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Update on South Australian energy resources and the energy transition

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SOUTH AUSTRALIAN DEPARTMENT FOR ENERGY AND MINING

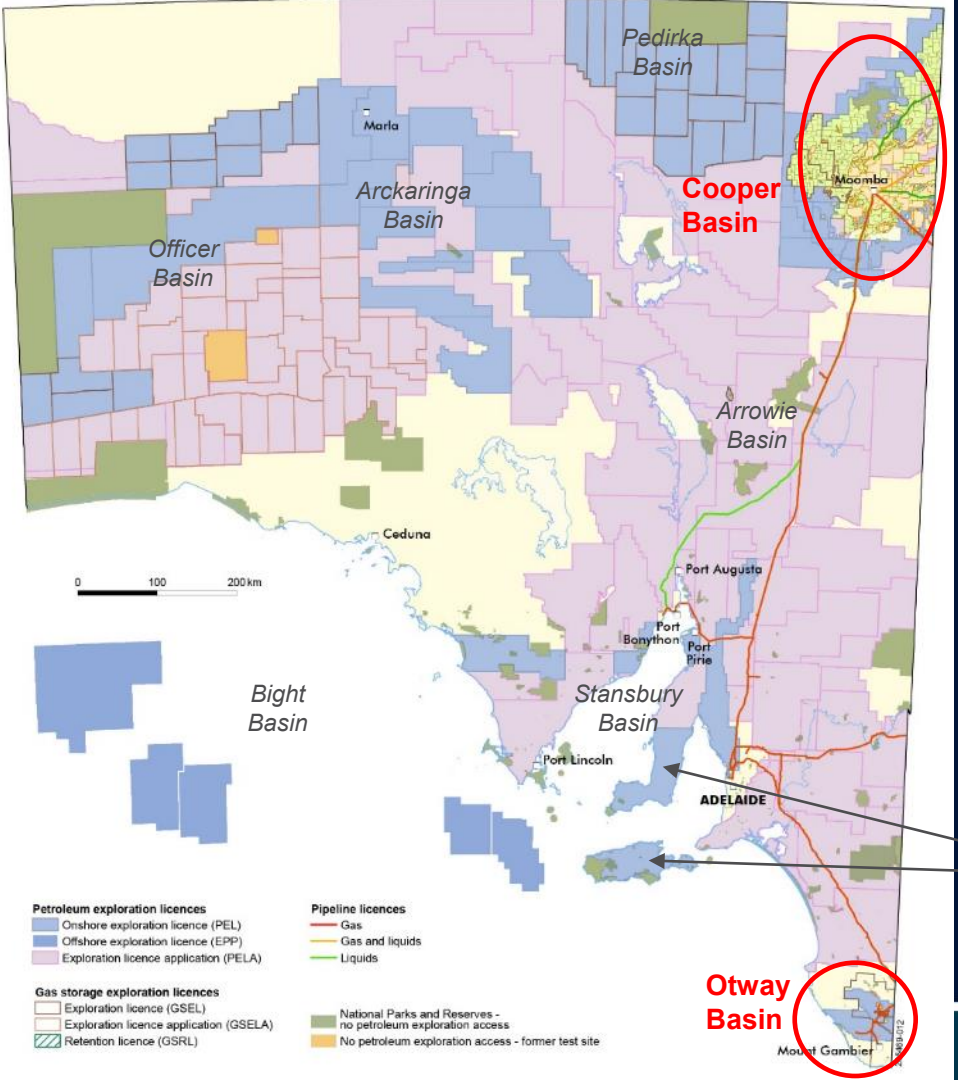
Leading the global transformation community: supporting a successful energy and mining sector that enables South Australia to responsibly grow and thrive.

Energy Resources Division

Growth and Low Carbon Division

Mineral Resources Division

Energy and Technical Regulation



Exploration licensing

Competitive tender basins

- Cooper & Otway basins - vacant acreage is only available via releases.
- There may be new releases in 2022.

Over-the-counter applications

- Everywhere else.
- Applications can be lodged at any time.
- 'Top filing' option exists over PELAs (pink areas).

Natural hydrogen exploration licencing

- Can now occur via a Petroleum Exploration Licence.
- 6 companies have lodged 19 PELAs targeting natural hydrogen since February 2021:
  - Gold Hydrogen Pty Ltd/Byrock Australia Pty Ltd
  - White Hydrogen Australia Pty Ltd
  - H2Ex Pty Ltd
  - 2H Resources Pty Ltd.
- PEL 687 granted to Gold Hydrogen Pty Ltd on 22 July 2021, more to come.

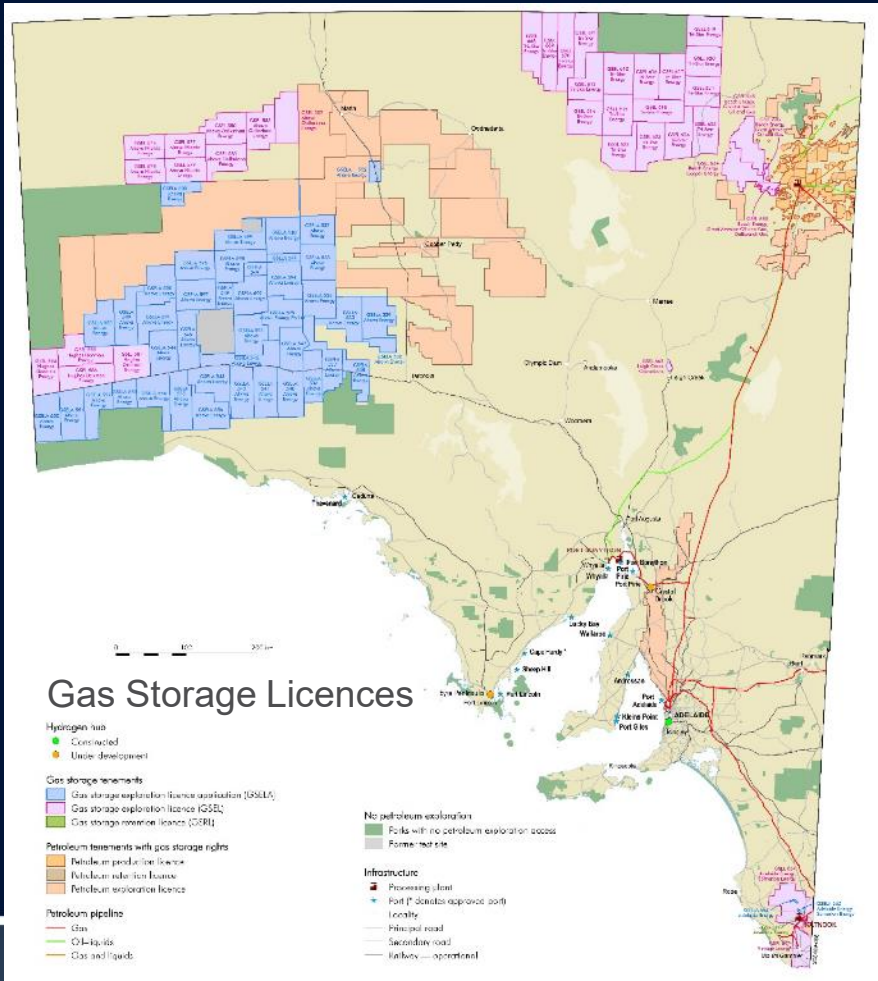
Fast & flexible natural gas remains an important part of SA's energy mix

Source: Energy Magazine

211 MW Barker Inlet Power Station (AGL) – 2019

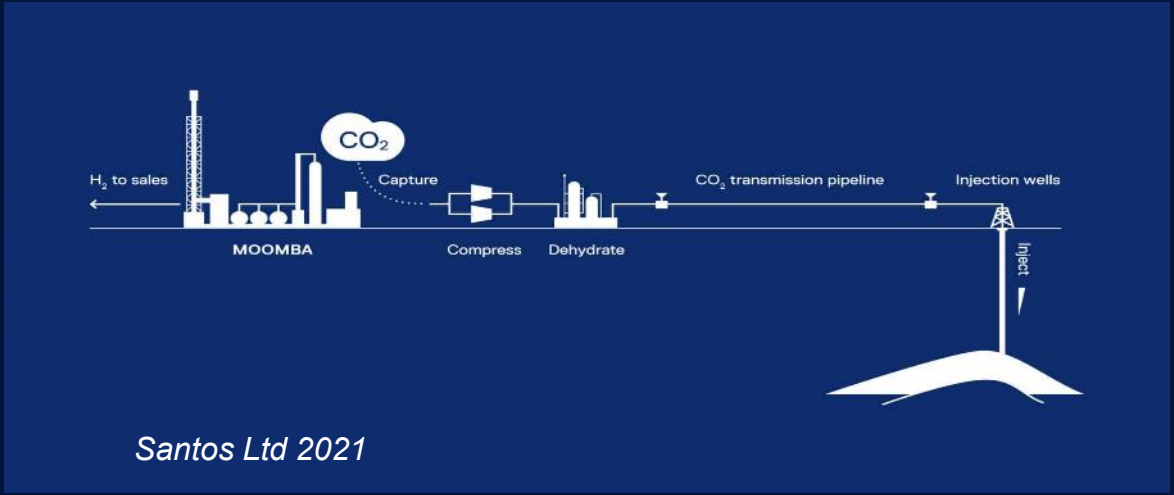
The station is capable of operating at full capacity within five minutes, providing a rapid response to changes in renewable generation supply

Gas Storage Licences



- Leading practice regulation already in place for Carbon Capture & Storage (CCS) and gas storage.
- SA offers:
  - Gas Storage Exploration licences (< 2,500km^2),
  - Gas Storage Retention Licenses (< 1,000km^2),
  - Gas Storage Licences (< 1,000km^2).
- Depleted oil and gas fields in the Cooper and Otway basins have excellent potential as storage reservoirs suitable for CCS.

Carbon Capture and Storage



Santos Ltd 2021

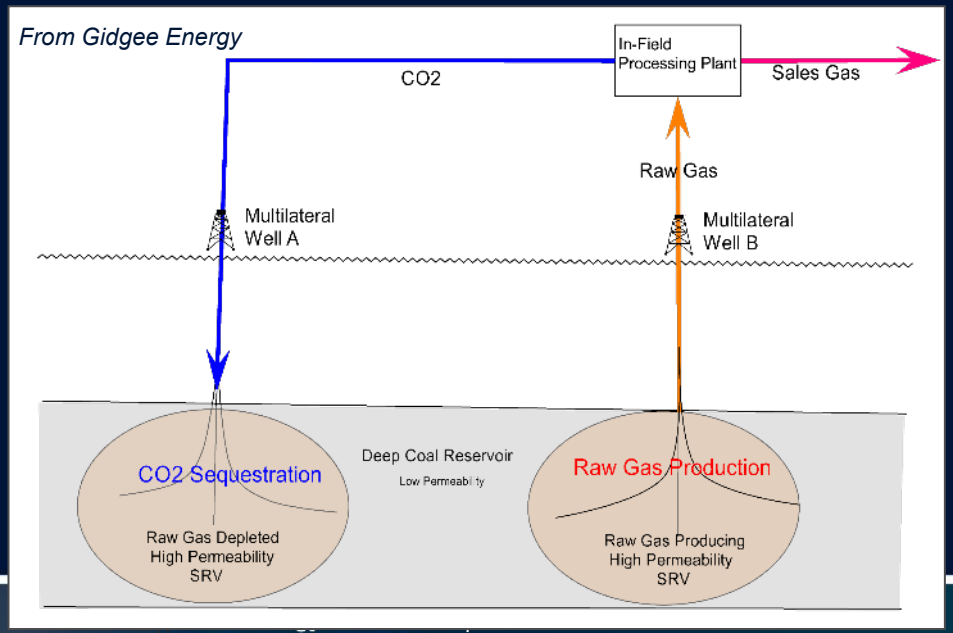
EIR & SEO approved and gazetted April 2021

- DEM is implementing a framework to facilitate carbon capture and storage (CCS) projects.
- Santos are proposing a $210 million CCS project at Moomba in depleted Cooper Basin oil and gas fields which can provide safe, low-cost and permanent storage of CO_2.
- Initial target is 1.7 million tonnes CO_2/year.
- In the long term, carbon storage in the Cooper Basin could store 20 million tonnes a year from other industrial emitters for more than 50 years.
- Santos are exploring the production of zero-emissions hydrogen enabled by the CCS project.

Low Cost Carbon Neutral Energy from Gidgee Energy
PEL 678, SA Cooper Basin

– contact David Warner (President): Dswpet@bigpond.com, cell +61 419859985

ARCoSTIM – a new disruptive drilling and completion methodology (patent pending) is designed to create large, high permeability stimulated reservoir volumes to facilitate simultaneous gas production from and sequestration of CO_2 into deep coal reservoirs

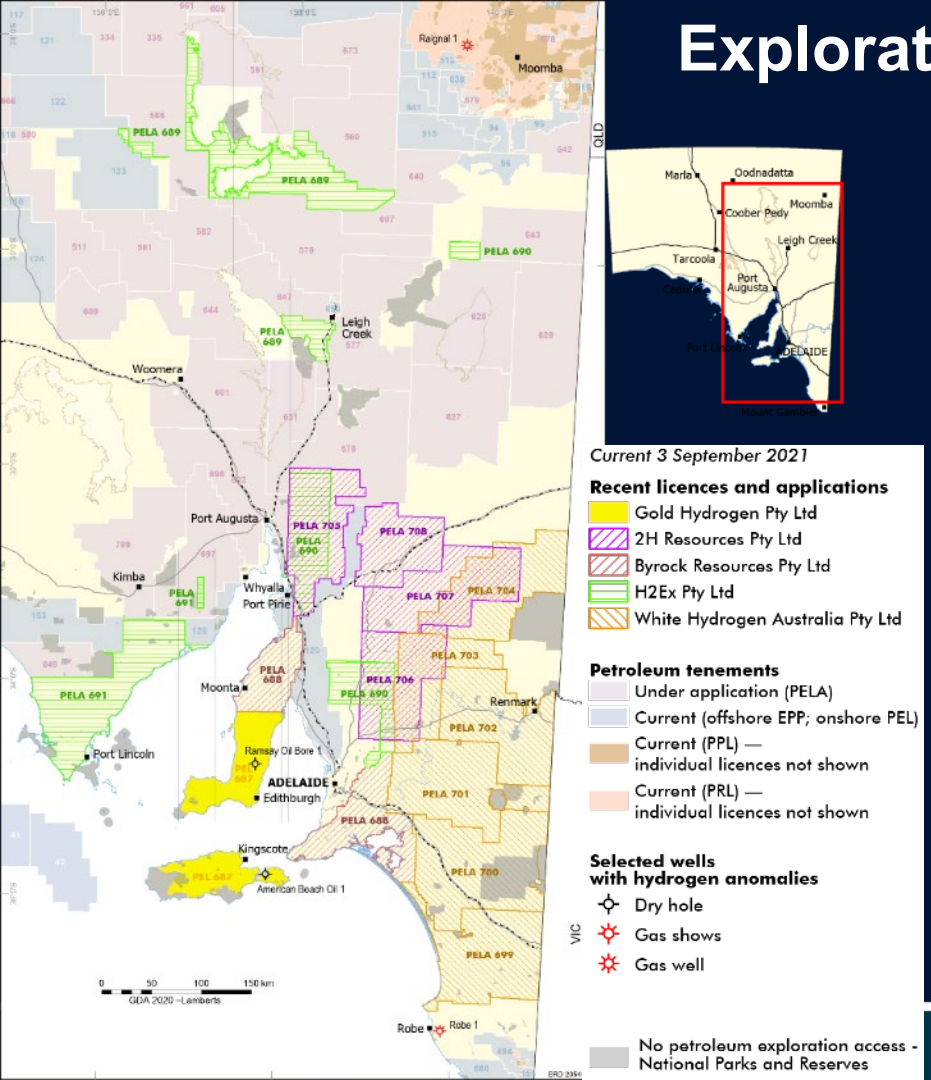


Initial production of raw gas from Deep Coal reservoirs will result in large areas of gas depleted, low pressure, high permeability coal reservoirs – Stimulated Reservoir Volumes (SRV)

These SRV's can be subsequently used for CCS:

- Can permanently trap CO_2 by adsorption
- Very large areas and large volumes of coal SRV's provide very large CCS.

Exploration for natural hydrogen



Current 3 September 2021

Recent licences and applications

- Gold Hydrogen Pty Ltd
- 2H Resources Pty Ltd
- Byrock Resources Pty Ltd
- H2Ex Pty Ltd
- White Hydrogen Australia Pty Ltd

Petroleum tenements

- Under application (PELA)
- Current (offshore EPP; onshore PEL)
- Current (PPL) — individual licences not shown
- Current (PRL) — individual licences not shown

Selected wells with hydrogen anomalies

- Dry hole
- Gas shows
- Gas well

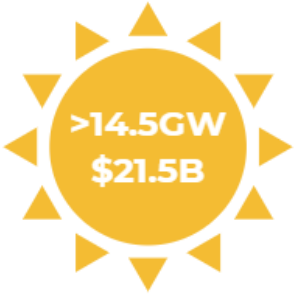
No petroleum exploration access - National Parks and Reserves

- Early days! First licence granted in July 2021.
- 50-80% hydrogen was measured in 1931 by the Mines Dept in gas samples from wells on Kangaroo Island, Yorke Peninsula and the Otway Basin.
- Recent international publications in 2020-21 highlighting the hydrogen occurrences have attracted explorers (e.g. Zgonnik, 2020; Moretti et al., 2021; Boreham et al., 2021).
- Potential natural hydrogen source rocks include:
  - ultrabasic rocks and iron-rich cratons (hydrogen generation from the oxidation of Fe(II) bearing minerals), and
  - uranium-rich basement with hydrogen generated by radiolysis of water (Gaucher, 2020).
- Proposed company exploration include soil sampling, sniffer surveys, airborne geophysics with drilling later in the 5 year programs.

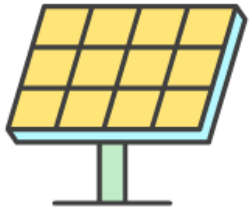
SA’s energy transition snapshot

52%
renewable electricity generation in 2018/19... the second highest penetration of variable renewables in the world behind Denmark

Home to the world's largest battery
100MW
- soon to be upsized:
150MW



A large scale renewable energy pipeline... including SA's first GW scale, wind, solar and storage project



1 in 3
households with solar PV and accelerating adoption by businesses

the world's largest per capita roll out of home batteries

A Hydrogen Action Plan
focussed on scaling up renewable hydrogen production for export and domestic consumption

SA's Hydrogen Action Plan
Action Themes

Vision:

South Australia leverages its wind, sun, land, infrastructure and skills to be a world-class renewable hydrogen supplier.

Objective:

Scale-up renewable hydrogen production for export and domestic consumption

Facilitate investments in hydrogen infrastructure

Springboard from first renewable hydrogen production in 2020 towards a hydrogen economy

Establish a world class regulatory framework

Deliver global best-practice hydrogen regulations that are simple and efficient, building community and investor confidence

Deepen trade relationships and supply capabilities

Establish robust relationships and value chains to supply renewable hydrogen to new and emerging trade partners

Foster innovation and workforce skills development

Accelerate hydrogen innovation based on solid academic research and industry partnerships, and ensure South Australia has the workforce skills, capability and capacity to deliver

Integrate hydrogen into our energy system

Understanding the value of hydrogen in our decarbonised energy system

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Hydrogen regulatory framework

- The State's ***Climate Change Action Plan*** commits to embrace future fuels, which require regulatory frameworks to ensure safe operation of essential infrastructure.
- The scope of the *Petroleum and Geothermal Energy Act 2000* will be expanded to cover production and pipeline transmission of hydrogen, and renamed to the ***Energy Resources Act***.

- The new Act will cover generation of hydrogen from means not already permissible under the existing Act, such as electrolysis of water, via a specific **Hydrogen Generation Licence**.
- This provides all hydrogen generation sectors the same leading practice regulatory and one-window to government regime as is currently provided to the oil and gas industries.

- A hydrogen export tool is available for project proponents: https://hydrogenexport.sa.gov.au/

Image: *Iron Road and H2U*

Hydrogen Park SA – Australian Gas Infrastructure Group

- Since May 2021 Australian Gas Networks has supplied a blend of natural gas and 5% renewable hydrogen to 700 customers through the existing gas network – an Australian first.
- The HyP SA 1.25MW electrolyser at Tonsley Innovation District, just south of downtown Adelaide, is the largest electrolyser currently in Australia.
- Industrial hydrogen customers are also being supplied via truck.

Source: *Australian Gas Networks*

Opportunities to unlock the value of SA's renewable energy resources

Domestic

Electrify domestic transport (via battery or fuel cell EV)

Decarbonise gas networks (via hydrogen and biogas)

Decarbonise existing industrial emissions

Export

Export power interstate

Export hydrogen overseas

Grow and attract energy intensive industries to export green commodities:

- Green chemicals – e.g. green ammonia, green fertiliser
- Green minerals / metals – e.g. green steel, green copper

Images (top to bottom): ZEVNZ, Getty Images, Penn State University, Iron Road and H2U

South Australian Mineral resources

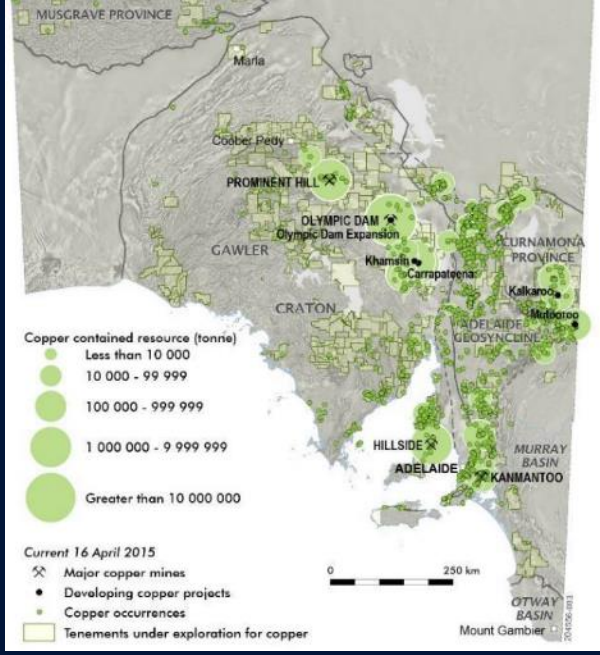
Copper: 67% of Australia's Economic Demonstrated Resources (EDR)

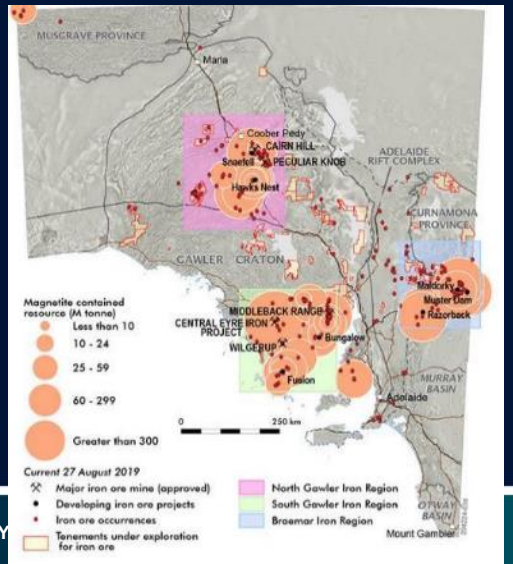
(**Copper to World** annual conference)

Magnetite: 6 billion tonnes or 44% of Australia EDR

Graphite: 65% of Australia's EDR

REE: Most advanced technology smelter in Australia for production – Port Pirie





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