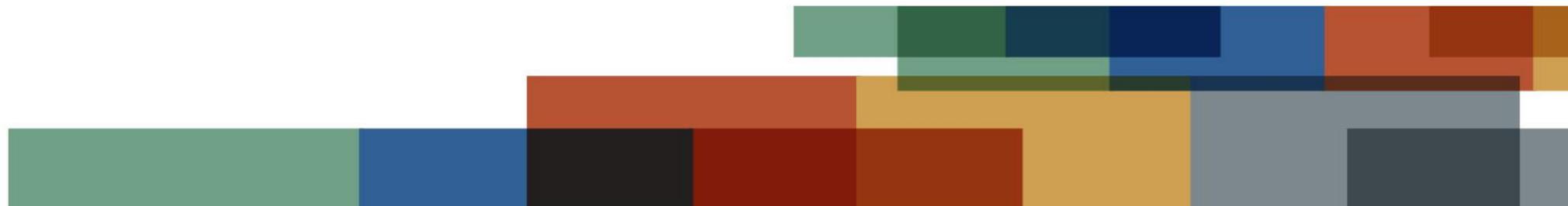




decisions with confidence

The role of Gas in a low emissions future for WA

Date: 18 October 2016



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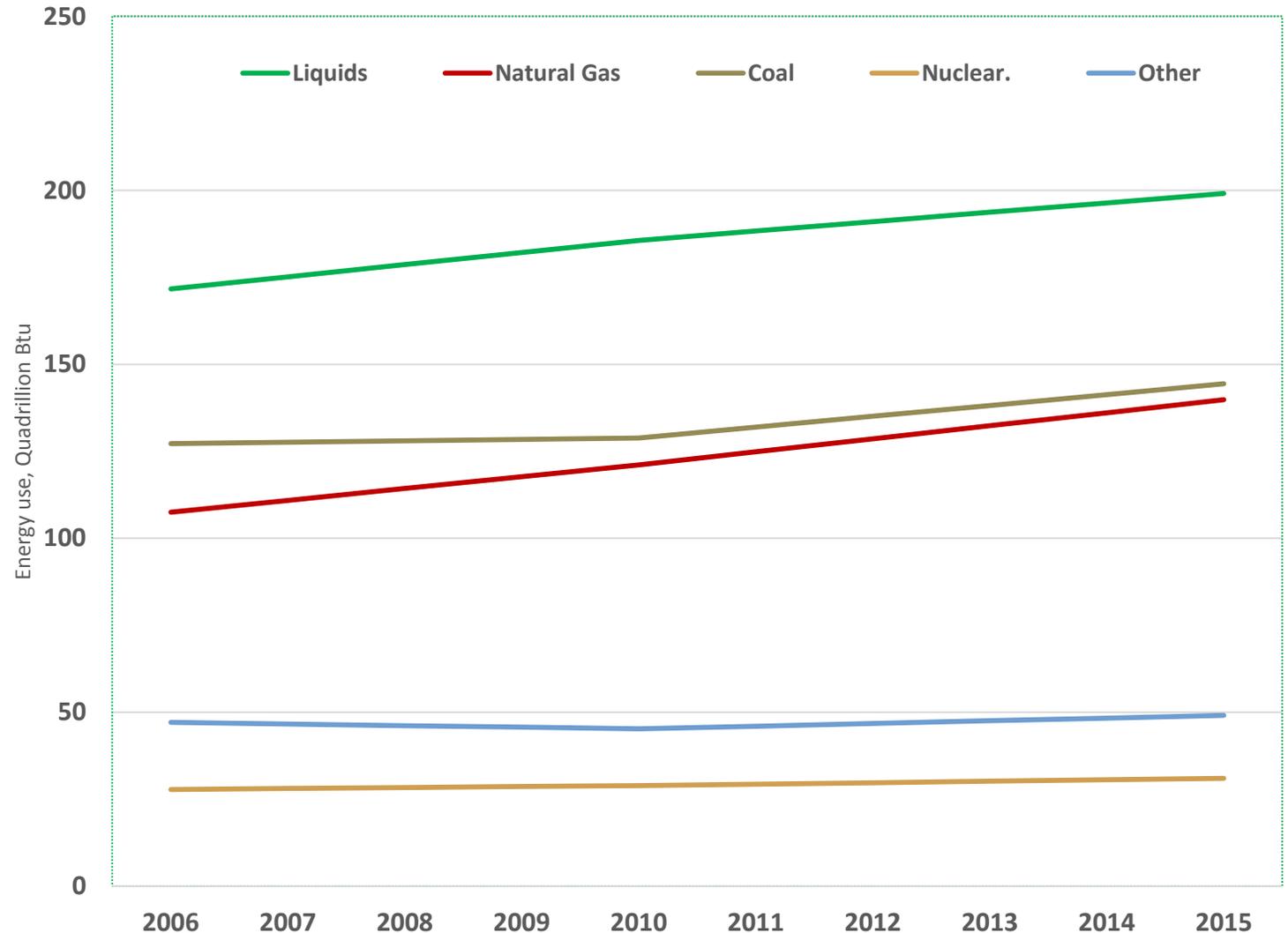
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Energy Use projections from 2006

In 2006 Global Warming was firmly on the Map (later to become Climate Change), and as a result it was anticipated that:

- Coal use would rise more slowly than other fuels
- Gas would be the highest growing fossil fuel as it is the “cleanest”
- Renewable growth would be slow and dominated by large scale hydro in developing countries

2006 EIA World Energy Use Projections by Fuel Type



Energy Use projections from 2006, actual outcomes

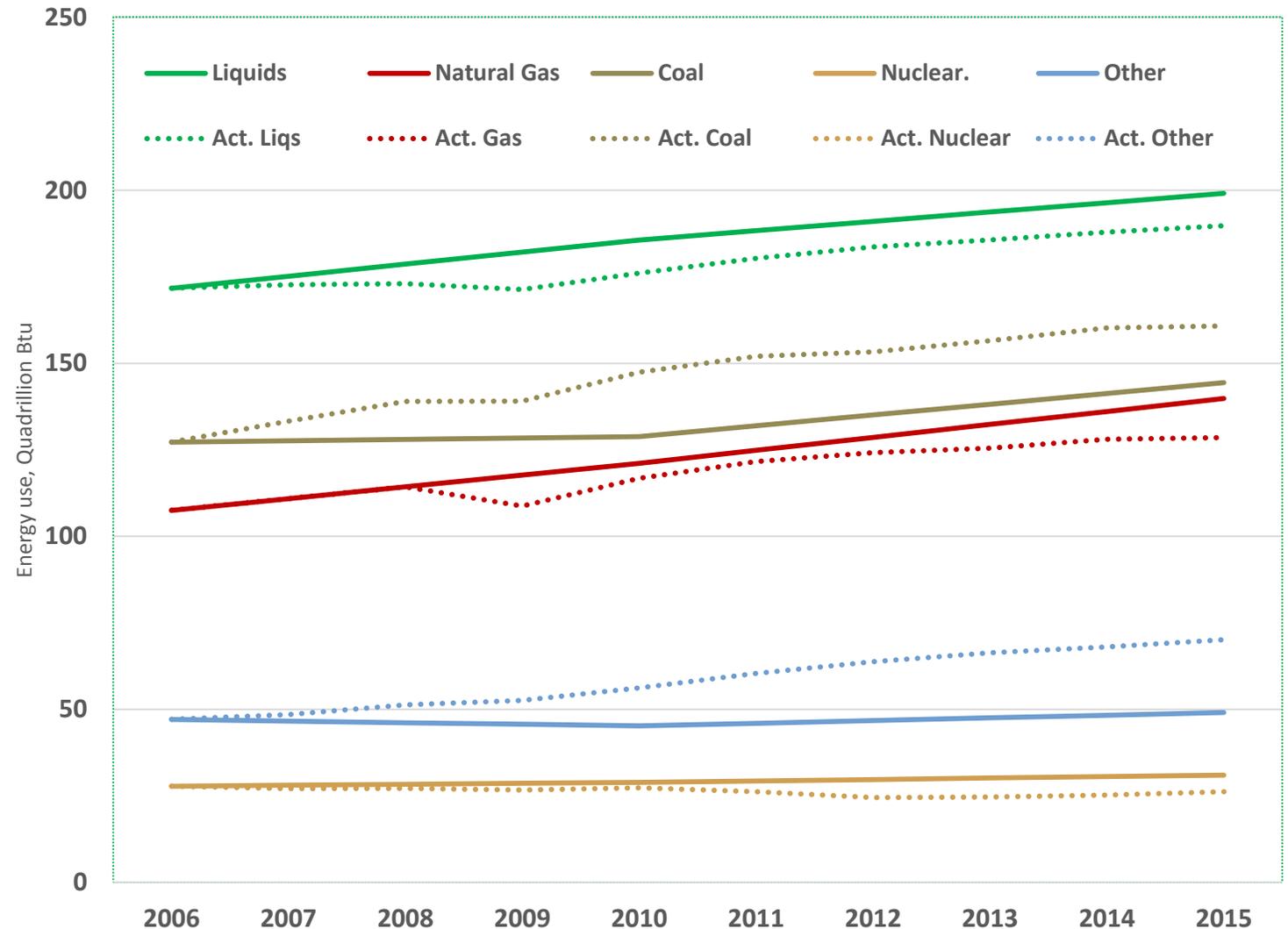
What actually happened:

- Growth in renewables has been dominated by wind and solar in developed countries, and has grown much more strongly than anticipated
- Oil and gas were both significantly impacted by the GFC
- Gas use has grown in step with renewables growth

...but...

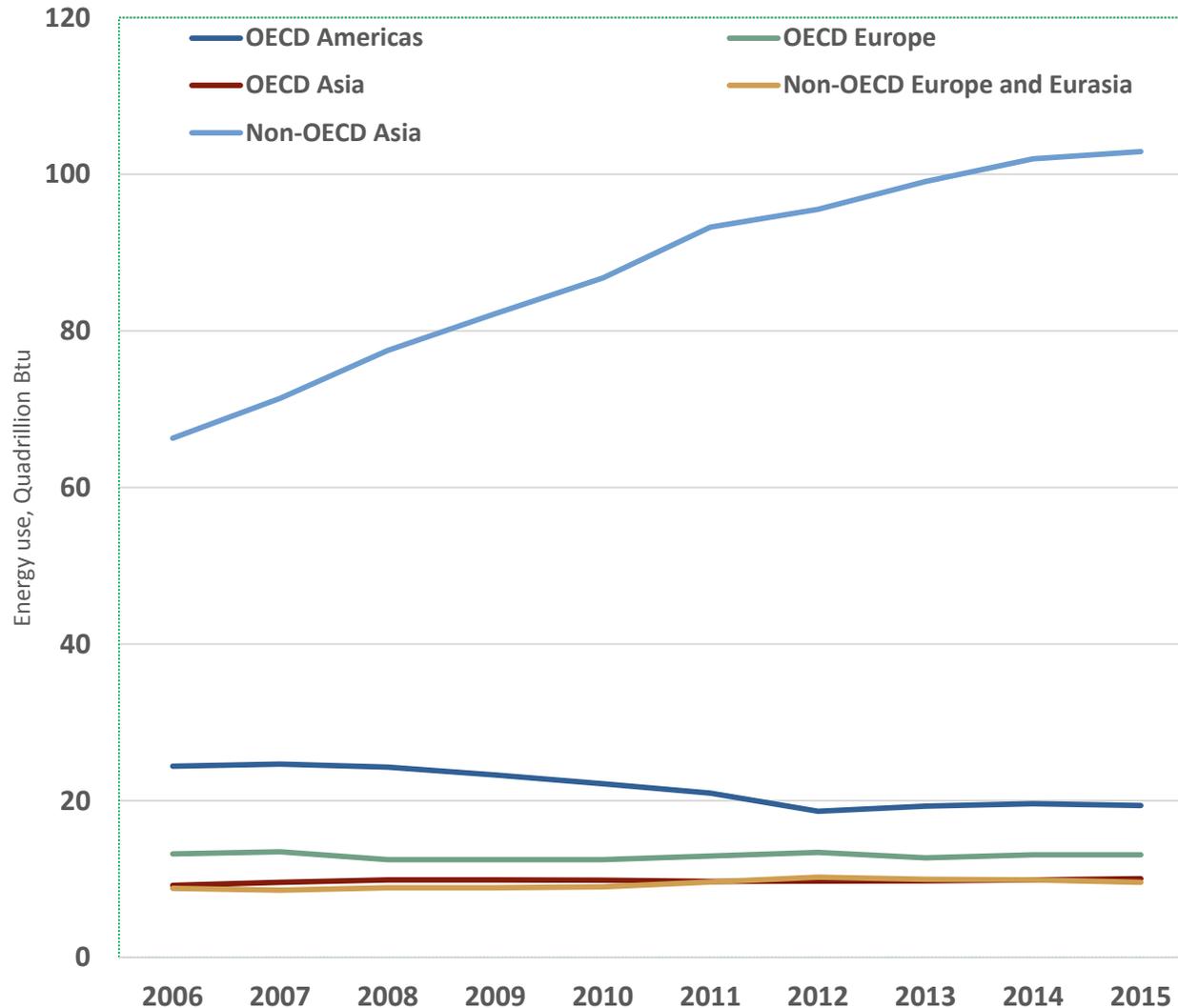
- Coal has been the fastest growing of all fuels, growing by almost 50% more than either renewables or gas
 - This presents problems for reducing emissions

2006 EIA World Energy Use Projections by Fuel Type



Coal use increased in Asia, and only decreased in N. America

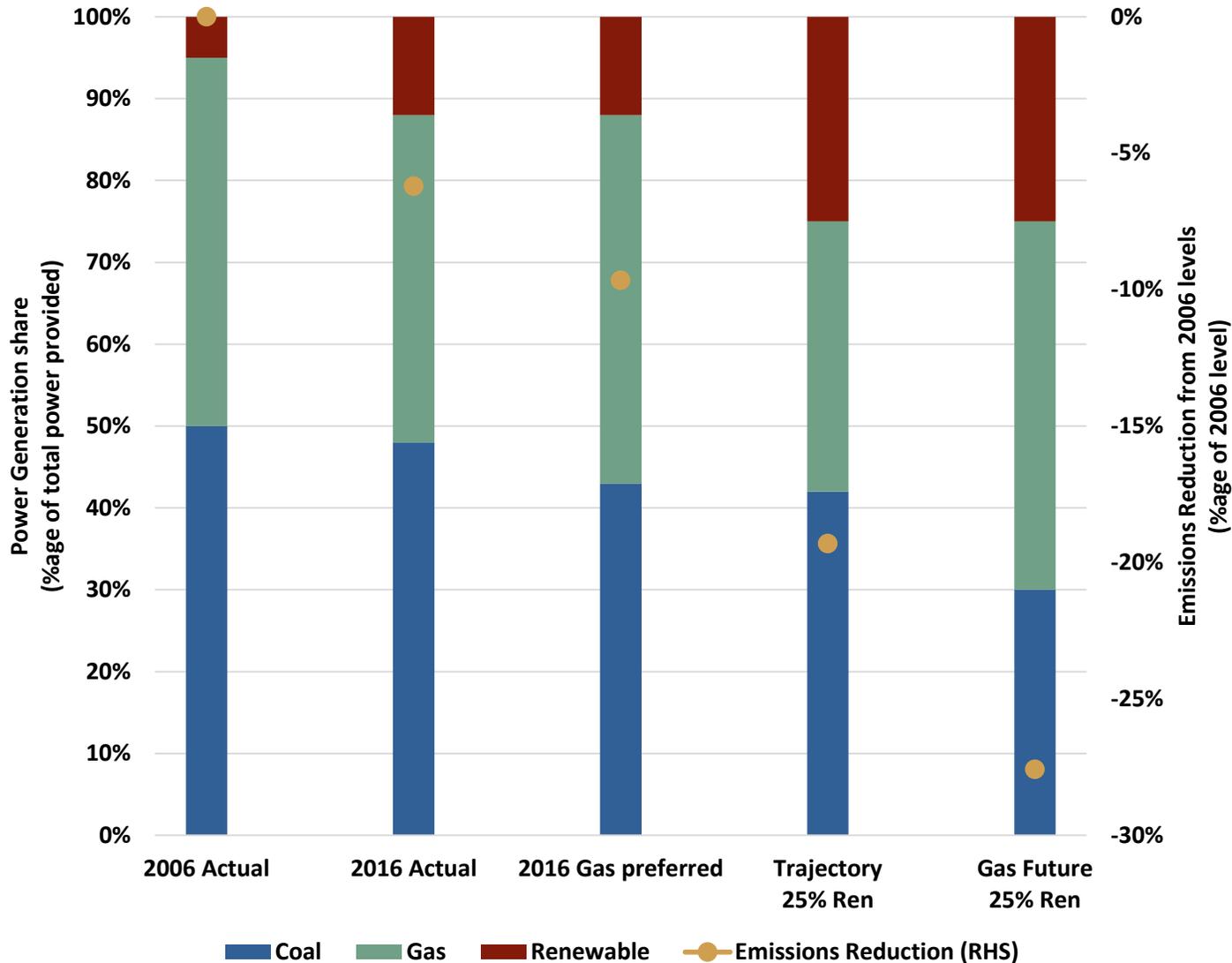
2016 EIA World Coal Use History



Between 2006 and 2012

- Coal use increased significantly in developing countries
- Gas power generation in the USA grew from ~18%~30% In 2012 Gas generated ~30% of the nations electricity
- Coal fired generation in the USA declined from >50% to ~35%
 - US emissions have reduced by ~12%
 - In the same timeframe EU emissions have reduced by ~18%, and Germany by ~10%.
- US renewables generate ~13% of power
 - Germany has installed more renewable generation than they can use on a peak day. They generate ~26% of power, but also have caused instability and security of supply issues

Gas clearly has a role in helping reduce emissions whilst maintaining security of supply



Source: AEMO (Actuals) & RISC Analysis

In WA since 2006:

- Renewables have grown from 5% to 12%, and emissions reduced by ~6%
- Renewables have replace more gas fired generation than coal fired generation.
 - If renewables had replaced coal instead, emissions would have been reduced by ~10%
- If WA continues on the same trajectory of replacing more gas generation than coal, then from a future system with 25% renewable generation we can expect a ~19% reduction in emissions (from 2006)
- If we preferentially replace coal fired generation and keep gas fired generation then the reduction in emissions will be close to 30% (the target for Australian emissions reductions agreed in Paris)

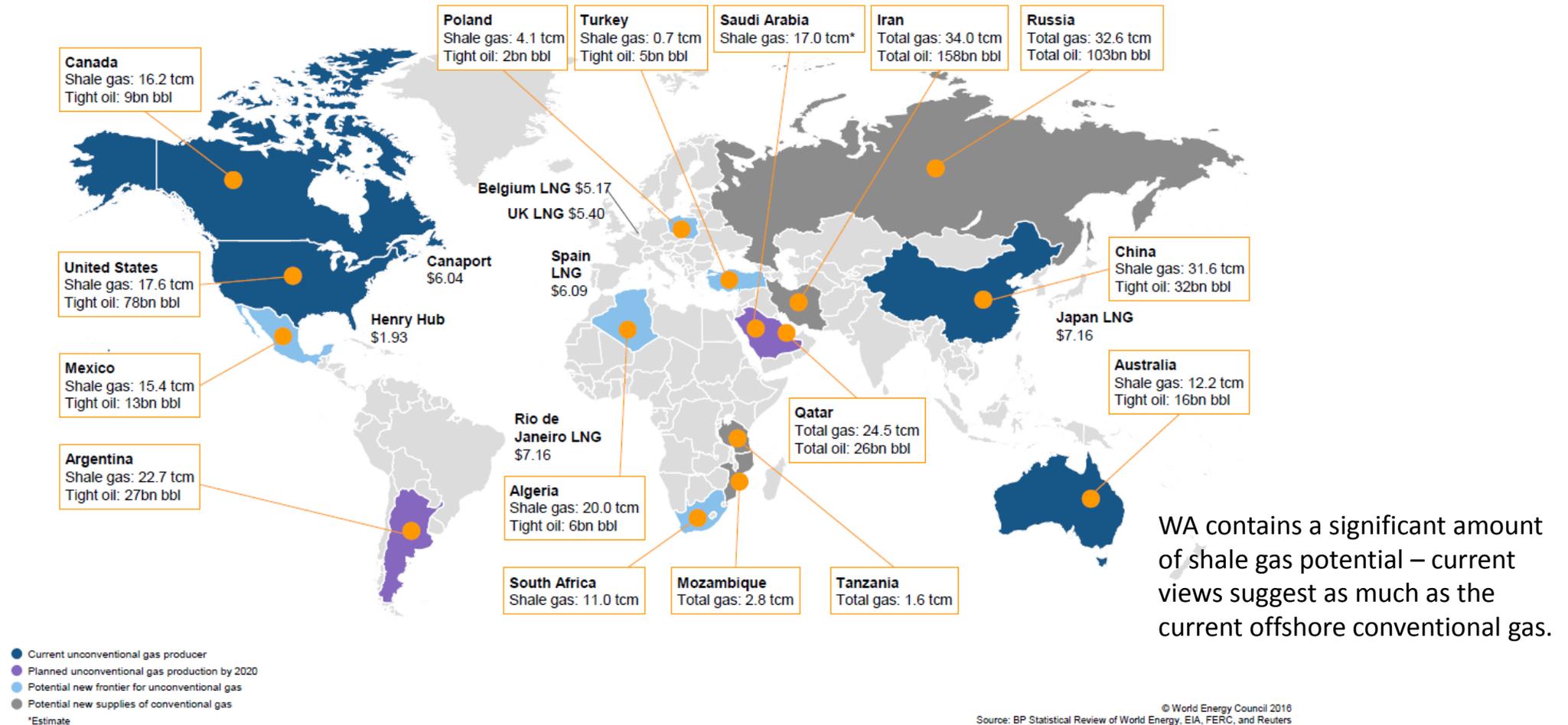
WA is in a unique position to capitalise on its existing gas fired generation capacity

- Gas generation produces approximately half the emissions of coal generation, so simply switching from coal to gas generation has a material impact on emissions (as seen in the USA)
- Gas generation is a natural companion to renewables as it can be turned on and off and ramped up and down as the renewables generation changes.
- Gas generation is already capable of providing ~50% of the WA power requirement
- (Because of this) gas generation is an enabler for the integration of renewables into the grid

Promotion of a future energy mix based on renewables and gas is likely to lead to the lowest cost and least disruptive way of maximising emission reductions for WA (and Australia?)

Unconventional gas, a global phenomenon

Despite the uncertain price environment, unconventional gas has become a global phenomenon with new supplies coming from Australia, China and New Frontier countries.



The availability of low cost gas relies on competition between suppliers.

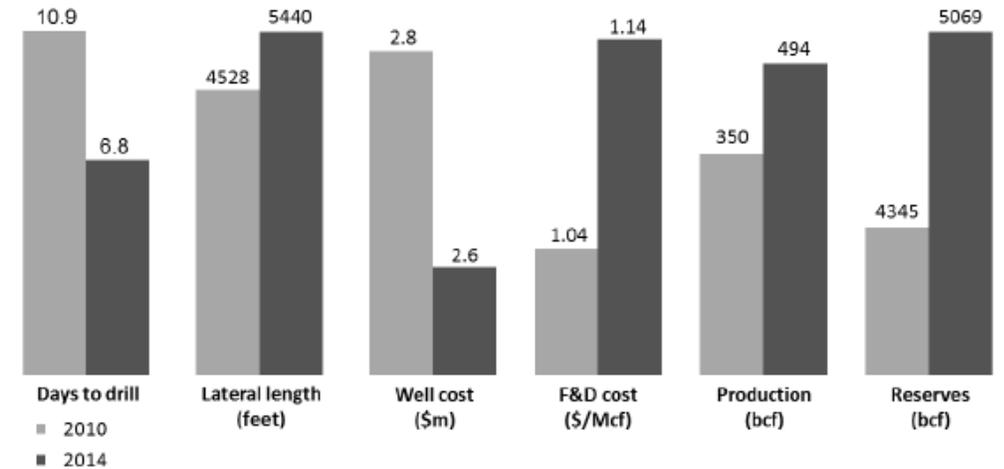
- In order to promote competition development of all gas resources is required

CO2 emissions have significantly decreased in US as a result of a switch to gas for power generation

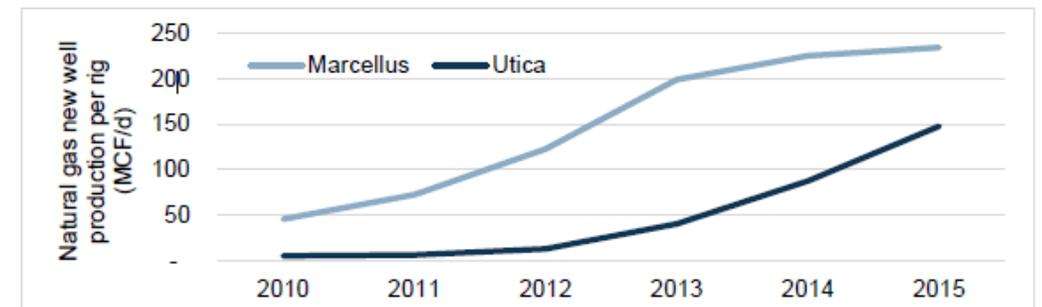
- USA – shale gas growth and commerciality continues to outstrip expectations. Shale gas now accounts for more than 50% of US gas production, and is being exported to the world via LNG exports.
 - Significant technology improvements
- Saudi Arabia has announced plans to develop large shale deposits in order to reduce its' internal reliance on oil.
- England – Yorkshire and Lancashire have both allowed development activities including fracturing.

Shale Gas is here to stay – even if we don't embrace it in Australia

Source: Southwestern Energy July 2015 Update



Sources: EIA Drilling Productivity December 2015 and BP Conversion Factors



There have been a large number of investigations into hydraulic fracturing including in Australia, New Zealand and the UK in the past 4 years. None of them supported bans or moratoria:

- UK June 2012 – Royal Society and Royal Academy of Engineering
 - The health, safety and environmental risks associated with hydraulic fracturing (often termed ‘fracking’) as a means to extract shale gas can be managed effectively in the UK as long as operational best practices are implemented and enforced through regulation.
- NZ November 2012 – Parliamentary Commissioner for the Environment
 - “...environmental risks associated with fracking can be managed effectively provided... “operational best practices are implemented and enforced through regulation”.
- NZ June 2014 – Parliamentary Commissioner for the Environment
 - Extensive reform of New Zealand’s laws, agencies, and processes is not yet required for effective management of the local environmental effects of onshore oil and gas extraction.
- NSW Sept 2014 – NSW Gov’t Chief Scientist and Engineer
 - The Review concluded that the technical challenges and risks posed by the CSG industry can in general be managed...
- NT Nov 2014 – Independent Inquiry into Hydraulic Fracturing in the NT
 - the environmental risks associated with hydraulic fracturing can be managed effectively subject to the creation of a robust regulatory regime
- WA November 2015 – Parliamentary Inquiry into Unconventional Gas (Fracking)
 - the risk of spills of chemicals or other fluids associated with hydraulic fracturing can be effectively managed...and...the risk of water contamination during hydraulic fracturing in Western Australia is highly unlikely”
- SA Nov 2015 – Inquiry into Unconventional Gas (Fracking) Interim Report
 - No conclusions, noted differences of opinions, and will continue to examine evidence to inform the final stage (2016)
- Vic Dec 2015 - Inquiry into onshore unconventional gas in Victoria
 - The committee could not reach a majority decision on the 2 proposed recommendations in its Term of Reference, and had alternative recommendations
 - The Chair indicated a level of frustration at the restrictions of the TOR imposed on the committee (inability to examine other regimes etc..)



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