



**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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**11<sup>th</sup> November 2013**

# Natural gas is an increasingly important source of energy

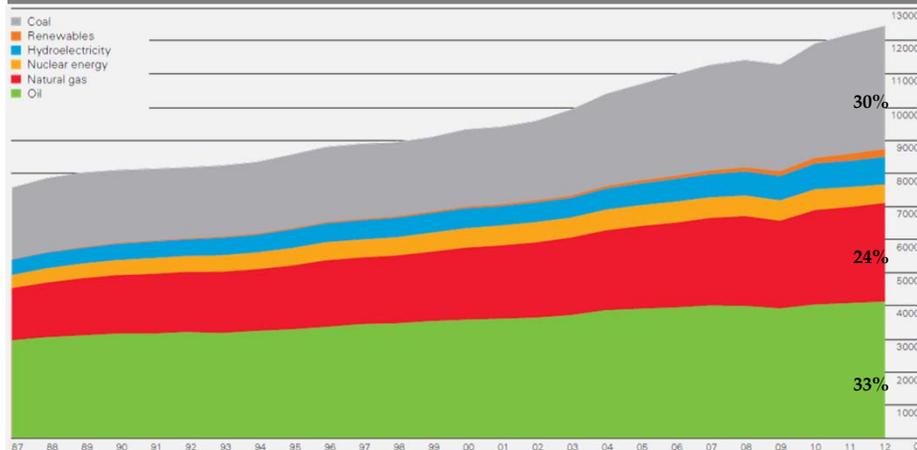
## Overview

- 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.

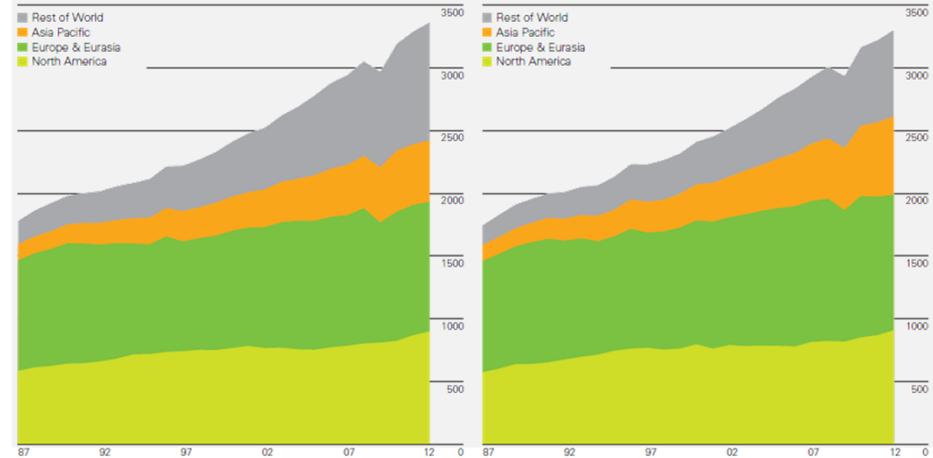
\* Includes Canadian Oil Sands

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

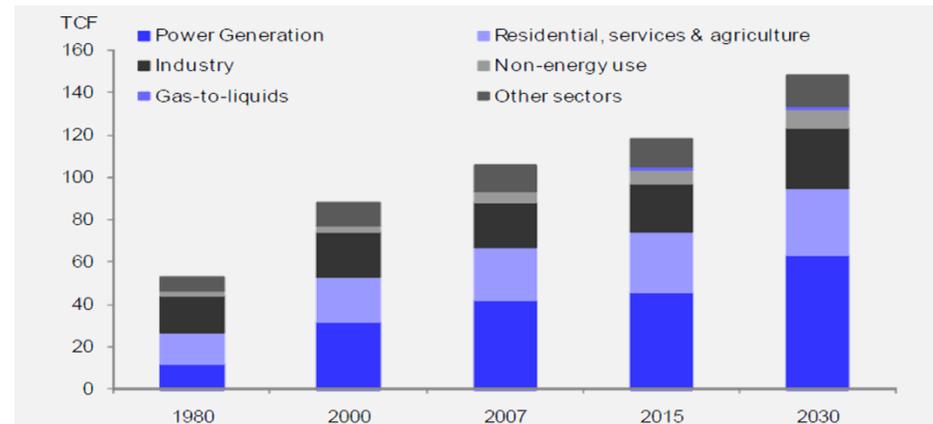
## Largest consumers and principal use

- **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)



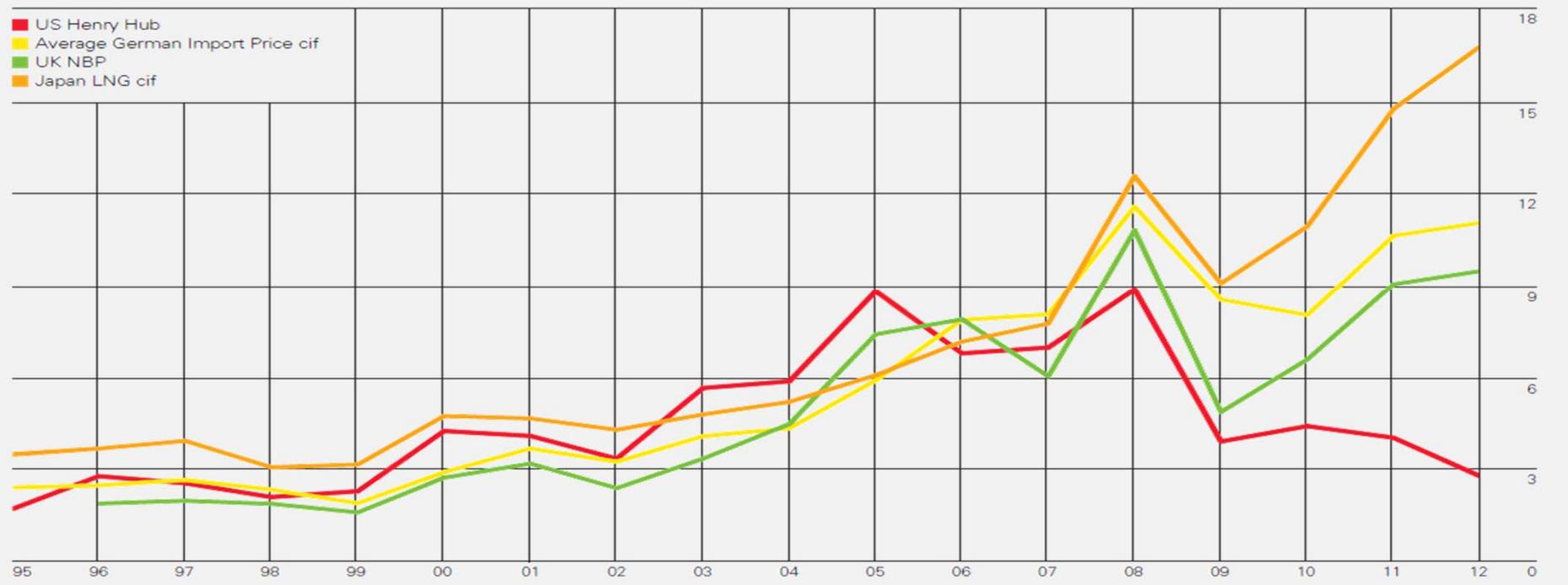
## Natural gas demand growth by sector



# 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

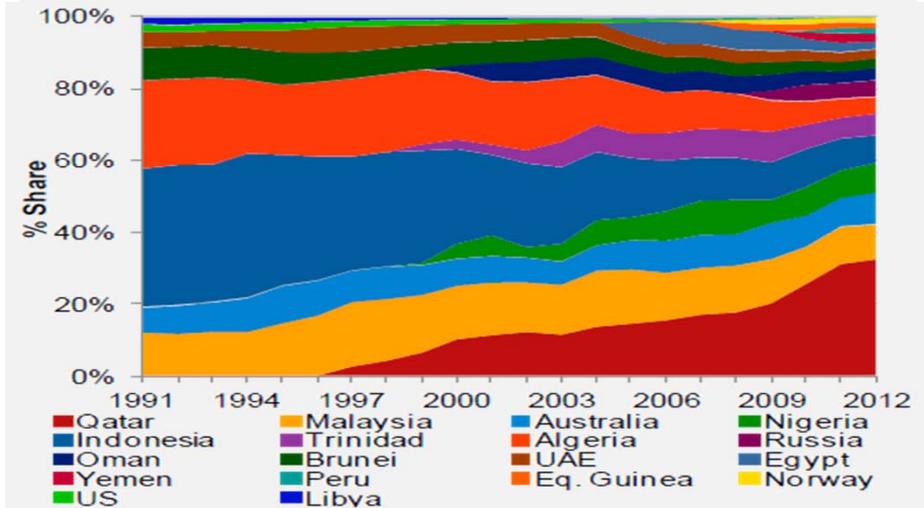
#1 Iran 	#2 Russia 	#3 Qatar 
<ul style="list-style-type: none"> <li>➤ <b>Proven reserves:</b> 33.6 TCM (18.0%)</li> <li>➤ <b>R/P ratio:</b> 100+ years</li> <li>➤ <b>Production:</b> 160.5 bcm               <ul style="list-style-type: none"> <li>▪ <b>10yr CAGR:</b> 7.9%</li> </ul> </li> <li>➤ <b>3<sup>rd</sup> largest producer:</b> 4.8%</li> <li>➤ <b>Consumption:</b> 156.1 bcm</li> <li>➤ <b>Exports 2012:</b> 8.4 bcm (all pipeline)</li> <li>➤ International sanctions have crippled Iran's future potential and projects               <ul style="list-style-type: none"> <li>▪ LNG delayed due to lack of FID</li> <li>▪ Without sanctions, <b>"Iran could easily aim for a 10 per cent share of global gas trade"</b> (Bloomberg)</li> </ul> </li> <li>➤ High local consumption</li> <li>➤ Major customer Turkey; planned: Pakistan, Oman</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Proven reserves:</b> 32.9 TCF (17.6%)</li> <li>➤ <b>R/P ratio:</b> 55.6 years</li> <li>➤ <b>Production:</b> 592.3 bcm               <ul style="list-style-type: none"> <li>▪ <b>10yr CAGR:</b> 1.0%</li> </ul> </li> <li>➤ <b>2<sup>nd</sup> largest producer:</b> 17.6%</li> <li>➤ <b>Consumption:</b> 424.6 bcm</li> <li>➤ <b>Exports 2012:</b> 185.9 bcm (pipeline) and 14.8 bcm (LNG)</li> <li>➤ High local consumption</li> <li>➤ Gas production is dominated by state controlled Gazprom</li> <li>➤ Major European countries make up 70% of pipeline exports</li> <li>➤ Vast pipeline infrastructure (220,000km) but much needs urgent investments</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Proven reserves:</b> 25.1 TCF (13.4 %)</li> <li>➤ <b>R/P ratio:</b> 100+ years</li> <li>➤ <b>Production:</b> 157.0 bcm               <ul style="list-style-type: none"> <li>▪ <b>10yr CAGR:</b> 18.2%</li> </ul> </li> <li>➤ <b>4<sup>th</sup> largest producer:</b> 4.7%</li> <li>➤ <b>Consumption:</b> 21.9 bcm</li> <li>➤ <b>Exports 2012:</b> 19.2 bcm (pipeline) and 105.4 bcm (LNG)</li> <li>➤ World's leading LNG player with 77 MTPA capacity</li> <li>➤ Comparably low local consumption</li> <li>➤ Major customers India, Japan, South Korea, Taiwan and China (53% of all exports); Europe/Eurasia (25%)</li> </ul>
<ul style="list-style-type: none"> <li>➤ <b>Iran, Russia, and Qatar hold together nearly half the world's proven reserves (2012)</b> <ul style="list-style-type: none"> <li>▪ <b>US remains largest producer with share of 20.4%</b> (2012); above Russia's level and more than fourfold that of Iran and Qatar each</li> </ul> </li> <li>➤ 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"> <li>▪ There has been rumours, <b>attempts and discussions to form a "Gas Cartel"</b></li> </ul> </li> </ul>		

# Liquefied Natural Gas was an industry game changer...

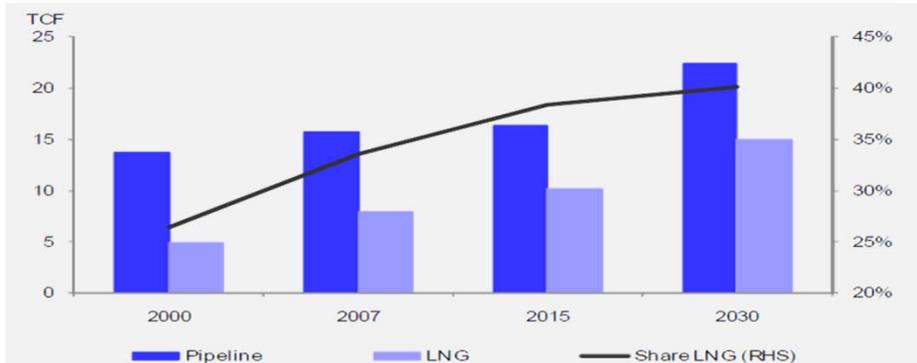
## Dominance of Qatar and promising supply from Australia

- **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

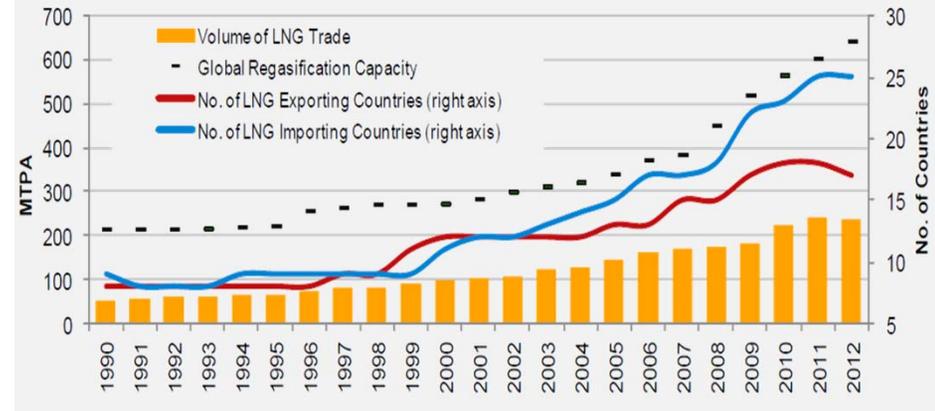


# ...and more LNG ramp-up is expected in the mid-term future

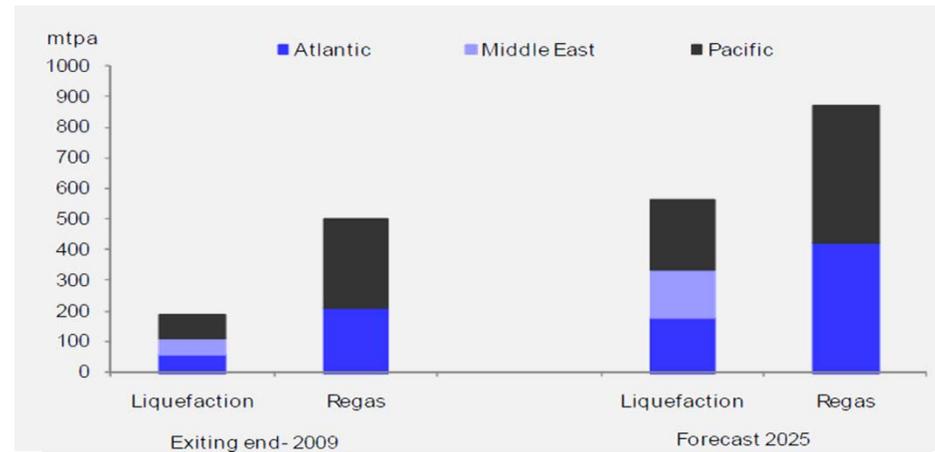
## Asia largest LNG buyer

- 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

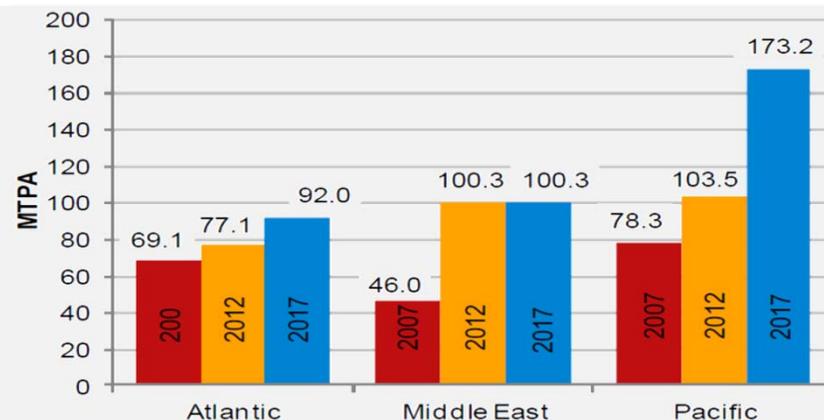


# Australian LGN may change the global supply/demand equation...

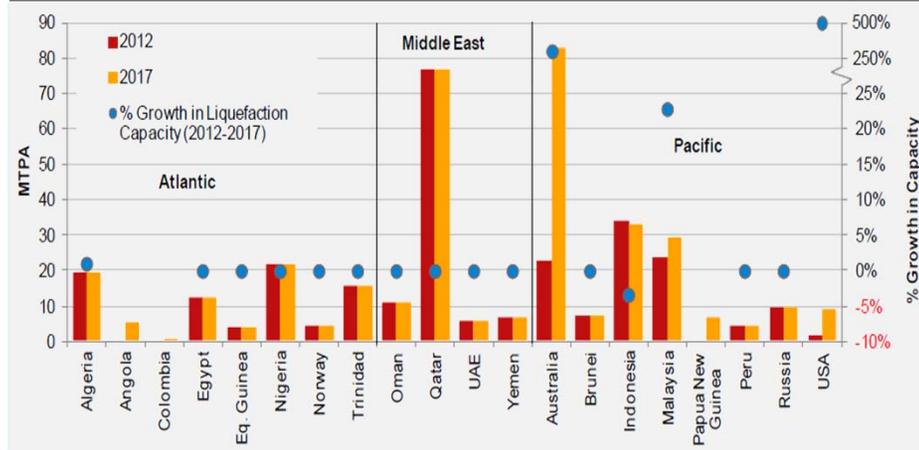
## Australia's potential

- 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)

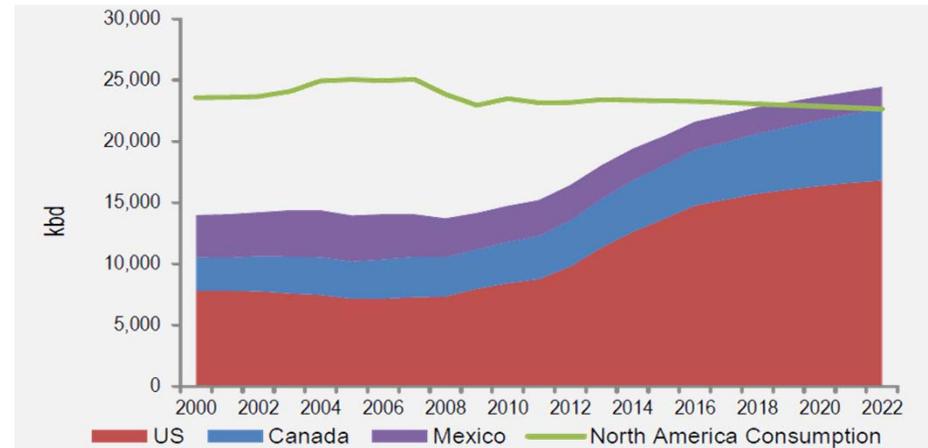


# ...as will the shale gas boom

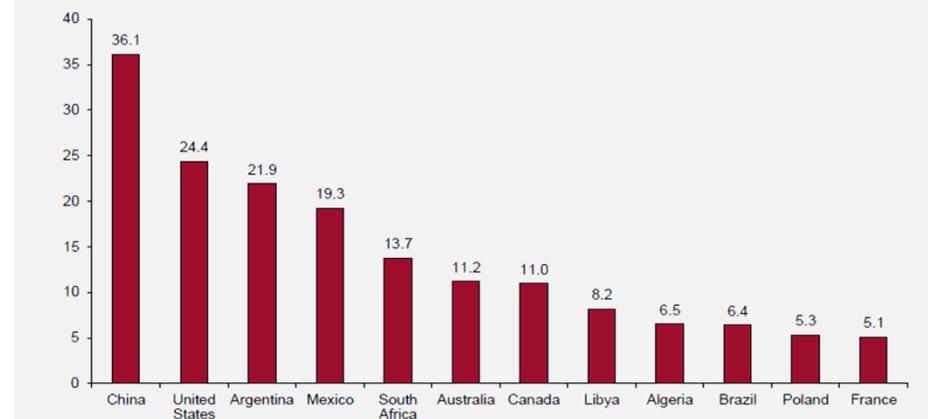
## Impacts of the shale gas rise

- 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?