

EMPIRE ENERGY GROUP (EEG)

BEETALOO GAS - THE UPSIDE CASE IS REAL

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We say

Price

Target

SPEC BUY

\$0.34 \$1.10

Empire Energy Group Limited (ASX: EEG) continues to pursue its exciting shale gas opportunities in the Beetaloo Sub-basin.

Drilling and testing results at Carpentaria have added confidence that the permit is host to a sizeable wet gas resource with substantial economic potential.

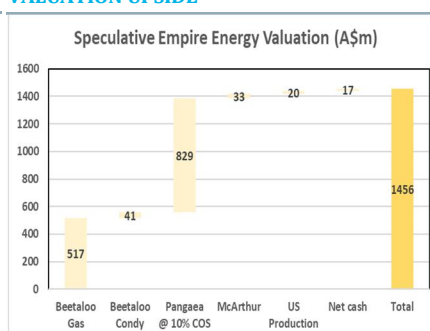
The Pangaea assets may realise added upside beyond our base case value. Given the large prospective resource base and a modest chance of success, these assets could add a further value of \$1.20 per share.

EMPIRE SHARE PRICE CHART



Source: IRESS

VALUATION UPSIDE



Source: Blue Ocean Equities

COMPANY DATA & RATIOS

Enterprise value	\$203m
Market cap (fd)	\$220m
Issued capital (fd)	646m
Free float	70%
12-month price range	\$0.27 – \$0.40
GICS sector	Energy

IMPLIED RETURN

Implied all-in return	224%
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UPCOMING CATALYSTS

- Upcoming NSAI resources review
- Testing of the adjacent wells at Tanumbirini-2H and -3H.
- Scheduled fracture stimulation and testing of Carpentaria-2H in Q2 2022.
- Early-stage progress on commercialisation options.
- Strong uptick in global energy prices.

COMPANY SCORECARD

- Experienced board and management team.
- Highly prospective acreage, with active offset appraisal activity
- Large scale gas and liquids resource potential
- Low CO₂ gas which leaves a light Carbon footprint
- Value entry into the strong energy market

VALUE UPSIDE

Commercial production rates have been reported from the Beetaloo Sub-basin

Further drilling and testing are likely to see even higher rates being reported

The Pangaea assets provide huge upside within its 27Tcf Prospective Resource.

Exploration on the Pangaea ground to restart in late 2022.

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.

We expect an upgrade of the gas resource by internationally renowned experts Netherland Sewell and Associates Inc. (NSAI) when they release their review in early February.

Current appraisal activity in adjacent permits by Santos and Origin will further reduce development and commercial risks.

Early-stage well testing at Amungee (ORG and Falcon) has reached commercial flow rates, with further testing set to confirm the flow potential of the basin across a large area. Further, testing at Tanumbirini (Santos and Tamboran) is also underway, with initial flow results expected around the end of January,

The offset activity by substantial oil and gas companies highlights the premier position of Empire, which will benefit from this regional success.

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 a large-scale commercial development in the region.

Significant contingent gas resource estimates have been reported in the region to date, with Empire likely to report an upgrade in gas resources at Carpentaria. **We believe that this could be upwards of 300 Billion cubic feet (Bcf) of low CO2 gas.**

Our valuation modelling indicates that the Carpentaria asset has an unrisks value of over \$1.1 billion in comparison with Empire's current enterprise value of approximately \$200 million.

The Pangaea assets (27,625 Bcf) have been valued in our base case at the acquisition cost. Given a modest COS (10%), speculative values could add a further \$760 million (\$1.20 per share) to our base valuation. Appraisal activity is in planning for late 2022.

Empire is valued conservatively at 108 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 224% from current prices.

2021 IN REVIEW AND THE 2022 OUTLOOK FOR EMPIRE

The past 12 months have been a watershed year for the broader Beetaloo shale play and Empire Energy.

During the past 12 months, Empire has:

- Fracture stimulated and tested the Carpentaria-1 well (drilled in late 2020)
- Announced an initial Contingent Gas resource of 41 Bcf at Carpentaria
- Acquired the Pangaea assets, adding new acreage with large scale opportunities.
- Completed a Memorandum of Understanding (MOU) with APA Group for the future transportation of gas from the Carpentaria assets
- Signed an MOU to sell future gas to Power and Water Corporation, an NT government-owned gas distribution business.
- Drilled the Carpentaria-2 well as an 11-kilometre offset to the initial discovery and completed a 1,345-metre lateral from the vertical well
- Completed the 162 km Charlotte 2D seismic survey

These operational highlights have significantly improved the size of the gas opportunity in Empire's Beetaloo acreage and have made significant inroads towards reducing risk and improving project economics.

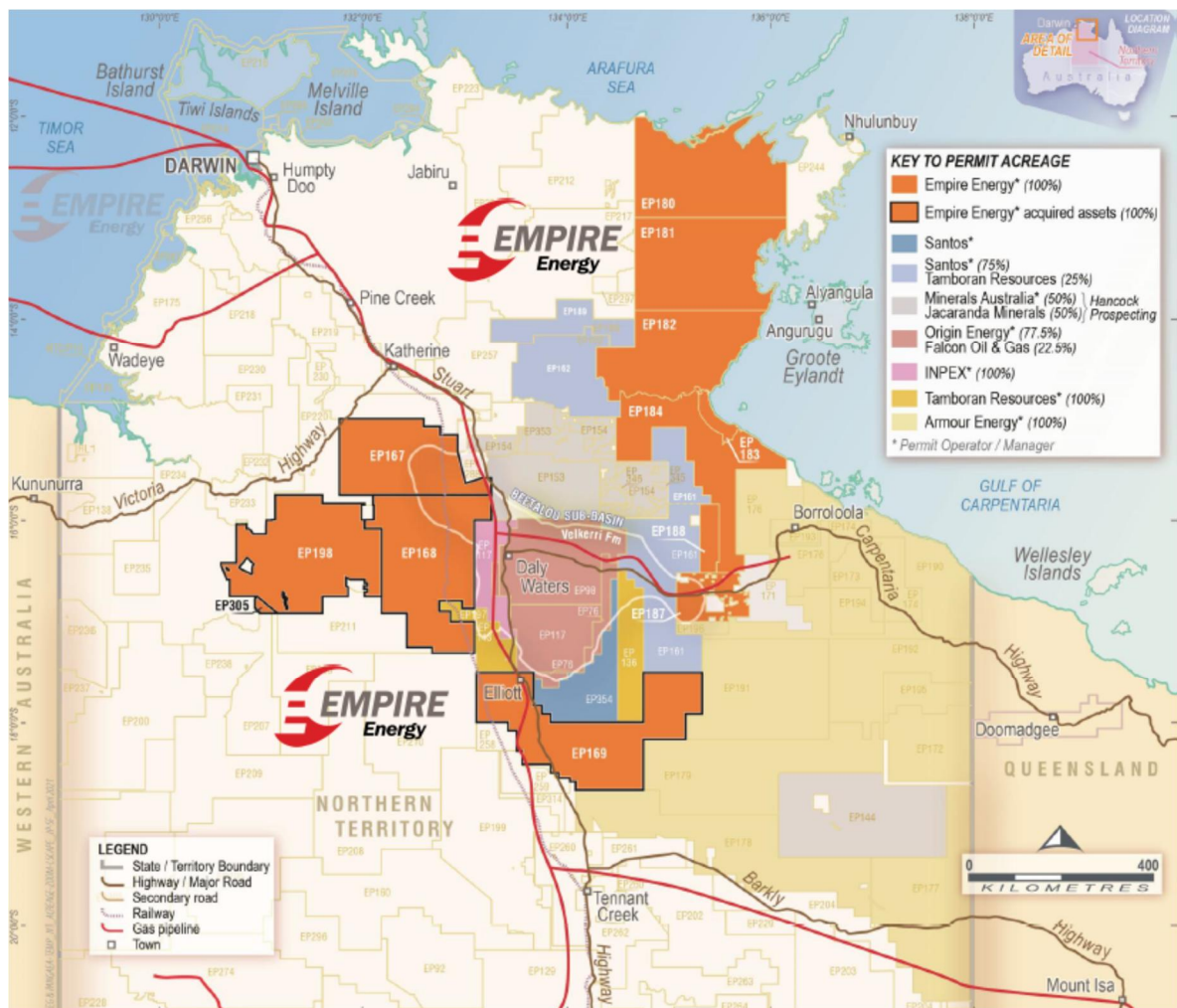
The 2022 operations program also aims to reduce risk and increase the likelihood of commercial operations. The key operational items include:

- An update of the NSAI resource report (February 2022)
- Fracture stimulation and testing of the Carpentaria-2H well (Q2 2022)
- Liaison with Pastoralists in the western Beetaloo to discuss access agreements for future work programs in the Pangaea acreage. This may include further seismic and/or drilling in 2H 2022
- Complete the interpretation of the Charlotte seismic program, including integration of data from the recent Carpentaria-2 well
- Advance work programs for the drilling of additional lateral wells in the Carpentaria region. These added wells (up to 6) have received government approvals

In addition, key activities will be undertaken in adjacent acreage, including:

- The Santos Tanumbirini-2H and -3H wells are undergoing testing and will shortly report initial IP30 rates (Initial Production over first 30 days). A strong result is anticipated from these wells
- Further appraisal and testing activities will be undertaken at the Amungee NW and Velkerri 76 locations following recent testing and drilling success

Figure 1: Beetaloo project map



Source: Empire Energy

It is clear from the increased drilling and testing that is being reported that the Beetaloo play has emerged as an important large scale gas play in Australia.

The Velkerri shales across the Beetaloo Sub-basin have proved to be laterally consistent. This predictable geology is beneficial for enabling large areas for resource estimates and planning development activities.

The gas flow rates from the vertical and initial horizontal wells have been above expectations and draw strong comparisons with the early-stage US shale gas projects. This has helped generate additional interest from US shale investors and operators.

We believe that future Resource and Reserve reporting will highlight economic outcomes. Empire will be a beneficiary of this added interest.

UPCOMING NSAI REVIEW

In February 2021, NSAI reviewed the available data for the Carpentaria-1 well and opined on the Contingent Resource in the locations adjacent to the discovery well. Unsurprisingly, the reported resources were relatively small, with 41 Bcf reported at a 2C level and 86 Bcf at a 3C level. These modest initial volumes were reported for 3 square km and 5 square km, respectively. In context, NSAI booked the initial Perspective Resource across an area of approximately 260 square kilometres (i.e. 86 times the area of the current 2C resource).

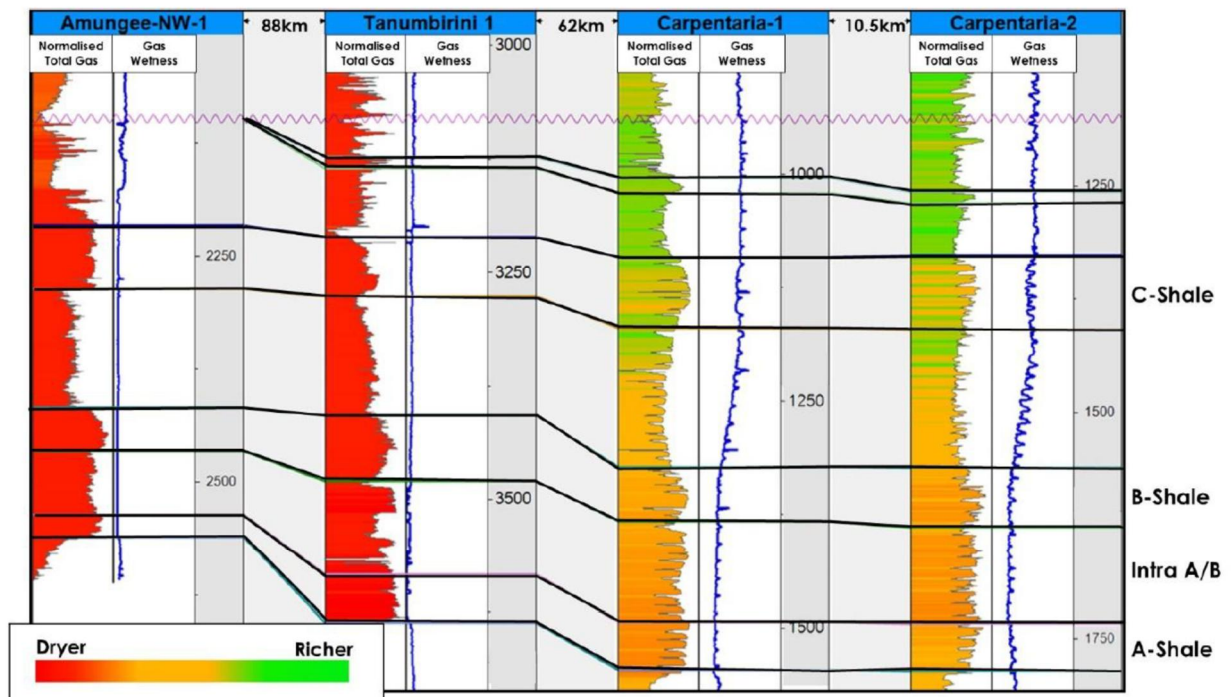
NSAI has been engaged to report on the resources added by completing the Carpentaria-2 well, which was drilled in late 2021. The review is reportedly due in February 2022.

The lateral continuity of the Velkerri shales and the potential for higher than expected flow rates should lead to greater confidence in the resource reporting and the potential for more significant than anticipated resource and future reserve numbers from this play.

Based on the strong correlation between Empire's two Carpentaria wells (11 kilometres apart), we believe a larger than expected area may be included as Contingent Resource in the upcoming review. This assessment is supported by experienced observations in the early days of the Eagle Ford Shale boom in the US.

We expect 2C resource estimates of over 300 Bcf for the upcoming review.

Figure 2: Strong regional correlations across the Beetaloo



This diagrammatic section of well logs across the Beetaloo spans 160km and shows the extraordinary lateral continuity of the specific shale target units within the Velkerri Formation

Source: Empire Energy

COMMERCIALISATION STEPS

Empire remains focussed on the early commercialisation of the Carpentaria gas resource. In context, EEG has the advantage of nearby gas pipeline infrastructure for early development options. Still, the group is focussed longer-term on access to the east coast gas market and value-adding opportunities in Darwin.

- Initial gas sales may be achieved through the existing gas pipeline, which services the McArthur River Mine and accesses the main north-south pipeline from Darwin to Alice Springs. The high-quality Beetaloo gas will have positive cost benefits in gas blending into this network.
- Larger scale development options would include gaining access to the East Coast gas networks. Other operators in the basin are pursuing this opportunity, which will add supply to the east coast market (and ease the current pricing pressure) and potentially provide gas to the LNG facilities through sales to the Gladstone plants.
- Development options may also be available in Darwin, with opportunities to deliver natural gas to the Darwin LNG facilities (operated by Santos and Inpex) and expand the regional gas reticulation network. Furthermore, access to large scale gas may also allow for petrochemical processing options in Darwin.

The execution of MOU's with APA Group and Power Water Corporation will help facilitate these small scale opportunities as a precursor to developing a substantial gas reserve from Empire's Beetaloo acreage.

The low CO₂ gas from the Beetaloo will be beneficial in multiple commercial settings.

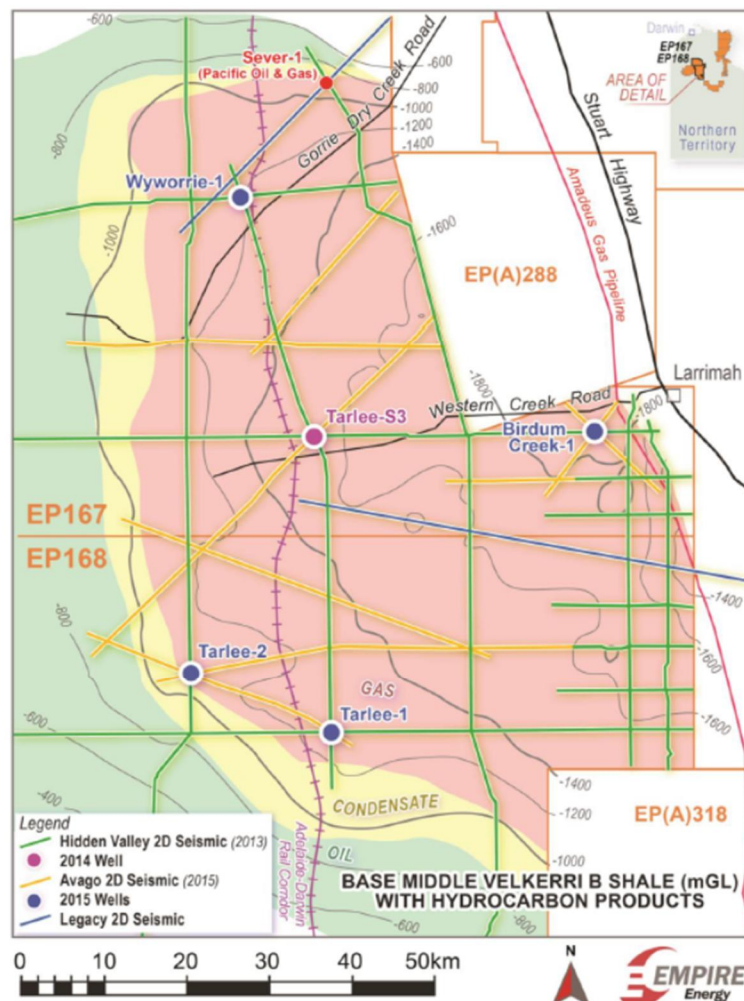
PANGAEA ASSET ACQUISITION

Empire announced the acquisition of the Pangaea exploration assets in April 2021. Shareholders approved the purchase in August 2021, and the highly regarded Paul Fudge joined the board of EEG after the meeting.

The asset purchase includes four exploration permits located on the southern and western edge of the Beetaloo Sub-basin. Expenditure of approximately \$110 million had been spent historically on these areas. A total of 7 wells (stratigraphic and exploration) and 1,400 km of 2D seismic was acquired over the previous decade. These new permits cover 14 million acres, including some areas of high Velkerri shale prospectivity.

NSAI has reported a 2C Contingent Resource of 158 Bcf (and 3.5 million Bbls of condensate) across the Pangaea permits. In addition, a 2U Prospective Gas resource of 27.6 Trillion cubic feet (Tcf) was also highlighted.

Figure 3: Pangaea drill locations and resource density



Source: Empire Energy

The purchase consideration of the permits was:

- Cash of \$6.1 million
- 170 million ordinary shares in EEG (some with escrow conditions)
- 9.7 million 70 cent options (Ex. August 2024)

This equates to a total value consideration of approximately \$65 million for a highly-rated exploration portfolio with transformational upside.

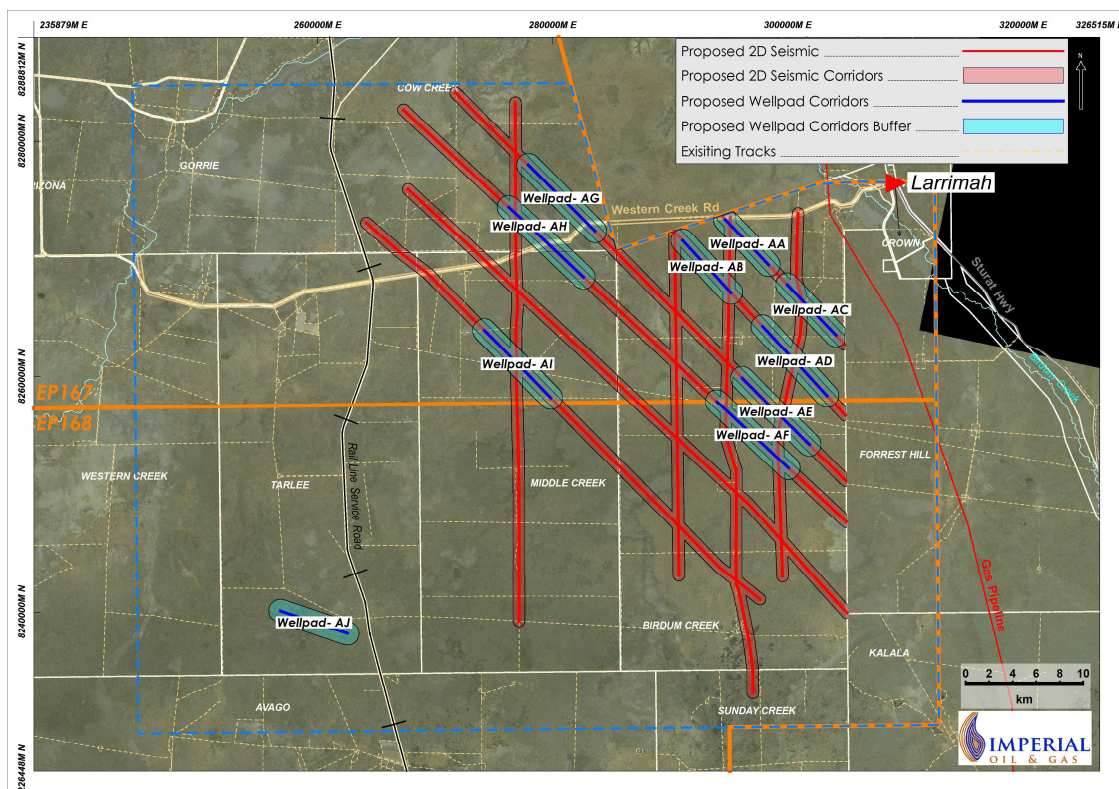
This purchase price equates to 41 cents per GJ of 2C gas resources and 0.2 cents per GJ of 2U prospective gas resources. (i.e. very cheap in the success case)

Drilling activity to date in the western permits has encountered a thick sequence of Velkerri Shale, which correlates well with the prime exploration targets across the basin, extending for over 300km from west to east.

The consistent correlation of the shales is a critical hallmark of other successful shale gas basins in North America, which saw active developments change the energy landscape in the USA.

The strong comparison with the key US shale basins has been highlighted previously, with the quality of the rocks providing a meaningful resemblance to the Marcellus and Fayetteville shales.

Figure 4: Forward seismic and drilling plans in EP 167 and EP 168



Source: Empire Energy

Exploration activity is planned to resume in these permits in 2H 2022, following the re-engagement with local landowners and pastoralists and subject to governmental environmental approvals.

Empire has lodged an Environmental Management Plan for the next phase of appraisal on the Pangaea acreage, with an initial focus on the eastern edge of permits EP 167 and EP 168 (see figure 4). The Plan, which will be subject to the customary approval processes, includes both seismic and horizontal drilling actions, which will (in the success case) accelerate the case for developments.

Economic thresholds in the western Beetaloo may be lower due to the improved infrastructure access (Roads, rail and gas pipelines). The recognised shallower depth, scope for enhanced liquids yields and lower drilling costs make this an exciting venture.

VALUE UPSIDE FROM PANGAEA ASSETS

We have conservatively valued the Pangaea assets at their acquisition cost but recognise substantial speculative upside in this asset value.

The \$110m of exploration expenditure to date has delineated a 2C Resource of 158 Bcf of gas while also reporting a 2U Prospective Resource of 27.625 Tcf of gas plus liquids (numbers are from NSAI). This resource may contain a substantial value, to be confirmed with further drilling and testing activity.

Applying a conservative 10% Chance of Success to these gas resources, a value of approximately \$830m can be derived, which would represent a value uplift of \$1.20 per share to our EEG valuation.

COMMERCIALISATION OF THE BEETALOO PLAY

The commercialisation of shale gas resources and reserves differs from conventional oil and gas plays. Shale gas is more capital intensive and requires more well intercepts than a typical conventional gas development. But there are offsets to this cost impediment.

Individual wells can cost from \$20 - \$40m in an early-stage exploration phase. Given the shallower drilling targets, EEG's costs are at the lower end of this range. In future, these costs will benefit from a campaign approach to drilling, as the developments approach a "manufacturing" stage and multiple wells are drilled from a single well pad. This cost reduction process has been seen in US shale activities and is well recorded from Queensland CSG developments' experience.

Furthermore, the nature of the shale gas business is that the geological risk is lower as the rocks are more predictable than in traditional oil and gas developments. The correlation of shales across the Beetaloo already supports this premise. Recent gas appraisal in the Perth Basin also adequately describes the risk in conventional gas reservoirs.

Lastly, as the development phase accelerates in a shale gas play, recycling cash flow from existing wells helps fund ongoing development and other activities. Under this thesis, the capital burden is reduced as cash flow accelerates. Again, this has been well demonstrated by US historical actions.

Industry discussion around commercial flow rates has focused on around 3 million standard cubic feet of gas per day (MMscfgd) per 1,000 metres of lateral in the Velkerri. This oft-quoted number is supported by both companies and analysts and reinforced by economic modelling. The recently reported rate of 5 MMscfgd at Amungee NW-1H easily clears this hurdle. Our industry sources are holding high hopes for the upcoming Tanumbirini testing, which is in progress and reportedly due for release in late January.

On this basis, economic flows have been achieved in the deeper sections of the Beetaloo, expecting further commercial support at both Tanumbirini and Carpentaria in the first half of 2022.

The shallower zones, located on the eastern and western edges of the Beetaloo, will benefit from substantially lower drilling costs and reach an economic hurdle rate at commensurately lower gas flow rates.

Drilling success in the Beetaloo has also attracted added international attention, increasing the level of inquiry from North American companies regarding the Beetaloo activity. This jump in interest is also driven by the improved global energy prices and the improved cashflows from US shale assets following the steep rally in US gas prices.

The Australian government has estimated Gas in Place of approximately 500 Tcf in the Beetaloo within the Velkerri B Shales. Using recovery rates of 10-20% equates to a Prospective Resource of 50-100 Tcf. On a domestic stage, this early stage estimate is larger than the NW Shelf and at least twice the volume of gas reported in the Queensland CSG fields. In this context, this is a significant gas play.

The Beetaloo shale play compares favourably with the established shale gas developments in the US, particularly the Marcellus and Fayetteville shale gas plays. These two shales have yielded 260 Tcf and 42 Tcf of gas reserves, which has assisted in changing the US energy mix.

UPDATED VALUATION

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 Chance of Success to 50%, following the drilling and testing at Carpentaria-1 and the drilling of the Carpentaria-2H lateral.
- Incorporation of the Pangaea purchase at cost. On the basis that a substantial Contingent Resource has been booked on this acreage, we see this initial valuation as being very conservative.
- Updated US valuation based on improvement in US gas prices.

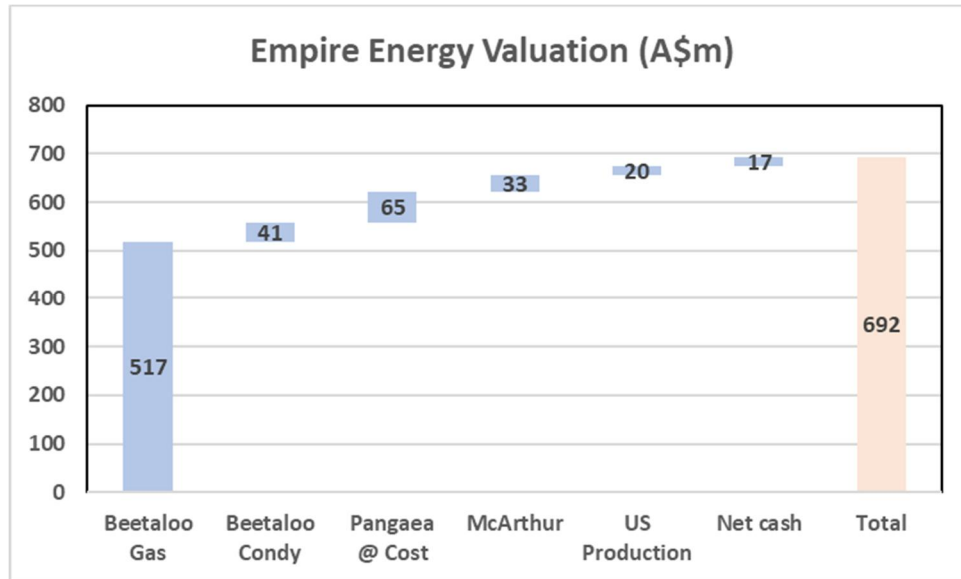
Asset	Basis	A\$ million	CPS
Beetaloo Velkerri Gas	3,446 Bcf prospective resource, @ \$0.50 per GJ, risked at 50% COS	517	80
Beetaloo Velkerri Condensate	27mm Bbls prospective resource, @ \$5 per Bbl, risked at 50% COS	41	6
Pangaea Assets	At purchase cost	65	10
McArthur Basin	11,000 Bcf prospective resource, @ \$0.50 per GJ, risked at 1% COS	33	5
US assets	PV10 uplifted for gas prices	20	3
Cash	(est at December 31, 2021)	25	4
Future option proceeds		1	0
Debt	(est at December 31, 2021)	(9)	(1)
Total		692	108

* Numbers may not add due to rounding

Based on fully diluted capital of 646 million shares

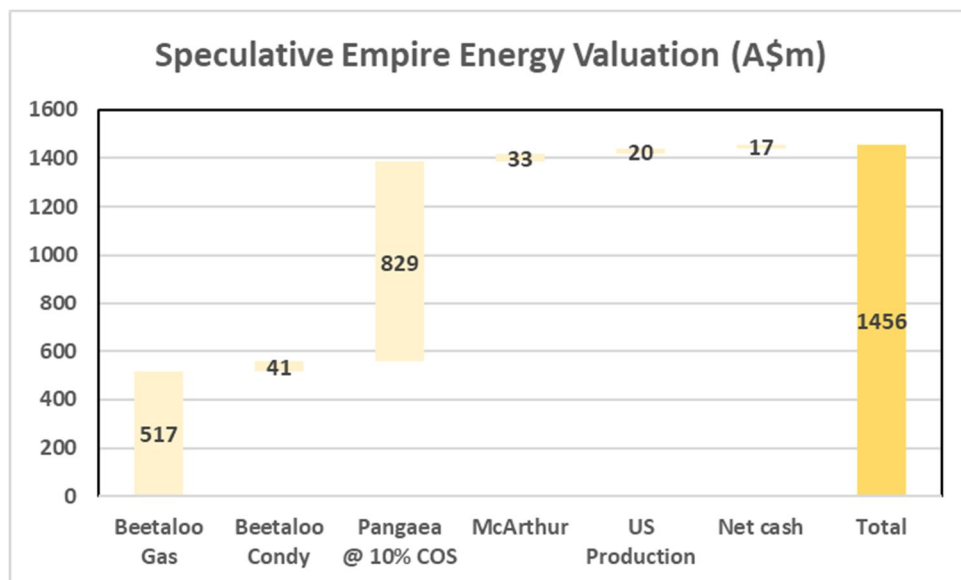
Source: Blue Ocean Equities

Valuation breakdown (Base Case)



Base value is \$1.08 per share (fully diluted)

Valuation breakdown (Speculative Upside case)



Speculative value is \$2.26 per share (fully diluted)

Note Pangaea upside case reflects a 10% COS based on the P2U prospective resource of 27,625 Bcf gas

FUNDING

Empire is well funded for the current phase of appraisal activity, with a cash balance estimated at \$25 million as of the end of December 2021. This will clearly cover the costs of fracture stimulation and testing of the Carpentaria-2H well.

Research and Development grants of \$5.4 million were received in late 2021 by Empire for the exploration activities undertaken during 2020. Further grants are likely to be available, in line with this Incentive Scheme.

Federal government support for the drilling program through the *Beetaloo Cooperative Drilling Program* has also been approved, which will assist in accelerating the activity in the basin. It is noted that Empire was the first to access this innovative funding.

Recent decisions in the Federal Court have delayed some funding for the Beetaloo drilling program due to some procedural issues. However, in announcing the delays, Federal Minister Pitt has highlighted the approval for the program into 2022, which will require Empire to reapply for the drilling funds. Whilst frustrating, this modest delay is unlikely to impact the forward operational plans, which will recommence after the wet season.

KEY 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 and the use of experienced industry consultants. This workforce has 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 cash flows.

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. The ESG framework is expected to be released in mid-2022.

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, impacting the company's reported cash flow, profitability and share price.

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Garry Marsden holds shares in Empire Energy Group Limited (EEG).