



ASX:EEG

# Empire Energy – Sights Set on Early Production in the Beetaloo



South East Asia Australia Offshore & Onshore Conference (SEAAOC) - 24 August 2022

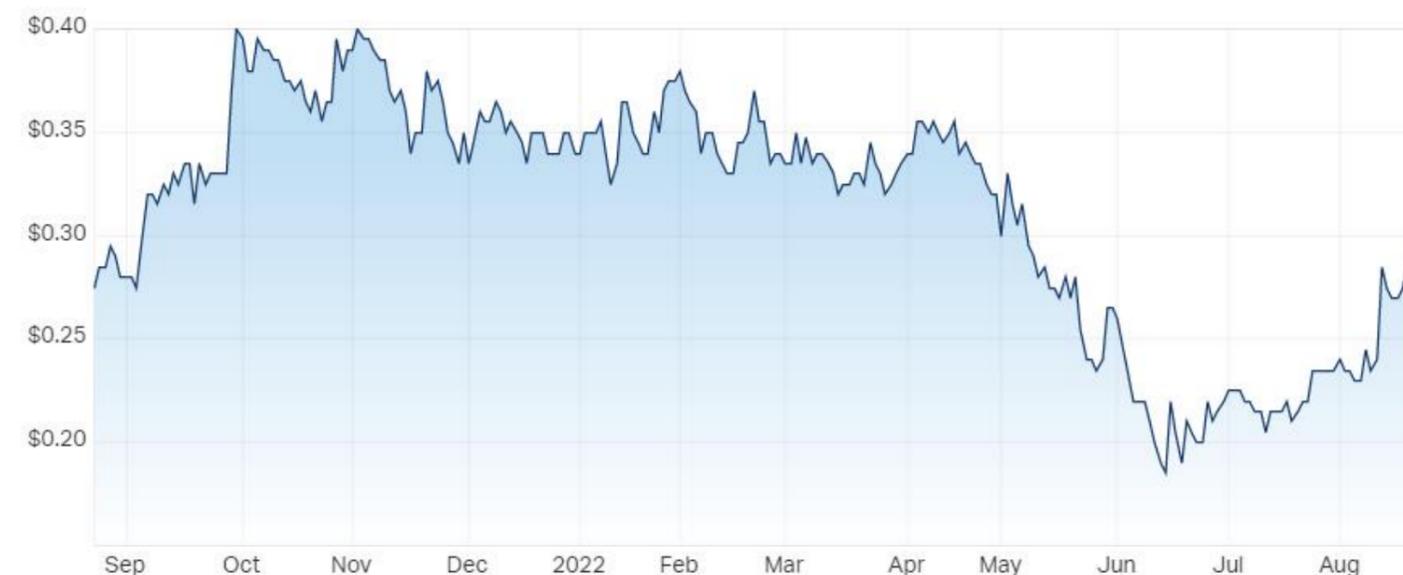
# Corporate Snapshot



## Capital Structure

Shares on issue <sup>1</sup>	770.4M
Share price <sup>3</sup>	\$0.25
<b>Market cap</b>	<b>\$192.6m</b>
Net (debt <sup>2</sup> ) / cash	~\$30.6m
Enterprise value	~\$162.0m
<b>Cash at bank<sup>3</sup></b>	<b>~\$38.7m</b>

## ASX Share Price



## Top Shareholders

Pangaea Resources	18.2%
Elphinstone Group	8.3%
Global Energy and Resources	4.2%
Sheffield Holdings	4.1%
Energy and Minerals Group	3.4%
Macquarie Bank	3.4%
Board of Directors <sup>4</sup>	20.5%

- **Board of Directors owns 20.5%**
- **Top 20 shareholders own 61.4%**
- **Top 50 shareholders own 70.7%**

1. Empire has 14.2m unlisted options on issue with an average exercise price of ~A\$0.63 per share. In addition, there are 14.7m Share Rights on issue to members of the management team and Board. Most of the Share Rights have performance hurdles tied to total shareholder return.  
 2. Empire has a US\$7.5 million debt facility (drawn to US\$5.56 million) with Macquarie Bank maturing in September 2024 which is secured against the Company's USA gas production assets. Under new management, total debt has been reduced by over 80% since 2018  
 3. As at 19 August 2022  
 4. Board shareholding includes Mr Paul Fudge (Pangaea) and vested Performance, Restricted and Service Rights

# Sights set on first production from the Beetaloo Basin



## EXPLORATION

**2021**

- ✓ 2C Contingent Resource: 575 BCFe
- ✓ 2U Prospective Resources: ~48 TCFe
- ✓ Gas Sales & Transportation: APA Group and Power and Water MoUs Executed

## APPRAISAL

**2022**

- ✓ Fracture stimulate and flow test Carpenteria-2H: to optimise design (flow test started 5 August)
- Drill Carpenteria-3H: optimise flow rates by applying data acquired from Carpenteria-2H
- Drill Carpenteria-4V: to grow EP187 Contingent Resources

## DEVELOPMENT PLANNING

**2023**

- Execute gas sales agreements
- Obtain government approvals: NT Petroleum Production Licence over portion of EP187
- Initiate Field Development Planning: including engineering, financial analysis etc
- Complete farmout

## EARLY DEVELOPMENT / PRODUCTION

**2024 -  
2025**

- Initial field development (~25 TJ/d)
- Book reserves
- Commence production / sales and generate cashflow
- Plan for larger scale development to feed East Coast and LNG export markets

# Carpentaria-2H Flow Testing Update (100% EEG)

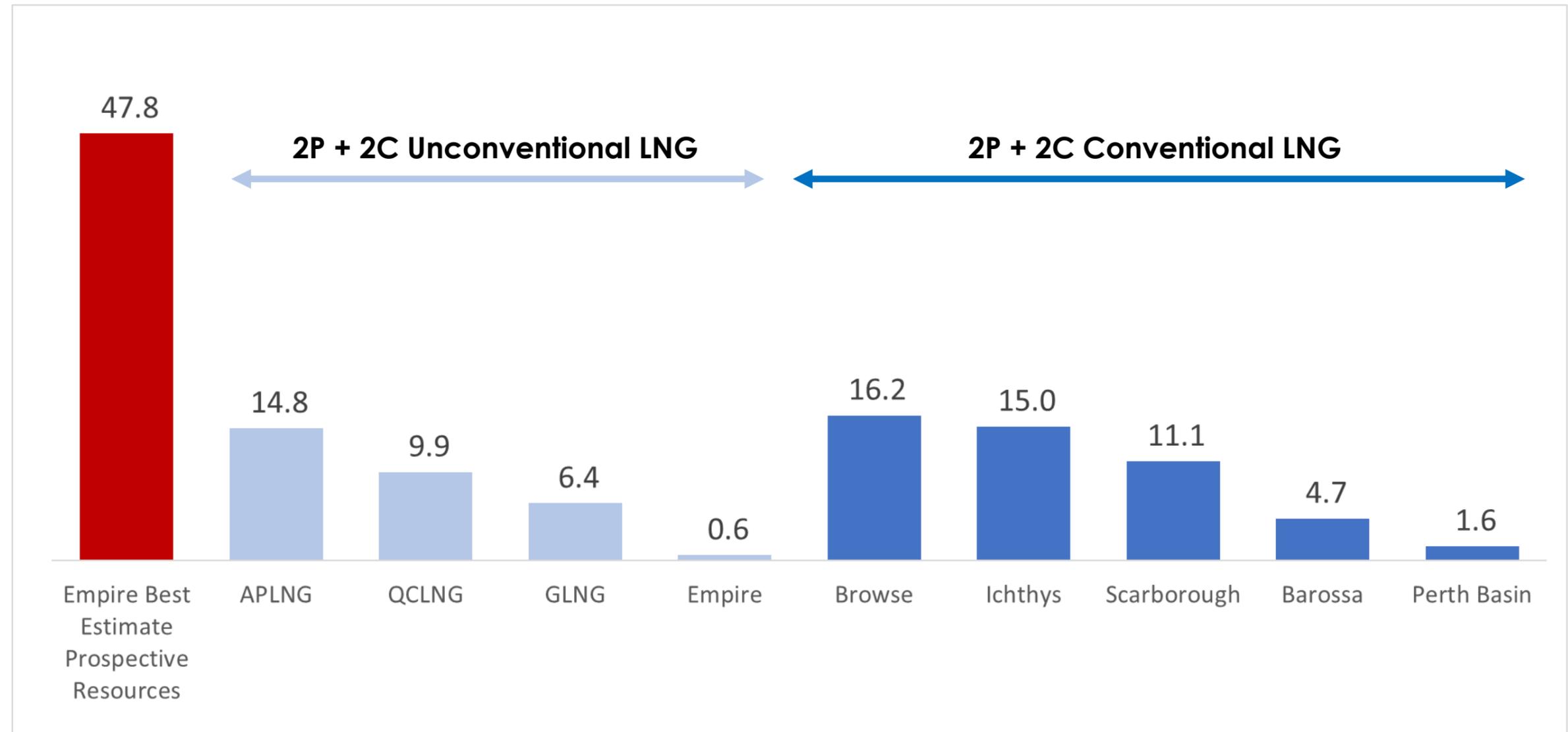
- **Average 2.6 million standard cubic feet (mmscf) per day** sustained flow rate achieved over the first 13 days of flow testing from 927m effective stimulated horizontal length
- **Normalized rate of 2.8 mmscf per day** per 1,000m of horizontal section
- **Peak rate of > 11 mmscf per day** achieved after a 2-day shut-in to change wellheads and monitor pressure build up following which the well returned to trend production rate as expected
- **Currently producing at 2.5 mmscf / day** at a stabilised rate, with water flowback rate gradually declining
- **Flow testing is continuing** - data collected and analysed will be incorporated into the completion design for the upcoming Carpentaria-3H on the same well pad
- Gas composition data and zonal contribution expected in coming weeks
- Preparations for **Carpentaria-3H drilling and hydraulic stimulation**, and **Carpentaria-4V** drilling, continue according to plan



# Empire's Prospective Resources in Context

- Certified Prospective Resource base suggests the potential for a world-class gas resource capable of supplying domestic and international markets for many decades
- Ongoing appraisal work aims to move Prospective Resources to Contingent Resources and ultimately 2P Reserves
- Empire has a market leading management team and highly experienced Board to drive early commercialisation

## Empire's Prospective Resources Relative to LNG Scale Resources



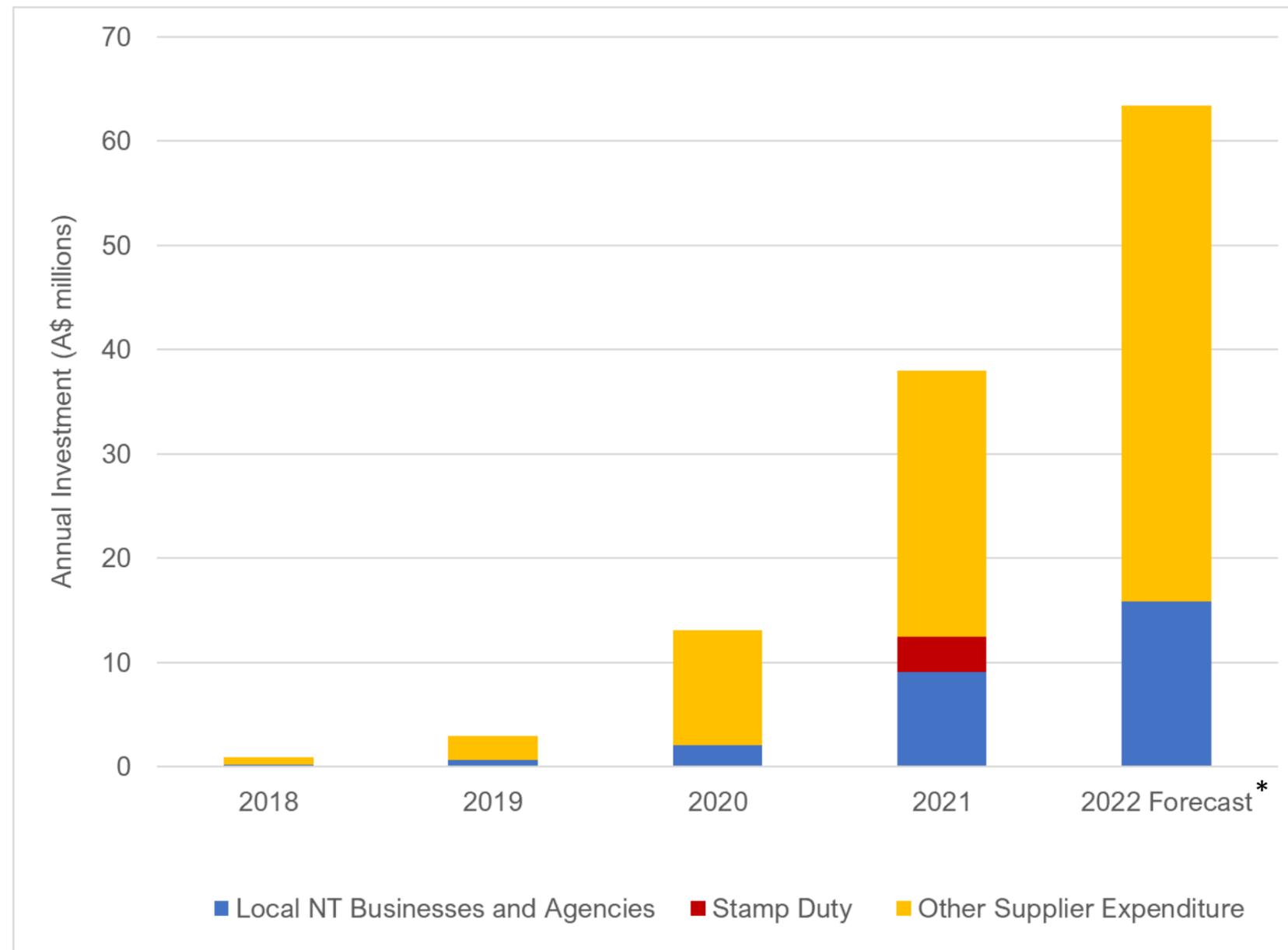
Sources:

1. Energy Quest Energy Quarterly June 2022
2. <https://www.woodside.com.au/what-we-do/australian-growth-projects/browse>
3. <https://www.inpex.com.au/projects/ichthys-lng/>
4. <https://www.woodside.com.au/what-we-do/australian-growth-projects/scarborough>
5. Santos 2021 reserves statement
6. Beach 2022 reserves statement

Note: Refer to EEG announcements dated 16 February 2022 for Netherland, Sewell & Associates, Inc. Contingent and Prospective Resources

# Empire's growing investment in the NT

## Empire's growing investment into the Northern Territory (by year)



\* Estimate

**Empire's Pangaea spent ~\$110 million in the Western Beetaloo prior to the NT moratorium**

## Empire's NT Economic Contributions (Since 2018)

- Forecast ~\$28 million total spend to businesses and organisations that operate in the NT to Dec 2022
- \$3.4 million paid to the NT Government (stamp duty)
- NLC exploration payments for the benefit of Traditional Owners
- Empire is providing opportunities for Traditional Owner through arts sponsorship, employment and royalties
- ~1,800 hours of work provided to Traditional Owners



Alex Underwood, Empire Managing Director with Leslie Rice, KD Machinery Hire  
Mr Rice has consented to the photo being taken and used publicly

# Government supporting the Beetaloo



## NT Government has primary responsibility for regulation of the Beetaloo Basin Federal Labor Government is supportive of Beetaloo development

### NT Government supports the development of the onshore gas industry

- **Territory Economic Reconstruction Commission** highlighted the critical role of gas
- NT's new Chief Minister Natasha Fyles has committed to implementing the Pepper Inquiry recommendations before year-end which will allow for the **award of production licences in 2023**

### Beetaloo Cooperative Drilling Program

- **Executed grant agreements with the Federal Government for up to \$19.4 million for three horizontal appraisal wells**
- \$5.4 million cash received to date including \$3.5 million on 23 June 2022

### Darwin Middle Arm Sustainable Development Precinct

- \$1.5 billion commitment made by both major parties during the election campaign to support expanded port infrastructure at Darwin
- **Includes \$300 million for production of clean LNG and hydrogen; and \$550 million for renewable energy supply, CCUS and other technologies**

### Northern Australia Infrastructure Facility (NAIF)

- Energy/gas is a key focus sector of NAIF
- Funding increased from \$5 billion to \$7 billion

### Nicole Manison (NT Deputy Chief Minister):

*“There’s been a huge amount done by the other gas companies around the Beetaloo but when you have a look at the pace Empire’s going, all doing it within the rules, conditions and regulations but you can see it is advancing very well.”<sup>1</sup>*

1. NT News, “Empire building: Project on track with production timetable” dated 28 July 2022

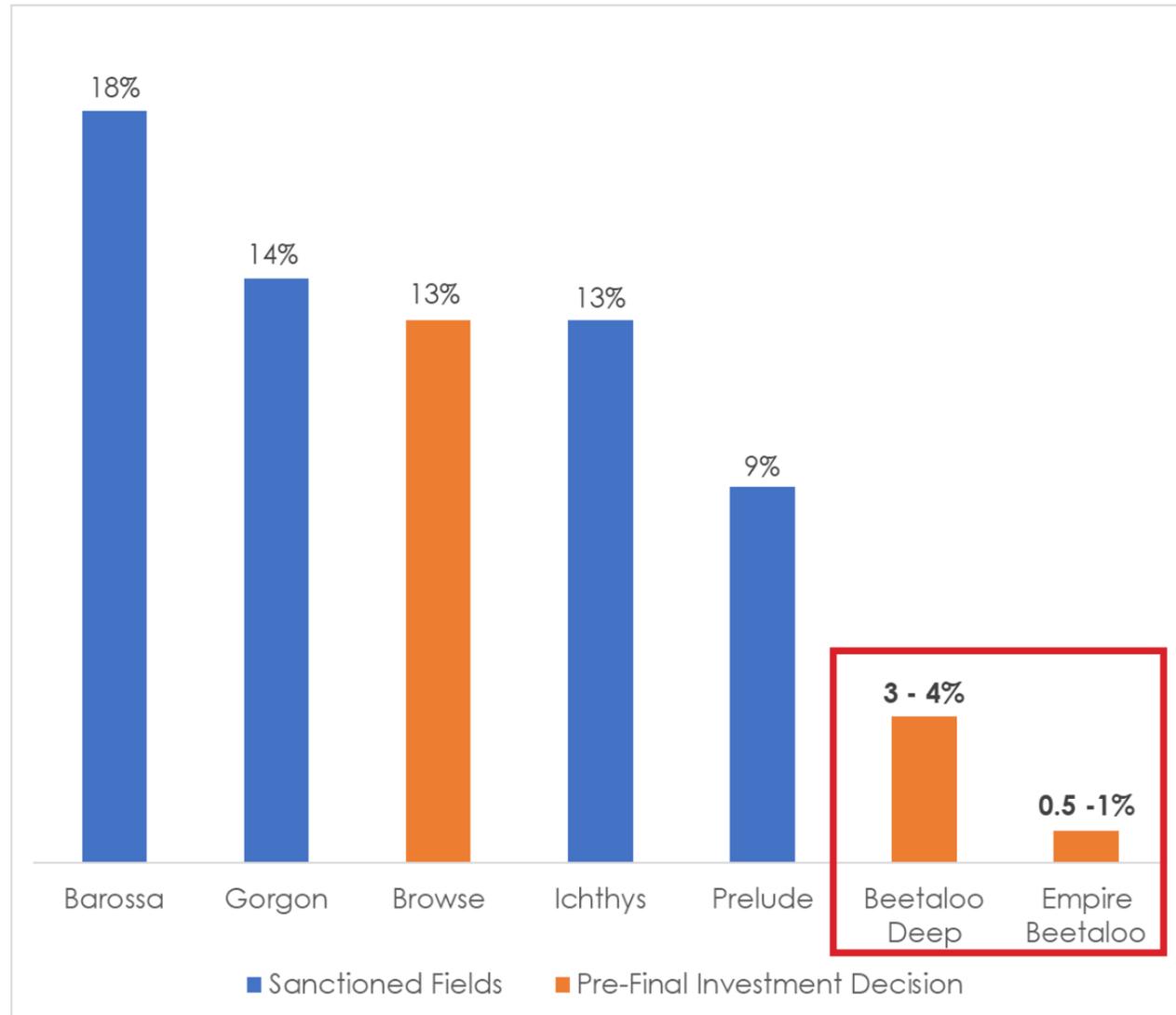
### Anthony Albanese (Prime Minister):

*“We’ve been supportive of the Beetaloo Basin Exploration on the basis of looking at, of course, environmental approvals which need to be considered there, as well as the traditional owners.”<sup>2</sup>*

2. <https://anthonyalbanese.com.au/media-centre/alpa-darwin-doorstop-interview-strategic-roads-package>

# Empire's gas is the lowest CO<sub>2</sub> on development path

## Scope 1: Contained Reservoir CO<sub>2</sub>

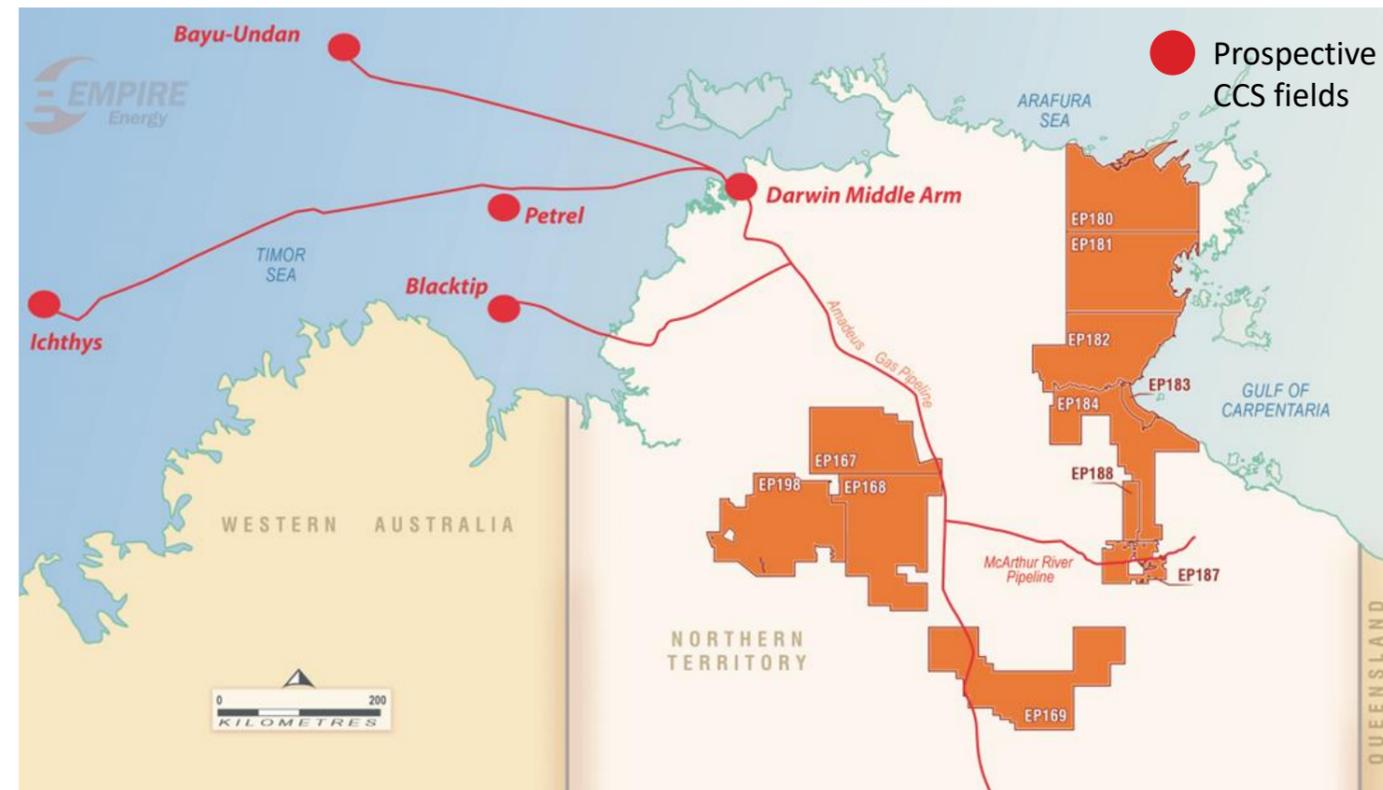


Sources:  
 Strike Energy ASX release "Australian Domestic Gas Outlook, WA Gas Market Update", 23 March 2022  
 Beetaloo Deep as sourced from Tamboran Resources ASX release "Operational update: Approximately 17 per cent upward revision to Tanumbirini 2H and 3H flow test results", dated 23 March 2022

- Federal and NT Governments have committed to Recommendation 9.8 of the Scientific Inquiry into NT fracture stimulation: **"both the NT and Australian governments must seek to ensure there is no net increase in the lifecycle greenhouse gas emissions emitted in Australia from any onshore shale gas produced in the NT"**
- Empire is advancing carbon offset strategies

## Darwin Carbon Capture Utilisation and Storage Hub<sup>1</sup>

- Potential to store ~30mt of CO<sub>2</sub> per annum across **Bayu Undan and Petrel** enabling development of blue hydrogen and petrochemical industries



Under the **IEA Net Zero scenario**, 7.6 billion tonnes of CO<sub>2</sub> per year would need to be stored in CCUS by 2050, 200 times more than is being stored in the 30 or so commercial projects around the world today

1. <https://territorygas.nt.gov.au/projects/carbon-capture-utilisation-and-storage-hub>



## Gas market and supply

Gas markets are critically short - Empire can play a significant role in increasing supply



## NYMEX HENRY HUB SPOT PRICE

**US\$9.16 / MMBtu**  
**(up 138% in a year)**

## LNG (JKM) SPOT PRICE

**US\$59.33 / MMBtu**  
**(up 239% in a year)**

## WALLUMBILLA SPOT PRICE

**A\$18.50 / GJ**  
**(up 117% in a year)**

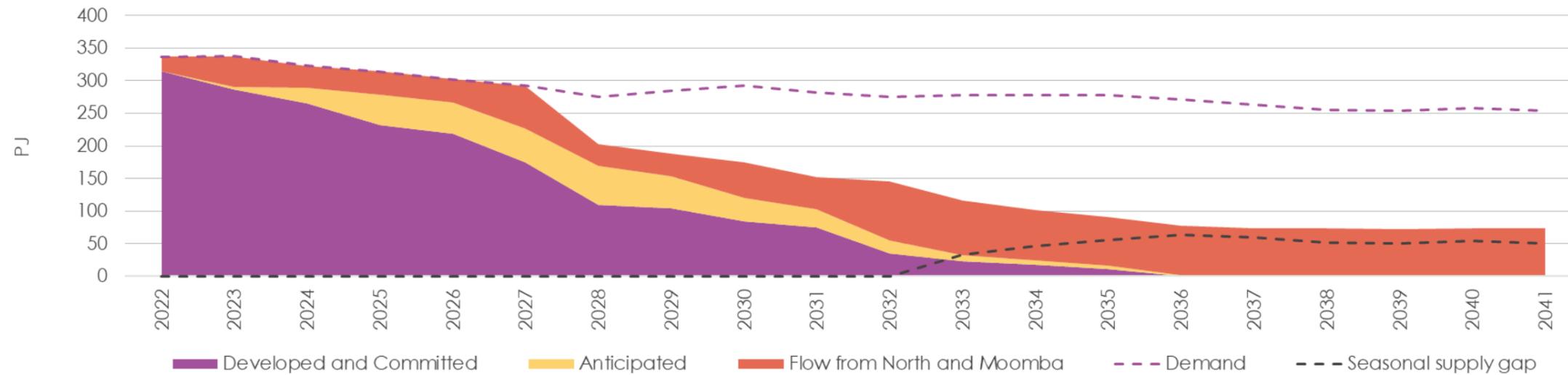
## ACCC LNG NETBACK PRICE

**A\$56.26 / GJ**  
**(up 279% in a year)**

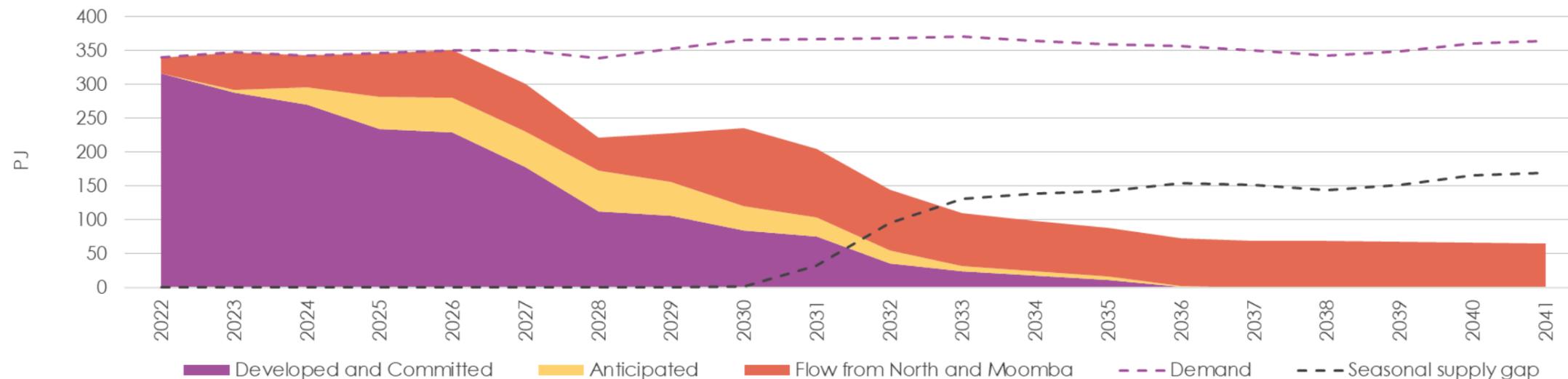
# Australia's gas shortage has arrived

## Australian Energy Market Operator 2022, Gas Statement of Opportunities

### Step Change<sup>1</sup>



### Progressive Change<sup>2</sup>



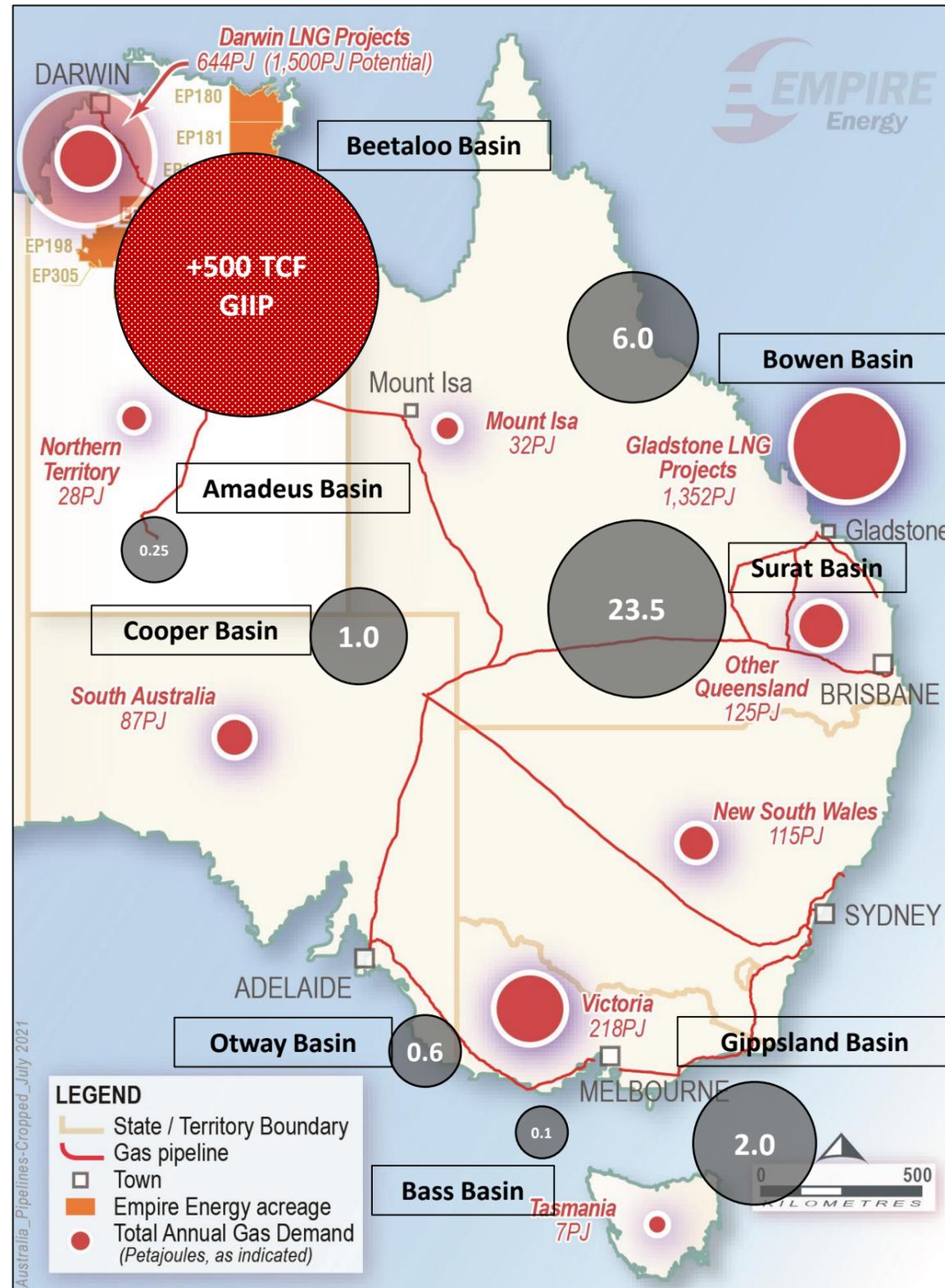
- The Beetaloo Sub-basin is well positioned to meet this shortfall with the large-scale gas resource and infrastructure
- Empire's Beetaloo gas has notably low CO<sub>2</sub> (0.5% to 1%) and high calorific content
- Wallumbilla hub gas price at \$18.50 / GJ on 19 August 2022
- Seasonal supply gap arising due to insufficient gas forecast to be in storage to manage winter demand spike
- **AEMO forecasts east coast LNG imports to meet shortfall (but at what price?)**

AEMO has forecast gas shortfalls for Australia's south-east (ACT, NSW, Victoria and Tasmania) under two the energy transition scenarios above

1. *Step Change* assumes tangible and rapid change, with gas demand declining quickly and significant electrification (users switching from gas to electricity)

2. *Progressive Change* assumes a slower transformation and gas consumption closer to historical levels

# The Beetaloo is Australia's largest Undeveloped Gas Resource



- Total potential prospective resources in the Velkerri B shale of between **50 Tcf and 100 Tcf** (one of five productive shale units) based on Government estimates of **500 Tcf** gas-in-place (assuming recovery factors of between 10% and 20%)
- Andrew Liveris, former Chairman of DowChemicals described the Beetaloo as “the **third-largest** shale **gas** deposit on the planet”\*
- The Australian Federal Government, 14 January 2021: “The Beetaloo Sub-basin has the potential to rival the world’s biggest and best gas resources...”
- **Empire (100%) 2C Contingent Resource of 554 BCF gas and 3.5 MMBBLs liquids**
- **Empire (100%) P(50) Prospective Resource of 43 TCF gas and 797 MMBBLs liquids**

- **Beetaloo Velkerri B GIIP Estimate**  
(SEAAOC 15 November 2018)
- **2P Reserves (Tcf)**  
(ACCC data as at 30 June 2020)

Source: 2P data sourced from ACCC's Gas inquiry January 2021 interim report (published February 2021)

\*The Australian newspaper- 23 May 2019



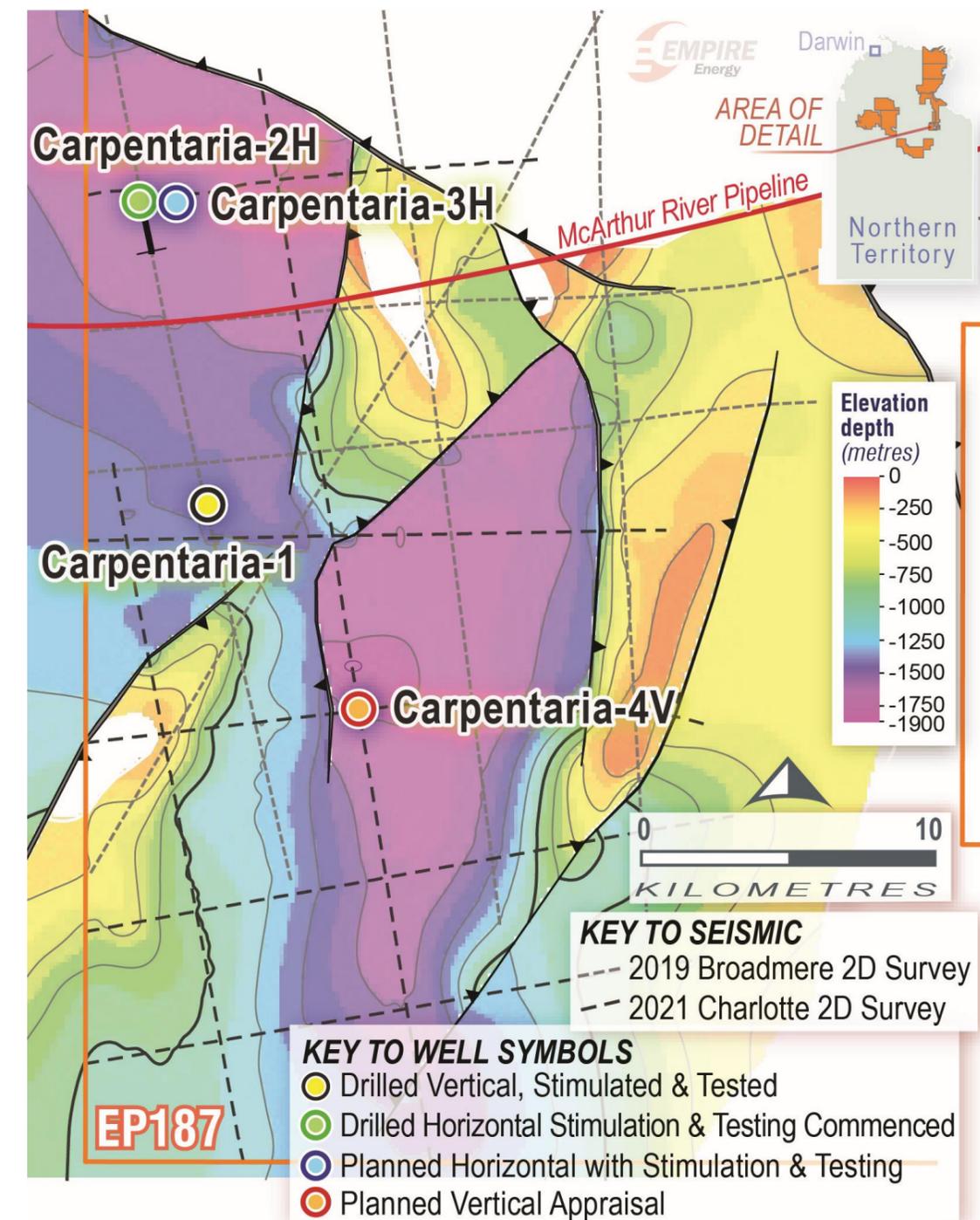
## Sights set on early production

Empire is driving ahead with multi-year work programs and commercial arrangements on the pathway to development



# EP187 Appraisal Program Underway (100% EEG)

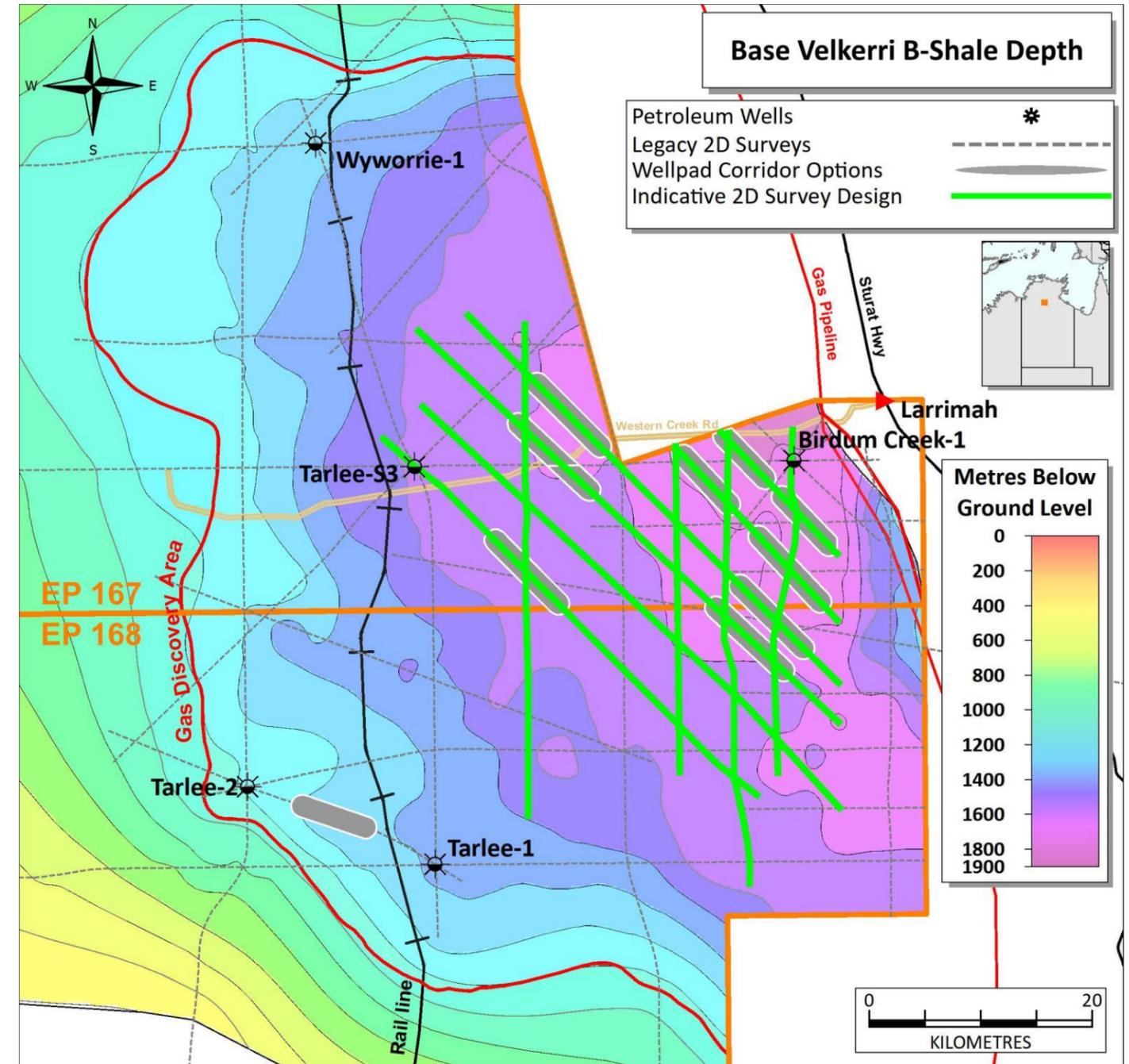
- Seismic data and drilling results have enhanced Empire’s understanding of the **Carpentaria Resource Area** and refined definition of the undrilled but highly prospective **Carpentaria East and Carpentaria South Resource Areas**
- Carpentaria East and Carpentaria South have been **demonstrated to be deeper over a more extensive area** than previously mapped, enhancing prospectivity and potential future productivity
- Large portion of acreage is at ideal depths for shale gas development
- **Favourable Velkerri shale depths cover 110,000 acres**
- Five additional drilling locations have environmental clearances across Carpentaria and Carpentaria East
- Current EP187 2C Contingent Resource: **396 BCF**
- Current EP187 3C Contingent Resource: **1292 BCF**
- Current EP187 P(50) Prospective Resource: **~4.3 TCF**
- **Carpentaria-2H fracture stimulation complete. Flow test continues**
- **Carpentaria-3H and Carpentaria-4V wells planned for H2 2022**
- **There are hundreds of drilling locations across Carpentaria and Carpentaria East fault blocks with potential to drill multiple wells from each pad to minimise surface disturbance**



# Western Beetaloo Multi-Year Work Program Clearances Underway



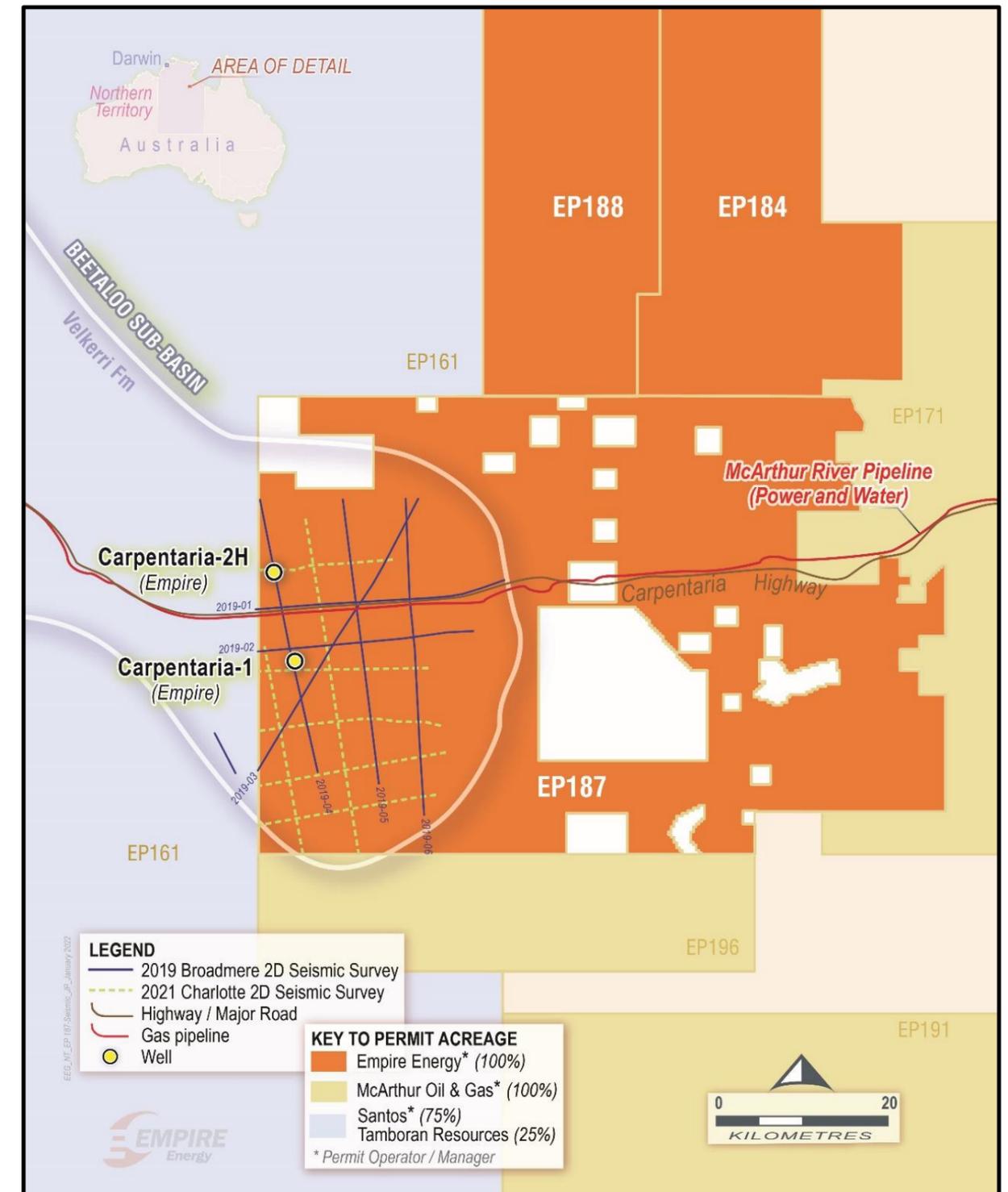
- Environmental approvals submitted to the Northern Territory Regulator for:
  - The acquisition of up to ~380 km in-fill 2D seismic orientated for future horizontal wells
  - Clearance for drilling, stimulation and flow testing of up to six horizontal wells on six well pad locations within the gas discovery area
- The approvals have the potential to accommodate numerous production wells in a future commercial development scenario
- Planned appraisal activities are focused within the Gas Discovery Area (\$110 million spent to date, >1m acres)
  - Strategically located near gas pipeline, highway and train line
- Current **2C** Contingent Resource of **157.5 BCF** (+3.5 MMBBLS)
- Current **3C** Contingent Resource of **415.8 BCF** (+14.1 MMBBLS)
- Current P(50) Prospective Resource of **~28 TCF and 764 MMBBLS**
- Land access negotiations advancing with pastoralists



EP 167 and EP 168 100% EEG

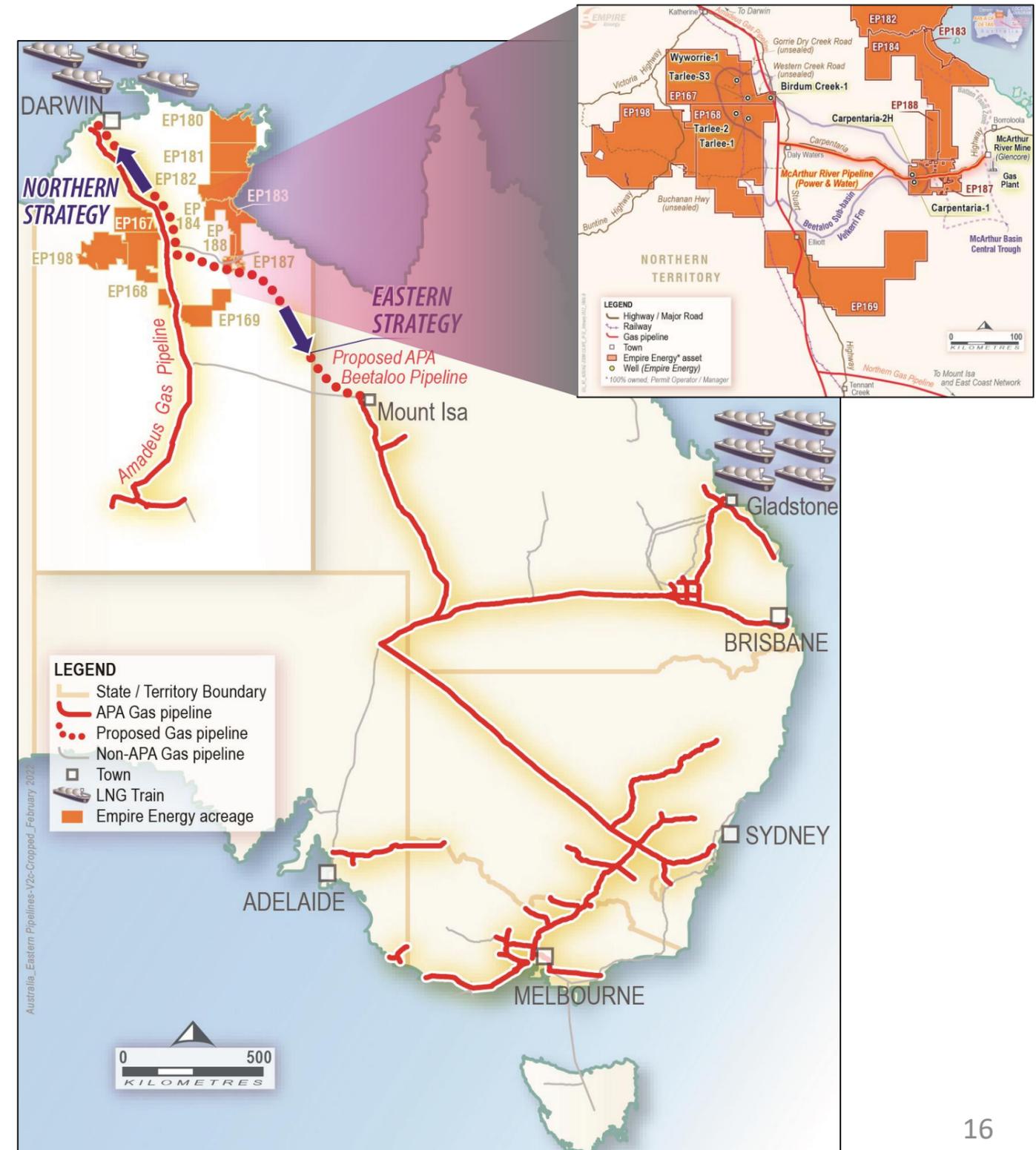
# Exploration & Appraisal Campaign Successes To Date

- Carpentaria-1 drilled to TD 1,915m intersected a **column of liquids rich gas in the Velkerri nearly 1 km thick (998m)**
- Substantial proportions of heavier-end, **higher-value liquid hydrocarbons** intersected - **enhancing the economics** of future production scenarios
- The Velkerri Shale is shallower than in analogue Beetaloo Basin wells and offers **lower drilling costs**
- Post-well analysis undertaken at W.D. Von Gonten & Co (Houston, Texas) in collaboration with Empire's technical team recorded **favourable rock properties**
- Carpentaria-1 four stage vertical fracture stimulation and flow testing produced a peak rate >1.6mmcf / day and ~0.25 mmcf / day average in EPT 1 and **~0.364mmcf / day average in EPT 2**
- October 2021: Drilling and hydraulic stimulation **of up to 7 horizontal wells across EP187 approved**
- Carpentaria-2H horizontal appraisal drilling **completed on time and budget (~\$11.1 million final cost)**
- **Carpentaria-2H fracture stimulation complete. Flow test continues**



# Commercial Arrangements

- **APA Group (ASX: APA)** and Empire have executed an MOU to explore opportunities for the development of Beetaloo mid-stream infrastructure including gas and liquids gathering, processing and pipelines
- APA will support Empire to get production to market, promptly, leveraging its existing network of gas transmission infrastructure
- ‘Northern Strategy’ will support the development of a gas-fed manufacturing industry and LNG export expansion at Darwin
- ‘Eastern Strategy’ including a new Beetaloo Pipeline to Mount Isa will allow Beetaloo gas to be transported to all Australian east coast domestic markets (Wallumbilla, Brisbane, Sydney and Melbourne) and LNG export through Gladstone
- Empire has also executed an MOU with NT Government owned utility **Power and Water Corporation** to facilitate negotiations for potential gas sales and transportation arrangements utilising the McArthur River Pipeline
- Empire’s infrastructure plans do not contemplate material investment of Empire shareholder funds in pipeline development



# Pathway to Development in the Beetaloo Basin



## EEG is progressing towards LNG-scale production

	2020	2021	2022	2023	2024	2025+
UPSTREAM	<p><b>CARP-1 PAD</b></p> <p>1 x Vertical Well ✓ (Carpentaria-1)</p>	<p><b>CARP-1 PAD</b></p> <p>✓ 1 x Vertical Frack (Carpentaria-1)</p> <p><b>CARP-2 PAD</b></p> <p>✓ 1 x Horizontal Well (Carpentaria-2H)</p> <p>✓ 2D Seismic</p>	<p><b>CARP-2 PAD</b></p> <p>✓ 1 x Horizontal Frack (Carpentaria-2H)<sup>1</sup></p> <p>1 x Horizontal Well + Frack (Carpentaria-3H)<sup>1</sup></p> <p><b>CARP-4 PAD</b></p> <p>1 x Vertical Well (Carpentaria-4V)<sup>1</sup></p>	<p>Further horizontal drilling / extended production testing to grow contingent resources to execute gas sales agreements</p>	<p><b>3 to 4 New Drilling Pads</b> →</p> <p>2+ continuous rigs</p> <p>10+ Horizontals</p> <p><b>500 – 700+ mmcf/d target production</b></p>	
PROCESSING FACILITIES				<p>Liquids Stripping Gas Compression &amp; Treatment</p>	<p>Central processing facility Gathering network Additional compression and treatment <b>LNG processing</b></p>	
COMMERCIALISATION OPTIONS		<p><b>Memoranda of Understanding</b></p> <p>✓ (APA Group / Power and Water Corp)</p> <p></p>		<p><b>Northern Domestic Gas Markets</b></p> <p>(e.g. Mines, Power Stations, Darwin, Power and Water Corp, etc.)</p> <p></p>	<p><b>East Coast LNG / Domestic</b> (via Amadeus Gas Pipeline, New Beetaloo Pipeline to Mt Isa) <b>LNG export ex-Darwin</b> (APA upgrade)</p>	
MIDSTREAM				<p>Existing (Amadeus Gas Pipeline, McArthur River Pipeline)</p> <p></p>	<p><b>Beetaloo Shared Infrastructure</b></p> <p>Owned by infrastructure builder and operator Tariff paid by users, with to be a foundation shipper </p> <p>→</p>	
FUNDING			<p>Cash on Hand / R&amp;D Rebates / Beetaloo Cooperative Drilling Program Grants</p>	<p>Farmout [?]</p>	<p>Project Finance [?]</p>	<p>Project Finance [?]</p>
	2020	2021	2022	2023	2024	2025+

1. Approvals in place

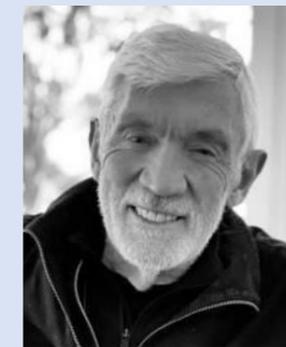


<https://empireenergygroup.net/>

**ASX:EEG**

**Alex Underwood**  
**Managing Director**  
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# Appendix 1: Empire's Board of Directors



**Paul Espie AO**

**Chairman & Non-Executive Director**

- Founding principal of Pacific Road Capital, a resources investing manager of private equity funds
- Former Chairman of Oxiana Ltd during the development of the Sepon copper/gold project in Laos
- Former Chairman of Cobar Mines Pty Limited after a management buyout
- Former Head of Bank of America operations in Australia, New Zealand and PNG

**Alex Underwood**

**Managing Director**

- Associate Director Energy Markets Division of Macquarie Bank Limited (Sydney and Singapore)
- Director Natural Resources Division of Commonwealth Bank of Australia (Singapore)
- Financial Analyst BHP Billiton Petroleum (Perth)
- Experience investing debt and equity in the upstream oil and gas sector and identification of value creation opportunities for upstream oil and gas development / production assets

**Peter Cleary**

**Non-Executive Director**

- Distinguished 29-year career representing Santos, the North West Shelf Venturers and BP in Asia. His executive career was in LNG, pipeline gas and chemicals operations
- Member of the Executive Committee of the Australia Japan Business Co-operation Committee and the Australia Korea Business Council

**Louis Rozman**

**Non-Executive Director**

- Former Managing Director of CH4 Gas which merged with Arrow Energy and later acquired by PetroChina and Shell
- Founding principal of Pacific Road Capital, a resources investing manager of private equity funds
- Former Chief Operating Officer of AurionGold Limited
- Chairman of the VALMIN Code Committee for the AusIMM and Australian Institute of Geoscientists

**Prof. John Warburton**

**Non-Executive Director**

- Highly regarded petroleum geoscientist experienced in big fields
- 30 years technical & leadership experience in leading E&P companies including BP, LASMO-Eni and Oil Search
- Previously Chief of Geoscience & Exploration Excellence for Oil Search
- Non-Executive Director of Senex Energy

**Paul Fudge**

**Non-Executive Director**

- Controlling shareholder of Pangaea
- Significant investment experience in onshore Australian oil & gas, including being an early mover in the Queensland Coal Seam Gas industry and in the Beetaloo Sub-Basin
- Paul brings significant business and investment experience to the Board of Empire

**Jacqui Clarke**

**Alternate Director**

- 30 years professional services experience, with over 15 years as a Partner at Deloitte.
- Jacqui is a Chartered Accountant and Fellow of the Institute of Chartered Accountants, Graduate of AICD (Australian Institute of Company Directors), Chartered Tax Advisor and Justice of the Peace

**Pangaea Representatives**

# Appendix 2: Industry leading Management



**Robin Polson**

**Chief Financial Officer**

- Robin has been deeply involved in the development of the Australian east coast gas industry for over 20 years.
- Extensive knowledge of the gas industry in the Northern Territory gas markets in particular; with strong relationships and experience working with key gas industry financiers, analysts, producers, transport providers, customers, and relevant regulatory bodies.
- Ex-Deloitte Partner
- Almost 30 years with big four accounting firms (Deloitte and PwC) on three continents, covering audit, corporate finance, M&A, valuation and strategy

**Kylie Arizabaleta**

**Financial Controller**

- Longest serving Empire management team member
- Prior to joining the Company, Kylie worked in the Audit division of Chartered Accounting firms as a senior and lead external auditor where she gained broad experience in Audit and other Assurance Services

**Ben Johnston**

**Vice President Business Development  
Company Secretary**

- Director, Natural Resources & Energy, Commonwealth Bank of Australia
- Vice President, RBC Capital Markets energy investment banking team
- Chartered Accountant and MBA (Australian Graduate School of Management)
- Energy sector specialist across M&A, ECM and debt / project finance transactions

**Sonia Harvey**

**VP Community and Government Relations**

- Based in Darwin
- Joined Empire from the Energy Club NT where she was the founder and served as Chief Executive. In this role, she built deep relationships across Empire's stakeholder groups including with Northern Territory Government and Shadow Ministers and Department leaders, service providers and peers in our industry.
- These relationships will be invaluable to Empire as we progress through to development and seek to raise our profile in the Northern Territory.

**Charles Dack**

**Environmental and Compliance Reporting Officer**

- Environmental manager with qualifications in environmental engineering and environmental law.
- Extensive experience as the environmental regulator of the petroleum industry for the NT Government
- +6 years at the Northern Territory Government, employed as the lead Environmental Engineer for the NT Government to regulate the upstream petroleum industry.

**Dr Alex Bruce**

**Chief Geoscientist**

- PhD from the University of New South Wales (2001) in machine learning applications to geology
- 20 years experience across onshore and offshore projects from exploration to development and conventional and unconventional oil & gas
- Has held similar positions with other ASX oil & gas mid-caps including Drillsearch (acquired by Beach), AWE (now Mitsui), Roc Oil (now FOSUN) and Bridgeport Energy (part of New Hope Corporation)

**Daniela Garrad**

**Geophysicist**

- Over 35 years' experience with international and Australasian projects, including everything from basin scale regional studies, exploration and detailed field evaluation and development
- Started as a seismic interpreter with Esso Australia, and since worked in technical roles for diverse companies ranging from minnows, mid-caps to majors, most recently with Oil Search Alaska.
- Special interests and expertise in structural geology and sequence stratigraphy in both carbonate and clastic sedimentary systems.
- Holds a BSc(Hons) from The University of Newcastle and is a member of PESA, the AAPG and the EAGE

**Todd Hoffman**

**Consultant Geoscientist**

- Over 15 years experience across onshore conventional and unconventional oil and gas exploration and appraisal projects, including geoscience operations
- More than 12 years working on Proterozoic shales in the Beetaloo and McArthur Basins
- Involved in large CSG and shale discoveries in the Queensland and Northern Territory
- Previous roles with privately held Pangaea Resources

# Appendix 3: Industry leading Operating Team & Consulting Support



**Dr Simon Hann**

**Principal Engineer**

- Founding partner of inGauge and a well engineering professional with over twenty years' operational experience including conventional oil and gas, geothermal, HPHT, and coal seam gas drilling and completions.
- Fourteen years' management experience with Santos, Woodside and Shell including roles as Operations Manager, Drilling Team Leader, Drilling and Completions Manager and Production Manager;

**Qualifications**

- PhD Materials Science University of Queensland, 1998
- Masters of Engineering Science, Qualifier University of Queensland, 1993
- Bachelor of Engineering, Manufacturing and Materials, University of Queensland, 1992
- Shell International Exploration & Production (SIEP) Round I and Round II Well Engineering Competency Certification SIEP



**Kelvin Wuttke**

**Principal Engineer**

- Over 24 years of industry experience ranging from conventional onshore oil & gas to CSG and international offshore operations at Santos and Chevron.
- Technical expertise includes drilling & completions design, workovers, well testing, artificial lift, pipelines and surface facilities, across conventional and CSG environments.
- Experience includes managing combined drilling, completion and stimulation projects, remediation workovers, snubbing, fracture stimulation, underbalanced operations, and a wide variety of artificial lift projects.

**Qualifications**

- Registered Professional Engineer of Queensland, Mechanical & Petroleum
- Chartered Professional Engineer (MIE Aust CP Eng), Mechanical
- MBA, Queensland University of Technology, 2003
- Bachelor of Engineering, Mechanical, University of South Australia, 1992



**Jordan Bunning**

**Principal Engineer**

- Founding member of inGauge. Over 17 years' operational experience at Santos, Oil Search, Roc Oil and Origin in complex well execution and project management, this includes projects in conventional oil and gas, HPHT, coal seam gas and deep water bores.
- Jordan has experience in roles such as Drilling Manager, Drilling Team Leader, Senior Drilling Engineer and Drilling & Completion Engineer.
- Has been the lead in some of inGauge Energy's most successful projects including as in situ Drilling Manager for Westside Corporation, Comet Ridge and most recently Empire Energy's Northern Territory Carpentaria 1 well.

**Qualifications**

- Bachelor of Engineering, Petroleum Engineer (Hons), University of New South Wales, 2003



**Jon Bennett**

**Project & Construction Manager**

- Jon has 25 years operational experience, including twelve years management experience at Santos in roles such as Pre-Development Manager, Construction Manager, Civil Construction Manager and several management roles in large scale Agriculture.
- Jon is an experienced professional with a strong focus on business outcomes. Offering experience in planning, design, and construction of gathering, power, well-pad, civil and other CSG facilities. Proven strengths in business and project management and driving efficiencies through innovation and simplification over a range of industries.
- In his management roles Jon has proudly achieved and maintained industry leading EHS performance across operations.



**Daniel Kalinin**

**Stimulation Consultant**

- 28 years of international experience in Russia, Turkmenistan, Kazakhstan, Mexico, the Middle East, China, and Australia.
- 20 years Schlumberger career included starting several new locations in Russia, business development in Turkmenistan & Uzbekistan, project engineer at Karachaganak, G&G/stimulation support for an integrated well construction project in Mexico
- Unconventional experience includes shale & tight gas in Saudi Arabia, Kuwait, Bahrain, Oman, China, and various basins in Australia. He has designed the fracturing stimulation of the maiden horizontal Velkerri discovery well.
- Degrees in Geology, Economics; post-grad Integrated Reservoir Management from IFP & Imperial College; ResEng program at Tulsa University. Holds several patents and published a few SPE technical papers.



**NETHERLAND, SEWELL & ASSOCIATES, INC.**

**WORLDWIDE PETROLEUM CONSULTANTS**



**W.D. Von Gonten & Co. Petroleum Engineering**

# Appendix 4: A Globally Significant Resource Position

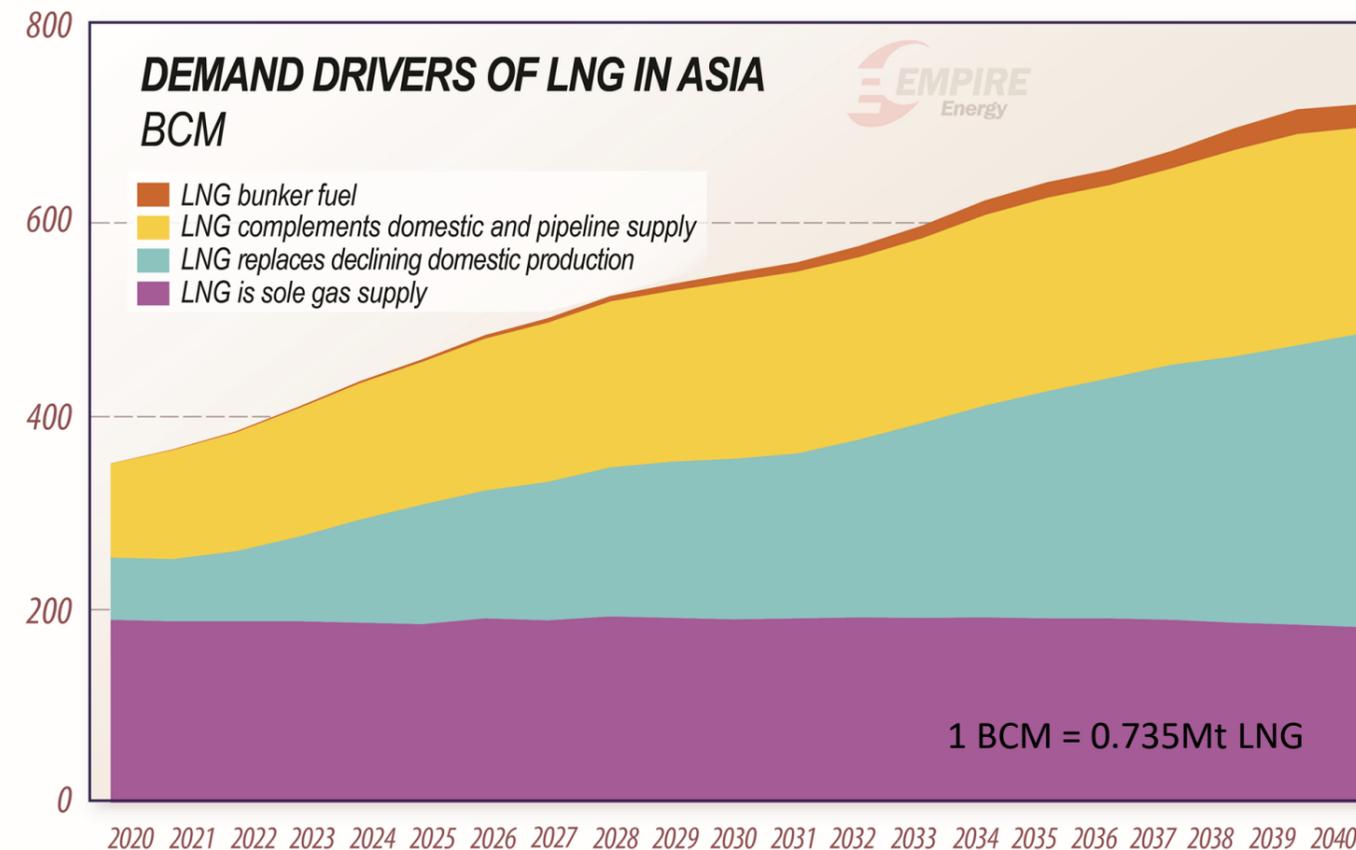
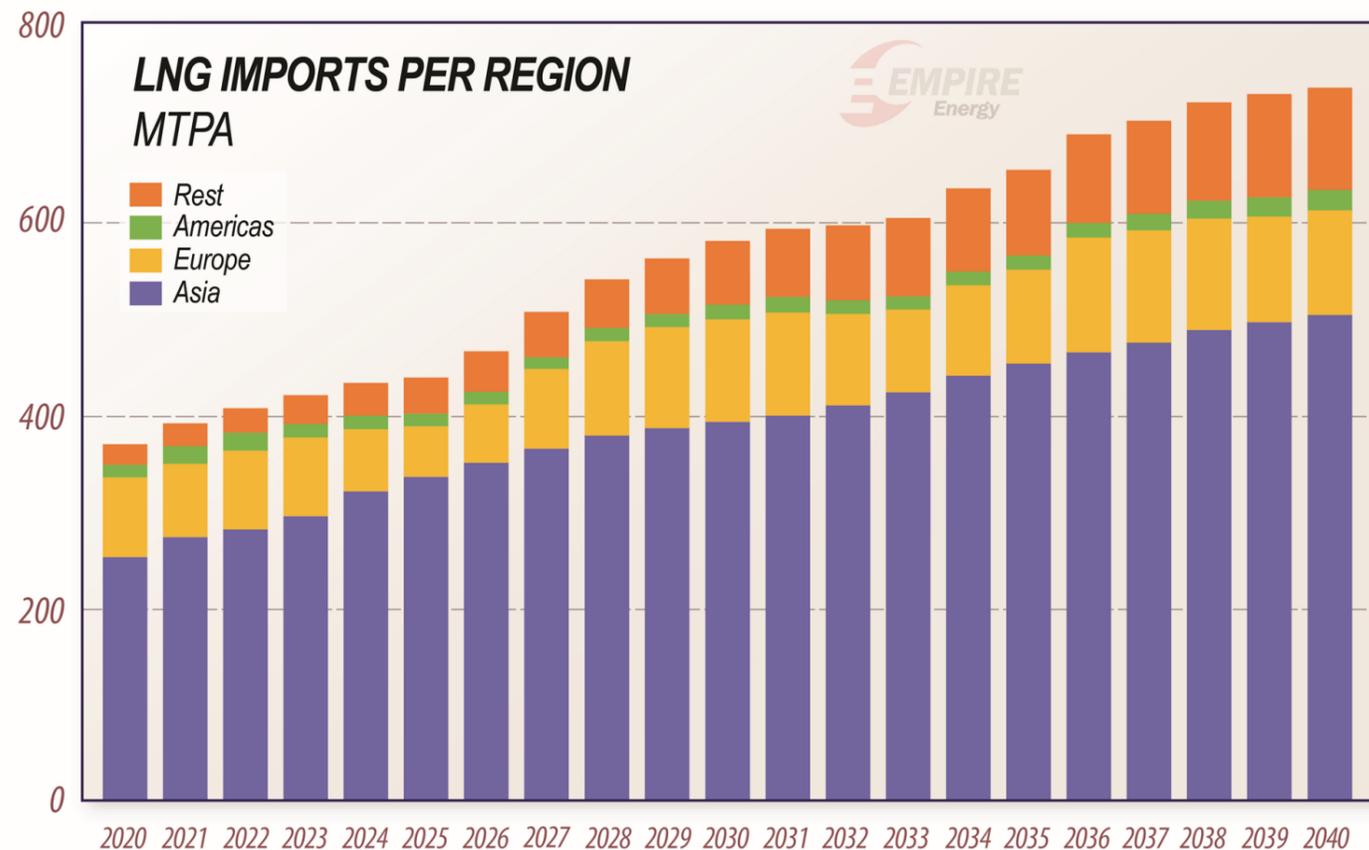


Shale Unit	Contingent Resources (Liquids)			Contingent Resources (Gas)			Prospective Resources (Liquids)			Prospective Resources (Gas)		
	Low Estimate (1C)	<b>Best Estimate (2C)</b>	High Estimate (3C)	Low Estimate (1C)	<b>Best Estimate (2C)</b>	High Estimate (3C)	Low Estimate (1U)	<b>Best Estimate (2U)</b>	High Estimate (3U)	Low Estimate (1U)	<b>Best Estimate (2U)</b>	High Estimate (3U)
	<i>mmbbls</i>	<i>mmbbls</i>	<i>mmbbls</i>	<i>bcf</i>	<i>bcf</i>	<i>bcf</i>	<i>mmbbls</i>	<i>mmbbls</i>	<i>mmbbls</i>	<i>bcf</i>	<i>bcf</i>	<i>bcf</i>
Kyalla	0.8	3.0	11.1	0.8	4.5	27.7	88	378	1,571	184	857	4,891
Mid Velkerri	0.1	0.5	3.0	138	549	1,680	82	419	2,062	10,744	31,018	89,217
Barney Creek	-	-	-	-	-	-	-	-	-	1,633	11,053	45,380
<b>Total</b>	<b>0.9</b>	<b>3.5</b>	<b>14.1</b>	<b>138.8</b>	<b>553.5</b>	<b>1,707.7</b>	<b>170</b>	<b>797</b>	<b>3,633</b>	<b>12,561</b>	<b>42,928</b>	<b>139,488</b>

Empire 2C Contingent Resource of **554 BCF gas** and **3.5 MMBBLs liquids**

Empire P(50) Prospective Resource of **43 TCF gas** and **797 MMBBLs liquids**

# Appendix 5: Gas running strong - Asian LNG demand increasing dramatically

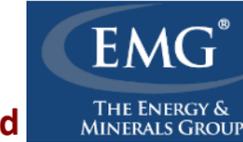


## Graphs extracted from: Global LNG Outlook – Shell LNG Outlook 2022

- Shell estimates global LNG demand will reach **700 million tonnes by 2040 (2021: 380mt)**, as demand for natural gas continues to grow strongly in Asia and gains further traction in powering hard-to-electrify sectors, tackling air quality concerns and meeting emissions targets
- Wael Sawan, Integrated Gas, Renewables and Energy Solutions at Shell said:
 

“As countries develop lower-carbon energy systems and pursue net-zero emissions goals, focusing on cleaner forms of gas and decarbonisation measures will help LNG to remain a reliable and flexible energy source for decades to come.”
- While natural gas accounts for about a **quarter of global electricity generation, half the total natural gas produced today is consumed in sectors other than power generation**

# Appendix 6: Major Activity in the Beetaloo to Date



NT Fracking Moratorium (Sep 2016 – Apr 2018) NT Environmental Baseline and Regulation Update

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Operational Highlights</b>										
<ul style="list-style-type: none"> <li>Pangaea NT acquires 29,000 line km full-tensor gravity gradiometry (FTG) survey</li> </ul>	<ul style="list-style-type: none"> <li>Pangaea NT acquires ~1,400-line km 2D seismic survey</li> </ul>	<ul style="list-style-type: none"> <li>Pangaea NT drills three stratigraphic wells targeting Beetaloo and McArthur Basin shales. Tarlee-S3 discovers world class source rocks in the Velkerri Shale</li> <li>Santos Tanumbirini-1 drilled to 3,945m TD. Play opening well, with 500m of shale logged in the Mid Velkerri section</li> </ul>	<ul style="list-style-type: none"> <li>Pangaea NT drills 4 appraisal wells and acquires ~380-line km 2D seismic survey</li> <li>Pangaea NT lodges ~100 TCF Gas Discovery Notice</li> </ul>	<ul style="list-style-type: none"> <li>Origin Energy announces Amungee NW-1H production test results, 66TJ produced at an average rate of 1.1mmscf/d</li> </ul>	<ul style="list-style-type: none"> <li>Origin books 2C contingent resources of 6.6Tcf in the Beetaloo Basin and indicates existence of a material gas resource</li> </ul>	<ul style="list-style-type: none"> <li>End of Northern Territory fracking moratorium</li> </ul>	<ul style="list-style-type: none"> <li>Empire completes 231-line km 2D seismic survey in EP187</li> </ul>	<ul style="list-style-type: none"> <li>Empire drills the Carpentaria-1 well</li> <li>Santos books maiden 2C resource</li> <li>Origin and Falcon Oil drill and fracture stimulate the horizontal Kyalla 117 well</li> <li>Santos announces initial peak gas flow rate of 10mmscf/d at Tanumbirini-1 vertical well</li> </ul>	<ul style="list-style-type: none"> <li>Empire drills Carpentaria-2H and acquires infill 2D seismic</li> <li>Origin confirms liquid-rich gas discovery at Kyalla 177 with CO2 estimated at less than 1%</li> <li>Santos drills Tanumbirini 2H and 3H</li> <li>Origin drills Velkerri 76</li> <li>Origin completes EPT at Amungee NW-1H flow rate 5.2 - 5.8mmscf/d / 1000m</li> </ul>	<ul style="list-style-type: none"> <li>Empire books certified 2C contingent resources of 396 BCF for Carpentaria</li> <li>Carpentaria-2H achieves normalised flow of 2.8mmscf/d over 1,000m</li> <li>Tamboran announces normalised flow rates for Tanumbirini 2H and 3H of 4.3mmscf/d and 7.4mmscf/d over 1,000m</li> </ul>
<b>Corporate Highlights</b>										
<ul style="list-style-type: none"> <li>Santos farms into EP161 (and other tenements) with Tamboran Resources</li> </ul>		<ul style="list-style-type: none"> <li>Origin Energy and Sasol farm-in to Falcon Oil &amp; Gas' Beetaloo acreage</li> </ul>	<ul style="list-style-type: none"> <li>Energy &amp; Minerals Group farms into Pangaea Resources Beetaloo acreage</li> <li>INPEX awarded Beetaloo acreage</li> </ul>		<ul style="list-style-type: none"> <li>Origin increases its interest in its Beetaloo JV to 70% following the acquisition of Sasol's share</li> </ul>			<ul style="list-style-type: none"> <li>Origin increases its interest in its Beetaloo JV to 77.5%, valuing the project at A\$333 million (gross)</li> <li>Tamboran acquires Sweetpea</li> </ul>	<ul style="list-style-type: none"> <li>Empire acquires Pangaea NT for cash and scrip</li> <li>Tamboran IPO on ASX</li> </ul>	

# Appendix 7: How the Middle Velkerri matches the Marcellus Shale

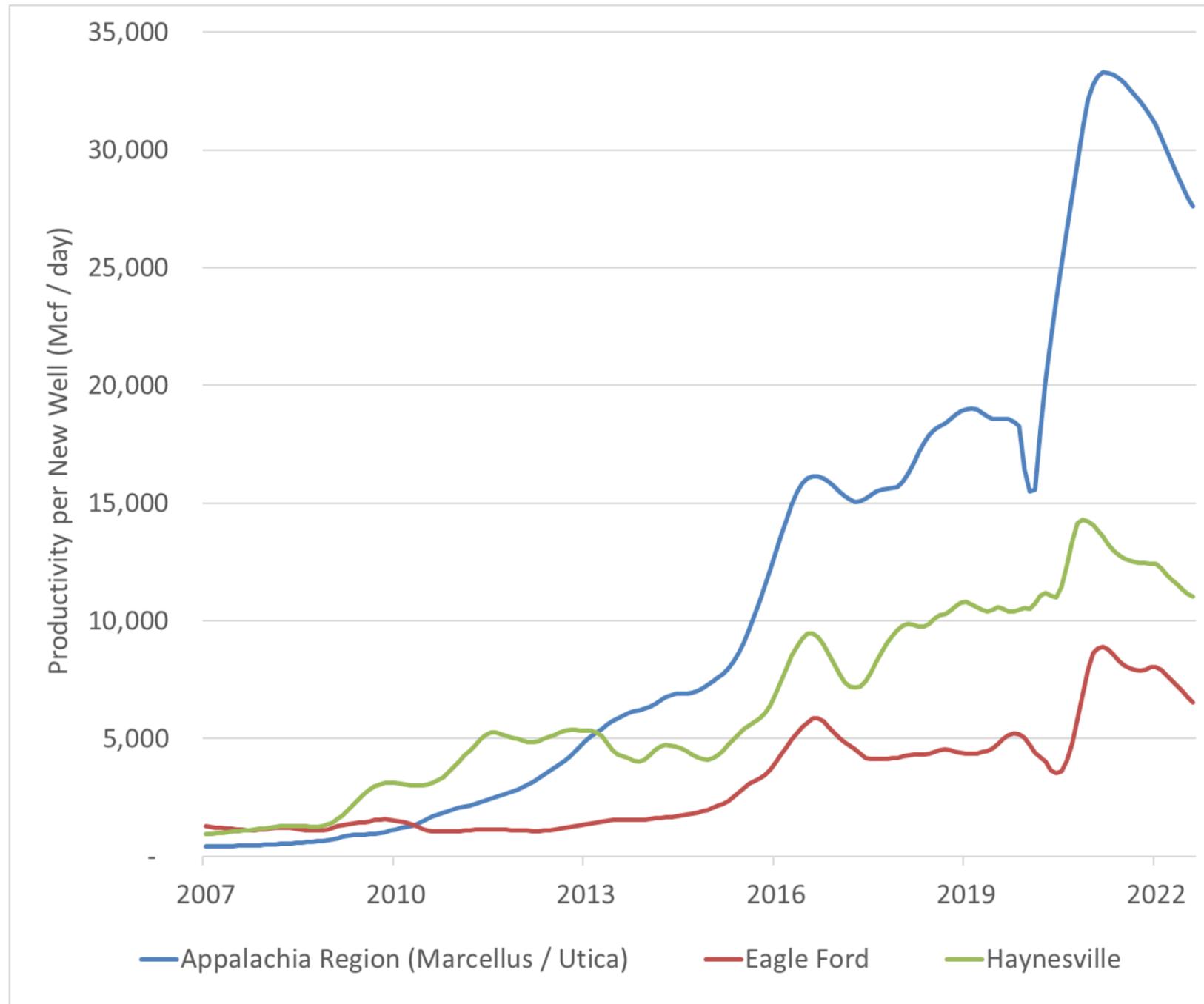


## Empires regional core and log data confirms gas in-place and deliverability properties for the Middle Velkerri Shale

	Gas-In-Place	Thickness	<b>The middle Velkerri Shales show high lithological consistency and thickness</b> <ul style="list-style-type: none"><li>Thickness intervals ranges from ~40 – 100+m for the B Shale alone</li></ul>
		TOC & Thermal Maturity	<b>The middle Velkerri Total Organic Carbon (TOC) content is regionally consistent</b> <ul style="list-style-type: none"><li>The B Shale averages 4.0% TOC, and thermal maturity ranges from oil to dry gas</li></ul>
		Storage Capacity HC Saturation	<b>Excellent storage capacity and hydrocarbon (HC) saturations indicates large gas-in-place</b> <ul style="list-style-type: none"><li>Effective porosities ranging from ~4 –8% with high hydrocarbon saturations</li></ul>
		Resource Concentration	<b>High gas concentration equivalent to the Marcellus Shale</b> <ul style="list-style-type: none"><li>Velkerri B Shale GIP from ~40 to over 100 BCF/sq mile - stacked A, B &amp; C Shales can exceed 160 BCF/sq mile GIP</li></ul>
	Deliverability	Mineralogy & Rock mechanics	<b>Favourable mineralogy and rock mechanics for well treatments – shales are brittle and frackable</b> <ul style="list-style-type: none"><li>Stimulations, core and logs confirm Velkerri shales have favourable fracture stimulation characteristics - high quartz (~60%) and low non-reactive clays (20 -35%)</li></ul>
		Overpressure	<b>Shale reservoirs are consistently over-pressured to similar level as the Marcellus Shale</b> <ul style="list-style-type: none"><li>DFIT's, pressurised core confirm the shales are over-pressured (0.51 – 0.59 psi/ft).</li></ul>
		Permeability	<b>Good to excellent shale permeabilities</b> <ul style="list-style-type: none"><li>DFITs indicates good permeability and is consistent with core data.</li></ul>

**Carpentaria-1 vertical fracture stimulation confirms sustained flow to surface across all four zones in the middle Velkerri**

# Appendix 8: The US Experience – a Learning Curve



Improving shale gas well productivity reflects:

- Understanding and identification of play 'sweet spots' and landing zones
- Staying in target zones (directional drilling technology)
- Longer horizontal lengths (can now exceed 7 miles)
- Optimisation of well completion design allowing increased stimulated rock volumes
- Managed flow-back to increase Estimated Ultimate Recoveries over time

# Appendix 9: Continuously productive shales, with encouraging flow rates

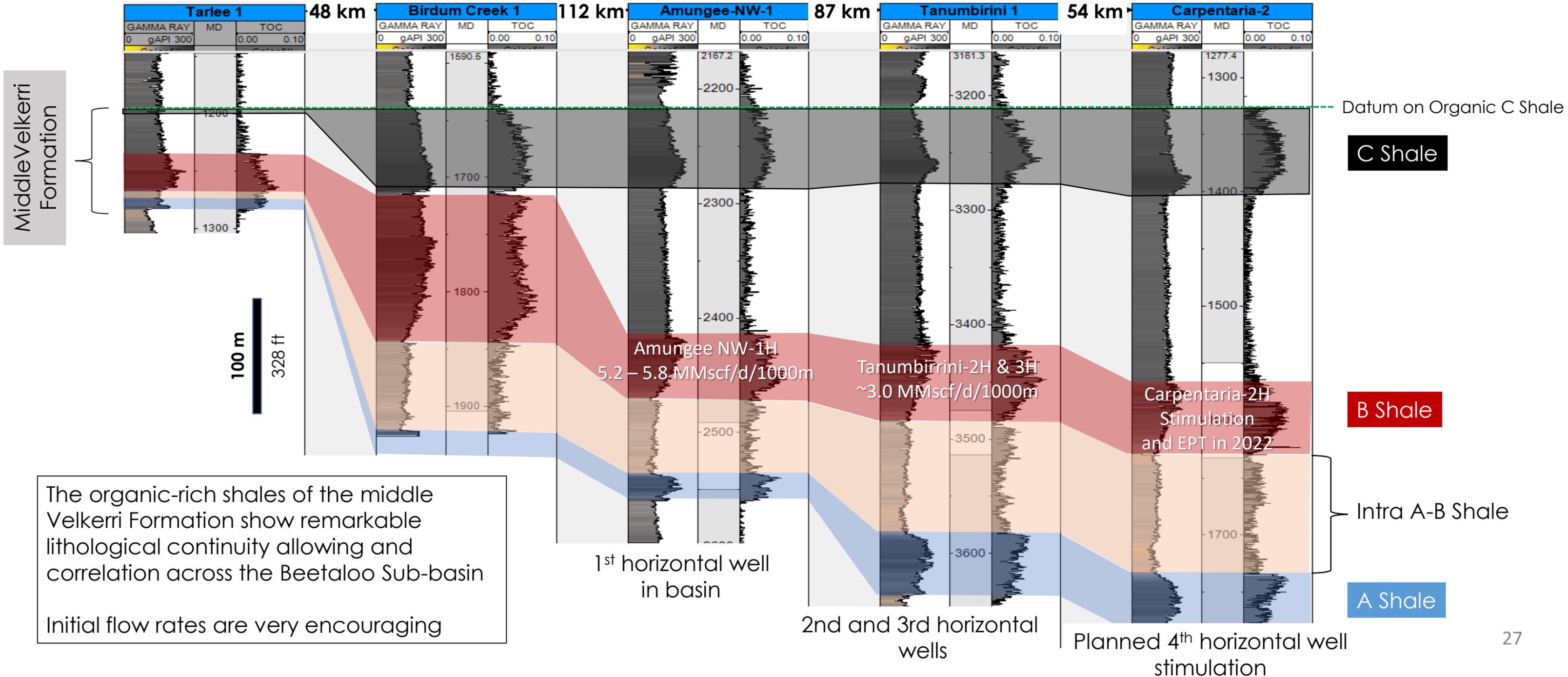


West

East



Santos



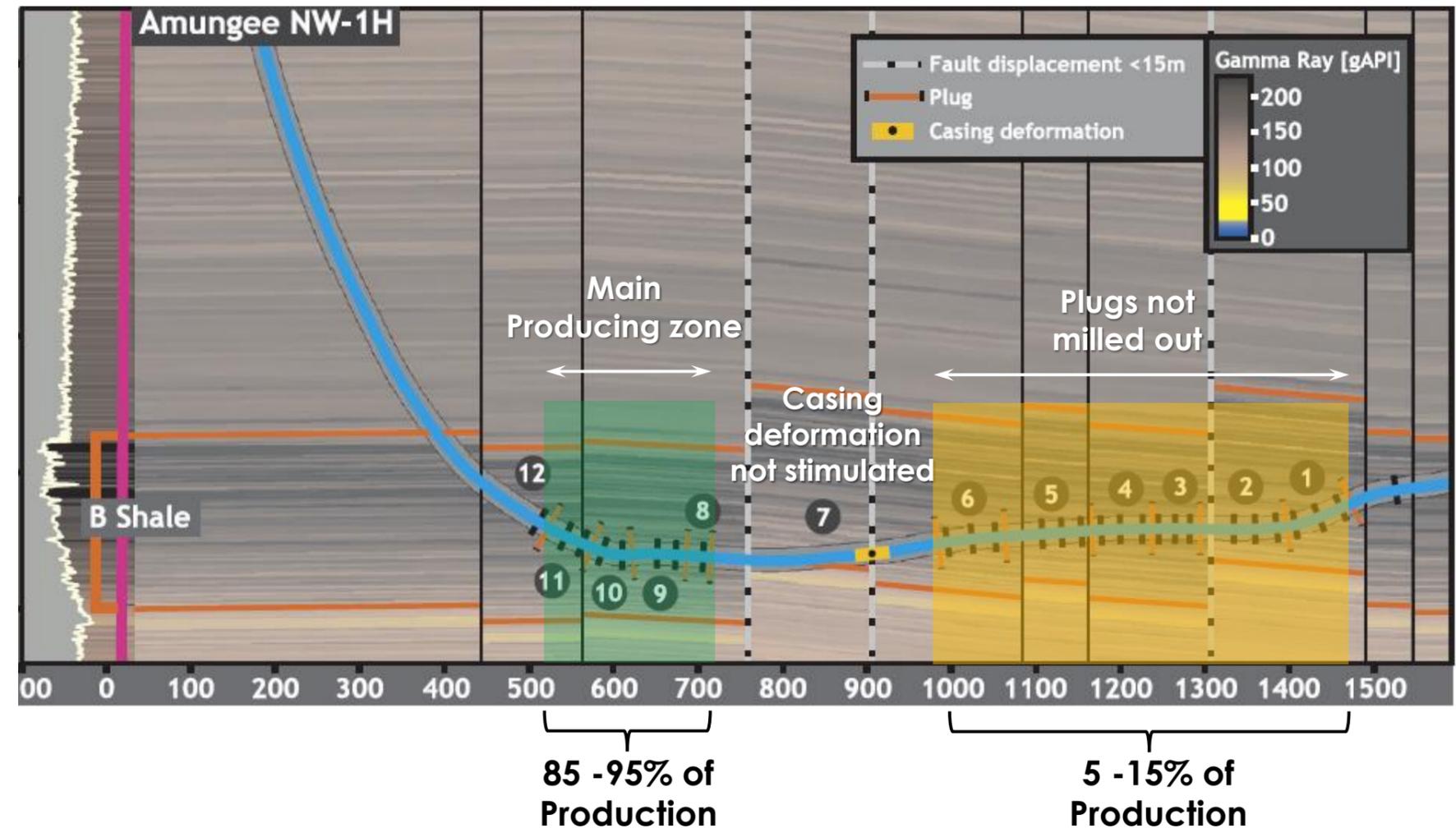
The organic-rich shales of the middle Velkerri Formation show remarkable lithological continuity allowing and correlation across the Beetaloo Sub-basin  
Initial flow rates are very encouraging

# Appendix 10: First Horizontal Well in Beetaloo Achieved US Scale Flow Rate

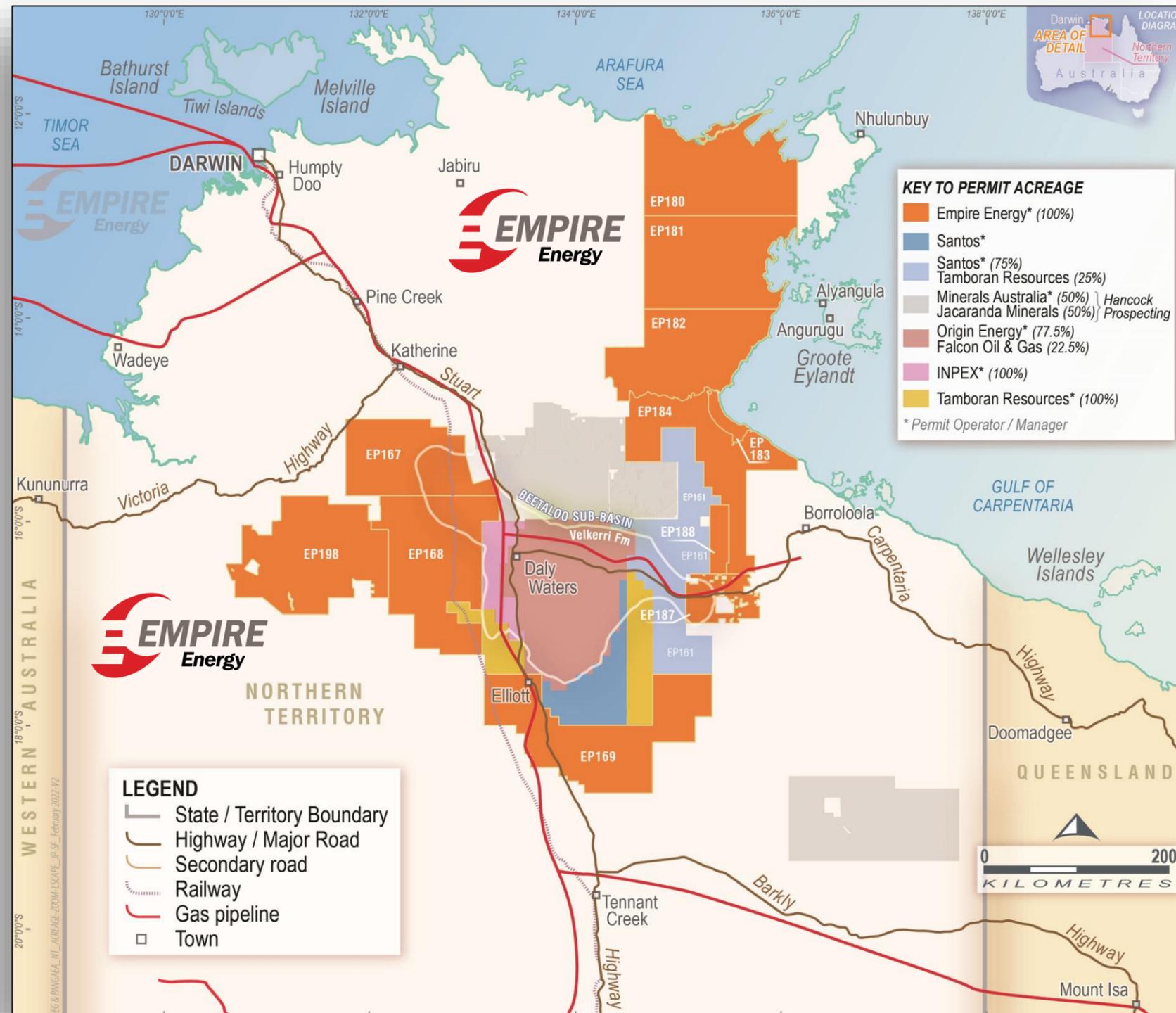


Amungee NW-1H achieved a normalised gas flow rate of between 5.2 – 5.8 mmscf/d/1000 m (1.6 – 1.8 mmscf/d/1000 ft) from the Middle Velkerri B Shale

- **Two Extended Production Tests conducted over a combined 80+ days**
  - First (2016) - average production rate of 1.1 mmscf/d over 57 days
  - Second (2021) – average production rate of **1.2 mmscf/d for first 23 days**
- **Limited decline on EPTs**
- Production logged to confirm producing zones
  - **85 – 95% of production is coming from 200 m (~650 ft) zone**
  - 5 – 15% of production from stages beyond casing deformation and unmilled plugs



# Appendix 11: Empire's 28.9 million acre footprint



- Pangaea and EMG invested ~\$110 million in exploration and appraisal between 2012 and 2015
- Empire acquired for \$57 million
- Stuart Highway, Darwin to Adelaide rail corridor and the Amadeus Gas Pipeline (connecting to the East via the Northern Gas Pipeline)

## Prospective Resources (2U)

Gas	43 TCF
Liquids	797 MMBBLs

## Contingent Resources (2C)

Gas	554 BCF
Liquids	3.5 MMBBLs

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