

EMPIRE ENERGY GROUP LIMITED (EEG)

STRONG LEVERAGE TO UPSIDE CASE IN BEETALOO

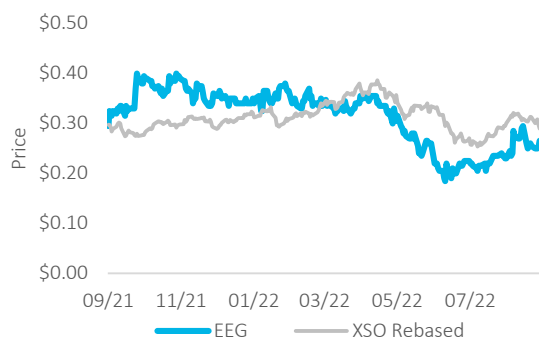
Analyst
Date

Garry Marsden
6 September 2022

SPEC BUY

SHARE PRICE	TARGET PRICE
\$0.27	\$1.25

SHARE PRICE CHART



COMPANY DATA

Enterprise value	\$174m
Market cap	\$205m
Issued capital	789m
Free float	82%
12-month price range	\$0.18-\$0.40
GICS sector	Energy

DIRECTORS

Non-Exec Chairman	Paul Espie AO
Managing Director	Alex Underwood
Non-Exec Director	Prof. John Warburton
Non-Exec Director	Peter Cleary
Non-Exec Director	Louis Rozman
Non-Exec Director	Paul Fudge
Alt Non-Exec Director	Jacqui Clarke

MAJOR SHAREHOLDERS

Pangaea Resources	18.2%
Elphinstone Group	8.3%
Global Energy and Resources	4.2%
Sheffield Holdings	4.1%
Macquarie Bank	3.4%
Energy and Minerals Group	3.4%
Board & Management	20.5%

DRILLING AND TESTING RESULTS FROM THE BEETALOO

Empire Energy Group Limited has commenced testing after successful drilling and fracture stimulation activities at Carpentaria-2H. **Initial flow test results have been very encouraging, pointing to commercial outcomes.**

RESULTS WILL ADD TO RESOURCES AND VALUATIONS

The successful Beetaloo programs will be accretive to gas resources in the Basin and will drive towards initial reserve announcements. To date the company has booked a 2C Contingent Resource of 396 Bcf at Carpentaria and a further 157 Bcf in the Pangaea assets.

POSITIVE RESULTS FROM NEARBY ACTIVITY

We continue to note stronger appraisal activity from nearby operators, with an ongoing commitment to drilling and flow testing across the region. These results are driving interest from Asian gas utilities, LNG proponents and US shale players.

FIRST MOVER COMMERCIAL ADVANTAGE

We see growing evidence of early commercialisation for EEG, utilising the existing pipeline infrastructure in the region. This early production will allow access to initial cashflow and help fund the larger ambitions.

TARGET PRICE REFLECTS UPSIDE

Our target price has been upgraded to \$1.25 per share, reflecting a lift in the Commercial Chance of Success from 50 to 60% and the addition of the larger resources number being reported by Empire and others in the basin.

Our risked valuation derives an implied return of 360%

The highly prospective Pangaea assets are conservatively assessed at the original cost base, which does not reflect the potential of the 27.6 Tcf Prospective Resource. Our previous research highlighted potential upside value of \$800m on this asset.

Current energy market momentum adds further support to the upside value of Empire.

A valuation of \$1.94 per share is calculated based on a 100% COS at Carpentaria.

INTRODUCTION

Empire Energy Group Limited (ASX: EEG) is advancing the appraisal activity on its exciting shale gas opportunities in the Beetaloo Sub-basin in the Northern Territory.

The Carpentaria-1 well (EEG: 100%) was drilled in late 2020, and subsequent testing has highlighted the upside potential. Further recent drilling at Carpentaria-2H has confirmed our view of the scale of this commercial opportunity.

Resources have been upgraded following successful drilling. Expect further upgrades as drilling progresses.

Gas prices have advanced globally, which will benefit economics and support the initial phase of appraisal and development. Continued interest from Asian utilities, LNG proponents and US shale players is being noted. This farmin activity could occur suddenly, with little reference to current low share prices.

EEG remains our preferred play in the Basin, with quality assets, a strong board and first mover commercial advantage.

INVESTMENT THESIS

Empire is a key player in the momentum of the Basin, representing a leveraged play on the economic potential of the Beetaloo.

The drilling and testing programs in the Beetaloo Sub-basin continue to enhance the prospects for large-scale commercial development in the region. Nothing seen to date on the technical side has been at the low end of expectations. This supports the high calibre of technical work and the good rocks.

In parallel with EEG's actions, Santos and Origin continue to pursue large-scale regional targets. **This growing option for these majors may underpin substantial increases in domestic sales via Mount Isa, LNG sales via Darwin or both of these opportunities.**

Significant contingent gas resources have been reported in the region to date, with Empire likely to report a further upgrade in gas resources at Carpentaria following added drilling.

Our valuation modelling indicates that the Carpentaria asset has an unrisks value of over \$1.25 billion compared with Empire's current enterprise value of approximately \$200 million.

Empire is valued conservatively at 125 cps. Value upside is seen as risks reduce on the Beetaloo gas projects, and work commences on the transformational Pangaea assets.

Our risked valuation derives an implied return of 360% from current prices.

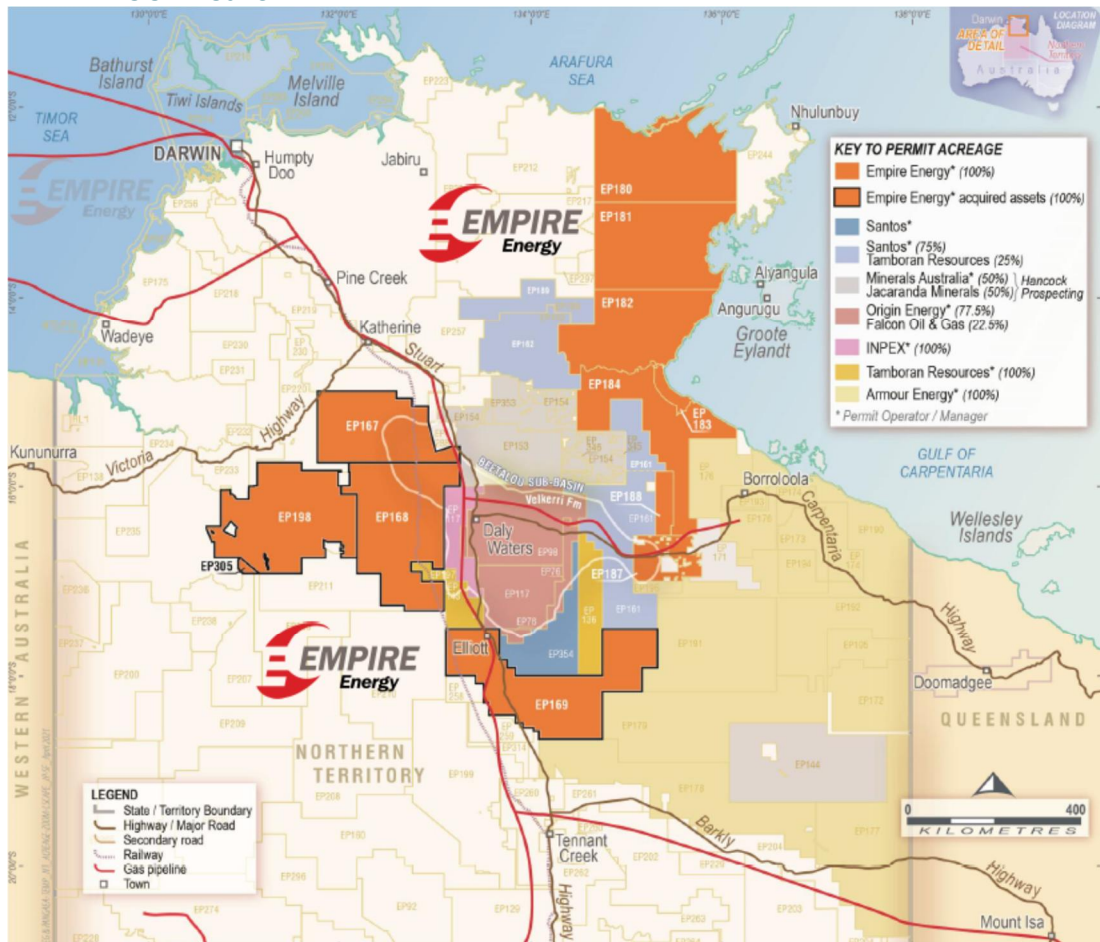
BEETALOO LOCATION AND OPTIONS

The Beetaloo Sub-basin is located in north central Northern Territory, approximately 600 km southeast of Darwin. Operational access is provided either by road or air, with airstrip access for both light and heavy planes.

The remote area is also serviced by road and rail corridors on the region's western edge, with two gas pipelines crossing the basin. The largest pipeline traverses the length of the Territory from Alice Springs in the south to Darwin in the north. The second smaller pipeline intersects the main line and provides gas to the large MacArthur River mine on the edge of the Gulf of Carpentaria. Both pipelines are open access to new supplies. Empire has MOU's with the operators of both these pipelines to transport gas from Empire's assets.

Empire controls 100% of the permits on the western edge of the Basin and on the eastern flank, with extensions north to the Arafura Sea, an area of substantial unexplored potential encompassing the entire McArthur Basin Central Trough.

FIGURE 1: BEETALOO PROJECT MAP



Source: Empire Energy Group Limited

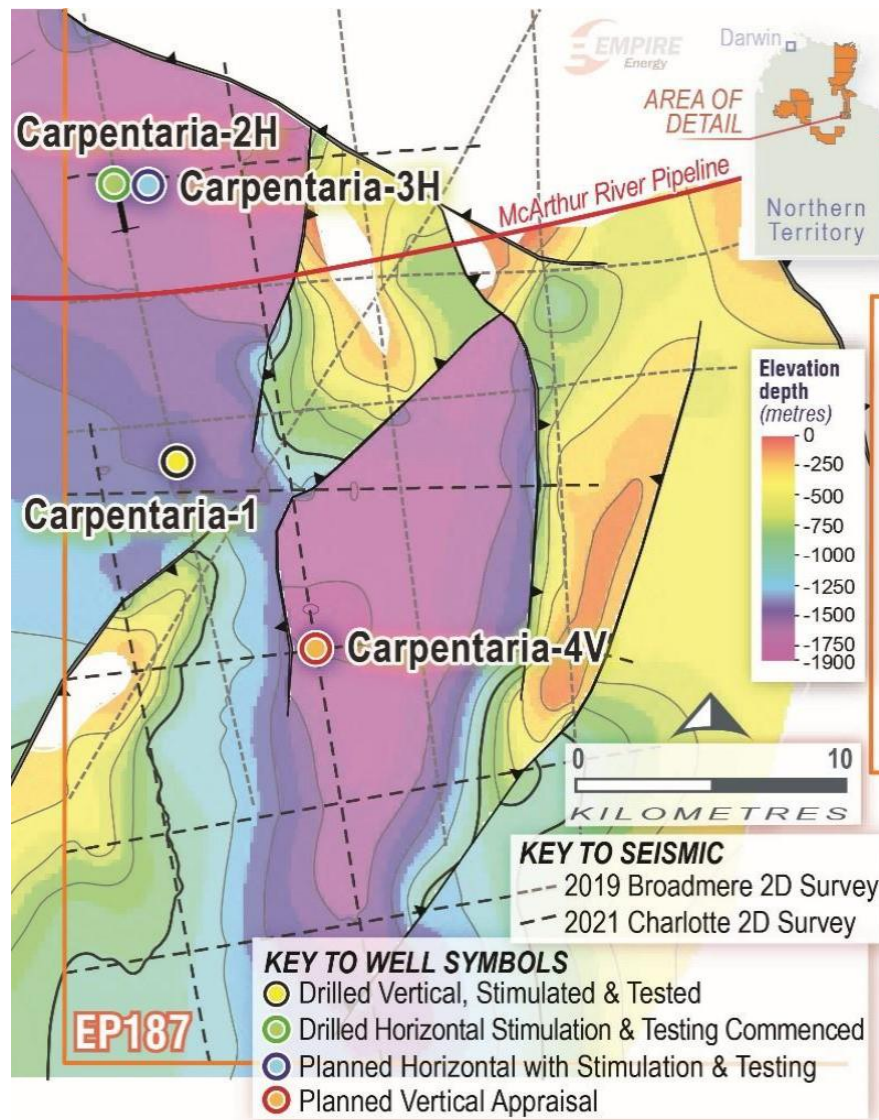
EEG's current exploration and appraisal activity is focused on the Basin's eastern edge in EP 187. Two wells have been drilled to date.

Two further wells (Carpentaria-3H and Carpentaria-4V) are planned for the current drilling season, with drilling scheduled to start in September 2022.

Success from the upcoming drilling activity will see substantial upgrades in the Contingent Resources in EP 187 and may lead to the first reserve booking in the Basin in and around the Carpentaria-2H and -3H wells.

Reserve booking at Carpentaria will be massively beneficial towards the confidence in the Basin's deliverability and shareholder value.

FIGURE 2: CARPENTARIA REGION DRILLING PLANS



Source: Empire Energy Group Limited

BEETALOO ACTIVITY FOR 2022

2022 TO BE THE WATERSHED YEAR

Despite the lack of commentary from the major companies on the immediate Beetaloo activities, there is a growing air of confidence amongst the smaller joint venture partners regarding their current and upcoming exploration and appraisal activities.

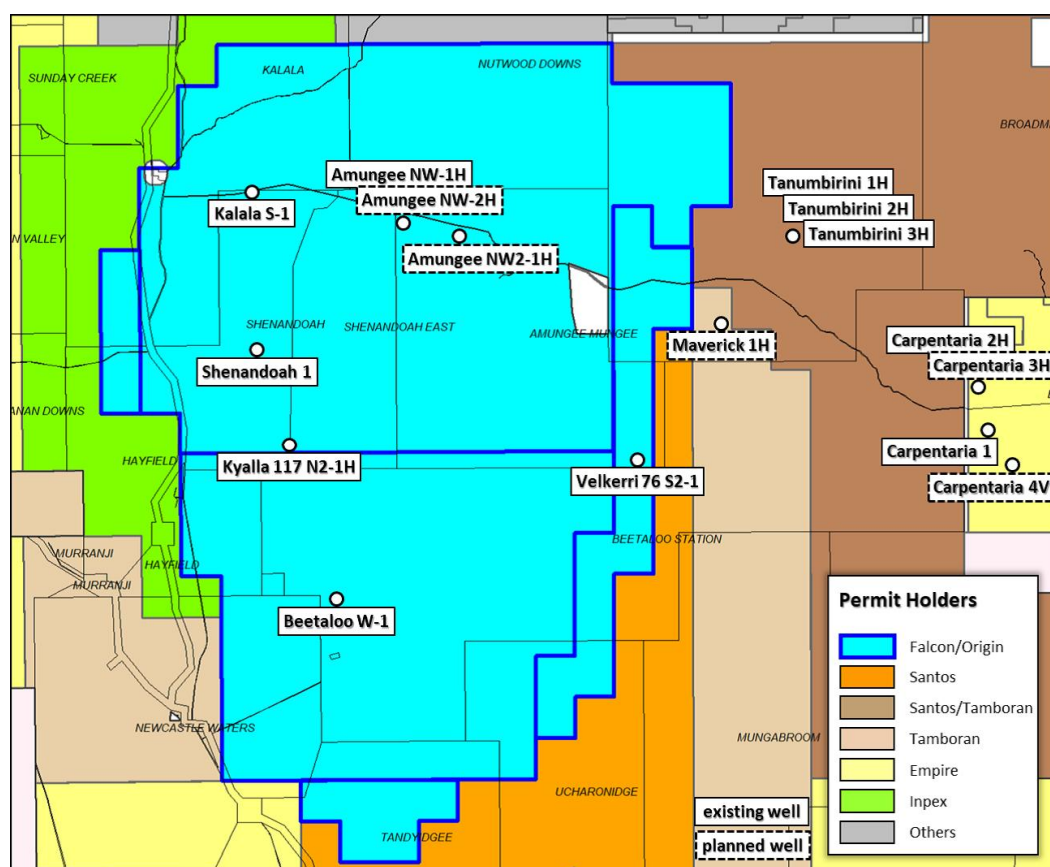
The year's second half is scheduled to see five exploration and appraisal wells in the basin. This will involve three separate rigs operating in parallel, a first for the region.

- Empire to drill Carpentaria-3H and -4V starting September in EP 187
- Origin and Falcon to drill appraisal wells Amungee NW-2H and Amungee NW2-1H in EP 98, including 1,000 metre lateral sections
- Tamboran to drill the long-awaited Maverick-1H well in EP 136, including a 1,000 metre lateral

After drilling, fracture stimulation and testing will be undertaken on these wells, in addition to the ongoing test programs from previous drilling campaigns.

- Empire to continue testing at Carpentaria-2H
- Empire to initiate testing at Carpentaria-3H following drilling
- Santos to continue testing the Tanumbirini-2H and 3H via the long-term production tests
- Origin/Falcon and Tamboran are planning fracture stimulation and testing of the Amungee and Maverick wells respectively in early 2023

FIGURE 3: MAP OF KEY BEETALOO PERMITS



Source: Falcon Oil and Gas Limited

The high levels of activities will also likely see added drilling and appraisal work in 2023 and some early development work in the success case, including converting the MOU's for gas sales and pipeline access.

This appraisal work is being undertaken in a highly supportive oil and gas environment, with record prices noted in both domestic and export markets and ongoing support from both Territory and Federal governments.

An excellent following breeze for an exciting campaign.

ACTIVITY AND RESULTS TO DATE

A SUMMARY OF EXPLORATION ACTIVITY TO DATE

Historical intersections of oil and gas shows in the Beetaloo corresponded with early minerals exploration drilling from 1984 by CRA Exploration Pty Ltd.

Modern oil and gas exploration commenced in the Beetaloo in 2007 with the drilling of Shanendoah-1 and subsequently deepened in 2011. The well was successfully fracture stimulated and tested with results from the vertical well yielding modest but encouraging flow rates (0.70 MMscfgd)¹. This was the first successful test of the Middle Velkerri Shales in the Beetaloo.

In 2015, Origin Energy (with Falcon as a partner) drilled two vertical exploration wells (Kalala S-1 and Amungee NW-1) and one horizontal well (Amungee NW-1H).² Further drilling confirmed the presence of organic-rich shales in the Velkerri, and comparisons were being made to the then-developing shale gas industry in the United States of America. History will show the massive investment and energy market shift that these shales have proved in the US, but activity in Australia stalled at this time.

To the east of Origin's work programme, Santos drilled the Tanumbrini-1 well in the deepest part of the Beetaloo Sub-basin in 2014. The well was guided towards the Kyalla and Velkerri sequence targeting the presence of several thick, regionally extensive, thermally mature organic-rich marine shales³. Extensive coring was undertaken, but no testing was completed.

On the western edge of the Basin, Pangaea Resources (NT) Pty Ltd undertook several exploration wells focussed on the Velkerri section in a shallower geological setting. These wells successfully encountered the target sequence with positive results. No testing was undertaken on these wells at the time. This area now forms a part of the Empire Energy Group, following the acquisition of the acreage in a cash and scrip deal in mid-2021.⁴

The early-stage activity also highlighted a shallower interval, the Kyalla Shale, demonstrating some oil and gas prospectivity. Exploration to date has been mixed in this zone. However, some attraction remains in the deeper part of the Basin, as the zone is assumed to contain greater potential for wet gas (i.e., Condensate), which would enhance returns in the success case.

In September 2016, the Northern Territory government announced a moratorium on fracture stimulation, effectively stalling all exploration activity in the Beetaloo for a period. The moratorium was lifted after the publication of the Pepper Inquiry Report⁵ in March 2018, which reported that the activity could be undertaken subject to the implementation of 135 recommendations.

Drilling recommenced after a time, with Santos, Origin and Empire all initiating exploration and appraisal campaigns, which are now on the cusp of commerciality in the Basin.

¹ Falcon Oil & Gas Ltd. Announces completion of testing at Shanendoah-1

² Close et al, Proterozoic shale gas plays in the Beetaloo Basin and the Amungee NW-1H discovery. AGES (2017) Proceedings

³ Tanumbrini-1 Well completion report (2014)

⁴ Empire Energy ASX Release (14 April 2021) Transformational acquisition of Pangaea Resources

⁵ Scientific Inquiry into hydraulic Fracturing in the Northern Territory, (2018)

A SUMMARY OF THE RESOURCES ENCOUNTERED

In 2017, The NT Geological Survey commissioned a study by Weatherford Laboratories to assess the gas resource size of the Kyalla and Velkerri shales in the Beetaloo Sub-basin. The study was based on the region's initial 14 gas exploration wells (effectively up to the moratorium).

The NT Government estimates that there is over 500,000 PJ of gas in place in the region in the Beetaloo Sub-basin's Velkerri B shale sequence alone.⁶

Based on a conservative 10% recovery factor, we can note a potential reserve of up to 50,000 PJ of gas in the region.

Applying a potential gas price of \$8/GJ equates to a Basin-wide revenue stream of A\$400 billion.

Table 1 below highlights the Contingent Resources that have been reported to date by the key operators across the Beetaloo.

TABLE 1: COMPILATION OF BEETALOO SUB-BASIN CONTINGENT GAS RESOURCES

Project	Contingent Resources	Comments
Amungee Project EP 76 Origin Energy (77.5%) Falcon Oil and Gas (22.5%)	Gross 2C gas resource of 6,600 Bcf	Based on the 1,968 square km area of Velkerri B Shale around the Amungee NW-1H well ⁷
Carpentaria Project EP 187 Empire Energy (100%)	Gross 2C gas resource of 396 Bcf (An increase of 866% from the previous)	NSAI estimates are based on the area between Carpentaria-1 and -2 wells. ⁸ (3C resource of 1,292 Bcf also reported (up 1,402% from previous))
Pangaea Project EP 167 and 168 Empire Energy (100%)	Gross 2C gas resource of 158 Bcf	NSAI estimates. ⁹ (3C resource of 416 Bcf also reported)
Tanumbirini Project EP 161 Santos Limited (75%) Tamboran (25%)	Gross 2C gas resource of 1,617 Bcf	NSAI estimates. ¹⁰ (3C resource of 3,762 Bcf also reported)

Source: Company Reports

Further large Prospective Gas Resources have also been noted by all the Operators in the region. Conversion of these will also attract added value to the participants.

⁶ NTGS Weatherford Laboratories (2017), Kyalla and Middle Velkerri Resource Assessment: Gorrie, Beetaloo, OT Downs and Broadmere Sub-basins

⁷ Origin Energy Limited ASX release, 15 February 2017.

⁸ Empire Energy Group Limited ASX Release, 16 February 2022

⁹ Empire Energy Group Limited ASX Release, 27 May 2021

¹⁰ Tamboran ASX release, 5 September 2022

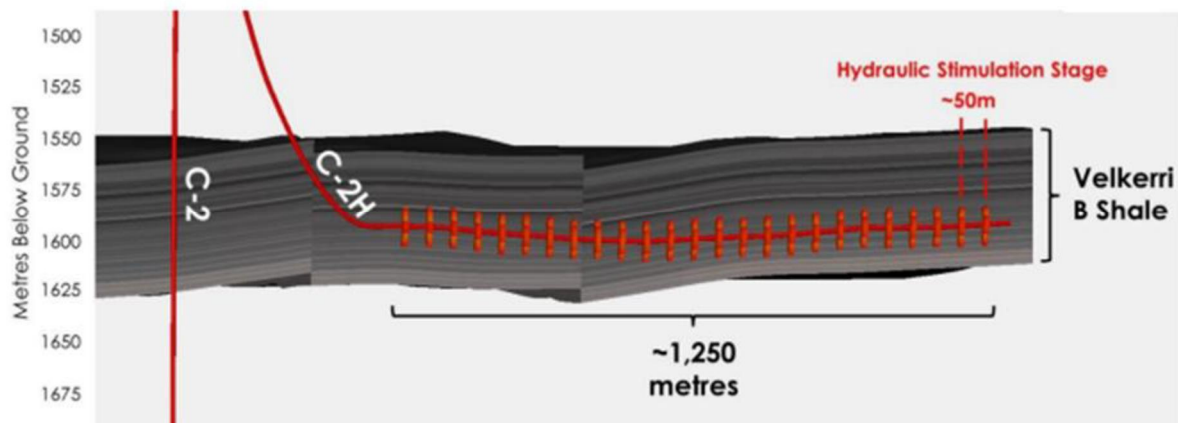
EMPIRE ENERGY’S CARPENTARIA-2H RESULTS

Carpentaria-2H was drilled successfully in late 2021. The well was located in the northern segment of the permit, approximately 11 km north of the discovery well, Carpentaria-1. The well encountered an entire Velkerri Shale sequence in the vertical well before the lateral was completed. The well was cased and suspended in December 2021.

Carpentaria-2H was only the fifth horizontal well in the Beetaloo Sub-basin, highlighting the early-stage opportunity that is being pursued. By contrast, over 20,000 oil and gas wells are planned in the USA during 2022, with the majority focused on Shale opportunities¹¹. **This underlines the need for strong links with the US industry and the beneficial learning curve for the Beetaloo.**

Fracture stimulation activities were undertaken in July 2022, with 21 stages completed across a lateral section of 927 metres within the 1,250-metre horizontal section. During the stimulation works, 6.3 million pounds of sand were placed in the wellbore representing 97% of the design volume. **This was one of the largest fracture stimulation jobs ever completed in Australia.**

FIGURE 4: EXTENT OF THE CARPENTARIA STIMULATIONS



Source: Empire Energy Group Limited

As part of the Research and Development scope of these early-stage wells, Empire has undertaken a series of different fracture stimulation fluid styles in Carpentaria-2H. These different styles have the prime benefit of testing for the optimal stimulation method at minimal additional cost.

TABLE 2: FRACTURE STIMULATION STYLES AT CARPENTARIA-2H

Fluid system Type	Number of stages
Slickwater	7
Crosslink	8
Hybrid	4
HVFR (High Viscosity Friction Remover)	2
Total	21

Source: Empire Energy Group Limited

The results of the different stimulation techniques will be recorded later in the testing program via the use of tracer elements in the fracture fluids. The analysis of this data will provide crucial information on

¹¹ Number of oil and gas wells in US, www.statista.com/statistics

the effectiveness of individual stimulation stages and allow optimisation for the next phase of drilling and testing.

Of note, current US best practice sees largely Slickwater fracture stimulations being undertaken based on cost, effectiveness, and chemical usage.

INITIAL FLOW TEST RESULTS HAVE BEEN ENCOURAGING

Flow testing started in August with reported rates of up to 2.8 MMscfgd. As testing has continued, the rate has fallen slightly and has more **recently plateaued at between 2.5 and 2.6 MMscfgd (or 2.8 MMscfgd per 1,000 metres of lateral)**¹². These are encouraging signs. The gas flows have continued to indicate very low CO₂ levels (<1% CO₂).

Consistent with the costs involved in stimulating horizontal wells in the Beetaloo, analysts and industry sources have used an often-quoted commercial flow rate of 3 MMscfgd per 1,000 metres of lateral. This is largely based on drilling by the major companies in the deeper section of the Beetaloo. EEG's lower cost base will add value in this case.

On that basis, the preliminary results of these tests have come in just beneath this commercial threshold, but we need to consider two key points:

- The R&D nature of this well will see subsequent wells optimisation of fracture stimulation techniques. This will enhance average flows, and
- The lower drilling costs in the Basin's shallower section at Carpentaria.

From the initial testing rates at Carpentaria-2H and based on the lower drilling costs, we are increasingly confident that we have achieved a commercial threshold within the Basin.

UPDATED VALUATION AND SCENARIO ANALYSIS

Asset values have been updated following the testing success at Carpentaria and the growing momentum around the Beetaloo drilling progress. The key increments are as follows:

- An increase in the Prospective resource in line with updated NSAI estimates,
- An increase in the Chance of Success from 50% to 60%, following the successful initial test results of the Carpentaria-2H lateral,
- NPV value of \$0.50 per GJ,
- Updated US valuation based on improvement in US gas prices, and
- Cash and debt levels updated for the latest disclosures.

¹² Empire ASX releases 11 August and 22 August 2022.

TABLE 5: VALUATION

Asset	Basis	A\$ million	CPS
Carpentaria Velkerri Gas	4,250 Bcf prospective resource, risked at 60% COS	765	97
Carpentaria Velkerri liquids	33 million Bbls prospective resource, risked at 60% COS	59	8
Pangaea Assets	At purchase cost	65	8
McArthur Basin	11,000 Bcf prospective resource, risked at 1% COS	33	4
US assets	PV10 uplifted for gas prices	30	4
Cash	(as of August 2022)	39	5
Future option proceeds			
Debt	(as of June 30, 2022)	(8)	(1)
Total		984	125

* Numbers may not add due to rounding, source: Blue Ocean Equities.

Based on a fully diluted capital of 789 million shares (includes shares, all rights, and in-the-money options).

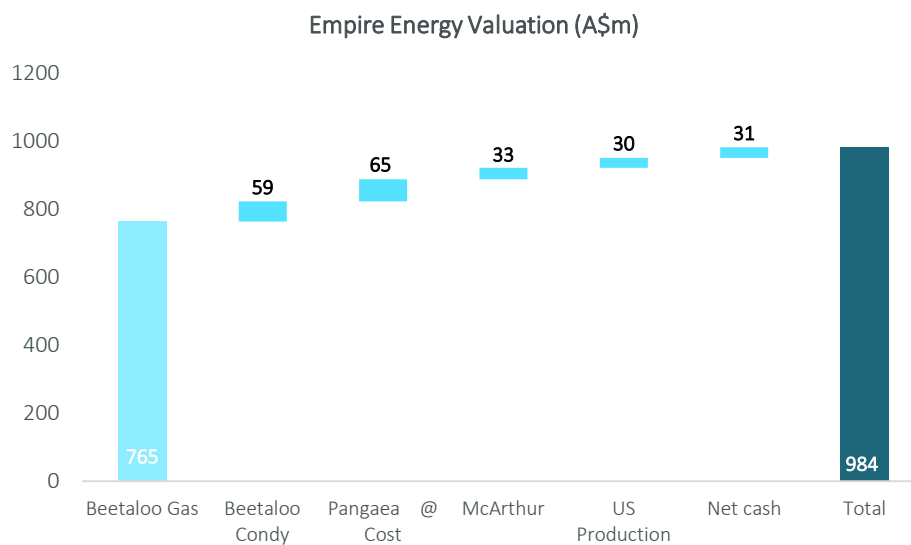
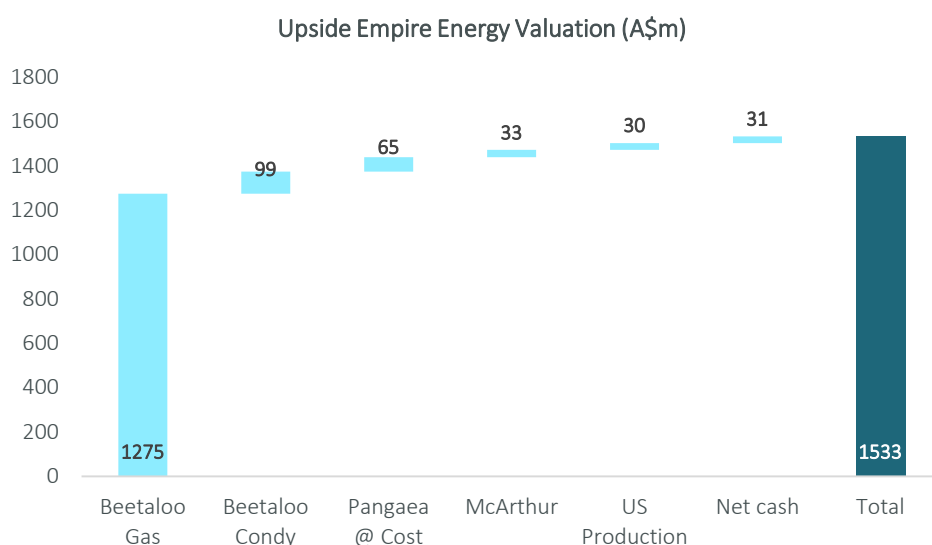
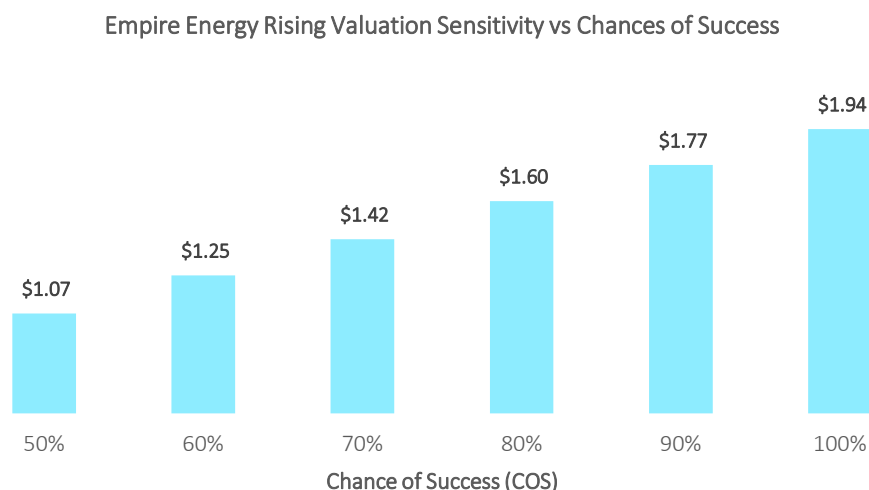
FIGURE 6: VALUATION BREAKDOWN (BASE CASE) - \$1.25 PER SHARE


FIGURE 7: VALUATION BREAKDOWN (UPSIDE CASE) -\$1.94 PER SHARE


Upside value is \$1.94 per share, which assumes commercial flow rates from the upcoming drilling and testing at Carpentaria-3.

The EEG value per share retains leverage to further success in the upcoming drilling and testing campaigns risk risks. As risks reduce further, we see additional upside in the valuation as highlighted in Figure 8 below.

FIGURE 8: VALUATION RISING WITH INCREASING CHANCE OF SUCCESS


ADDED UPSIDE LEVERAGE CAN ALSO COME FROM

- Increasing the value of “in ground” resources above the conservative \$0.50 per GJ:** Comparable gas companies in Australia trade at resource and reserve multiples of in excess of \$1 per GJ. The recent Senex takeover was struck at a valuation of circa \$1.20 per GJ.

Furthermore, the rapid escalation of Asian LNG prices could arguably result in further enhancements in the value of domestic gas stocks with access to this opportunity. Empire is well placed to enter the LNG markets in Asia, with a short pipeline link to Darwin where LNG capacity is available.

- Enhancing the value of the western edge permits, of the “Pangaea acreage”:** We continue to carry the Pangaea assets at cost in our valuation. Given the large scale of this opportunity (27.6 Tcf of

P50 Prospective Resource), our valuation of \$65 million appears conservative. (see January 2022 Note on EEG)

RISKS

Empire is exposed to all the normal risks associated with exploring and appraising deep shale gas targets, including exploration, fracture stimulation, testing, funding and commercial risks.

The lifting of the moratorium on unconventional gas in the Northern Territory and the recent re-election of a pro-gas government has also reduced some of these risks.

Operational risk is reduced through the presence of an experienced board and management team, who have extensive knowledge in the exploration and appraisal for gas in Australia and overseas.

Environmental activists can stall or slow exploration appraisal and development activities in the gas business. This risk has been heightened recently after the Senate inquiry and the legal attempts to stall the government funding of the appraisal work.

EEG retains minor gas production operations in the USA. Movements in the US gas price may influence revenues and cashflows.

EEG retains a light carbon footprint with low levels of CO₂ in the test gas to date. The company is developing a carbon strategy commensurate with the size and scale of its potential future operations.

Assuming EEG can delineate an economically viable project and make the transition into production, future revenues will be derived from the sale of natural gas and possible liquids. These prices and volumes may be contracted and could vary from year to year, which could impact the Company's reported cash flow, profitability and share price.

ABBREVIATIONS

BCF	Billion cubic feet
COS	Chance of Success
GJ	Gigajoule
LNG	Liquified Natural Gas
MMscfgd	Million standard cubic feet of gas per day
MOU	Memorandum of Understanding
NSAI	Netherland, Sewell & Associates Inc.
PJ	Petajoule
R&D	Research and Development

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Blue Ocean Equities Pty Limited acted as Joint Lead Manager for the EEG Placement in June 2022 and acted as Underwriter for the recent SPP.

The Analyst of this report owns shares and options in Empire Energy Group Limited.