Competitive tender basins**
 - Vacant acreage is only available via releases
 - Cooper and Otway basins – no current releases
 - New regions added last year - Arrowie, Poldia and Arckaringa basins
- **Over-the-counter applications**
 - Applications can be lodged at any time for non-competitive tender areas

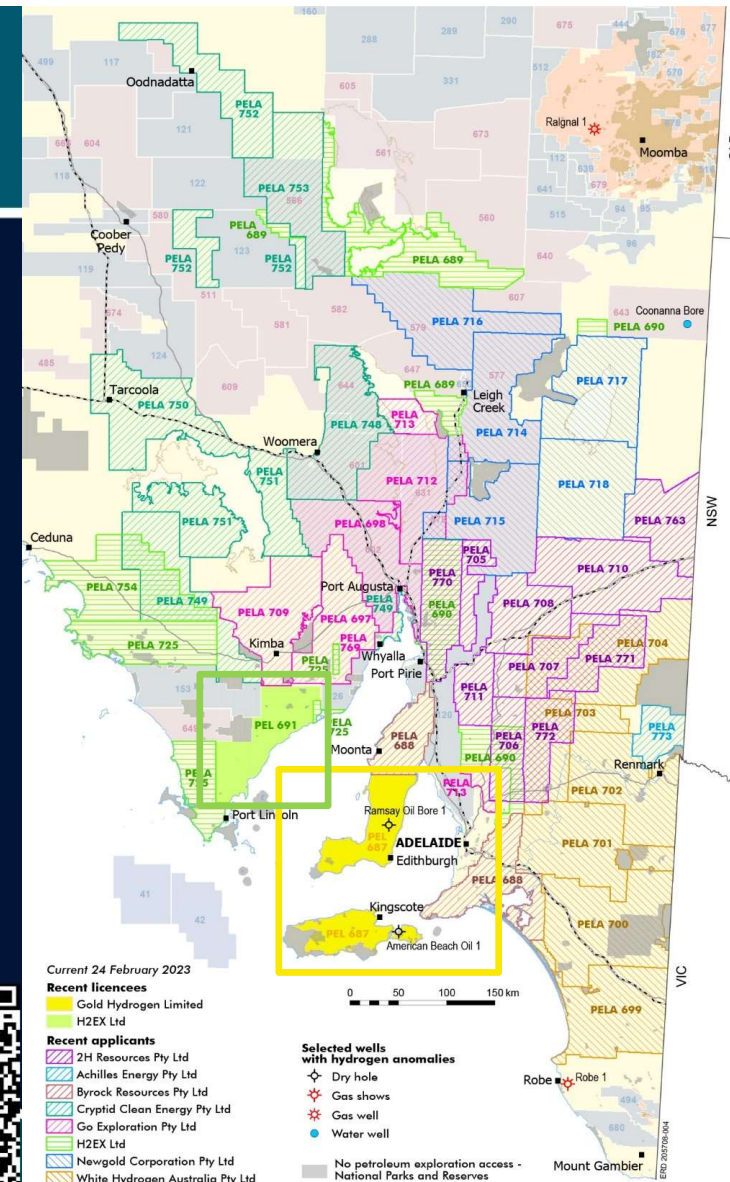


AUSTRALIA Energy Resources: *South Australia*

Oil & gas exploration licensing

- In February 2021 the definition of a 'regulated substance' in the SA Act was expanded to include "hydrogen, hydrogen compounds and by-products from hydrogen production".
- Companies can apply to explore for natural hydrogen via a Petroleum Exploration Licence (PEL) and transmit hydrogen via a Pipeline Licence.
- 40 PEL applications have been lodged by 8 companies targeting natural hydrogen.
- 1st PEL (687) was granted in July 2021 to Gold Hydrogen Pty Ltd. The company will commence low impact exploration soon (soil gas sampling and airborne geophysics) and are planning to drill an exploration well later in 2023.
- 2nd PEL (691) was granted to H2EX in June 2022. The company will commence soil gas sampling in Q1/2 2023
- A diversity of natural hydrogen plays will be tested by explorers.

For more information:



AUSTRALIA Energy Resources:

Victoria



Energy transition

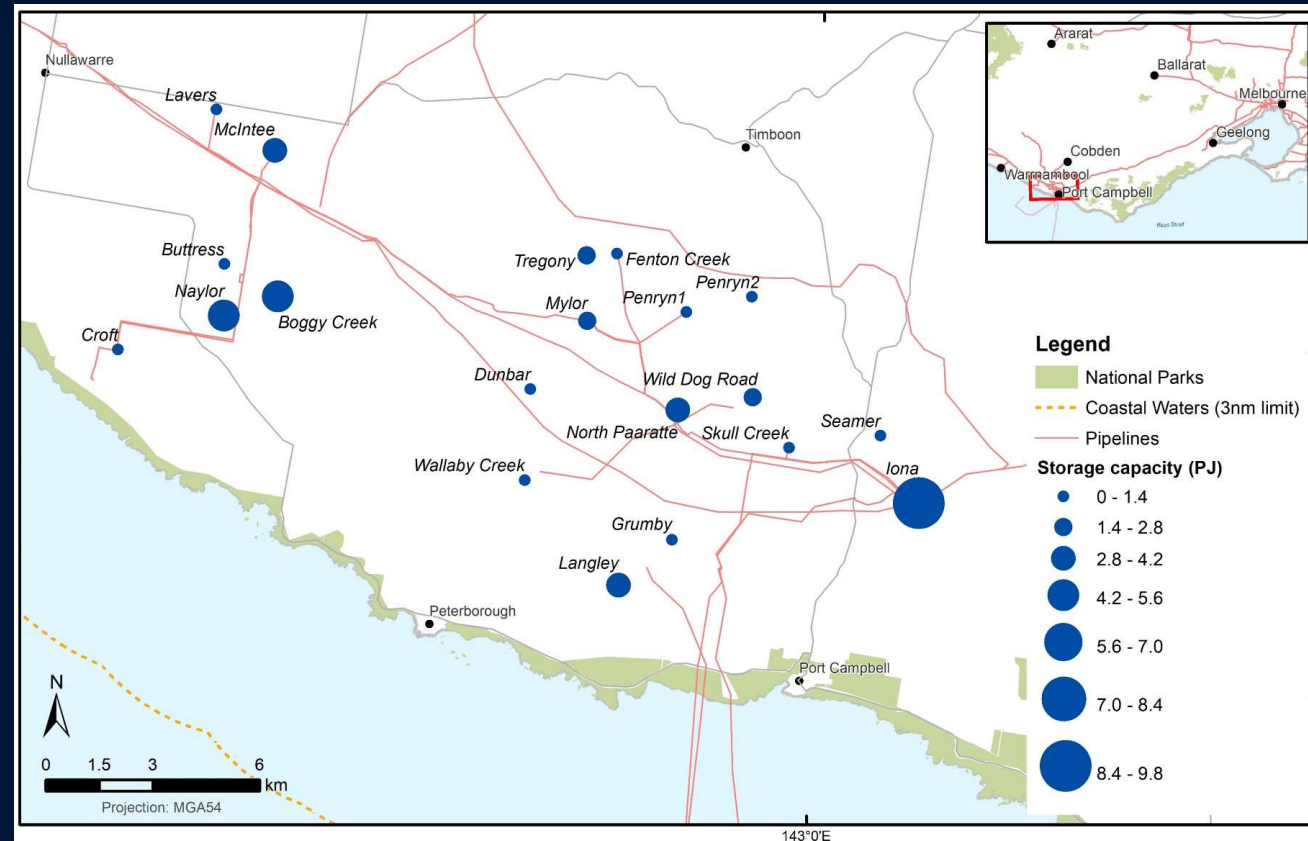
- Victoria will transition away from gas on the path to net zero by 2045
- There is a role for alternative gases such as hydrogen in the State's energy future
- Current projects include the Hydrogen Energy Supply Chain (or HESC) and CarbonNet
- Industry and research storage projects include GB Energy, Lochard Energy and CO2CRC.



AUSTRALIA Energy Resources: *Victoria*

Hydrogen potential

- The Geological Survey of Victoria (GSV) completed a preliminary investigation of underground hydrogen storage (UHS) potential of operating, depleted and unproduced gas fields in the onshore Otway Basin
- Injectivity, seal capacity and UHS capacity were assessed
- Geology is favourable for UHS with a working capacity of 120 Bcf (43 PJ).



AUSTRALIA Energy Resources: Key Contacts



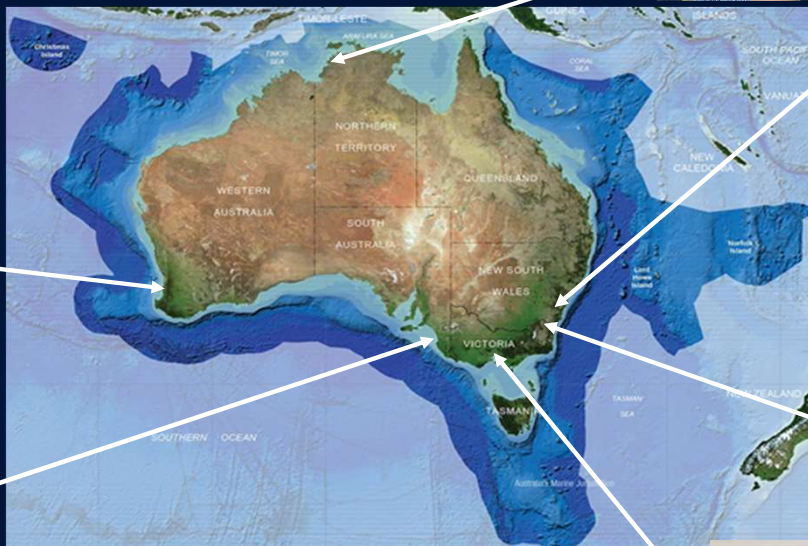
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