

The Liquefied Natural Gas (LNG) markets



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Overview

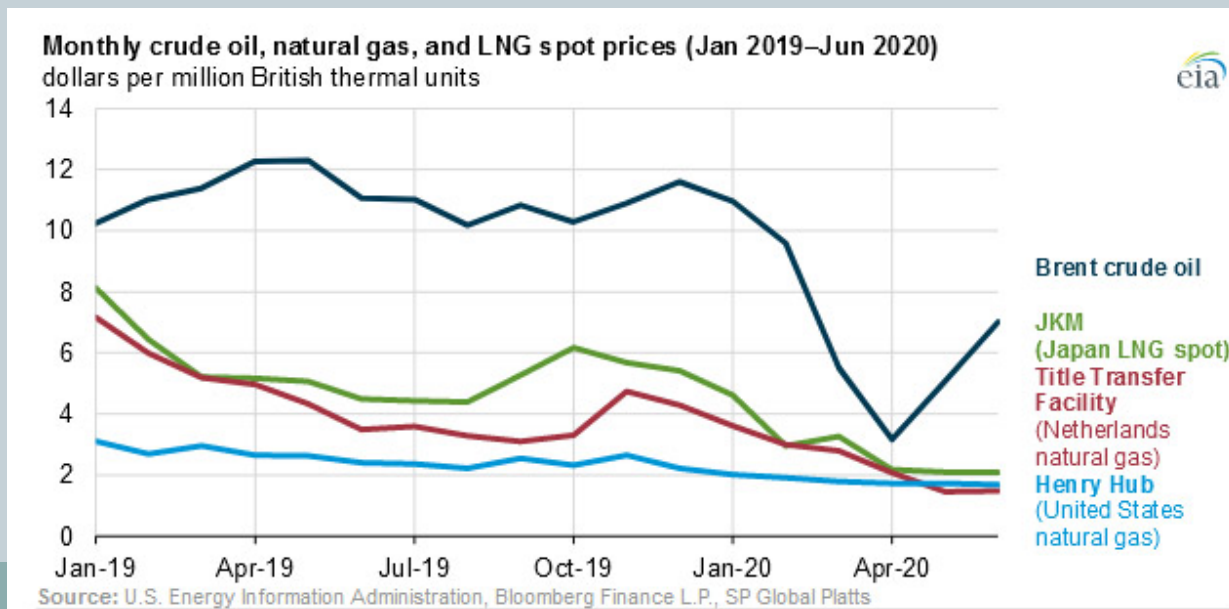
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- Important energy developments
- Low oil price environment & impact on natural gas
- The LNG market
- Liquefied natural gas (LNG) markets
- Oilfield service companies

The changing face of the LNG sector

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- LNG is becoming a global market
- Economies of scale increasingly important
- World capacity. **2014**: 245mtpa → **2019**: 430.5mtpa (+75% vs 2014)
- **2018**: 100MT (31%) on non-long term LNG contracts
- 2040: LNG demand to reach 700MT (Shell)
- 2020: US LNG exports declined from 9.8Bcf/d to 4Bcf/d (June)



2 LNG Trade

Global LNG trade increased to **354.7 MT** in 2019, an increase of **40.9 MT** or 13% vs. 2018. This is the sixth year of consecutive growth in global LNG trade.

Australia is the second largest exporter with a total of **75.4 MT**



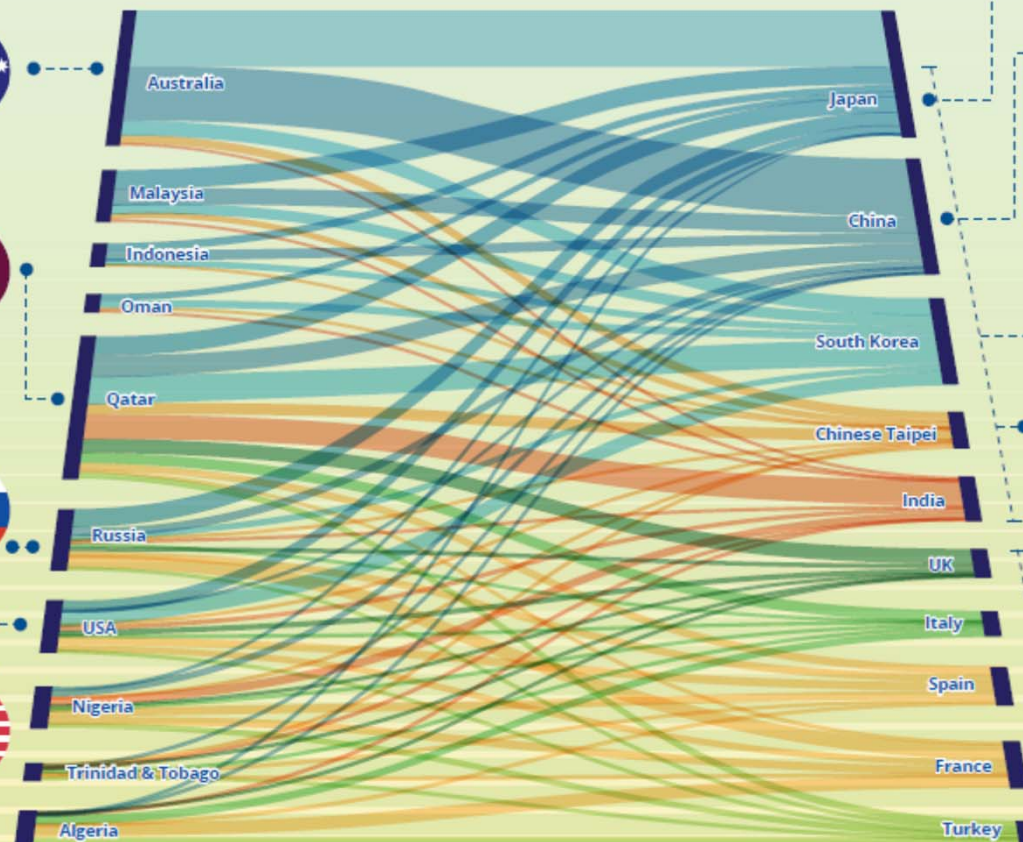
Qatar managed to maintain its position as the largest exporter in the world, exporting **77.8 MT**



Russia is now the fourth largest exporter of LNG, with **29.3 MT** of export in 2019



The USA overtook Malaysia as the third largest exporter, and added a record of **+13.1 MT**



Japan imported **76.9 MT**
(-5.6 MT vs. 2018)



China imported **61.7 MT**
(+7.7 MT vs. 2018)



The largest global LNG trade flow route continues to be intra-Asia Pacific trade **77.3 MT**



The largest importing regions, consistent with 2018, were
• Asia Pacific **131.7 MT**
• Asia **114.5 MT**



European imports surged on the back of low prices, almost doubling to **85.9 MT**

The LNG sector (2)

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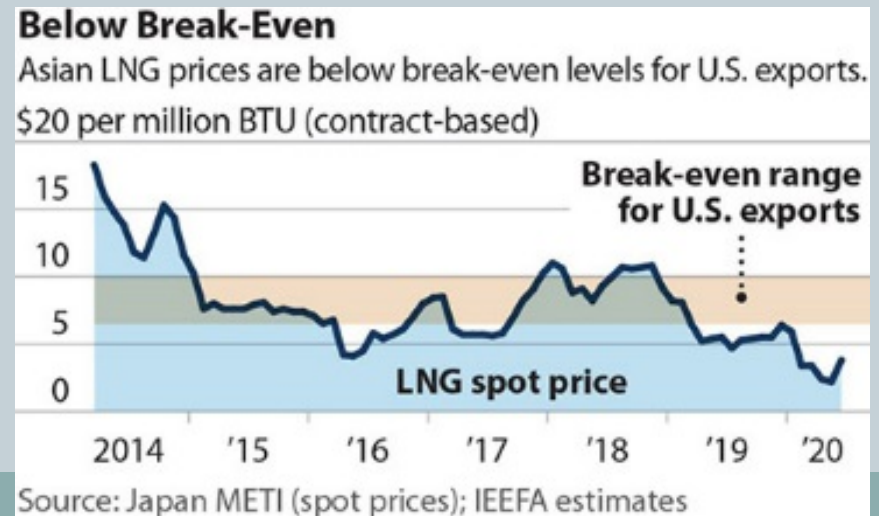
- Qatar claims to be lowest cost LNG producer in the world
- 600mtpa projects under consideration. Most will not materialize:
 - 1. Construction costs 2007-13 = 2x the 2000-07 costs
 - 2. Break even price for new projects = \$70-80/bbl
 - 3. Sluggish demand from China & EU
 - 4. LNG market glut until 2020
 - 5. Difficulty of financing projects
 - 6. Consumers reluctance to enter long-term LNG contracts
 - 7. Boost in US shale gas production
- LNG construction period 4-6 years
- FSRU capacity: 84mtpa
- LNG: 9.8% of global gas supply '16



Major energy developments

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- Post 2005: US shale gas & oil revolution
- Nov. '14: slide in oil prices
- 2020: Covid-19 collapsed prices
- Spat btw US & China dented exports
- Accelerated decarbonisation efforts
- Global NG demand to drop by 4%
- 359MT (2019) → 700MT (2040)



The LNG market

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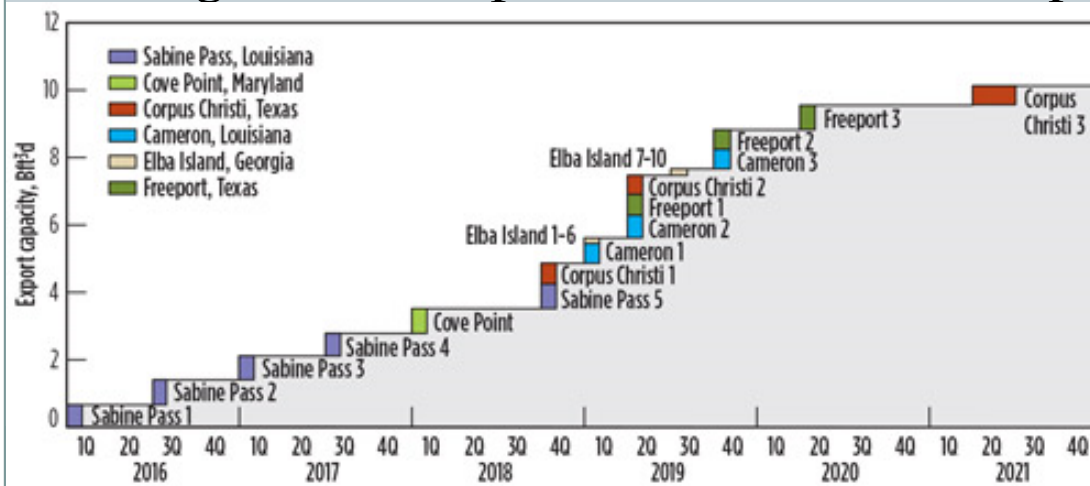
- Gas-to-gas competition in US
- Oil-linked gas market in Asia
- Hybrid (gas-2-gas & oil-linked) market in Europe
- Spot LNG gas market



LNG market

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- LNG: world energy mix from 9% (2010) → 15.5% (2030)
- LNG from offshore Mozambique & Tanzania (100 tcf);
- Australia largest LNG exporter by 2017—
Reserves: 400 tcf | Browse | Preclude | Ichthys | Pluto
- US granted two permissions for LNG export by 2017





CUMMINGS

Shell acquisition of BG

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- 08/04/15: Shell takes over BG for \$70bn
- Replenish reserves: offshore domain
- Strong LNG presence: 45mpta (64bcm/y) by 2018
- Assets in Tanzania, Brazil, Curtis LNG project (Aus)

Shell and BG in Brazil

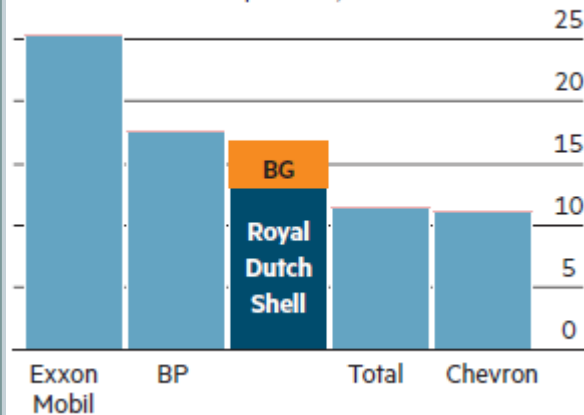
Production ('000 barrels of oil equivalent per day)



LNG production capacity, 2014
Million tonnes per annum

Reserves

Billion barrels of oil equivalent, 2014



Natural gas hub

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- Pipeline hub: pipeline interconnection terminals
- Gas price determined at the hub
- Hubs: receive gas from & supply to other p/lines
- Strong int'l banking system, solid legal system
- Sufficient gas storage facilities
- Considerable volume of gas pass through
- Enhanced supply **flexibility** & **reliability**



New oil price realities

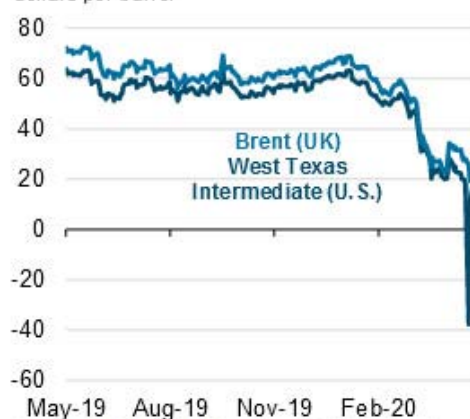
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- Covid19 forced oil futures to go negative
- Oil demand has rebounded
- Flat demand from China & EU for 2020
- US oil production reached 13mpbd (Nov. 2020)
- OPEC+ limits production by 9.6mbpd now at 7.7mbpd

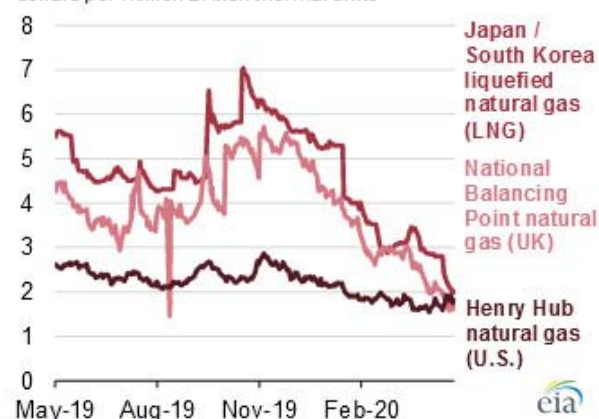
Natural gas markets remain regionalized compared with oil markets

Daily prices of select international energy benchmarks (May 1, 2019-Apr 24, 2020)

Crude oil prices
dollars per barrel



Natural gas prices
dollars per million British thermal units



Source: U.S. Energy Information Administration, based on data from Bloomberg L.P.



Implications of oil price collapse

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Pros

- Big savings for consumers: lower fuel cost
- Boost for world economy
- Lower fuel costs for comps eg, airlines, agriculture
- Golden opportunity to lower fuel subsidies

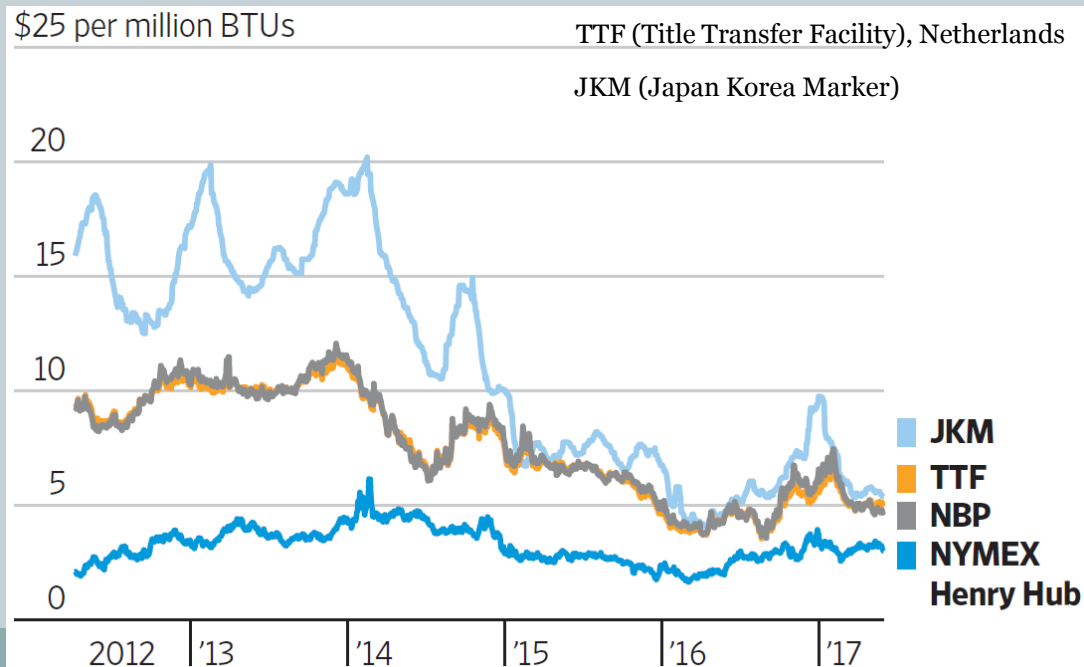
Cons

- Deflationary pressure
- Lower share price of players
- Slash capital expenditures of O&G comps
- Fewer funds for RES
- Contracted natural gas & LNG prices
- Venezuela & Nigeria at brink of collapse

Impact on LNG prices

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- LNG spot price collapse to \$4.24/MMBtu
- Asia accounts for $\frac{3}{4}$ of LNG demand
- 24/04/16: US exports first LNG cargo
- EU & Asian LNG demand in decline
- Break even prices: \$12-20/MMBtu (Austr.)



Bad Timing

LNG production is ramping up as oil price

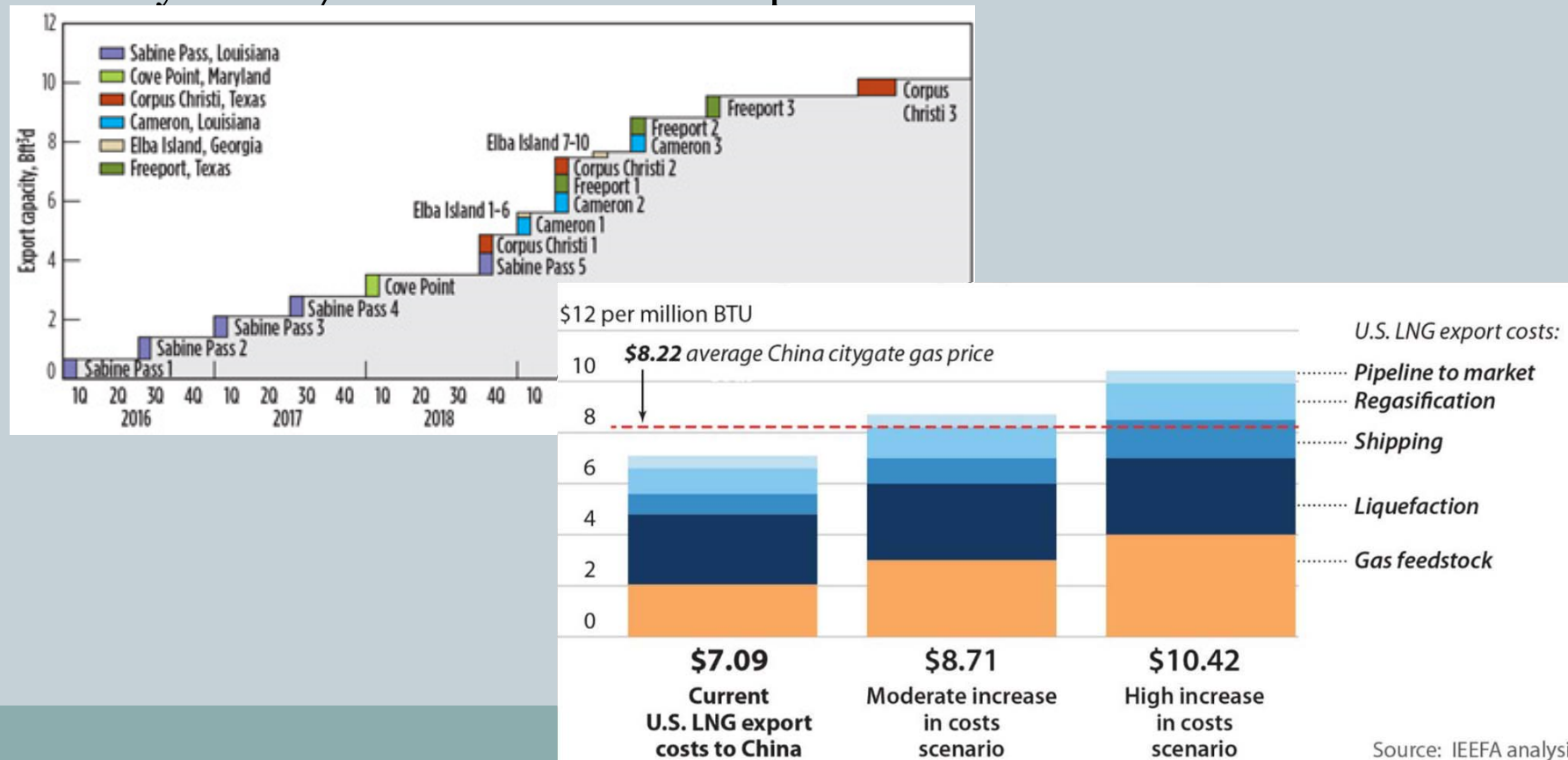
LNG export growth, in billion cubic meters

Sources: Australian government (export); WSJ Market

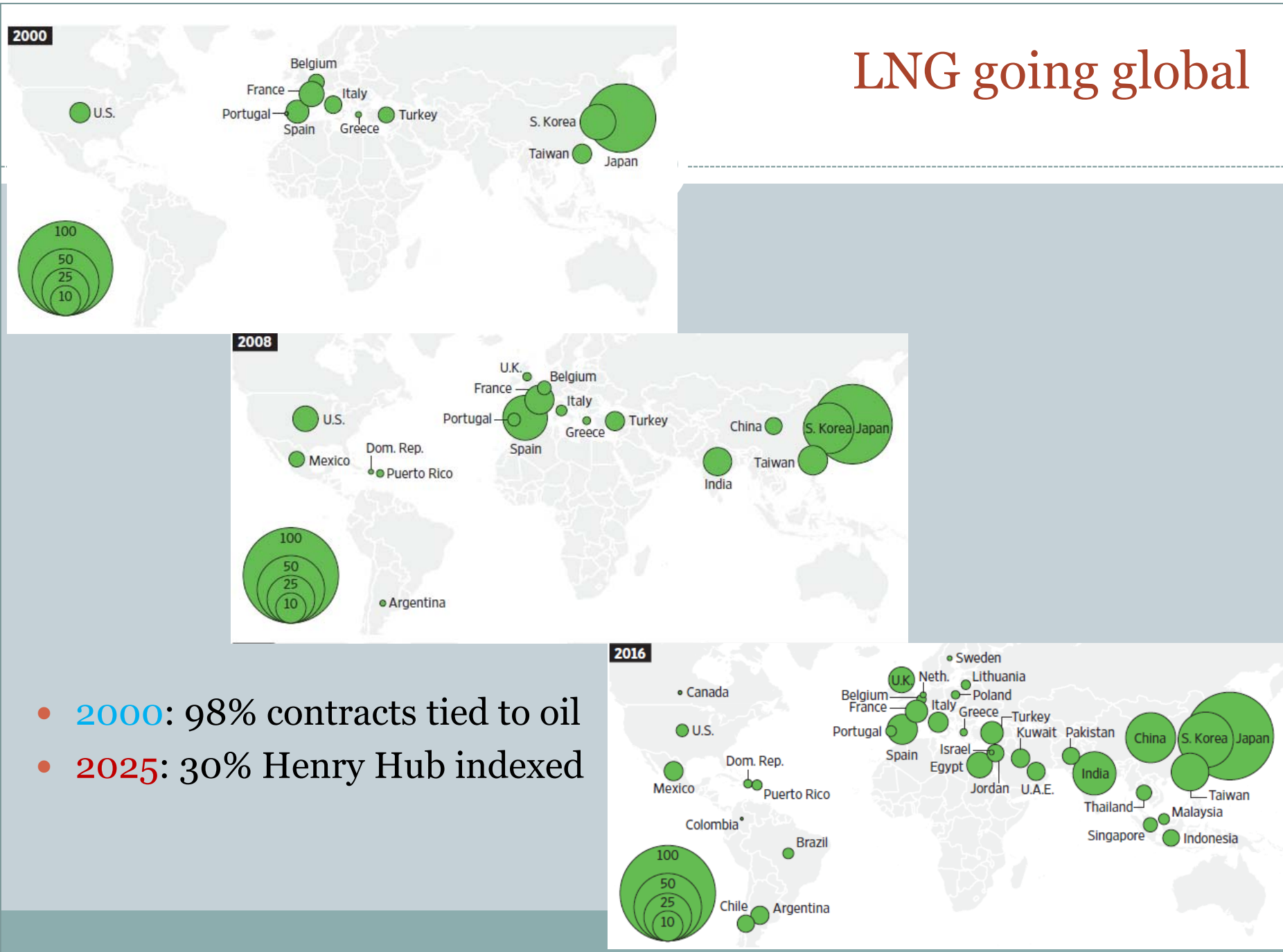
US LNG exports

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- Cheniere Energy Sabine Pass first US LNG shipments
- Sabine Pass cost \$19bn
- At any time 170 LNG carriers transport LNG



LNG going global

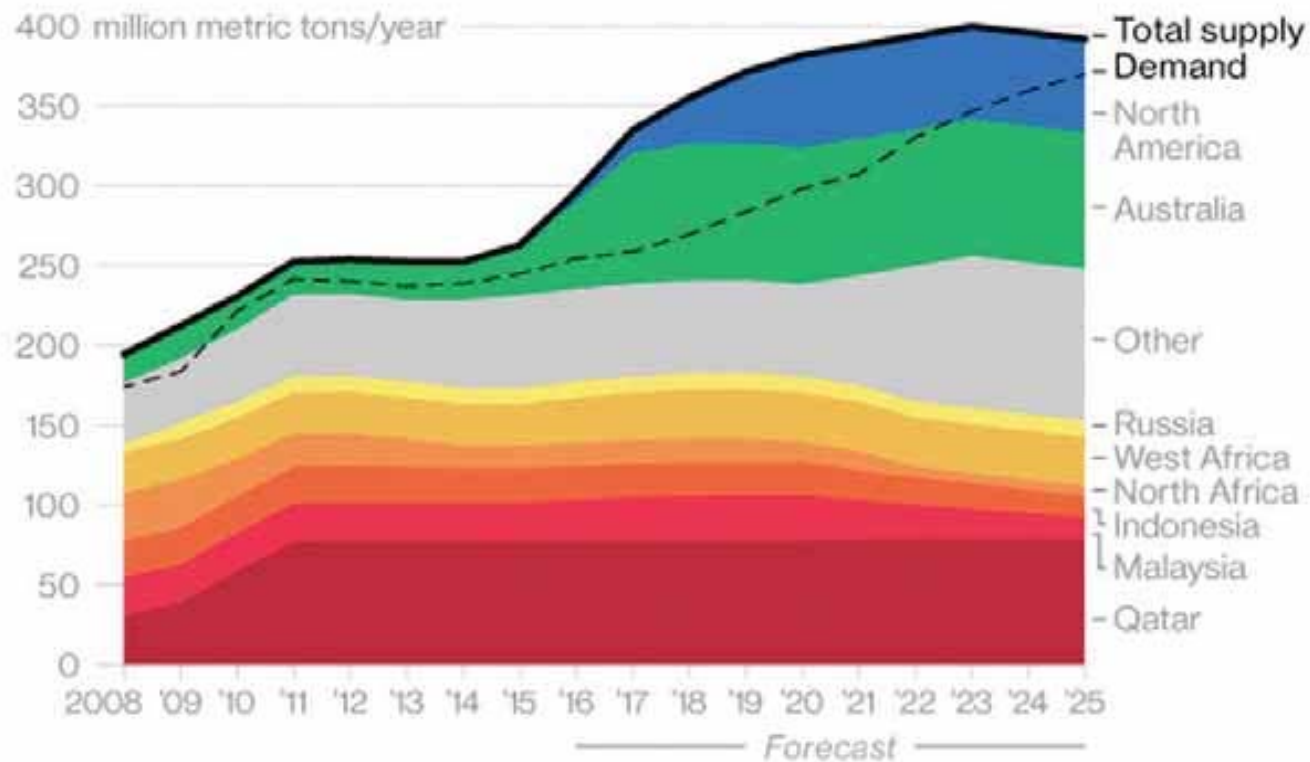


LNG players

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More Players in the LNG Game

Commitments for new production from Australia and North America will leave the world awash in liquefied natural gas.



Source: Bloomberg

World's LNG plants

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IGU Annual Report 2020



Note: Numbers in parentheses behind project names refer to Appendix 1: Table of Global Liquefaction Plants.
Source: Rystad Energy

LNG shipping routes



Rystad Energy 2020

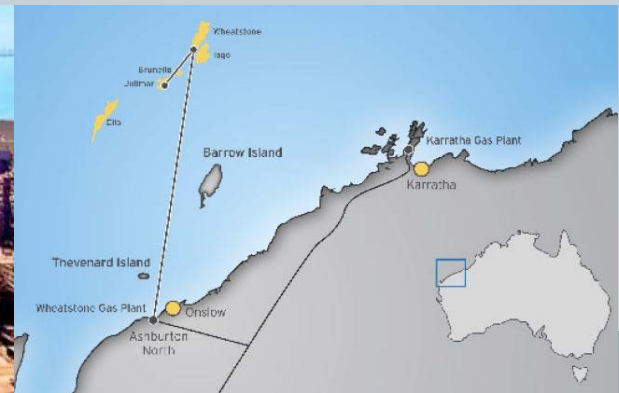
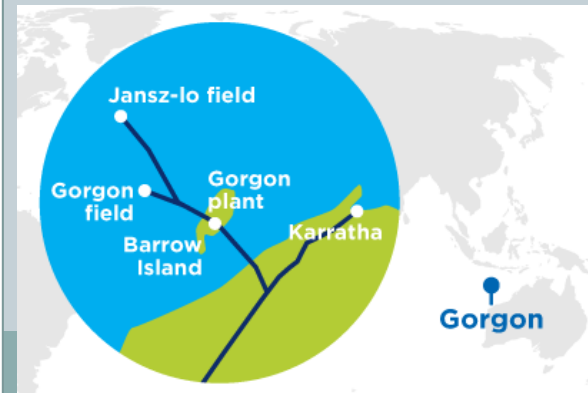


Source: Rystad Energy

Lessons for the LNG industry

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- Gorgon LNG (15mtpa) cost Chevron \$54bn
 - First LNG cargo in April, 2016
 - [Gorgon project video](#)
 - Wheatstone LNG (8.9mtpa) amounted to \$36bn
 - First LNG exports in Oct., 2017
 - [Wheatstone video](#)
- Cost overruns **\$23bn!**



Natural gas hubs

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- Pipeline hub: pipeline interconnection terminals
- Gas price determined at the hub
- Hubs: receive gas from & supply to other p/lines
- Strong int'l banking system, solid legal system
- Sufficient gas storage facilities
- Considerable volume of gas pass through
- Enhanced supply flexibility & reliability



Natural gas reserves

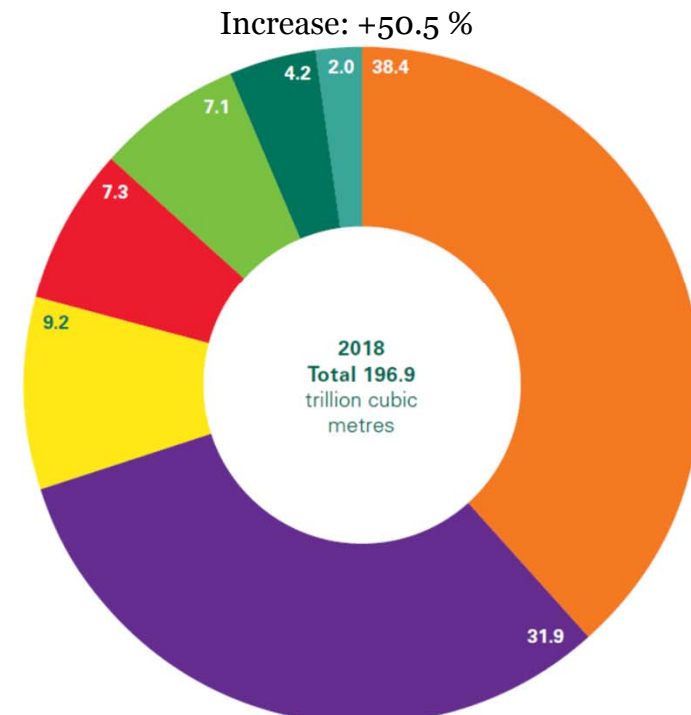
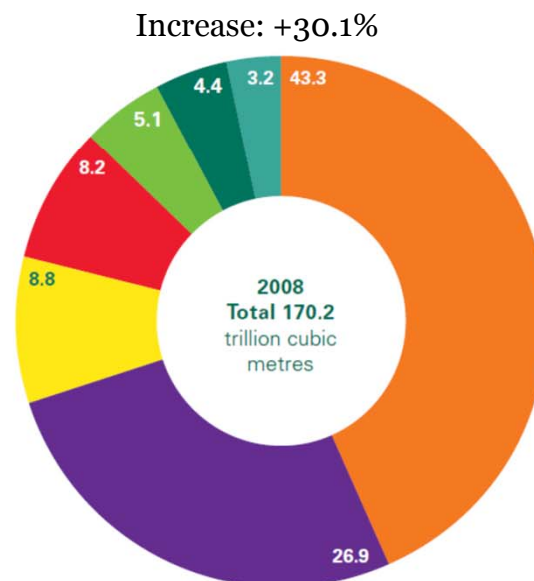
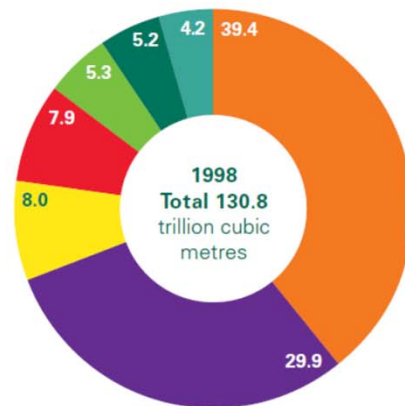
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- There is enough gas to power the world for the next 300 years (IEA)!

Source: BP Statistical Review 2019

Distribution of proved reserves in 1998, 2008 and 2018

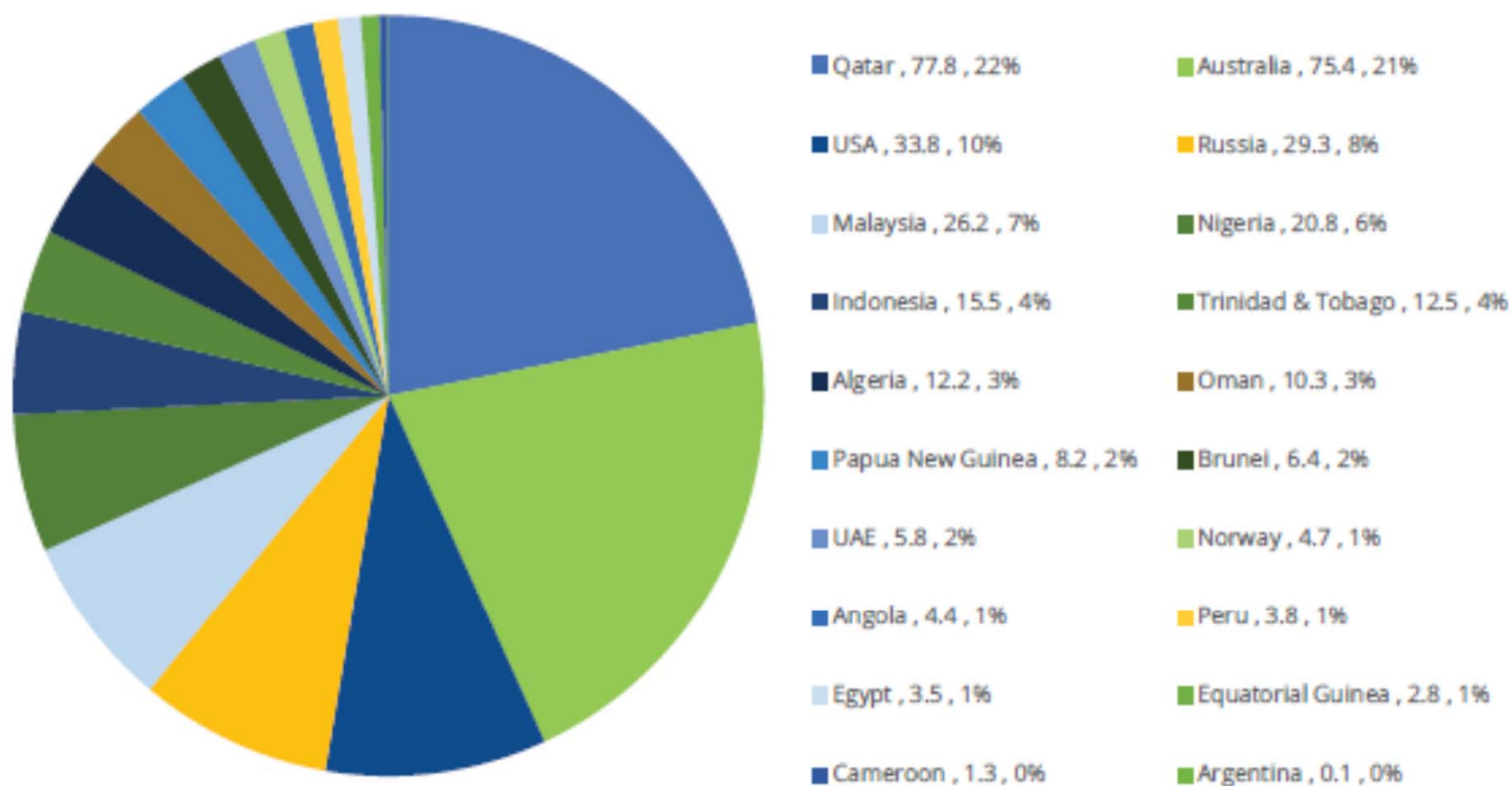
Percentage



LNG exports (2018)

23

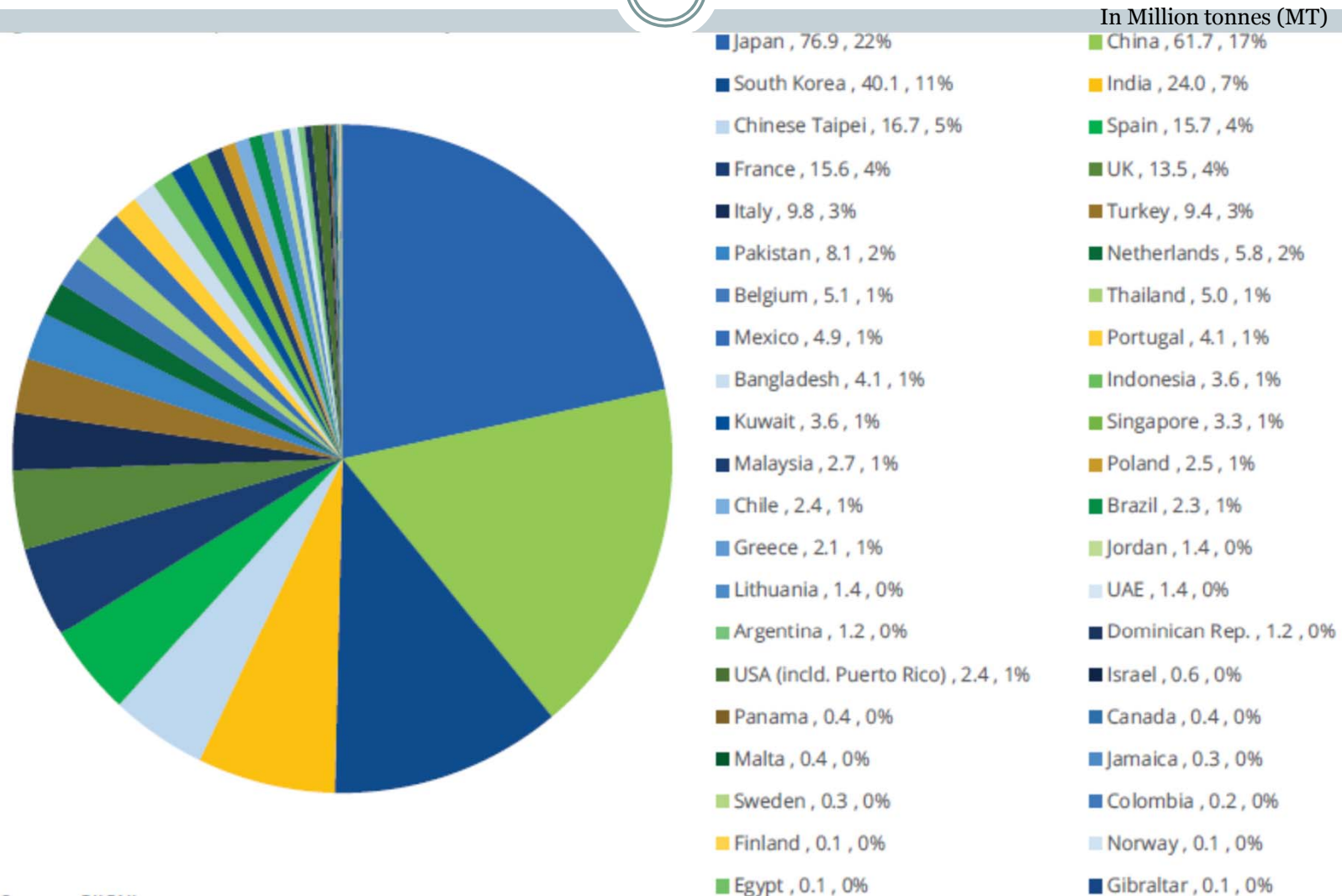
In Million tonnes (MT)



Source : GIIGNL

LNG imports (2018)

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Source : GIIGNL

LNG receiving terminals

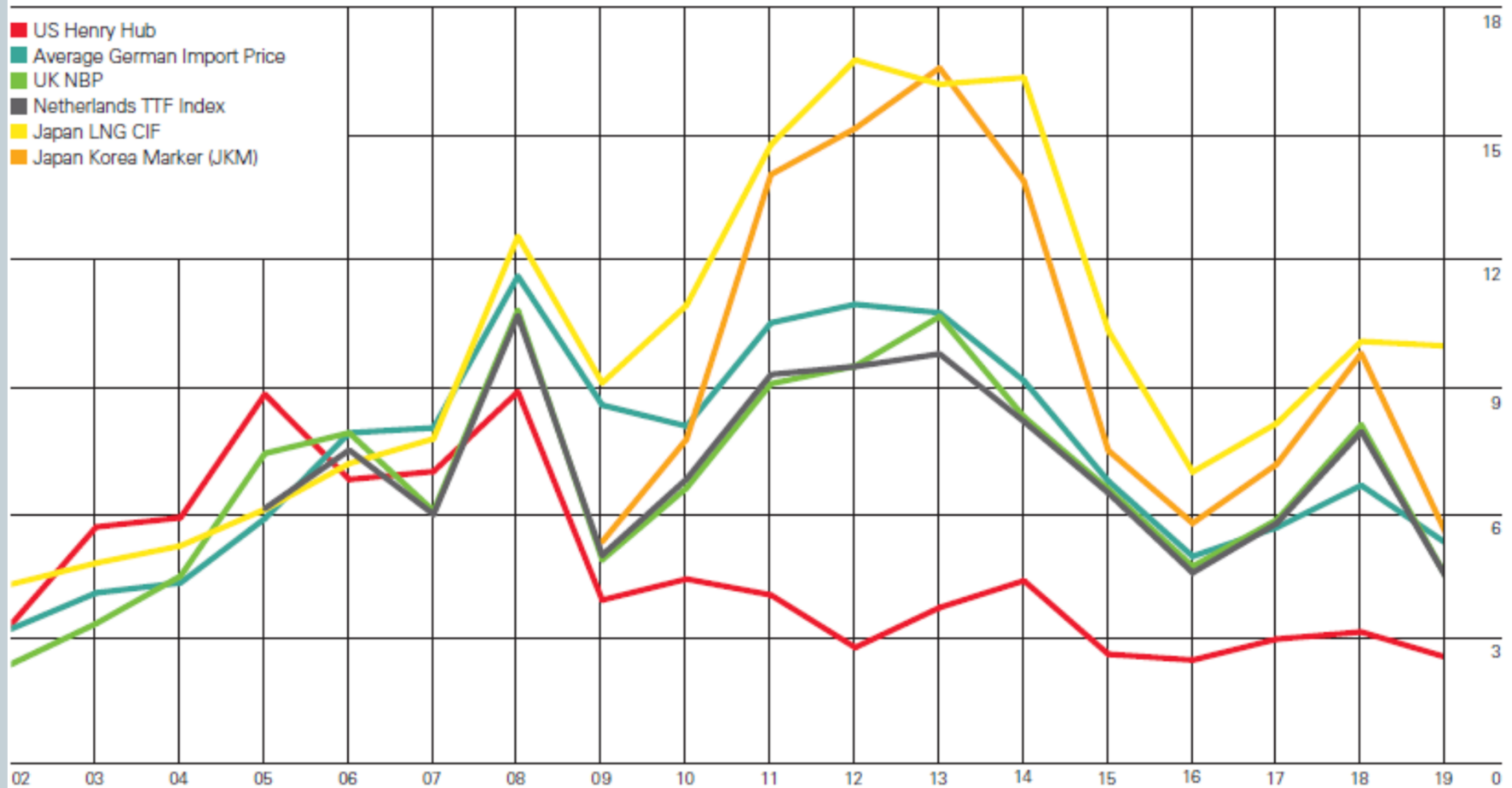
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NG prices

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Prices
\$/mmBtu



cif: cost + insurance + freight

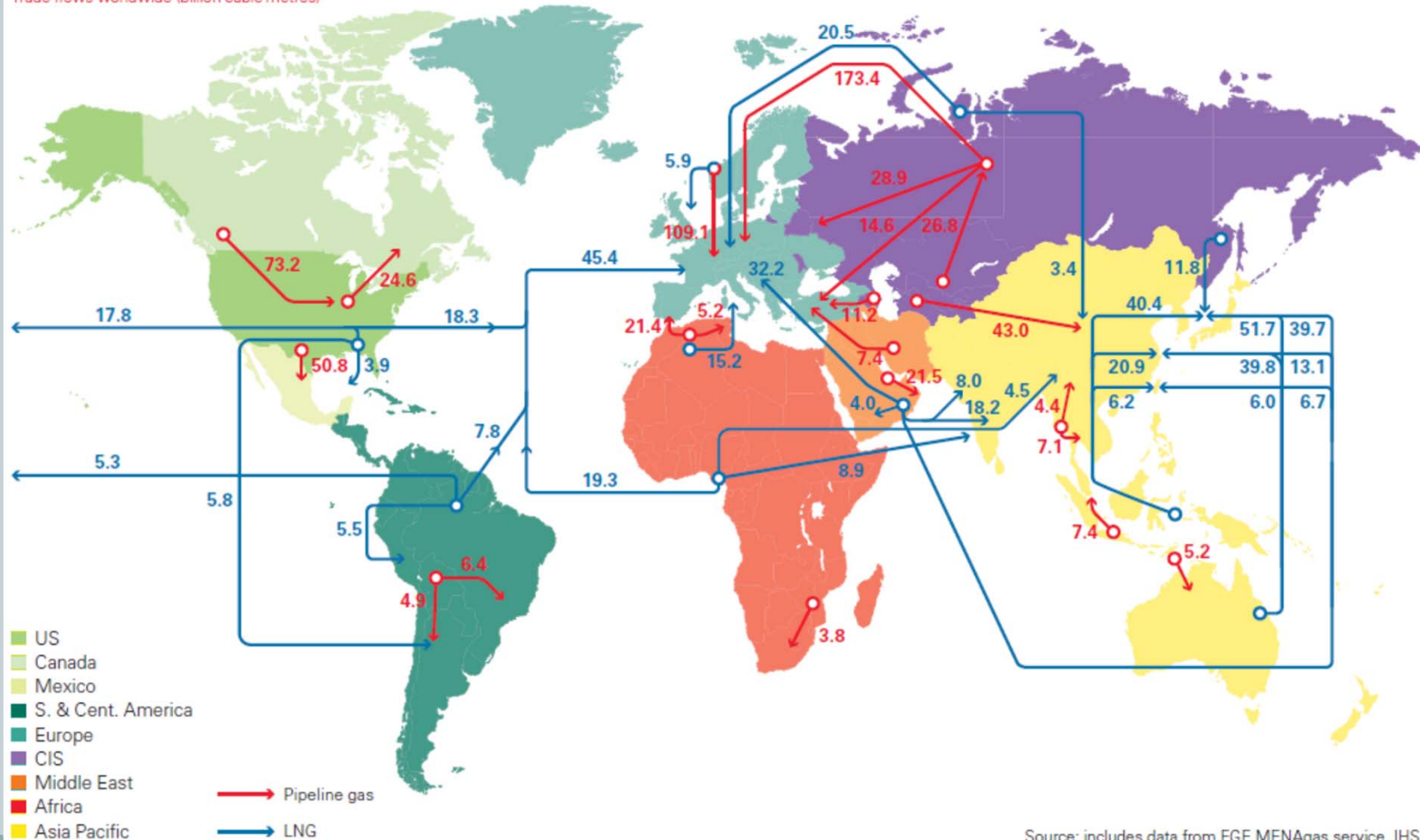
Source: BP Statistical Review of World Energy, 2020

Major NG trade routes

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Source: BP Statistical Review of World Energy, 2020

Major trade movements 2019
Trade flows worldwide (billion cubic metres)

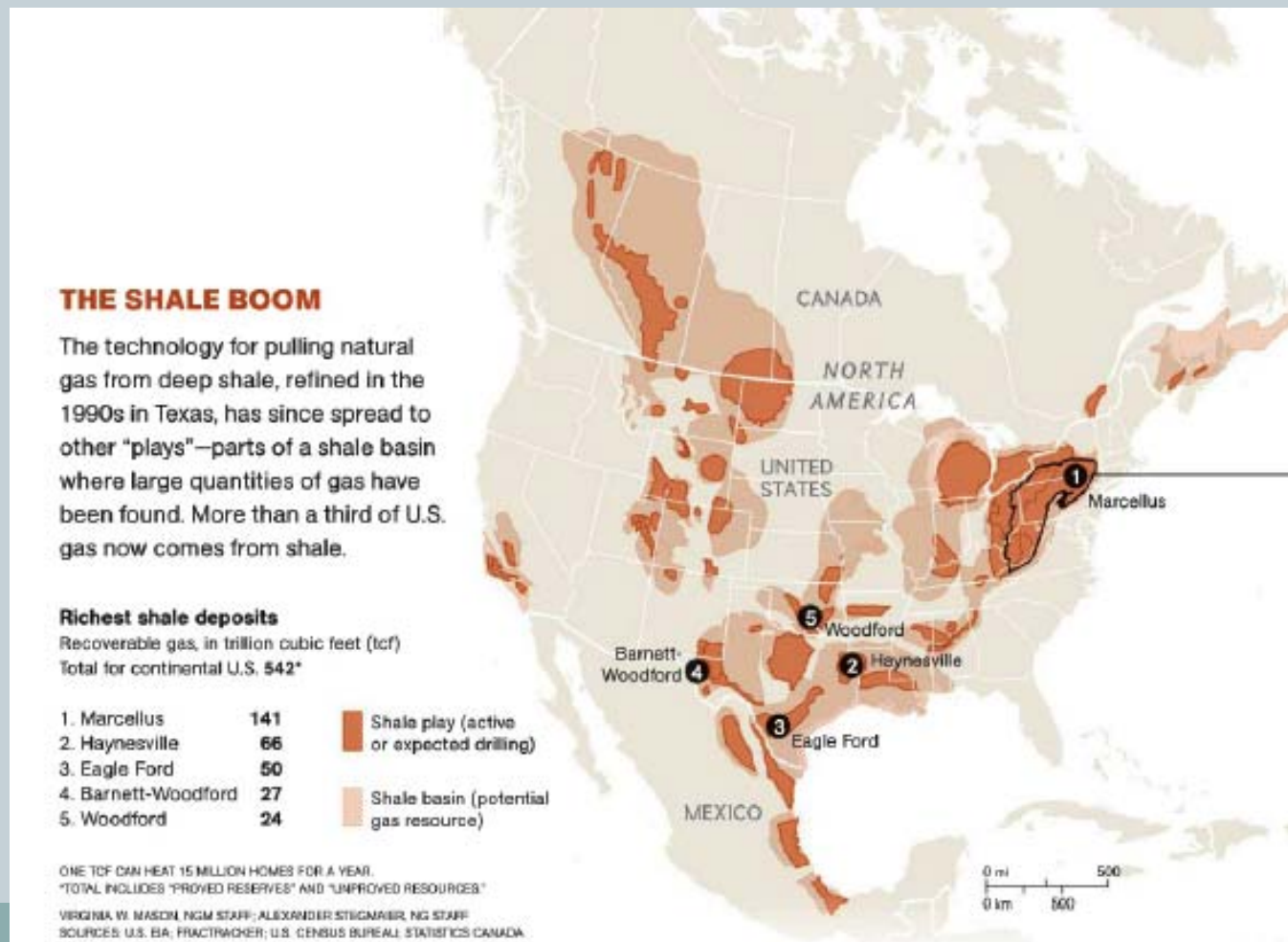


Source: includes data from FGE MENAgas service, IHS.

US energy revolution

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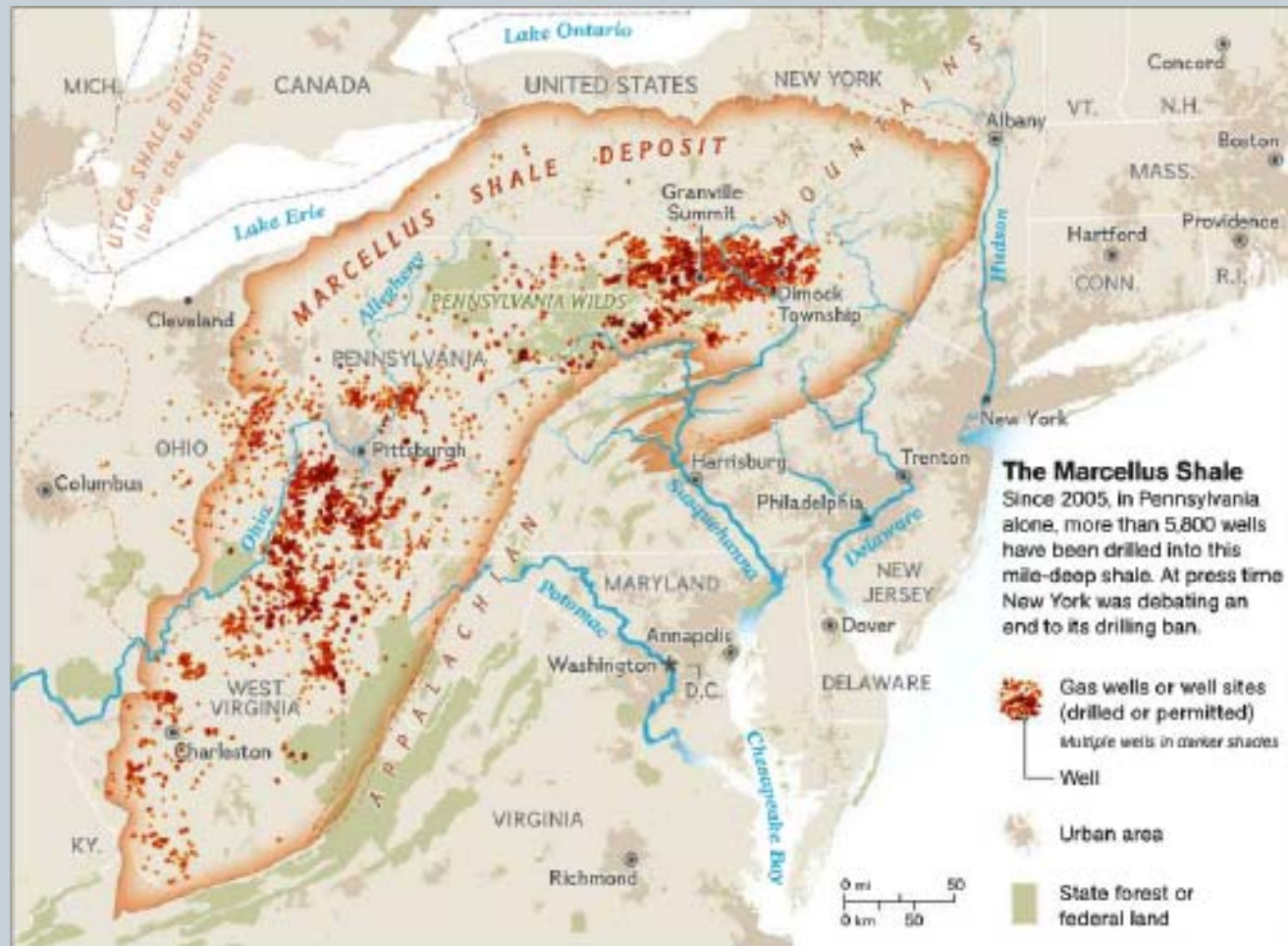
- Horizontal drilling and hydraulic fracturing



Marcellus shale

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- 141 tcf



US energy revolution (2)

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- Extraction of shale gas (& oil)
- Technically possible & financially viable
- Reasons:
 - Extensive geological & seismic data
 - Abundant funding from Wall Street
 - Citizens own mineral rights
 - Abundant water supply
 - Right of access to pipelines & rail trains
 - Considerable expertise with technology
 - Local markets & consumption
 - Plentiful NG & oil



LNG seaborne transport

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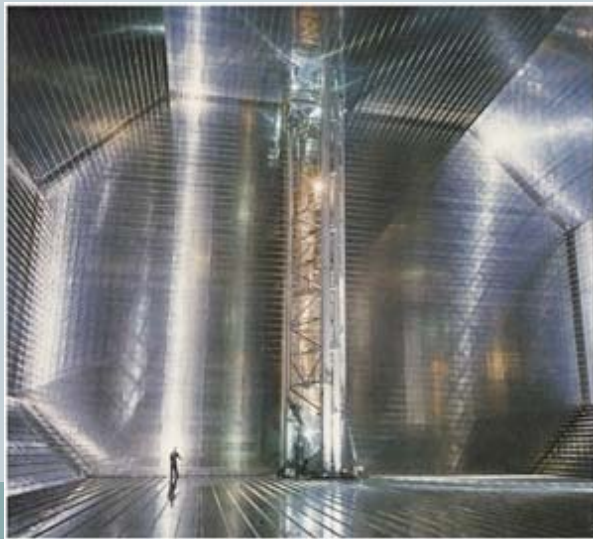
- 2016: 400 LNG carriers, cost about \$250m
- On-board boil-off liquefaction
- Operate on 15 to 20 year contracts
- LNG transported under atm. pressure at -161°C
- Need for regas receiving terminal
- Q-max: 266,000 m³ (Qatar)



LNG vessels

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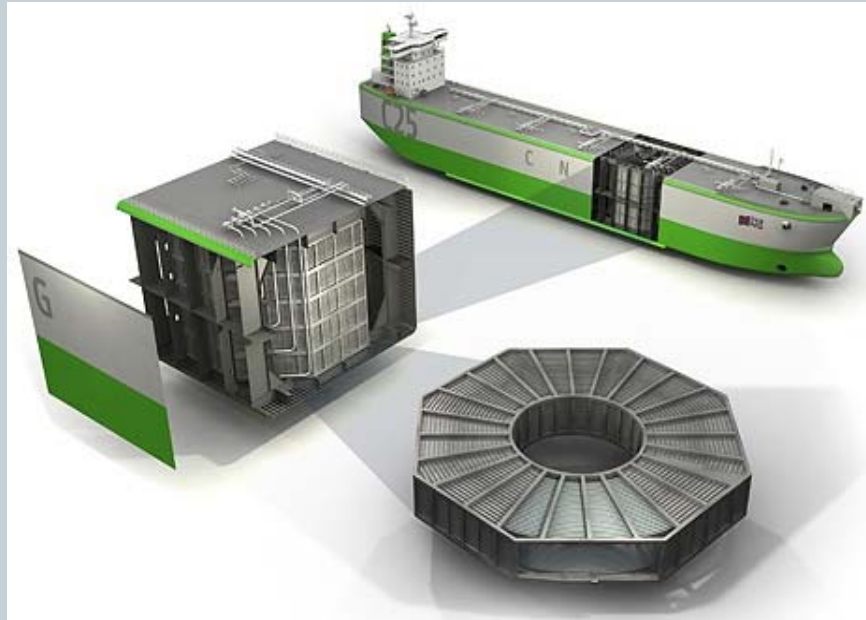
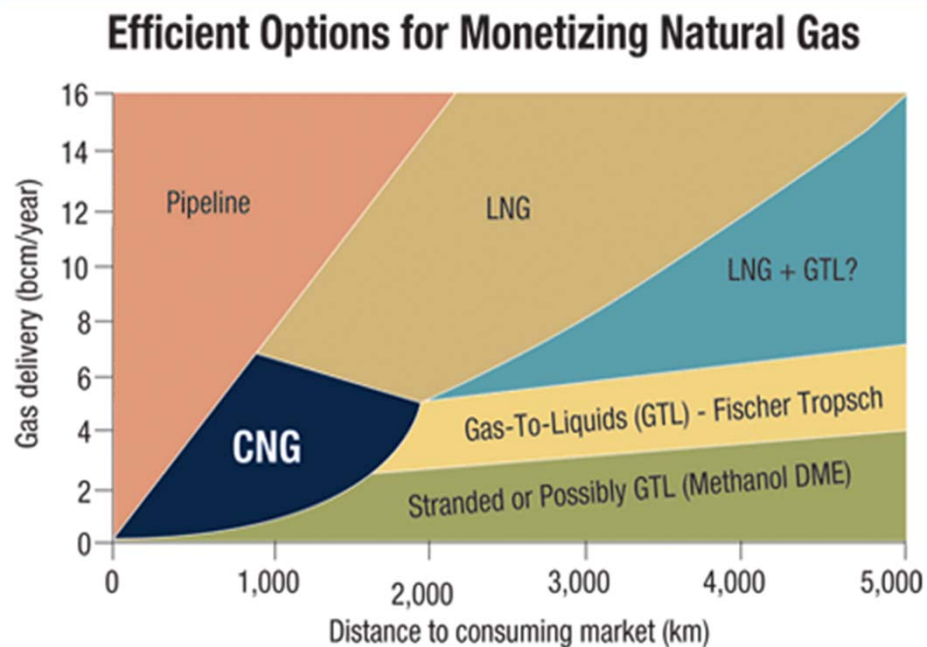
- 3 types of ships:
 - Prismatic design
 - Spherical type
 - Membrane design
- Materials: aluminium, balsa wood, stainless steel, polyurethane
- Advanced gas leak detection systems



Compressed natural gas (CNG)

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- Transport in gas state. Pressure ~200 bar, volume: 200:1
- None such vessel has yet to be build
- Attractive solution for short distance LN trade
- Potential use of composite materials



Oilfield service (OFS) companies

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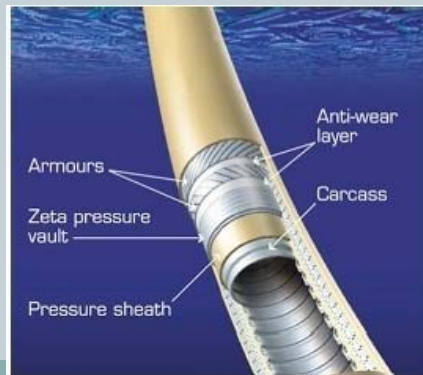
- Oilfield service companies do not hold O&G rights
- Subcontractors to NOCs, supermajors & IOCs
- What do oil field service companies do?
 - Constructors & subcontractors i.e., Aker solutions
 - Services i.e., Schlumberger, Baker Hughes
 - Equipment sales i.e., NATCO Group (electrical)
- The OFS market:
 - Schlumberger: income, \$40bn; 115,000 employees
 - Halliburton: \$25bn; 68,000 employees
 - Baker Hughes: \$20bn; 58,000 employees
 - Weatherford: \$13bn; 57,000 employees

The logo for Schlumberger, featuring the word "Schlumberger" in a bold, blue, sans-serif font.The logo for Halliburton, featuring the word "HALLIBURTON" in a bold, red, sans-serif font.The logo for Weatherford, featuring a red diamond shape above the word "Weatherford" in a bold, black, sans-serif font.The logo for Baker Hughes, featuring a blue square with a white stylized 'B' and 'H' inside, above the words "BAKER HUGHES" in a bold, black, sans-serif font.

Oilfield service (OFS) companies

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- Some of their services:
 - α) Constructors & outsourcing: design of drilling rigs (Aker slns), laying of pipelines (Saipem)
 - β) Services: well drilling (Schlumberger), piping, cementing, logging, drilling mud, seismic acquisition
 - γ) Equipment sales: submarine electric cables (Siemens), umbilicals, diving gear, submarine welding, drill bits, catering, personal ferrying, etc



Thanks for your attention!