



Celebrating **25** years

Worldwide Shale Developments: What makes them work and is there a sweet spot in Europe?

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June 2019

decisions with confidence

Declarations



-
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 - Whilst every effort has been made to verify data and resolve apparent inconsistencies, neither RISC nor its servants accept any liability for its accuracy, nor do we warrant that our enquiries have revealed all of the matters, which an extensive examination may disclose. We believe our review and conclusions are sound but no warranty of accuracy or reliability is given to our conclusions.

Who are RISC ?



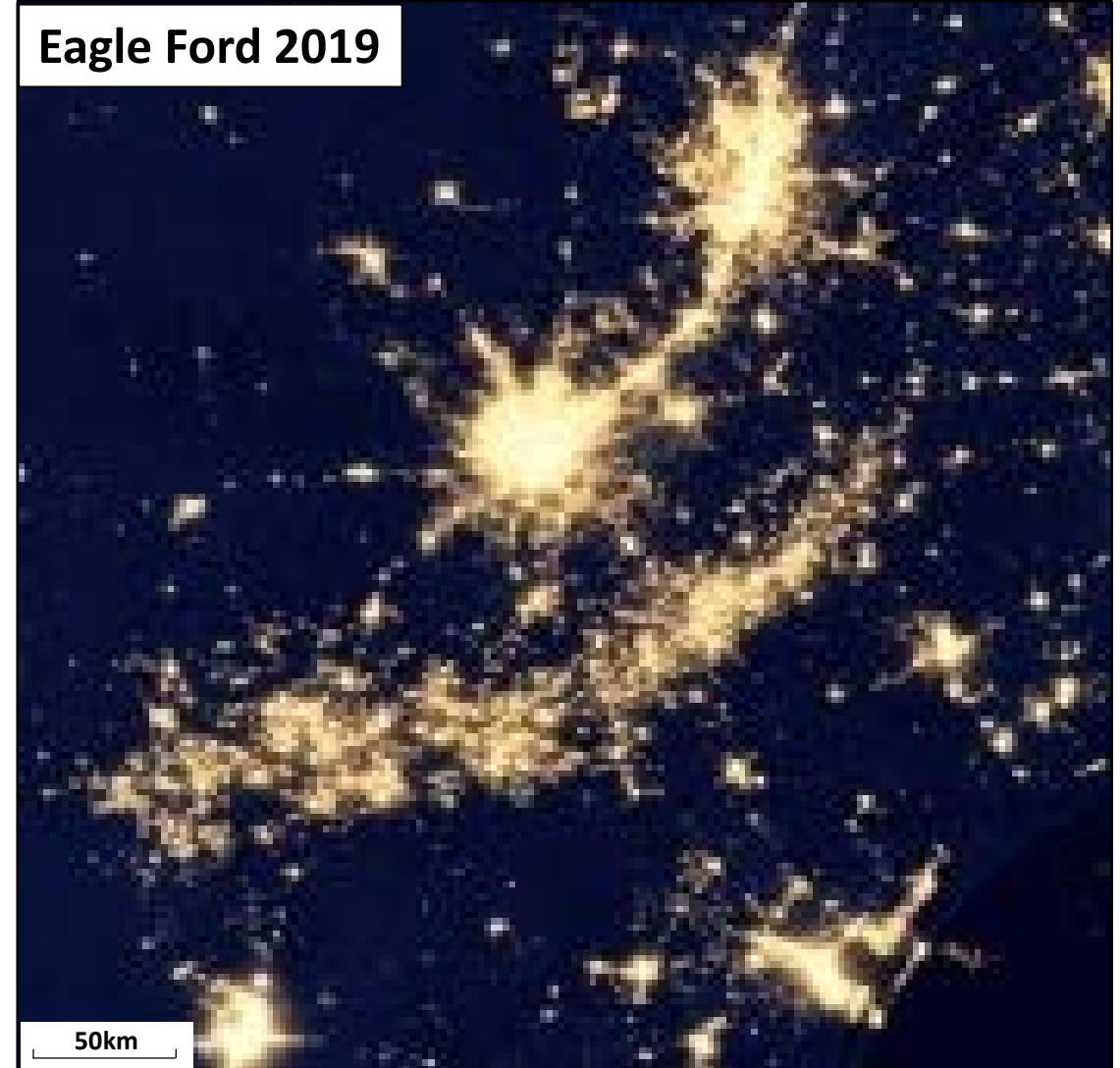
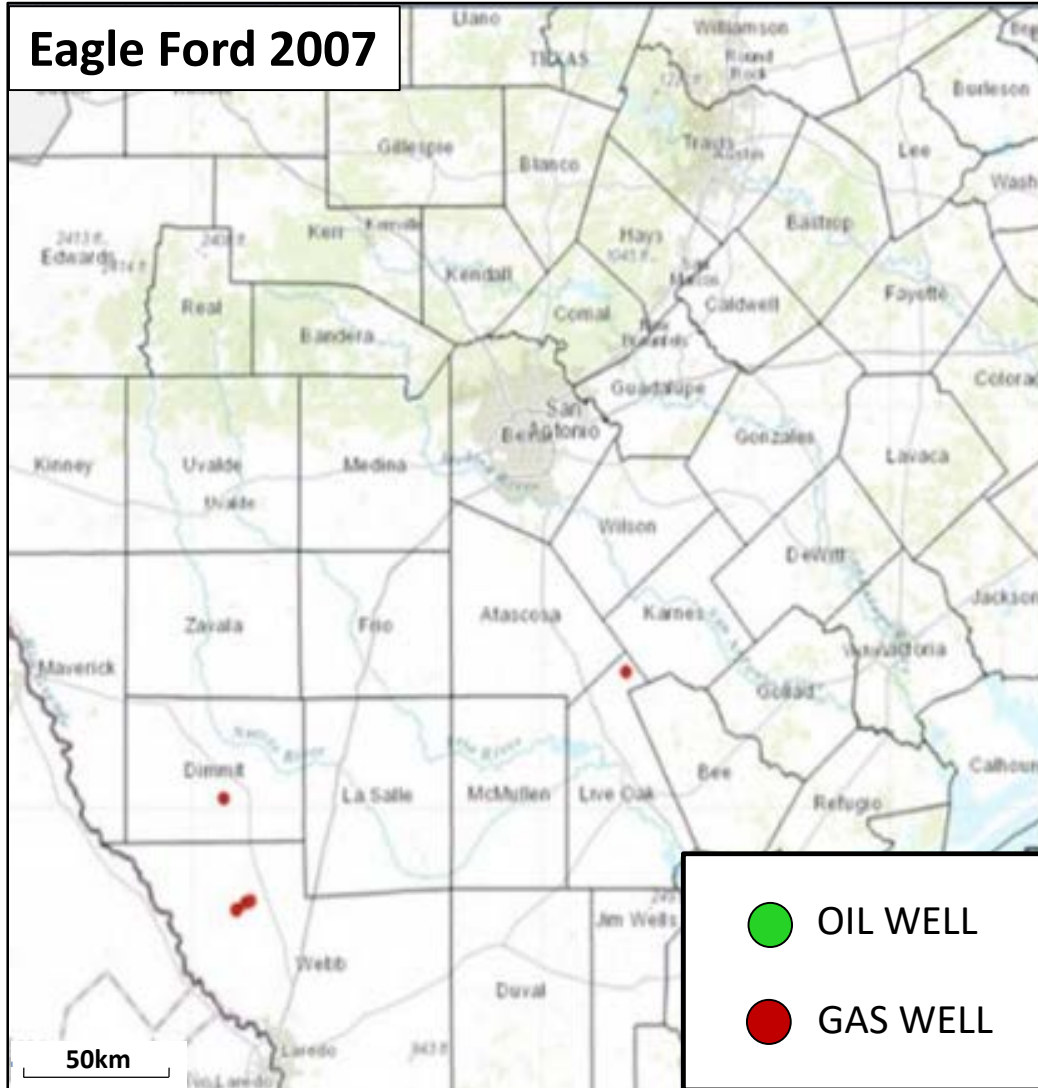
INDEPENDENT EXPERT & TECHNICAL SPECIALIST INVOLVEMENT IN AUSTRALIAN O&G TRANSACTIONS

RISC has been involved in 11 of 19 O&G transactions observed over the past 10 years

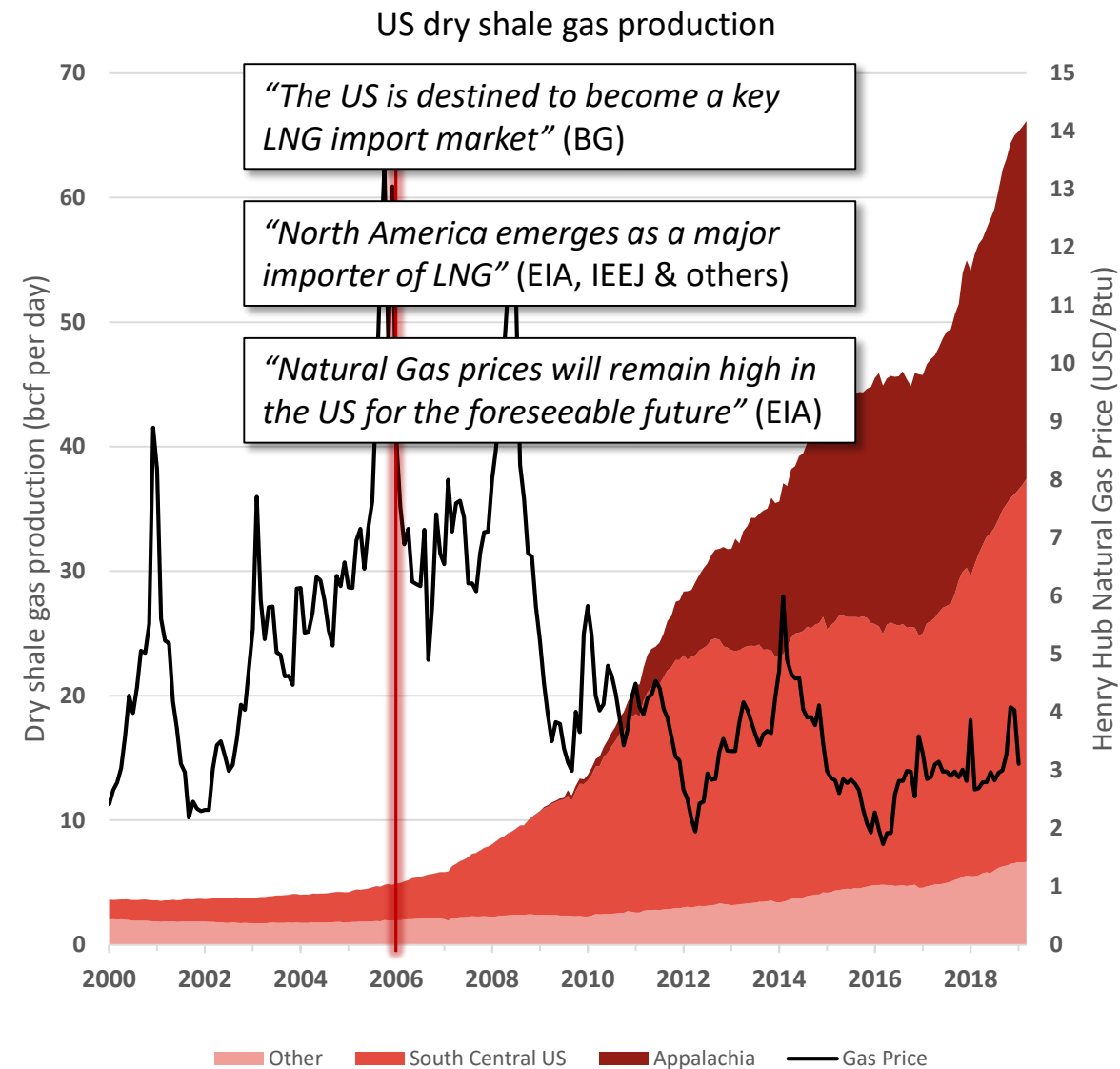
RISC London has the same capability in UK and Europe

Year	Target / Asset	Bidder	Value (AUD'MM)	Independent expert	Technical specialist	
2018	UIL Energy Ltd	Strike West Holdings Pty Ltd	16	BDO Corporate Finance	RISC Operations Pty Ltd	
2018	Sino Gas & Energy Holdings Ltd	LSF10 Summertime Investments	530	Grant Thornton	RISC Operations Pty Ltd	
2018	AWE Ltd	Mitsui & Co Ltd	594	Grant Thornton	RISC Operations Pty Ltd	
2016	Horizon Oil (refinancing)	IMC Investments Limited	n/a	Grant Samuel & Associates	RISC Operations Pty Ltd	
2015	Drillsearch Energy Ltd	Beach Petroleum Ltd	399	Ernst & Young Corporate Finance	RISC Operations Pty Ltd	
2015	Cue Energy Resources Ltd	NZOG Offshore Limited	70	Grant Samuel & Associates	RISC Operations Pty Ltd	
2014	Dart Energy Ltd	IGas Energy plc	Completed deals with due diligence supplied or managed by RISC Advisory's London Office			
2014	Aurora Oil & Gas Ltd	Baytex Energy Corp				
2014	ROC Oil	Fosun (post Horizon)	Year	Acquirer	Seller & Asset/Company	Value (USD\$)
2014	Nexus Energy Ltd	Seven Group Holdings	2019	BlackRock	ADNOC oil pipelines	\$4 Billion
2012	Texon Petroleum Ltd	Sundance Energy Ltd	2018	Vitol, Delonex, Africa Oil Corp	Petrobras Nigeria	\$1.5 Billion
2011	Bow Energy Ltd	Arrow Energy Holdings	2018	Ophir	Santos SE Asia assets	\$ 205 million
2011	Eastern Star Gas Ltd	Santos Ltd	2015	Premier Oil	E.On UK	\$120 million
2010	Apollo Gas Ltd	Dart Energy Ltd	2015	First Reserve	EMAS Offshore Lewek FPSO	\$166 million
2010	Mosaic Oil NL	AGL Energy Ltd	2013	Qatar Petroleum	Total E&P Congo assets	\$1.6 Billion
2010	Adelphi Energy Ltd	ARC Energy Ltd	2012	Premier Oil	Rockhopper Falklands assets	\$1 Billion
2010	Arrow Energy Ltd	CS CSG (Australia)	2009	Centrica plc	Venture Production plc	\$2.1 Billion
2008	Origin Energy	BG Group plc / ConocoPhillips	2009	Premier Oil	Oilexco	\$505 million
2008	Anzon Australia Limited	ROC Oil (off-market)				

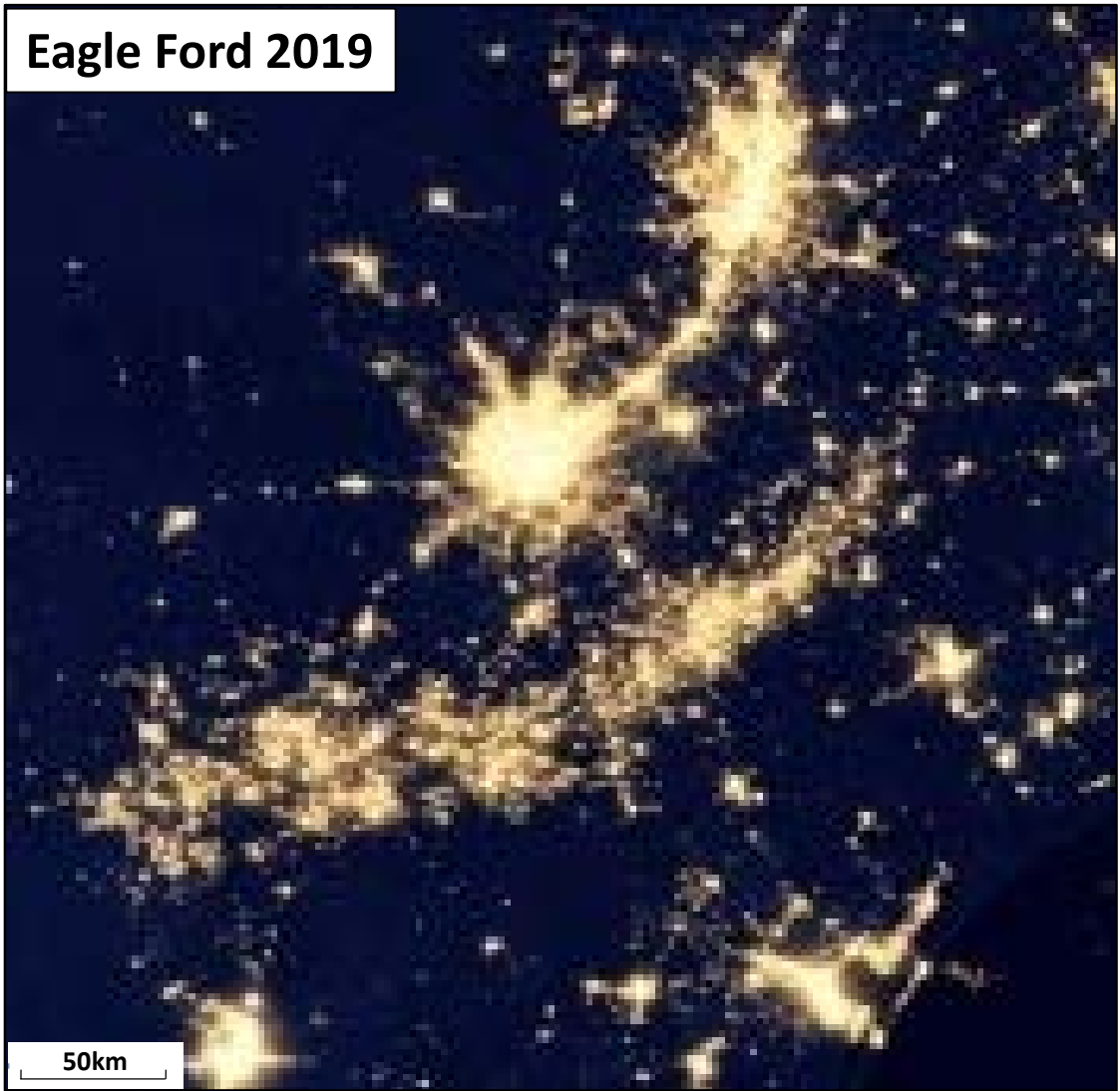
Where it all started: Growth of the Eagle Ford



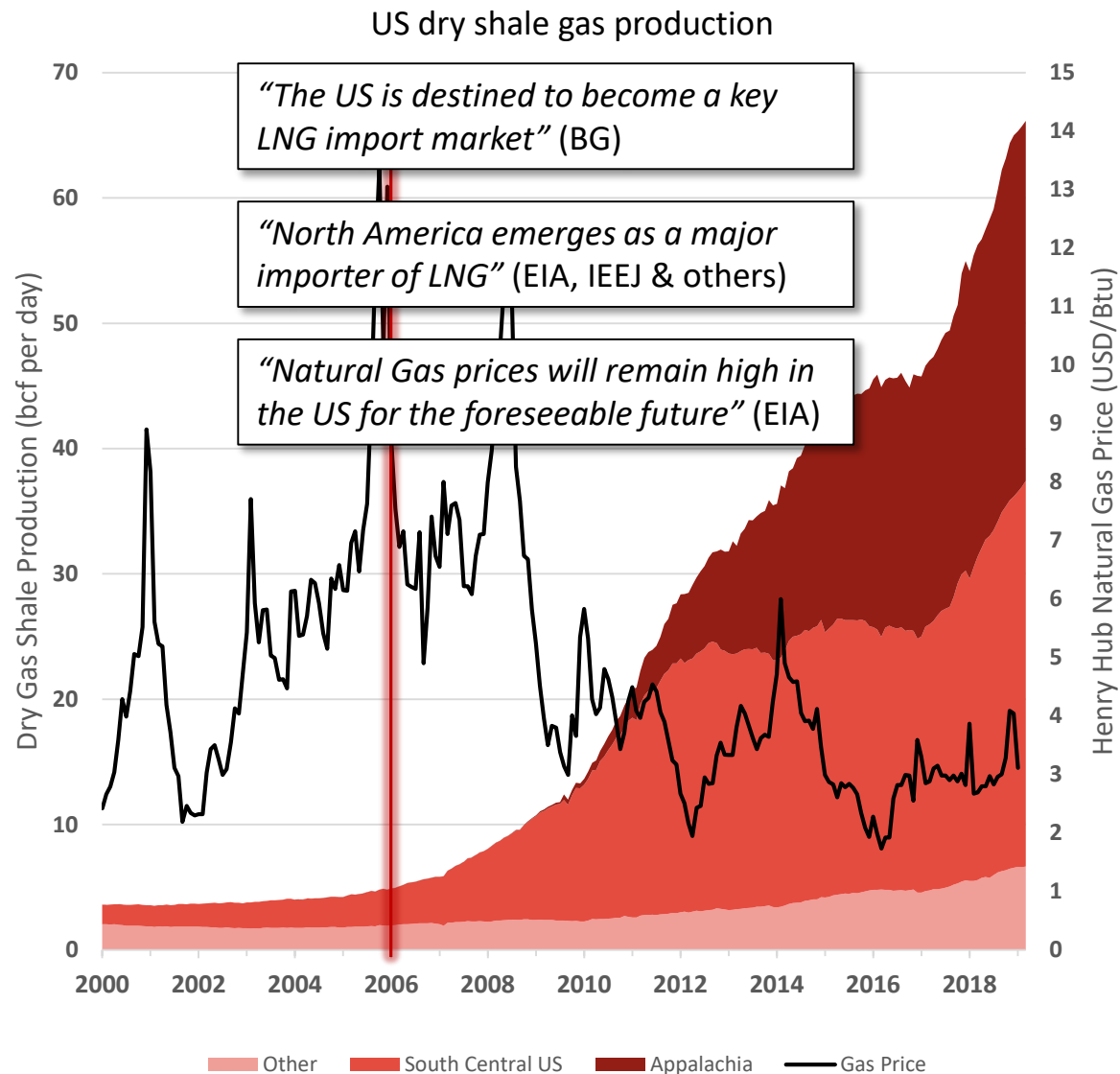
Growth in US natural gas production



Source: EIA



History repeating itself on Australia's east coast



NATURAL GAS — 27 Feb 2019 | 07:44 UTC — Sydney

Australia's east coast needs to urgently start importing LNG: EnergyQuest

Sydney — Australia's gas-strapped east coast needs to urgently start importing LNG in order to mitigate a range of risk factors stretching from supply issues to regulatory uncertainties, energy consultancy EnergyQuest said Wednesday.

When insanity makes sense: Australia's best option is LNG imports

By Clyde Russell
March 7, 2019 — 12:06pm

Australia has painted itself into a corner with its natural gas industry and faces the stark reality that there are no easy choices to alleviate the dual problem of a looming supply crunch and the associated higher prices.

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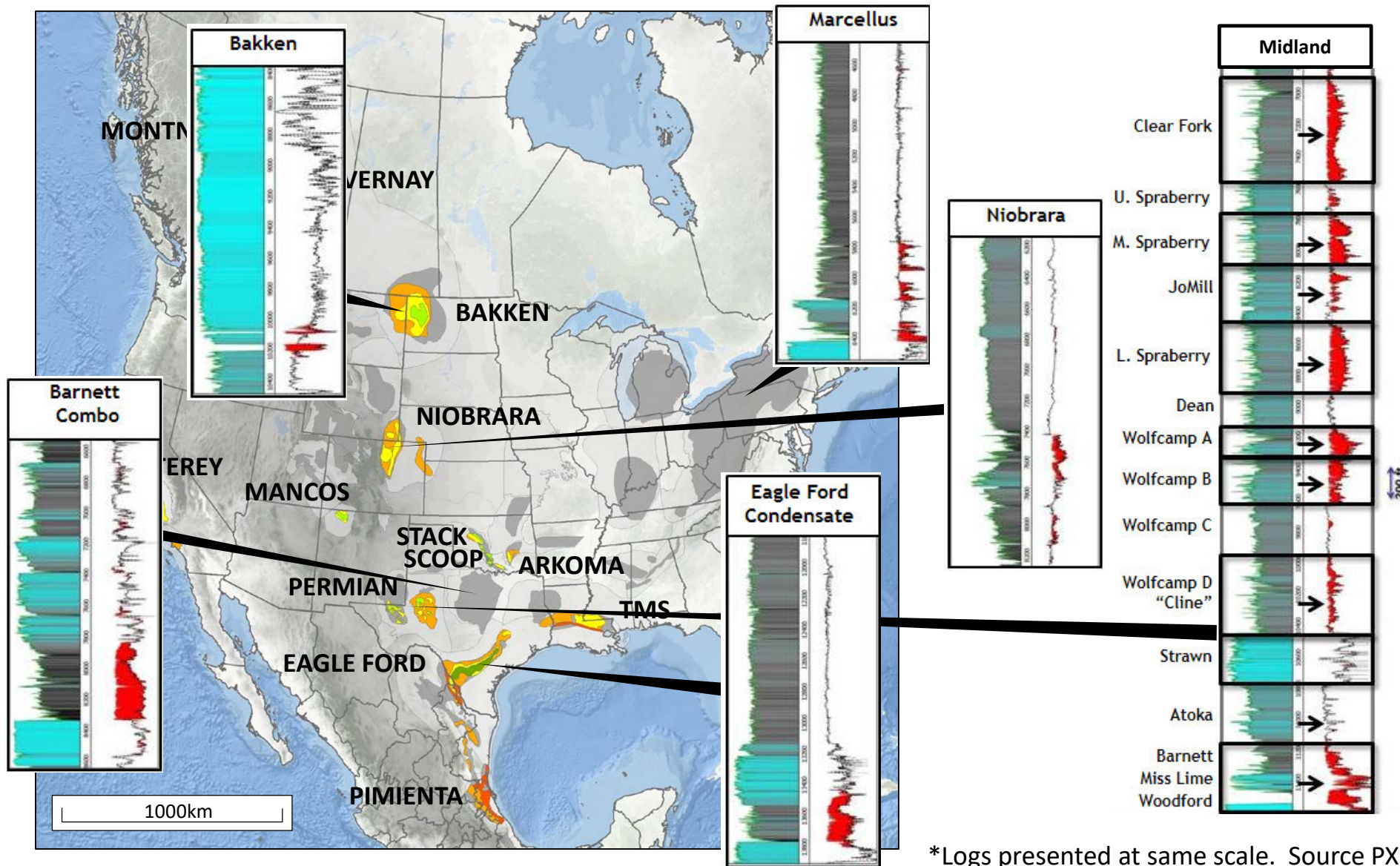
LNG import terminal approval — an Australian first — a sign of hope for NSW manufacturing

ABC Illawarra By Kelly Fuller and Gavin Coote

FROM ABC ILLAWARRA

- Why Tania Daykin is putting old chickens before the eggs
- Art and alcohol bringing out creative flair in expanding entertainment landscape
- Liberal candidate angry over 'go back to where you came from' comment

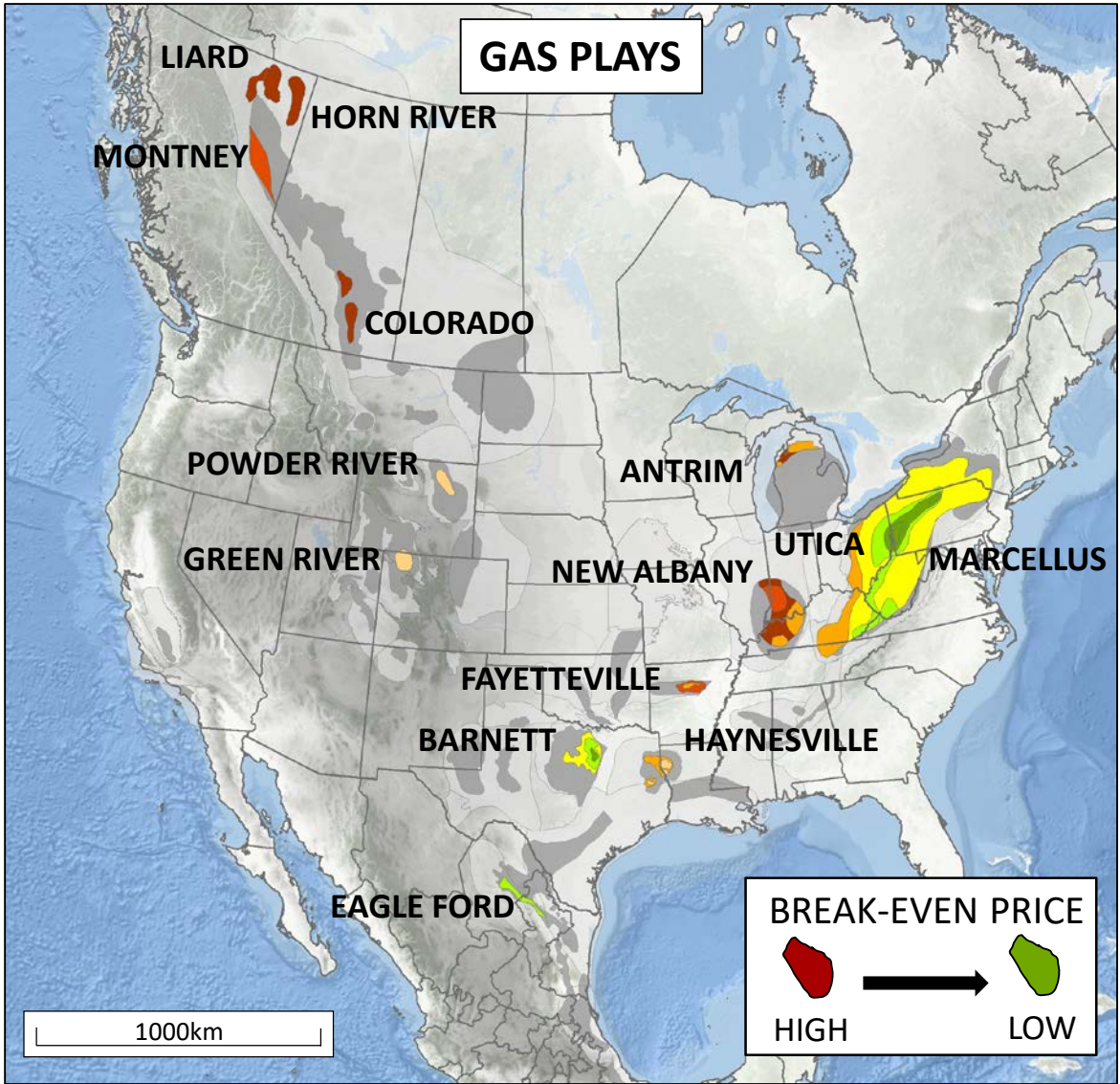
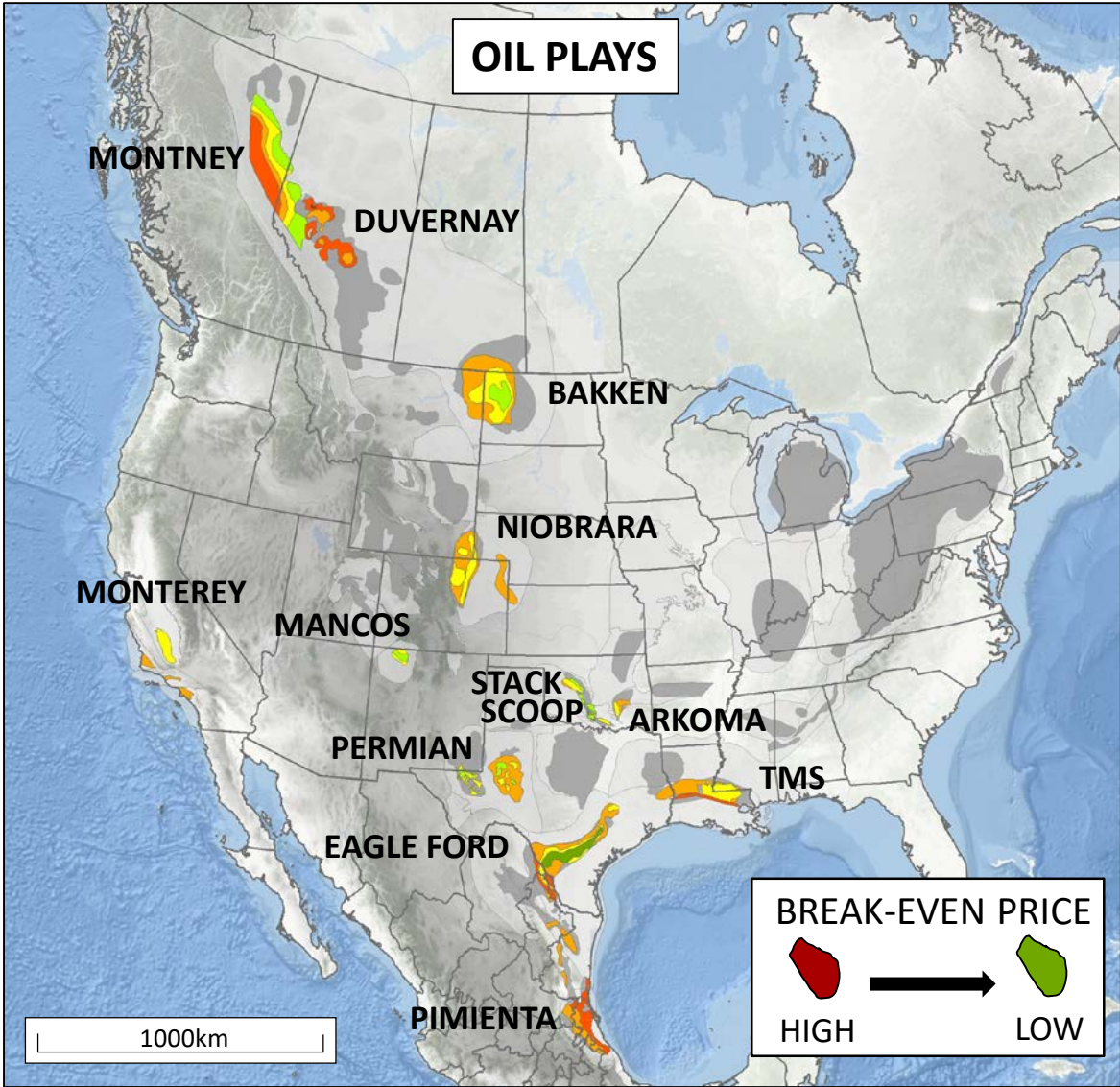
Major North American unconventional plays



- Discrete zones of higher porosity /higher resistivity
- Plays are laterally heterogeneous
- Over-pressure. Rate more important than in-place
- Finding the balance in GOR. Rate versus product
- Areas of very mature conventional production – data / infrastructure / tolerant community stakeholders

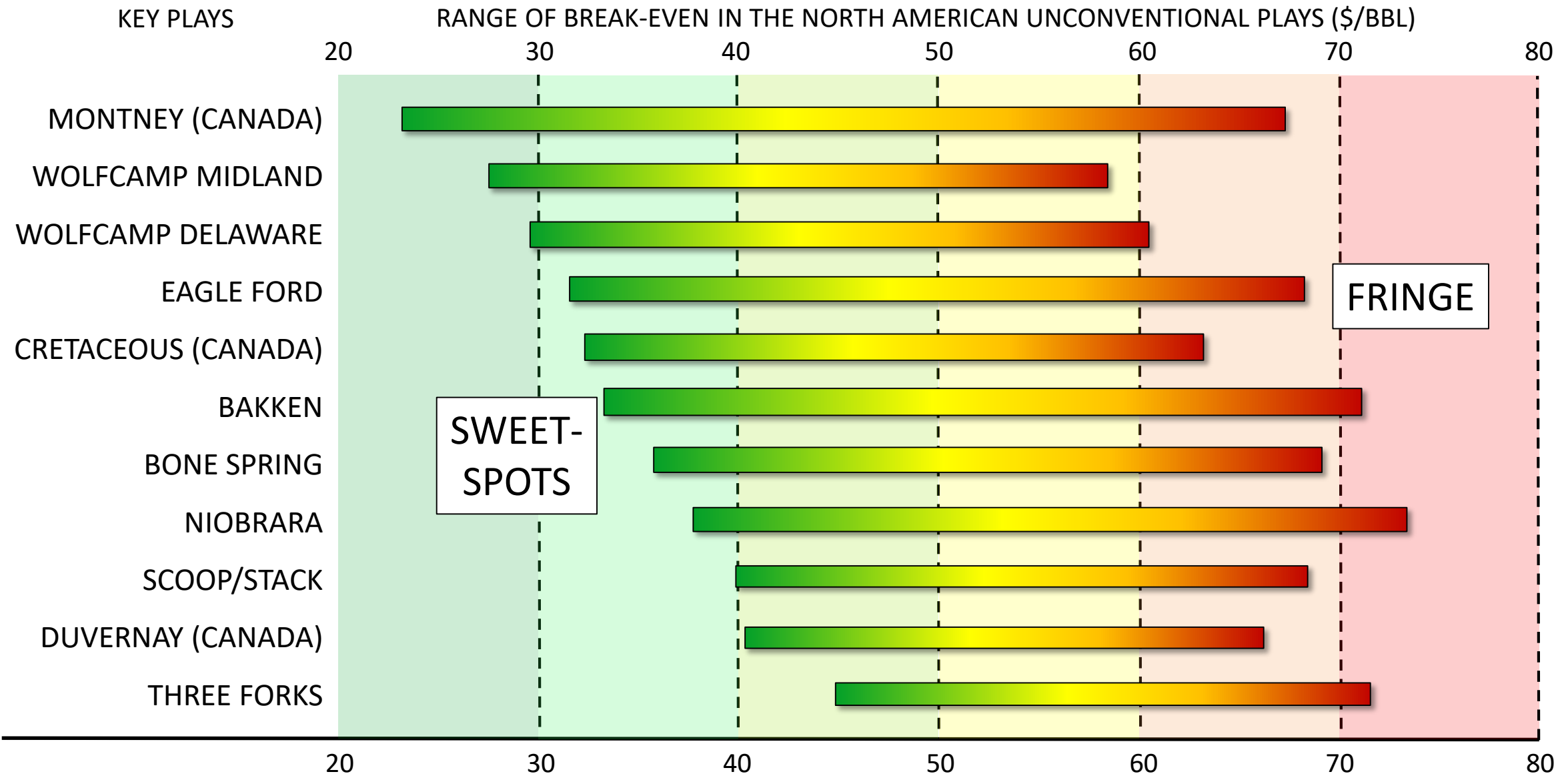
*Logs presented at same scale. Source PXD

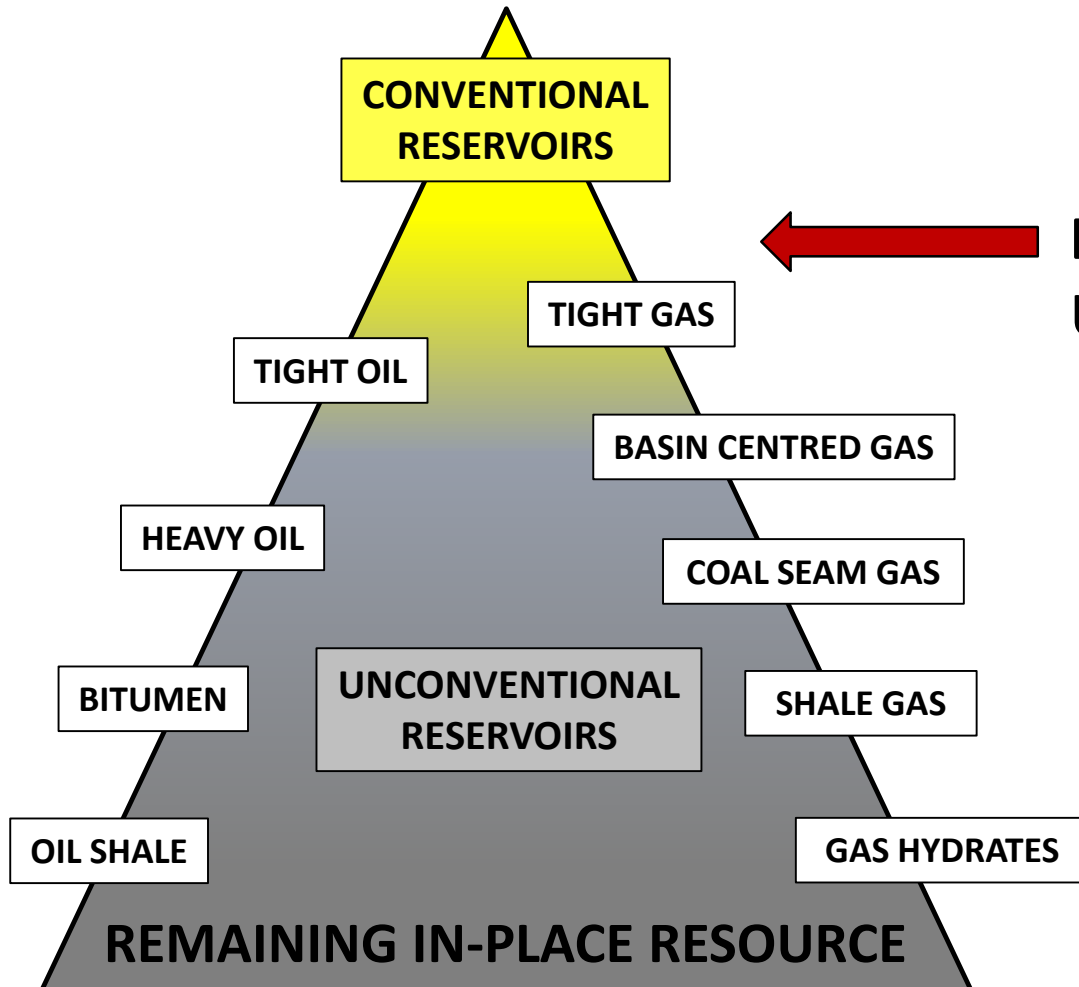
Heterogeneity in unconventional plays



Source: Consensus view from public domain information

Break-even oil prices for new wells in North American plays





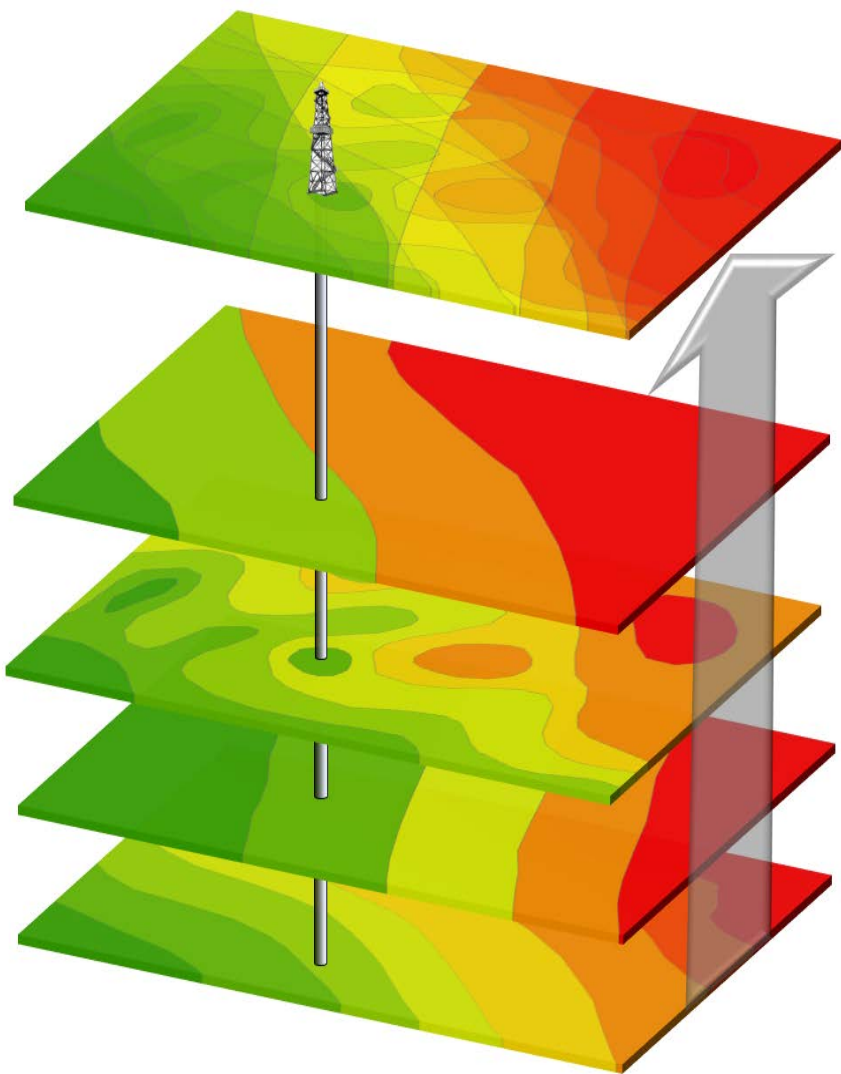
THERE ARE NO HARD LINES
BETWEEN CONVENTIONAL AND
UNCONVENTIONAL RESOURCES

**UNCONVENTIONAL RESERVOIRS SHARE A LOT OF
SIMILAR CHARACTERISTICS TO CONVENTIONAL RESERVOIRS**

- Zones of higher porosity / permeability
- Zones of higher resistivity
- Zones of higher pressure
- Regional structures or structural highs

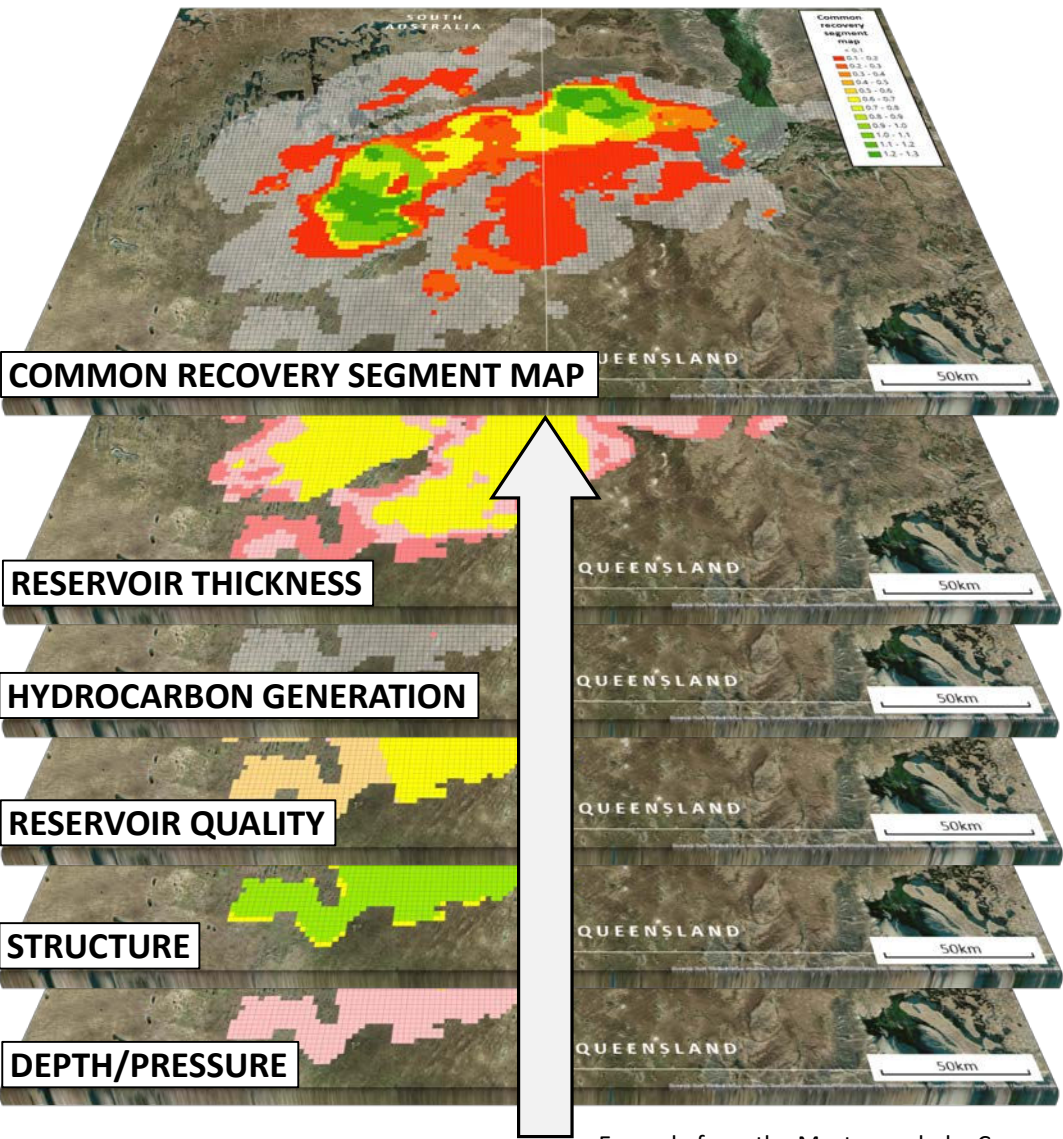
**UNDERSTANDING HETROGENEITY IS KEY - ITS NOT JUST A
GAME OF FINDING A SHALE AND FRACING THE BEJEEZUS
OUT OF IT**

Common recovery segment mapping



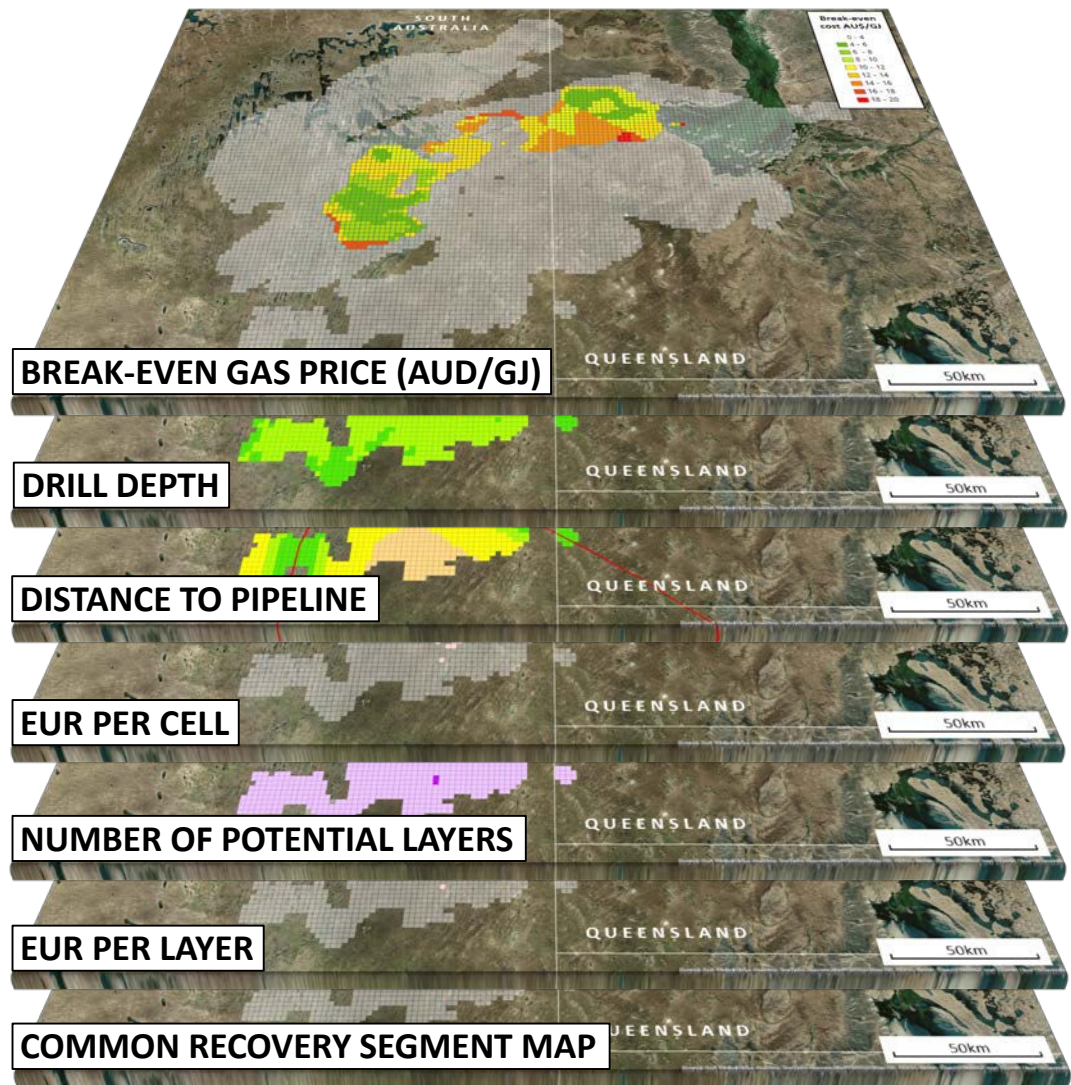
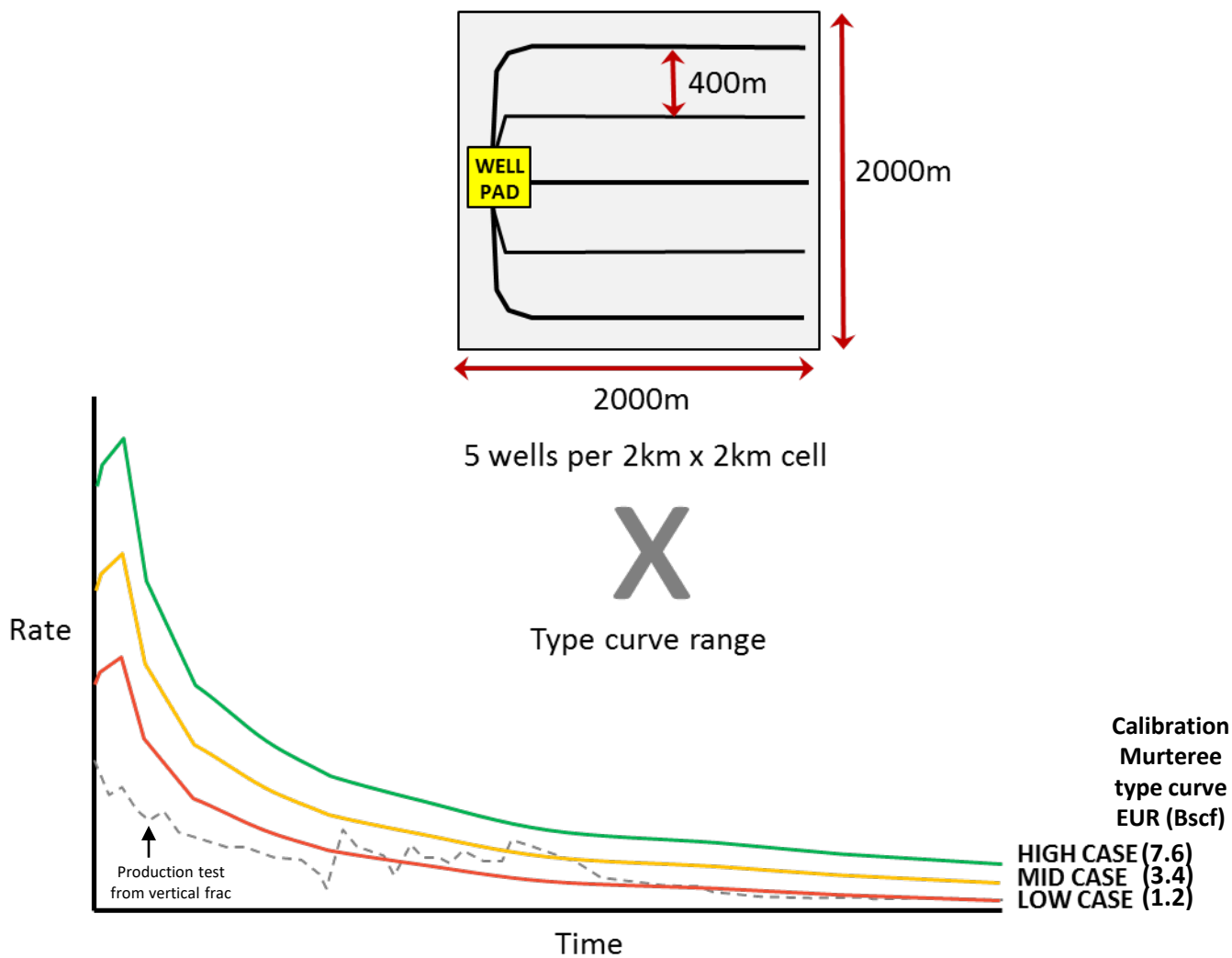
**COMMON RECOVERY
SEGMENT MAP
(Sweet Spot Map)**

RECOVERY
POTENTIAL IS THE
COMBINED
EFFECT OF
MULTIPLE
ATTRIBUTES

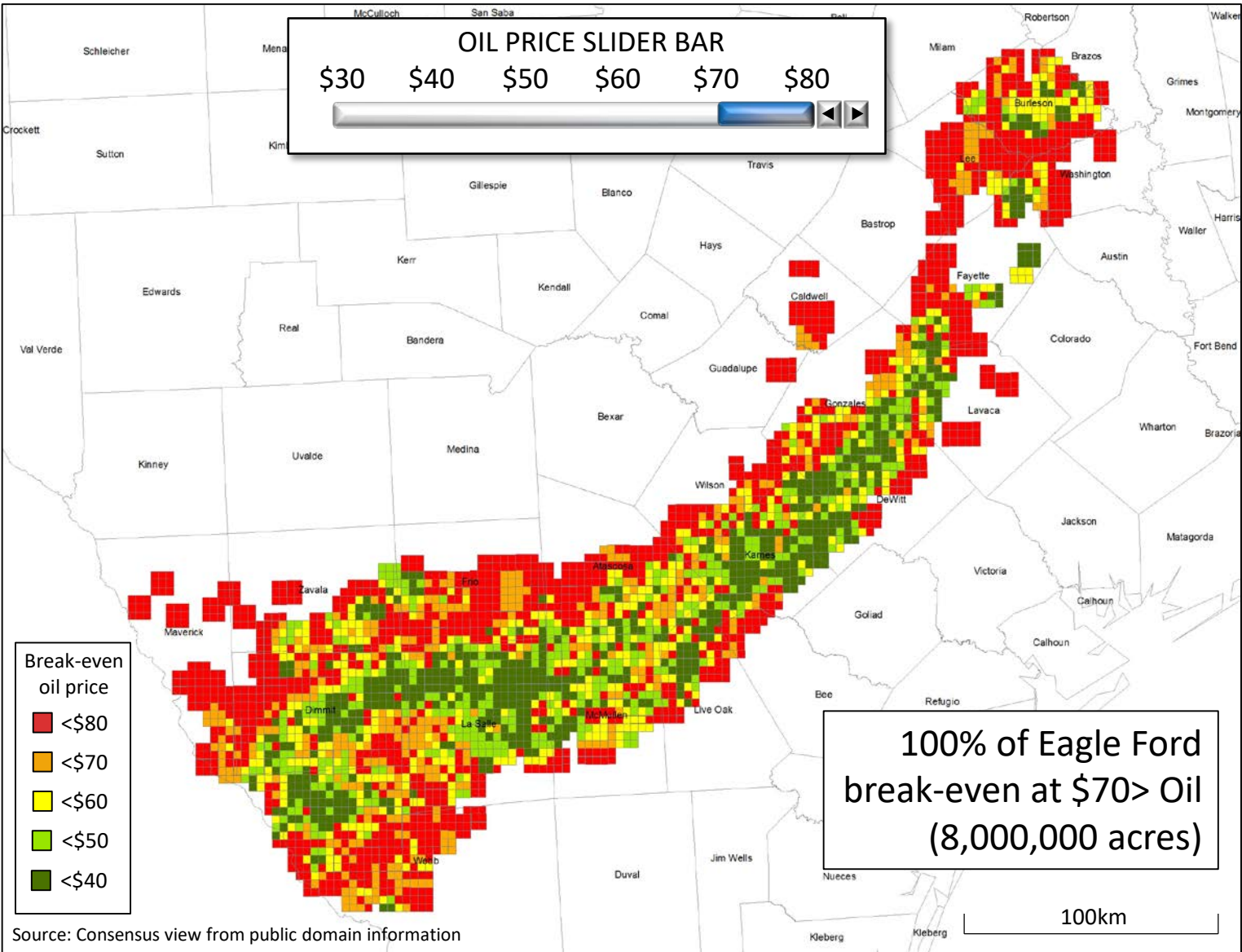
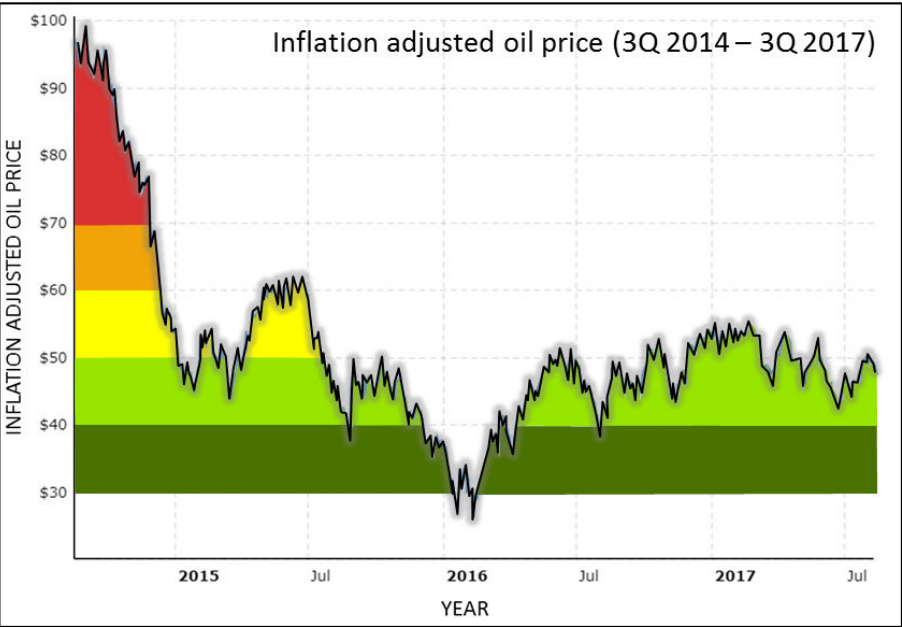
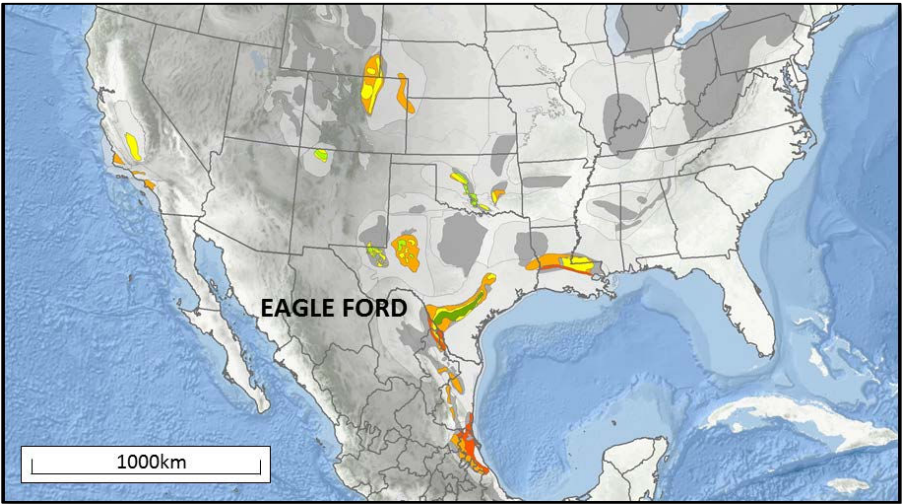


Example from the Murterree shale, Cooper basin

Break-even gas price mapping



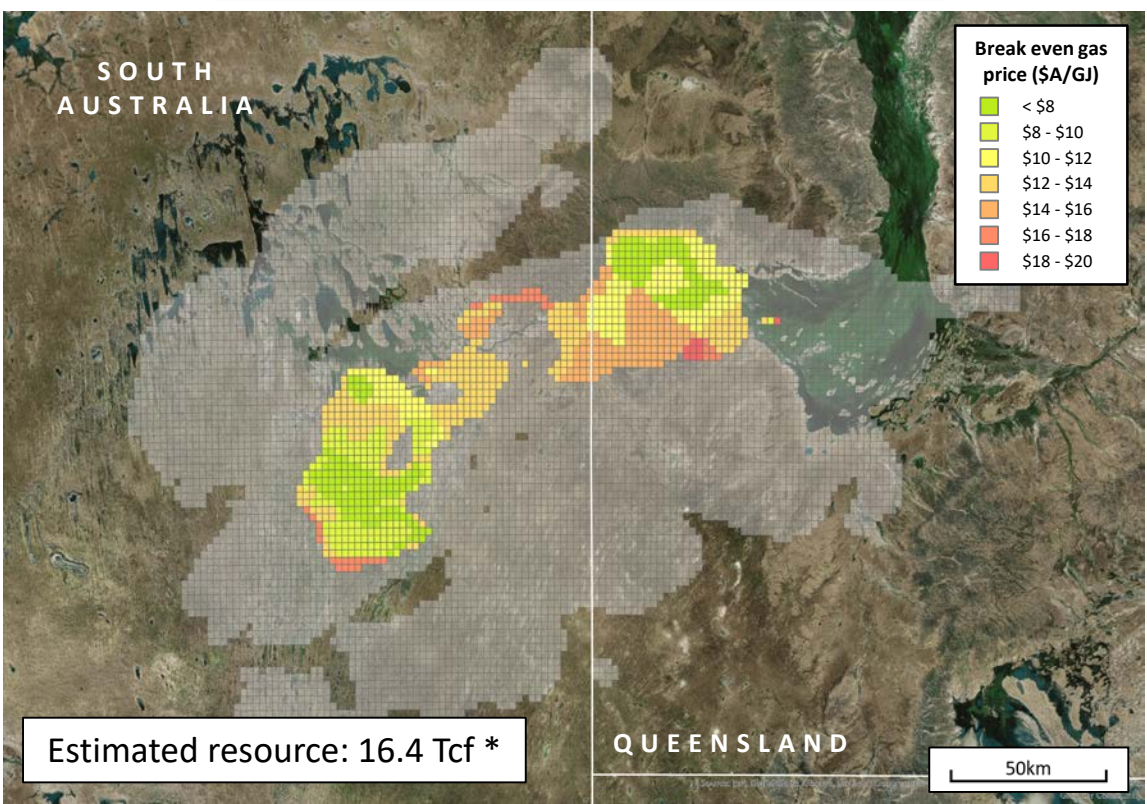
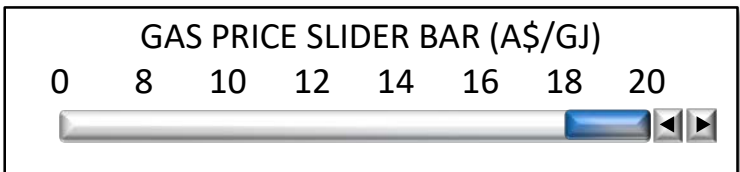
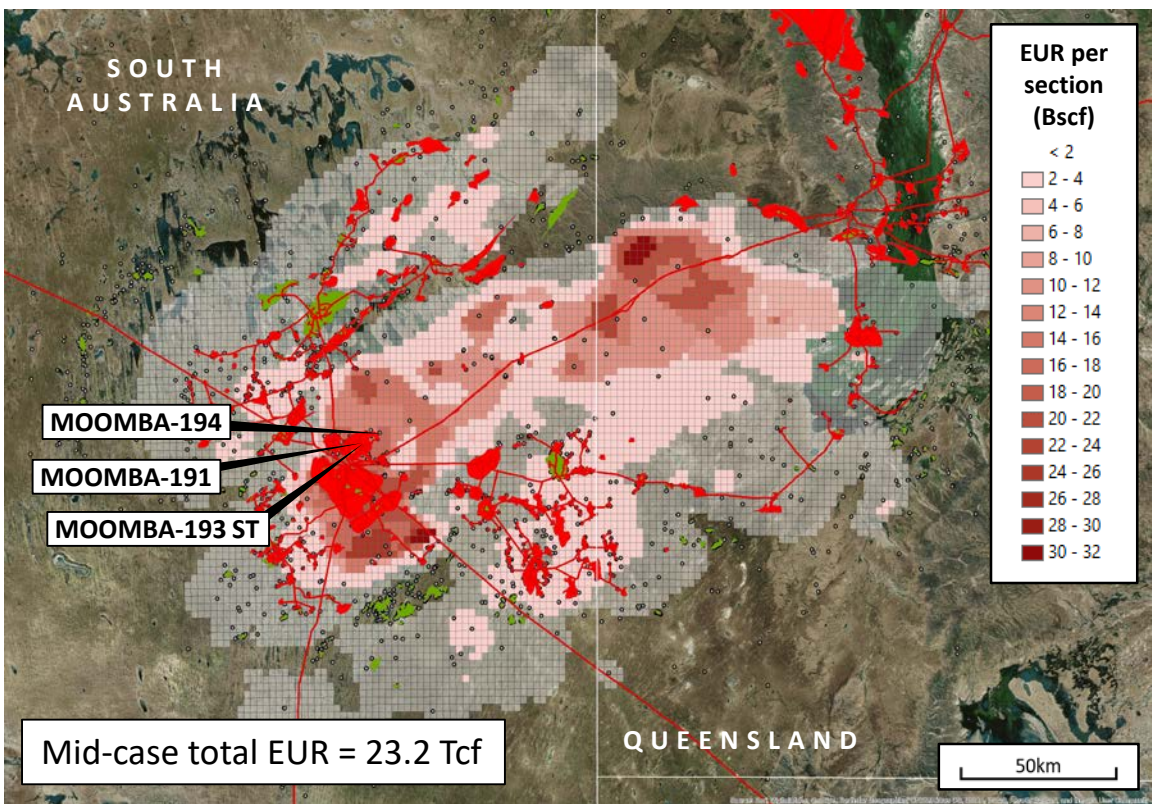
Eagle Ford break-even analysis



Break-even price development of the Murteree play



MURTEREE ESTIMATED ULTIMATE RECOVERY POTENTIAL

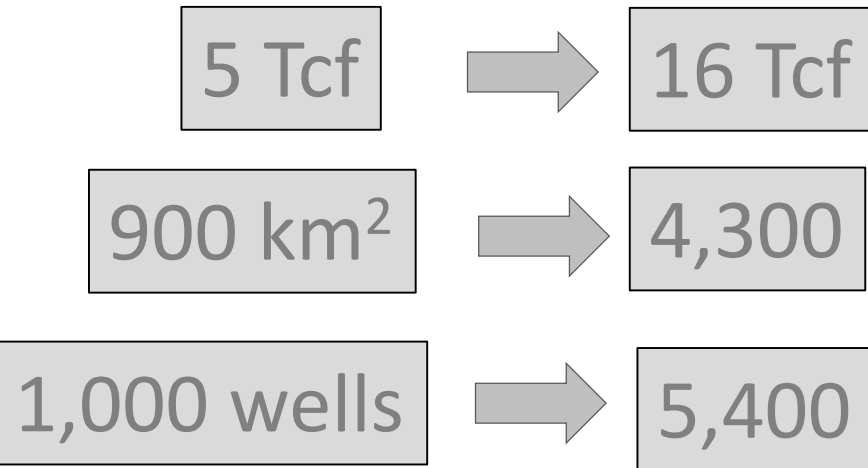


* Mid-case type curve EUR with full development (Well count: **5363**)

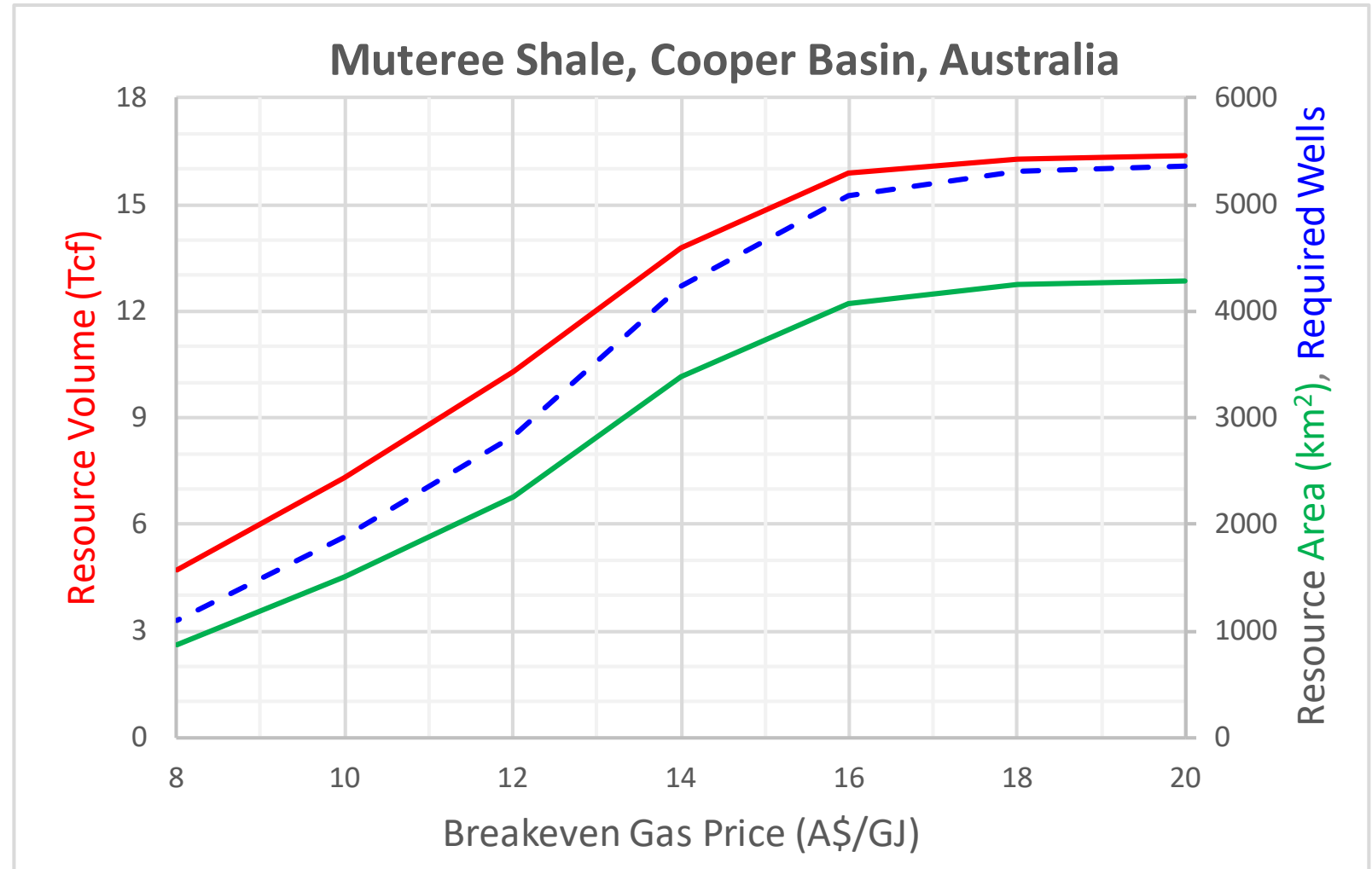
Break-even price development of the Murteree play



Depending upon gas price:



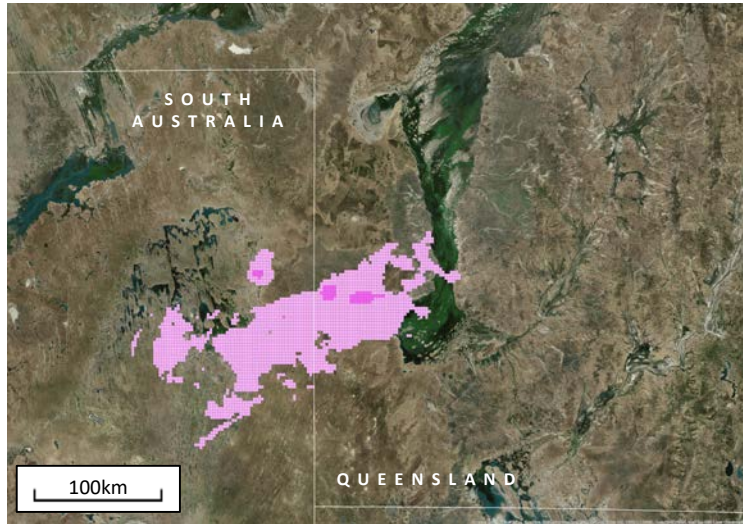
Murteree is one of 6 shale plays in Cooper Basin



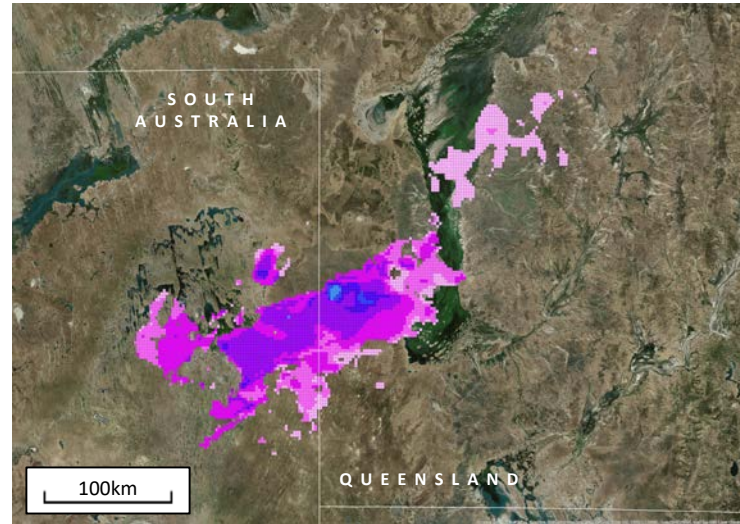
Cooper basin resource totals (all prospective units) at \$8/GJ break-even



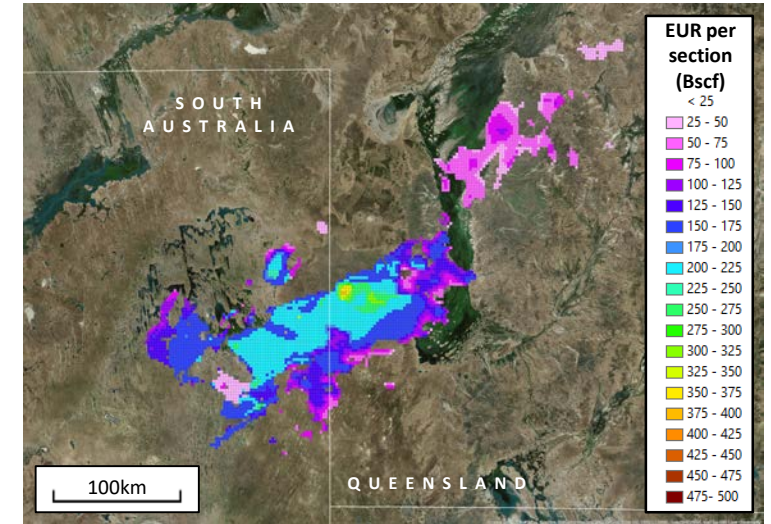
Low estimate



Mid estimate



High estimate



Total resource estimates for Cooper unconventional plays at \$8/GJ

106 Tcf

288 Tcf

548 Tcf

-10% for inert gas and assuming 40% of maximum development

33 Tcf

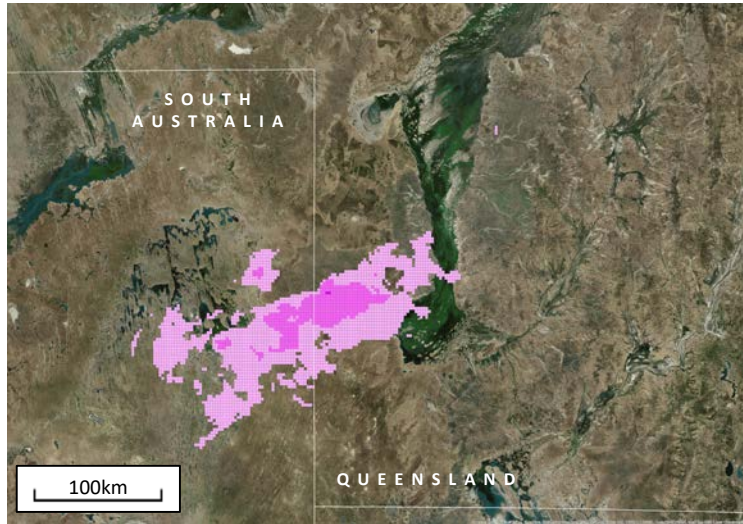
99 Tcf

192 Tcf

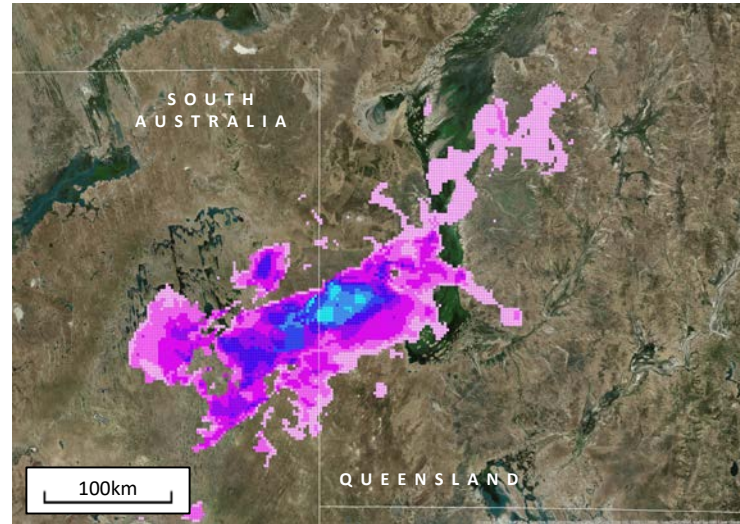
Cooper basin resource totals (all prospective units) at \$12/GJ break-even



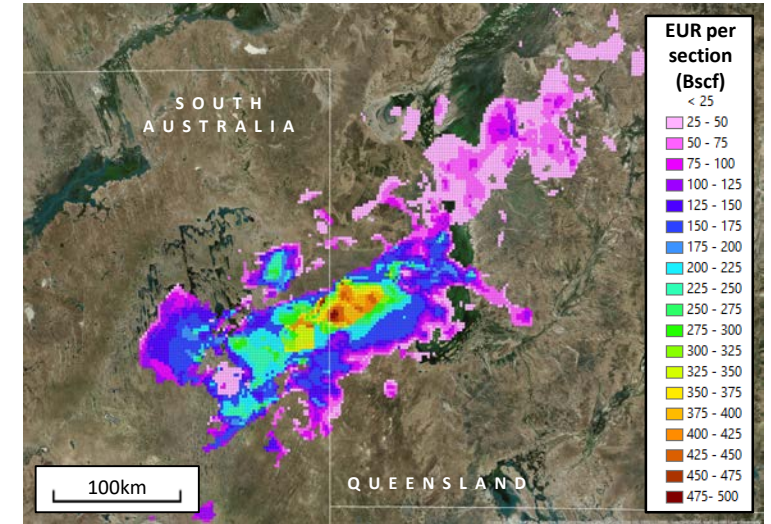
Low estimate



Mid estimate



High estimate



Total resource estimates for Cooper unconventional plays at \$12/GJ

158 Tcf

427 Tcf

829 Tcf

-10% for inert gas and assuming 40% of maximum development

52 Tcf

149 Tcf

294 Tcf

- Proven unconventional systems are typically extensions of conventional petroleum systems
- Heterogeneity is key. Resource potential is tied to wells drilled – which is tied to demand and pricing. The *'unconventional accordion'*
- Rising gas prices in the Eastern Australian gas market are driving speculation about LNG import requirements for the market. The same speculation occurred in the US in the mid 2000's. The US responded by developing unconventional resources
- We need to quantify and understand unconventional potential to determine in what gas price environment it make sense to develop our unconventional resources



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