

The Golden Age of Gas

What Will it Take to Get There?

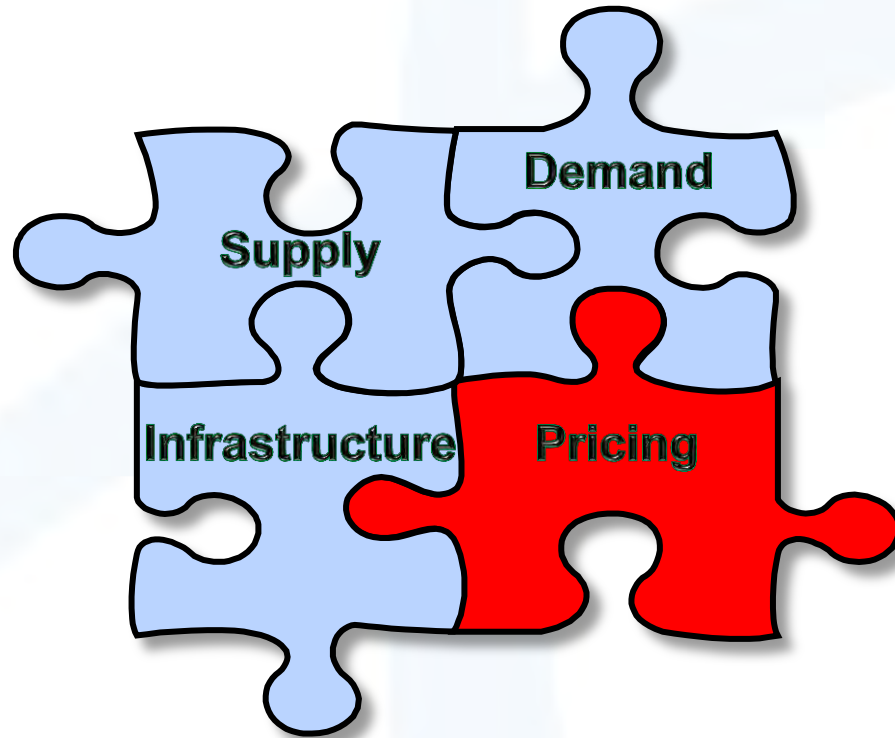
Gas Pricing Analysis

Royal Institution: 19th September, 2013

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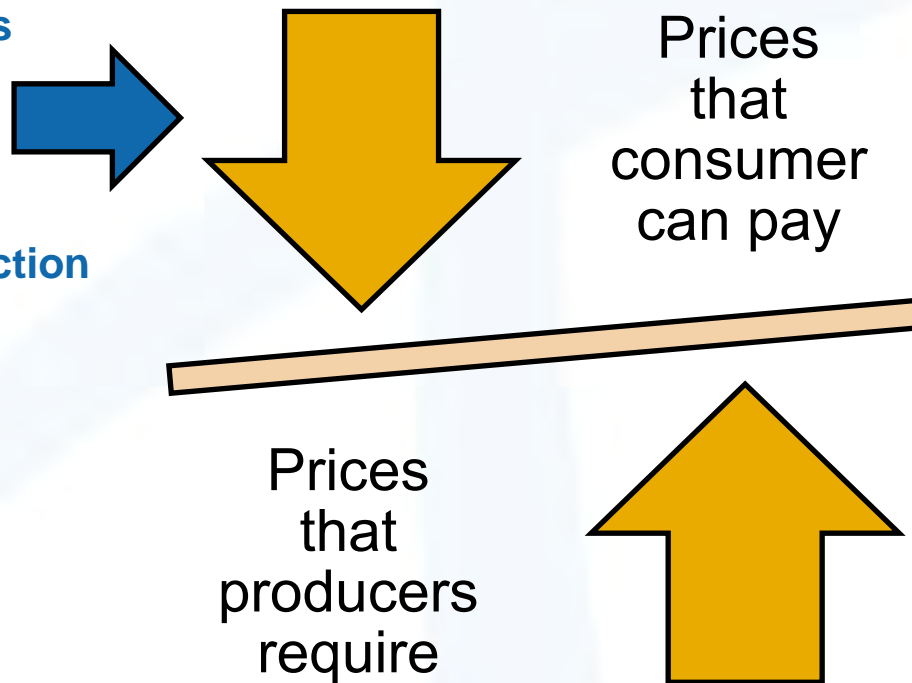
Pricing



Gas Prices

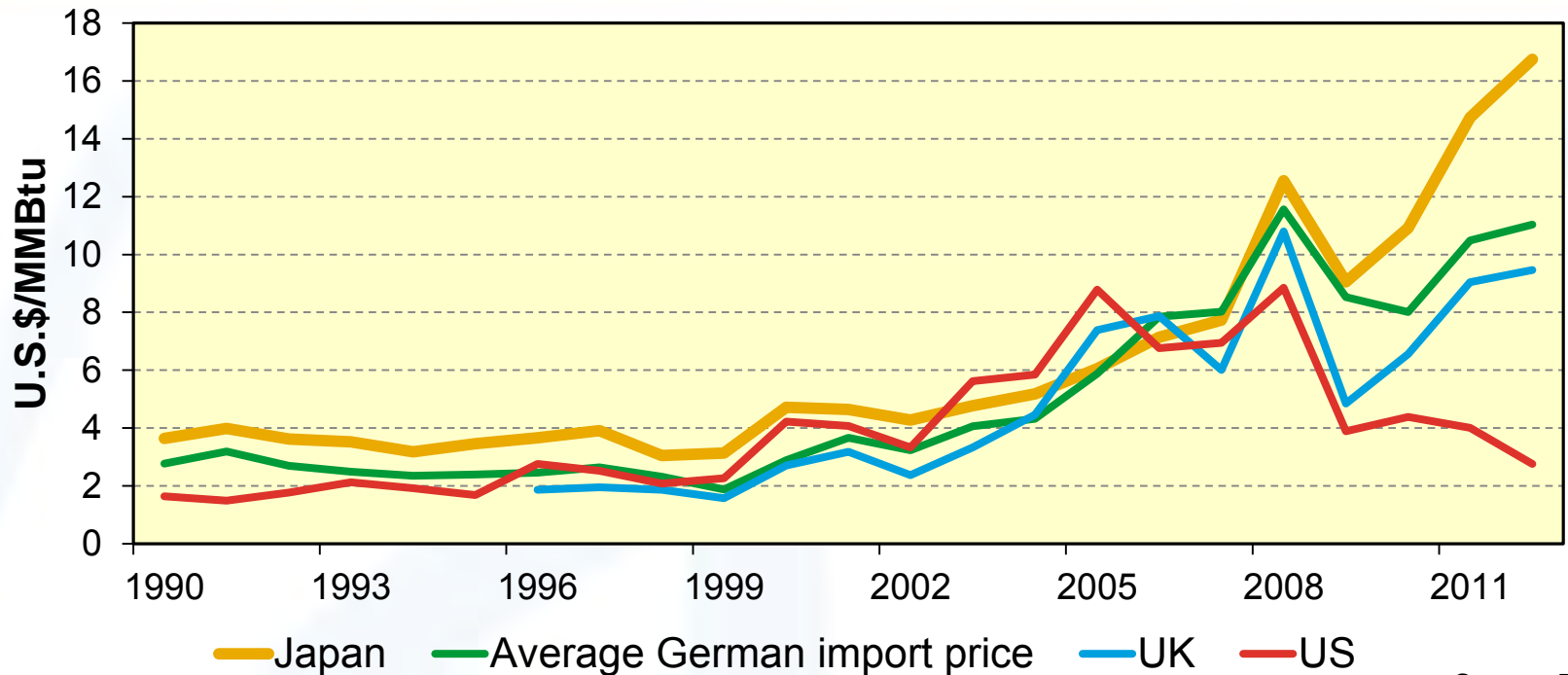
- Pricing Issues – can a balance be found between supply costs and market price?

- Demand for energy
- Competing fuels
- Environmental drivers
- Subsidies
- Demand destruction



- EPC costs
- Fiscal
- Shareholder expectations
- Infrastructure

What Will Consumers Pay for Gas – What Have They Paid in the Past?



Source: BP

- Significant regional variations
 - Note German prices diverging from Japan – result of contracts renegotiations away from crude price indexation
- Although these are the main pricing hubs these prices are not representative of prices for all gas paid worldwide – large volumes on long term confidential contracts

What Will Consumers Pay for Gas – What do They Pay for LNG

World LNG Estimated September 2013 Landed Prices



- Should Asia and South America (and others) be building coal-fired power stations or renewables?
 - If LNG is incremental supply then other forms of generation are attractive
 - But generally a country's gas supply is mixed and landed LNG price does not represent average gas price

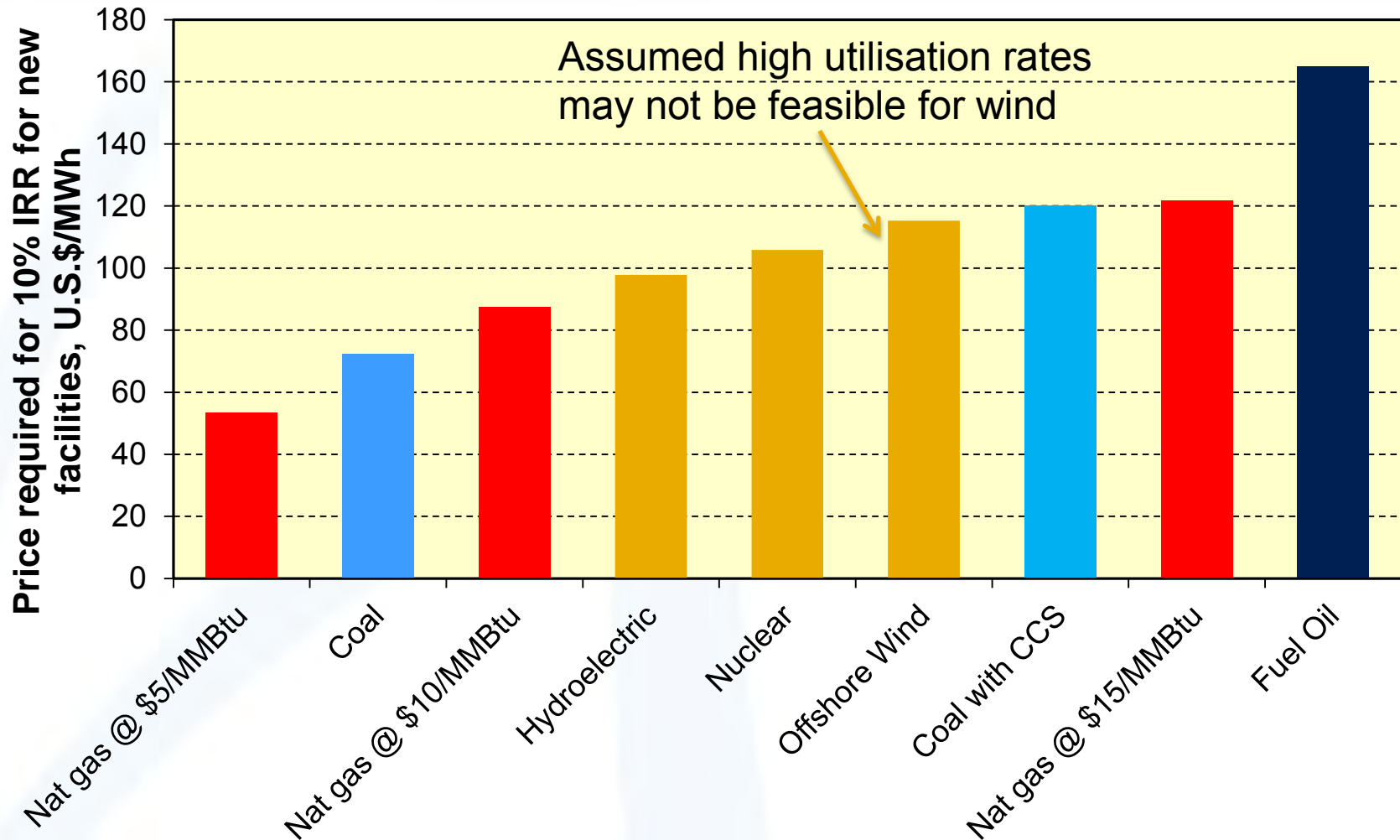
Market Prices – What Will Consumers Pay for Gas?

- Some demand is more price sensitive than others
 - Geographical variations
 - Sector variations
- Alternative fuels and the ease of which a consumer can switch to these determines floor and ceiling prices
 - Although general trends can be looked at these are different for each consumer
 - Availability of fuels, pricing, contractual terms etc
- Environmental drivers
 - Gas is cleanest fossil fuel
 - Renewables better for CO₂

What Will Consumers Pay for Gas? Alternative Fuels and Ceiling Prices

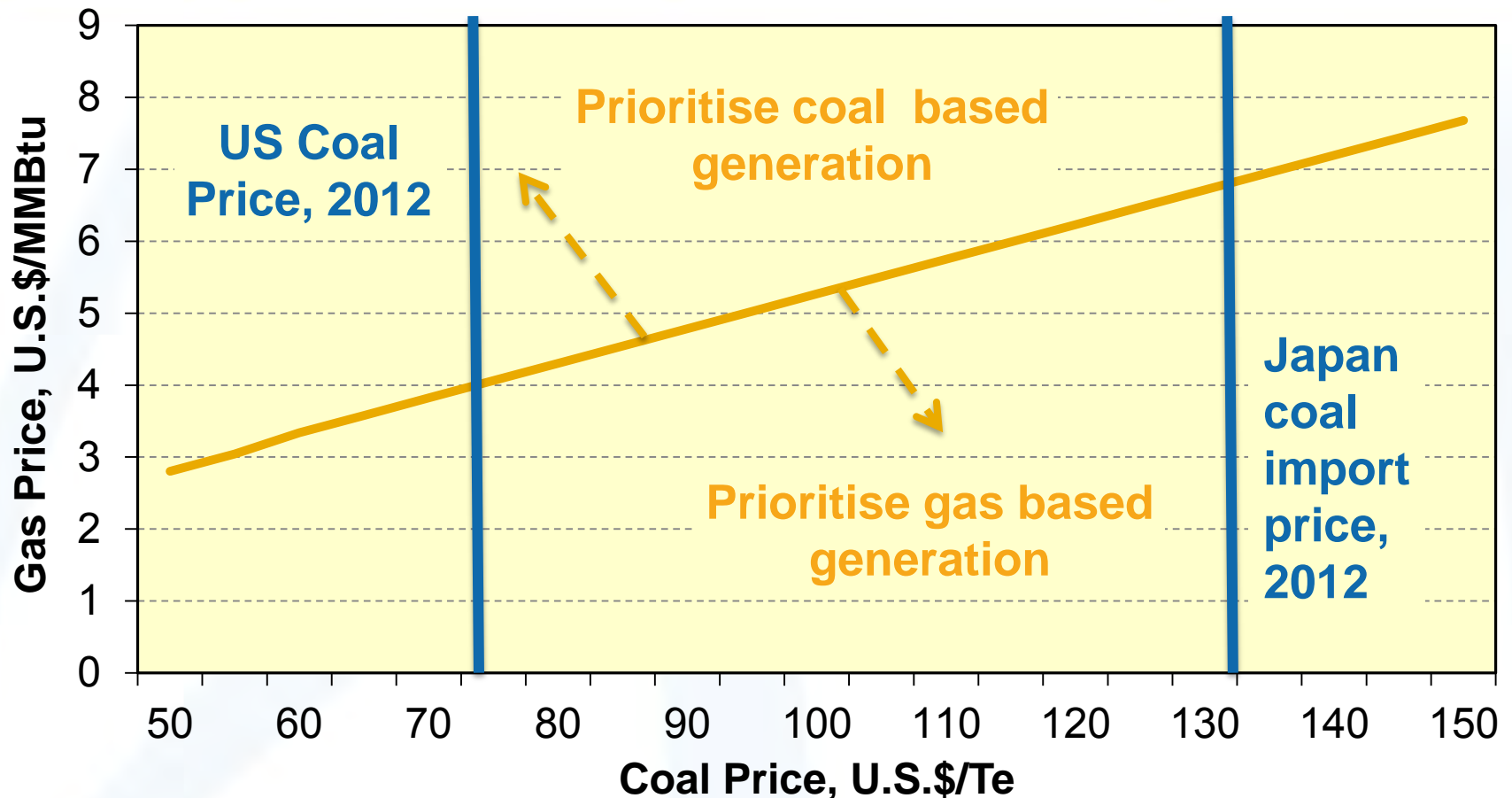
Natural Gas Use	Key Competing Fuels	Typical Influences on Ceiling Price	Ease of Switching (existing)	Ease of Switching (new)
Power	Coal, nuclear, renewables, HFO	See separate analysis	Limited	Good
Industry	Heavy Fuel Oil, Electricity, Coal, Diesel	Very variable but HFO a reasonable average guide	Limited	Good
Residential/Commercial	Biomass, electricity, LPG, kerosene	In developing markets price influenced by affordability of fuel as % of income. Key competitor is biomass (can be very cheap). LPG/kerosene/electricity in more developed markets,	Reasonable	Good (If infrastructure exists)
Transport	Bunker Fuel, Diesel, gasoline	Diesel or gasoline Bunkers in Marine market	Limited	Ok
Petrochemical Feedstock (Ethane)	LPG, Naphtha	LPG and/or Naphtha price	Limited	Good

Estimated Electricity Generation Costs



Source: GCA Analysis

Gas & Coal Switching in Power Generation



Should Japan (and others) be building coal fired power stations? Environmental considerations?

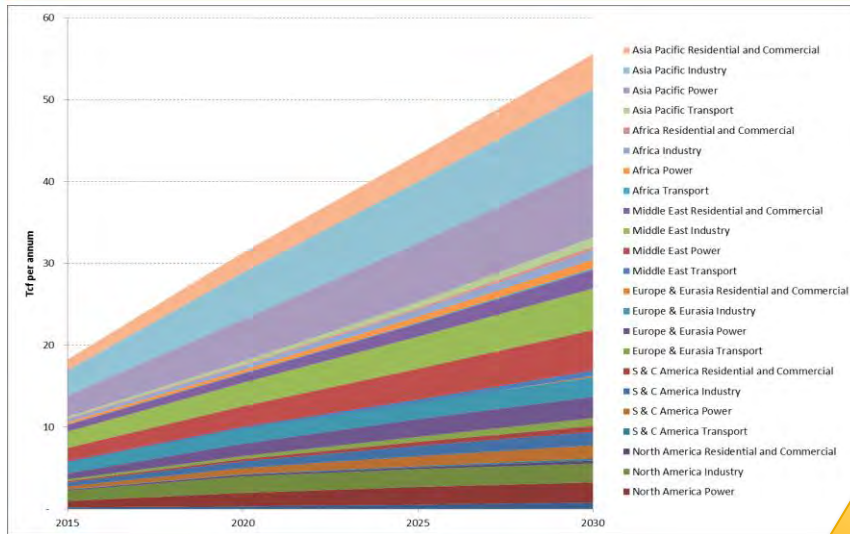
Transport fuel prices

- Typical price range of transport fuels
- Bunker Fuel Oil 14 – 16 US\$/MMBtu
- Diesel 20 – 22 US\$/MMBtu
- Gasoline 20 – 22 US\$/MMBtu

Global Picture – Gas Prices Scenario Analysis

- An alternative way of looking at what the global market can pay for gas is to divide demand into sectors and regions and assign an estimated maximum price to each tranche of demand.
- Then a weighted average price can be calculated for incremental demand since 2010
 - This represents an estimated price that global markets should be able to bear
 - But it is **very high level only and not a prediction of future gas prices** – subject to variations in demand volumes, other fuel prices, ease of switching etc

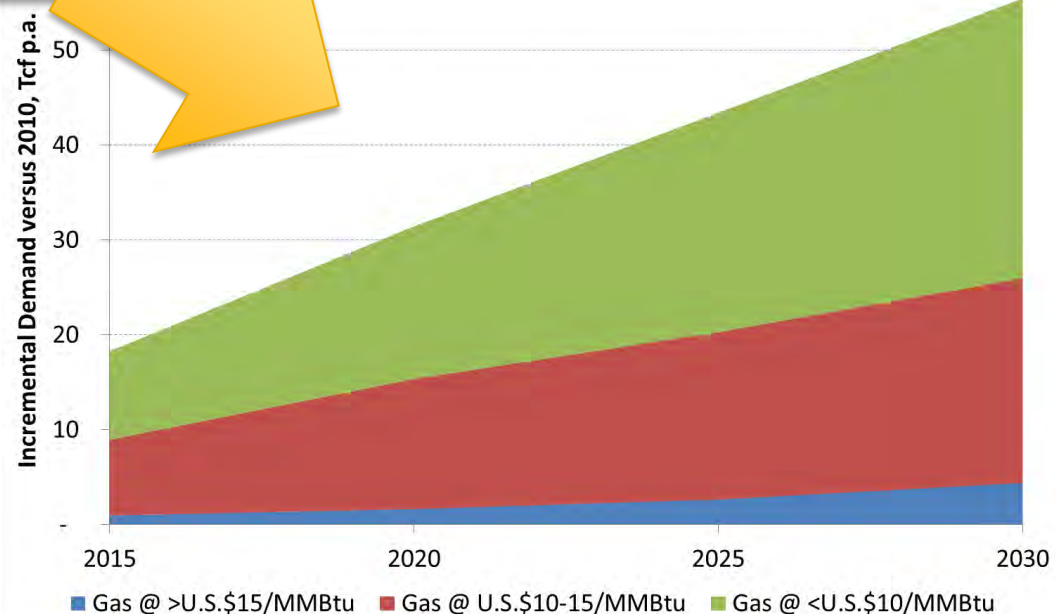
Global demand growth 2010 to 2030



- Scenario analysis suggests, for new demand since 2010, global market can absorb average gas prices in region of U.S.\$10 /MMBtu

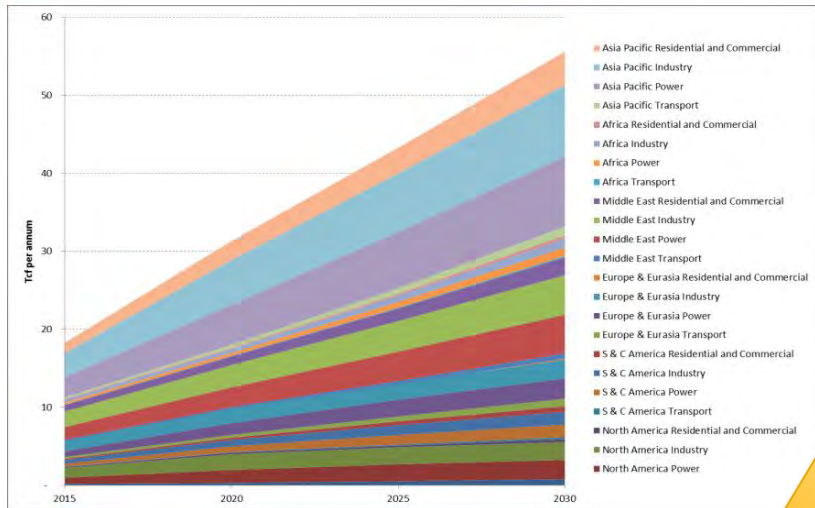
- But there are huge variations from market to market and sector to sector
- But a large slice could face competition from coal

Source: GCA Analysis



Gas Price Scenario Analysis

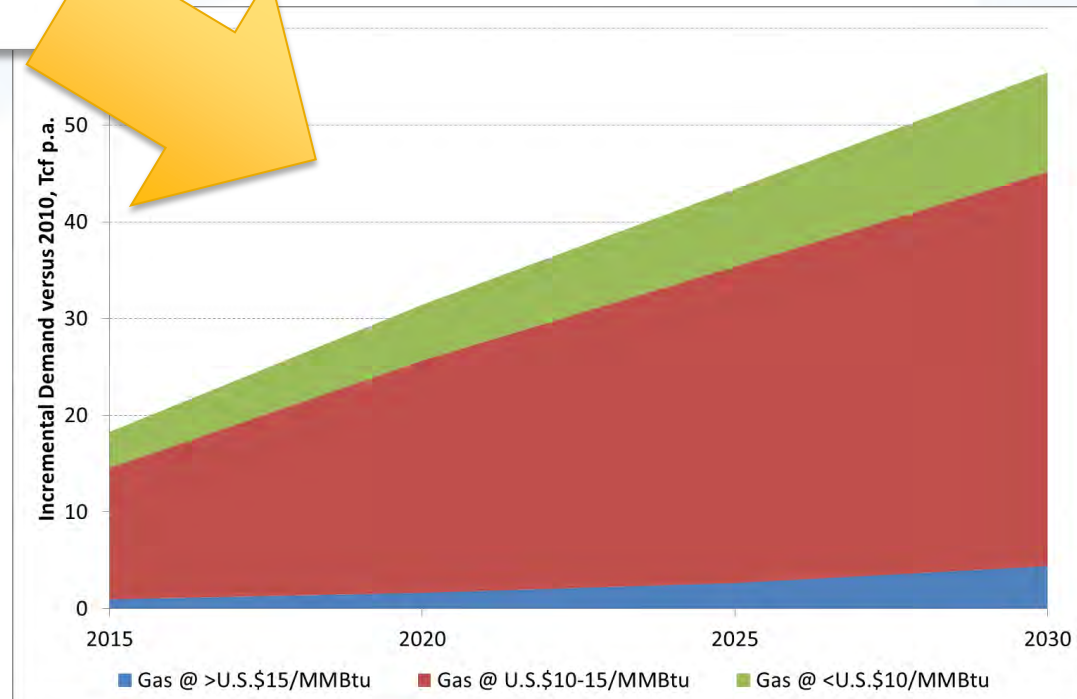
Global Demand Growth 2010 to 2030



- Considering an alternative pricing scenario - If power producers continue to favour gas (e.g. if carbon credit enhance its economic appeal) then average global gas prices may be closer to U.S.\$12/MMBtu

- This illustrates that environmental factors are often key in determining gas's appeal

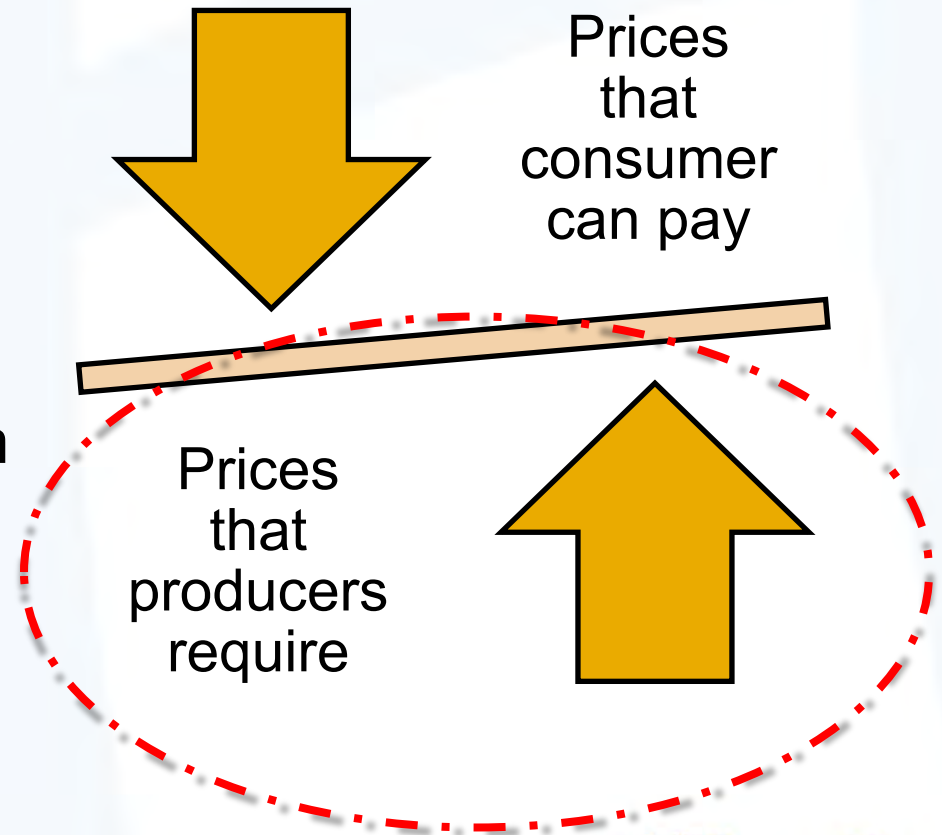
Source: GCA Analysis



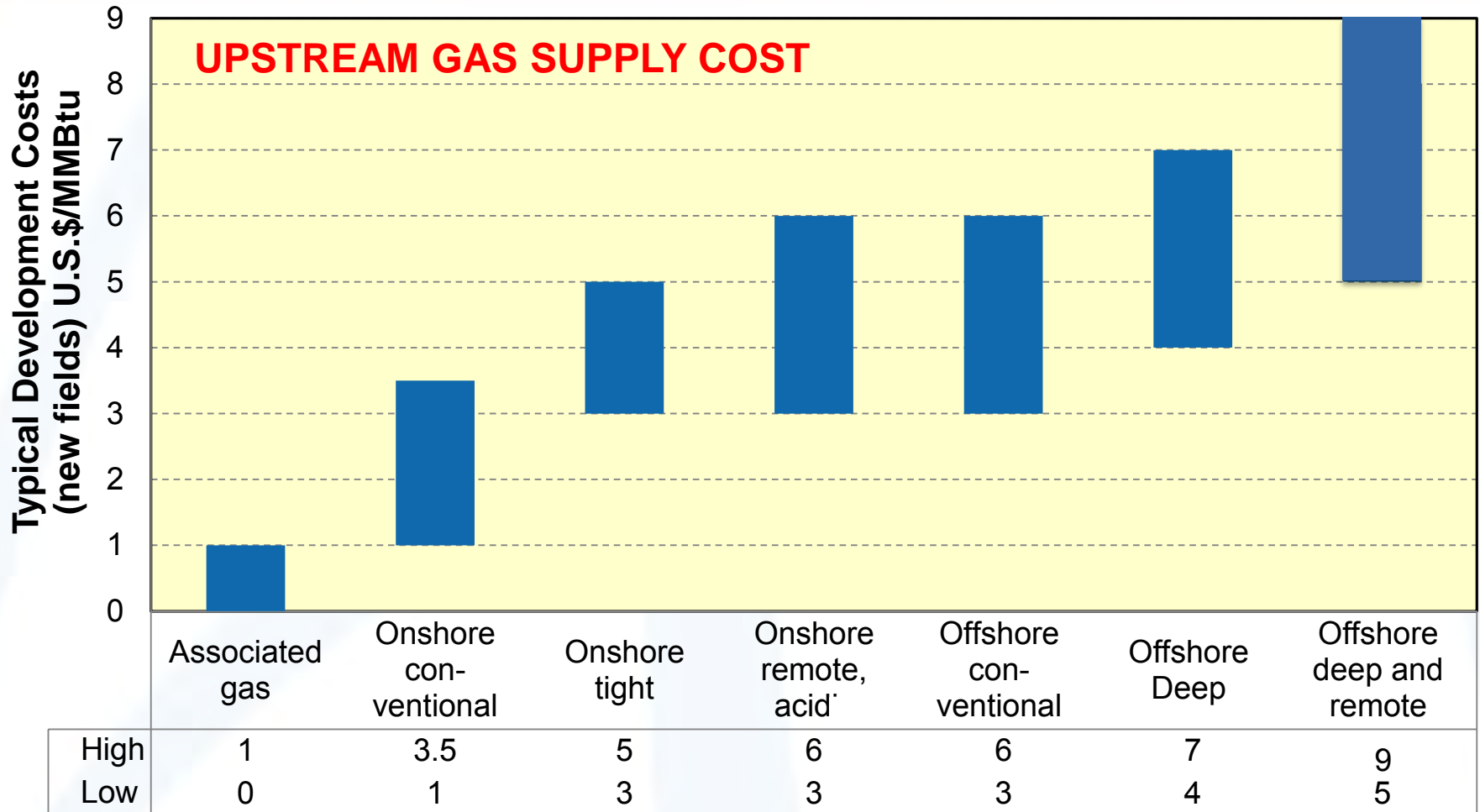
Production Costs and Supply Challenges

Other side of the equation is production costs

- Can these be low enough to match market requirements?
- Is new gas higher cost than old developments?



What Does Gas Production Cost?



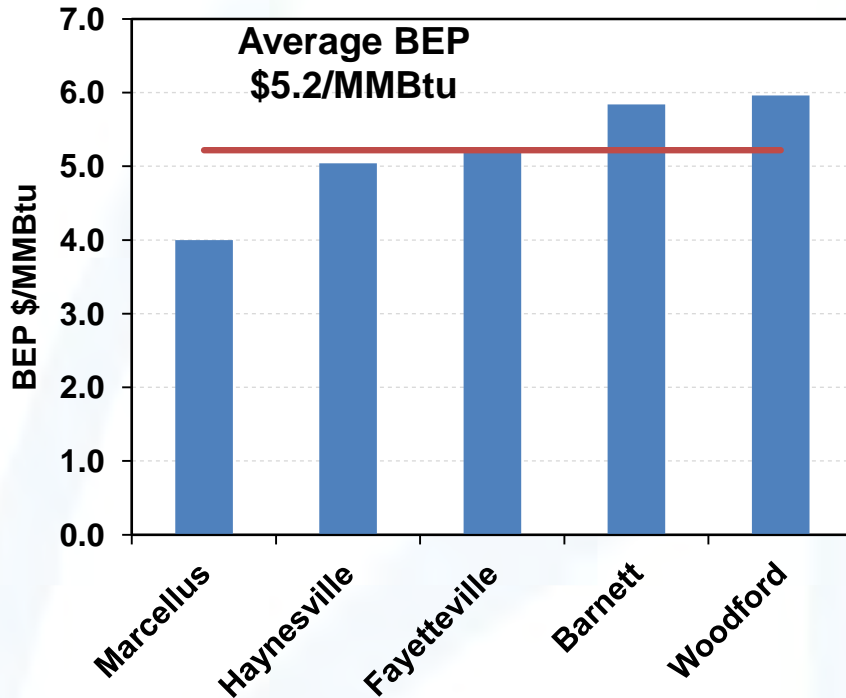
Source: GCA Analysis

Global Gas Supply Costs

- In a similar manner to looking at market caps on prices by considering tranches of demand, we can consider tranches of supply and what price they may be available at
- Influence of subsidies / taxes can be profound – a consumer may afford U.S.\$X/MMBtu but if Government subsidises it then the gas supplier can charge U.S.\$X plus subsidy
- Associated Liquids
 - can have profound effect on price of gas!
 - Valuable liquids can reduce supply cost of gas significantly

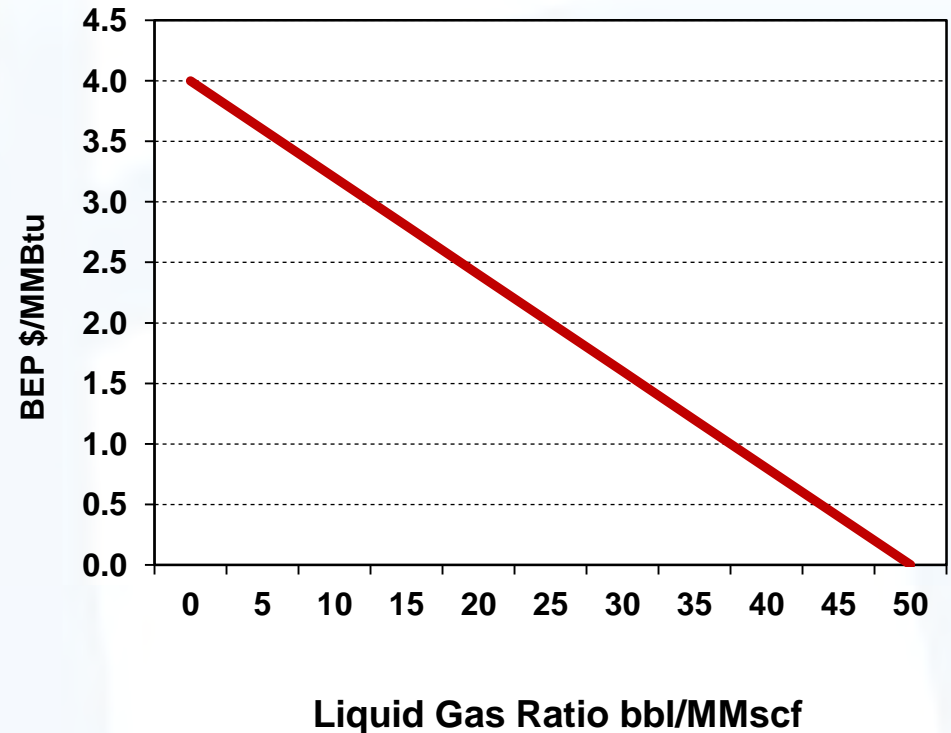
Liquids Rich Gas = "Cheaper" Gas a US case study

Break-Even Gas Price - Dry Gas



U.S. Shale Play

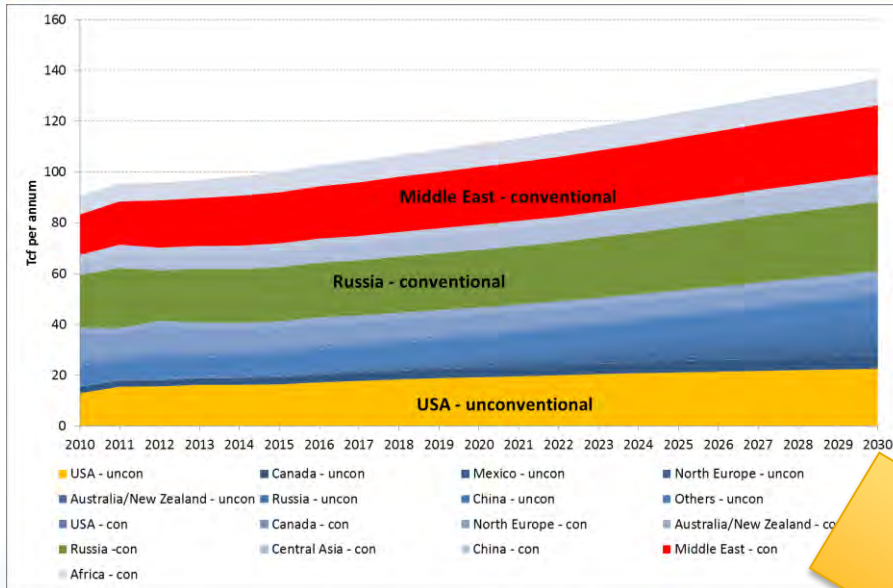
Marcellus Shale with varying condensate ratio (bbl/MMscf) @ 80\$/bbl



The MIT study of some US shale plays show that a Liquid Rich (sweet) Play would still be profitable even if gas price hits zero

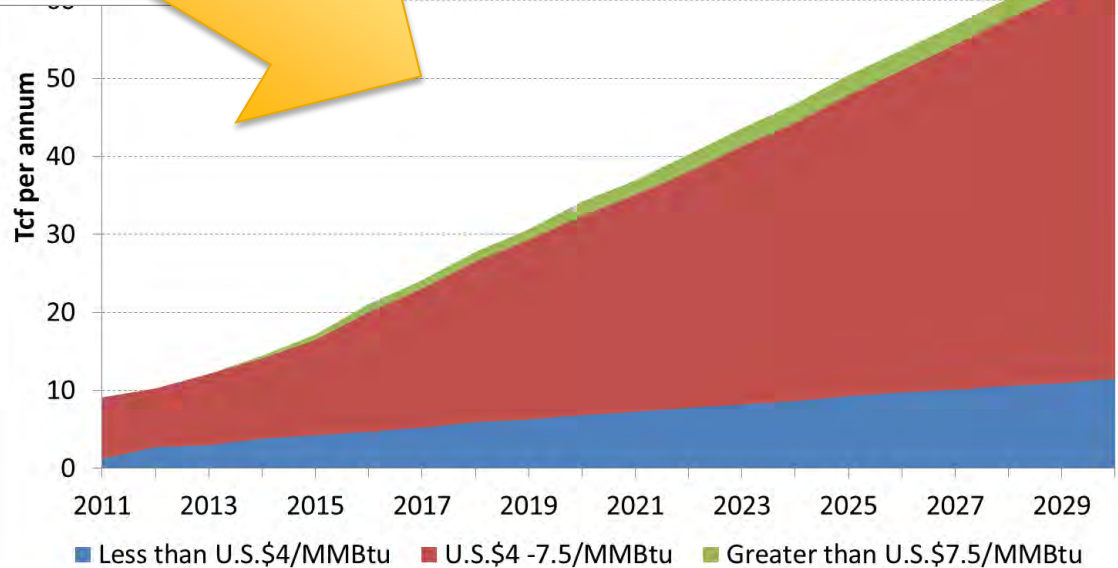
Source: MIT Study June 2011

Global Gas Supply growth 2010 to 2030



- Plentiful gas available and much of it likely available in range U.S.\$4-7.5/MMBtu cost range.....

- Based on differing gas development types high level analysis suggests overall average development costs of U.S.\$5-7/MMBtu?



Will Gas Be Available at the Right Price?

- Yes!. It seems likely that producer costs can be satisfied whilst still supplying market demand (although beware cost overruns)
 - Based on analysis there is clear differential between market price and well head price (enough for monetisation and transport in most cases!)
 - Ultimately these are indicative global averages only – the industry will thrive by the right gas supply finding the right monetisation option and the right market.

Well head production costs (global average)

U.S.\$5-7/MMBtu



**Monetisation/
transportation costs**

Competitive price to drive gas demand

U.S.\$10-12/MMBtu

The Golden Age of Gas – What Will it Take to Get There?

FINAL CONCLUSIONS



Summary of today

The golden Age of Gas – What will it take to get there

- The world will continue to see a growing demand for energy, dominated by the developing countries
- Significant growth in gas demand is available
 - Limitations of future oil supply
 - Environmental concerns for coal
 - Limit to how fast and far renewables can grow
- Plenty of gas resource is available, not necessarily near the demand centres

Summary of today

The golden Age of Gas – What will it take to get there

- The price/financial bridge between supply and demand looks reasonable
 - Each project needs to be justified on its own merits
 - Best monetisation route chosen for each project
- The biggest challenge is building the infrastructure required to get the gas to market
 - Huge investments are required
 - How do we manage the financial risks to ensure the projects happen