COMMERCIALISATION OF SHALE/TIGHT GAS IN AUSTRALIA

UBS AUSTRALIAN RESOURCES, ENERGY & UTILITIES CONFERENCE, SYDNEY

GEOFF BARKER, PARTNER

13 JUNE 2012

DECISIONS WITH CONFIDENCE

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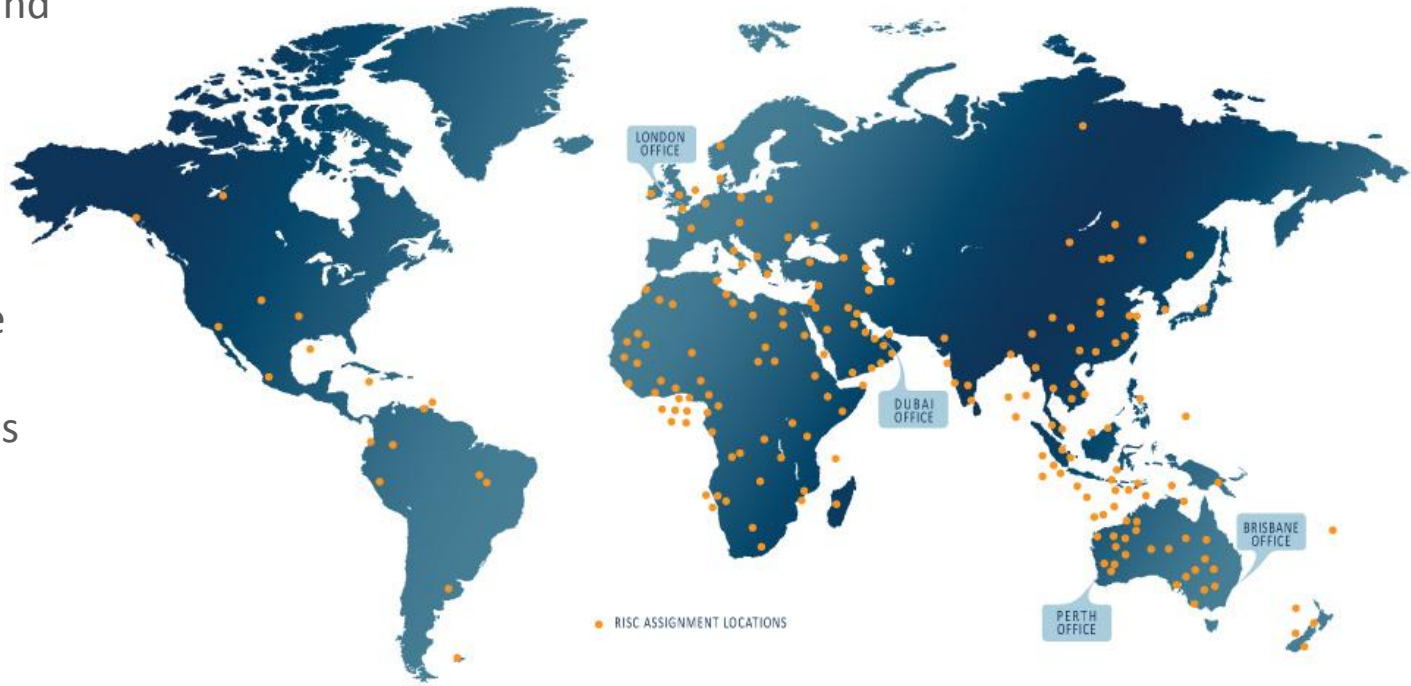
DISCUSSION TOPICS

1. SHALE / TIGHT GAS POTENTIAL
2. COMMERCIALISATION CHALLENGES
3. SOME THOUGHTS ON AUSTRALIAN LNG

RISC Advisory

- RISC is an independent oil and gas advisory firm
- Offices in Perth, Brisbane, Dubai and London
- Highest level technical, commercial and strategic advice to clients around the world.
- Basin to Boardroom services



Mission

- Enable clients are able to make key decisions with confidence.

Disclosure
The statements and opinions in this presentation are given in good faith and in the belief that such statements are neither false nor misleading. RISC recommends that specific advice relating to your particular circumstances be obtained before implementing actions mentioned in this presentation.

SHALE/TIGHT/BCG GAS POTENTIAL

Shale/Tight/BCG Gas Prospective Resources

- 545 Tcf potential prospective resources (RISC 2010/2012 & EIA 2013)
- EIA 437 Tcf in 6 Basins (2013)
- 1300 Tcf ACOLA/AWT (2013)

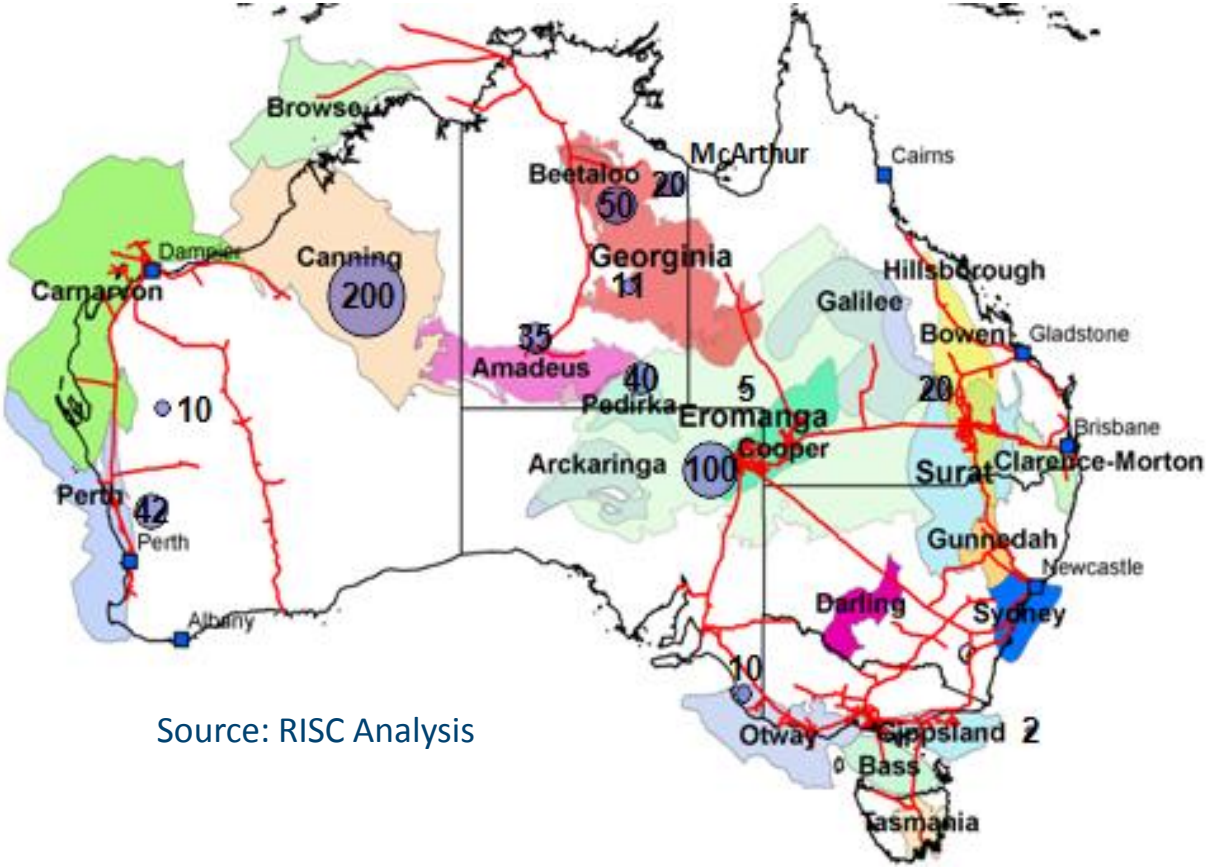
Infrastructure

- Bowen, Cooper/Eromanga, Gippsland and Otway Basins close to well developed production infrastructure

Liquids

- Approx 40% gas considered to be liquids prone which is important for commercialisation
- Areas of Canning, Cooper, Perth and McArthur Basins stand out

545 Tcf Prospective Resources

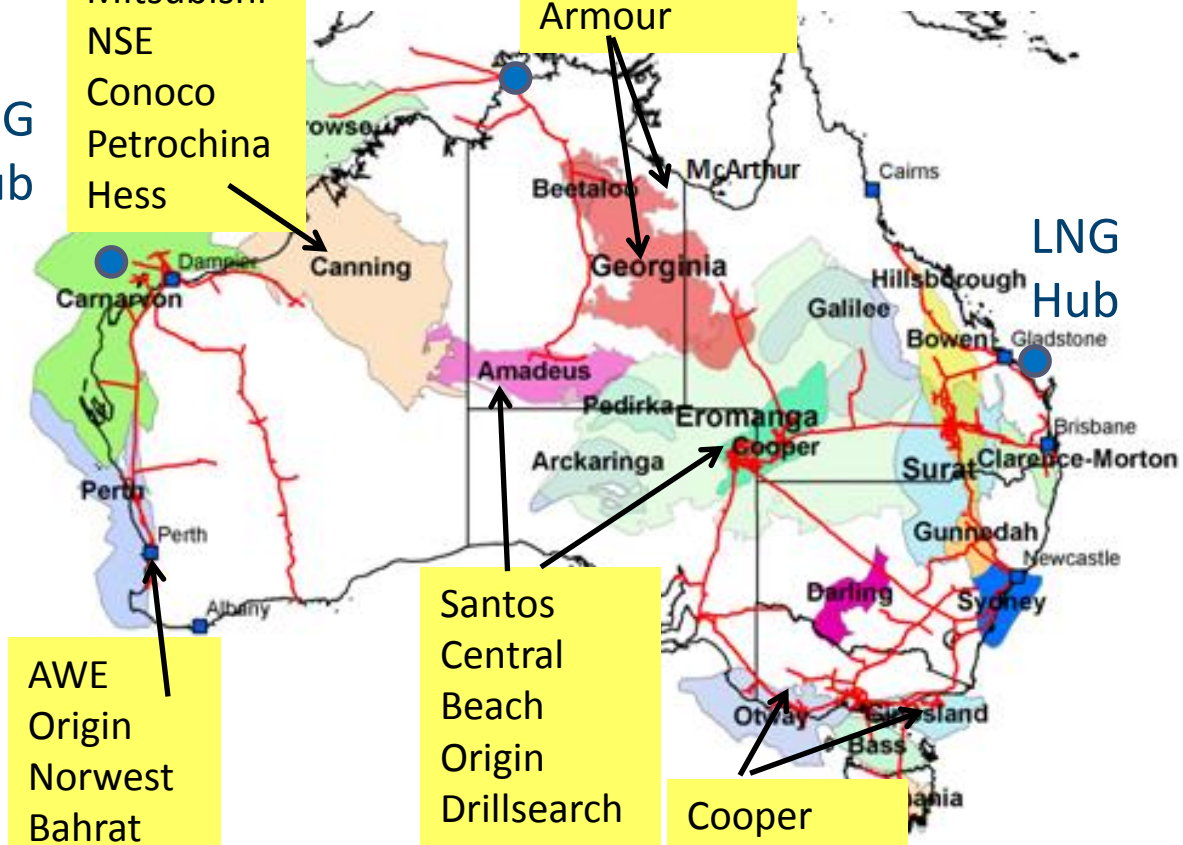


Source: RISC Analysis

SHALE/TIGHT GAS ACTIVITY HIGHLIGHTS

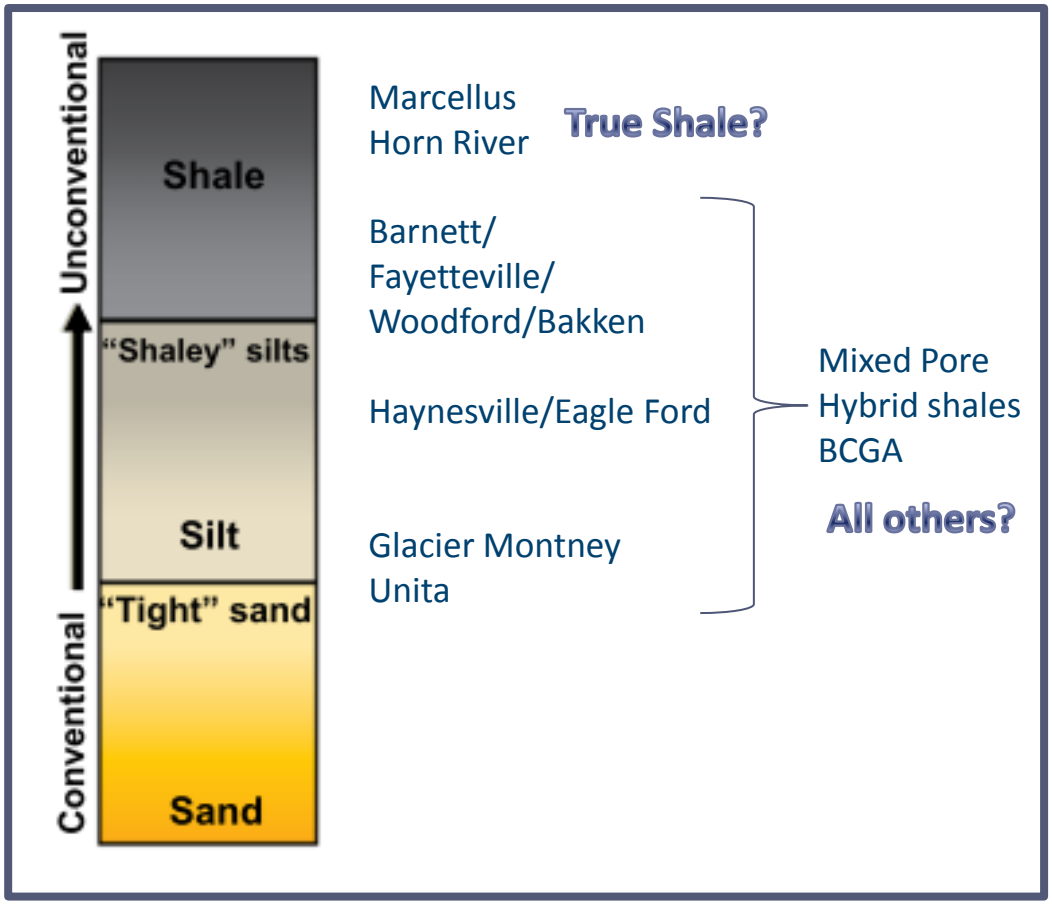
Commercial Maturity Profile

- **Cooper, Perth and Amadeus Basin** have been producing tight gas for decades
- Focus now on ultra low permeability shale/basin centred gas prospects
- Strong JV's with major players
- **Cooper** (Beach, Santos/Origin) most advanced 11 "shale/tight gas" vertical wells fracced and successfully tested, horizontal drilling underway. 1 Well hooked up and producing (Moomba 191)
- **Perth Basin** (AWE, Norwest, Transerv) 4 vertical "shale/tight gas" wells fracced and successfully flow tested
- **Canning Laurel** BCG (Buru) – 1 well fracced and tested gas/condensate, 5 wells drilled and ready for testing
- **Georgina** (Petrofrontier) 1 horizontal well fracced and tested did not produce



SHALE-TIGHT GAS CONTINUUM

SHALE VS. SILTS VS SANDSTONE



- Tight gas, shales, and hybrids are all different petroleum systems:
  - Petrophysics,
  - Completion,
  - Stimulation,
  - Economics,
- Each lithology exhibits high vertical and lateral variability (despite lateral continuity)

SHALE GAS TECHNICAL SUCCESS FACTORS

USGS Screening Criteria	Canning Basin Goldwyer Fm	Perth Basin IRCM Caringinia Kockatea	Cooper Basin REM	Amadeus Basin Horn Valley Siltstone	Beetaloo Basin Kyall Fm Velkerri Fm	Georgina Arthur Ck Fm	McArthur Barney Ck Fm	Otway Basin Eumerella Fm Casterton Fm
TOC > 2%	✓	✓	✓	✓	✓	✓	✓	✓
Porosity > 4%		✓	✓					
Overpressure	×	×	✓	✓	✓			
Dry Gas Ro > 1.2% - 3.5%	✓	✓	✓	✓	✓	✓	✓	✓
Wet Gas Ro > 0.8-1.2%	✓	✓	✓	×	✓		✓	✓
Thickness > 30m	✓	✓	✓	✓	✓	✓	✓	✓
Clay < 40%	✓	✓	✓	✓				✓
Brittleness	✓	✓	✓	✓				✓
Natural Fracture Potential	✓	✓	✓	✓				✓
High Lateral Continuity	✓	×	✓	✓	✓	✓	✓	×

BASIN CENTRED GAS (BCG)

Criteria	Canning Basin Laurel Fm	Cooper Basin Nappamerri BCG ???	Perth Basin IRCM Caringinia Kockatea
Abnormal Pressure	✓	✓	×
Low Permeability <0.1 mD	✓	✓	✓
Continuous Gas Saturation	✓	✓	×
No Downdip Water Leg	✓	✓	×

DOMESTIC GAS +20 YEARS

Western Australia

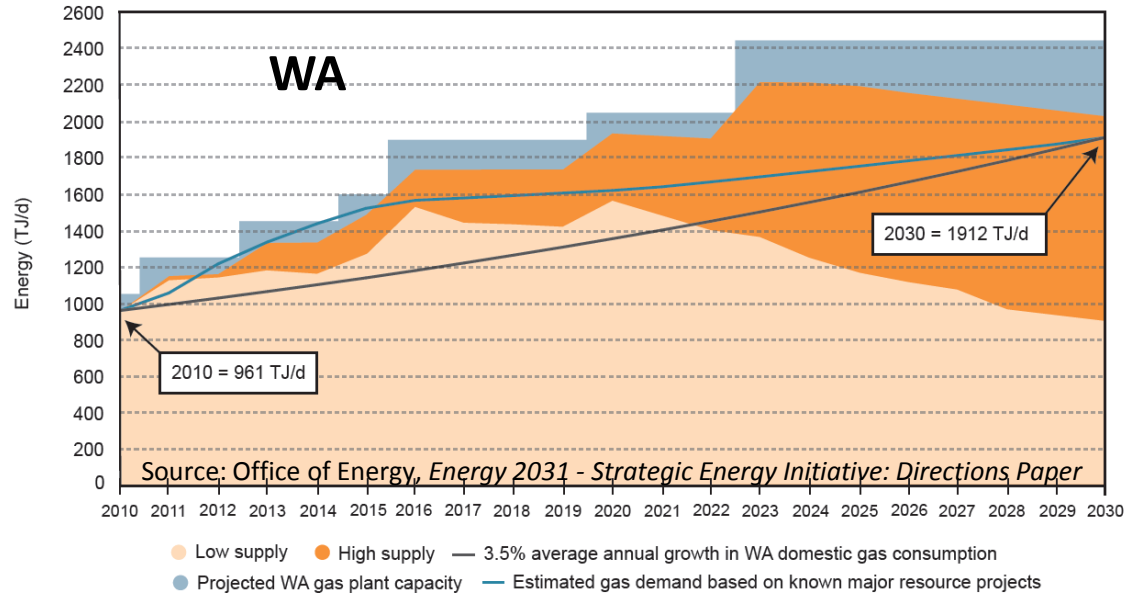
- Circa 10 Tcf demand
- Circa 2 Tcf supply shortfall

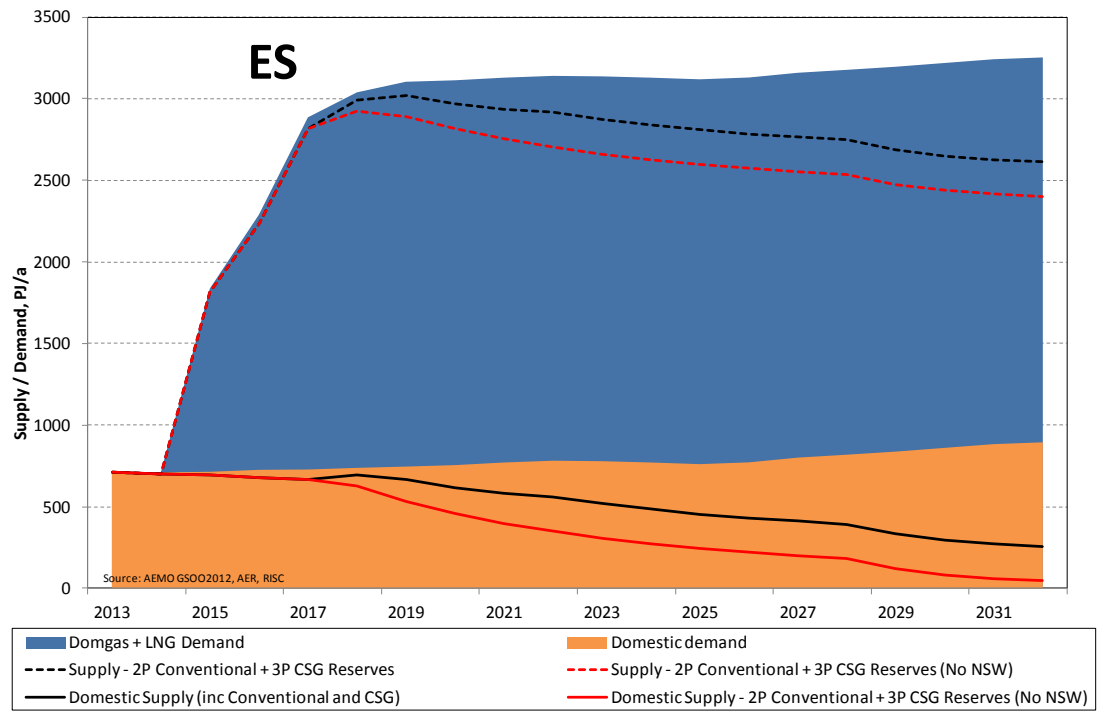
Eastern Australia

- Circa 20 Tcf domestic demand
- Circa 10-15 Tcf supply shortfall

Opportunity

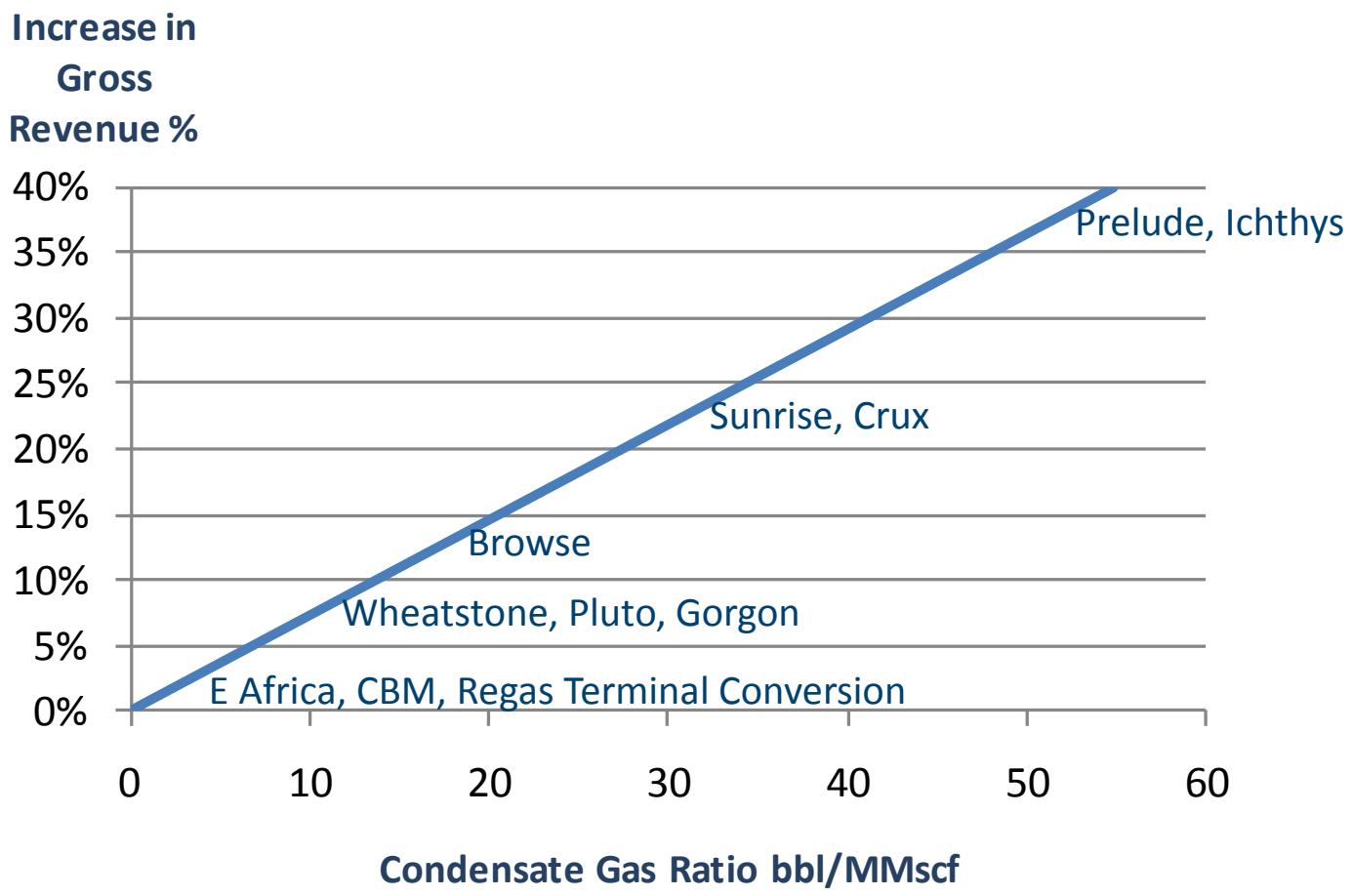
- 12-17 Tcf Domestic Gas
- Export required to monetise more than this





LIQUIDS CONTENT IMPACTS LNG REVENUE STREAMS

MODERATE LIQUIDS CONTENT IN PRODUCED GAS CAN BOOST PROJECT REVENUE BY MORE THAN 20%

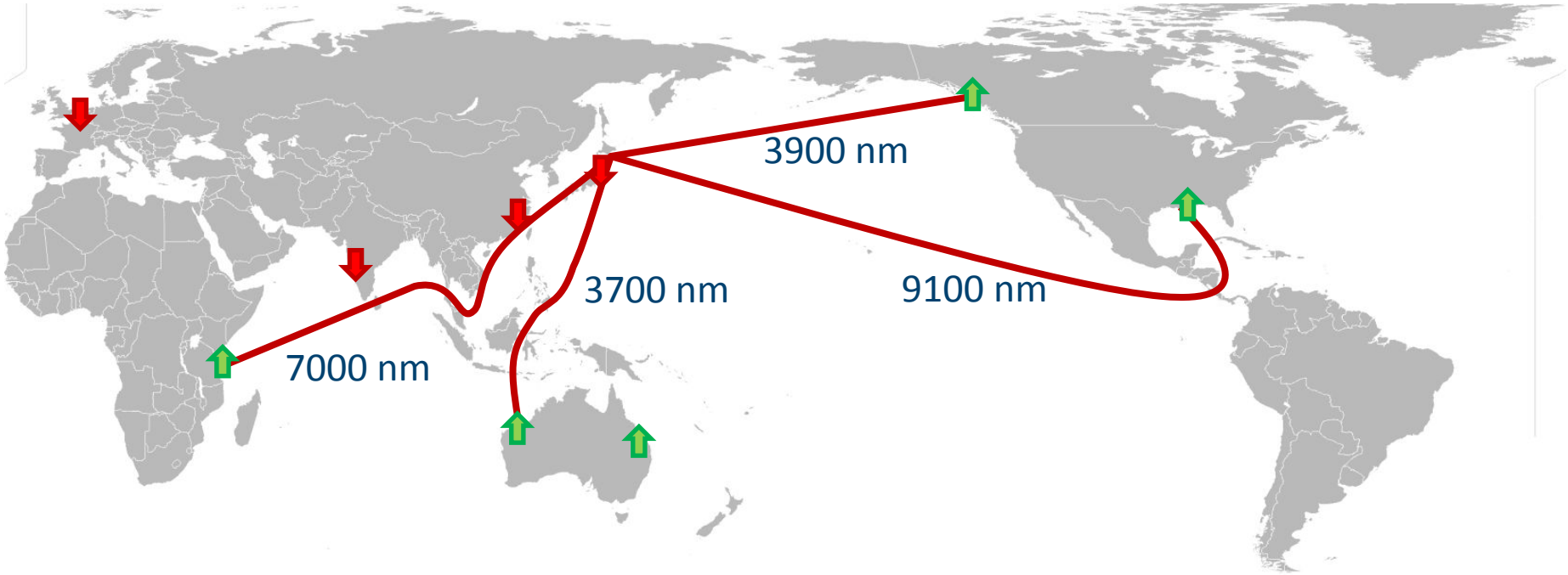


Assumes LNG sold at energy value parity to condensate
Source: RISC Analysis

DISTANCE TO MARKET IS ALSO A FACTOR

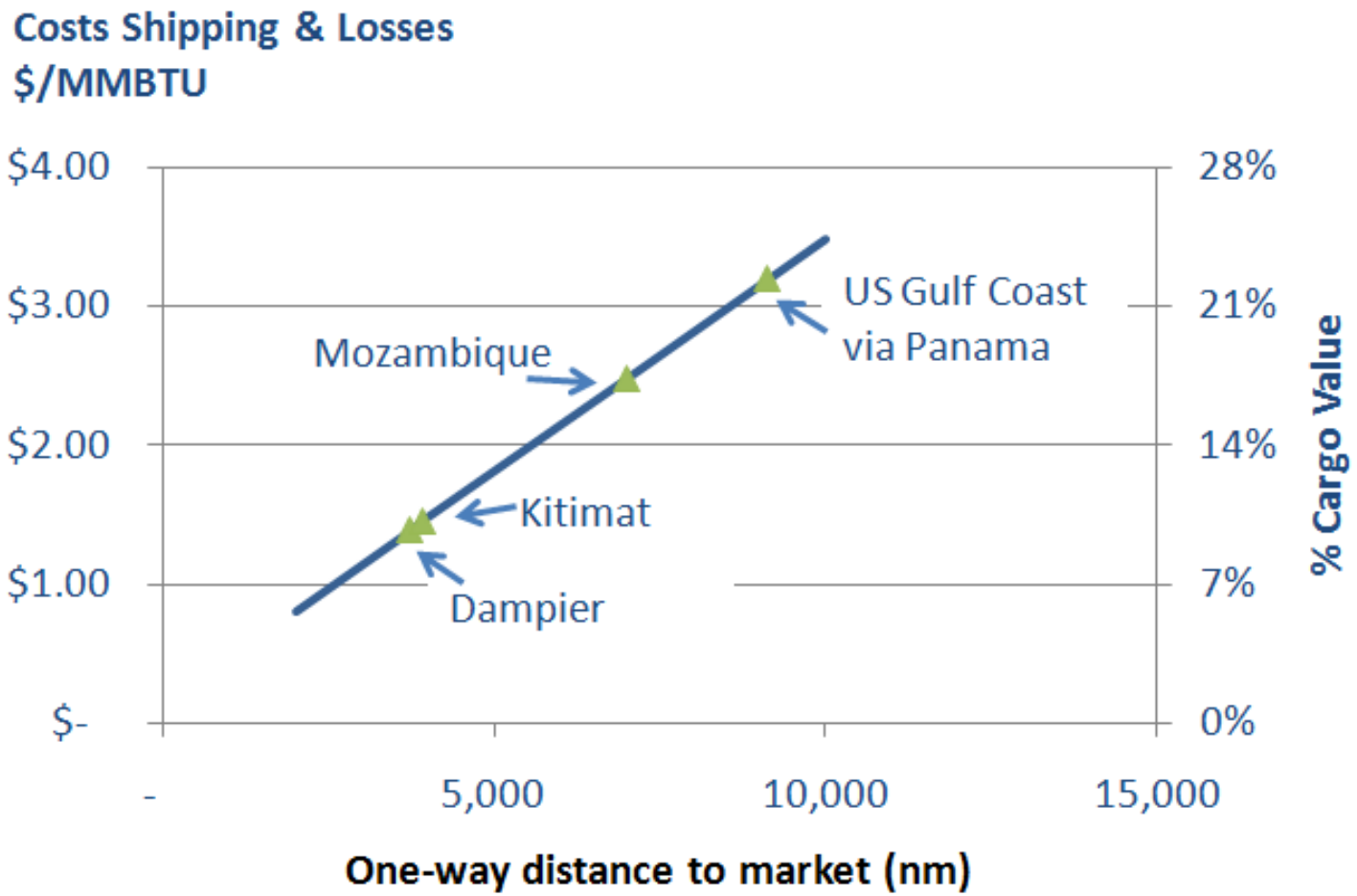
SIGNIFICANT SHIPPING DIFFERENCES FOR PROJECTS TO REACH KEY MARKETS WILL INFLUENCE COST COMPARISON.

THIS EXAMPLE SHOWS ONE-WAY DISTANCES FROM PRODUCERS TO JAPAN



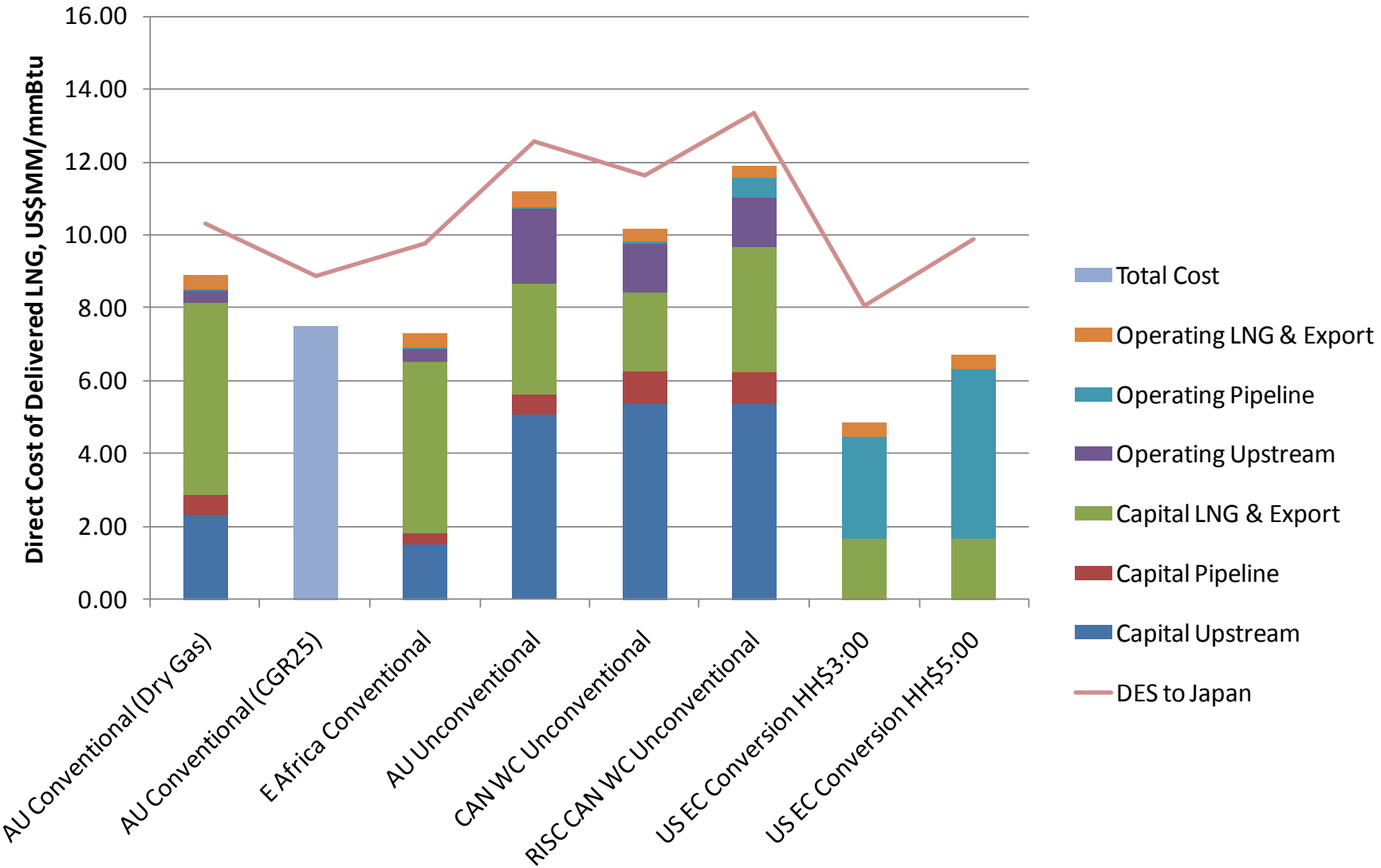
ESTIMATED TRANSPORT COSTS TO JAPAN

SHIPPING TO MARKET COSTS FALL IN THE RANGE OF 10-20% OF CARGO VALUE



Notional costs include: BOG, fuel, ship charter.
Source: RISC Analysis

UNIT COST OF DELIVERED LNG TO JAPAN



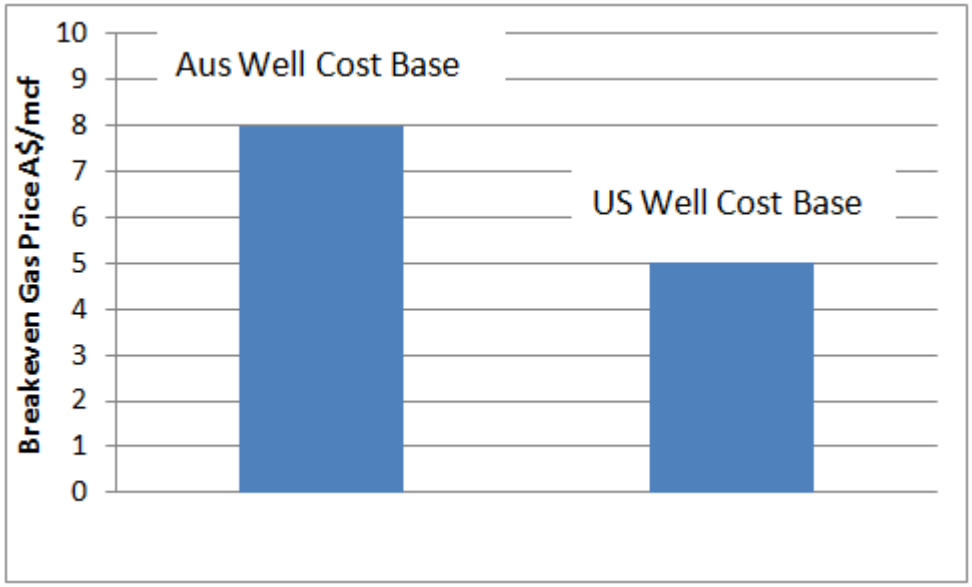
CAN AUSTRALIAN UNCONVENTIONAL GAS COMPETE FOR REGIONAL LNG MARKETS?

Challenges

- Production infrastructure
- Services (rigs, frac spreads)
- Well Costs

- Australian well drilling, completion and stimulation costs currently 3-4 times higher than N America
- US Rig rates, drilling rates, frac costs all significantly better

- Well Cost a major driver in value



"Greenfield" shale gas example

- 6 bcf/well, 25 bbl/MMscf liquids
- 3000 m well with 2500 m lateral, 12 stage fracs
- US well cost $6-8 mill drilled and completed
- Aus well cost $12-14 mill (assumes learning curve)

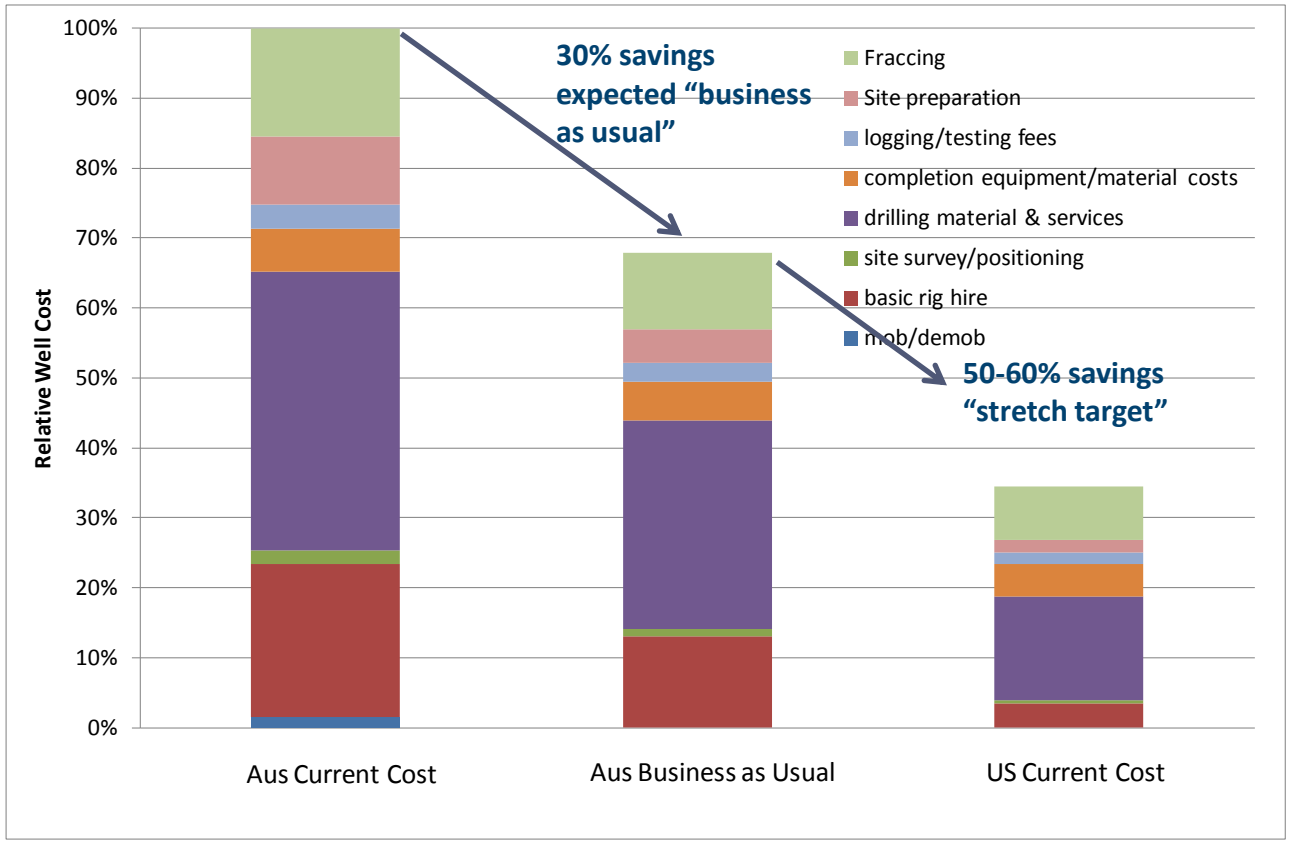
HOW CAN AUSTRALIAN SHALE GAS COMPETE?

"Business as Usual) Cost Reduction

- 30% savings on current cost
- Campaign drilling
- Pad drilling
- Drilling learning curve
- Well will still cost 2X US equivalent

Still not enough

- Even with 30% savings, result is breakeven costs of supply 60% higher than US comparable
- Stretch target should be 50-60% savings on current costs to achieve even greater efficiencies



HOW CAN AUSTRALIAN OPERATORS DRIVE FURTHER IMPROVEMENT?

- Due to market/geographical issues, Aus costs unlikely to reach US benchmarks
- Remote locations, flooding and lack of infrastructure will all inevitably add to costs

"Technical Limit" Concept

- 50% improvements the norm
- Different business model required
  - Imperative from CEO down required
  - Different skill sets, continuous improvement systems and culture
  - Whole supply chain approach
  - Re-engineering of well construction, supply and development process: need campaigns
  - Integrated contract alignment with service providers essential
  - Manpower intensive compared to current operations, but good engineering is cheap

- Not a new idea, been around since the 80's

Bond, D.F. et al.: "Step Change Improvement and High Rate Learning are Delivered by Targeting Technical Limits on Sub-Sea Wells," SPE 35077 March 1996.

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OUTLOOK FOR AUSTRALIAN SHALE GAS

- Vast resource potential 500+ Tcf
- Domestic market potential circa 15 Tcf over next 20 years
- Access to export market the key to unlocking the full scale potential
- Basins close to markets and Export infrastructure favoured
- Cost a major value driver making Australian shale gas 60% more costly than N American equivalents
- Scale, vision and a different business model is required to unlock the challenge

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L3 / 1138 Hay Street
WEST PERTH WA 6005
P. +61 8 9420 6660
F. +61 8 9420 6690
E. admin@riscadvisory.com

L2 / 147 Coronation Drive
MILTON QLD 4064
P. +61 7 3025 3369
F. +61 7 3025 3300
E. admin@riscadvisory.com

53 Chandos Place, Covent Garden
LONDON WC2N 4HS
P. +44 20 7484 8740
F. +44 20 7812 6677
E. riscuk@riscadvisory.com

www.riscadvisory.com

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