RESEARCH REPORT

CORPORATE CONNECT

Empire Energy Group Ltd

The Empire Strikes Gas

SHARE PRICE & ESTIMATED FUTURE PRICE

12-Month Target*	$1.06
Price	$0.13
Implied Return	770%

*Implied Return

Empire Energy Group Ltd (EEG)

The Carpentaria Project – incremental value accretion in the Beetaloo Basin through process management.

We initiate coverage on Empire Energy Ltd with a Buy recommendation and a target valuation of $1.06/share – over 7x the current share price of $0.13/share.

Empire Energy provides exposure to the development of the world class unconventional gas resource located in the Beetaloo Sub basin in Australia's Northern Territory. The company's recent work program on the Carpentaria Project (EP187) in the East Beetaloo has produced commercial flow rates from their initial horizontal wells drilled into the Velkerri B shales as well as successfully driving down unit drilling and completion costs – a crucial metric in the unconventional shale gas industry.

Carpentaria Project – 25 TJ/day Pilot Plant

The Carpentaria Project in the East Beetaloo Basin has now seen the completion of four wells – two vertical and two horizontal - with commercial flow rates being achieved in both lateral wells. The project is now in in the Front End Engineering & Design (FEED) phase with a Final Investment Decision due by the end of Q1 CY2024. Development of the 25 TJ/day plant would begin in 2024 with first gas delivered to market by 2025.

Empire has swiftly grown the 2C Contingent Resource at Carpentaria to 1.5TCF/1,700 PJ and has the potential to feed directly into an LNG project. We see conversion of the 2C Resource into a 2P Resource as being highly probable within the next 6 months – an event that is likely to trigger a significant uplift in valuation.

Figure 1: Carpentaria 3H drilling operations

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Company Data

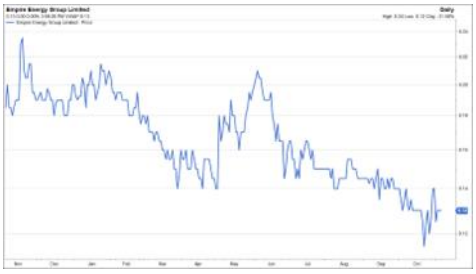
ASX code	EEG
ASX price	$0.13
Shares on issue	773 mill.
Market capitalisation	$105.1 mill.
Cash on hand	~$29 mill.
12-month price range	$0.12 – $0.24

Key Personnel

Alex Underwood	MD & CEO
Robin Polson	CFO
Dr Alex Bruce	Chief Geoscientist
Peter Cleary	Chairman

Top Shareholders

Pangaea NT	18.1%
Elphinstone Holdings	8.5%
Global Energy & Resources Development	4.2%
Bryan Sheffield	4.2%



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Investment Thesis

Empire Energy is in a position to see significant uplift in valuation driven by the development of the Carpentaria Project in EP 187, located in the Northern Territory's Beetaloo Basin. We believe the company is significantly undervalued given the status of their flagship Carpentaria Project, the size of their Contingent Resource and the potential for international interest in the supply of LNG into Asian markets.

Carpentaria 25TJ/day Pilot Plant: a $120-140million revenue pa project.

The Carpentaria Project is progressing in line with company expectations. Four wells have now been completed in the Carpentaria Project with all wells intersecting the Velkerri B Shale. Results have shown conclusively consistent reservoir quality across the Velkerri B shales and the broader stacked play. Corporate Connect believes the consistency and continuity of the stacked play is conducive to an Unconventional shale gas development like those seen in the USA with the stacked shale play having significant similarities to the productive zones of the Marcellus Basin.

Commercial flow rates have been achieved in the earliest stages of well development. IP30 flow rates have been in excess of the 3000mcf/day which is considered a likely minimum rate needed for commercial development in the 'Shallower Beetaloo". Further studies on the two horizontal wells (Carpentaria 2H & 3H) have shown that improved flow rates can be achieved through "soaking". Corporate Connect believes that flow rates will continue to improve as the knowledge base on the Velkerri B's production characteristics increases. This will follow into the strong potential for increased gas recovery over the average well life.

Front End Engineering and Design (FEED) activity is currently being undertaken to estimate capex and opex requirements for a 25TJ/day Pilot Plant development at the Carpentaria Project. Final Investment Decision (FID) for the Carpentaria 25TJ/day Pilot Plant is expected by the end of 2023.

Our analysis indicates that the Pilot Plant could generate $120-140million in revenue (p.16) at a $12.50/GJ gas price with early operating margins in excess of $40-45million pa. Given this analysis, we believe FID approval is likely within the next few months, in which case development drilling and construction of the Pilot Plant would begin in 2024 with "first gas" going to market in 2025 (subject to requisite regulatory approvals).

1.5TCF 2C Resource – Conversion to Reserves.

For investors it is important to recognise that the development of the Pilot Plant would trigger the conversion of 2C Contingent Resources in EP187 to 2P reserves which, in turn, would likely drive a significant uplift in valuation (see "Resource to Reserves – Mind the Gap!, p.21).

Empire has adopted a "low overheads" strategy to developing the Carpentaria Project through the use of external consultants for much of their Well engineering and Well Completion work. This has enabled the company to progress to this stage with minimal calls for capital. Financially the company is in a sound position to progress to FID with a Macquarie Debt Facility in place, $29million in cash on hand and the potential for the sale of non-core US assets. The requirement to fill a funding gap by raising equity is minimal.

Markets need Beetaloo gas.

Macro conditions for the Unconventional players in the Beetaloo Basin are also aligning. With a deficit in NT gas supply that is continuing to deteriorate, gas from the Beetaloo Basin is desperately needed to support the needs of NT's Power & Water Corporation as supply from ENI's Blacktip continues to decline. Our recent conversations with NT gas buyers would suggest that there are a very strong price incentives for the delivery of Beetaloo gas into the NT market. In addition, the much vaunted gas supply deficit on the East Coast of Australia continues to draw closer.

The US Industry can't be ignored any longer.

Finally Australian investors cannot continue to ignore what is happening globally. Exxon's recent acquisition of Pioneer Natural Resources shows that the world's largest energy companies see Unconventional gas as a necessary part of their resource portfolio. As they search globally, the Beetaloo's acreage will seem very cheap – especially given its proximity to Asian LNG markets.

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Australia - Assets

Empire Energy has a significant tenement position of approximately 29 million acres across the Northern Territory's MacArthur Basin, an ancient sedimentary basin which contains some of the oldest hydrocarbons on earth.

Fig. 2 below shows the location of Empire's exploration permits across the Northern Territory (orange shading). The tenements with black borders were acquired as part of the Pangaea transaction.

The two projects that are the primary focus of Empires current work program have been highlighted within blue and green ovals

- Carpentaria
- Western Beetaloo

Corporate Connect believes it is these two projects that will drive near term value accretion for Empire Energy as they are derisked through further exploration and development – in particular the Carpentaria Project as it heads towards Pilot Plant Development.

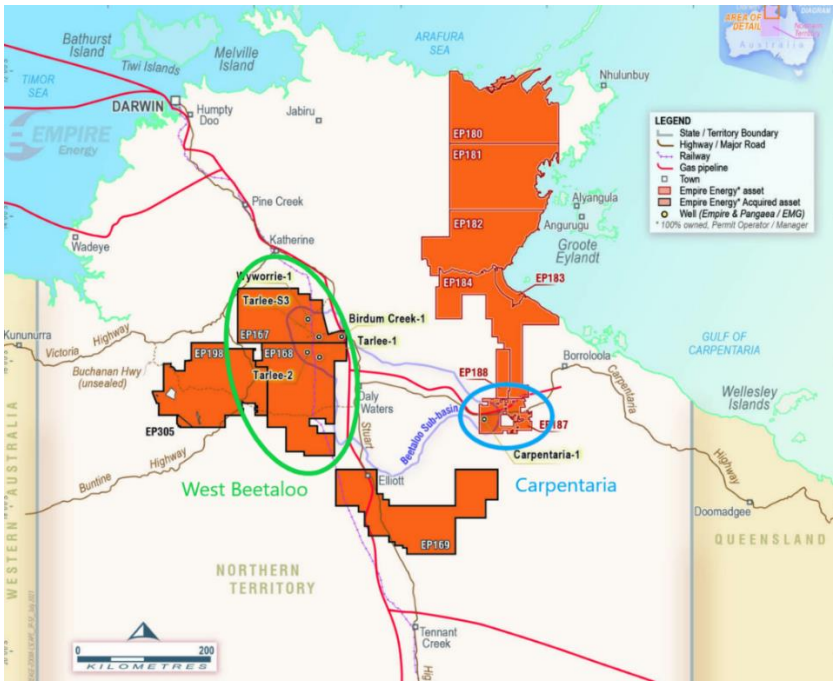

Figure 2: Empire Energy: Exploration permit position and current project location (Carpentaria and West Beetaloo)

This report will focus on the exploration permits located over the Beetaloo Sub-basin, in the Carpentaria Project (EP187) and the West Beetaloo Project (EP167, EP 168). Located at the south of the MacArthur Basin, the Beetaloo Sub Basin is considered to be one of Australia's primary exploration provinces for unconventional hydrocarbons and is crucial to the current economic development plans of the Northern Territory government.

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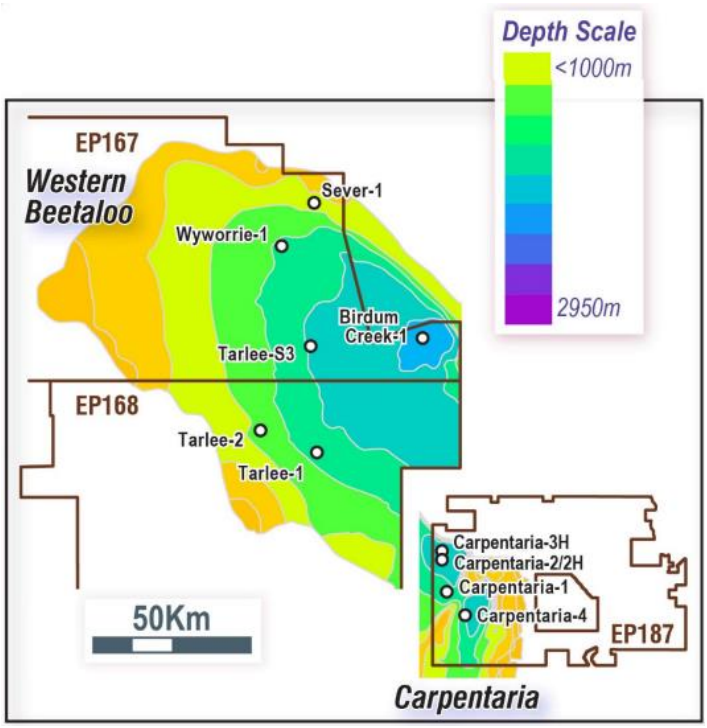


Carpentaria Project - EP 187

The Carpentaria Project sits at the eastern side of the Beetaloo Basin. Four exploration wells have been drilled into EP 187 and all have been successful in establishing the consistency and continuity of the targeted reservoirs – primarily the Velkerri and Kyalla Shales.

Two of the four wells were horizontal and successfully targeted and intersected the Velkerri B shale – both wells have recorded flow rates of dry, extremely low CO_2 gas which are in excess of the minimum flow rates that Corporate Connect believes is needed for commercial development.

The Carpentaria Project is currently undergoing Front End Engineering and Design (FEED) for a 25TJ/day Pilot Plant with Final Investment Decision by the end of 2023.

Western Beetaloo Appraisal Area – EP167 & EP168

The Western Beetaloo Project is located across tenements acquired as part of the Pangaea acquisition and is currently undergoing appraisal.

It is a large play covering over 1 million acres. There have been 5 wells drilled into the project area previous to Empire acquiring the tenements. The previous drilling brings derisking as logging of all wells has proven the same lithologies and reservoir characteristics as seen across the more recent wells across the basin.

Figure 3: Empire's current project development areas

Resources

The 2C Contingent Resource position for Empire's Carpentaria Project currently sits at approximately 1.5TCF or 1,739 PJ gas – with an additional 3.5mmbls liquids as assessed by Netherland Sewell and Associates.

Reservoir	As at 30 April 2023 Unrisked Contingent Resources (100% and Net) Sales Gas (BCF)			As at 30 April 2023 Unrisked Contingent Resources (100% and Net) Sales Gas (PJ)		
	Low Estimate (1C)	Best Estimate (2C)	High Estimate (3C)	Low Estimate (1C)	Best Estimate (2C)	High Estimate (3C)
Velkerri C	125	718	1,448	148	852	1,717
Velkerri B	131	732	1,476	156	868	1,750
Velkerri Intra A/B	-	7	14	-	8	16
Velkerri A	-	10	20	-	12	24
Total*	**256**	**1,467**	**2,958**	**304**	**1,739**	**3,507**

**Empire derived arithmetic summation of NSAI deterministic and probabilistic resources estimations*

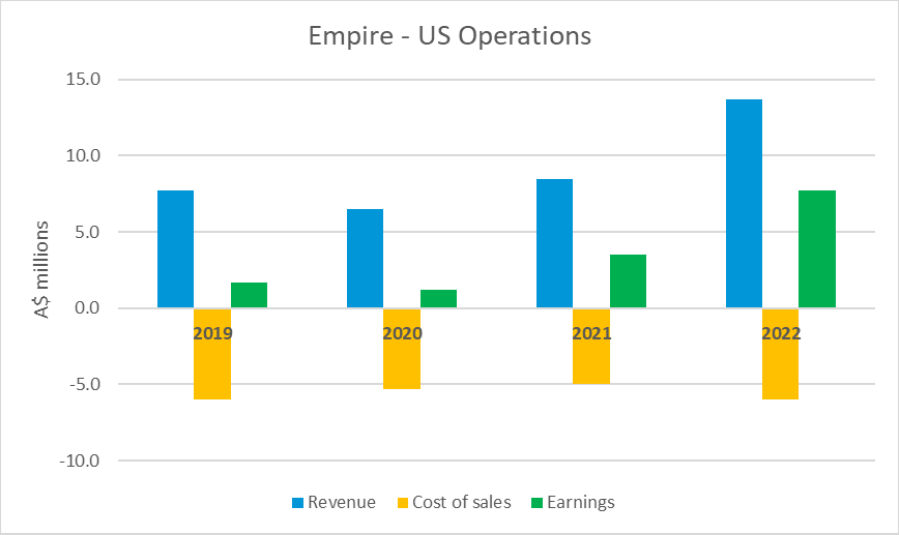
Figure 4: Contingent Resources for Carpentaria Project - EP187 (*Source: Empire Energy*)

Zone	As at 30 April 2023 Unrisked Contingent Resources (100% and Net)						As at 30 April 2023 Unrisked Prospective Resources (100% and Net)					
	Liquids (MMBBL)			Sales Gas (BCF)			Liquids (MMBBL)			Gas (BCF)		
	Estimate			Estimate			Estimate			Estimate		
	Low (1C)	Best (2C)	High (3C)	Low (1C)	Best (2C)	High (3C)	Low (1U)	Best (2U)	High (3U)	Low (1U)	Best (2U)	High (3U)
Kyalla*	0.8	3	11.1	0.8	4.5	28	88	378	1,571	184	857	4,891
Mid Velkerri*	0.1	0.5	3	313.3	1,620	3,346	76	386	1,938	9,683	29,756	86,341
Barney Creek*	-	-	-	-	-	-	-	-	-	1,633	11,053	45,380
Total*	**0.9**	**3.5**	**14.1**	**314**	**1,625**	**3,374**	**164**	**764**	**3,509**	**11,500**	**41,666**	**136,612**

Figure 5: Empire Energy: Total Net Contingent & Prospective Resources for Northern Territory Tenements *(Source: Empire Energy)*

US: Assets

Empire has a small operating asset in the United States operated through the 100% owned Empire Energy (USA) LLC. The company is the holding vehicle for Empire's Appalachian assets consisting of approximately 2400 wells that produce around 3,329mcfe/day (as at June 2023).



Empire has indicated that the US operations are not part of the company's growth strategy. The operations provide a small cashflow stream to Empire and require no capital to operate as they are cash flow positive over the cycle. Natural decline of the fields is currently slightly below 3% per annum.

Corporate Connect has valued the assets at A$15million based on average earnings and discounted on an NPV basis. There is also an additional discount applied for the lack of growth opportunities from the assets.

Figure 6: Empire Energy US Operations (Source: Corporate Connect)

Executive Management

Managing Director & CEO: Alex Underwood LLB, BCom (Hons). Joined March 2018

Mr Underwood has 20 years of specialist upstream oil and gas investing, financing and management experience. Previously he spent two years with the Commonwealth Bank of Australia, Singapore as Director of Natural Resources and nine years with Macquarie Bank in Sydney and Singapore as Associated Director of Energy Markets Division. He commenced his career at BHP Billiton Petroleum.

MD/CEO Remuneration:

The remuneration report for 2022 sets out clearly the opportunities and outcomes for executive compensation. With fixed pay at $430k for FY2022, remuneration appears to be below the sector average – certainly not excessive. The mix of Short Term and Long Term incentives is clearly outlined and the Performance metrics and weightings are all clearly set out. Performance metrics are all clearly aligned with shareholder interests.

Board

Directors

Chairperson & Non-Executive Director: Mr Peter Cleary B.Com LL.B, Appointed May 2020

Mr Cleary is a highly experienced oil and gas executive with a 29 year career with Santos, the North West Shelf Venturers as well as BP Asia – across LNG, Pipeline gas and chemicals operations. He has also been a Board member of the Australian Petroleum Production and Exploration Association (APPEA) and the Australia Japan Foundation.

- Australia Japan Business Cooperation Committee - Executive Committee member
- Australia Korea Business Council
- Australian Institute of Energy – Chair and Fellow

Non-Executive Director: Professor John Warburton PhD, FGS, FPESA, MAICD. Appointed February 2019

Prof Warburton has 40 years of professional oil and gas experience in operated and non-operated conventional and unconventional petroleum discovery, development and in new business delivery. Having worked across the globe, Prof.Warburton spent 14 years in senior technical and leadership roles at BP. He was Executive General Manager for Exploration & New Business at Eni in Pakistan, and until March 2018 was Chief of Geoscience & Exploration Excellence at Oil Search Ltd.

- Director of Empire's subsidiary Imperial Oil & Gas since 2011 – serving as CEO from 2011 to 2014
- Non Executive Director of TMK Energy Ltd
- Previously Non Executive Director of Senex Energy before being taken over by POSCO/Hancock Prospecting
- Visiting Professor in the School of Earth & Environment at Leeds University UK where he has served for twelve years on the GeoSolutions External Advisory Board.

Non-Executive Director: Mr Louis Rozman B.Eng, MGeoSc. Appointed March 2021

- Mr Rozman has over 40 years of experience in the Natural Resources sector spanning Operations, Development and Project Financing.
- A Mining Engineer, he has had significant experience in operating and constructing projects in Africa, Australia and PNG.
- Was a founding partner and director of Pacific Road Capital Management overseeing several of its key natural resources projects.
- Chief Operating Officer of Aurion Gold Ltd and was instrumental in the growth of its predecessor, Delta Gold Limited.
- Chief Executive Officer of CH4 Gas Limited, during its pioneering coal seam gas development in Queensland. CH4 was one of the first companies to commercialise a Queensland coal seam methane project and merged with Arrow Energy in 2006, which in turn was acquired by Royal Dutch Shell and PetroChina for over A$3 billion.
- Mr Rozman is a Fellow of the Australian Institute of Company Directors, the Australasian Institute of Mining and Metallurgy ("AusIMM") and a Chartered Professional (Management). He is the Chairman of the VALMIN Code Committee for the AusIMM and Australian Institute of Geoscientists.

Non-Executive Director: Mr Paul Fudge. Appointed August 2021

Mr Fudge brings significant business and investment experience to the board of Empire, having acquired vast investment experience in onshore Australian oil & gas.

He was one of the earliest movers in the Queensland Coal Seam Gas industry and in the Beetaloo Sub-Basin. He is the controlling shareholder of Pangaea Resources which sold the Western Beetaloo assets to Empire in 2021.

Board Assessment:

It is crucial that smaller capitalisation companies in their development phase have a Board with a range of skills that will actively contribute to the company's growth aspirations in addition to the normal Board responsibilities of Governance etc. In essence, choosing the right directors can be a lower cost way of improving a company's overall expertise and meaningfully influence incremental growth. Our assessment of the Empire Energy Board is that it is a very high quality one with a mix of Non-Executive Director skills across the following areas:

- Proven early identification of Unconventional hydrocarbon provinces and their development
- Onshore oil and gas development expertise
- LNG project development and marketing experience
- Relevant Geoscience experience
- Unconventional gas project development and commercialisation
- Resource project financing

All well respected executives, the Board is excellently placed to assist Empire's Management to develop the best overall business strategy advise on how best to achieve management objectives. We also believe the Board brings a high level of corporate governance skill.

Board Remuneration:

We have assessed the FY2021 and FY2022 remuneration reports for Non Executive Directors and find them "Fair and Reasonable" as well as strongly aligned with shareholder interests. Average cash remuneration in FY2022 was $57.3k per Director which is almost 50% below the Energy Sector companies in the ASX201-300 Group. The company's Fee Policy limits Aggregate NED remuneration to $400,000 per annum which is significantly lower than the sector average.

Of note, the previous Chairman, Paul Espie, and the current Chairman, Peter Cleary, both chose to take all of their remuneration in equity grants in lieu of cash. Professor John Warburton chose to accept consultancy fees of $207,000 (non Board related) in Empire Energy equity also. This is a significant vote of confidence from the Board in the company's future.

Operations and Work Plan

- Beetaloo Basin – Carpentaria & West Beetaloo
- Pilot Plant development in Carpentaria

Beetaloo Basin - Overview of current work program

Empire Energy holds a significant exploration tenement position across the McArthur Basin which includes significant acreage in the Beetaloo Sub-Basin that sits within the larger McArthur Basin. Empire's current work campaign is focussed on the Carpentaria Project - their eastern Beetaloo Basin permits in EP187 where developing a pilot plant which will inform a broader development of the company's assets. The development strategy also includes planning the appraisal program for the Western Beetaloo Project (EP167 & 168)

Final Investment Decision (FID) for the Pilot Plant is expected towards the end of Q1 2024 with construction of the plant expected to commence in later in 2024.

This focus of this report is largely on the Carpentaria Project (EP187). The location for the company's current work program and site of the proposed Pilot Plant development. It will be the activities and results in EP187 that will drive share price performance over the next 12 months and lay the foundations for further large scale development across Empires other tenements.

The key drivers to successful development of the Beetaloo's unconventional gas resource are:

- cost of well development and
- well flow rates that meet/exceed a commercial threshold.
- Volume of gas per well

Reservoir quality is confirmed through the completion of the four Carpentaria wells – with homogeneity and continuity of the Velkerri shale

Carpentaria Project (EP187) – Looking good for FI1

The Carpentaria Project covers 110,000 acres and has a 2C Contingent Resource of 1.5 TCF. The project is the focus for Empire's Pilot plant development planned to produce 25 TJ/day. Final Investment Decision (FID) is expected by the end of Q1 CY2024 with Pilot Plant construction to begin in 2024.

Carpentaria has been the site for 4 successful wells that have confirmed both the ability of the Beetaloo basin in this area to provide commercial flow rates but also shown Empire Energy's capabilities to deliver well development costs at or below budget.

Contingent Gas resources for EP 187 sit approximately 1.5TCF with half of that total sitting within the Velkerri B shale. 2C seismic coverage has mapped the Velkerri shale at favourable depths across the 110,000 acres of the Carpentaria Project.

EP187 Carpentaria: Contingent Gas Resources			
	Low Estimate	Best Estimate	High Estimate
	(BCF)	(BCF)	(BCF)
Reservoir	(1C)	(2C)	(3C)
Velkerri C	125	718	1448
Velkerri B	131	732	1476
Velkerri Intra B-A	0	7	14
Velkerri A	0	10	20
Total	**256**	**1467**	**2958**

Figure 7: EP187 Contingent Gas Resources

Well Program

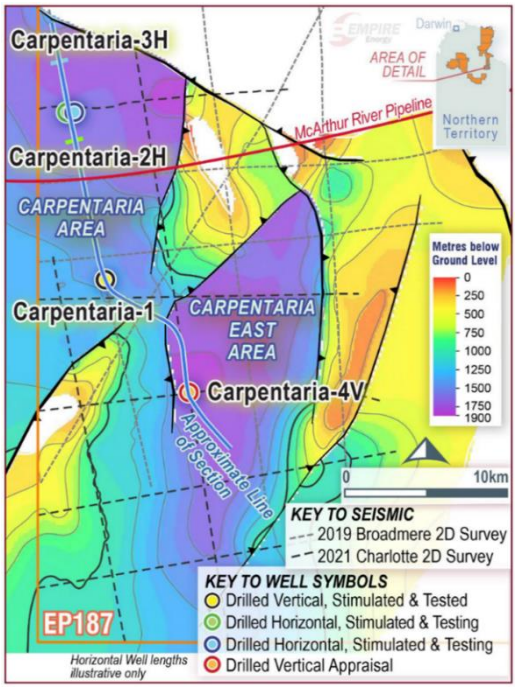


Figure 8: Carpentaria Project: Wells into Velkerri B shale (*Source: Empire Energy*)

Carpentaria 1

C-1 was a vertical hole only and was drilled in Sep/Oct 2020 to a Total Depth (TD) of 1916m. The Frac stimulation and Extended Production Testing (EPT) program was initiated around June 2021 and involved a 4 stage frac across the stacked play. The well was designed to evaluate the Velkerri and Kyalla shales.

The Velkerri shale was intersected and ascertained to be consistent with the intersection in the Tanumbirini-1 well over 63km away to the north-east, demonstrating exceptional geological consistency.

Carpentaria 2H

EEG's first horizontal well was spudded in November 2021 to a TD of 3150m with 1345m horizontal section. Following the Frac stimulation a normalised flow rate of 2.8mmscf/day per 1000m was achieved with 2.4mmscf/day over 51 days testing. It should be noted that these results came from the very first attempt at horizontal drilling into the Velkerri B reservoir and from a frac stimulation program of 21 stages over a 927m horizontal section. The Stimulation program used a variety of stimulation methods in order to better ascertain the optimal path forward.

Following "soaking", the well achieved a sustained average flow rate of 3.24mmcf/day over 8 days which was 21% higher than the initial IP8 and had a lower rate of decline. The post soak IP30 was confirmed at 3.0mmcf/day per 1000m.

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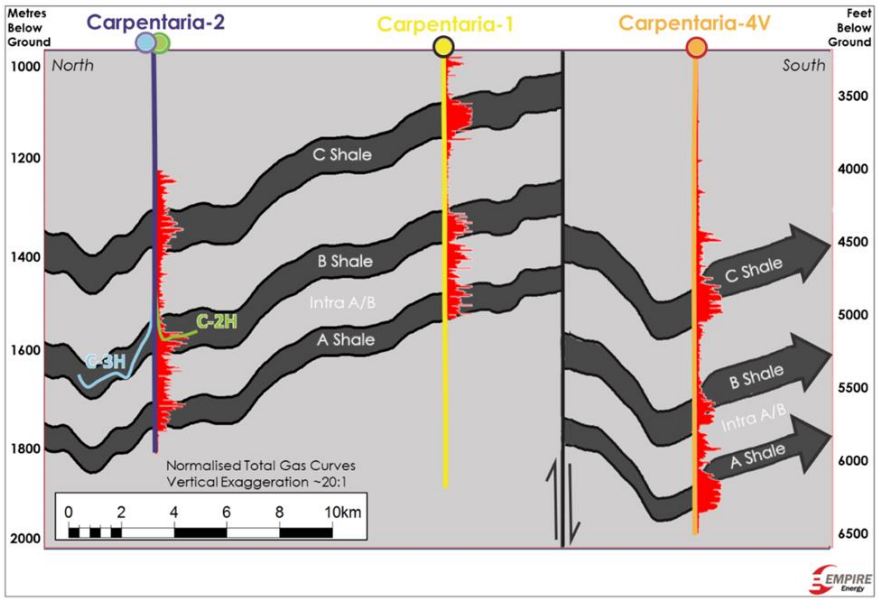

Figure 9: Carpentaria Project: Cross section of wells completed (Source: Empire Energy)

Carpentaria 3H

3H was spudded in October 2022 to a TD 4460m TD including a 2632m horizontal section of which 1989m was stimulated.

Flow tested for 27days with production ranging between 2.3mmcf/day and 5.7mmcf/day with an average of 2.6mmcf/day.

The well was shut in for soaking for 5 months and reopened August 2023. Gas flowed with an IP30 of 3.3mmcf/day – 30% higher than in the original EPT.

Carpentaria 4V

Drilled to a TD of 2000m in January 2023, 4V was a vertical Appraisal well drilled in the Carpentaria East area which is in an adjoining fault block. It was successful in establishing the continuity of the Velkerri and Kyalla shales in both formation thickness and reservoir characteristics.

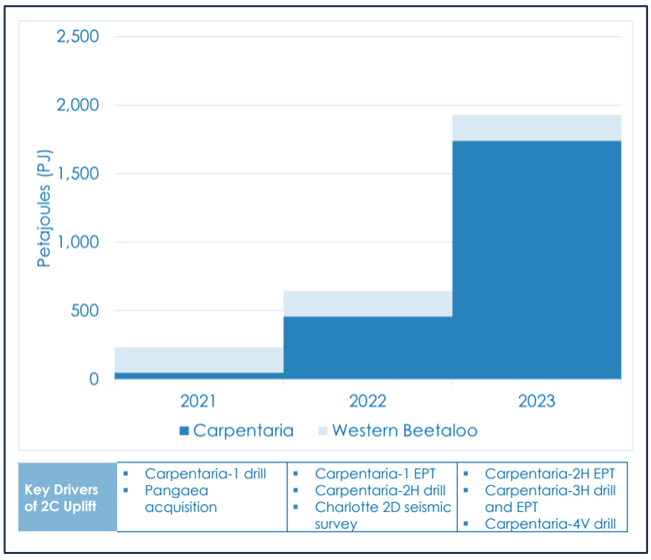

Figure 10: Growth in Carpenteria 2C Resource (Source: Empire Energy)

The four well program has been very successful at maturing the EP187 Prospective Resource (2U) to Contingent Resource (2C) of 1,739 PJ following assessment by NSAI in May 2023.

According to the company's announcement at the time, at a $10/GJ gas price "each development well in EP187 could produce between $62 million and $95 million of revenue over its life, compared to a development cost of ~$20 million in the pilot phase and ~$15 million in larger development scenarios."

NSAI identified over 200 2C drilling locations in the study which would represent the potential for an LNG scale development.

Well development cost – Early days but meaningful cost reductions so far.

Empire's progress in reducing well cost has been impressive so far. With unconventional shale wells the total well cost is generally considerably more than a similar conventional well due to the need to drill horizontal laterals into the gas bearing formation and then the subsequent completion costs. It is for this reason that it is vital to look at drilling cost per metre and stimulation costs based on the number of frac stages.

As Figure 11 below shows, Empire Energy has made significant cost reductions in both areas over the 4 well program.

Well	Year	Type	Total Cost	Total Depth (metres)	Drilling Cost ($mill)	Drilling cost per metre ($)	Stimulation and Production Testing Cost	Frac stimulation stages	Cost per stage
Carpentaria 1	2020/21	Vertical	16.7	1,916	11.4	5,950	5.3	4	1,325,000
Carpentaria 2H	2021/22	Horizontal	24.1	3,150	11.1	3,524	13.0	21	619,048
Carpentaria 3H	2022/23	Horizontal	27.3	4,460	10	2,242	17.3	40	432,500
Carpentaria 4V	2022/23	Vertical	9.8	2,000	9.8	4,900	-	-	-

Figure 11: Carpentaria well completion data. Source: Company and CC estimates

Though the sample size of four wells is relatively small, it is clear that Empire Energy is achieving meaningful reductions in drilling costs per metre and completion costs per frac stage – and we see no reason why these unit costs will not continue to reduce. This has been the industry norm in US Unconventional projects. Figure 12 shows how Range Resources continually pushed drilling costs down and increased the length of their lateral wells over a period of six years in the Marcellus Basin.

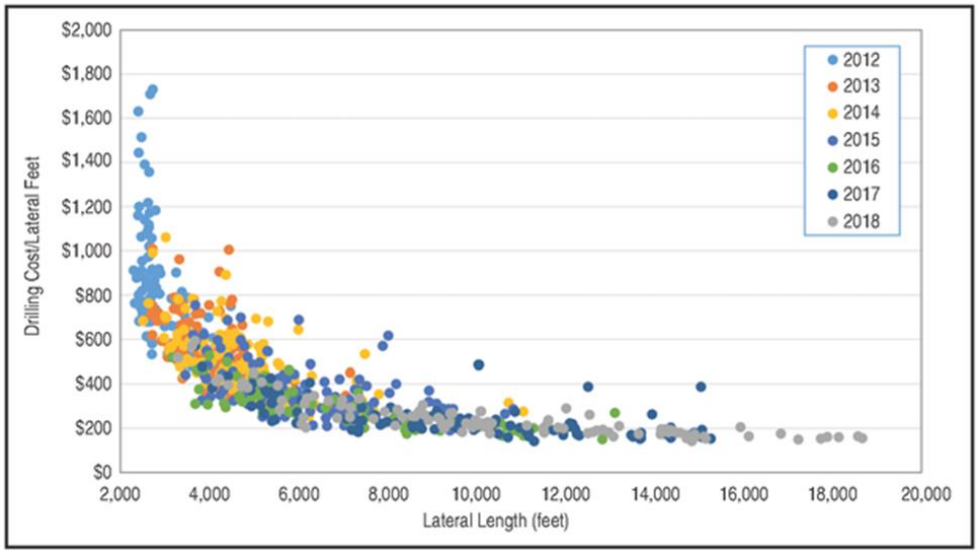

Figure 12: Drilling cost per lateral foot (US$) in the Marcellus Basin 2012 to 2018 (*Source – Range Resources*)

There are some constraints to Empire pushing costs down as low as what has been seen in the major US Basins however – largely to do with the frontier nature of the Beetaloo Basin with costs being particularly high in the early stages of development as engineers design the optimal programmes for maximising flow rates.

The capex cost per well comprises largely of the following:

- Mobilisation of the drill rig
- Drilling of the well – including lateral length
- Cost of completion including casing, fracture stimulation, proppants, muds & chemicals, and testing
- Well head equipment
- Personnel and services

Initially costs such as mobilisation, proppant and its transport, personnel costs etc. will also be high in a remote location such as the Beetaloo Basin but it is envisaged that those costs will decline significantly as more permanent drilling operations are sustained across the region and long-term facilities are constructed to support drilling and completion activities. Costs also come down sharply when drill pads are utilised for multiple well heads – substantially reducing mobilisation costs.

Well Flow rates – commercial flow rates achieved in both horizontal wells

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Empire have now been able to confirm that the two horizontal wells, C-2H and C-3H, are producing at commercial rates.

In order to estimate production levels and costs for a proposed 25Tj/day Pilot Plant, we have used a type curve which is based on the limited amount of data we have from Empire's two horizontal wells, Carpentaria 2H and 3H. Post soaking on both wells, IP30 was estimated at 3.0mmcf/day and 3.3mmcf/day respectively. Corporate Connect has used an estimate for IP30 of 3.25mmcf day for a typical well.

Corporate Connect estimate for Initial Production from a "typical" Carpentaria well

IP30: 3.25 mmcf/day per 1000m

EUR/Well: 8.1 BCF or 9.3Pj

It should be noted that both Carpentaria 2H and 3H used a variety of different completion methods across different stages of their laterals - this was undertaken in order to inform the optimal completion methods for future work but would have restricted the possible maximum flow rates achievable under ideal conditions. Our estimate of 3.25mmcf/day is likely conservative given those constraints.

Flow rates for unconventional wells decline sharply in the initial stages of production before levelling out and the production profile is known as the "decline curve". Type curves or decline curves differ from basin to basin and well to well but, generally, they decline in a similar pattern if not similar rates. Production in the initial several years of the well's productive life declines hyperbolically, and at some point, the production decline levels off reflecting an exponential (constant annual percentage) decline rate. Developing an appropriate Type curve for each project is essential to project planning.

The high initial flow rates followed by steep decline tend to achieve a rapid payback of invested capital.

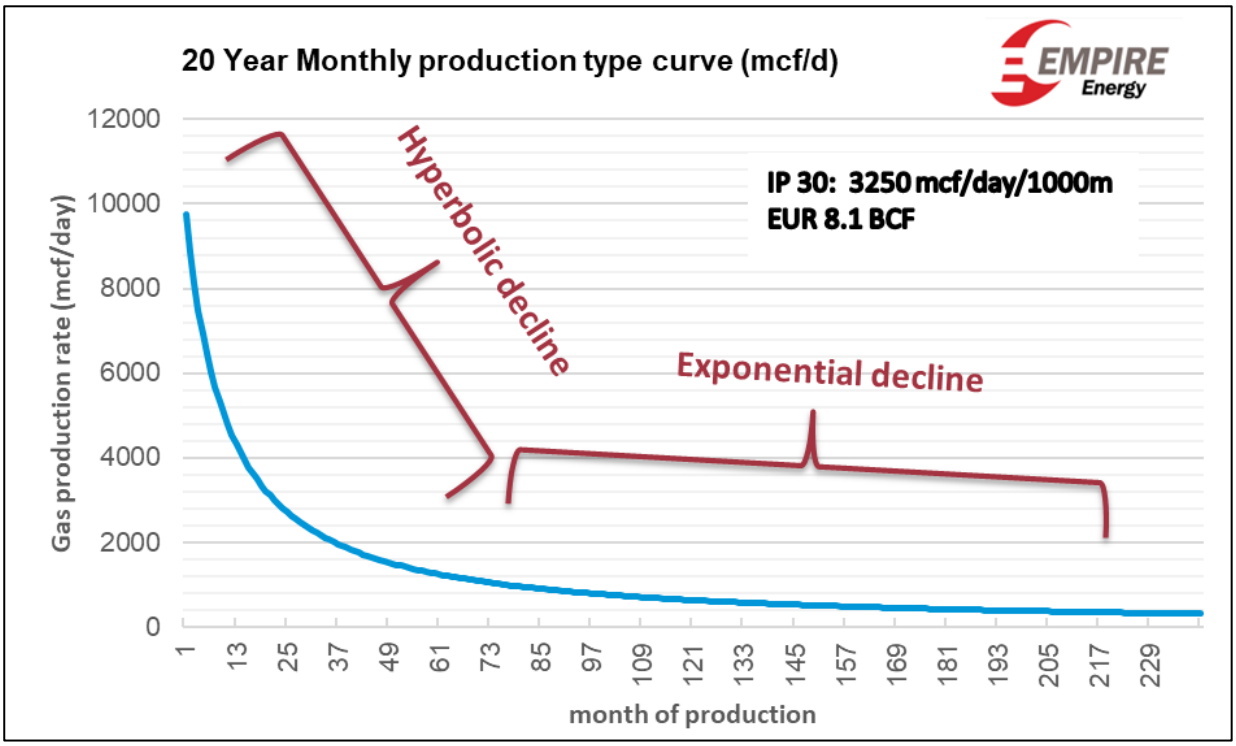

Figure 13: Carpentaria Project Type curve. ***Source: Corporate Connect estimates.***

Comparison of flow rates with US unconventional basins:

Flow rates for the Carpentaria horizontal wells compare favourably with early 90 day production metrics from unconventional basins in the USA. Figure 14 shows where Carpentaria 2H sits relative to a select average of some of the US's most productive unconventional basins.

This comparison is even more compelling given that Carpentaria 2H was Empire's first attempt at a horizontal well into the Beetaloo Basin. Corporate Connect considers that there is considerable opportunity to optimise design in future wells in order to optimise productivity.

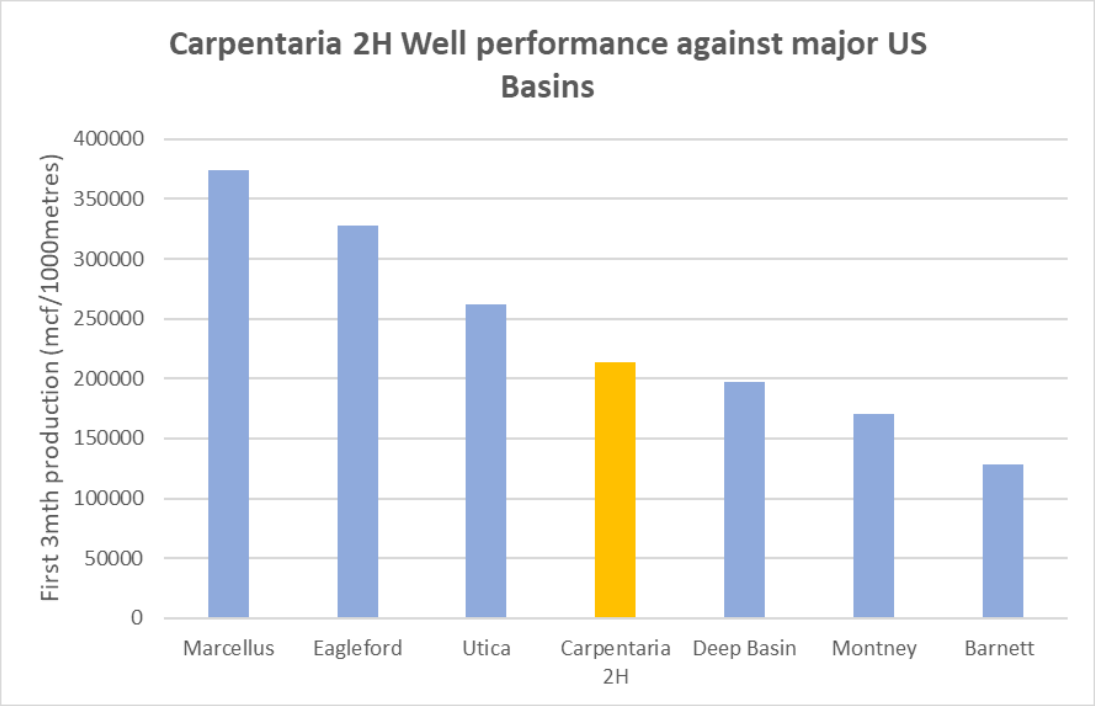

Figure 14: 90-day initial production for select US Basins vs Carpentaria 2H well. *Source: Daly Waters Energy and Corporate Connect.*

Carpentaria Pilot Plant

- Carpentaria Project gas will be profitable under currently observed well production rates
- Well production yet to optimised – provides upside for unit cost per mcf

Carpentaria Project: 25Tj/day Pilot Plant – it stacks up!

Corporate Connect has modelled a variety of scenarios for gas production in Empire Energy's Carpentaria Basin project. Our analysis shows that the proposed Pilot Plant would be viable under a variety of different operating conditions.

Our work suggests that Empire Energy would be likely to make a Final Investment Decision (FID) in favour of proceeding with the 25TJ/day Pilot Plant. The driver behind the decision is Capex cost per unit of gas and Corporate Connect estimates that Empire Energy can continue to drive this down through the two main levers:

Flow rates:

As outlined in the previous section, CC has used the relatively conservative IP30 flow rate assumption of 3250 mcf/day. We believe these flow rates will continue to improve as the following occurs:

Improved completion techniques are used – currently observed flow rates have come with minimal opportunity for optimisation, we expect significant benefits form stimulation optimisation to occur fairly quickly if the US experience is valid.

Reservoir management – Empire has seen significant improvements in flow rates when both the C2H and C3H wells were shut in for soaking. Not only could this improve flow rates further but it could also have benefits for total gas recoverable.

Well Capex:

As outlined in the previous section, CC believes that Empire will continue to drive down the cost of Well Capex through both drilling and completion cost. We would envision that a significant proportion of the Carpentaria Pilot Plant wells would be drilled from the same well pad thereby minimising mobilisation costs.

Note: CC has only modelled a reduction in Well Capex costs in the NPV calculation of the 25 TJ/day Pilot Plant. IP30 Flow rates have been left stable so any improvement in Flow Rates would impact favourably on the NPV.

Capital Expenditure sensitivity – Well cost per unit of gas produced

The variable cost per unit of gas produced is determined primarily by the flow rates obtained and the upfront cost of completing the well. We have estimated (Figure 15) what that variable cost might look like under a variety of flow rate scenarios and well completion costs. It should be noted that while initial well costs are likely to be approximately $30 million that these total well costs are likely to decrease over time as Empire Energy and their contractors work towards achieving efficiencies in scale. These estimates use an initial flow rate (IP30) over 1000m but production is based on a 3000m lateral length.

Well Capex cost per mcf (A$)						
		Initial Flow Rate (mcf/day per 1000m)				
		2000	2500	3000	3500	4000
Well Cost (A$mill.)	20.0	3.49	2.79	2.33	2.00	1.75
	25.0	4.37	3.49	2.91	2.50	2.18
	30.0	5.24	4.19	3.49	2.99	2.62
	35.0	6.11	4.89	4.08	3.49	3.06
	40.0	6.99	5.59	4.66	3.99	3.49

Figure 15: Well Capex cost per mcf (A$) – CC Estimates

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Carpentaria Project Pilot Plant - NPV Analysis

Corporate Connect has undertaken a "What if" NPV analysis of the proposed 25TJ /day Pilot Plant at Carpentaria using the following assumptions

Gas price: $11/mcf - adjusted to $12.54/GJ for high calorific value of Carpentaria gas.

Capex (or Variable) Cost: Beginning at $3.52/GJ before dropping back to $2.93/Gj. We believe this is a conservative assumption and assumes that 3000m lateral wells cost approximately $25-30million.

Fixed costs: Fixed costs are driven largely by surface facilities such as gas gathering infrastructure, staff camps, etc. As at the time of writing, Empire Energy are exploring options with APA to effectively outsource midstream infrastructure thereby reducing the capex requirements for Empire. We have estimated fixed costs at approximately $1.00/Gj and have added a contingency for APA's involvement in the Gas Transport cost.

Gas Transport cost: $3.40/Gj. This estimate is at the high end of the range and we expect it would drop lower – however we have modelled the higher level and inflated it over time to allow for costs associated with the proposed APA midstream involvement.

Carpentaria 25TJ/day Pilot													
Year	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Drilling & Completions													
Wells drilled pa	3	-	4	-	3	-	3	-	3	-	2	-	-
Cumulative Wells	3	3	7	7	10	10	13	13	16	16	18	18	18
Daily Production													
(TJ/day)	16	14	27	28	30	30	33	32	39	32	34	29	22
per well (mmcf/day)	4.8	4.2	3.4	3.5	2.6	2.6	2.2	2.1	2.1	1.8	1.7	1.4	1.1
Annual Production													
Unchoked Production mmcf/year	5,267	4,608	8,561	8,860	9,655	9,463	10,472	10,198	12,446	10,289	10,958	9,238	7,097
TJ/day post shrinkage	15	13	25	26	28	27	30	30	36	30	32	27	21
Sales Gas													
Sales (Gj pa)	5,583,874	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000	9,125,000
Drilling & Completion													
Capex/Well (A$mill)	30	30	25	25	25	25	25	25	25	25	25	25	25
Sales Revenue ($/Gj)													
$12.54	12.54	12.85	13.17	13.50	13.84	14.19	14.54	14.91	15.28	15.66	16.05	16.45	16.86
Revenue A$mill.	70	117	120	123	126	129	133	136	139	143	146	150	154
Variable (capex) costs ($/GJ)	-3.52	-3.52	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93	-2.93
Fixed Operating Costs ($/GJ)	-1.00	-1.03	-1.05	-1.08	-1.11	-1.13	-1.16	-1.19	-1.22	-1.26	-1.29	-1.32	-1.36
Variable (capex) costs (A$mill)	(21)	(18)	(29)	(30)	(32)	(32)	(35)	(34)	(42)	(34)	(37)	(31)	(24)
Fixed costs (A$mill)	(6)	(5)	(10)	(11)	(12)	(12)	(14)	(14)	(17)	(15)	(16)	(14)	(11)
Total Upstream cost (A$mill)	(27)	(24)	(39)	(40)	(44)	(44)	(49)	(48)	(59)	(49)	(53)	(45)	(35)
Upstream unit cost per GJ (A$)	**(4.52)**	**(4.54)**	**(3.98)**	**(4.01)**	**(4.04)**	**(4.06)**	**(4.09)**	**(4.12)**	**(4.15)**	**(4.19)**	**(4.22)**	**(4.25)**	**(4.28)**
Operating Earnings - Well Head													
Operating Earnings pre Royalty	43	93	81	83	82	86	84	88	80	94	94	105	119
Govt Royalties @ 10%	(4)	(9)	(8)	(8)	(8)	(9)	(8)	(9)	(8)	(9)	(9)	(11)	(12)
Operating Earnings	39	84	73	74	74	77	75	79	72	84	84	95	107
Transport cost (per GJ)	-3.40	-3.49	-3.57	-3.66	-3.75	-3.85	-3.94	-4.04	-4.14	-4.25	-4.35	-4.46	-4.57
Transport total	(20)	(18)	(35)	(37)	(41)	(41)	(47)	(47)	(59)	(50)	(54)	(47)	(37)
Total upstream unit cost (A$/GJ)	(7.92)	(8.03)	(7.55)	(7.67)	(7.79)	(7.91)	(8.04)	(8.16)	(8.30)	(8.43)	(8.57)	(8.71)	(8.86)
EP 187 Pilot Operating Earnings													
Project EBITDA ($mill)	18	66	38	37	32	36	28	32	14	35	30	48	70
Project EBITDA ($/GJ)	3.03	12.52	3.93	3.71	2.94	3.30	2.38	2.78	0.96	2.95	2.40	4.54	8.69

Pre tax NPV ($A million)	**$354**	**Initial prod. rate (mmcf/day) 1000m**	**3,250**
		EUR/Well (BCF)	**8.1**
Value per share (Pre tax)	**$0.46**	**Discount rate**	**10%**
		Gas Price (A$/GJ)	**$11.00**

Figure 16: What if NPV analysis of 25TJ/day Pilot Plant

We calculate the Pre-tax NPV of a 25TJ/day pilot plant at approximately $354 million with an IRR of 23%. They are very robust numbers given the conservative nature of Corporate Connects cost assumptions, in particular:

- Relatively high assumption of average well cost over time – compared to US peers
- Relatively high assumption of $3.40/GJ for gas collection and transport.

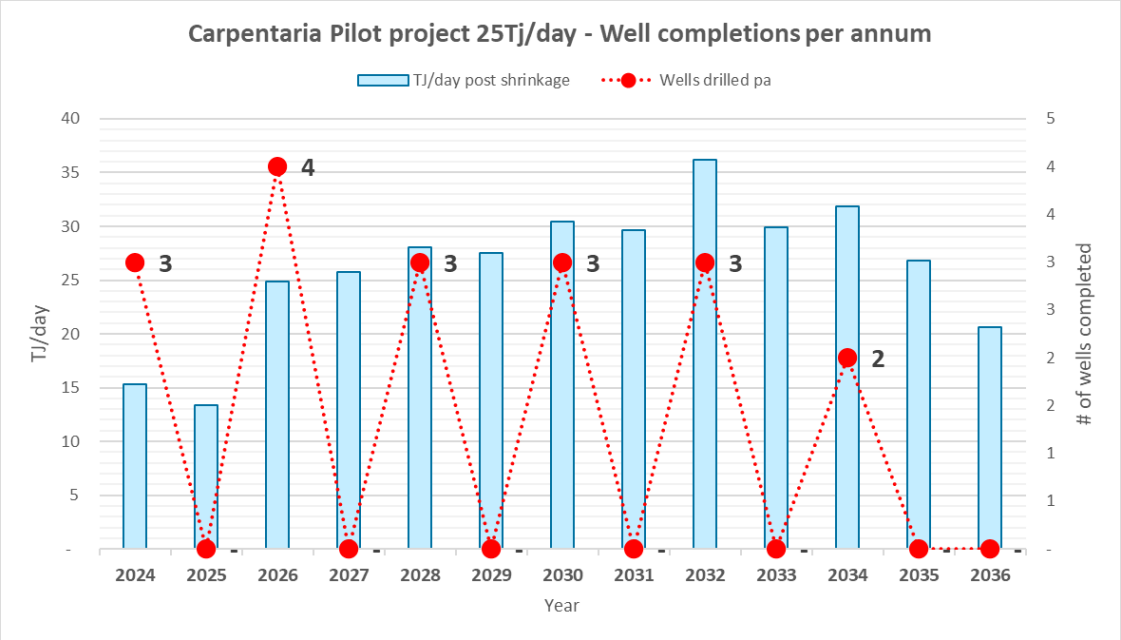

Figure 17: Well completion schedule and unchoked production estimates for the Carpentaria Project. (Source: Corporate Connect estimates)

Carpentaria Project – Pilot Project Operating earnings sensitivity

Our analysis shows the Pilot Project would be profitable under a variety of gas price and well capex scenarios (Figure 18). Our preferred range of scenarios for the Pilot Plant are highlighted with green shading. The lower limit of commerciality for the plant would be a combination of gas price at $8.00/mcf, IP30 of 3000mcf/day and well cost of $30million.

25 Tj/ day Pilot Plant - Operating margin ($million pa)							
		Well Capex cost per mcf (A$)					
		2.50	3.00	3.50	3.75	4.00	4.25
Gas Sale price (A$/mcf)	8.0	12	6	1	-2	-4	-7
	10.0	33	27	22	19	17	14
	12.0	54	48	43	40	38	35
	14.0	75	69	64	61	59	56

Figure 18: Pilot Project Operating Margin (A$mill) – CC Estimates

Funding

Funding options for the next stage of Empire Energy's operations appear adequate. The current cash balance is approximately $29million following the $15.5million R&D Rebate from the Federal Government in October and we believe that high levels of R&D Rebates will be ongoing while optimisation studies of well completions are ongoing.

CC estimates that EEG will need to make repayments to Macquarie Bank in the order of $6-7 million which will leave a balance of $22-23million – well in excess of what is required for FEED studies to get to FID.

2024 Funding -

Assuming that the FID is affirmative, we estimate that three development wells in 2024 will cost in the order of $90million (3 x $30mill.) to drill and complete. We assume funding will come from a mix of debt funding, in the order of $50-60million assuming Gas Supply Agreements are finalised.

The balance of $20-30million is likely to be raised from a farm out of the project – which is likely preferred by the company. Alternatively, this could come from an equity raise.

In addition, we assume around $10million from Federal Government R&D rebates as well an additional $5 - 7.5million from the potential sale of EEG's US assets.

We have assumed that surface gas gathering infrastructure and associated facilities will be funded by APA as part of the August 2023 Partnership agreement on APA providing connections into the NT gas supply network.

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Valuation Summary

- Valuation Summary
- Enterprise Value to Resource multiple
- Resources to Reserves – Mind the Gap!
- The US Experience – how much longer the Australia ignore it?

Valuation Summary

Empire Energy Ltd - Valuation Summary	Method	2C Resource (BCF)	Value per mcf ($)	Interest (%)	Unrisked Valuation (A$mill)	Unrisked Valuation (A$/share)	Commercial CoS*	Risked Valuation (A$ mill)	Risked Valuation ($A/share)
Exploration, Development & Operating Assets									
Carpentaria (EP187) : 25Tj/day Pilot Plant	Pre tax NPV_{10}			100%	354	0.46	90%	319	0.41
Carpentaria (EP187) : 2C Resource (ex Pilot Plant)	2C Resource	1350	1.00	100%	1,350	1.75	20%	270	0.35
West Beetaloo (EP167 & 168)	2U/2C Resource [1]	9083	0.40	100%	3,633	4.70	5%	182	0.23
US Appalachian Operations	NPV10			100%	15	0.02	100%	15	0.02
Other									
Cash					29	0.04		29	0.04
Debt					(15)	(0.02)		(15)	(0.02)
Property, Plant & Equipment					8	0.01		8	0.01
Other Exploration Assets					20	0.03		20	0.03
Capitalised Corporate Costs					(8)	(0.01)		(8)	(0.01)
Total NAV					**$5,386**	**$6.97**		**$819**	**$1.06**
Shares Outstanding	773,121,148								

** = Chance of Success*

Notes:

1. EP167 & EP168 valued using risked 2U resources converted to 2P reserves multiplied by an estimated NPV per mcf of A$0.20
2. All projects are geologically risked

Figure 19: Valuation Summary *(Source: Corporate Connect)*

Corporate Connect's Risked valuation for Empire Energy is $819 million or $1.06 per share with the unrisked valuation sitting at $5.4 billion or $6.97/share.

Virtually all value is attributable to the Carpentaria and West Beetaloo acreage given that they are the two assets that are the focus of the company for the foreseeable future. A nominal value of $20million has been placed on all other exploration acreage.

Carpentaria Project

Our analysis ascribes a value to the Carpentaria Project alone of nearly $590 million or $0.76 per share.

As a cross check, that value equates to an acreage value of approximately US$3500 per acre (A$5360 per acre). That is well below the values of producing acreage in the Marcellus Basin, USA which is transacting for between US$5,000 to US$25,000 per acre.

West Beetaloo Appraisal Project

Our risked value for the West Beetaloo Project is $180 million or $0.23/share. This is nearly three times the acquisition price of Pangaea assets from where the project originated. The planned program of work has yet to add value on the ground however given the continuous nature of the Velkerri Shale reservoir and the consistent well results across the Beetaloo, CC believes that further derisking of the Beetaloo Basin since the Pangaea acquisition as well as international corporate activity means that this vast prospective resource should be valued upwards.

Enterprise Value to Resource

Empire Energy's Enterprise Value to Resource (2P+2C) multiple is the lowest, by some margin, in our selection of peer companies in Figure 20. At a resource multiple of approximately 6c per GJ, it is half the value of its nearest peer in the Beetaloo (Tamboran Resources) and well below Rystads Average M&A multiple over the last four years of 0.83c per GJ.

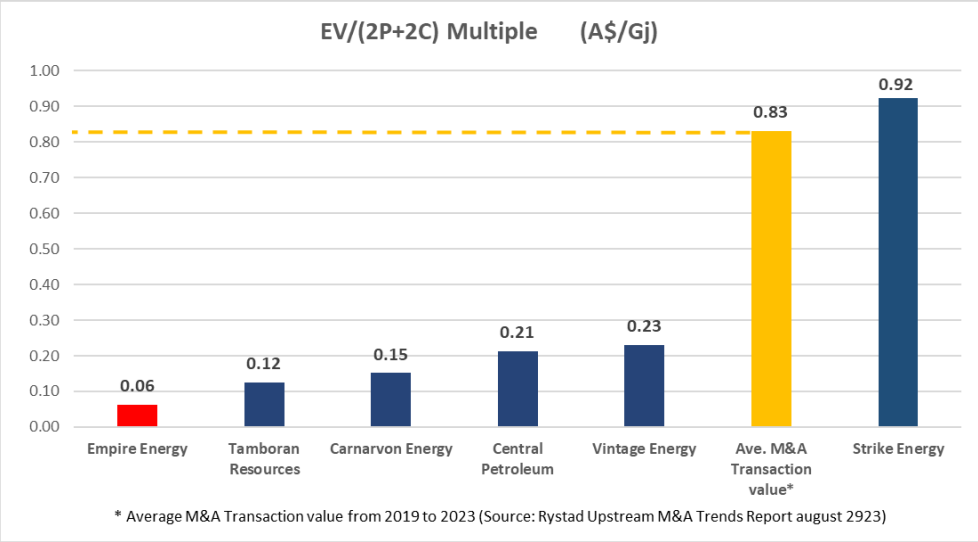

Figure 20: EV to Resource multiple - Australian E&P peers

	Enterprise Value (A$ mill)	2P (Pj)	2C (Pj)	2P+2C (Pj)	EV/(2P+2C) (A$/Gj)
Empire Energy	102		1,625	1,625	0.06
Tamboran Resources	246		1,971	1,971	0.12
Carnarvon Energy	89		587	587	0.15
Central Petroleum	55	73	185	258	0.21
Vintage Energy	27	52	66	118	0.23
Ave. M&A Transaction value*					0.83
Strike Energy	895	365	604	969	0.92

Figure 21: Table of Australian E&P Peers

Figure 21 shows the current EV/2P+2C Resource + Reserve multiples for a number of Australian exploration and production companies. What stands out consistently with tables of this nature is the low value that Australian investors are placing on large scale Unconventional shale gas projects, in particular the Beetaloo Basin (ie., Empire Energy & Tamboran Resources). The reasons for this are unclear but it is likely a combination of the following:

- General macro concerns around the small cap market.
- Negative publicity relating to activist groups targeting the Beetaloo Basin regarding Fracking, Traditional Land Owners and LNG operations in Darwin.
- Misunderstanding about the future role of gas in domestic markets.

While market conditions will correct in time, the other two issues appear misguided for the following reasons:

- The Northern Territory committed to the full implementation of all recommendations in the Pepper Inquiry and is fully supportive of the development of an onshore gas industry.

- Empire Energy enjoys excellent relations with Traditional Landowners and Pastoralists alike. They actively manage those relationships and recognise the importance of these as a key factor in Beetaloo development.
- Gas markets both on the Australian East Coast and the Northern Territory are heading for supply deficit in the near future. While supply deficits in the East Coast are not expected until post-2025, the NT Power & Water Corporation are urgently looking for new gas supply agreements as their existing gas supply arrangements with ENI's Blacktip Field suffer from accelerated decline issues.

Resources to Reserves – Mind the Gap!

Range Resources – increase in reserves equals increase in market value

US companies were amongst the first companies in the world to develop unconventional oil and gas reserves, in fact the successful development of these resources from the early 2000's onwards have been entirely responsible for the US moving from being a net importer to net exporter of energy.

Corporate Connect has studied the development of one of the frontier companies in the Appalachia's Marcellus Basin, Range Resources (https://www.rangeresources.com/). They pioneered the development of the Marcellus shale in 2004 when they drilled the Renz #1 well. It wasn't an exploration program that had immediate success and it is an important case study in understanding how developing unconventional shale plays require continual assessment and application of learnings in order to maximise production outcomes.

Range Resources (RRC) is also an ideal company to see how US investors valued a company building up an oil and gas inventory from nothing. Figure 22 shows the growth in Range Resources reserve position over the 10 years from 2003 to 2013. By the beginning of 2004, RRC reported a 1400 BCF (1.4TCF) reserve position and had just started production with an approximate 71 BCFe initial production for the 12 months to Dec 2003. It's market valuation increased from US$530million to US$1.6billion in 12 months.

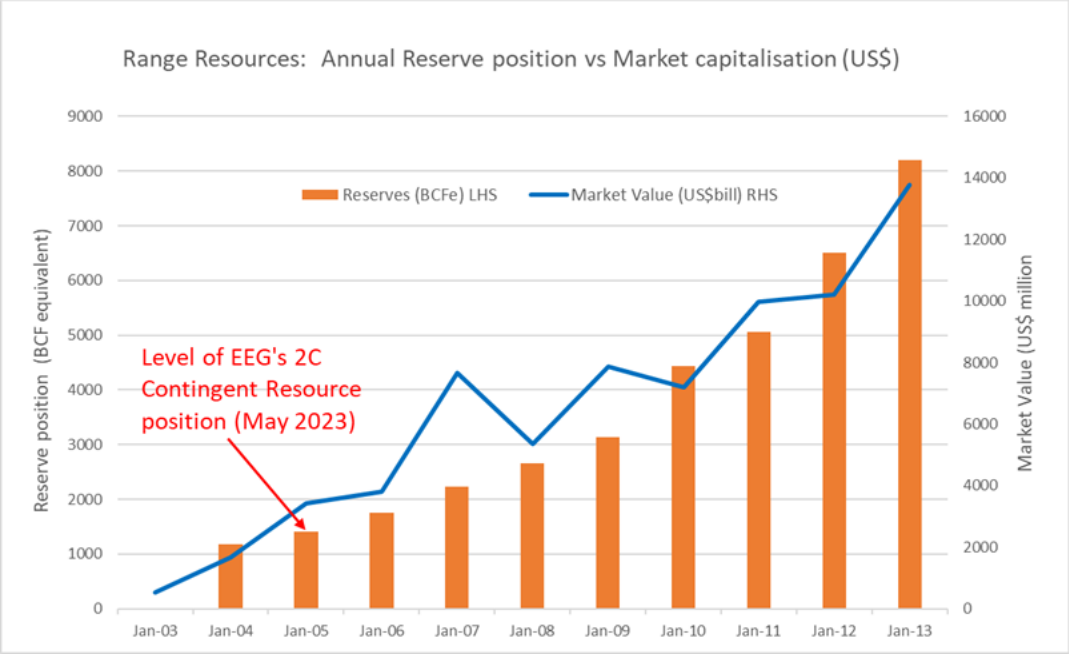

Figure 22: Range Resources: Annual Reserve position vs Market Value (Source: Factset, CC Estimates)

In comparison, Empire Energy's increase in 2C resource has been completely ignored by the Australian market (see Figure 23). Clearly the market is discounting any chance of the company converting 2C resources to 2P Reserves in the next 12 months and is pricing the company vaguely in line with domestic peer company valuations (see Figure 21) for 2C Resources.

However, it is notable that the Unconventional resource positions in the Beetaloo Basin of both Empire Energy and Tamboran Resources sit at the very low end of those peer valuations. Corporate Connect believes this is indicative of the markets lack of understanding on the likelihood of Beetaloo Basin development and the capacity of Beetaloo Basin operators to progress to successful commercial outcomes.

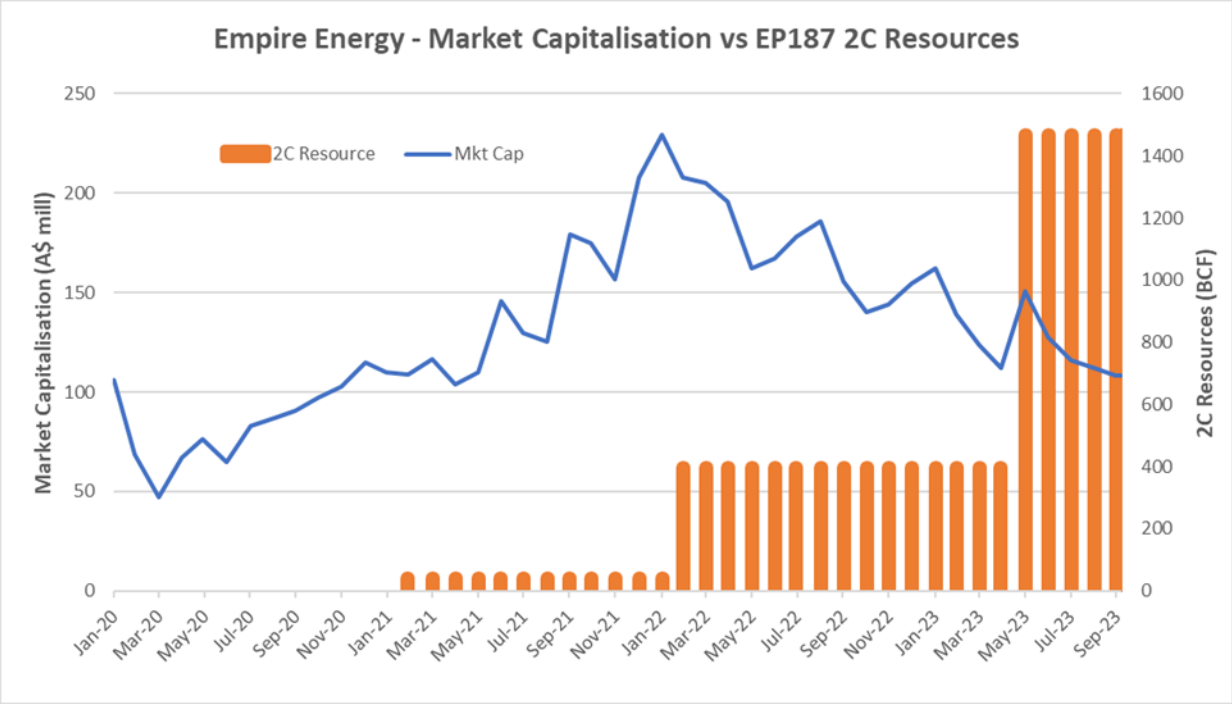

Figure 23: Empire Energy – Carpentaria Project 2C Contingent Resources vs Market Capitalisation

Valuation uplift catalyst – Conversion of Empire's 2C Resource to 2P Reserves

The Final Investment Decision (FID) for the 25TJ/day Carpentaria Pilot Plant development is expected by the end of 2023. As discussed in the previous section of this report, CC believes that the FID will approve development. A decision to go ahead with the Pilot Plant will mean that some of Empire's Carpentaria 2C Resource will move into the Reserve category.

The current 2C Contingent Resource position for Empire's Carpentaria Project in EP187 currently sits at approximately 1.5 TCF (1,739 PJ) gas following assessment by Netherland Sewell and Associates of the four Carpentaria wells. 732 BCF of the total 1500 BCF is contained within the Velkerri B shale, considered to be the highest yielding formation within the stacked play.

Upon a successful FID for Carpentaria, Corporate Connect believes it is not unreasonable to assume that at least 50% of the current 732 BCF 2C Resource within the Velkerri B shale would be converted to 2P Reserves. This would result in a maiden 2P Reserve of approximately 365 BCF.

At a conservative multiple of A$0.90 per mcf this implies a valuation on Empire's Carpentaria (EP187) gas reserves of approximately $330 million or $0.42/share.

This valuation is in line with British Gas's bid for QGC in 2008, where BG bid $0.80/GJ for QGC's 3P Reserves. The bid for QGC by BG was well below similar deals at the time by Santos and Origin which were in the $1.65-1.88/GJ range.

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APPENDICES:

- Unconventional Hydrocarbons
- The Beetaloo Basin Geology

Appendix 1: Unconventional Hydrocarbons – Shale Gas – a quick explanation

The term “unconventional gas” refers to the method of extraction used for natural gas. Conventional gas consists of drilling conventional vertical wells through hard rock to get to trapped subterranean reservoirs of natural gas. Unconventional gas, on the other hand, is contained in porous, low-permeability features that act like a “sponge,” such as shale rock, sandstone, and coal seams. In order to extract unconventional gas economically, well operators make use of a combination of horizontal drilling and hydraulic fracturing.

Horizontal drilling begins with a vertical shaft, like a typical well. Once it approaches the depth of the targeted gas reservoir, the shaft bears off at an arc, so it can intersect the reservoir at a near-horizontal angle. It continues horizontally, through the reservoir, until the desired length is reached. Horizontal wells are designed to significantly increase the production of a well by offering greater contact with the productive layer of a reservoir. While the construction of a horizontal well often costs two to three times as much as a conventional well, initial production is often three to four times that of a conventional well.

This increased exposure to the productive layer of the reservoir allows additional hydraulic fracturing with greater water volumes and proppant (small, solid particles, usually sand). The lateral length of horizontal wells has also increased, allowing for more exposure to natural gas-producing rock from a single well. Because tight formations have very low permeability, which impedes gas from moving toward the well bore, using hydraulic fracturing to increase permeability, along with horizontal drilling, is necessary for oil and gas to be produced from these formations economically.

Hydraulic fracturing — often referred to as “fracking”—consists of injecting water, proppant (e.g., granules of sand, ceramic, etc), and chemicals at high pressure into the gas bearing formation. The build-up in pressure causes the formation to fracture, and the proppant fills the fractures to keep them from resealing. This allows the natural gas impounded in the formation to rush into the well for extraction. Unconventional shale gas development is more akin to a manufacturing process and is not comparable to conventional hydrocarbon development. Central to this is that a large scale shale gas resource must be consistent in reservoir characteristics and commercial thickness, displaying continuity across the play. Successful development relies on consistent well completion bringing gains in flow rates and costs.

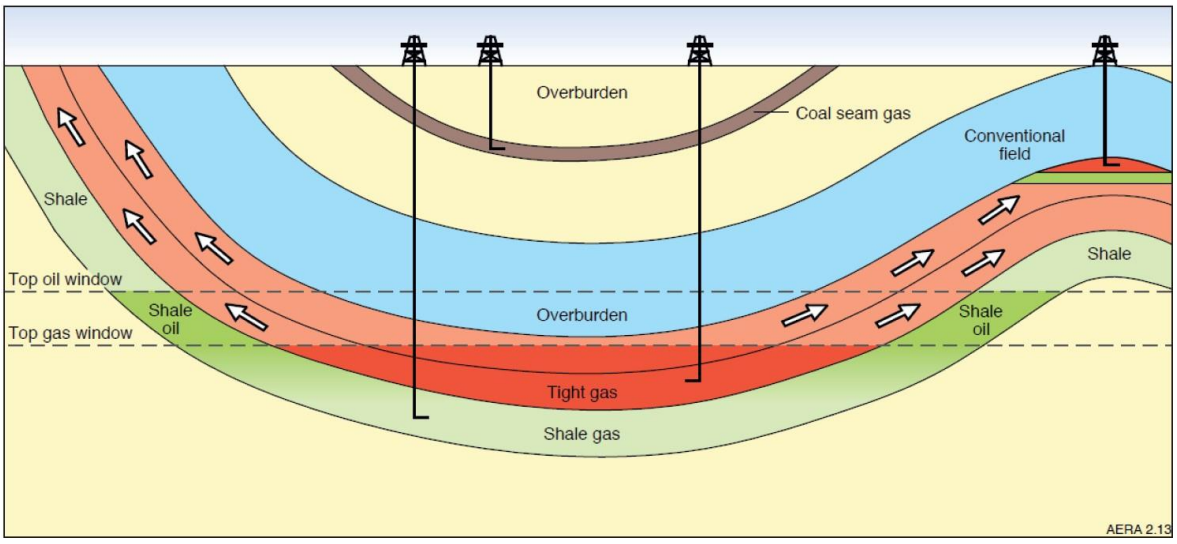
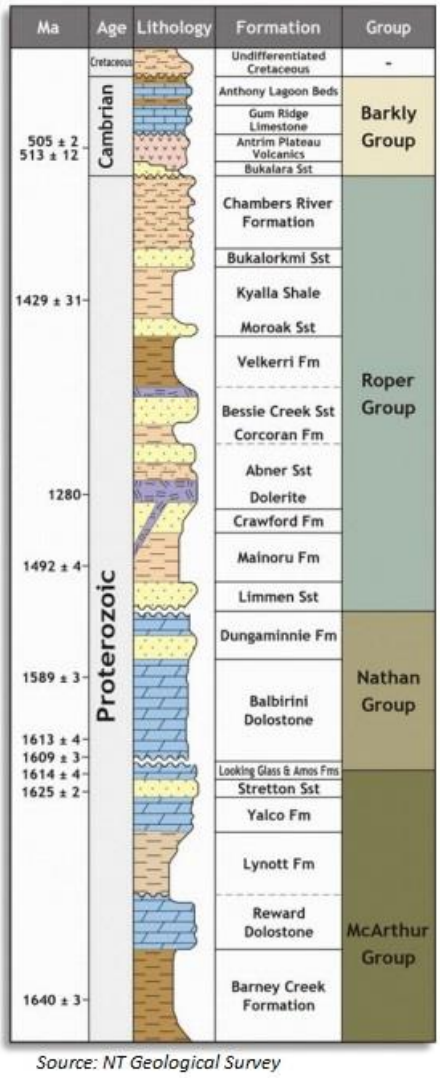


Figure 24: Diagram of conventional and unconventional natural gas reservoirs (Source: Geoscience Australia)

Appendix 2: Geology



Source: NT Geological Survey

The Beetaloo Basin is recognised as one of the oldest hydrocarbon deposits in the world. The Basin began around 1.6 billion years old (early Proterozoic) and are the result of a broad and continuous organics rich deposition event over that period. Given their age, the rocks have been subject to a relative lack of tectonic activity and the alteration – instead, they have remained at depths and temperatures that are in line with the thermogenic generation of gas.

There are a number of hydrocarbon bearing formations within the Beetaloo Sub-basin which is why it is known as a "stacked pay", which in effect means that there are a number of formations or layers within that contain hydrocarbons that lie on top of each other. Those that are of interest to exploration companies in the play are stratigraphic layers within the Roper Group – principally the Kyalla Shale Formation and the middle shale member of the Velkerri Formation (Velkerri B). What is of particular note is not just the favourable reservoir characteristics of these rock but also their thickness.

"The thickness of Roper Group rocks are the greatest in the depositional centres Beetaloo Sub-basin… …where the Velkerri Formation has been intersected to about 750 m and the Kyalla Formation to greater than 800 m. The thickness of these formations improve the unconventional resource potential through retention of a higher percentage of generated hydrocarbons than their thinner counterparts. Globally, net source rock thicknesses are typically less than 100 m and are dominated by marine petroleum systems."

Source: Adapted from Revie D, 2017. Unconventional petroleum resources of the Roper Group, McArthur Basin. Northern Territory Geological Survey, Record 2017-002.

The Velkerri B Formation has been studied extensively by both the Northern Territory Geological Survey and several companies that have conducted exploration activities over a number of years.

Estimates of the gas resource in the Beetaloo are generally of significant size but are of significantly different ranges. The Northern Territory Geological survey has estimated Gas in Place resource of over 200,000PJ (~186Trillion Cubic feet (TCF))

Structurally, the basin is significant in that it is a thick and has a continuous stratigraphy, which is ideal for unconventional horizontal wells because it provides greater predictability for the modern lateral drilling and completion techniques that have been successfully utilised in the USA.

Figure 25: Beetaloo Basin geology - Stratigraphic column

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