



decisions with confidence

Petroleum Exploration (& Appraisal) Year in Review 2023

AEP Conference 2024

Adam Craig

Principal Advisor - Geoscience



Disclaimer and Declaration



RISC is an independent advisory firm, providing insightful and impartial advice to a broad range of clients in the energy industries. We provide a more comprehensive, reliable and respected opinion faster than anyone else in the industry, enabling our clients to make their business decisions with confidence.

The statements and opinions attributable to the author and/or RISC in this presentation are given in good faith and in the belief that such statements are neither false nor misleading.

In preparing this presentation the author has considered and relied solely upon information in the public domain. This information has been considered in the light of RISC's knowledge and experience of the energy industries and, in some instances, our perspectives differ from some of our highly valued clients.

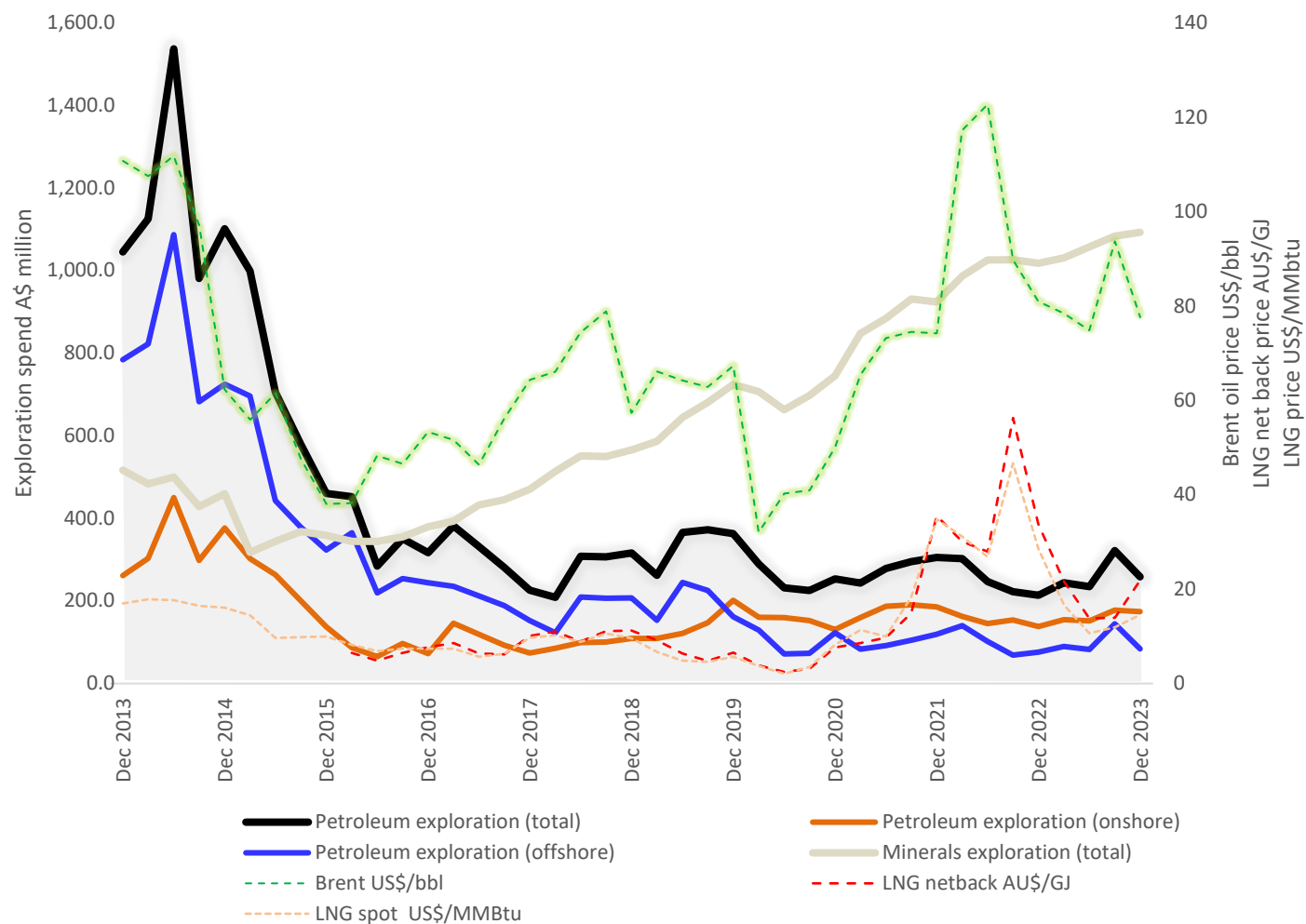
In some cases the views and opinions of the author may differ from those held by others within RISC.

RISC has no pecuniary interest or professional fees receivable for the preparation of this presentation, or any other interest that could reasonably be regarded as affecting our ability to give an unbiased view.

This presentation is the copyright of RISC and may not be reproduced, electronically or in hard copy, without the written permission of RISC.

- Petroleum exploration spend *trends and observations*
- Petroleum titles..... *trends and observations*
- Summary of exploration acreage releases and permits awarded
- Summary of exploration transactions & farmins
- Summary of exploration & appraisal activity – wells and surveys
- Key exploration and appraisal well summaries
- Exploration wells planned 2024+
- Summary, key take-aways & acknowledgements

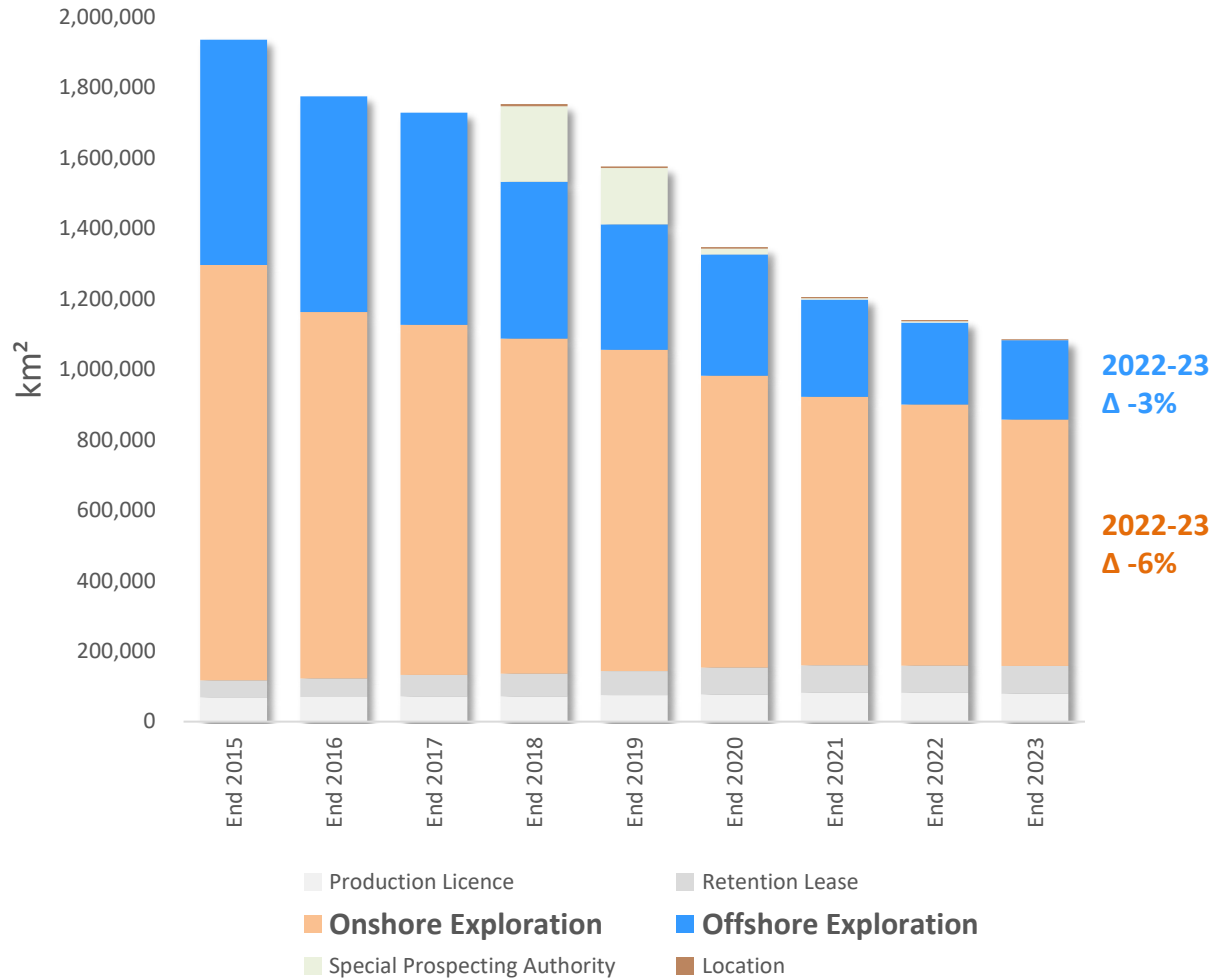
Petroleum Exploration Spend



- **Petroleum exploration spend is FLAT**
- **Onshore exploration spend has been greater than offshore spend since late-2019**
- **Petroleum exploration spend is de-linked from commodity prices (oil price and LNG netback)**

- Petroleum exploration spend for 2023 (A\$1,058 million in total +7% from 2022)
 - Onshore exploration spend A\$658 million, up 10% from 2022
 - Offshore exploration spend A\$400 million, up 4% from 2022
- For comparison, minerals exploration spend for 2023 was over A\$4.2 billion

Area under Petroleum Title
(Federal Offshore and State jurisdictions)



- **9 Australian Federal offshore exploration permit titles surrendered in 2023 (14 in 2022)**
- Production licenses and retention licenses increasing

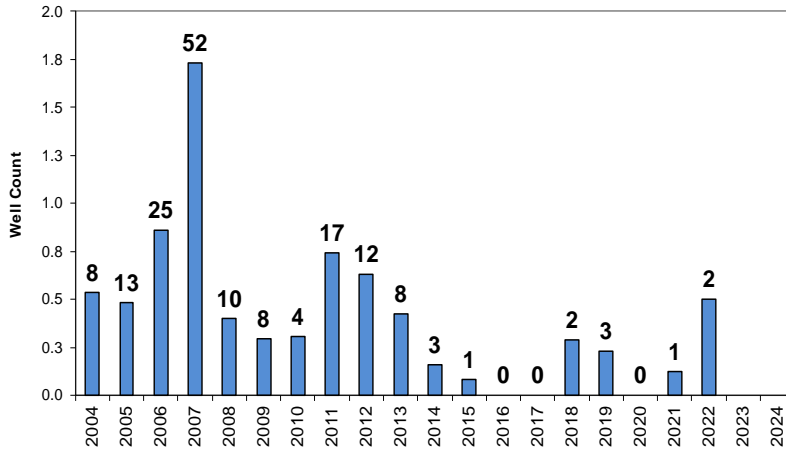
Over the past 9-years:

- Area under production license has grown 14%
- Area under retention lease has grown 66%
- **Area under exploration license has decreased 49%**
 - **-41% onshore**
 - **-65% offshore**
- Offshore exploration licenses represented 38% of the total in 2017 declining ever since to 24% in 2023

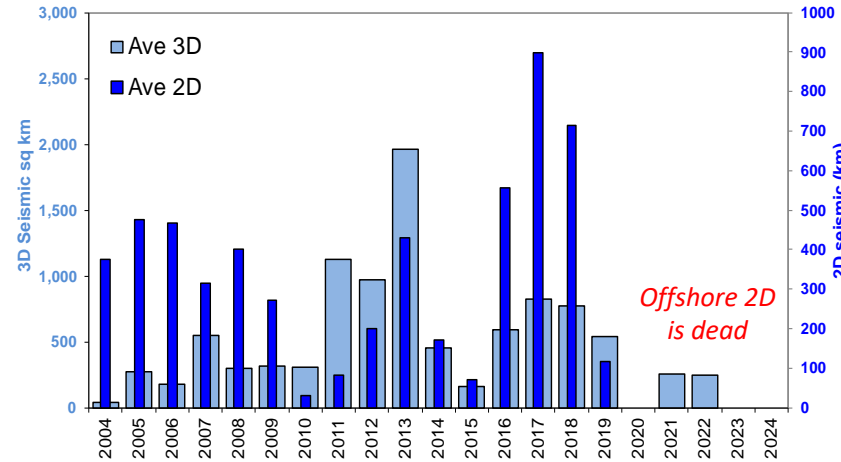
Federal Offshore Petroleum Release Round Bids & Awards (or lack thereof)



Average Commitment Wells Bid per Permit
(plus total number of wells shown)



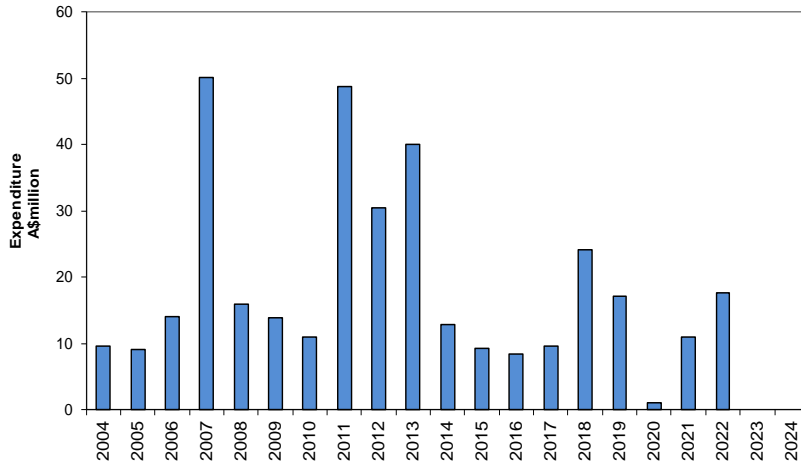
Average Seismic Commitment Bid per Permit



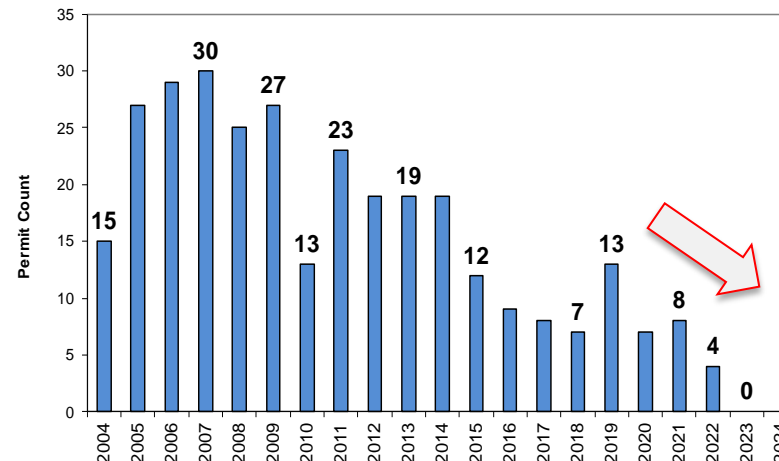
In 2023.....

- No offshore exploration permit awards
- No release round either

Average Commitment Expenditure Bid per Permit

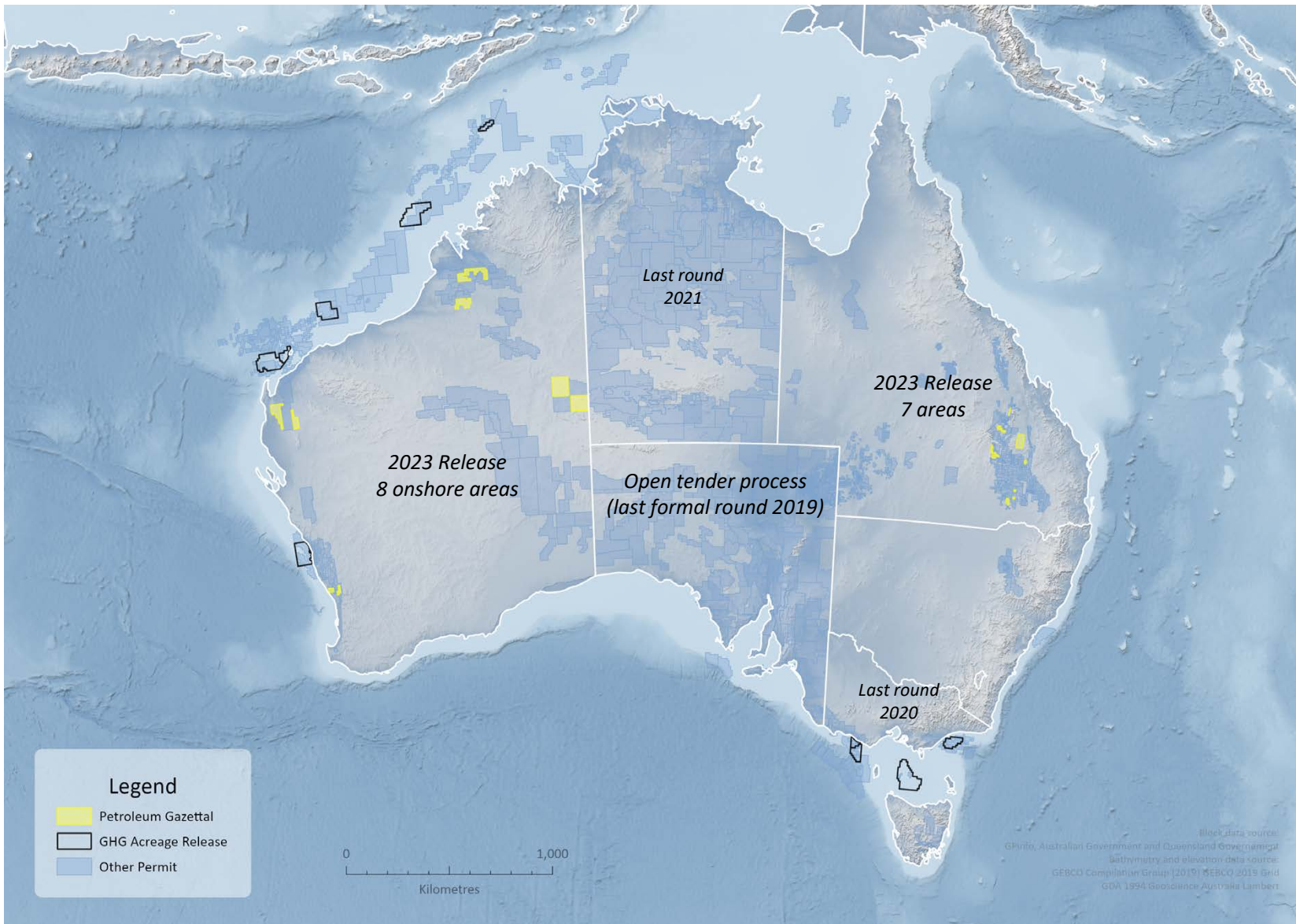


Permits Awarded per Year



- No awards from 2021 Release Round which closed 3 March 2022
- No awards from 2022 Release Round which closed 2 March 2023
- 12 applications with the Joint Authority for decision (9 from 2021 round, 3 from 2022 round)
- 4 Federal offshore exploration permits were awarded in 2022
 - 1 award from 2019 round
 - 3 awards from 2020 round
- Last petroleum exploration permit award was WA-551-P (ex W20-11) to BP Australia in February 2022
- Last award by NOPTA was G-11-AP (GHG21-2) to Santos in August 2022
- No awards yet in 2024

2023 Acreage Releases



Federal Offshore Petroleum Release Round

- **No release round in 2023**
- Nominations closed 1 September 2022
- 2022 release round closed 2 March 2023

Federal Offshore Greenhouse Gas Storage Acreage Release

- 10 release areas
- Released 29 August and closed 28 November

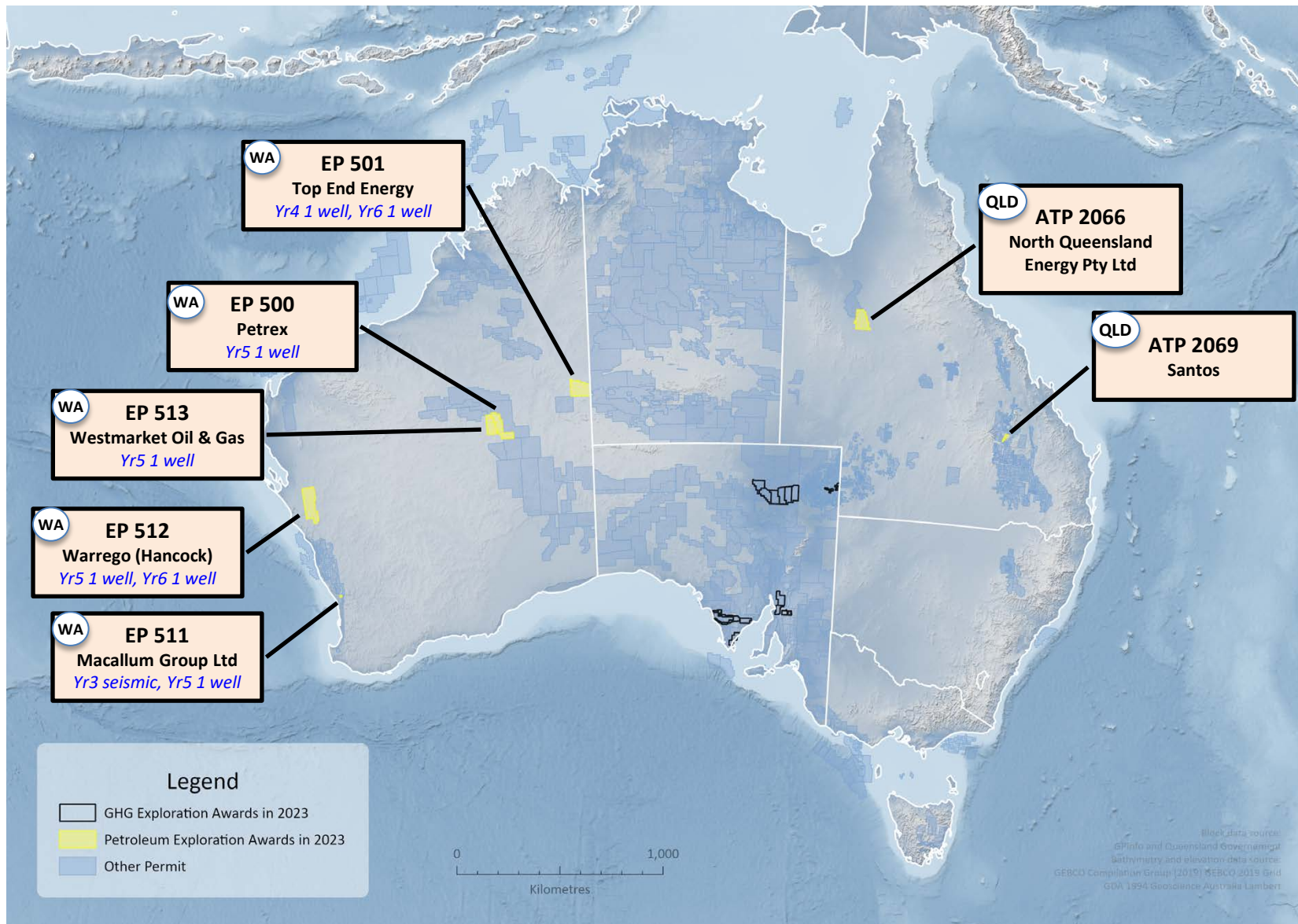
Western Australia Petroleum Release Round

- 8 onshore areas, no offshore areas (territorial waters)
- Released 20 October 2023 and bids were due 19 January 2024

Queensland Petroleum Release Round

- 7 areas
- Released 12 October 2023 and bids were due 20 December 2023

2023 Petroleum Exploration Permit Awards



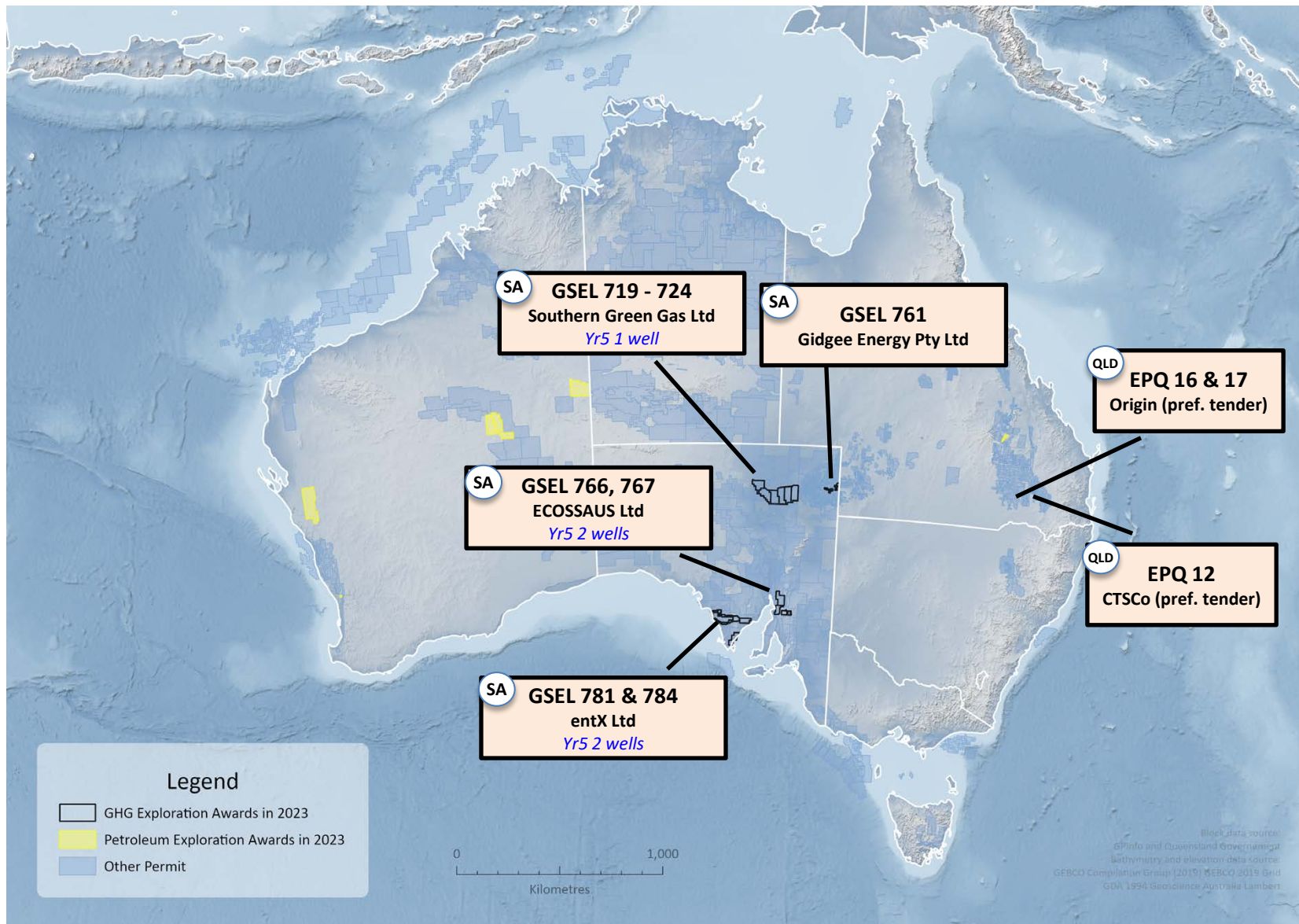
Australian Federal Offshore Petroleum Exploration Permits

- No awards
- 12 applications with the Joint Authority for approval
 - 10 from 2021 round (closed March 2022)
 - 2 from 2022 round (closed March 2023)

State Jurisdiction Petroleum Exploration Permits (onshore)

- WA 5 permits
- QLD 2 permits
Without domestic supply obligations (AMSC)

2023 GHG Assessment Permit Awards



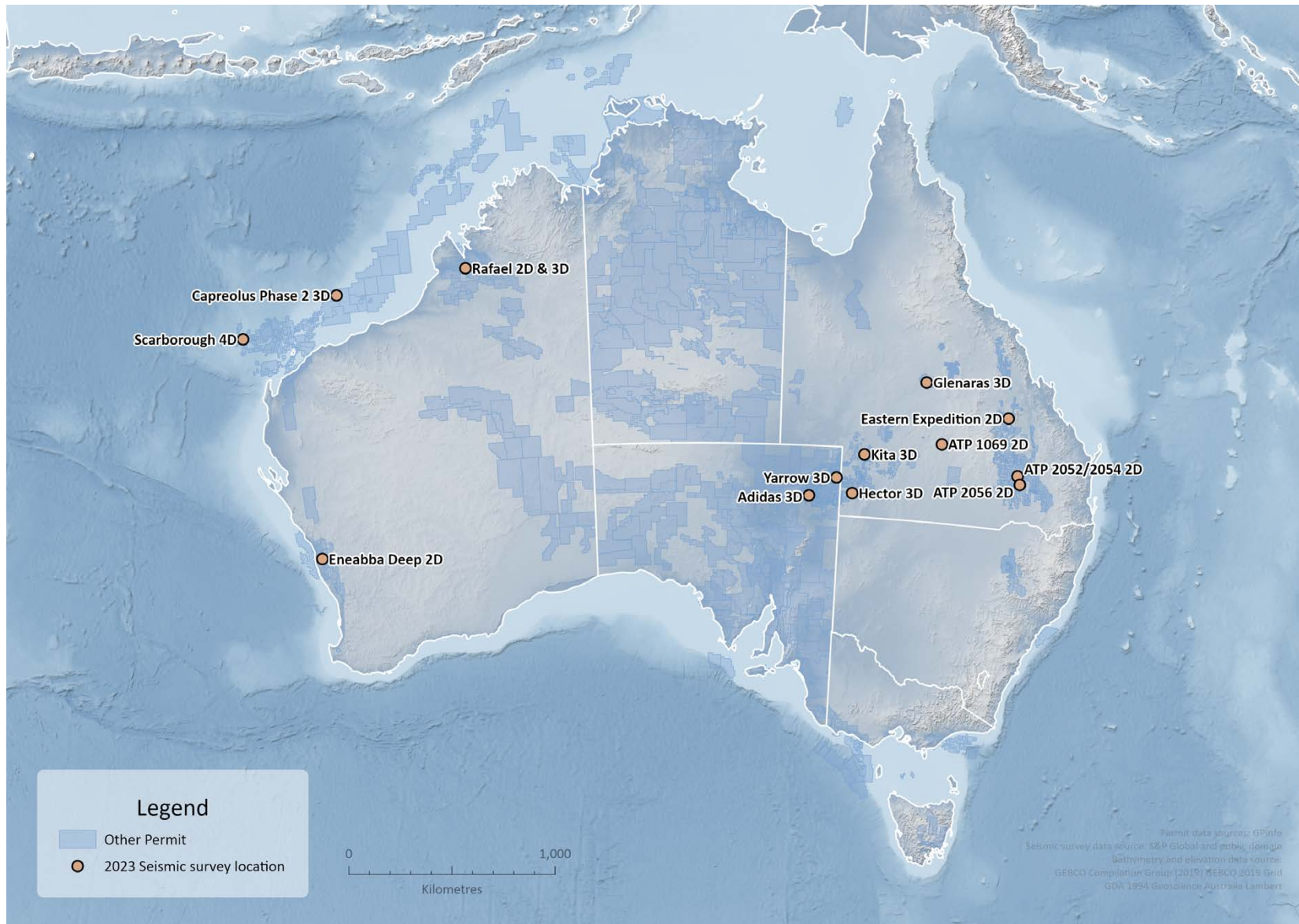
Australian Federal Offshore Greenhouse Gas Storage (GHG) Acreage Awards

- No permit awards in 2023
- 5 permit awards in 2022

State Jurisdiction GHG Exploration Permits

- SA; 12 permits awarded (no firm drilling commitments)
- SA; 11 areas under consideration
- QLD; 3 areas under consideration

Seismic Surveys Acquired 2023



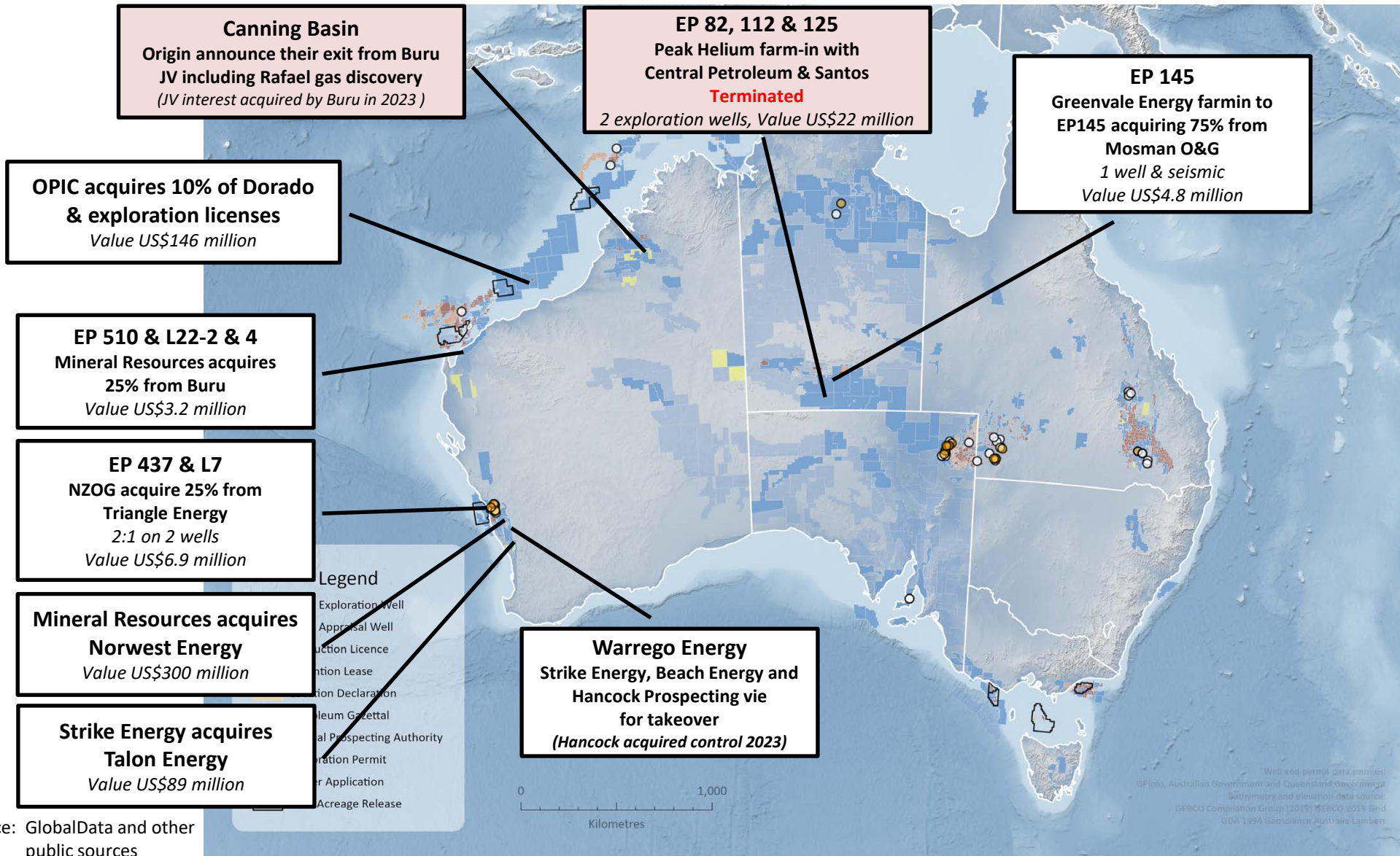
Offshore seismic limited to:

- Scarborough 4D (delayed due to legal challenge to environmental approvals)
- Capreolus Phase 2 4,500km² of multiclient data acquisition

Onshore:

- Perth Basin seismic acquisition limited to Strike's Eneabba Deep 2D program
- **Significant 2D & 3D acquisition in the Cooper – Eromanga and Bowen – Surat Basins**

Exploration Deals 2023



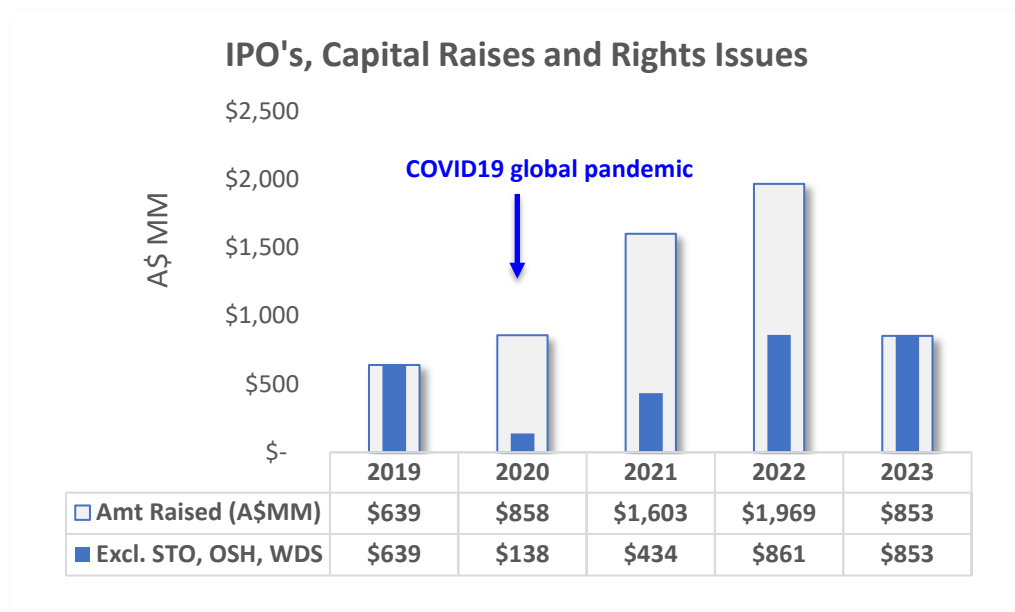
Other deals with exploration components

Potential merger of Woodside and Santos
Terminated

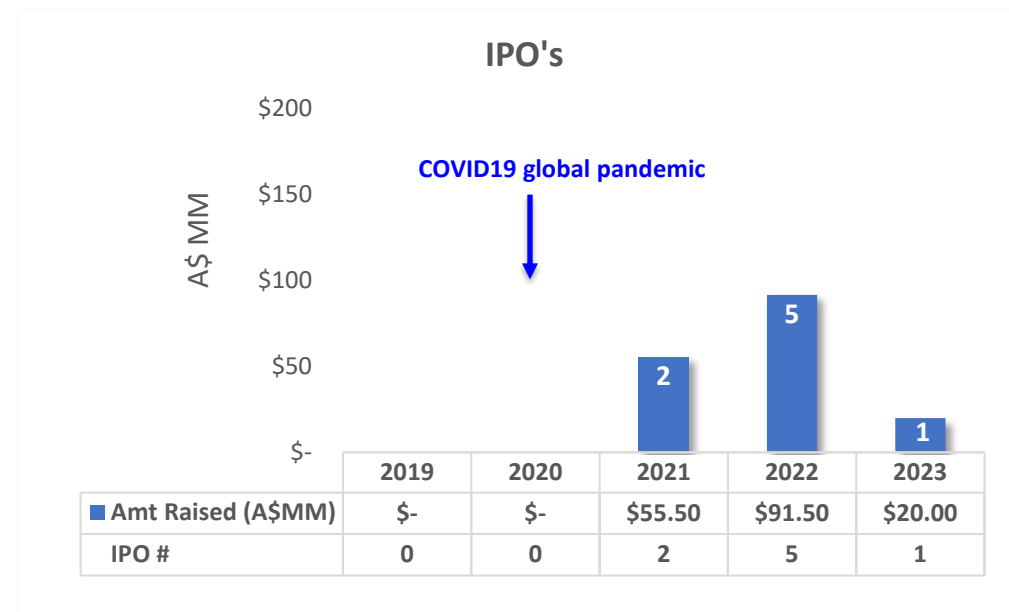
Acquisition of Origin by Brookfield & MidOcean Energy
Terminated

Armour Energy placed into liquidation after acquisition by Shunkang Holdings fails
(Acquired by ADZ Energy Jan 2024)

Litmus tests for the health of the O&G exploration industry

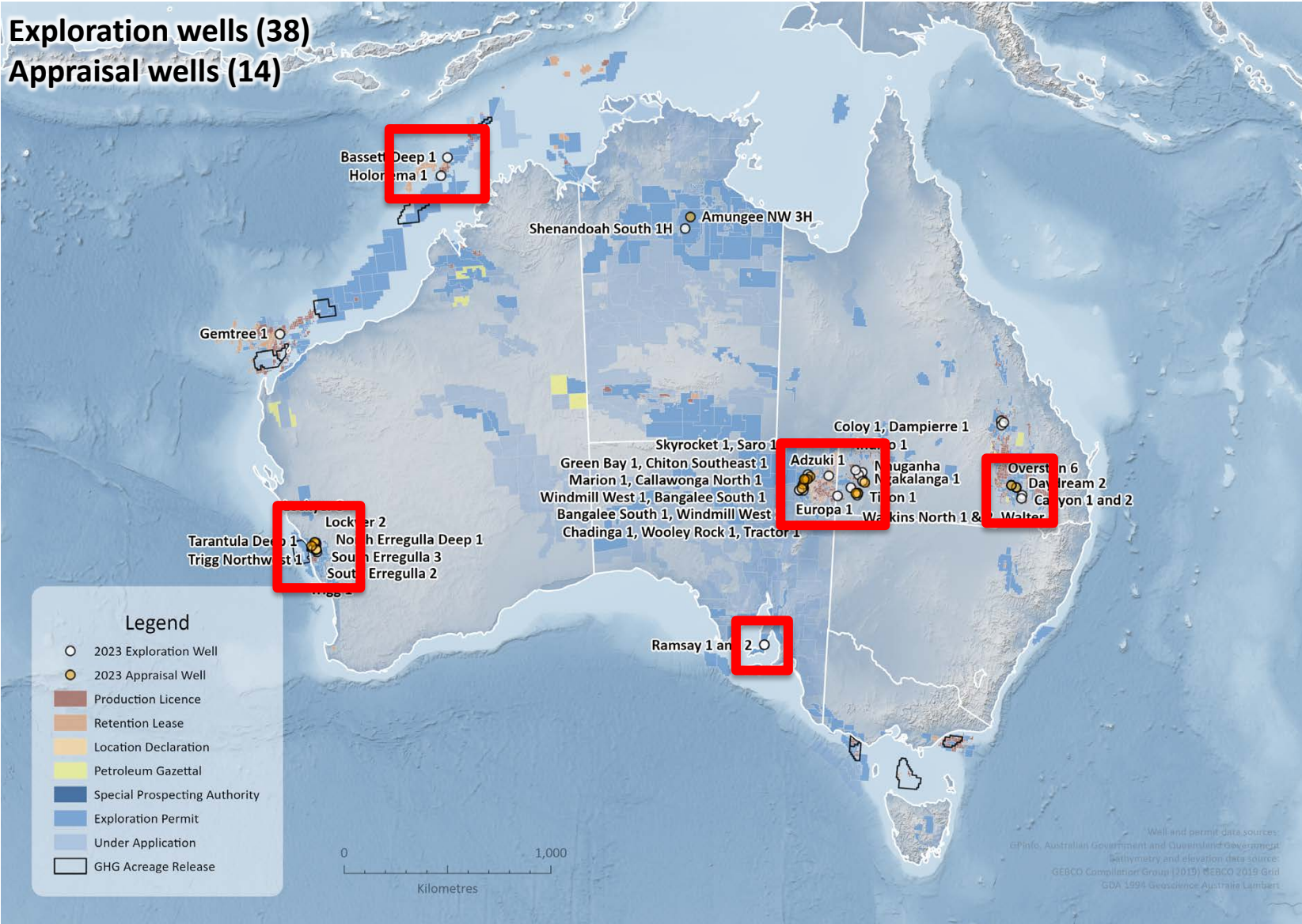


- Oil & gas companies on the Australian stock exchange (“ASX”).
- Excluding large caps O&G companies on the ASX are dominated by **exploration** companies with assets and activities worldwide.
- **Capital raised on equities market was increasing since COVID19 global pandemic but fell 1% in 2023.**
- **2023 dominated by Karoon Energy with A\$479 MM (56% of total) and Tamboran with A\$73.5 MM (9% of total) in capital raisings.**

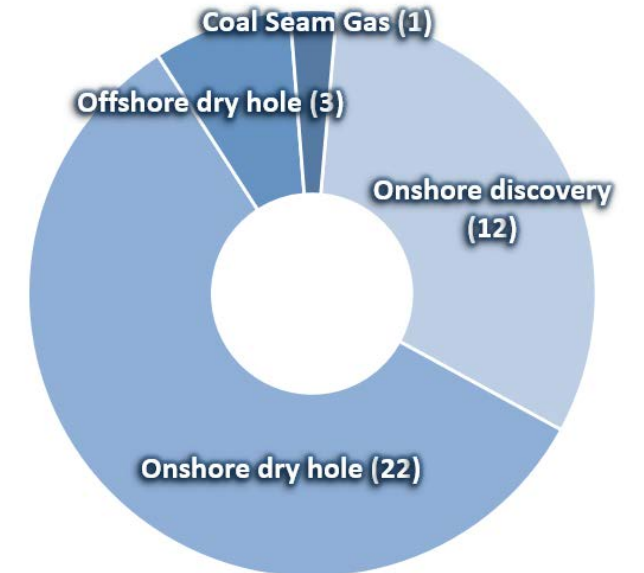


- Oil & gas company initial public offerings (“IPO”) on the ASX.
- IPO’s typically exploration focussed companies seeking funds for work program activities.
- **IPO’s are an indicator of the investment health and investor appetite for oil & gas equities (and their returns).**
- **1 IPO in 2023, Gold Hydrogen raising A\$20MM for their Ramsay-1/2 drilling program in South Australia.**

Exploration & Appraisal Wells 2023



Exploration wells (n= 38)
(26 in 2022)

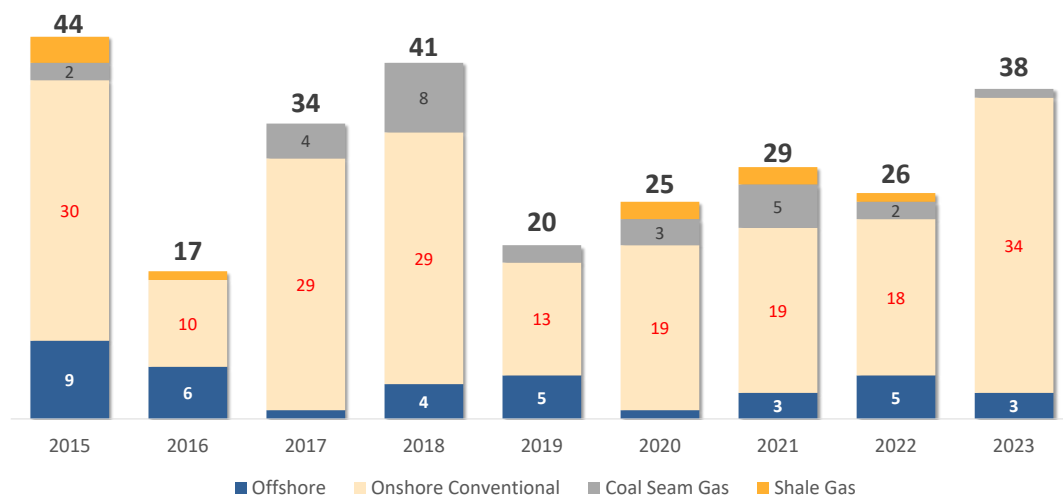


- **Offshore exploration wells = 3**
- **Offshore discoveries = 0**
- **Onshore exploration wells = 35**
- **Onshore conventional discoveries = 12**
- **35% success rate**

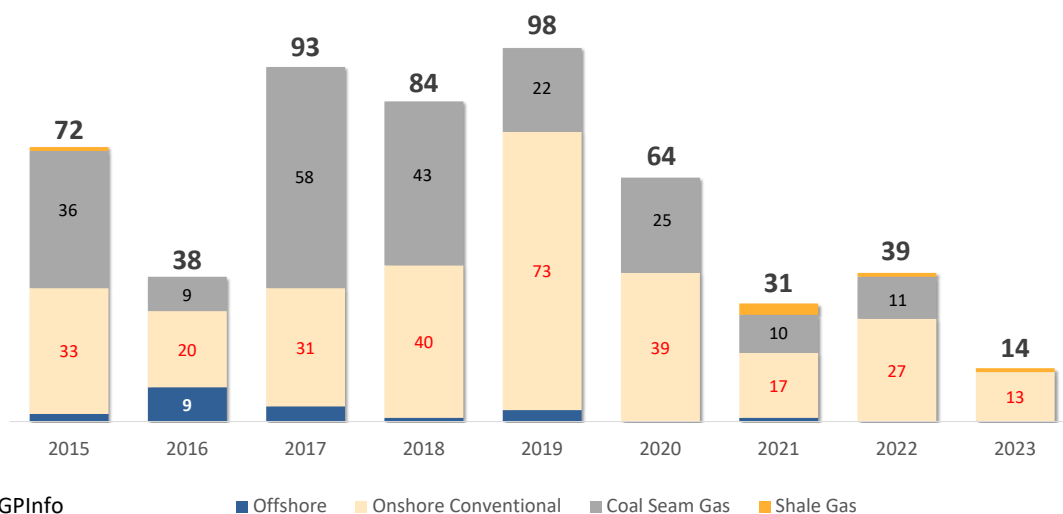
Exploration & Appraisal Drilling Trend



Exploration wells

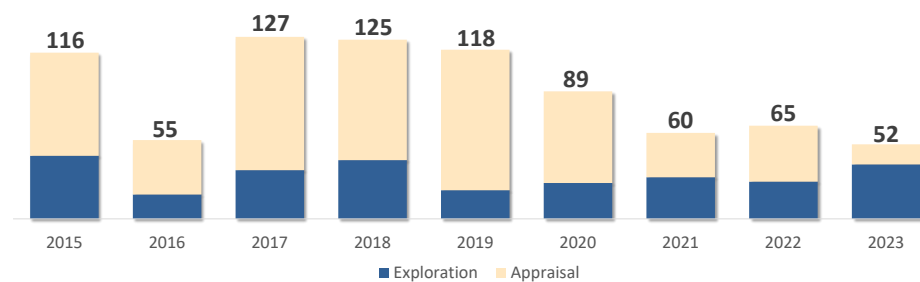


Appraisal wells

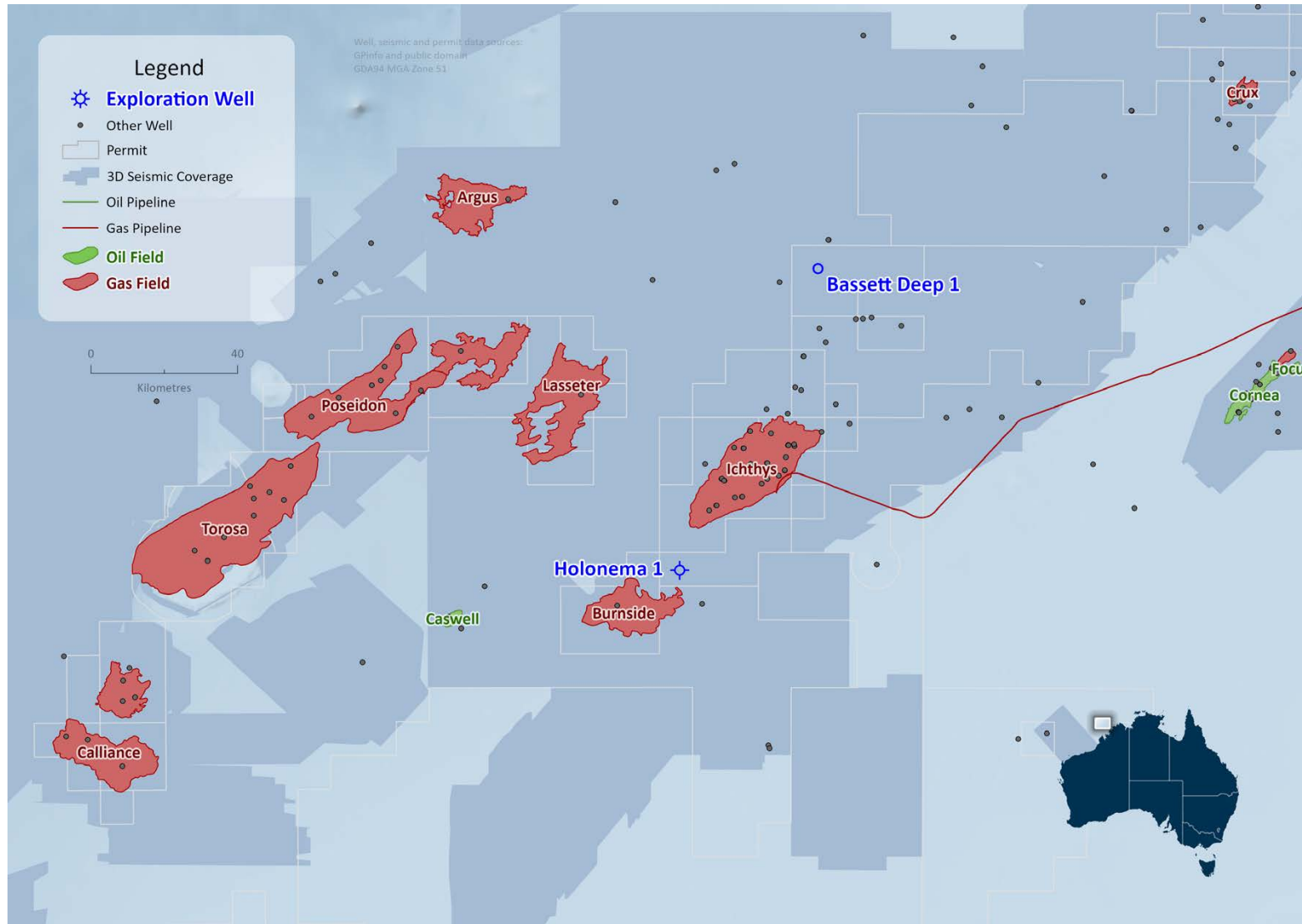


- **Total petroleum exploration well count is increasing. At the highest level since 2018.**
- Offshore petroleum exploration well count relatively flat since 2015, dwarfed by onshore petroleum exploration well count.
- Onshore petroleum exploration well count has increased since 2019, was steady over the 2020-2022 period, and is now at the highest level since 2015.
- Cooper/Eromanga Basin dominates conventional onshore petroleum exploration well count.
 - Onshore Perth Basin now 20-25% of well count.
- **Appraisal drilling has steadily been decreasing since 2017-2019.**
- CSG drilling dominated onshore appraisal drilling until 2018.
- **Total exploration & appraisal drilling at lowest level.**

Exploration & Appraisal wells

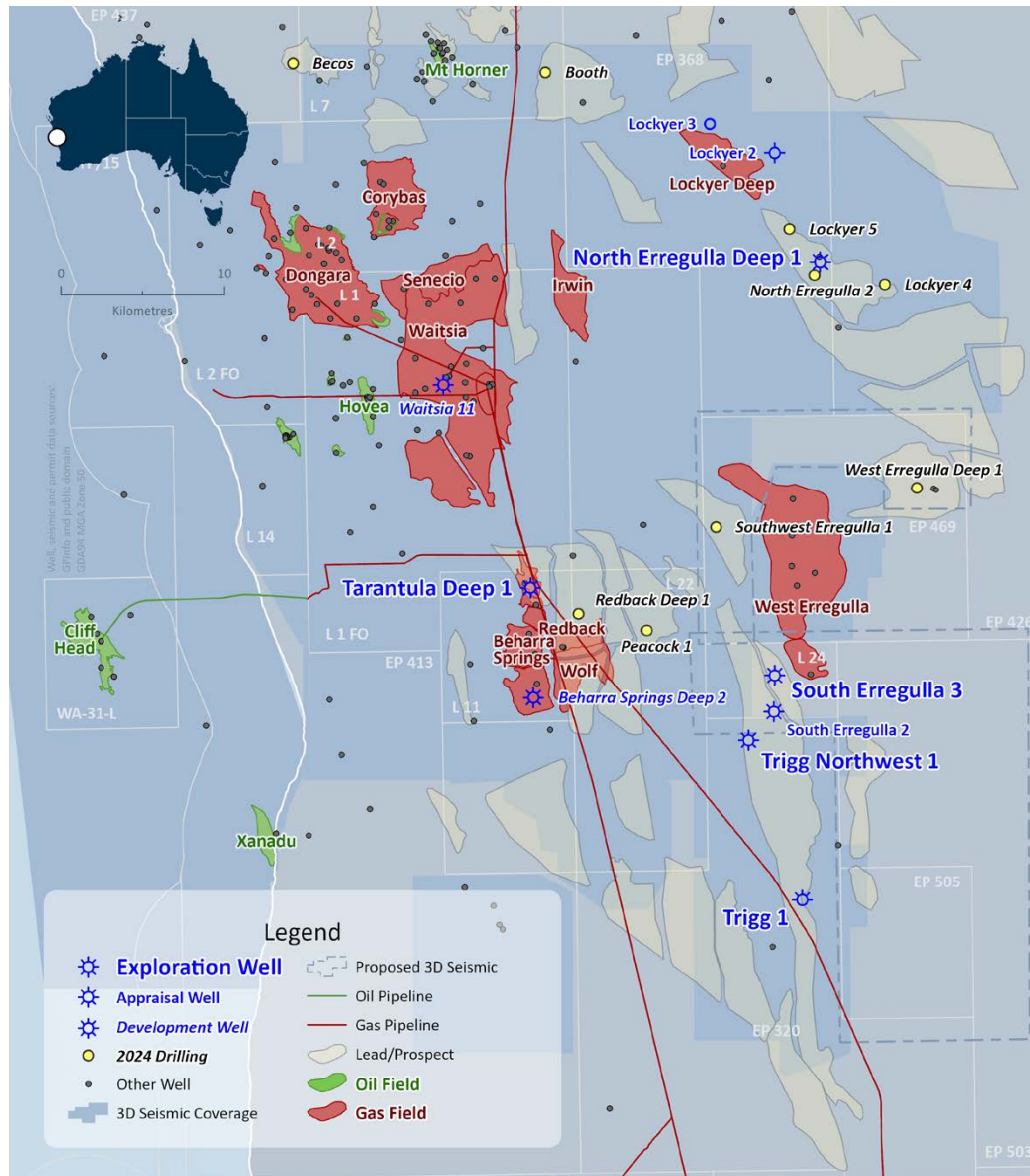


Exploration Hotspot – Browse Basin



- **Offshore exploration drilling in 2023 was focused on confirming tiebacks to existing LNG projects.**
- **Gemtree-1** drilled in the Carnarvon Basin, was targeting prospective resources for tieback to the Brunello-Julimar project and the Wheatstone LNG project.
 - P&A intersecting minor gas shows
- The remaining 2 offshore exploration wells drilled in 2023 located in the Browse Basin.
- Drilled by INPEX, targeting prospective resources for tieback to the Ichthys LNG project.
 - **Holonema-1** drilled to target a Brewster & Plover Fm stratigraphic trap, P&A'd.
 - **Basset Deep-1** was drilling at year-end.

Exploration Hotspot – North Perth Basin



Exploration Drilling:

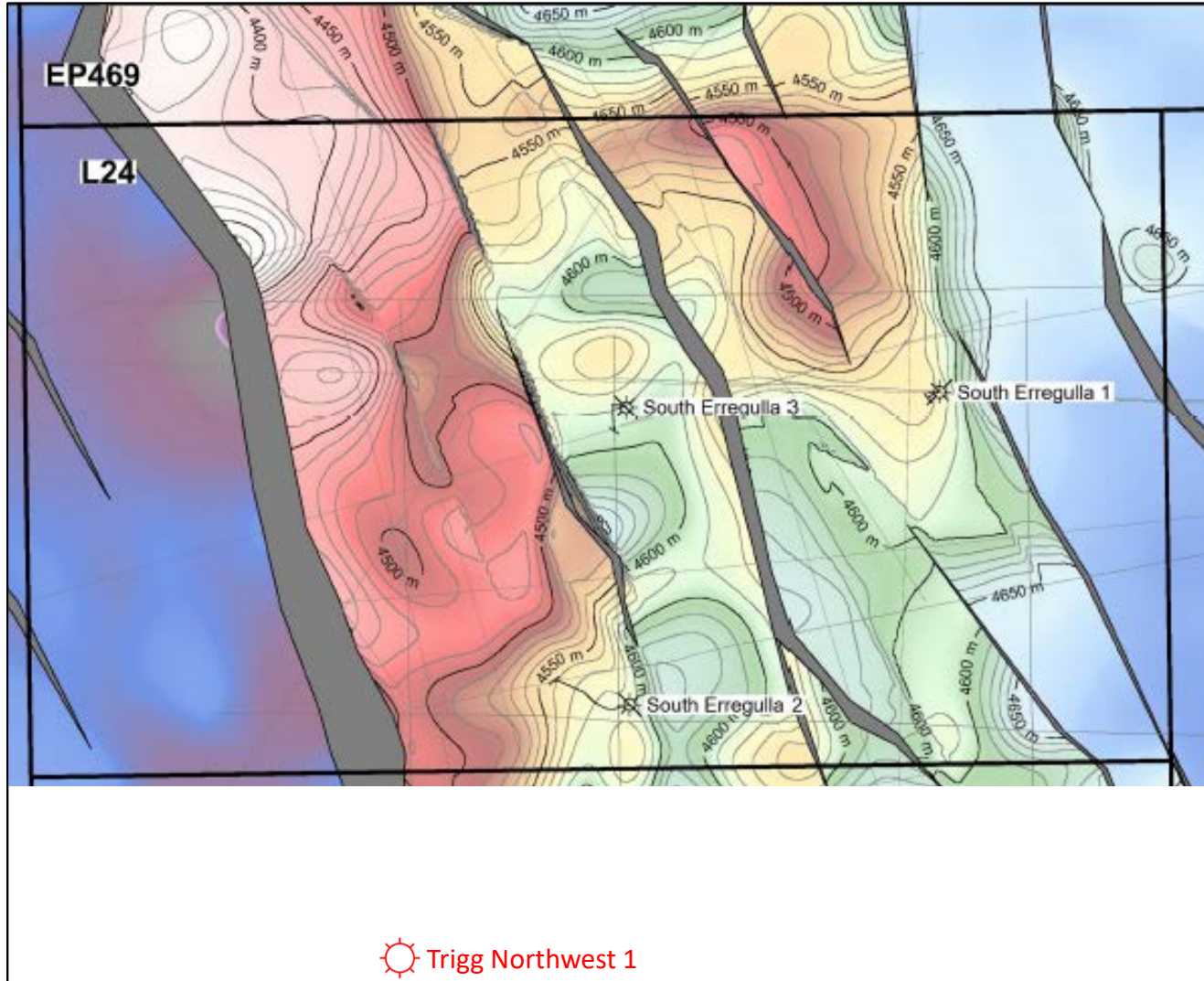
- Beach drilled:
 - **Trigg-1** was drilled to a TD of 4,914 mMD and P&A'd with gas shows in the Kingia Fm primary objective.
 - **Trigg Northwest-1** drilled to a TD of 5,000 mMD, intersecting 6 m of net gas pay in a 49 m (gross) Kingia Sandstone reservoir.
 - **Tarantula Deep-1** was drilled to a TD of 4,121 mMD, intersecting 10 m net gas pay above a GWC within a 63 m (gross) Kingia Sandstone reservoir.
- Strike Energy drilled:
 - **South Erregulla-3** exploration/appraisal well intersected 13 m of net gas pay in a 54 m (gross) Kingia Sandstone reservoir. *Gas recovered on test in 2024 but failed to flow.*
- Mineral Resources drilled:
 - **North Erregulla Deep-1** drilled to a TD of 4,446 mMD, intersecting 28 m of net gas pay in a 37 m (gross) Kingia Sandstone reservoir. A 47 m net oil column was intersected in the Dongara Sandstone secondary objective over an estimated 90 m gross interval. Kingia interval tested at rates up to 99 MMscf/d.

Appraisal Drilling:

- Strike drilled the **South Erregulla-2** well to a TD of 4,843 mMD, intersecting 16 m of net gas pay in a 45 m (gross) Kingia Sandstone reservoir.
- Beach drilled the **Beharra Springs Deep-2 result?**
- Mineral Resources drilled **Lockyer-2** (water wet) and **Lockyer-3** (13 m net gas) on the Lockyer Deep Kingia Sandstone gas pool.
- Mineral Resources commenced drilling **Lockyer-5** appraisal well on North Erregulla Deep.

Future Drilling:

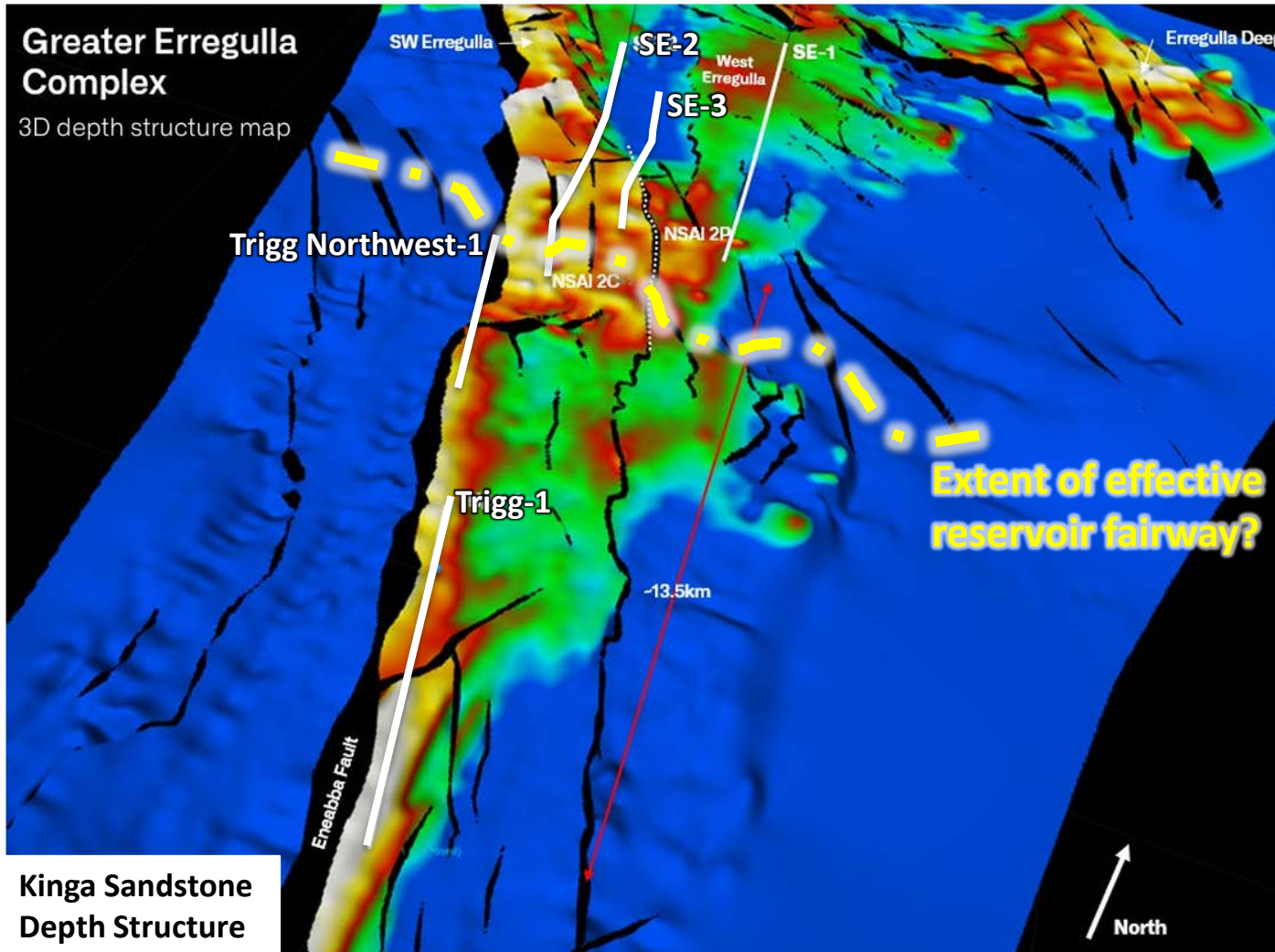
- Beach to consider drilling **Redback Deep-1** and **Peacock-1** exploration wells
- Strike Energy to drill **Southwest Erregulla-1** and **West Erregulla Deep-1** exploration wells
- Triangle operated JV to drill **Booth-1** and **Becos-1** exploration wells.



- Trigg-1 was P&A'd with gas shows in the Kingia Fm primary objective.
- Trigg Northwest-1 intersected 6 m of net gas pay in a 49 m (gross) Kingia Sandstone reservoir.
- South Erregulla-2 intersected 16 m of net gas pay in a 45 m (gross) Kingia Sandstone reservoir.
 - Gas and water recovered. Failed to establish flow¹
- South Erregulla-3 intersected 13 m of net gas pay in a 54 m (gross) Kingia Sandstone reservoir.
 - Failed to flow on test. Gas recovered, GWC intersected?²
- **Well results indicate that a potential southern 'net' reservoir limit of the Permian Kingia Sandstone play has been defined.**

Kingia top
4,843 mMD
Φave 11%, <18%

Kingia top
4,817 mMD
Φave 10%, <16%



Modified from Strike ASX announcement 15 June 2023

- Trigg-1 was P&A'd with gas shows in the Kingia Fm primary objective.
- Trigg Northwest-1 intersected 6 m of net gas pay in a 49 m (gross) Kingia Sandstone reservoir.
- South Erregulla-2 intersected 16 m of net gas pay in a 45 m (gross) Kingia Sandstone reservoir.
 - Gas and water recovered. Failed to establish flow¹
- South Erregulla-3 intersected 13 m of net gas pay in a 54 m (gross) Kingia Sandstone reservoir.
 - Failed to flow on test. Gas recovered, GWC intersected?²
- **Well results indicate that a potential southern 'net' reservoir limit of the Permian Kingia Sandstone play has been defined.**

Kingia top
4,843 mMD
Φave 11%, <18%

Kingia top
4,817 mMD
Φave 10%, <16%

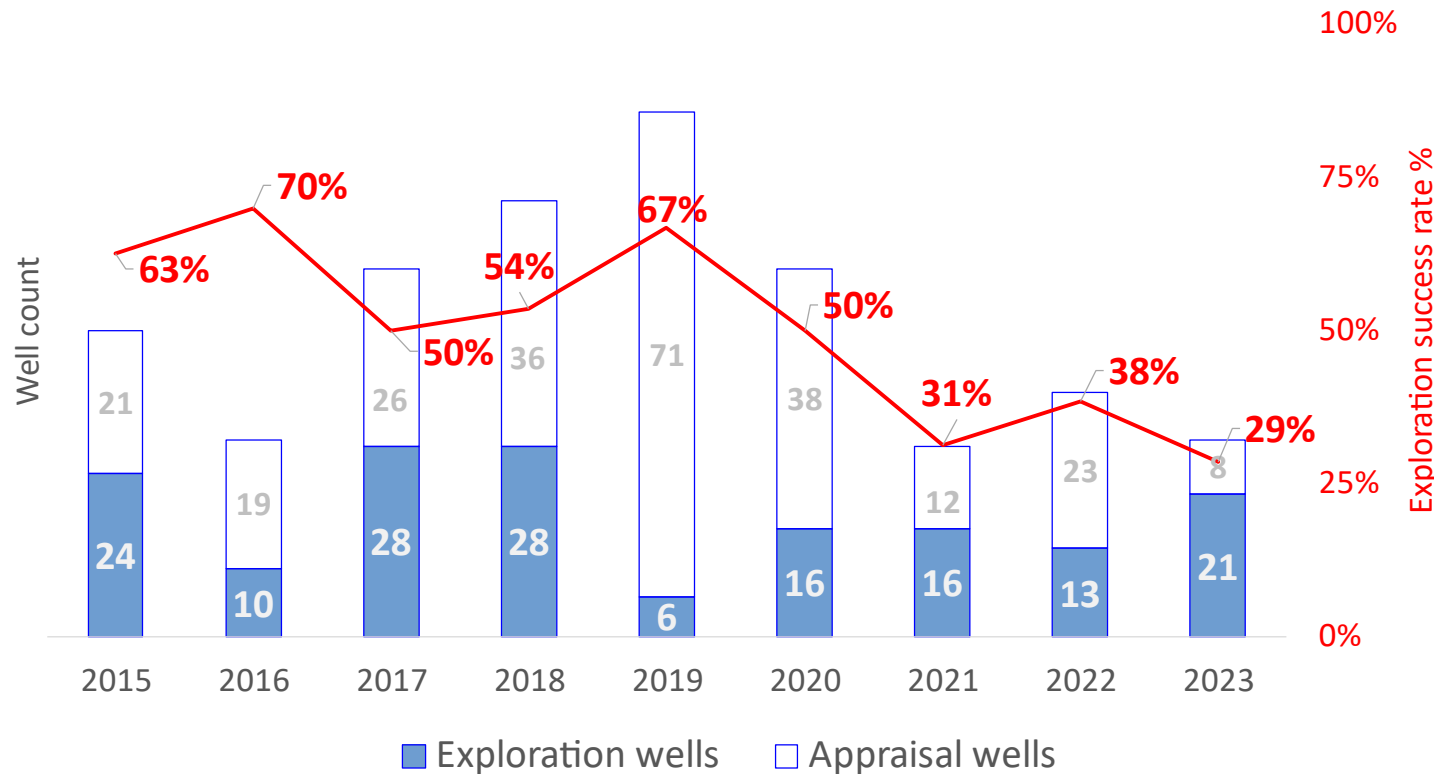
¹ Strike ASX announcement "South Erregulla Update", 20 February 2024

² Strike ASX announcement "South Erregulla Update", 13 February 2024

Cooper/Eromanga Exploration Drilling

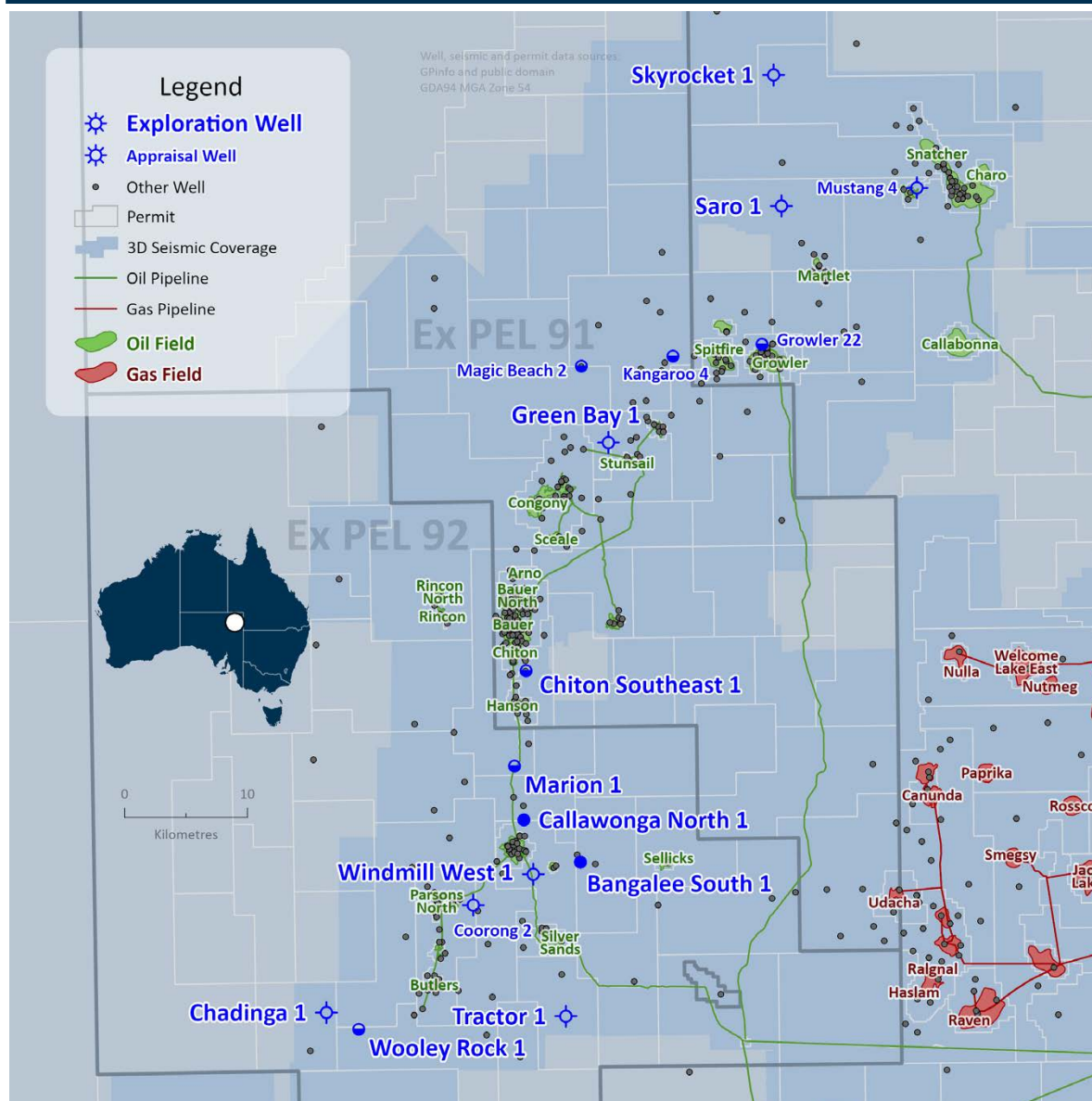


Cooper-Eromanga Basin Wells & Exploration Success Rate



- 21 exploration wells
- Beach Energy participated in 20
 - 7 operated ‘Western Flank’ wells
- 13 Cooper Basin JV wells (Santos op)
- 1 Santos operated exploration well outside of CBJV
- 8 appraisal wells
- **Exploration success is declining**
- **Total well count is declining**

Exploration Hotspot – Cooper/Eromanga Basin (‘Western Flank’)



Exploration Drilling:

- 7 exploration wells Beach Energy operated ‘Western Flank’
- **Saro-1 and Skyrocket-1** high risk exploration wells to test limit of oil migration on Western Flank.
- Chiton Southeast-1 P&A’d with oil shows in the Namur Sandstone.
- Oil discoveries at
 - Bangalee South-1 intersected 2.9 m oil column in the primary objective Namur sandstone, and 4.3 m oil column in the secondary objective Birkhead Fm
 - Callawonga North-1 intersected 3.2 m oil column in the primary objective Namur sandstone

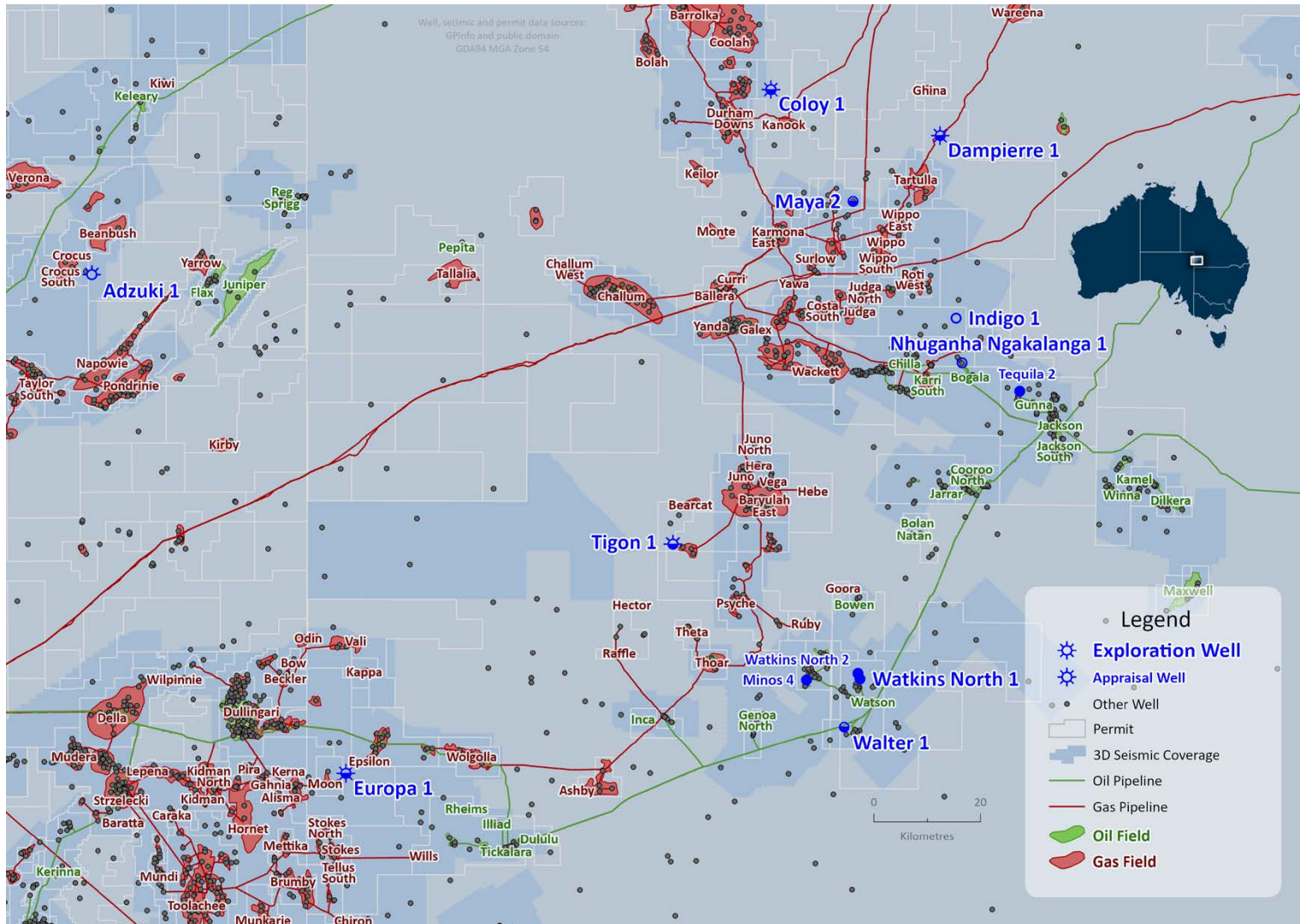
Appraisal Drilling:

- Growler 22, Kangaroo 4 and Mustang 4 targeting the Birkhead Fm were P&A’d with oil shows but had poor reservoir development.
- Coorong 2 and Magic Beach 2 targeting the Namur Sandstone were P&A’d.

Future Drilling:

- It has been reported that Beach is to suspend exploration efforts as part of a strategic review.

Exploration Hotspot – Cooper/Eromanga Basin (central/east)



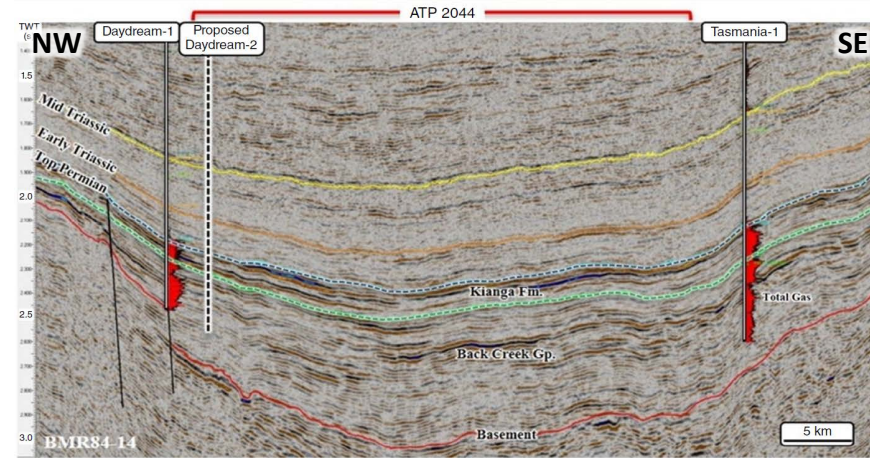
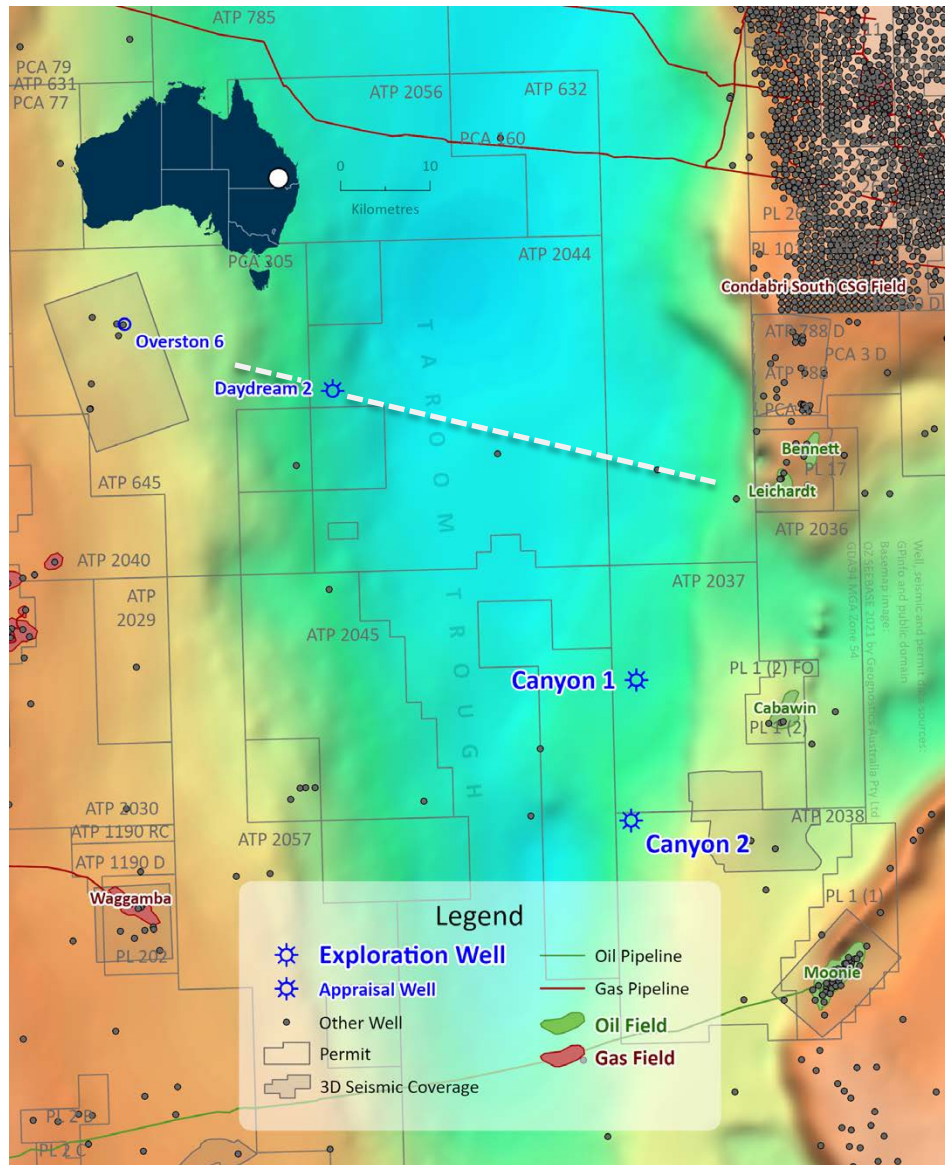
Exploration Drilling:

- Santos Operated Cooper Basin JV
- Gas discoveries at Coloy-1, Europa-1, Nhuganha Ngakalanga-1
- Oil discovery at Watkins North-1

Appraisal Drilling:

- Watkins North-2 and Minos-4

Exploration Hotspot – Taroom Trough, Bowen/Surat Basin



Play:

- Late Permian Kianga Fm and Back Creek Gp BCG.
- QGC wells Daydream-1, Fantome-1, Magnetic-1, Tasmania-1 & Dunk-1 were drilled to test the play in 2012-15 and tested at low flow-rates after frac-stim.

Gas Resources:

- Omega O&G report 2C 1.5Tcf (net)
- Elixir report 2C 0.4Tcf (gross) & 2U 1.3 Tcf (gross)

Exploration Drilling:

- Omega Oil & Gas drilled the **Canyon-1 & 2** wells. Canyon-1 drilled to a TD of 4,000 m and Canyon-2 drilled to a TD of 3,807 m.
- Both wells intersected 360 - 400 m interval with high gas readings.

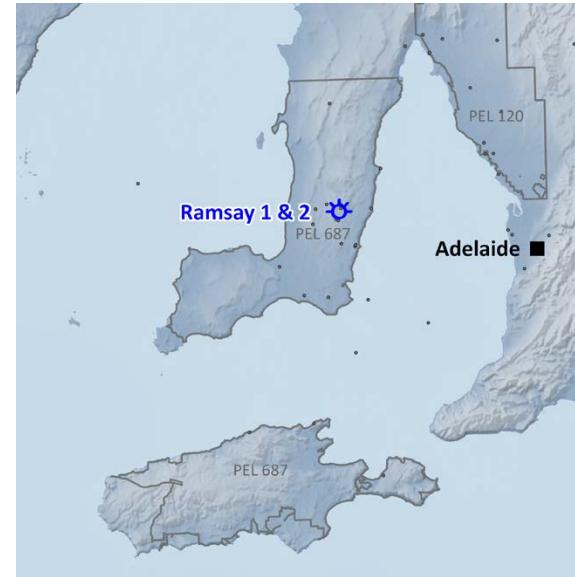
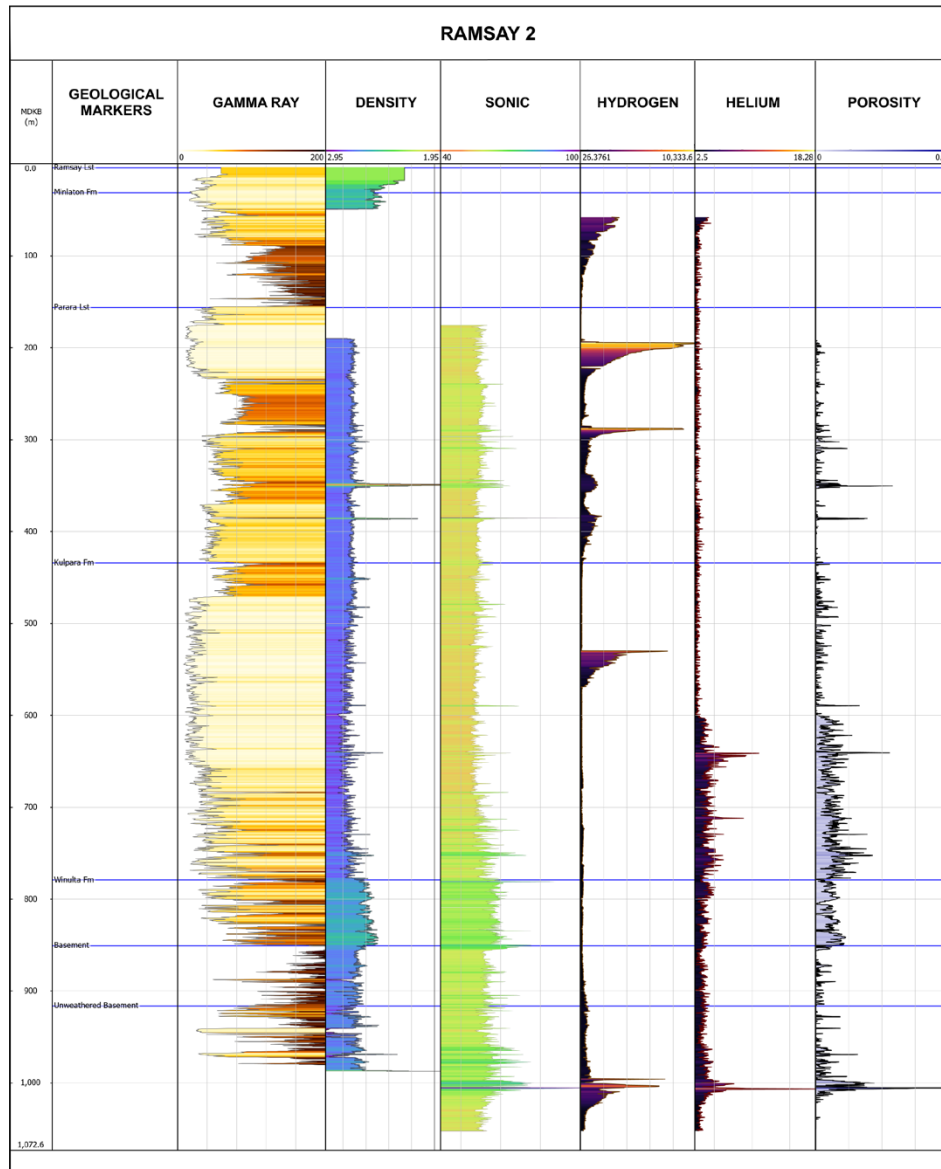
Appraisal Drilling:

- Elixir drilled the **Daydream-2** well to a TD of 4,300 m.
 - Report 154 m net pay
 - Intersected a gas bearing permeable sand of the Lower Lorelle Sandstone of the Back Creek Gp at 4,200 m of 12 m gross thickness.
- Shell (QGC) commenced drilling the **Overston-6** well.
 - TD of 4,228 mMD reached in January 2024.
 - Horizontal well in Tinowan Sandstone of the Back Creek Gp.

Future Drilling/Testing:

- Omega O&G to drill Canyon-1H horizontal section, frac-stim and flow test.
- Elixir plan to frac-stim and flow test Daydream-2 mid-2024.

Gold Hydrogen drilling PEL 687



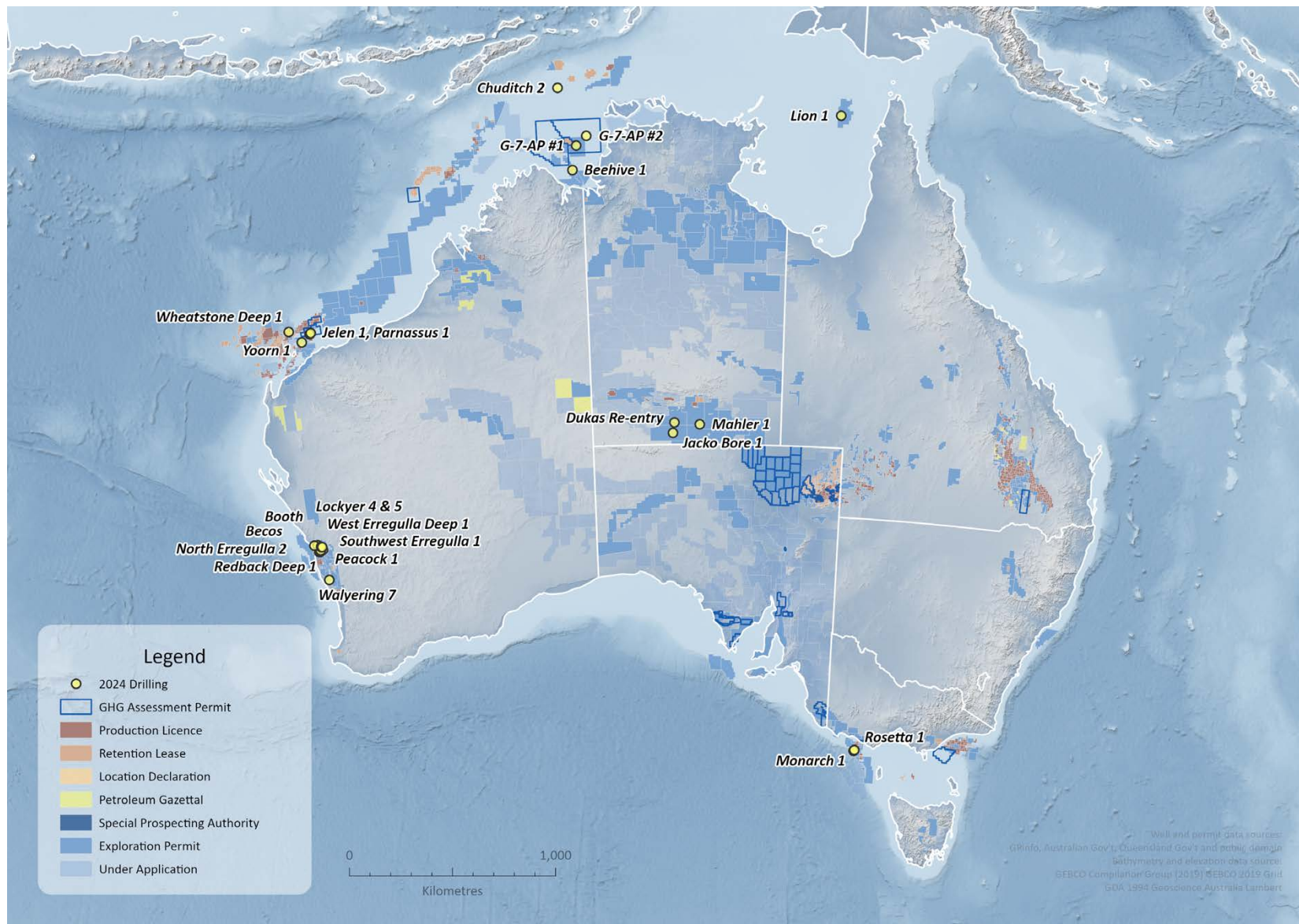
- PEL 687 granted July 2021
- Gold Hydrogen (ASX:GHY) IPO January 2023
- Commenced drilling campaign in October 2023.
- Wells located 0.1 & 0.5 km from historical Ramsay Oil Bore-1 well with reported H2 indications.
 - Ramsay-1 drilled to a TD of 1,005 mMD
 - Ramsay-2 drilled to a TD of 1,068 mMD

Ramsay-2			Ramsay-1			Ramsay Oil Bore-1 (1931)		
Depth (m)	H2 %	He%	Depth (m)	H2 %	He%	Depth (m)	H2 % [§]	He%
194 - 199	86 % [#]		240	73 % ^{#§}		241	76 %	
288 - 293	82 % [#]		260	73.1%		262	73 %	
531 - 536	81 % [#]		507	89.3%		508	89 %	
778		6.8 % ^{*&} 6.1 % ^{*&}	892		3.6 % ^{*§}			

[#] Mudgas sample ^{*} MDT sample [&] Non-air corrected [§] Air corrected

Sources:
 Gold Hydrogen ASX releases 31 October 2023, 6 & 19 December 2023
 Gold Hydrogen Qtrly report, 30 January 2024
 Ward, L. K. (1944) The Search for Oil in South Australia. Geological Survey of South Australia Bulletin 22

Exploration & Appraisal Wells planned for 2024+



Offshore:

- **Wheatstone Deep-1** (Chevron Op) exploration tieback to Wheatstone LNG project.
- **Beehive-1** (EOG Resources) in WA-488-P, Bonaparte Gulf targeting 416 MMboe 2U Prospective Resources.
- **Lion-1** is a well commitment in Q/23P in the Gulf of Carpentaria. Subject to farmout and likely to be delayed.
- Santos plan to drill the **Yoorrn-1, Jelen-1 & Parnassus-1** gas prospects.
- Inpex plan to drill 2-wells in the G-7-AP GHG assessment permit
- ConocoPhillips plan to drill the **Monarch-1** and **Rosetta-1** exploration wells in the Otway Basin.
- **Chuditch-2** appraisal well is planned

Onshore:

- In the North Perth Basin:
 - Beach to drill **Tarantula Deep-1, Redback Deep-1 & Peacock-1** exploration wells, in addition to **Beharra Springs Deep-2** appraisal well
 - Strike to drill the **Southwest Erregulla-1 & West Erregulla Deep-1** exploration wells, and the **Walyering-7** exploration/appraisal well.
 - Energy Resources to drill **Lockyer-4 & 5** and **North Erregulla Deep-2** appraisal wells
- Re-entry of the suspended **Dukas-1** and **Mt Kitty (Jacko Bore-1) & Mahler-1** are planned to test sub-salt prospects with TCF potential (hydrocarbons, He and H2)
 - Peak Helium farmin terminated September 2023

- **Petroleum exploration spend is flat.** *Onshore exploration spend has exceeded offshore since 2019. Petroleum exploration spend lags behind mineral exploration spend, and the gap is growing.*
- **Total area under petroleum exploration title is ever decreasing.**
- **No Federal offshore petroleum or GHG exploration permits awarded in 2023.**
- **No Federal offshore petroleum release round.** GHG acreage release with 10 areas.
- 15 petroleum exploration areas released in WA and QLD.
- 11 petroleum exploration permits were awarded in state jurisdictions of WA & QLD.
- 38 exploration wells (3 offshore) and 14 appraisal wells (all onshore)
- **12 onshore conventional petroleum discoveries.**

Key take-aways

- Petroleum exploration is very much focussed on the onshore basins.
- The Cooper – Eromanga is the focus of onshore exploration and continues to yield exploration discoveries. However, exploration success is declining and Beach Energy has announced a pause.
- Onshore Perth Basin continues as an exploration hot-spot

Acknowledgments



- Simon Barber (RISC)
- Craig Gumley (Consultant)
- Matthew Quinn (IHS)
- Rhys Simpson (EurozHartleys)
- Peter Cameron (Australian Oil & Gas Research)

- Data compiled from GPInfo, GlobalData and public sources



www.riscadvisory.com

Perth

Level 2
1138 Hay Street
WEST PERTH WA 6005
P. +61 8 9420 6660
E. admin@riscadvisory.com

Brisbane

Level 10
95 North Quay
BRISBANE QLD 4000
P. +61 7 3025 3397
E. admin@riscadvisory.com

London

Office 204
20 St Dunstan's Hill
LONDON UK EC3R 8HL
P. +44 (0)203 795 2900
E. admin@riscadvisory.com

South East Asia

Jakarta
Indonesia
P. +61 8 9420 6660
E. admin@riscadvisory.com