Beetaloo or bust

The route to commercial success for an Australian shale play

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Wood Mackenzie

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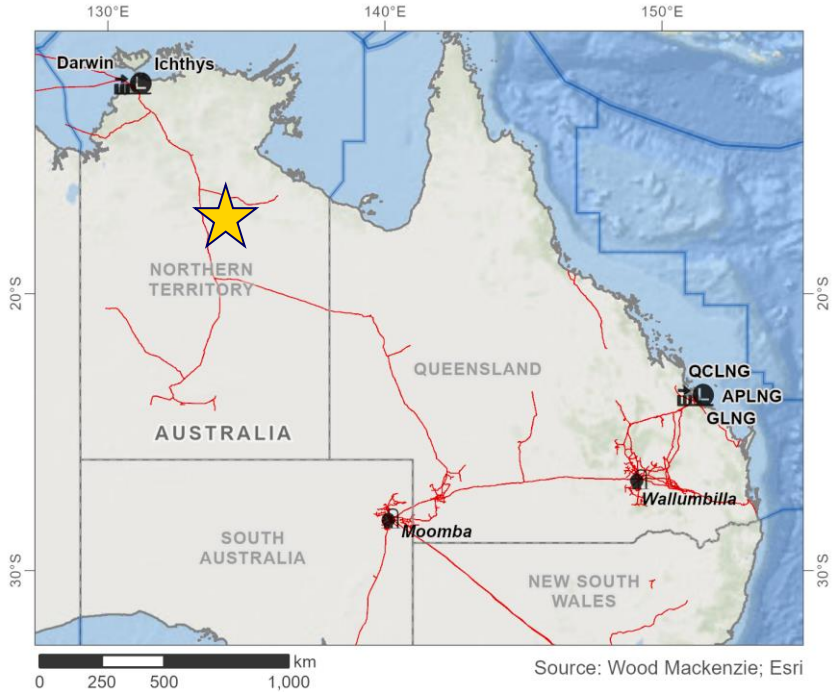
Beetaloo background

- Unconventional shale focus
  - Targeting Mesoproterozoic Roper Group
  - One of the world's oldest proven source rocks
  - Current interest focused on "B Shale" in Velkerri Formation
  - No clear US shale analogue? Organic & mineral properties may be quite different
- Huge volume of gas in place
- Challenges both above and below ground:
  - Lack of infrastructure, wet season
  - Isolated from large gas users
  - High costs
  - Flow rates have been low – but increasing…
- **What will it take the make the play commercial?**



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Progress to date

Key facts

- Operators: Santos, Tamboran Resources, Empire Energy
- 18 wells drilled last 10 years – picking up the pace
- Flow rates – increasing as well location & completion designs refined
- Latest results from Shenandoah South-1: IP30 19 mmcfd /3,000 m hz completion (normalised) from Shenandoah South-1, 17+ bcf EUR?

- **Next up:** Pilot project phases from Empire and Tamboran
- Both expecting FID 2024
- Empire – start-up 2025, 25 TJ/d by 2026
- Tamboran – start-up 2026 aiming for 40 TJ/d

Source: Tamboran Resources, https://www.tamboran.com/assets, accessed 13 May 2024

Beetaloo SWOT analysis

Strengths

- **High-priced east coast gas markets**
- Huge acreage
- Low reservoir CO_2
- New build – latest low CO_2 tech
- **Supportive state & fed government**

Weaknesses

- **High-cost development**
- Little existing infrastructure
- Transport – isolated play
- Early days: uncertainties abound
- Small-cap operators, limited cash

Opportunities

- **East Coast market is gas-short**
- LNG backfill: Gladstone, Darwin
- LNG greenfield: NTLNG – low carbon LNG?
- Growing levels of external interest

Threats

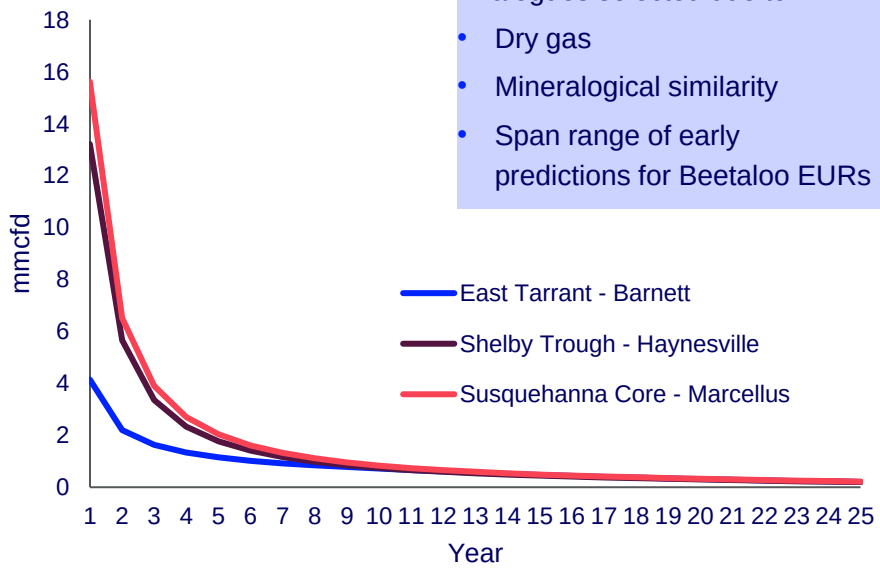
- **Investor confidence – momentum vital**
- Environmentalism, other land users
- Prevailing anti-gas sentiment
- Scope 3 consideration
- Wet season

Our approach – flexing well costs, project size and production profiles

Simplified models to flex multiple key factors

- Well costs (DCET* costs)
  - US$15 million
  - US$20 million
  - US$25 million
- Production analogues – EUR*/3,000 m hz development well
  - 7.5 bcf (Barnett)
  - 13.5 bcf (Haynesville)
  - 16 bcf (Marcellus)
- Project size – production at plateau
  - 150 mmcfd
  - 500 mmcfd
  - 1,000 mmcfd

Analogue production profiles: normalised to 3,000 m completion



Analogues selected due to:

- Dry gas
- Mineralogical similarity
- Span range of early predictions for Beetaloo EURs

Source: Wood Mackenzie

*EUR – estimated ultimate recovery per well in bcf

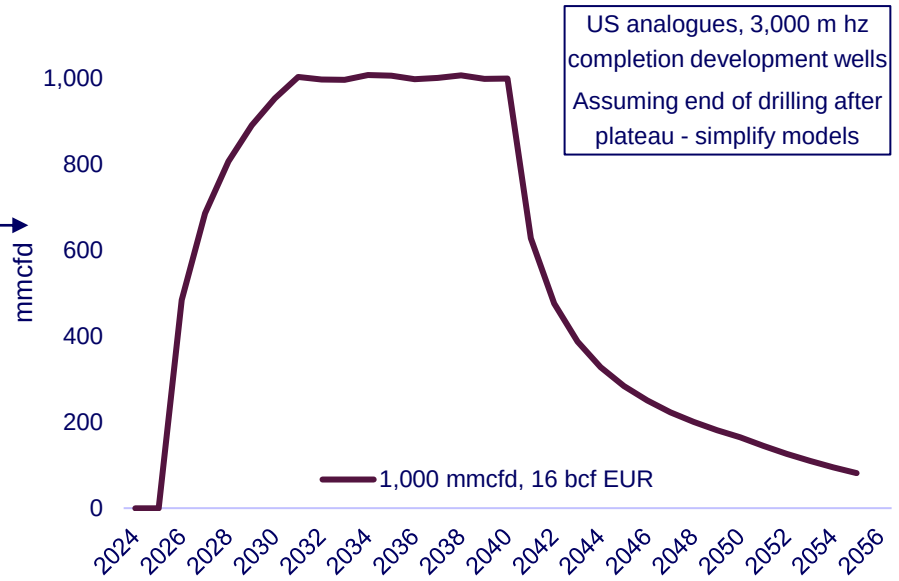
DCET – Drill, complete, equip, tie-in

Modelling assumptions

Key factors feeding into simplified economic models

- Dry gas
- Market / Market price
  - East Coast – ex. Moomba
  - 2026: US$9/mcf = A$12.8/GJ*
- Aggressive & rapid development scenario – no pilot phases
- Life of field: 6-year ramp up, 10-year plateau, 30-year field life
- Production profile – EUR
- Facilities costs and economies of scale
  - US$280 million to US$1.6 billion
- Other capex: compression, infield pipeline, workovers, maintenance, abex
- Opex costs and economies of scale
  - US$0.4/mcf plus fixed US$62.5-125 M/yr, decrease last 10 yrs
- Transport tariff - new build or existing pipelines (US$1.4-2/mcf)

A modelled development scenario: 1,000 mmcfd project plateau case



Source: Wood Mackenzie, 1,000 mmcfd plateau, 16 bcf EUR scenario

* A$1.49/US$ and 1.05 GJ/mcf

Results – some as expected, and some not

Can the subsurface deliver sufficient gas flows?

- Low EUR case struggles to meet commercial hurdle in almost every case
- High capex kills the project – must reduce well costs in lower EUR/well settings
- That should be possible in shallower targets

- But high EUR case almost always produces a viable project
- Best outcome results in 50% IRR and NPV10 US$6.7 billion

Low subsurface outcome: EUR 7.5 bcf / well

Post-tax IRR %	Plateau mmcfd		
Well cost US$ M	150	500	1000
15	*6%*	*13%*	*15%*
20	*2%*	*8%*	*9%*
25	*0%*	*4%*	*5%*

Source: Wood Mackenzie

High subsurface outcome: EUR 16 bcf / well

Post-tax IRR %	Plateau mmcfd		
Well cost US$ M	150	500	1000
15	*21%*	*41%*	*50%*
20	*16%*	*33%*	*39%*
25	*13%*	*26%*	*31%*

Source: Wood Mackenzie

Results

Flex well costs & EURs across fixed project sizes

- Larger projects deliver economies of scale, but no significant change in commerciality as modelled
- Using a 15% IRR cut-off only one additional scenario flips to uneconomic
- Subsurface deliverability key however. Lower flow rates require cheaper well costs to deliver an economic project.

500 mmcfd project plateau

Post-tax IRR %	Well EUR		
Well cost US$	7.5	13.5	16
15	*13%*	*36%*	*41%*
20	*8%*	*28%*	*33%*
25	*4%*	*21%*	*26%*

Source: Wood Mackenzie

1,000 mmcfd project plateau

Post-tax IRR %	Well EUR		
Well cost US$	7.5	13.5	16
15	*15%*	*44%*	*50%*
20	*9%*	*33%*	*39%*
25	*5%*	*25%*	*31%*

Source: Wood Mackenzie

Breakeven gas prices

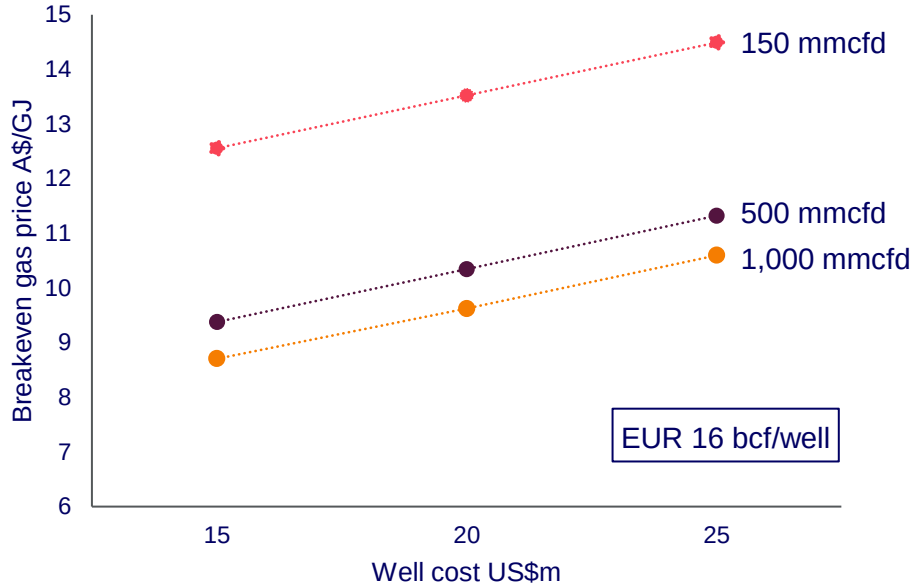
Beware the switch in units for the Australian market

- Breakevens aren't low – got to pay for all that new infrastructure!
- **But, includes transport to Moomba**
- Results suggest delivered Beetaloo gas can be competitive in the East Coast market
- If breakeven price ~A$9/GJ (delivered Moomba), **Melbourne gas > A$12/GJ**

Breakeven at EUR 16 bcf (ex. Moomba)

Breakeven A$/GJ	Plateau mmcfd		
Well cost US$m	150	500	1000
15	*12.6*	*9.4*	*8.7*
20	*13.5*	*10.3*	*9.6*
25	*14.5*	*11.3*	*10.6*

Breakevens (A$/GJ) under different cost/production profiles



Assumptions: A$1.49/US$ and 1.05 GJ/mcf, 10% discount rate

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Obstacles and stumbling blocks

- Returns contingent on build out “going to plan”
- Recent Australian projects seen higher costs, slower start-up
- Delays impact NPV – high capex upfront to build required infrastructure
- Gas market is volatile, government intervention possible

- What equipment & supplies are available locally given US dominance in shale?
- What can we learn from the US example in cost reduction?

- A multi-operator, full-scale, Beetaloo development could see cost inflation of relevant products and services:
  - OCTG – Casing, etc.
  - Frac sand
  - Rigs & other services
  - Labour

Number of wells required

Number of wells	Plateau mmcfd		
well EUR/bcf	150	500	1000
7.5	*149*	*499*	*997*
13.5	*75*	*242*	*484*
16	*64*	*209*	*417*

Source: Wood Mackenzie

Net zero – Emission impossible?

Beetaloo emissions are under the microscope

Safeguard Mechanism – targeting shale

Shale projects with emissions >100 ktCO2e/a require net zero scope 1 emissions

Options

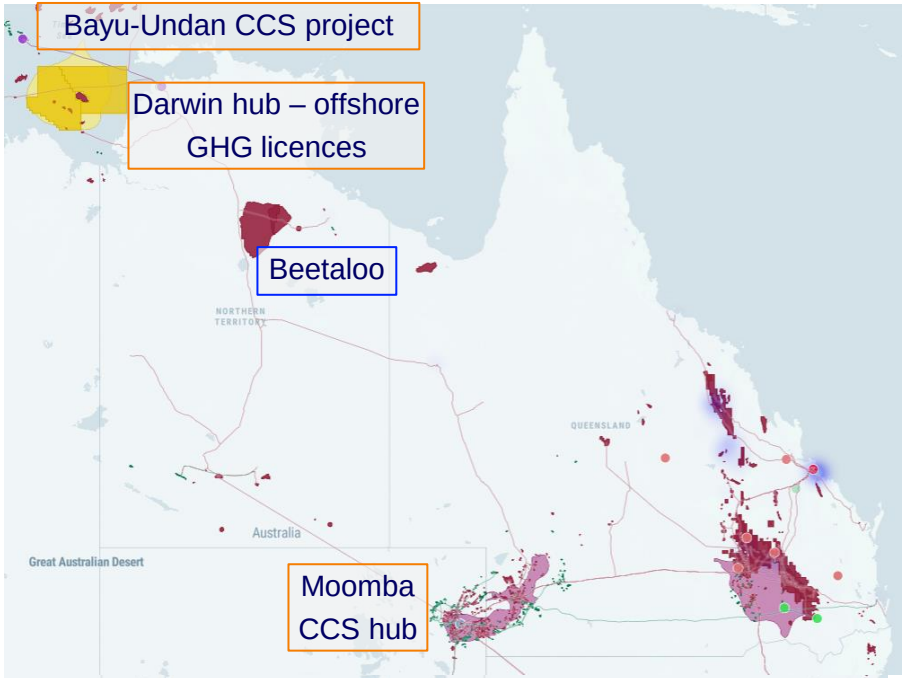
- Greenfield development – best practice from day one
- Renewable energy (+ BESS*) at gas plants, on well pads?
- CCS options both east and west for reservoir CO_2

Case Study

Scenario: 500 mmcfd plateau, US$20m/well, EUR 16 bcf

- Cost of CO_2 at US$50 per tonne
  - IRR drops by 2% from 33% to 31%
  - NPV10 decreases 8%

CCS options in Northern and Eastern Australia

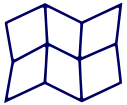


Source: Wood Mackenzie Lens Carbon

* Battery Energy Storage Solution

Summary & concluding thoughts

High-cost development requires high-price market



If breakeven price ~A$9/GJ (delivered to Moomba), gas in Melbourne > A$12/GJ

Projects are capex-heavy upfront (drilling, midstream infrastructure) – delays could be fatal for NPV

Well performance may be the defining factor, closely followed by well costs

There are still uncertainties: costs, long term well deliverability

But Beetaloo is trending in the right direction to provide competitive gas to the east coast market.

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