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Strategic Panel 10: Unconventional Gas

Grant King
Origin Energy

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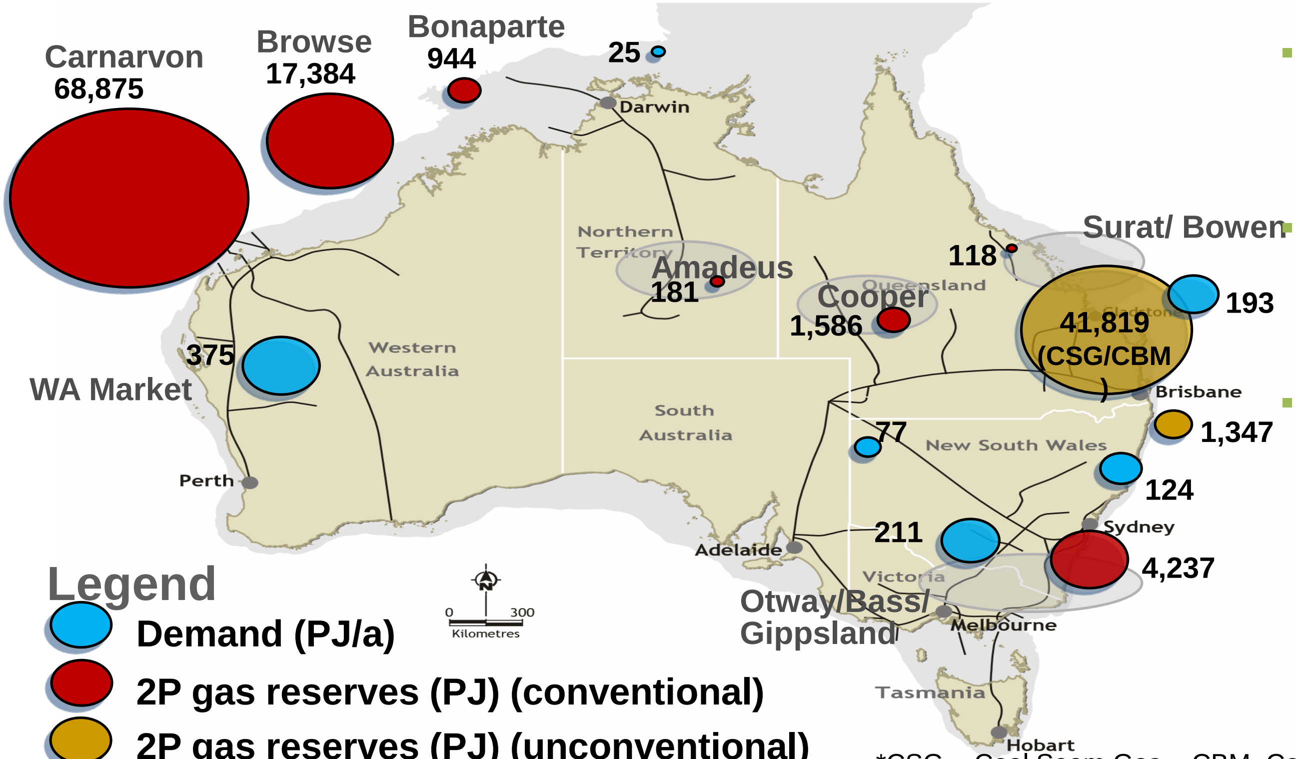
Australian gas resource position and domestic markets



- Australian has large gas reserves in the north west (conventional) and eastern Australia (largely unconventional e.g.CSG*)
- The domestic gas markets in the west, north and south-eastern Australia are relatively small and disconnected
- The development of the CSG resource in the east improved supply security, and led to cancellation of plans in 2007 to import gas from Papua New Guinea to Queensland by pipeline

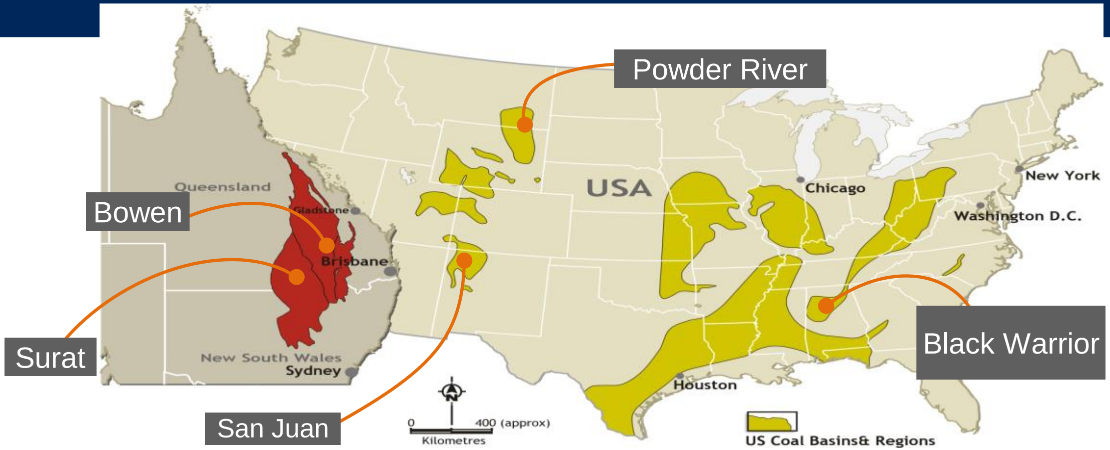
*CSG = Coal Seam Gas = CBM, Coal Bed Methane (USA)

Sources (reserves): Energy Quest (Mar 2015)

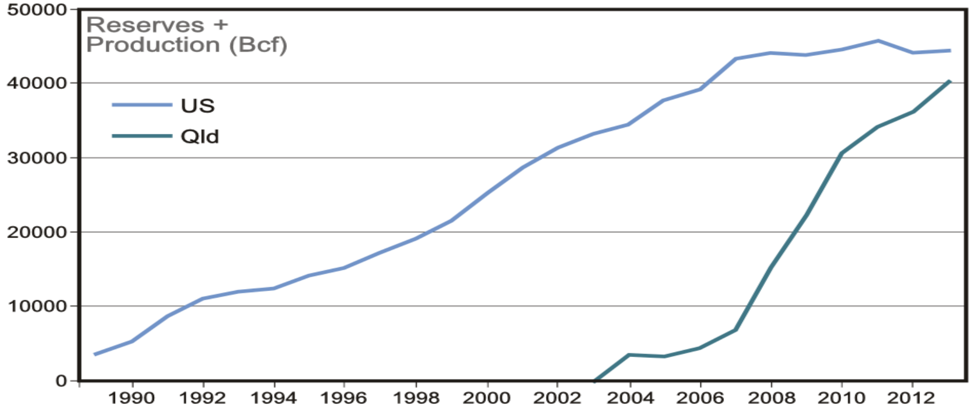
Sources (demand): AEMO NGFR Dec 2014, IMOWA GSOO Dec 2014, ACIL Tasman 2012

Australian CSG resource scale & quality

- Australian (CSG) and USA (CBM) resources are of comparable quality and scale (eg Gas density, Permeability, Reserves)
- Geological factors are critical to enabling coals to be economic in the production of CSG
- The Bowen and Surat basins in Australia contain Permian and Jurassic coals. Certain areas within the basins have the right combination of maturity, gas saturation, permeability and depth to be economic.

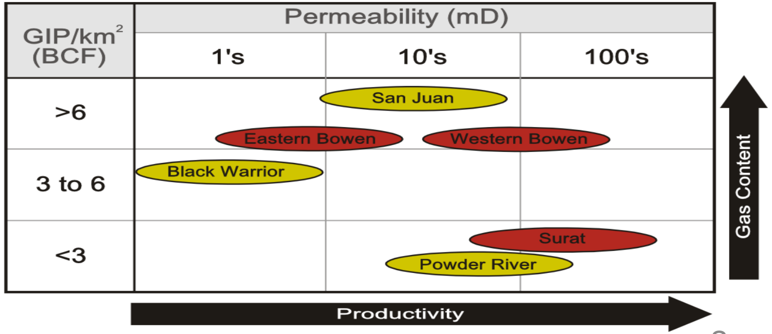


US and QLD estimated recovery



Source: Qld Dept of Natural Resources and Mines; US EIA

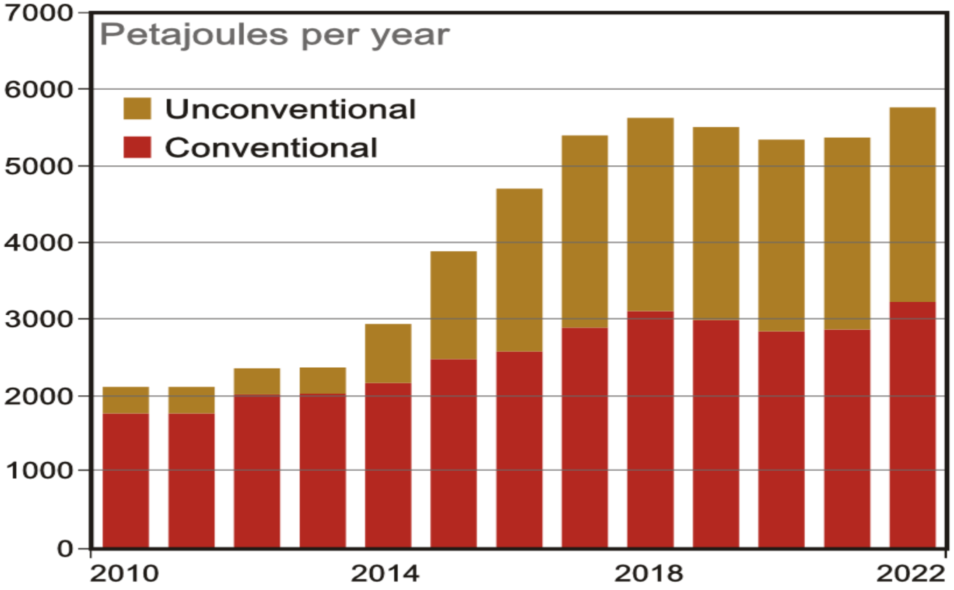
Commercial CSG Basins – permeability and resource concentration



Source:
Schlumberger Business Consulting, Internal Presentation (used with permission)

Importance of unconventional gas in Australia

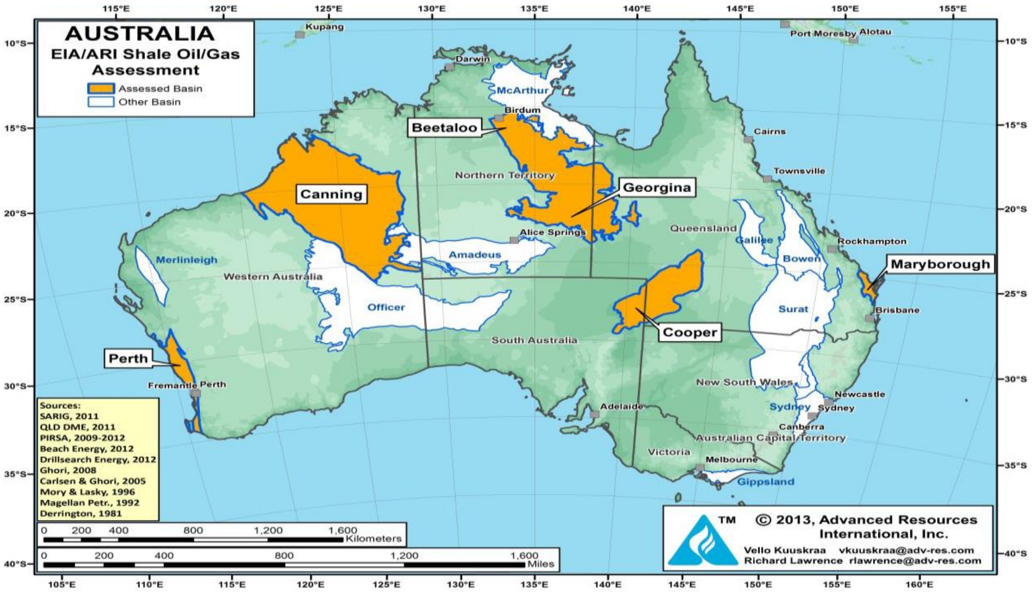
- Unconventional gas has secured east coast gas supply since early 2000's
- Relatively small role for unconventional gas production prior to ~2015
- A clear step change in production when all CSG-LNG projects are online around 2017
- Exploration success in any one of the prospective shale plays in Australia could provide the next tranche of LNG expansion or backfill
- Potential shale gas production may be in competition for market with currently stranded/non-commercial undeveloped offshore conventional resources (e.g. Browse/Bonaparte Basin gas)



Source: Grattan Institute

Beyond CSG...to shale gas

- EIA estimates of technically recoverable shale gas resources has altered the perception of the long term gas supply potential in Australia
- Not all prospective basins are included in the EIA assessments in 2011 & 2013
- Australia’s estimate only included Canning, Beetaloo, Georgina and Cooper Basins



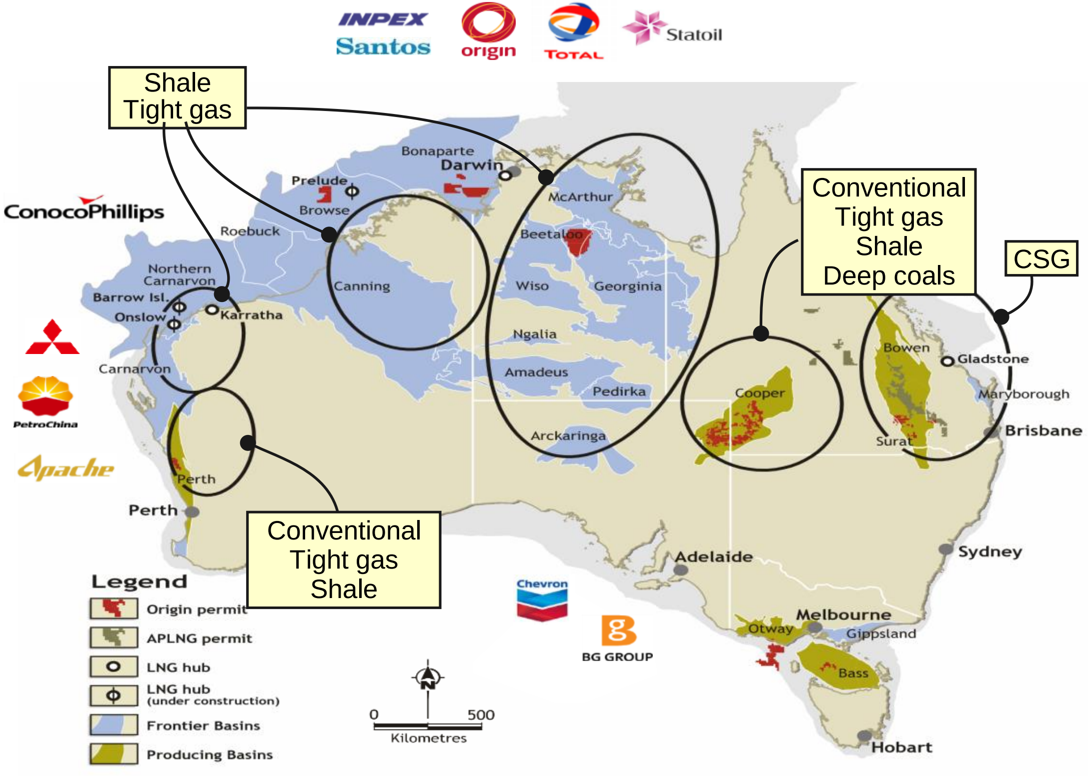
Source: EIA (2013)

Rank	Country	TCF
1	China	1,115
2	Argentina	802
3	Algeria	707
4	U.S.	665
5	Canada	573
6	Mexico	545
7	**Australia**	**437**
8	South Africa	390
9	Russia	285
10	Brazil	245
	World Total	**7,299**

Source: EIA (2013)

Shale gas exploration in Australia

- Very early days for shale gas and basin centred gas (BCG) exploration
- Focus of exploration in SA, WA and NT
- Proven source rocks but limited unconventional production
- 30-40 Cooper Basin (Australia's most mature onshore basin) shale and BCG focused exploration wells – fracture stimulated gas to surface in almost all wells
- ~25 shale gas exploration wells across WA and NT frontier basins – relatively few fracture stimulations with mixed success
- Majors farmed-in 2011-13 in partnership with smaller local companies
- Some Majors have since exited - poor technical results
- Recently reported results in the Beetaloo Basin: "Multiple thick intervals of organic-rich rock…accompanied by significant mud gas shows" *
- Seasonal flooding in some areas and vast distances challenge cost effective operations



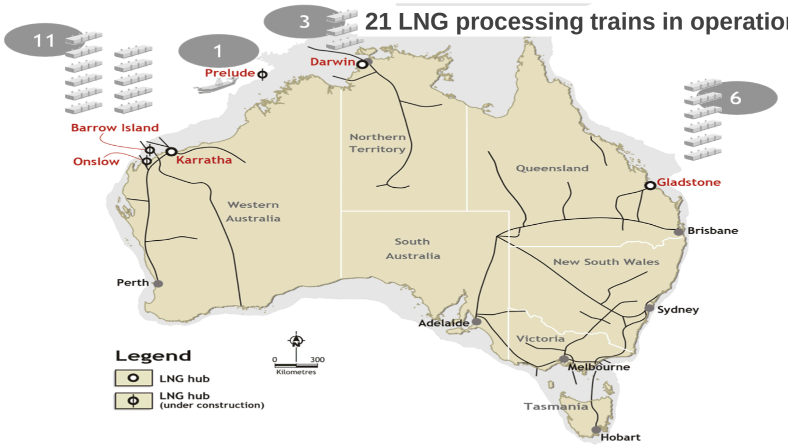
Major companies exploring for unconventional/shale gas in Australia

* Santos Investors report: santos.com

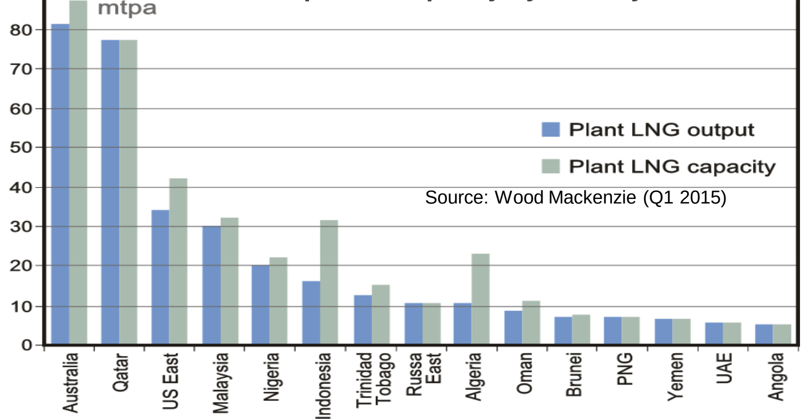
Australian LNG export industry

- LNG export growth a natural response to commercialise a large resource position with a relatively small domestic demand
- Domestic demand is equivalent to ~18 Mtpa, approx. 20% of 2019 export capacity
- LNG development started on the west coast (conventional), now also north coast (conventional) and east coast based on unconventional (CSG) gas
- Australia has become a large diverse LNG producer with further growth potential

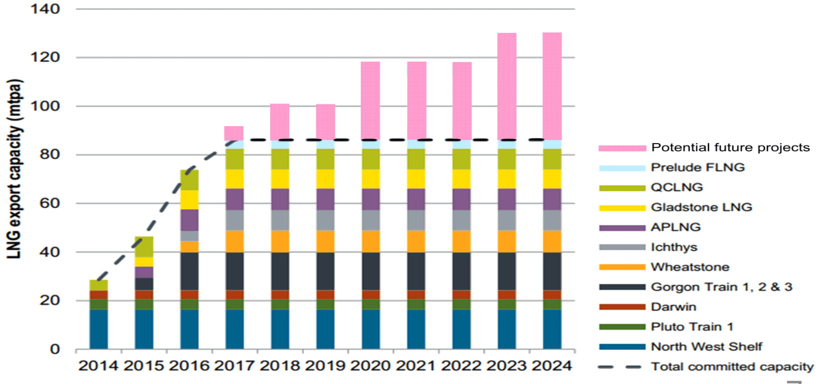
21 LNG processing trains in operation by 2017



LNG output vs. capacity by country – 2019



Total estimated LNG export capacity in Australia, 2014 to 2024



Source: Respective corporate websites and Groupe International des Importateurs de Gaz Naturel Liquifie (2014).

Thank you