



Cass Business School
CITY UNIVERSITY LONDON



Seventh City of London Biennial Meeting 2013

Broad Review of the Evolution of the Natural Gas Industry over the Past Decade

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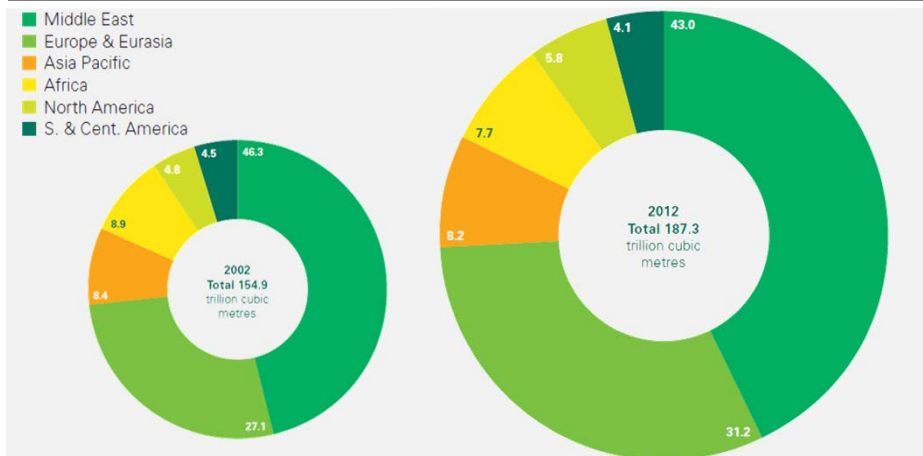
11th November 2013

Natural gas is an increasingly important source of energy

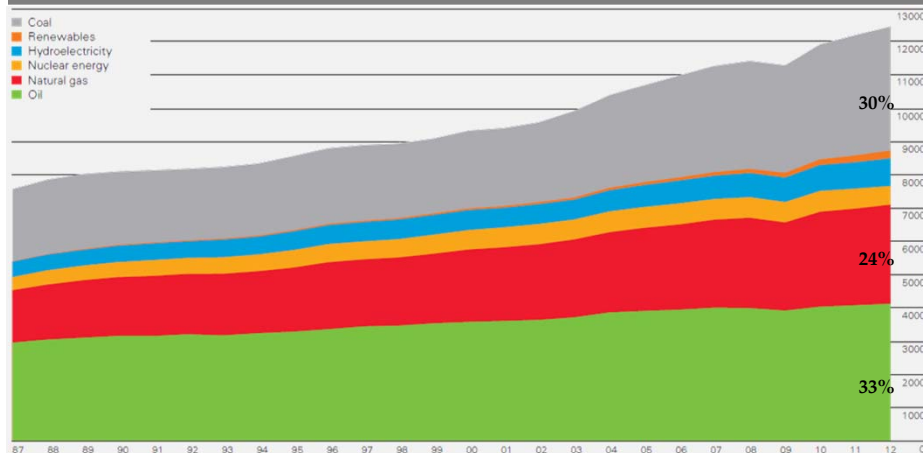
Overview

- Natural gas is the **world's third largest source of primary energy** (24% of total energy consumption)
- Global gas demand was estimated at 3,314 bcm (2,983 toe) in 2012, up 2.5% from 2011 and 12.6% from 2009 levels
- **Commercial gas reserves have risen by ~30% over last decade**
 - Energy companies: Search for gas in its own right
 - Historically flared gas: Now being re-injected for later recovery
 - Increasing view that gas is viable source of energy based on technology improvements
 - Gas is a **cleaner fossil fuel source than coal and oil**
- **Gas demand has increased by around 800 bcm (720 toe) over the last decade, or 2.8% p.a.**
 - In contrast: oil demand increased by only 1.3% p.a. over the last decade
- Reserves/production ratio of natural gas and oil
 - Natural gas is over 56 years
 - Oil*: compared with 53 years

Distribution of proved reserves 2002 vs. 2012



World consumption (million toe)



Source: BP Statistical Review of World Energy 2013, Deutsche Bank Oil & Gas Research.

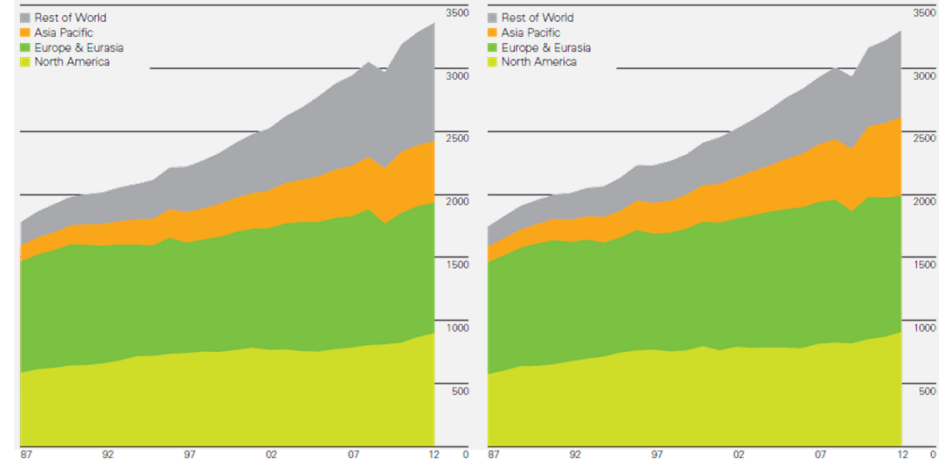
* Includes Canadian Oil Sands

Electric power is and will remain the major demand driver for natural gas

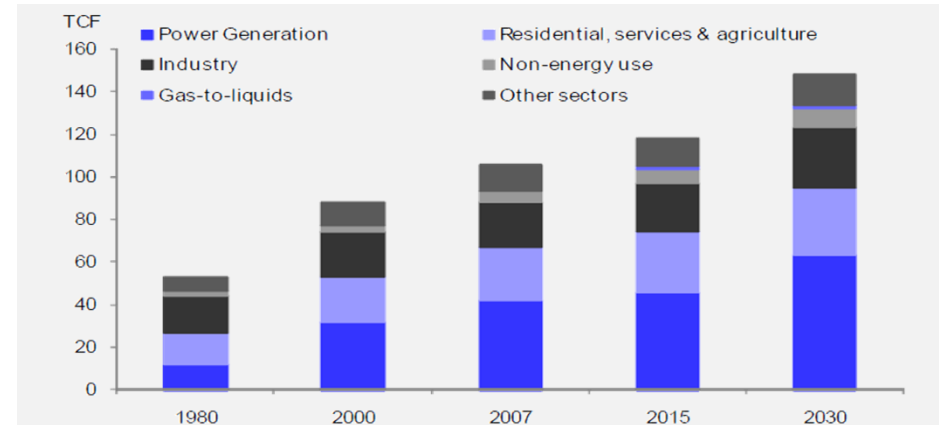
Largest consumers and principal use

- **Largest consumers of gas in the world are the US and Russia**
 - Russia is self-sufficient in gas
 - US has shown supply deficit since 1970 but domestic supply as a percentage of consumption increasing due to production of shale gas (82% in 2002 vs. 94% in 2012)
- Europe historically accounted for 55% of total global gas trade movements
 - Future: **growth in demand expected to come primarily from Asia**, notably China and India where demand is expected to grow by more than 5% p.a. out to 2030
- **Principal uses of gas are electric power generation, industrial sector processes (e.g. refrigeration, process heating/cooling) and other (primarily heating, air-conditioning and ventilation for both residential and commercial purposes)**
- **IEA expects power generation to remain main driver in accounting for 45% demand increase by 2030**

Evolution of production vs. consumption by region (bcm)



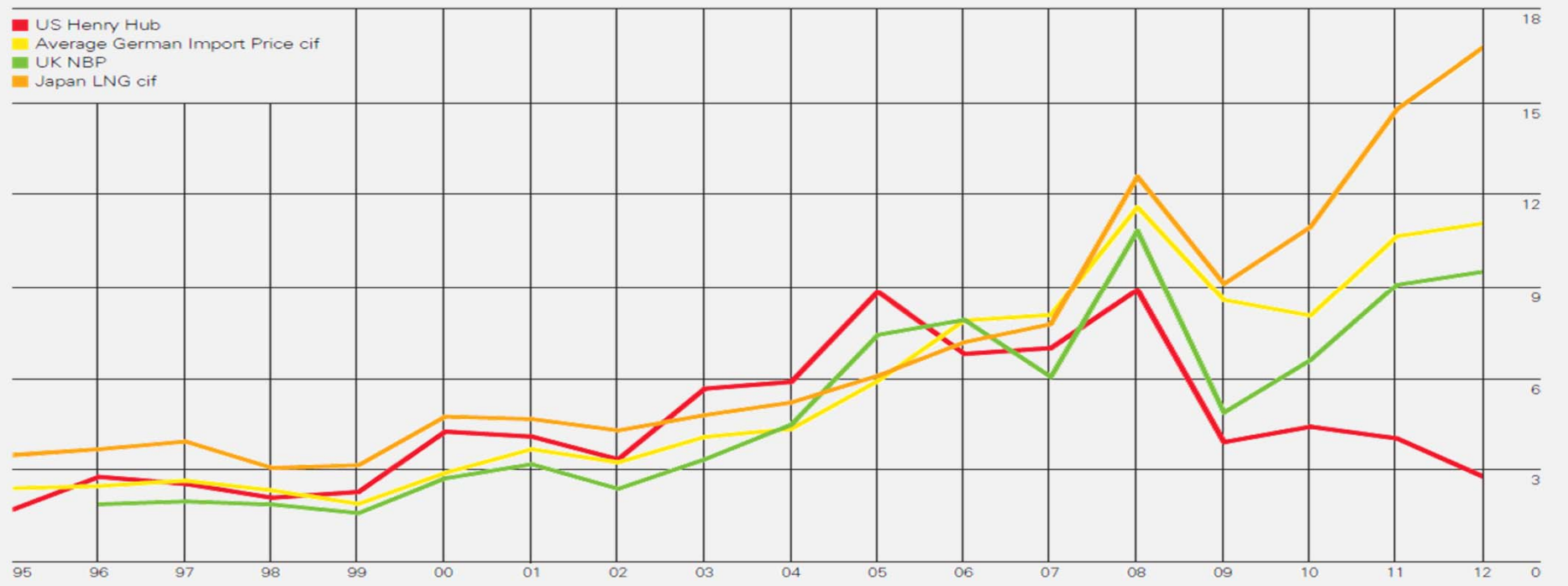
Natural gas demand growth by sector



Prices differ significantly in various regions, especially post financial crisis




Regional price characteristics and historical price development

- Unlike oil markets, **Gas markets are generally regional** owing to the limitations of infrastructure, transportation and currency
- Various gas consuming basins (North America, Europe, Asia,) dictate different prices
 - **North America:** Henry Hub gas pricing (traded on both the spot and futures market much in the same way as crude)
 - **Europe:** Mixed approach with different aspects. UK's National Balancing Point at nascent stage but comparable to HH
 - **Asia:** Long-term contracts based on oil-linked S-curves and near oil price parity



Source: BP Statistical Review of World Energy 2013.

Iran, Russia and Qatar hold jointly nearly half of world's proven reserves

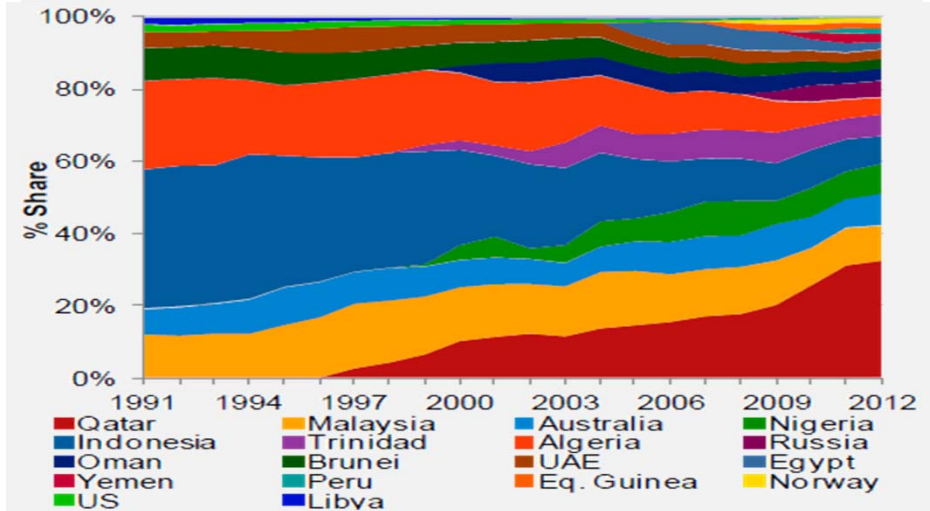
#1 Iran 	#2 Russia 	#3 Qatar 
<ul style="list-style-type: none"> ➤ Proven reserves: 33.6 TCM (18.0%) ➤ R/P ratio: 100+ years ➤ Production: 160.5 bcm <ul style="list-style-type: none"> ▪ 10yr CAGR: 7.9% ➤ 3rd largest producer: 4.8% ➤ Consumption: 156.1 bcm ➤ Exports 2012: 8.4 bcm (all pipeline) ➤ International sanctions have crippled Iran's future potential and projects <ul style="list-style-type: none"> ▪ LNG delayed due to lack of FID ▪ Without sanctions, "Iran could easily aim for a 10 per cent share of global gas trade" (Bloomberg) ➤ High local consumption ➤ Major customer Turkey; planned: Pakistan, Oman 	<ul style="list-style-type: none"> ➤ Proven reserves: 32.9 TCF (17.6%) ➤ R/P ratio: 55.6 years ➤ Production: 592.3 bcm <ul style="list-style-type: none"> ▪ 10yr CAGR: 1.0% ➤ 2nd largest producer: 17.6% ➤ Consumption: 424.6 bcm ➤ Exports 2012: 185.9 bcm (pipeline) and 14.8 bcm (LNG) ➤ High local consumption ➤ Gas production is dominated by state controlled Gazprom ➤ Major European countries make up 70% of pipeline exports ➤ Vast pipeline infrastructure (220,000km) but much needs urgent investments 	<ul style="list-style-type: none"> ➤ Proven reserves: 25.1 TCF (13.4 %) ➤ R/P ratio: 100+ years ➤ Production: 157.0 bcm <ul style="list-style-type: none"> ▪ 10yr CAGR: 18.2% ➤ 4th largest producer: 4.7% ➤ Consumption: 21.9 bcm ➤ Exports 2012: 19.2 bcm (pipeline) and 105.4 bcm (LNG) ➤ World's leading LNG player with 77 MTPA capacity ➤ Comparably low local consumption ➤ Major customers India, Japan, South Korea, Taiwan and China (53% of all exports); Europe/Eurasia (25%)
<ul style="list-style-type: none"> ➤ Iran, Russia, and Qatar hold together nearly half the world's proven reserves (2012) <ul style="list-style-type: none"> ▪ US remains largest producer with share of 20.4% (2012); above Russia's level and more than fourfold that of Iran and Qatar each ➤ Gas Exporting Countries Forum (GECF) not comparable to OPEC as the 13 members meet to discuss market; not to control supply <ul style="list-style-type: none"> ▪ There has been rumours, attempts and discussions to form a "Gas Cartel" 		

Liquefied Natural Gas was an industry game changer...

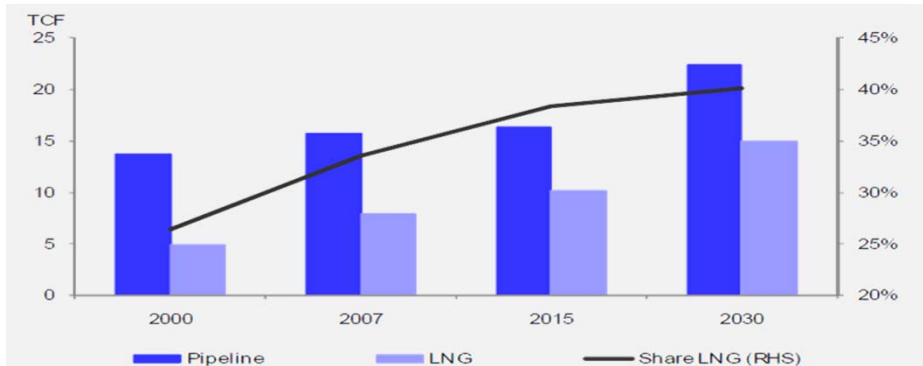
Dominance of Qatar and promising supply from Australia

- **LNG was a game changer to gas industry**
 - Prior to the LNG era, pipelines were the only way to transport gas from the wellhead to the market
- **Largest players**
 - **Qatar (by far the largest exporter with 77.4 MT in 2012; c.33% of global supply)**
 - Other large players: Australia, Indonesia, Malaysia and Nigeria
 - Promising competition from USA on back of shale gas boom
- **LGN consumption increase:**
 - 1980: LNG trade just 2% of global gas consumption
 - 2010: LNG more than 10% of global gas consumption
- **LNG as a proportion of supply has been increasing over the last years with demand growth of c.5-10% p.a.**
- **LGN's share of global trade expected to reach 40% in 2030**

Share of global LNG exports by country



LNG's share of global gas trade

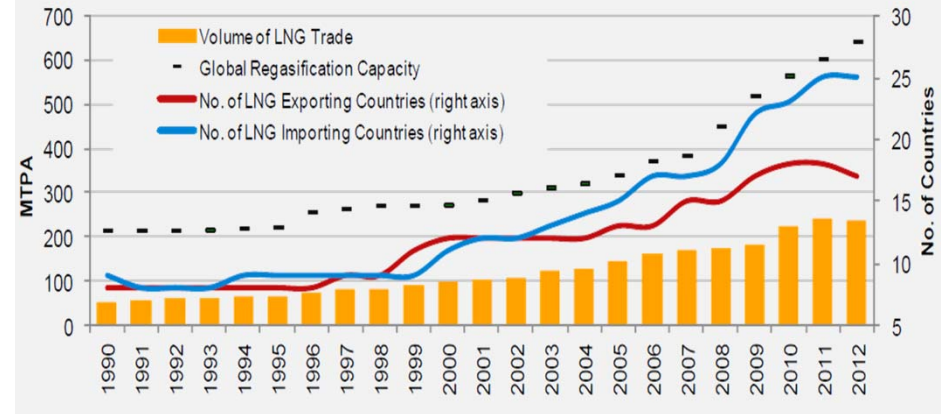


...and more LNG ramp-up is expected in the mid-term future

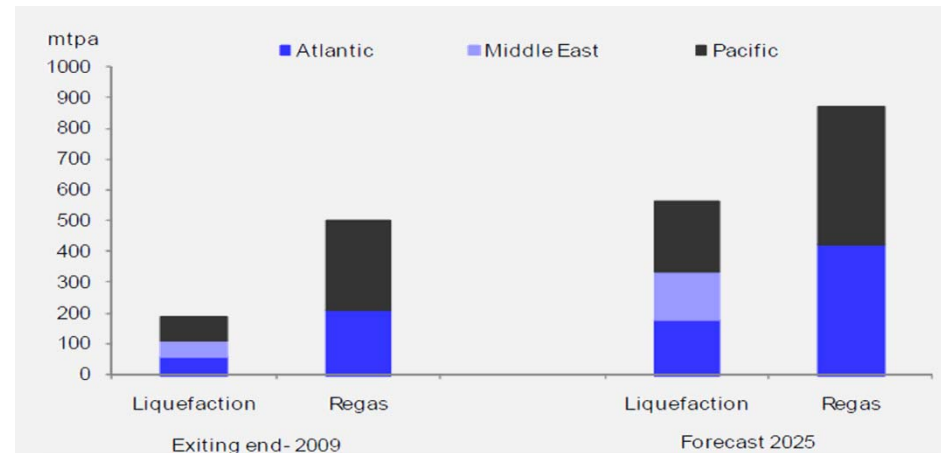
Asia largest LNG buyer

- Asia largest LNG market with more than 60% of worldwide imports (2012 supply).
- Two main consumers
 - Japan: 37% (massive increase post Fukushima disaster)
 - South Korea: 15%
- China (6%) and India (6%) are increasing imports but LNG is still less than 40% of total gas consumption
- Increasing demand from Europe
 - Decline in indigenous supply sources
 - Diversification of supply sources (moving away from current dependence on Russia)

LNG's share of global gas trade



Regional re-gas capacity

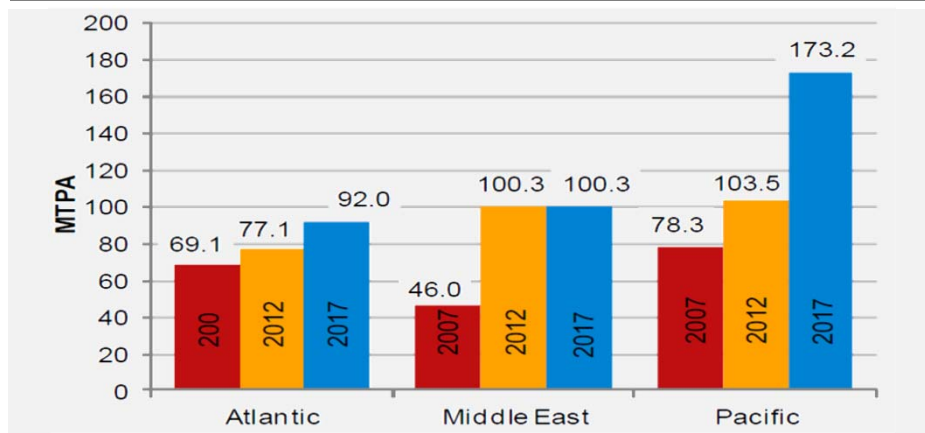


Australian LGN may change the global supply/demand equation...

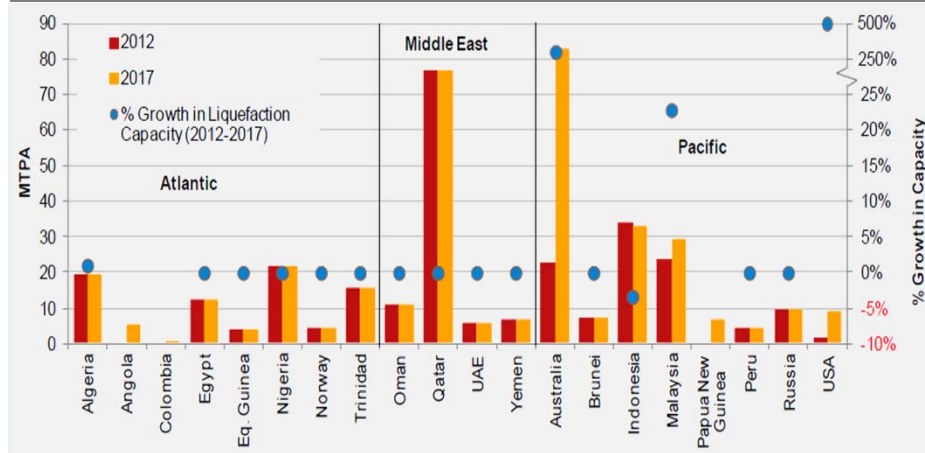
Australia's potential

- According to IEA **Australia is currently the third largest LNG producer in the world**
- Today Qatar has ~27% of global liquefaction capacity
- But majority of near-term growth in capacity expected to come from Australia over next five years
 - On completion (2018) Australia will add a further 61.4 MTPA of capacity exceeding with 85.8 MTPA Qatar
 - Indonesia expected to be third at 36.3 MTPA capacity
- Competition on the rise:
 - Shale gas production in North America has reversed the LNG outlook for Australia (US constructing plants for 17.8 MTPA capacity)
 - Considerable momentum also expected from projects in frontier region
- Other issues include delays and cost overruns
 - Ichthys production expected late 2016 (could come 30% over budget and 18 month delay)
 - Woodside's Pluto LNG now online but future uncertain (production approx. 16 months behind schedule and 25% over budget)

Liquefaction Capacity by Basin



Liquefaction capacity by country (2012 vs. 2017E)

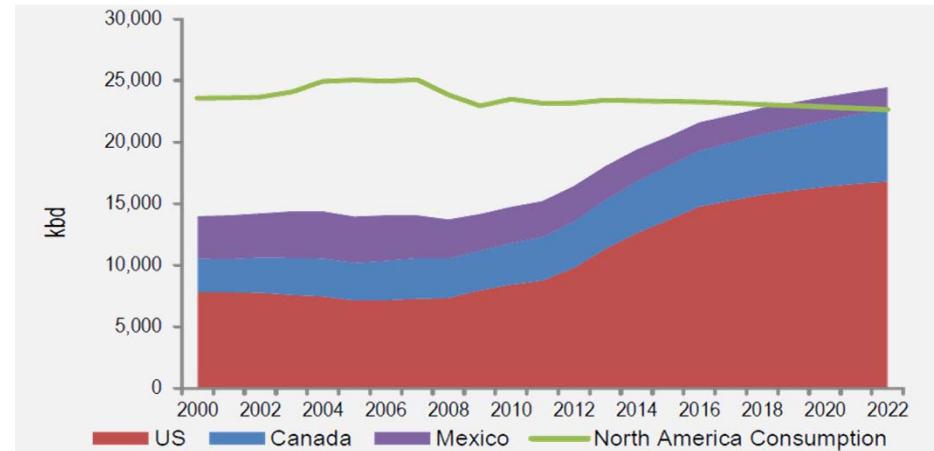


...as will the shale gas boom

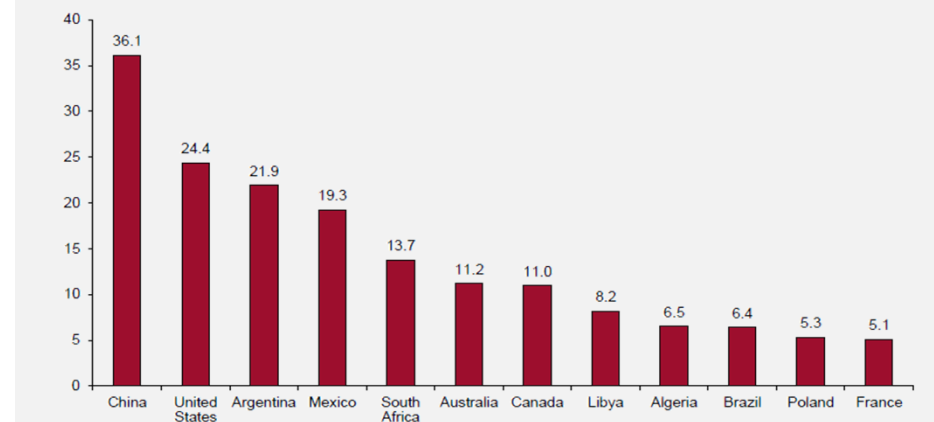
Impacts of the shale gas rise

- Unconventional shale boom is arguably **one of the biggest technology breakthroughs in decades**
- US gas production from shale
 - ~5% in 2000
 - ~23% in 2000
 - EIA expects ~50% by 2035
- Expected impacts of the shale gas boom
 - **North America to become increasingly self-sufficient**
 - “Unconventional” brake on the rising prices
 - Coal to become one of the biggest loser in the US (dethroning “King Coal”)
 - Significant impact on the power & utility sectors
 - US *could* emerge as a global LNG player
- **Spill over on other markets:**
 - **China could become biggest player with more recoverable shale reserves of the US**
- Environmental risks
 - Lower water supply
 - Hazardous chemicals and water contamination
 - Hydraulic fracturing can cause “small earthquakes”

North American energy production and consumption



Estimated technically recoverable shale gas (TCM)



Natural gas has many geopolitical implications on the global stage

Geopolitical subjects in the Middle East

- **Israel**
 - Fall of Mubarak regime and cut-off of ~50% of gas supplies from Egypt
 - Change of dynamics offshore gas field discoveries
 - 2013: Leviathan field ~500bcm
 - 2009: Tamar field ~ 275bcm
 - Potential export to Europe?
- **Jordan**
 - Dependence on imports and its options post cut-off after Mubarak
 - Israeli gas in near future?
 - Iranian gas?
- **Qatar / Iran**
 - Rivalry of the North Dome / South Pars field
 - “Islamic pipeline” (Iran-Iraq-Syria pipeline) – to be built and supply via Syria Europe?
 - Potential rival pipeline from Qatar, Saudi (bypassing Iraq) through Turkey to supply Europe
 - Russia’s response to planned competition
 - Implications/drivers behind lasting war in Syria?

Geopolitical subjects in other geographies

- **North America**
 - Boom of shale gas and significantly lower reliance on imports
 - US to become a net exporter in near future (LNG)?
 - Implication on US’s Middle East strategy going forward?
- **Europe**
 - Germany’s commitment to exit nuclear power
 - Less dependence on Russia – will Russia lose its political influence?
 - Concerns about dependence of Algeria (13% of Europe’s gas source) and questions about political stability in North Africa
- **Asia**
 - Tendency to reduce exposure to nuclear power means higher dependence on gas post Fukushima Japan
 - Japan and South Korea in particular highly depend on Qatar
 - Could Australian LGN become alternative source?
 - How will Chinese shale gas change Asian energy in future?