

# Australia's Energy Resources: adapting to change

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Explore  
**Australia.**



Australian Conservation Foundation

McKinsey & Company

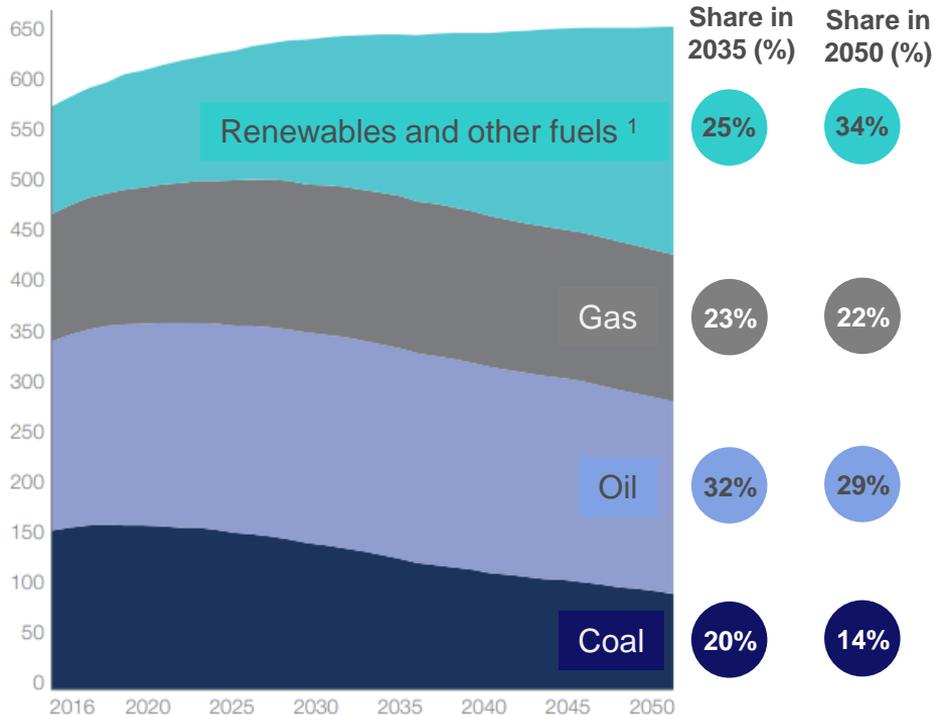
Investor Group on Climate Change

- Industry undergoing a major transition
- Appear prepared to take on emerging challenges
- Overall agreement that the way forward is to embrace low emission technologies
- Hydrogen and carbon capture, utilization and storage are hot topics
- Geoscience Australia and State/Territory Geological Surveys are well positioned to engage with industry and provide new regional-scale data/information in support of enabling Australia's energy transition

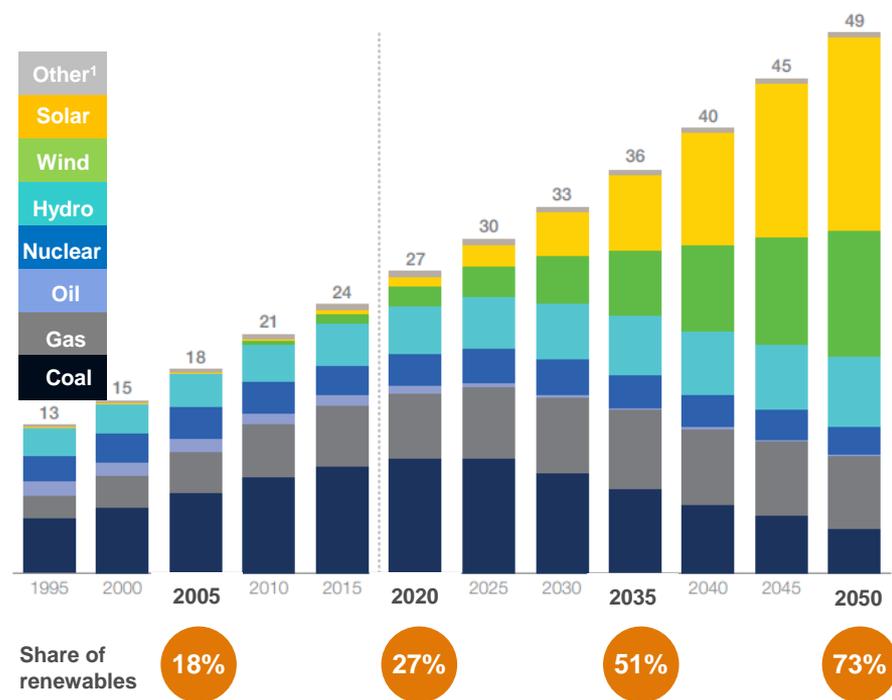


# Forecast global energy mix 2019 - 2050

## Primary energy demand per fuel (Million TJ)

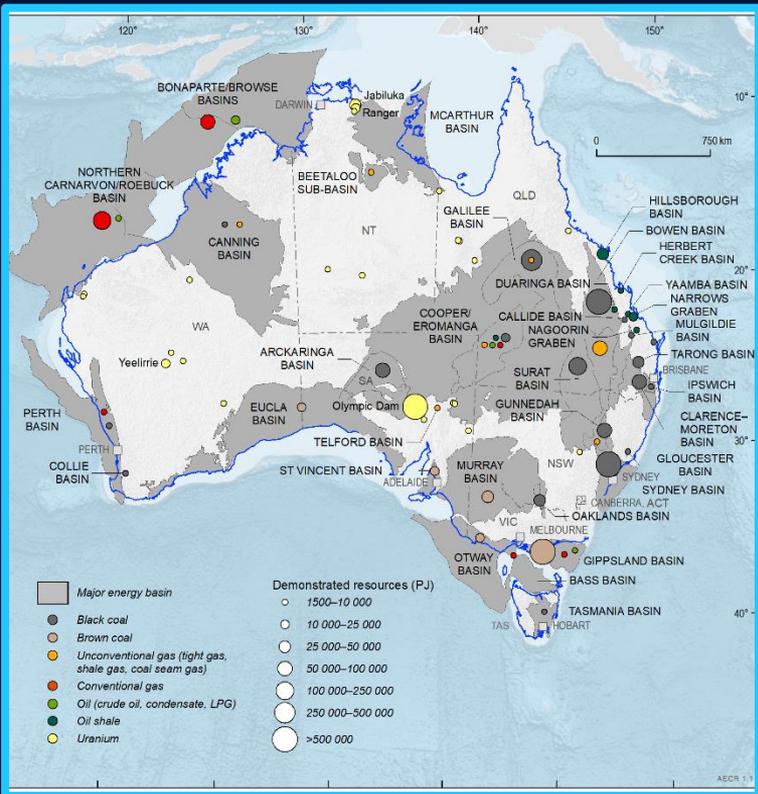


## Global power generation (Thousand TWh)



<sup>1</sup> Other includes biomass, geothermal and marine. Source: McKinsey Energy Insights' Global Energy Perspective, January 2019

# Australia's Energy Commodity Resources (AECR)

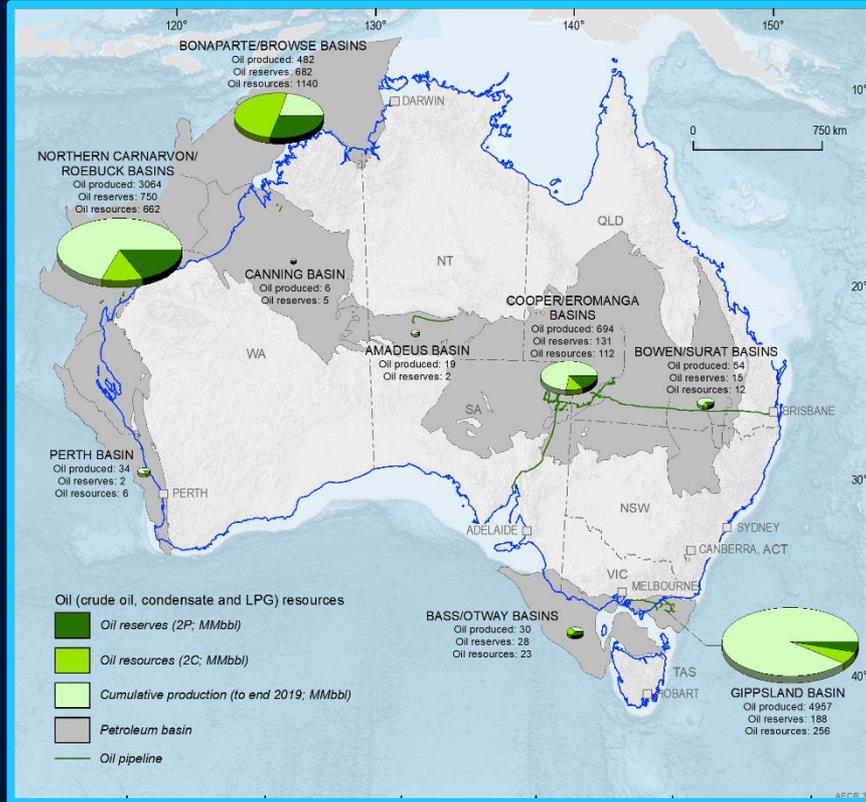


## Australian Energy Commodity Resources 2021 edition, Geoscience Australia

- AECR provides a synopsis of the distribution and scale of energy commodity resources across Australia
- Results show that Australia has abundant, high quality energy commodity resources that are expected to last for several decades
- Coal and coal seam gas resources in Eastern Australia
- Natural gas and oil on North West Shelf
- Uranium in South Australia (Olympic Dam)

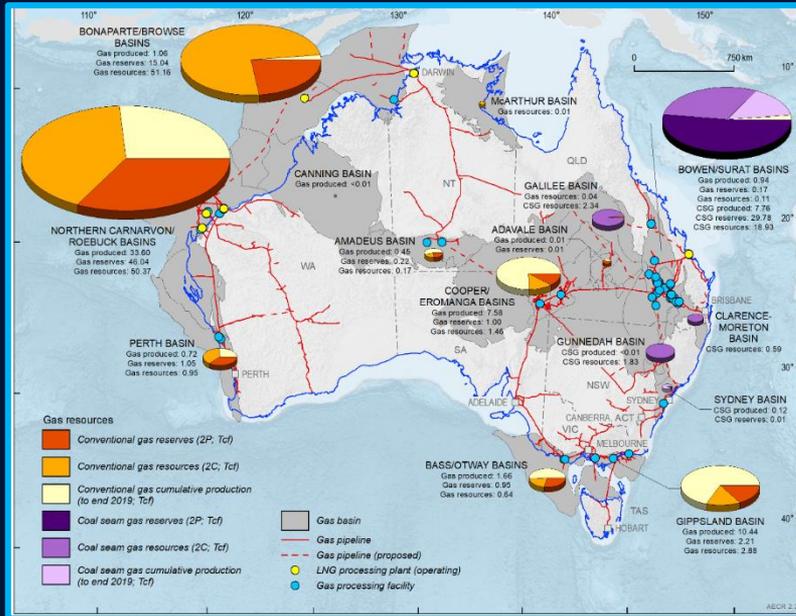
[www.ga.gov.au/digital-publication/aecr2021](http://www.ga.gov.au/digital-publication/aecr2021)

# Australia's Remaining Oil Resources (2019)



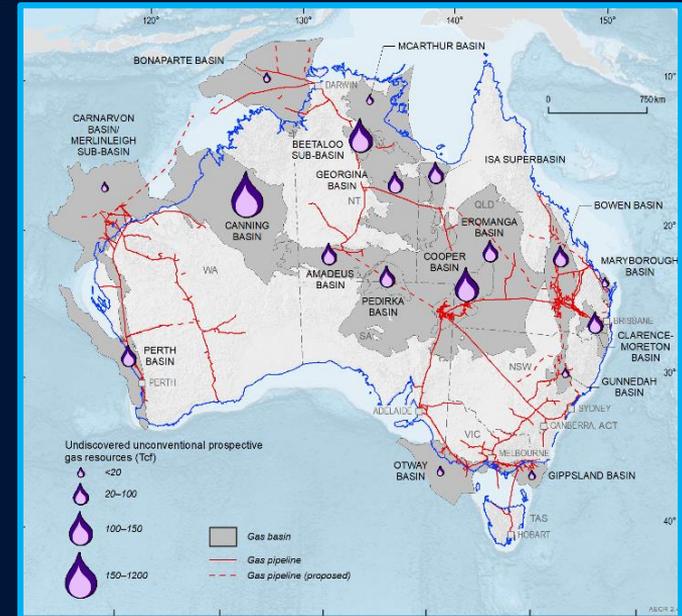
- Australia's oil resources (crude, condensate & LPG) are depleting faster than they are being replenished (5% decline in 2019)
- Remaining oil resources in 2019:
  - 2P reserves = 1,803 MMbbl;
  - 2C resources = 2,210 MMbbl;
  - Resource life = 30 years
- Condensate represents about 70% of our remaining oil resources
- 80% of remaining oil resources located in basins on the North West Shelf

# Australia's conventional and unconventional gas resources (2019)



93 per cent of conventional gas resources are located on the North West Shelf

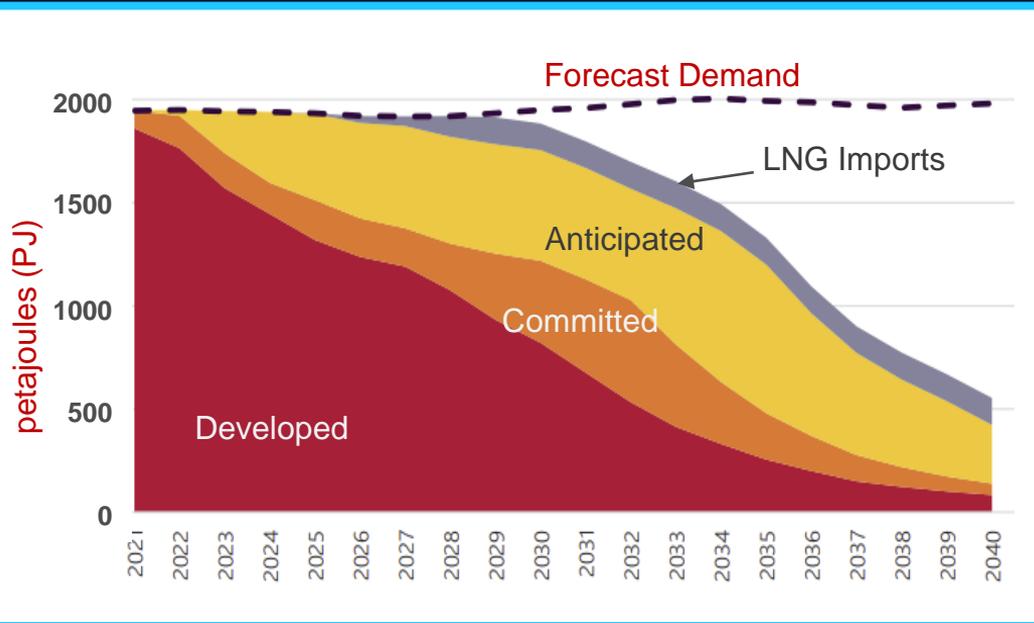
Large coal seam gas reserves in eastern coal basins (2P: 29.8 Tcf)



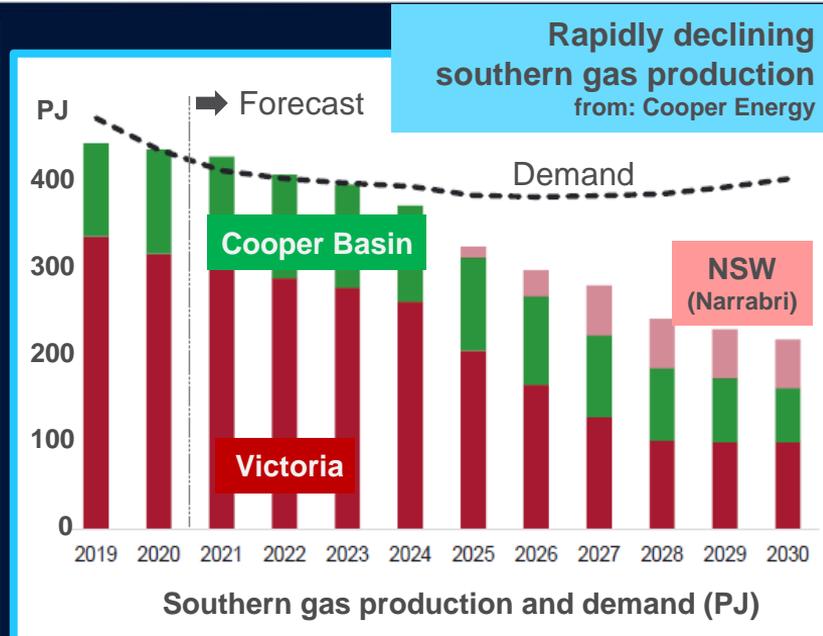
Large untapped unconventional gas potential in several basins

First production testing in Beetaloo Sub-basin completed by Origin Energy

# Predicted gas shortfall – SE Australia



Projected eastern and south-eastern Australia gas production (including export LNG), existing, committed and anticipated developments, 2021-2040



Rapidly declining southern gas production from: Cooper Energy

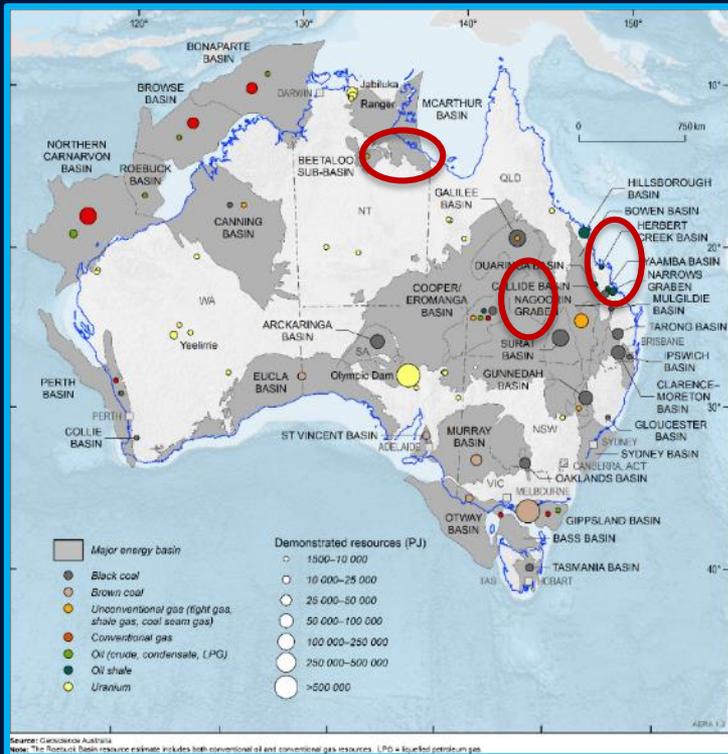
- Declining Victorian production a key driver of expected gas supply shortages
- Expected supply shortfall of 60PJ by 2025

# Government initiatives

- Post-Covid 19 response to stimulate economy
- Secure and stable energy supply to enable expansion of domestic manufacturing
- Accelerate the transition to a low carbon economy
- Establish a world class hydrogen export industry
- Strong focus on natural gas as the “ENABLER”

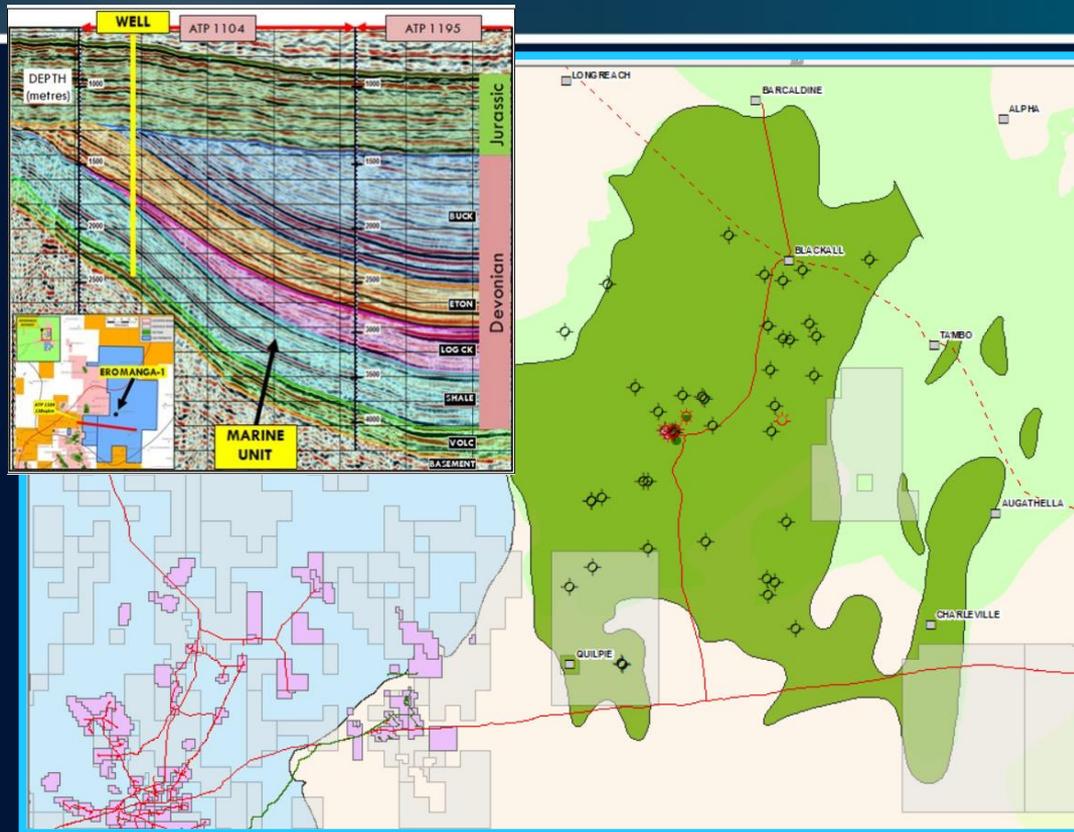


# The Strategic Basins Plan



(from: AECR, 2021 edition, Geoscience Australia)

- Part of “gas-fired economic recovery”
- Focus on gas-supply for eastern Australia as well as job creation to expand infrastructure and manufacturing capabilities
- Basins selected according to resource availability and proximity to existing infrastructure
- First three of five basins announced
  - Beetaloo Sub-basin (work completed)
  - North Bowen/Galilee Basin (work in progress)
  - Cooper/Adavale basins (work in progress)
- Through a government directive, Geoscience Australia will take on the responsibility to support the Strategic Basins Plan by providing trusted environmental and geological information
  - Baseline assessments
  - Possible impediments to resource development
- Remaining two basins to be announced



## Status:

- Confirmed as prospective with one produced gas field, the Gilmore gas field, discovered in 1964.
- Untested conventional plays include Devonian reefs and salt structures.

## Plan:

- Updates geological framework
- Resource Assessment
- Evaluate salt occurrences for hydrogen storage

# Government initiative: “Exploring for the Future”



Exploring for the Future (EFTF): Attracting investment into the exploration for and the development of Australia’s mineral, groundwater and energy resources . Four of eight projects are focussed on energy commodity resources



Continental-scale project applying a wide range of geoscientific disciplines to improve the knowledge of Australia's mineral, groundwater and energy systems

Australia’s Resources Framework



Evaluation of the energy and minerals potential of the Officer Basin and groundwater occurrence in the Musgrave Province. These regions are represented by the deserts of central Australia

Officer-Musgrave



Evaluation of prospectivity and energy resource potential of key underexplored onshore basins with an initial focus on central Australia

Australia’s Future Energy Resources



Adding value to energy, mineral and groundwater investigations previously undertaken in this region of NE-Australia

Barkly – Isa - Georgetown

[www.ga.gov.au/efft](http://www.ga.gov.au/efft)

# Australia's Future Energy Resources (AFER)

## Evaluating the resource potential for Australia's future energy requirements

**GAS (OIL)** defining new petroleum systems

**GREEN HYDROGEN** utilisation of renewable energy

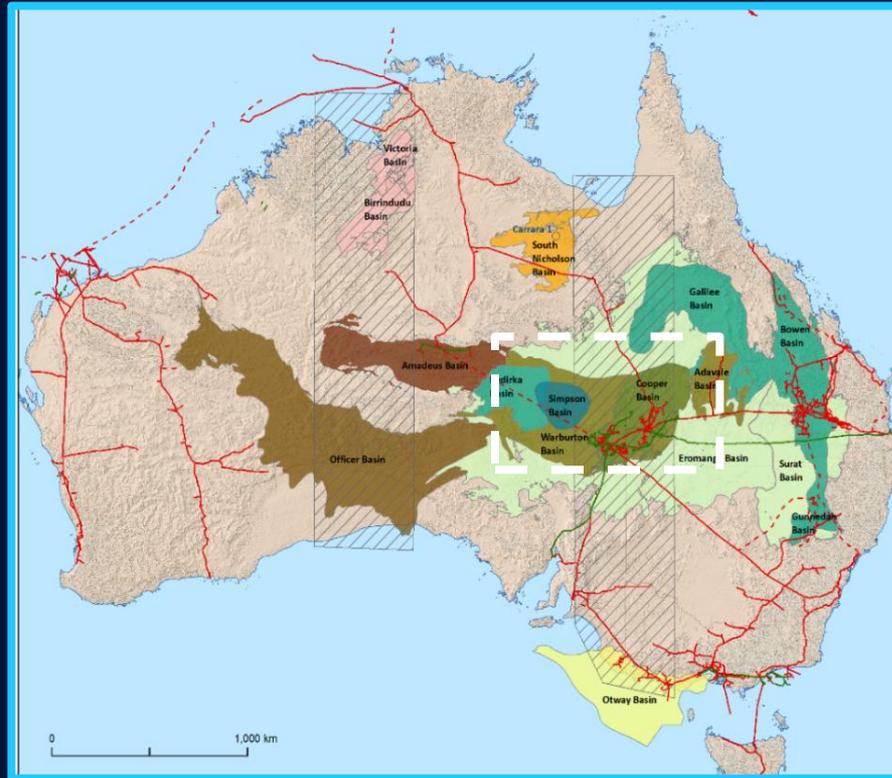
**BLUE HYDROGEN** petroleum systems + CCS

**OIL** utilising CO<sub>2</sub> for enhanced oil recovery

## Where?

**Central Australian basins**

Eromanga, Simpson, west Cooper, Pedirka, Warburton



# Australia's Future Energy Resources (AFER)



## Module 1: Resource Assessments

- Well failure analysis
- Play fairway mapping
- Prospective resources (“yet-to-find”)

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

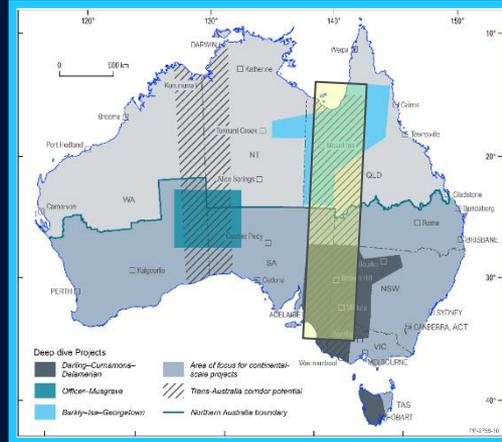
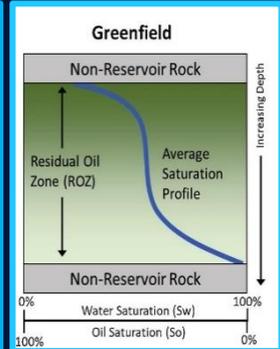
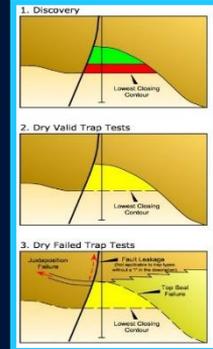
- Evaluation of depleted hydrocarbon fields
- Identification of palaeo-oil columns
- Assessment of CO<sub>2</sub> storage potential

## Module 2: Hydrogen

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

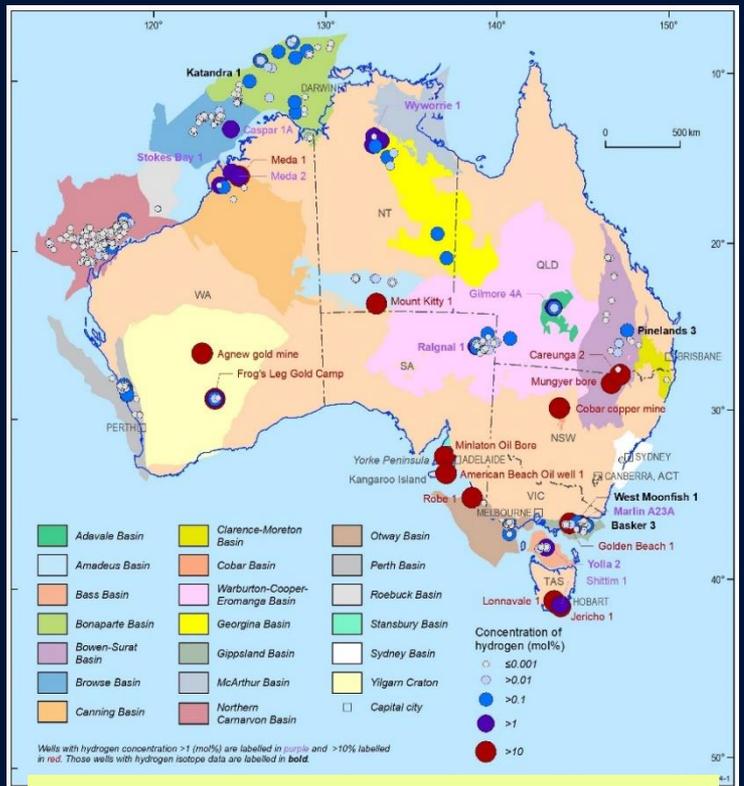
## Module 4: Basin Inventory

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



# Hydrogen:

Location map showing exploration well, mine and groundwater samples with measurable concentrations of H<sub>2</sub> (mol%)



- ≤0.001
- >0.01
- >0.1
- >1
- >10

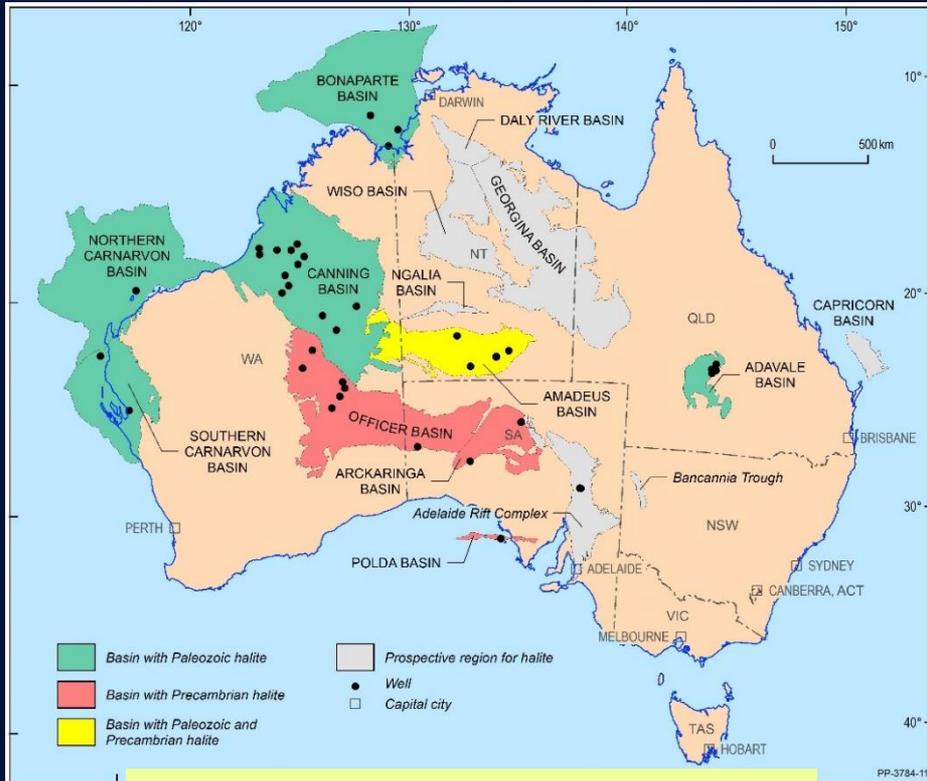
- H<sub>2</sub>-rich natural gases identified as early as 1917 (Yorke Peninsula; Kangaroo Island, SA)
- GA lab identified ~1000 natural gases from 470 wells that penetrated Neoproterozoic to Cenozoic reservoir rocks with detectable H<sub>2</sub> levels of up to 91.9 mol%
- Gases with elevated H<sub>2</sub> contents a mixture of deep inorganic sources and decomposed organic matter at high maturities.
- Opportunity to discover natural H<sub>2</sub> in areas previously not targeted by petroleum exploration

H<sub>2</sub> concentration (mol%)

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

# Hydrogen:

Australian basins with major halite discoveries (thickness >100 m)



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 centers

# Hydrogen: Australia's Hydrogen Opportunities Tool

Access HEFT



The screenshot displays the AusH2 tool interface. On the left is a map of Australia with various locations marked by colored dots. On the right is a configuration panel with the following sections:

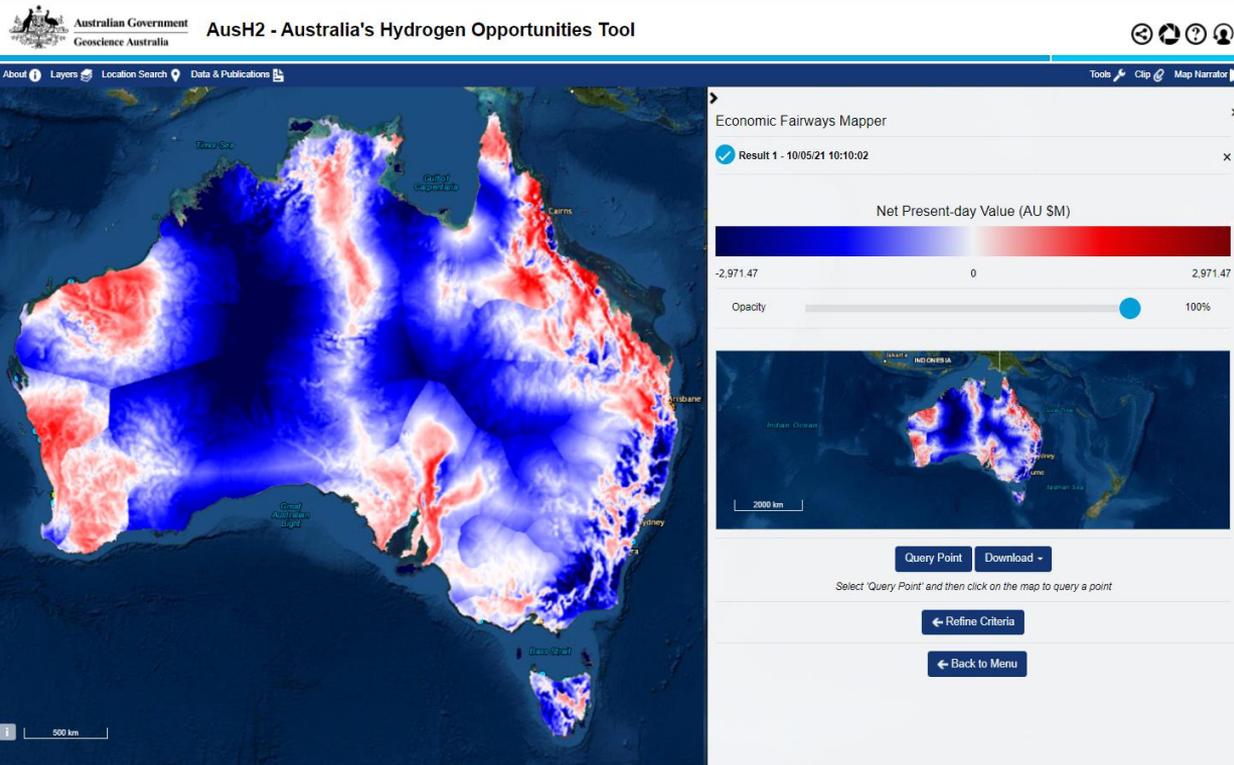
- Energy Input:** Hybrid Wind (onshore) and Solar
- Renewable Energy Capacity Factor (CF):** Hybrid Wind 150m hub height (onshore) and Solar (checked)
- Wind (Onshore):** Weight: 50%
- Solar Photovoltaics:** Weight: 50%
- Hydrogen Plant:** Year of Operations: 2021
- Electrolysis System Capex:** \$US1200/KW Alkaline (established supplier)
- Water Source:** Desalinated Water
- Desalinated Water Price:** Price: 0.01 AU\$/kgH2
- Amount of Hydrogen Produced:** Plant Capacity: 800 tH2/day
- Plant Operating Life:** Operating Life: 25 years
- Hydrogen End-point:** Nearest Suitable Port
- Company Discount Rate:**
- Currency:**
- Target Hydrogen Price:** Target Hydrogen Price (AU\$ per kg) (checked), Price: AU\$ 4
- Calculation Mode:** Net Present Value (NPV)

Navigation icons (Tools, Copy, Map Navigator) are circled in red in the top right corner of the interface.

<https://portal.ga.gov.au/persona/hydrogen>

# Hydrogen Economic Fairway Tool (HEFT)

## Hydrogen from Hybrid wind and solar

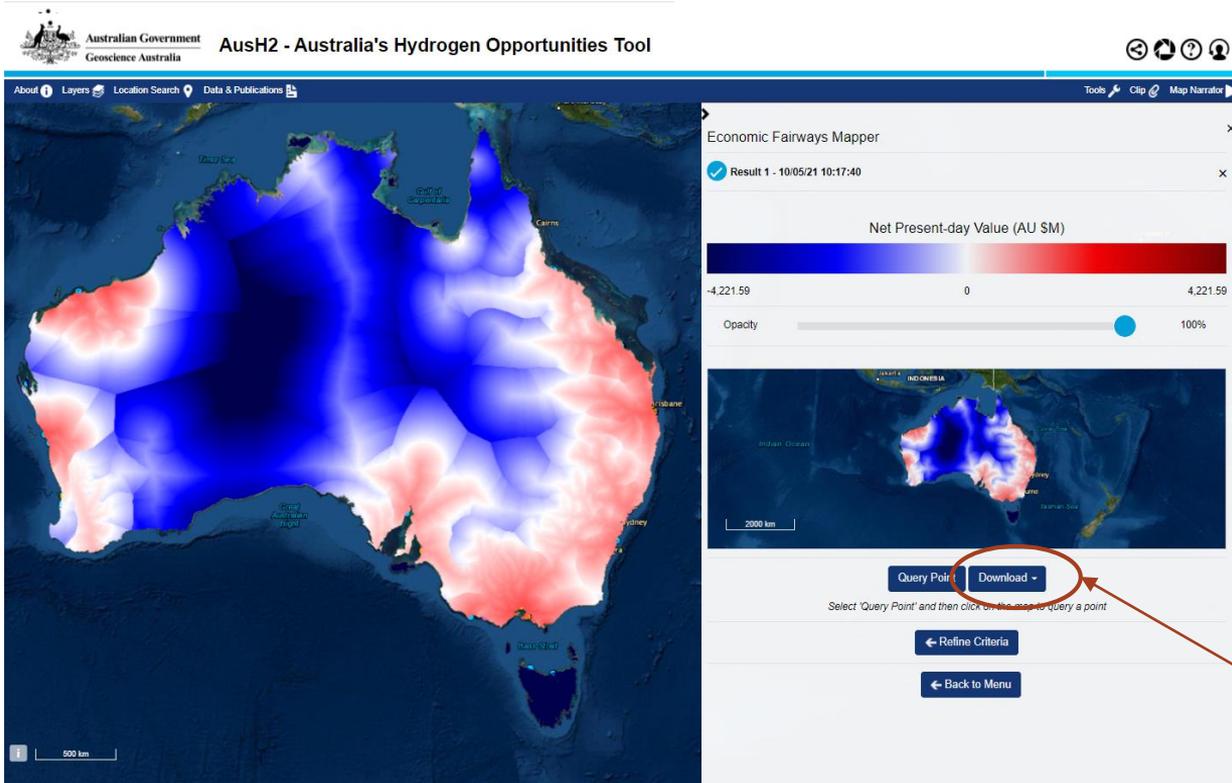


### Inputs:

- 50% wind, 50% solar
- Year 2021
- \$US1200/kW electrolyser CAPEX (alkaline)
- Desalinated water
- 800 tH<sub>2</sub>/day
- 25 year operating life
- Hydrogen sent to port
- 5% company discount rate
- **AU\$4/kg hydrogen price**

# Hydrogen Economic Fairway Tool (HEFT)

## Hydrogen from SMR + CCS (steam methane reformation and carbon capture and storage)



### Inputs:

- AU\$5.5/GJ natural gas price
- Desalinated water
- 500 tH<sub>2</sub>/day
- 25 year operating life
- Hydrogen sent to port
- 5% company discount rate
- **AU\$3.10/kg hydrogen price**

Download GeoTIFF or PNG

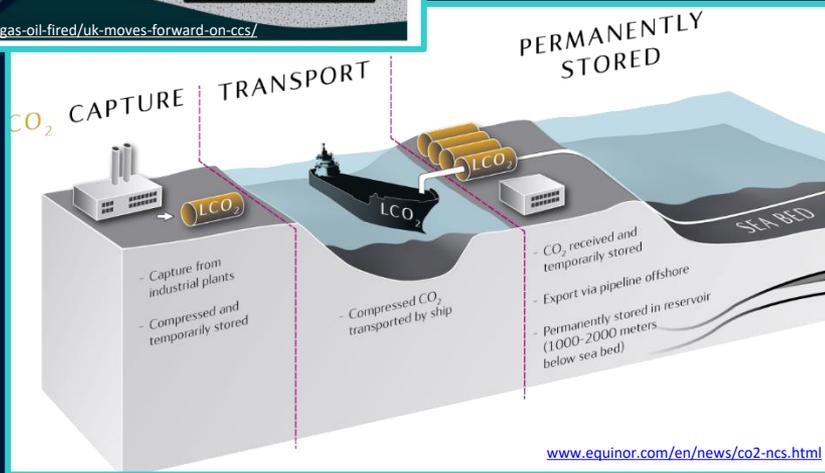
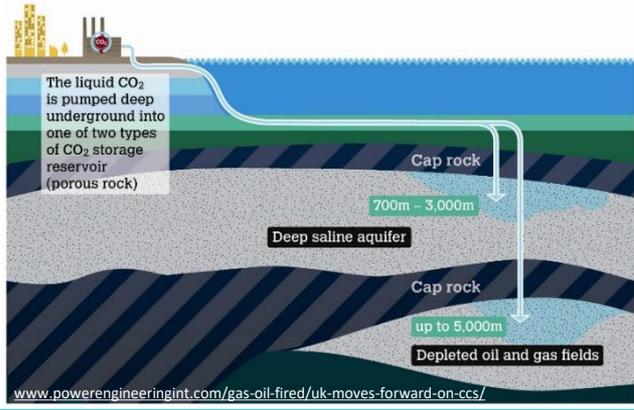
# The 2021 offshore acreage release



- 21 areas released on 15 June 2021, closing date for work program bidding: **3 March 2022**
- In 2021, nearly even split between number of release areas on NW Shelf and southern margin
- Three areas host hydrocarbon fields (Prometheus/Rubicon gas; Puffin oil; Cornea gas/oil)
- Release areas on southern margin (Otway/Gippsland) cover underexplored deep-water regions

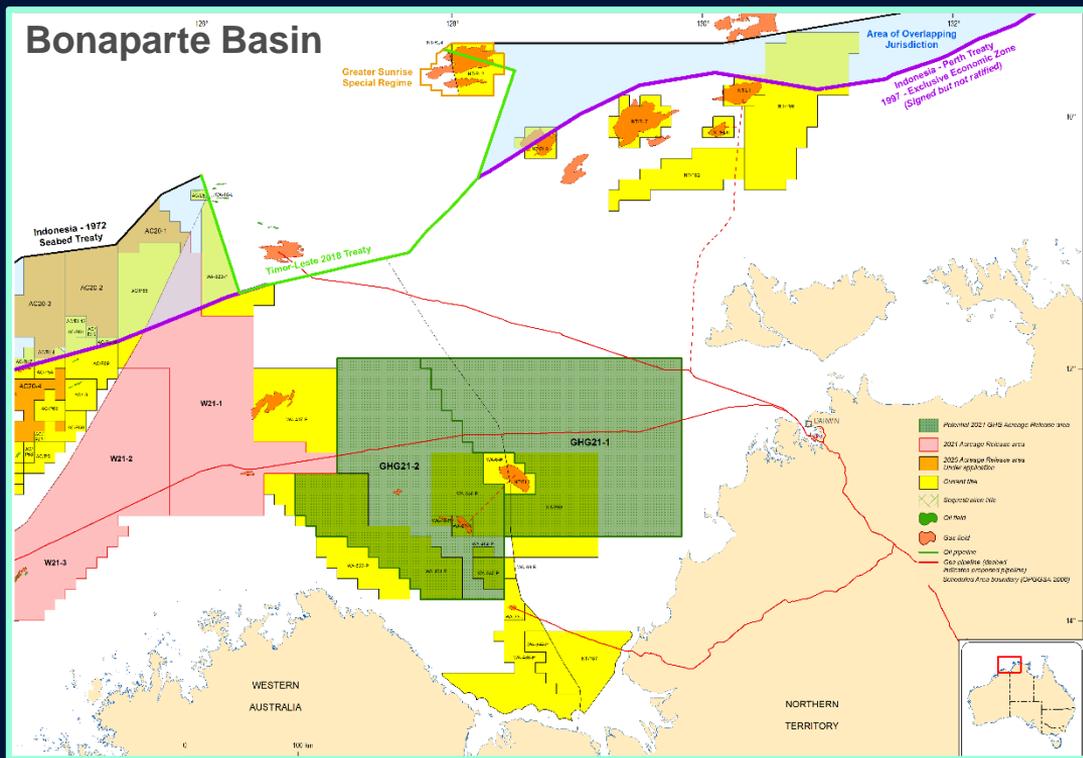
# Offshore acreage for greenhouse gas storage

## Safely Storing CO<sub>2</sub>



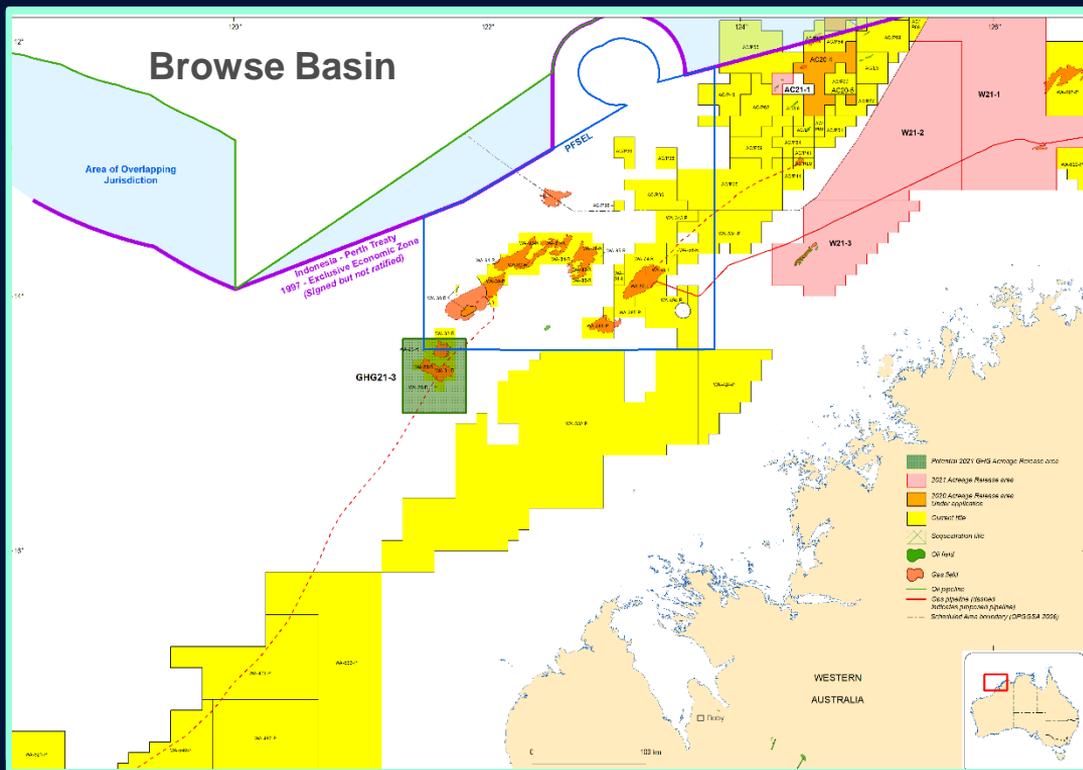
- Nominations for the 2021 Greenhouse Gas (GHG) Acreage Release, covering Commonwealth waters across Australia submitted for public consultation
- Opportunity to obtain acreage to explore for offshore greenhouse gas injection and storage locations
- Support initiatives to accelerate the deployment of carbon capture, use and storage, applying new technology to reduce emissions.
- First set of offshore GHG acreage to be released by end of 2021

# Offshore acreage for greenhouse gas storage: area location



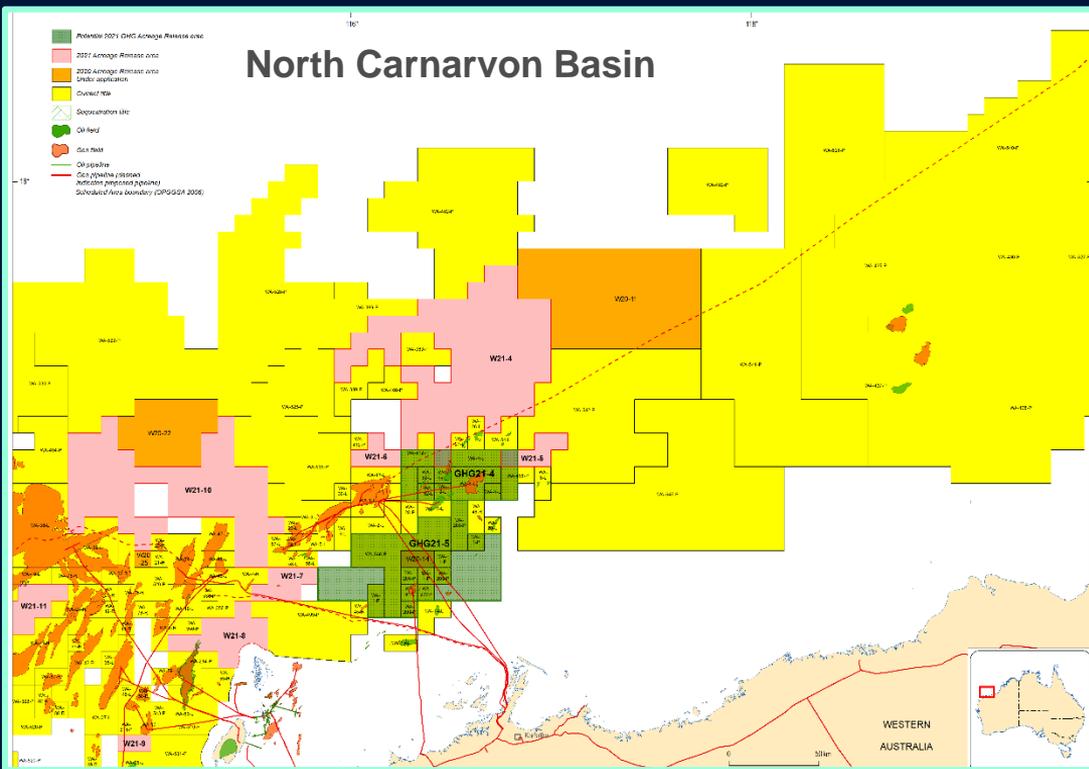
- A total of five areas proposed for release
- Bonaparte Basin (Petrel Sub-basin)
  - Storage in saline aquifers (Jur.-Lwr Cretaceous)
  - CO<sub>2</sub> sources: Darwin processing facilities; Bonaparte field developments
- Browse Basin (Caswell Sub-basin)
  - Storage in saline aquifers (mainly Lwr Cret.)
  - CO<sub>2</sub> sources: gas from future field developments
- Northern Carnarvon Basin
  - Storage in depleted gas fields
  - CO<sub>2</sub> sources: industrial emissions from greater Dampier region

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# Summary



- Australia's energy mix is changing rapidly
- The Australian government's energy initiatives, in the short to medium term, are targeting:
  - Speedy recovery from the COVID-19 economic downturn
  - Accelerating Australia's journey towards a low emission economy
- Natural gas is the “enabler” for the economic recovery AND expansion of the renewable energy network
- Assessing the resource potential of the newly required energy commodities, including geological storage of hydrogen and carbon dioxide, supports Australia's transition to a low emission economy



[www.ga.gov.au/digital-publication/aecr2021](http://www.ga.gov.au/digital-publication/aecr2021)



Australia's energy commodity reserves and resources

[www.ga.gov.au/efft](http://www.ga.gov.au/efft)

Concise overview of the  
**Exploring for the Future** program

[www.ga.gov.au/](http://www.ga.gov.au/)

Information about Geoscience Australia

