

ASX:EEG

# Carpentaria-1 Drilling Update Drilling Campaign Complete

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## Highlights

Empire Energy Group Limited (“Empire” or the “Company”) is pleased to provide shareholders with an operational update on its 100% owned and operated Carpentaria-1 exploration well in EP187, located on the eastern side of the Northern Territory’s Beetaloo Sub-basin.

Highlights include:

- **Empire has drilled Carpentaria-1 to total depth, carried out an extensive formation evaluation program, and cased, cemented and suspended the well**
- **The formation evaluation program has established that the thick Velkerri Formation in EP187 contains liquids rich gas across multiple pay zones which have attractive technical characteristics for further appraisal and production testing**
- **The formation evaluation program was expanded based on initial encouraging drilling results, with all logging, DFITs and large diameter rotary sidewall coring successfully executed**
- **Initial interpretation indicates the target zone thickness, gas saturation and porosity materially exceeded pre-drill expectations and compare favourably to offset wells in the Beetaloo Sub-basin**
- **Forward plan includes integrated analysis of log data, DFITs and core samples (Q4 2020), updated resource estimation (Q1 2021) and appraisal program including hydraulic stimulation and flow testing of the liquids-rich gas Velkerri Shale targets (Q2 2021)**

### Comments from Managing Director Alex Underwood:

The Carpentaria-1 drilling campaign has reached a successful conclusion with no health and safety incidents and a strong operational performance from our team of drilling and technical experts.

We were pleased to intersect liquids rich gas across the primary target Velkerri Formation which was thicker than we had anticipated. The formation evaluation program, which was expanded due to the encouraging early results, has been successfully executed.

Initial logging results demonstrate the presence of target pay zones in the Middle Velkerri A, B and C and a new target we are calling the Middle Velkerri Intra A / B. The thickness of the target pay zones, average gas saturation and average porosity are encouraging and compare favourably to results achieved to date by our neighbours in the Beetaloo Sub-basin.

We will now carry out further integrated analysis in collaboration with world class reservoir engineering and core laboratory experts W.D. Von Gonten & Co based in Houston, Texas, to refine Gas-in-Place estimates and our knowledge of the mechanical rock properties of the Velkerri Formation shales. The results of this analysis will allow us to optimise our hydraulic stimulation design for the Q2 2021 appraisal program and are likely to have a material impact on our existing prospective resource estimates which had previously assumed that the Velkerri Shale would contain dry gas.

We look forward to releasing the results of our evaluation program later in Q4 2020 and updated resource estimates in Q1 2021, to be followed by the hydraulic stimulation and flow testing campaign planned for Q2 2021.

## Geological Update

Empire has successfully executed an extensive formation evaluation program comprising:

- Wireline logging including Triple Combo, Spectral Gamma Ray, Lithoscanner, Combinable Magnetic Resonance, Formation Microimager (“FMI”) (before and after DFITs) and Sonic Scanner;
- 4 Diagnostic Fracture Integrity Tests (“DFITs”); and
- 50 large diameter rotary side wall cores taken from the Middle Velkerri A, B and C, intra-Velkerri A / B and surrounding units.

Empire’s technical team is working with W.D. Von Gonten & Co (“WDVG”), a Houston, Texas reservoir engineering firm and core laboratory which is highly respected in the industry for its technical expertise in the analysis of shale gas formations around the world.

Preliminary analysis indicates that the Middle Velkerri Shale encountered in Empire’s Carpentaria-1 has strong technical similarities to wells across the Beetaloo Sub-basin, including Santos’ Tanumbirini-1 well which is located 63km to the West. The key difference between these wells and Carpentaria-1 are the indications of liquids rich gas in Empire’s well which encountered the Velkerri Formation at shallower depths. Despite the substantial distance between Carpentaria-1 and Santos’ Tanumbirini-1 well, there is a clear correlation of key lithology units within the Middle Velkerri Shale. The correlation over a large distance enhances Empire’s confidence of the presence and likely thickness of the target shales in future drilling locations within Empire’s EP187 tenement.

Preliminary analysis carried out by Empire and WDVG indicates that key attributes including thickness, gas saturation and porosity compare favourably to neighbouring wells. The table below is a preliminary pay summary. These numbers will be refined following laboratory testing.

Zones	Top (m)	Bottom (m)	Gross (m)	Net (m)	Net to Gross	Total Porosity	Total Sg	Effective Porosity	Effective Sg
Velkerri Mid C	1091	1160	69	52	76%	~9%	~65%	~6%	>95%
Velkerri Mid B	1328	1374	46	40	87%	~8%	~65%	~6%	>90%
Velkerri Mid Intra A / B	1374	1494	120	51	42%	~8%	~50%	~5%	>70%
Velkerri Mid A	1494	1553	59	48	81%	~7%	~60%	~4%	>90%

*Gross and net thickness, porosity, gas saturation, effective porosity and effective gas saturation above are net petrophysical averages with cut offs of < 50% clay content, porosity > 4% and water saturation < 60%.*

*'Sg' = gas saturation (comprising raw gas with associated liquid hydrocarbons and inerts excluding adsorbed gas).*

A series of Diagnostic Fracture Integrity Tests (“DFITs”) was carried out across the target formations. DFITs are undertaken by pumping a small volume of fluid into the target formations until fractures are initiated and are designed to infer properties of the formation, including permeability, minimum principal stress and formation breakdown pressure. The results of the DFITs and subsequent FMI were encouraging, with evidence of vertical fractured intervals indicating that hydraulic stimulations in future appraisal programs are likely to be able to generate an interconnected dendritic fracture network to optimise hydrocarbon flow.



*Large diameter rotary sidewall core taken from the Middle Velkerri shale during the Carpentaria-1 formation evaluation program*

50 large diameter rotary side wall cores were collected at various depths across the target formations. These core samples will be sent to the WDVG laboratory in Houston, Texas where a series of tests will be carried out to establish reservoir and formation fluid properties. These tests will provide important technical data to refine the estimated Gas-in-Place to allow Empire to update its prospective resource estimates and an enhanced understanding of rock mechanics to optimise hydraulic stimulation design in preparation for the 2021 flow testing appraisal program. The core analysis results are expected later in Q4 2020.



*Empire Energy Managing Director Alex Underwood discussing drilling program with Federal Energy and Emissions Reduction Minister Angus Taylor MP and Empire Energy Chairman Paul Espie AO on site at the Carpentaria-1 location*



## Operational Update

Empire has successfully completed the 2020 drilling and formation evaluation program at Carpentaria-1 and Schlumberger Land Rigs 183 was released from the location at 1800hrs (NT time) on Friday 23<sup>rd</sup> October 2020.

The program was executed with no health and safety incidents or environmental incidents reported.

The well was drilled to a total measured depth of 1,916m. This was shallower than previously expected due to the target formations being encountered at shallower depths.

The program achieved its technical goals including drilling through the target formations and collecting all data required for the formation evaluation program.

The well has been cased and cemented from surface to total depth. The cement bonds have been pressure tested. There are now strong cement barriers between the well bore and the surrounding subsurface environment.

The surface aquifers are protected from the potential future flow of hydraulic stimulation fluids and hydrocarbons inside the well bore in future appraisal and development programs by multiple layers of high grade steel casing with premium gas tight connections and cement which creates an impermeable barrier between the aquifers and the well bore. As an added environmental protection, water monitoring bores already in place have collected a series of samples to analyse baseline water quality data prior to commencement of drilling operations. This data will be compared to future water samples taken from the same water monitoring bores to ensure that aquifer water quality is not negatively impacted by Empire's operations.

Future hydraulic stimulation activities in the EP187 Phase 1 Work Program Area will be carried out several hundred metres below surface aquifers to ensure that induced fractures do not intersect the aquifers.

While drilling through the target Velkerri Shale Formation, high rates of penetration were achieved, with peak rates of up to 40 metres per hour. Based on drilling conditions during the campaign, Empire anticipates that it may be able to achieve higher equivalent rates of penetration in future drilling programs with appropriate drilling bit selection which will put downward pressure on future drilling costs.

Empire utilised the services of several highly experienced oilfield services firms including InGauge Engineering, Schlumberger and Halliburton. Empire thanks all parties involved in executing this program to a high standard.

The total cost of the drilling campaign including well pad construction, water monitoring bore drilling and completion, formation evaluation program execution, casing and cementing, and suspending for future appraisal work, is expected to be approximately A\$11.5 million. Most of this investment (>A\$8 million) has already been paid in cash.

Empire's current cash balance is approximately A\$17.7 million.

As a result of reaching the target formations shallower than previously anticipated, Empire has retained approximately A\$625,000 worth of inventory, casing and drill bits which it will use for future drilling programs or on-sell to other upstream oil and gas companies.

Empire anticipates material savings will be achievable for future drilling campaigns based on the operational insights that have been gained from this program as is often the case after the first well in an exploration program. For example, approximately one third of the total program cost was mobilisation and demobilisation of the drilling rig which in future drilling campaigns has the potential to be reduced through utilising a single rig for multiple wells (either within a single Empire drilling campaign or sharing a rig with other Beetaloo Sub-basin operators). Furthermore, future drilling campaigns are likely to involve reduced formation evaluation.

## Forward Plan

Empire's technical and management team have commenced analysing the results of this program and planning for the next stage which will be appraisal of the Velkerri Formation at the Carpentaria-1 location and further delineation of the prospectivity of the broader EP187 tenement.

Empire is working closely with WDVG to analyse the log data and DFIT results. Once the large diameter side wall cores are delivered to WDVG's lab, WDVG will commence a series of tests designed to assess the total Gas-in-Place, rock mechanics and other key aspects of the Velkerri Formation in EP187. This will inform Empire's planning for the hydraulic stimulation and flow testing program scheduled for Q2 2021.

Upon completion of this analysis, Empire will update its resource assessment for its Northern Territory properties. Empire had previously assumed that the Velkerri Formation would contain dry gas in EP187 across thinner sequences. Once Empire's resource assessment is complete, it will commission Netherland, Sewell and Associates, Inc. to prepare an updated independent prospective resource estimate. Empire expects to publish the updated NSAI report in Q1 2021.

The regulatory approval process for the hydraulic stimulation and flow testing of Carpentaria-1 is already underway and will continue throughout the Northern Territory Wet Season. Empire will keep shareholders updated as the regulatory approval process progresses.



*Schlumberger Land Rigs 183 manager discussing drilling progress with Empire Energy Chairman Paul Espie AO*

**APPENDIX A: DISCLOSURES UNDER ASX LISTING RULE 5.30**

Name and Type of Well	Carpentaria-1, vertical exploration well
Location of Well	EP187, Northern Territory, Australia 16o47'40"S 135o07'23"E
Working Interest	100%
Gross vs Net Pay for conventional target	N/A
Geological rock type of formation	Mesoproterozoic marine shale
Depth of zones tested	833m Measured Depth to 1,831m Measured Depth
Types of tests and duration	Triple Combo, Spectral Gamma Ray, Lithoscanner, Combinable Magnetic Resonance, Formation Microimager (before and after DFIT), Sonic Scanner, Diagnostic ` Integrity Tests, Extra Large Rotary Side Wall Cores (1.5" * 2.5"), cement bond log
Hydrocarbon phases	C1 - C5 (Methane, Ethane, Propane, Butane, Pentane)
Any other recovery e.g. formation water	N/A
Choke size / flow rates / volumes	N/A (to be flow tested following hydraulic stimulation in 2021)
Number of fracture stimulation stages	N/A (to be hydraulically stimulated in 2021 subject to approvals)
Any other gases (e.g. CO2 / N2 / H2S, S)	<1% CO2

This ASX release has been authorised by the Managing Director

For queries about this release, please contact:

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