Empire Energy Group Ltd

Update Report

More flow-rate data equals more confidence

Energy

12 September 2023

Empire Energy Group Limited (ASX:EEG) is an oil and gas producer/developer, with onshore Northern Territory (NT) and US oil/gas production assets. EEG has the largest tenement position in the highly prospective Greater McArthur Basin, which includes the Beetaloo Sub-basin. The investment case is built around de-risking the development model as more evaluation data comes to hand and the latest data from Carpentaria-3H continues to build and shore up support for the economic case. Works are still in a preliminary phase, but the company remains on track for a project sanction around end-2023 subject to the requisite regulatory approvals. NT gas continues to firm as a realistic option at scale for east coast Australia's future domestic requirements; growing Gladstone LNG ullage; and as a potential supply source for Darwin's LNG export opportunities. The remainder of 2023 will see more activity across the Beetaloo play in total and commercial success at any scale has beneficial look-through impacts for all Beetaloo ventures…'a rising tide lifts all boats'. We maintain our view of EEG as the low-cost, strongly-leveraged exposure in the play, holding an early-mover advantage in the Carpentaria area where initial testing has delivered gas rates around the nominal commercial threshold and confirmed the high calorific/low CO_2 nature of the gas. Higher unit energy translates to lower gas requirements to support an initial development project with further optimisation to come. EEG represents a pure, independent and leveraged exposure to the NT gas opportunities; and in our view, is firmly on the development pathway. The way is clearing for EEG to deliver a final investment decision (FID) and first gas over the next 18 months to two years.

Business model

Empire Energy Group Limited (EEG) is an oil and gas development and production company, focused on maturing its portfolio of onshore, long-life oil and gas opportunities. The key asset is the substantial tenement holdings across the world-class McArthur-Beetaloo basins. The latest testing and evaluation data continues to underpin the commercial case in support of an early gas development option. In practical terms, we suggest the company can be considered to be in a pre-development phase, particularly with recently upgraded resource data, sufficient to underpin economic planning and an accelerated path to first gas.

The fundamentals are stacking up

The company has released further testing data from the Carpentaria-3H (C-3H) well, which resumed testing on 3-Aug after some five months of soaking. The gas rates confirm improvements evidenced in the C-2H well of like-like increases in IP30 rates of >30%. The numbers are stacking up and confidence in the development model is rising. The data is still somewhat preliminary in nature and there is no one well that has been drilled on a 3,000m lateral basis, however, we suggest the C-2H and -3H wells as a couplet could be considered as an early-stage analogue of what an extended production well may look like noting the still early-stage nature of the operations overall. Further testing and evaluation is in train with EEG looking to define an initial type curve and frack style. The upcoming gas attribution analysis will be important in determining the optimum stimulation method in a development context. Material resource upgrades to LNG-scale gas have been booked and FEED studies and environmental applications are under way. We are increasingly confident of further material de-risking across the portfolio across the next 12 months.

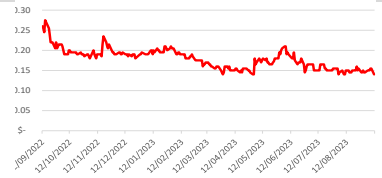
A valuation based on lower-risk gas

We maintain our valuation, underpinned by testing data and a material increase in contingent resources estimate. With further re-rating events to come, a project sanction could be delivered by end-2023 subject to regulatory approvals. We model a base-case (mid-point) valuation of $903mn ($1.17/share) with an upside case to $1.54/share. The success case at Carpentaria continues to build and could deliver further valuation upside well in excess of our base case.

Share Details

ASX code	EEG
Share price (11-Sept)	$0.14
Market capitalisation	$108M
Shares on issue	773M
Net cash (at 30 Jun)	$8.3M
Free float	~49.5%

Share Performance (12 months)



Upside Case

- Next-stage evaluation of Carpentaria-3H further confirms the viability of long lateral well design and commercial benefits of the 'soaking process'
- Further definition and acceleration of the early production opportunity
- Securing a binding off-take agreement and/or partner to offset market perceptions of future equity dilution

Downside Case

- Capex inflation impacts project returns potentially slowing progress to first gas
- Continuing financing reliance through equity issues on weaker field data resulting in excessive share dilution
- Slower progress through FEED and delays to the timing of FID, expected around end-2023

Board of Directors

Alex Underwood	Managing Director / CEO
Peter Cleary	Chair
Dr John Warburton	Non-Executive Director
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***Analyst holds shares**

Incremental Wins All Point Towards Growing Commercial Confidence

EEG remains our preferred exposure to NT gas, particularly as it should be fully funded through to its proposed FID point for a Carpentaria Pilot Project, expected by (around) end-2023 subject to timely regulatory approvals.

As part of the pathway to FID, the company has re-commenced its testing campaign at Carpentaria-3H (C-3H), since 3-Aug, following a five-month 'soaking' period where the well was shut-in, and the remaining frack fluid was allowed to drain naturally.

- Testing is planned for up to 90 days (through to early-Oct);
- C-3H has the longest horizontal (hz) completion in the basin and play to date of >2,600m of which ~2,000m has been fracked (40 stages); and
- The purpose of the campaign is to add data to verify and confirm the benefits of soaking and better define the optimal well development design (the wells have multiple frack styles), including production-type curves'.

The company reported a gas flow for C-3H, over the first 30 days (IP30), of 3.3mmcfd (3.8TJd), **noted as being >30% better than the equivalent rate of the initial** testing campaign conducted with no soaking through Q1 23). The well was originally shut after delivering an IP27 rate of 2.3mmcfd.

Previously, the C-2H well was reported as delivering an **IP30 rate some 34% higher than the corresponding initial test result** with **a measurably lower rate of decline** after a similar shut-in period of five months.

These results clearly demonstrate there is a significant beneficial impact from allowing wells to undergo a period of natural frack fluid recovery, although the optimum soak time is still to be determined from both economic and operational perspectives.

It's worth reminding that the C-2H well was completed with four different frack designs over 21 stages, whilst C-3H was fracked over 40 stages trialling three different (but common to C-2H) frack styles.

We also add that the C-3H well only placed 35 stages in the primary target, Velkerri-B section, with the remaining five stages over other Velkerri target zones.

The testing data is a critical input into the FEED studies for the proposed pilot programme to support evaluation and analysis to underpin a design for a proposed 25TJd commercial project.

We recognise that the data can still be considered to be somewhat preliminary in nature – the well design (including frack styles) is not fully defined, the population of wells is small, and the data from the hz completions has, in part, been extrapolated to a standard 1,000m section reference, however, we suggest the error margin around the data is robust and in particular, for C-2H, the data supports the nominal commercial flow rate threshold, within the context of exploration drilling.

We are comfortable on the use of extrapolated data per se based on the consistent geology of the target horizon as reported by both EEG and other play operators. That's not to say there is no risk…there is always some risk.

An extended horizontal well proxy?

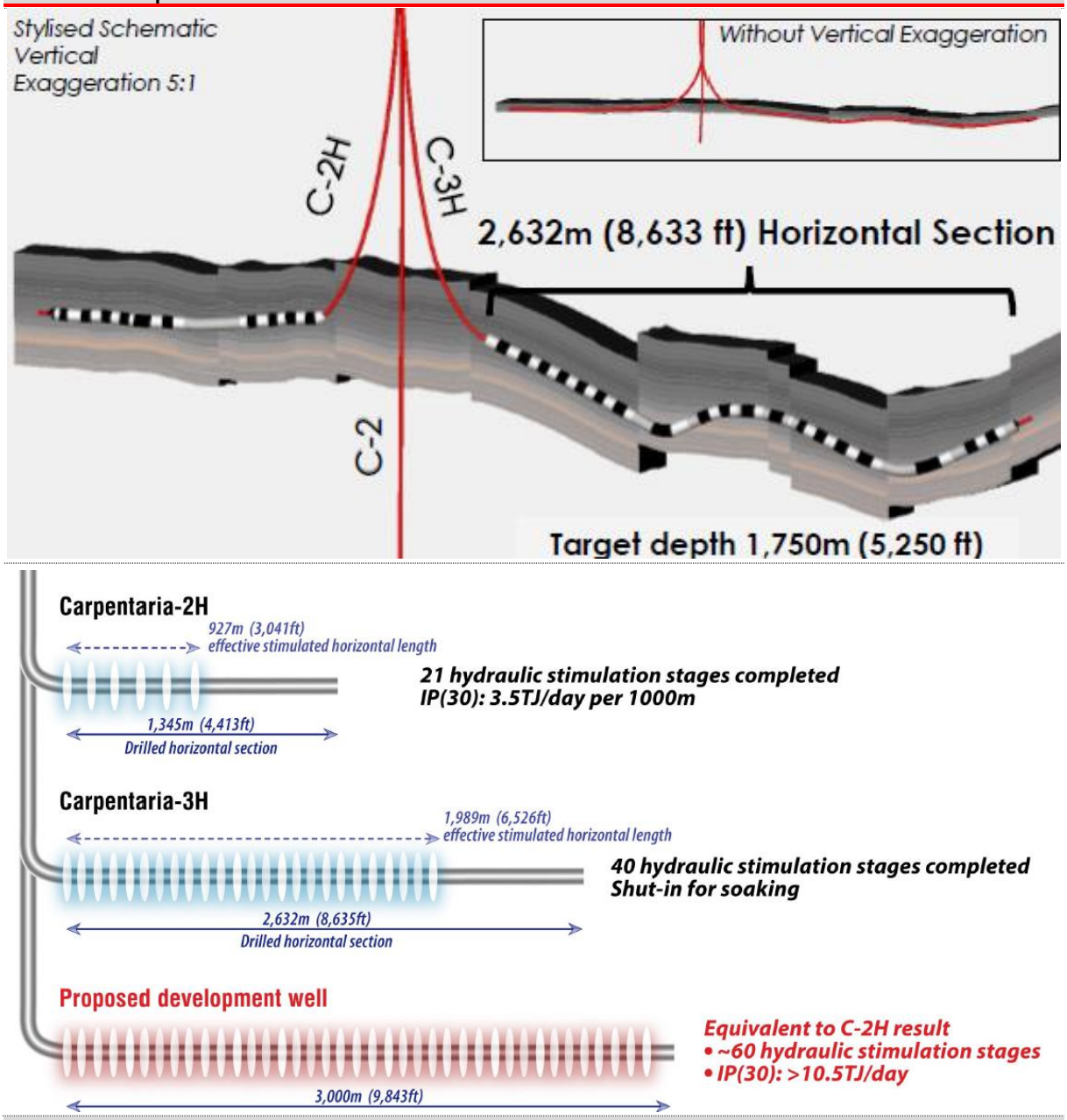
The nominal working well model is predicated on 3,000m lateral completions in the primary Velkerri B target zone. The only well that has approached that parameter has been the C-3H well at 2,632m lateral length and stimulated across 1,989m.

Importantly, the C-2H and C-3H wells were drilled from the same pad in opposite directions and can possibly be considered as a couplet tentatively representing what a development well could look like, or at least highlighting some of the risks associated with the model.

The schematic as published by the company (refer **Exhibit 1**) illustrates the significant geological differences between the two wells in structural terms at a minimum and although both wells are completed in the primary Velkerri B zone, C-3H did complete five (of 40) frack stages in in other parts of the Velkerri sequence.

The effective section was 35 stages across 1,655m on a like-like basis – totalling ~2,600m in the B shale over both wells.

Exhibit 1: Comparison data – more ticks in more boxes for EEG



Source: (Various) Company data

There is structural variation in the Velkerri Shale

The Velkerri Shale is a strong and very obvious seismic marker, allowing mapping of the formation on a regional basis with a high degree of certainty, but as obvious on the cross-sectional diagram (**Exhibit 1**), and particularly in 5:1 vertical exaggeration, there is/are areas of relatively more significant structural variation with the potential to impact cost and performance.

What is strikingly obvious is the greater structural complexity along the C-3H well bore, noting the more intense faulting and sinuous nature of the lateral completion.

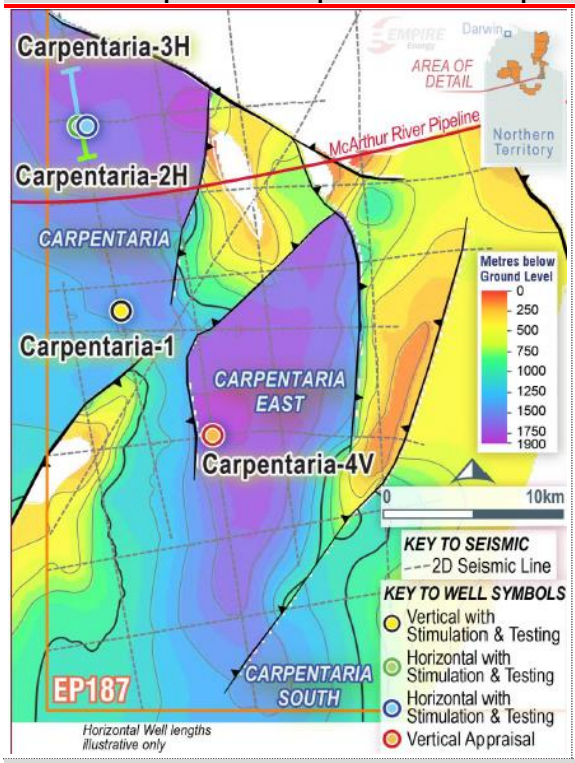
The small-scale faulting is not readily captured in the cross-sections (with no vertical exaggeration) provided in Exhibits 1 and 2 (RHS) on a regional basis, so may represent a development risk, albeit manageable we suggest.

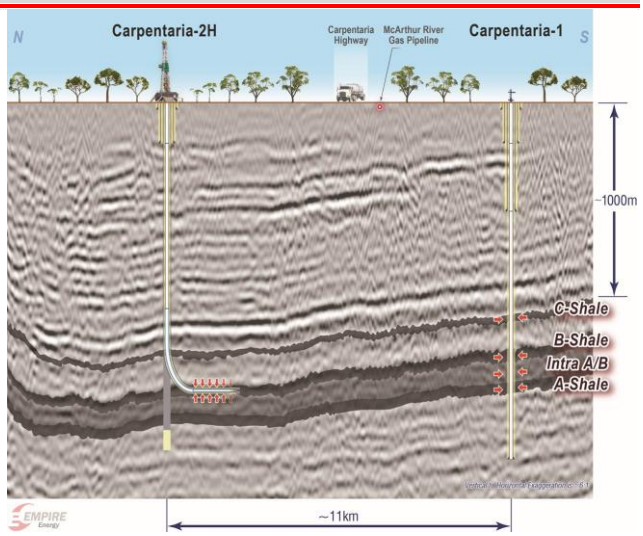
We understand the Velkerri-B has a gross thickness of about 80m over the Carpentaria area with a net pay thickness of 40-50m. Local structuring/faulting does not need to have a large throw to potentially impact any individual well bore in terms of net pay displacement.

The simplest and most obvious solution is to drill in areas with the 'quietest' geology – for example, similar to C-2H.

Identifying areas of risk and optimising the geology and geography is one of the purposes of the exploration and appraisal phase.

Exhibit 2: Proposed development area at Carpentaria





The Velkerri shale intervals are readily identifiable and mappable from seismic on a regional basis and in broad terms can be as relatively unstructured - certainly as evidenced between the C-2H and C-1 wells in this example. There is a regional dip, however, the sequence looks comparatively undisturbed.

The role of seismic in defining geologically quiet areas will be important.

Source: (Various) Company data

Fracking style is to be determined

The optimal fracking method is still to be determined. Attribution analysis from both wells is expected before end-2023 and will be critically important in determining the optimum frack style.

Frack Style	Slickwater	Crosslinked Gels	Hybrid*	HVFR**	Total Stages	
Carpentaria-3H	3 stages	16 stages	21 stages	nil	40	35/40 stages were placed in the Velkerri-B primary target zone
Carpentaria-2H	7 stages	8 stages	4 stages	2 stages	21	

* Slickwater and Crosslinked Gels

** High Viscosity Friction Reduction

We note that the C-3H well has been completed using a variety of frack methods in a similar fashion to the C-2H well, so to a degree there remains a significant evaluation element to the operations and final development well design.

On a simplistic basis, slickwater fracks are the least expensive of the styles being trialled, so it will be interesting to see the relative performance of the methods on a unit basis – which of the styles provides the best economic return.

In this regard, the results from the Shenandoah South well, currently drilling, could provide further operational insight, pending release of testing details into the public domain.

Recapping the EEG results and outlook – Sep-2023

We update the progress of the company's Carpentaria activities – we have seen:

- ✓ Confirmation of the critical commercial flow rates.
- ✓ Material upgrades in contingent resources with estimates of the EUR range based on flow rate testing data and the number of 'well locations' required to support the development of the gas resources.

…noting there's still more to come through 2023:

- Testing has recommenced at C-3H and has demonstrated/confirmed the operational benefits of the soaking process with >30% increases in IP30 rates. The testing phase will continue through October.
- Front End Engineering & Design ("FEED"): including engineering, economic modelling, preliminary costings for both capex and opex for an **early-stage development (up to 25 TJ/d) – with the potential to generate $110-137mn pa of sales revenue per annum in a $12-15/gj market.**
- Subsurface design planning (*finalising well and fracking designs*). Attribution analyses and results are expected to be at hand presently.
- Securing gas sales and transportation agreements (*discussions ongoing with multiple parties*).
- Financing for pilot (Macquarie Bank credit facility already in place).
- Obtain government approvals: NT Petroleum Production Licence. A Carpentaria development will largely be the first practical test of the regulatory process and as such can be considered as holding some intrinsic timing uncertainty. The NT Government is reportedly keen to see new projects progress and, as such, we suggest are likely to be highly co-operative, however, it also will want to ensure the process is properly and thoroughly adhered to.
- Negotiate Northern Land Council ("NLC") Production Agreement.
- FID on a first-stage project by end-2023, subject to requisite regulatory approvals being received.

We acknowledge that the data to hand should still be considered to be somewhat preliminary in nature – the well design (including stimulation programmes) is not fully defined, the number of completed and tested wells is limited, and the implied outputs from horizontal completions have been extrapolated.

But we believe the error envelope around the data is shrinking and the commercial case is becoming more robust.

* Timeline and activities outlined as per EEG Managing Director's AGM presentation (30-May)

There's a gas opportunity to be won

There is a quantum gas opportunity associated with the Beetaloo Basin that is there to be won, noting there are still remaining geological and engineering challenges to be overcome. We are confident that the play will evolve into a material (transformational) future supplier of gas into domestic (east coast) and export markets – the Velkerri and Kyalla target zones are pervasive and geologically consistent and in broad terms what works in one area is highly likely to work in others.

In this regard, the Beetaloo represents another regional unconventional play that can and probably will be developed like the US onshore analogues, in terms of scale.

Field activity is continuing but in concentrated areas so the pace of progress is slow overall but accelerating for those operators currently working their assets and driving towards potential commercial outcomes over the next six-12 months.

We continue to see EEG as the preferred exposure to the play – it is lower cost, more advanced towards first cash-flow, with phased growth opportunities and more highly leveraged to the success case.

Importantly, on its likely capital and operating cost profile, the company can be considered as holding a unique advantage to market gas across a range of offtake terms and individual gas users.

Our NAV largely unchanged - lower risk gas translates to more value

We maintain our valuation range for EEG at $1.01-1.54/share **with a mid-point (base case) of $1.18/share**, noting the closing share price of $0.14/share (11-Sep) represents an 85% discount to the lower end of the NAV range and in isolation can be considered a risk weighting of ~89% to our assigned value of the 2C resources.

Exhibit 3: More data can lower the risk – the value resides in EP-187

		Risked range (A$m)			
	Pr	Low	Mid	High	
Northern Territory					
EP-187					
Contingent Resources	30%	$720	$770	$938	2C volumes upgraded to 1,739PJ (from 637PJ) of which 1,364PJ (from 455PJ) are attributed to the immediate Carpentaria Block of which 50% are attributable to the mid-Velkerri B zone
Prospective Resources	5%	$41	$103	$215	
US Onshore		$24	$38	$42	Lower on a weaker forward curve benchmark
		$785	**$904**	**$1,189**	
Net cash/(debt)			$8		As at 30-June
Corporate			($9)		
TOTAL		**$784**	**$903**	**$1,188**	
Shares issued (mn) 773		$1.01	$1.17	$1.54	

Source: RaaS analysis; Risked ranges based on discretionary RaaS risk adjustments

Our valuation methodology weights the value primarily to EP-187 as the immediate area of clear economic and commercial interest.

We refer to commentary from the Managing Director's AGM address (30-May) that the upgraded Contingent Resource estimate represents gas *"…to an LNG scale"*, which is an important way to consider the context of the opportunity currently in front of EEG.

These 2U volumes are associated with the portfolio ex-EP 187 and ex-Pangaea tenements which represent longer-dated gas potential. The geological confidence level is relatively high on the look-through, but commercial realisation will require extensive drilling campaigns.

There is always an intrinsic value to the prospectivity associated with the remaining parts of the portfolio but given the focus of the company will be firmly across delivering a first project based on the Carpentaria potential, targeting end-2023 for an FID, the operating capacity of the company to adequately evaluate the remainder of the portfolio in a timely fashion is limited at this stage.

Carpentaria Demonstrates The Beetaloo Basin Will Flow Gas

The Carpentaria data makes a bullish case from both the C-2H and -3H wells.

The published results pertain to the Carpentaria-2H (C-2H) well, which was tested in two stages with a pause for pressure build up and soaking in between.

- 51 days over Q3 22;
- 76 days over Q1-Q2 23; and
- The gas composition remains consistent across the 21 frack stages – ~83% C_1, ~14% C_{2-5+}, <1% CO_2, ~2% other inerts – this is very low CO_2 and high calorific gas.

Carpentaria results are still underpinned by extrapolating the well performance to the nominal (3,000m) completion design and caution that up-scaling does not always deliver linear improvements akin to simple extrapolation, particularly where there can be geological variation, but uncertainty in the mathematical scale-up is somewhat offset by the likely material improvements that will be generated from optimising the frack style in any development case.

On that basis we are confident that the C-2H results do represent a realistic operational outlook.

A return to testing at the C-3H well will provide a more definitive model for well performance – the well has a longer lateral section, more fracks and fewer frack styles so will likely be a nominally better representation of what the end game can look like.

Although one well (or even two) does not represent an absolutely definitive economic case, we suggest the data at Carpentaria can be considered as strongly indicative and clearly at or close to the commercial threshold – we would also note that the current indicative flow rate hurdle (3mmcfd, per 1,000m of lateral on a IP30 basis) likely references a lower gas price and gj/mcf ratio. Empire's high calorific gas would equate to an equivalent benchmark rate of 2.6TJd/1,000m.

We also highlight that the C-2H well was completed without production tubing and free-flowed through 4½" (114mm) casing. Empire has indicated that it is likely to move to 5½ " (140mm) tubing in a production scenario – a 50% increase in cross-sectional pipe area. This is the model being trialled at Amungee by Tamboran based on its US analogue experience.

The positive side remains in that the data:

- **Meets the current threshold flow rate**;
- There are **likely material design optimisations** to be delivered;
- **The calorific value adds operating margin** (less gas per energy unit); and
- **It's very low CO_2** (0.9%) – so processing will be relatively easy and for that read inexpensive.

Exhibit 4: Financial Summary

EMPIRE ENERGY GROUP LTD		EEG
YEAR END		Dec
NAV	A$mn	$1.17
SHARE PRICE	A$cps	$0.14 priced as of close trading 11-Sep
MARKET CAP	A$mn	108
ORDINARY SHARES	M	773
OPTIONS	M	10

nm = not meaningful
na = not applicable

COMMODITY ASSUMPTIONS		2021	2022	2023E	2024E
Realised oil price	US$/b	67.98	94.25	73.93	70.20
Realised gas price	US$/mcf	3.72	6.42	3.01	3.53
Exchange Rate	A$:US$	0.7514	0.6946	0.6745	0.6773

NET PRODUCTION		2021	2022	2023E	2024E
Crude Oil	kb	2	2	2	2
Nat Gas	mmcf	1,676	1,727	1,727	1,640
TOTAL	**kboe**	**282**	**290**	**290**	**275**
Product Revenue	A$mn	8.5	13.7	8.5	9.3
Cash Costs	A$mn	(5.0)	(6.0)	(5.6)	(5.5)
Ave Price Realised	A$/boe	30.17	47.32	29.17	33.64
Cash Costs	A$/boe	(17.76)	(20.55)	(19.31)	(19.90)
Cash Margin		**12.41**	**26.76**	**9.87**	**13.74**

RATIO ANALYSIS		2021	2022	2023E	2024E
Shares Outstanding	M	612	773	773	873
EPS (pre sig items)	UScps	(2.41)	(0.86)	(0.54)	(0.41)
EPS	Acps	(2.41)	(0.86)	(0.54)	(0.41)
PER	x	na	na	na	na
OCFPS	Acps	(5.35)	9.50	32.29	1.38
CFR	x	na	na	na	na
DPS	Acps	na	na	na	na
Dividend Yield	%				
BVPS	Acps	23.8	24.9	24.7	22.9
Price/Book	x		0.6x	0.6x	0.6x
ROE	%		na	na	na
ROA	%		na	na	na
(Trailing) Debt/Cash	x				
Interest Cover	x				
Gross Profit/share	Acps	5.7	10.0	3.7	4.3
EBITDAX	A$M	3.0	6.8	3.8	4.5
EBITDAX Ratio	%				

RESOURCES and RESERVES	Contingent Resources			Prospective Resources		
	1C	2C	3C	1U	2U	3U
Northern Territory						
EP 187						
Carpentaria				566	1,282	2,284
East Carpentaria				1,020	1,878	3,782
South Carpentaria				204	383	668
TOTAL PJ				1,790	3,543	6,734
Carpentaria						
Velkerri C	113	666	846			
Velkerri B	120	678	844			
Intra Velerri A/B		8	16			
Velkerri A/B		12	24			
TOTAL PJ	233	1,364	1,730			
Carpentaria East						
Velkerri C	35	185	871			
Velkerri B	36	190	906			
Intra Velerri A/B						
Velkerri A/B						
TOTAL PJ	71	375	1,777			
Aggregate PJ	304	1,739	3,507			
US Onshore						
Gas (bcf)	28	38	42			

EARNINGS	A$000s	2021	2022	2023E	2024E
Revenue		8,502	13,722	8,454	9,258
Cost of sales		(5,005)	(5,961)	(5,595)	(5,477)
Gross Profit		**3,497**	**7,762**	**2,859**	**3,781**
Other revenue					
Other income		1,606	259	297	300
Exploration written off					
Finance costs		(568)	(2,259)	(709)	(1,089)
Impairment		0	(2,705)	0	0
Other expenses		(14,332)	(13,526)	(6,867)	(7,223)
EBIT		(11,305)	1,222	(2,887)	(1,564)
Profit before tax		**(10,835)**	**(5,765)**	**(4,008)**	**(3,442)**
Taxes		(213)	(239)	(200)	(172)
NPAT Reported		**(11,048)**	**(6,003)**	**(4,208)**	**(3,614)**
Underlying Adjustments		0	0	0	0
NPAT Underlying		**(11,048)**	**(6,003)**	**(4,208)**	**(3,614)**

CASHFLOW	A$000s	2021	2022	2023E	2024E
Operational Cash Flow		**(7,044)**	**(9,305)**	**9,100**	**8,938**
Net Interest		(568)	(679)	(478)	(738)
Taxes Paid		(213)	(239)	(120)	(250)
Other					
Net Operating Cashflow		**(2,460)**	**5,100**	**16,835**	**817**
Exploration		(11,228)	(37,356)	(20,000)	(10,000)
PP&E		(250)	0	(250)	(500)
Petroleum Assets		(12,965)	0	0	0
Net Asset Sales/other		0	0	0	0
Net Investing Cashflow		**(24,443)**	**(37,586)**	**(20,350)**	**(10,500)**
Dividends Paid					
Net Debt Drawdown		(817)	(1,035)	(8,313)	(850)
Equity Issues/(Buyback)		39,359	29,412	0	19,000
Other					
Net Financing Cashflow		**38,542**	**28,377**	**(8,313)**	**18,150**
Net Change in Cash		**11,639**	**(4,109)**	**(11,828)**	**8,467**

BALANCE SHEET	A$000s	2,021	2,022	2023E	2024E
Cash & Equivalents		25,650	21,880	10,052	18,519
O&G Properties		34,900	36,612	57,008	67,508
PPE + ROU Assets		1,306	1,608	250	500
Total Assets		**158,823**	**197,650**	**195,172**	**214,469**
Debt		8,027	7,823	7,310	6,499
Total Liabilities		**49,502**	**64,043**	**66,531**	**79,083**
Total Net Assets/Equity		**109,320**	**133,608**	**128,641**	**135,386**
Net Cash/(Debt)		17,622	14,057	2,743	12,020
Gearing dn/(dn+e)					

EQUITY VALUATION	Risked Range			Low	Mid	High
A$mn	Low	Mid	High	A$/share		
Northern Territory						
EP-187						
Scenario Weighting	720	770	938	$0.93	$1.00	$1.21
Prospective Resources	41	103	215	$0.05	$0.13	$0.28
US Onshore						
Appalachian	24	31	37	$0.03	$0.04	$0.05
	785	**904**	**1,189**	**$1.02**	**$1.17**	**$1.54**
Net cash/(debt)		8				
Corporate costs		(9)				
TOTAL	**784**	**903**	**1,188**	**$1.01**	**$1.17**	**$1.54**
Shares on issue (mn)	773 mn					

Source: RaaS Advisory, company data

FINANCIAL SERVICES GUIDE

RaaS Advisory Pty Ltd

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of

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Effective Date: 6th May 2021

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Our dealing service

RaaS can arrange for you to invest in securities issued under a prospectus by firstly sending you the offer document and then assisting you fill out the application form if needed.

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Website: www.afca.org.au; Email: info@afca.org.au; Telephone: 1800931678 (free call)
In writing to: Australian Financial Complaints Authority, GPO Box 3, Melbourne, VIC, 3001.

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