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Overview of Louisiana LNG issues and trends.

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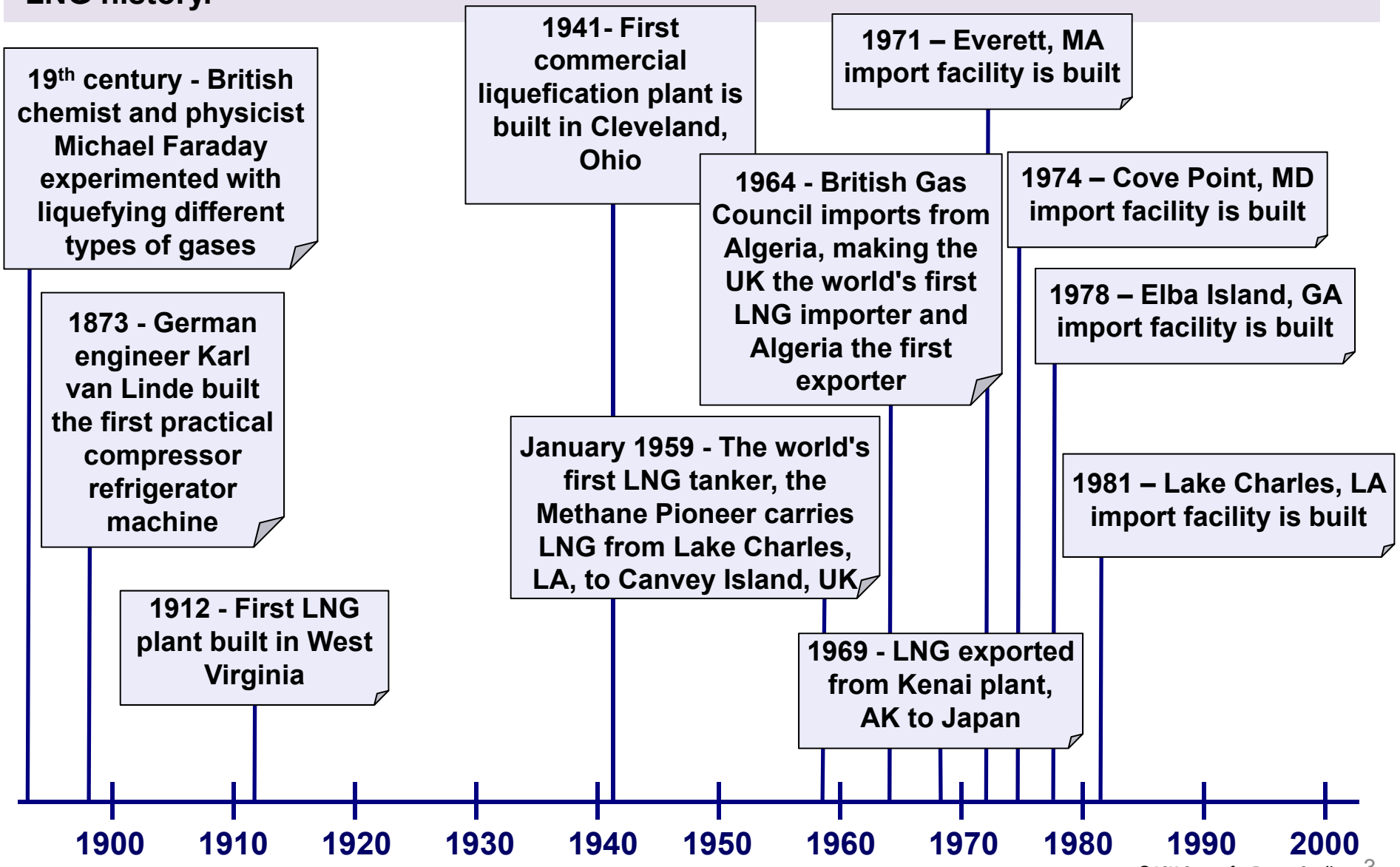
LNG Background

LNG history.

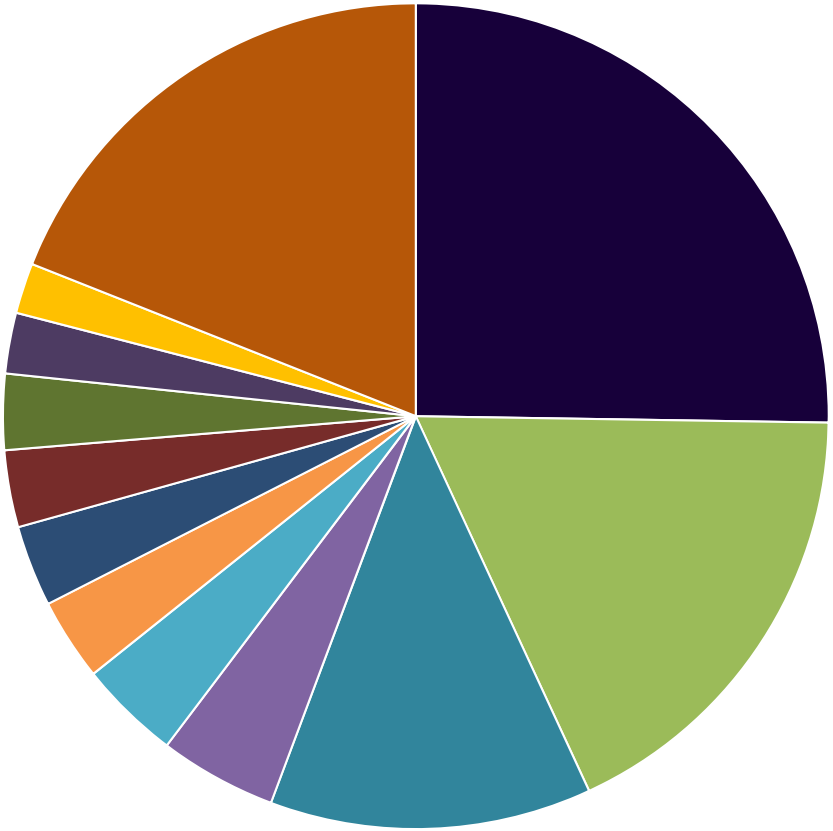


Properties of LNG.

- Liquefied natural gas (LNG) is natural gas that has been turned into a liquid by cooling it to a temperature of -256°F at atmospheric pressure.
- It consists of primarily methane (typically, at least 90 percent).
- LNG is odorless, colorless, non-corrosive and non-toxic.
- Liquefying natural gas reduces its volume by a factor of approximately 610.
- LNG's flammability range limits are 5 to 15 percent in air.

Natural gas reserves by country, 2019.

Considerable reserves around the world (6,700 Tcf), just not in the areas where the natural gas is needed.



- Russia, 25%
- Iran, 18%
- Qatar, 13%
- Saudi Arabia, 5%
- Turkmenistan, 4%
- United Arab Emirates, 3%
- China, 3%
- Venezuela, 3%
- Nigeria, 3%
- Algeria, 2%
- Iraq, 2%
- Rest of World, 19%

Few to no commercial natural gas uses.

Source: U.S. Energy Information Administration.

Economic sharing in the LNG chain.

Regasification terminals are one small portion of overall LNG trade.

Gas Producer
$3.08 - $4.88/MMBtu
50% of total cost

Liquefaction
$0.98 - $1.56/MMBtu
16% of total cost

Shipping*
$1.85 - $2.93/MMBtu
30% of total cost

Receiving Terminal
$0.40 - $0.63/MMBtu
7% of total cost

Cost out of Plant
$6.15 – $9.75 / MMBtu

Note: *Shipping cost will vary depending on distance.

LNG schematic: production to end user.

to fuel 20 percent of Louisiana's natural gas-fueled electric power plants for one month

OR

to fuel over 140,000 of Louisiana's residential customers for one year

OR

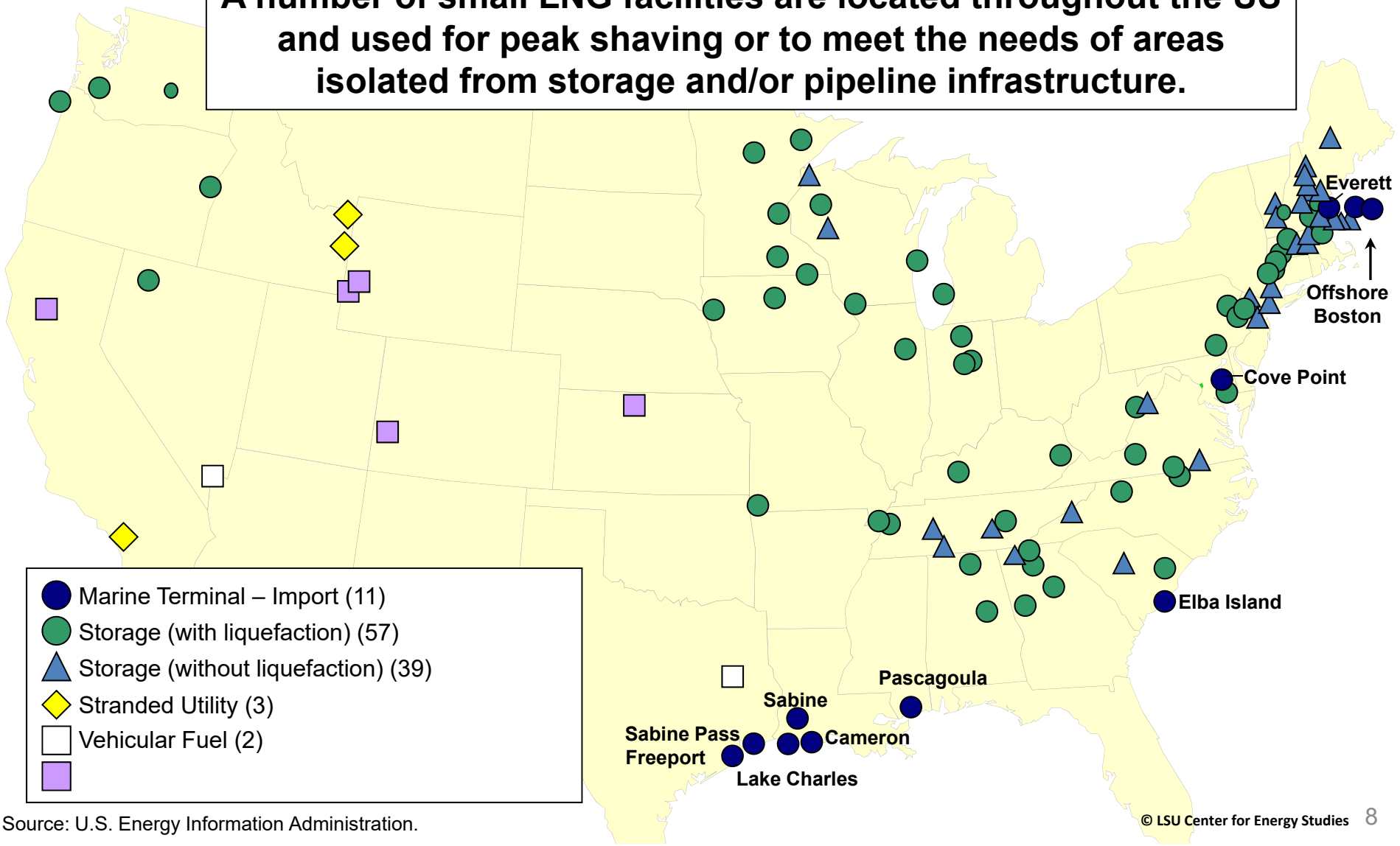
to fuel five percent of Louisiana's industrial plants for one month

Assumptions:
- One 1 LNG tanker carries approximately 120,000 to 140,000 cubic meters of LNG, which will provide about 4.2 to 4.9 bcf of natural gas.
- Average monthly power usage of 22.7 Bcf;
- Average monthly industrial usage of 91.4 Bcf

Source: U.S. Energy Information Administration.

U.S. LNG facilities.

A number of small LNG facilities are located throughout the US and used for peak shaving or to meet the needs of areas isolated from storage and/or pipeline infrastructure.



Source: U.S. Energy Information Administration.

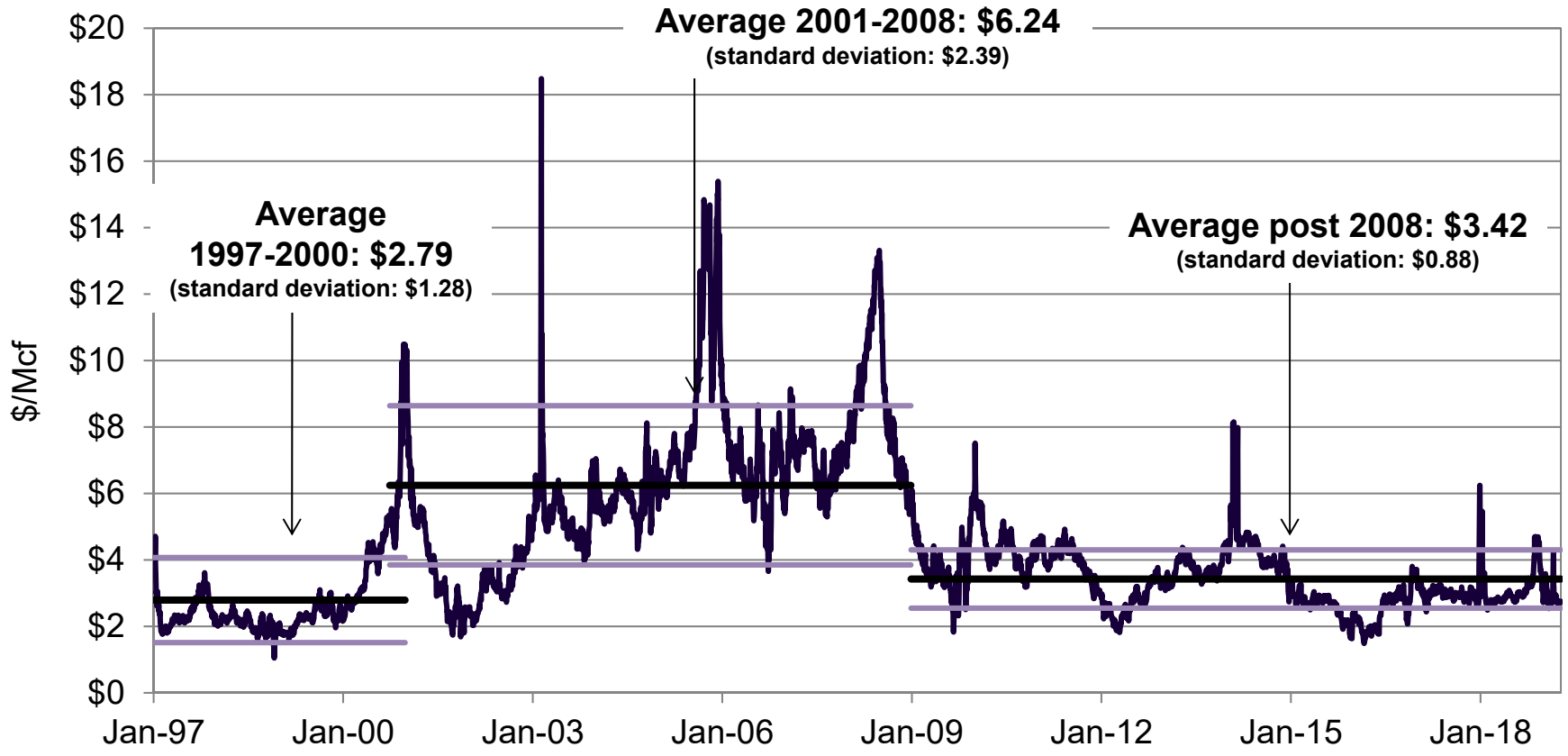
Current U.S. LNG import capacity.

Source: Federal Energy Regulatory Commission; and company websites.

Louisiana LNG Development

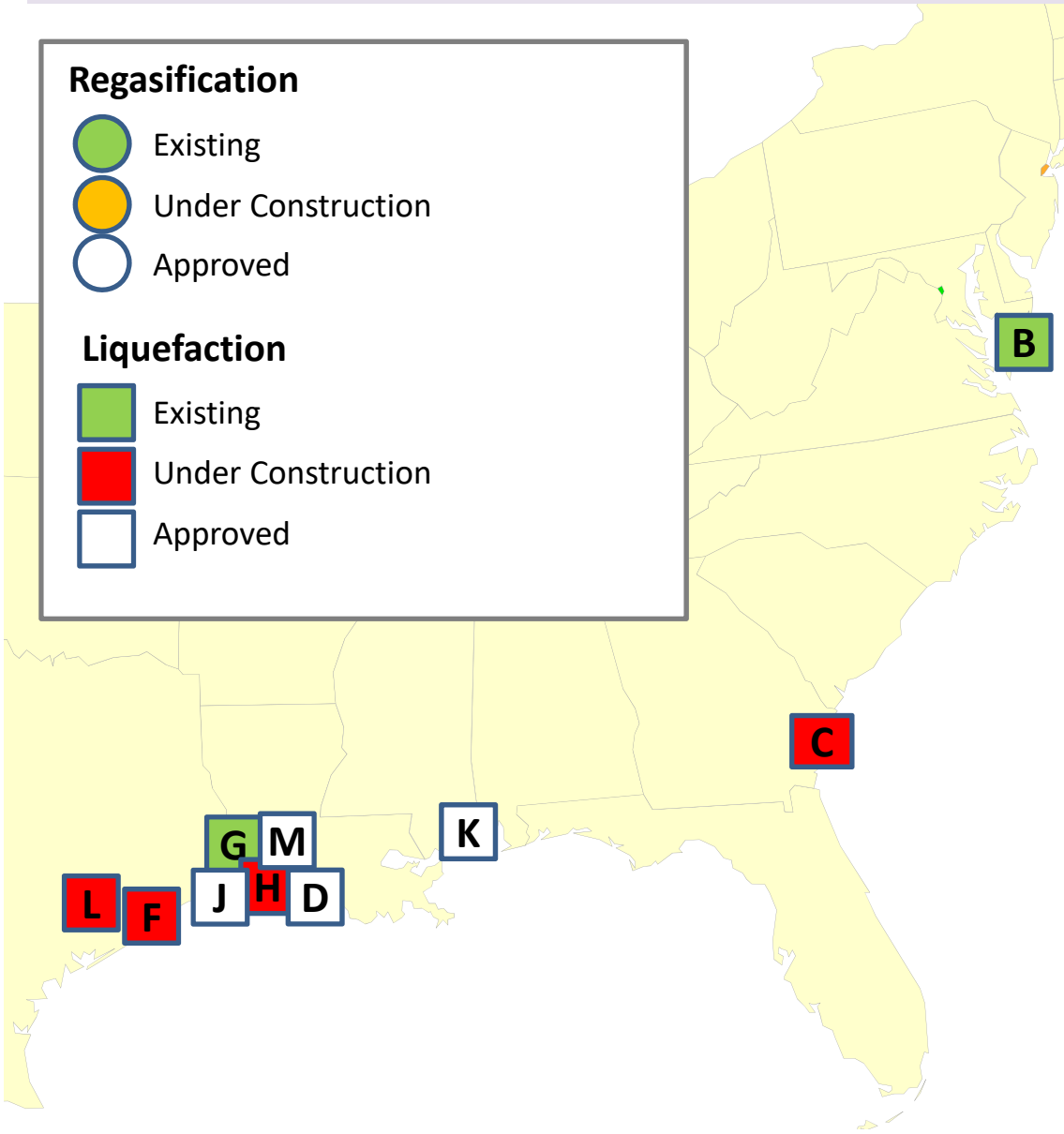
Natural gas price trends.

Natural gas price reductions (and reductions in volatility) are the direct result of unconventional oil and gas development.



Source: U.S. Energy Information Administration.

GOM LNG capacity.



Existing

A. Everett, MA: 1.035 Bcfd
B. Cove Point, MD: 1.8 Bcfd
C. Elba Island, GA: 1.6 Bcfd (+0.5 Expansion)
D. Lake Charles, LA: 2.1 Bcfd
E. Northeast Gateway, Offshore MA: 0.8 Bcfd
F. Freeport, TX: 1.5 Bcfd (+2.5 Expansion)
G. Sabine, LA: 4.0 Bcfd
H. Hackberry, LA: 2.1 Bcfd
I. Neptune, Offshore MA: 0.4 Bcfd
J. Sabine Pass, TX: 2.0 Bcfd
K. Pascagoula, MS: 1.5 Bcfd

Under Construction

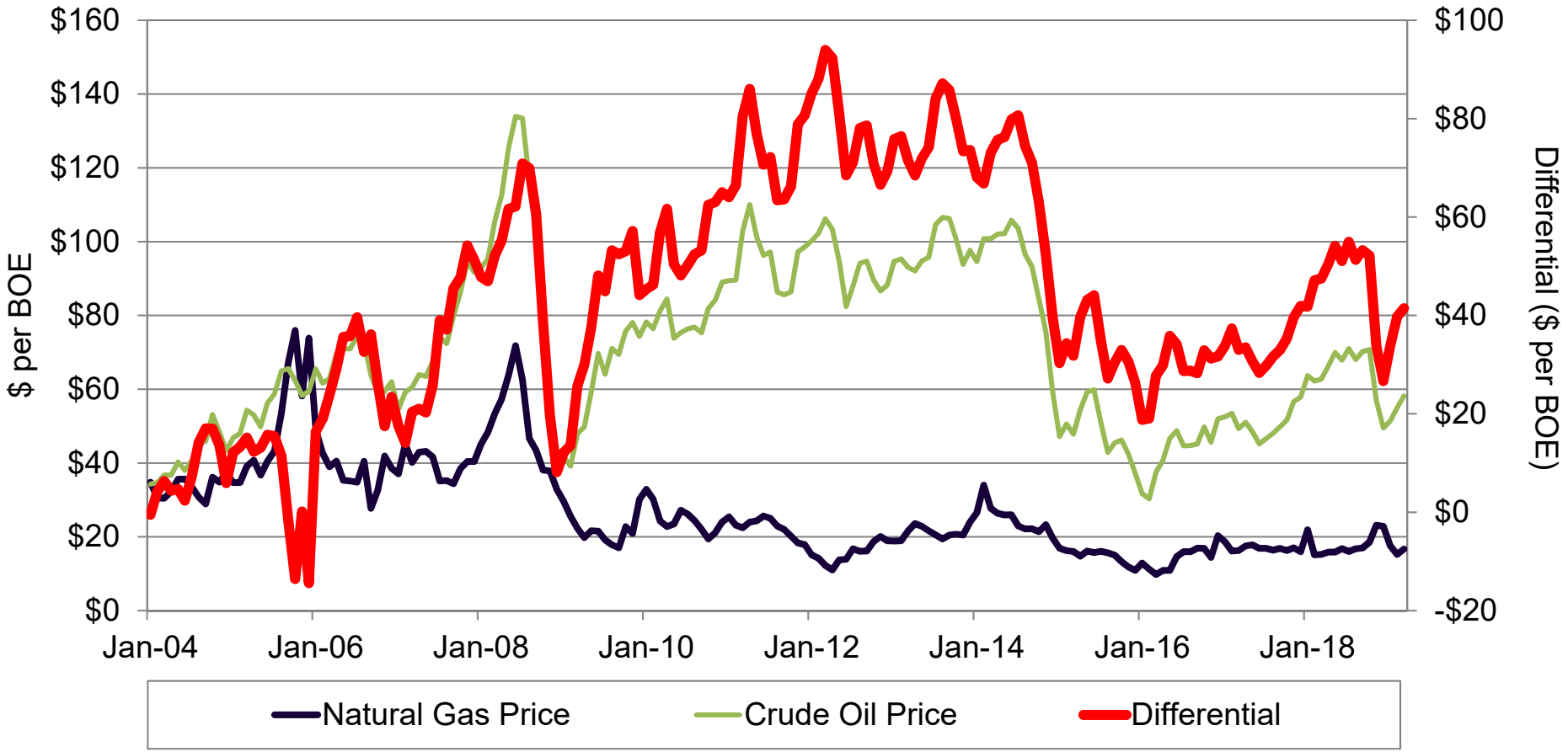
L. Corpus Christi, TX: 2.14 Bcfd

Approved

M. Lake Charles (Magnolia): 1.08 Bcfd

Natural gas and crude oil prices.

Natural gas/crude oil price spreads well in excess of $60 per Bbl and as high as $90 per Bbl. These differentials have collapsed by about half.



Source: U.S. Energy Information Administration.

Example: Changes in competitiveness of US-sourced LNG.

Economics of LNG development are important, but there are additional factors that can influence development such as geopolitical and supply stability concerns that could sustain continued projects.



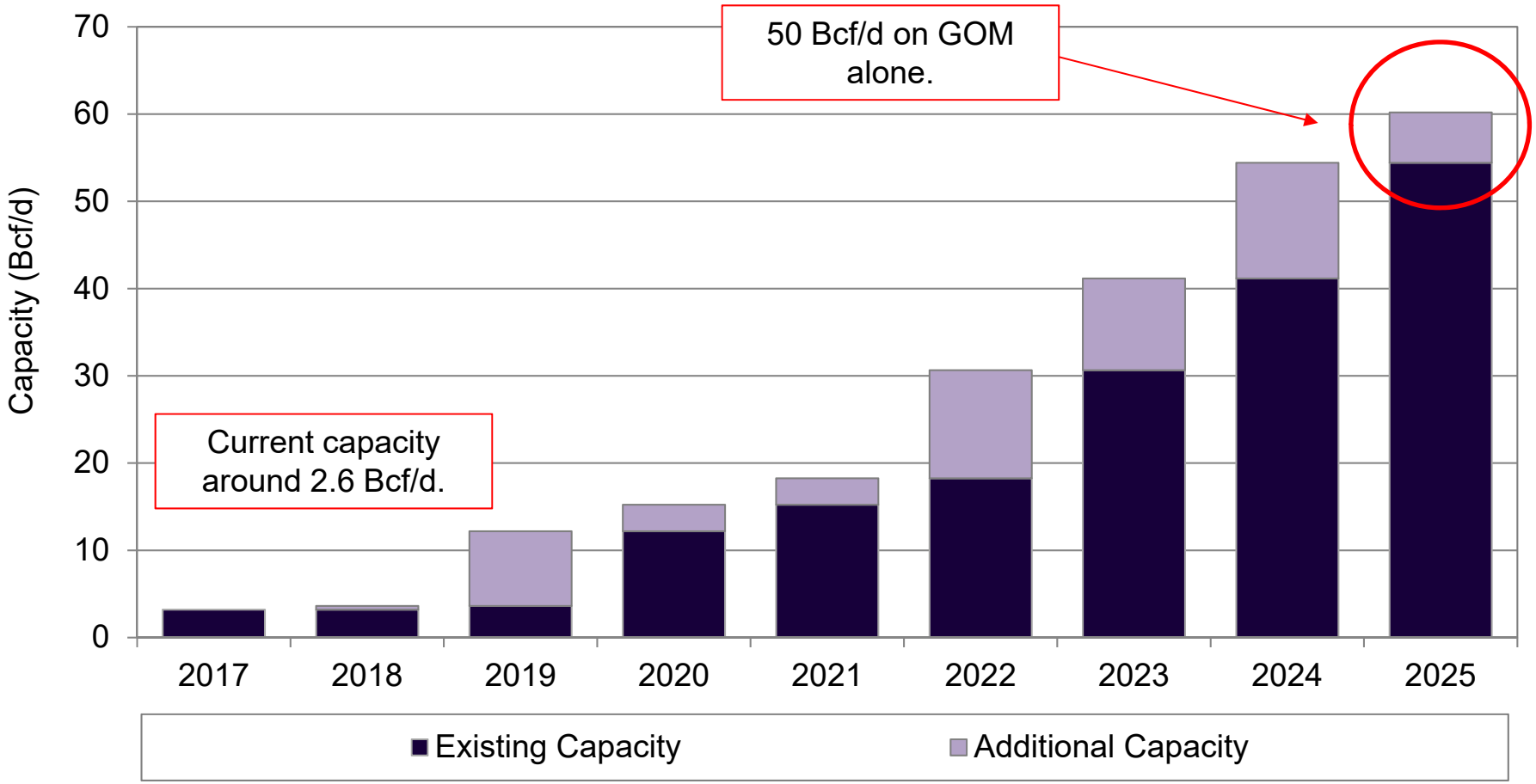

	Feedgas 40-60% ($/MMBtu)	Liquefaction 12%-20% ($/MMBtu)	Shipping & Fuel 20%-40% ($/MMBtu)	Regas 5%-8% ($/MMBtu)	Delivered Cost ($/MMBtu)	Equivalent Oil Price* ($/BOE)
Europe:						
Low	$3.00	$1.25	$1.40	$0.50	$6.15	$35.65
High	$5.00	$1.25	$1.65	$0.50	$8.40	$48.72
Asia:						
Low	$3.00	$1.25	$2.50	$0.50	$7.25	$42.05
High	$5.00	$1.25	$3.00	$0.50	$9.75	$56.55
Caribbean:						
Low	$3.00	$1.25	$0.75	$0.50	$5.50	$31.90
High	$5.00	$1.25	$1.00	$0.50	$7.75	$44.95

Henry Hub (Apr-2019):	WTI (Apr-2019):	Brent (Apr-2019):
$2.72	$63.25	$70.48

Note: *uses a BOE conversion of 5.8 Mcf/BOE.
Source: Various sources

U.S. LNG capacity development outlook.

If all of the LNG applications currently filed with the Department of Energy were to come online, U.S. liquefaction capacity would exceed 60 Bcf per day by 2025.

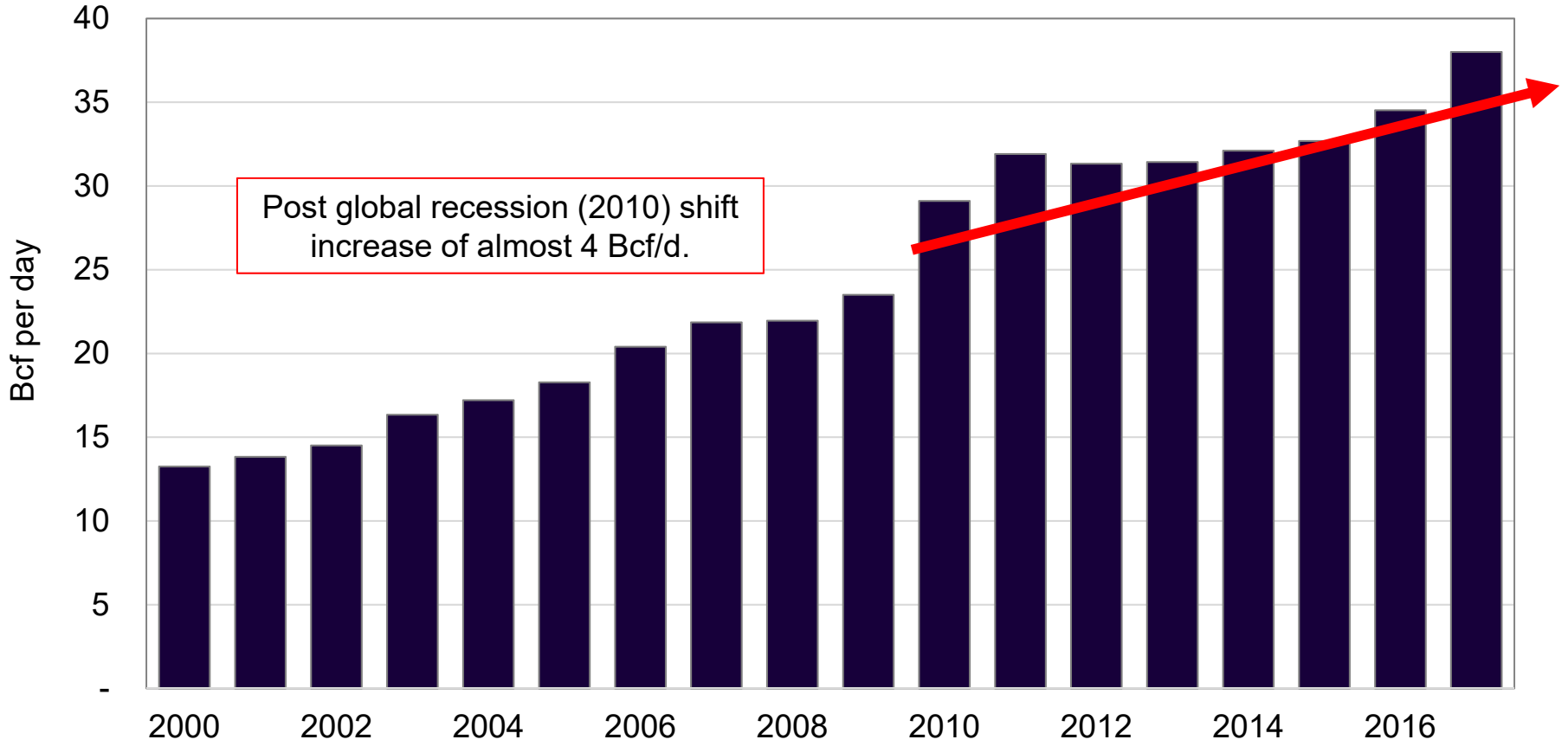


Source: U.S. Department of Energy.

Recent Market Trends: LNG Imports

World LNG trade volumes.

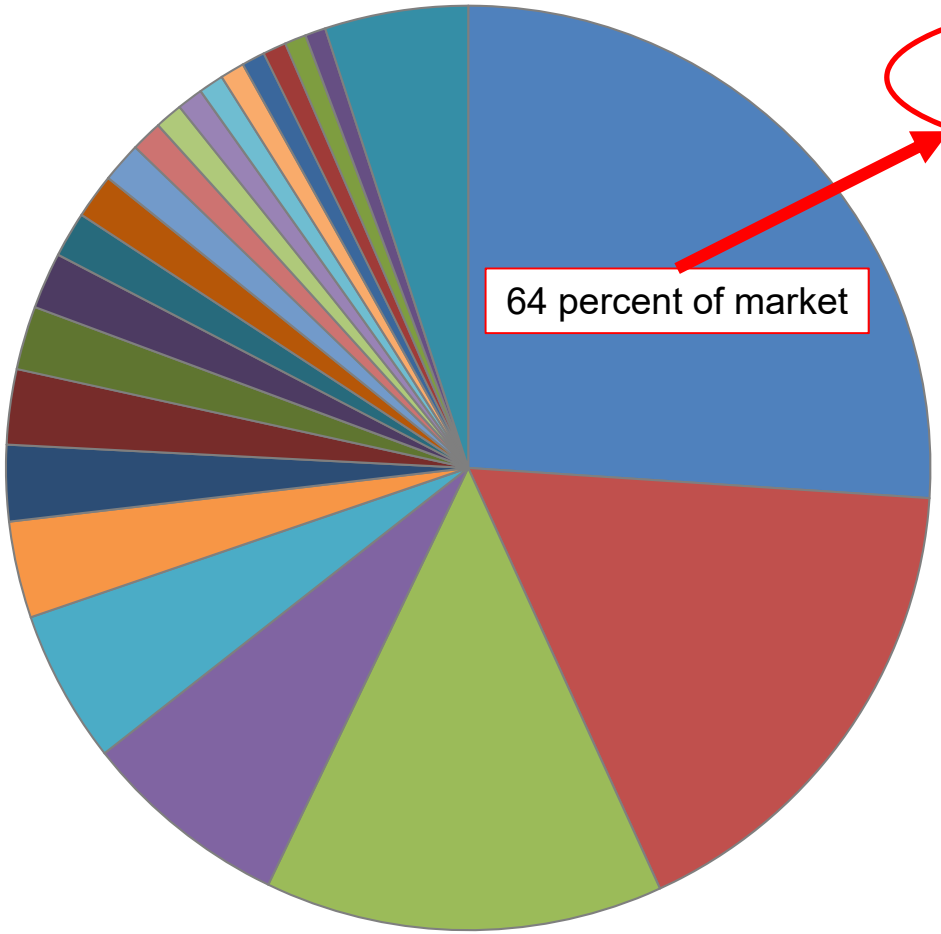
World LNG trade volumes have increased at an **average annual rate of seven percent over the last 18 years** and have increased **73 percent over the last 10 years.**



Source: BP Statistical Review of World Energy.

LNG imports and market share by country, 2018.

Asian markets (Japan, China, S. Korea) dominate the share of world LNG imports. Note this is total usage/imports, not import "growth" in percentage terms.

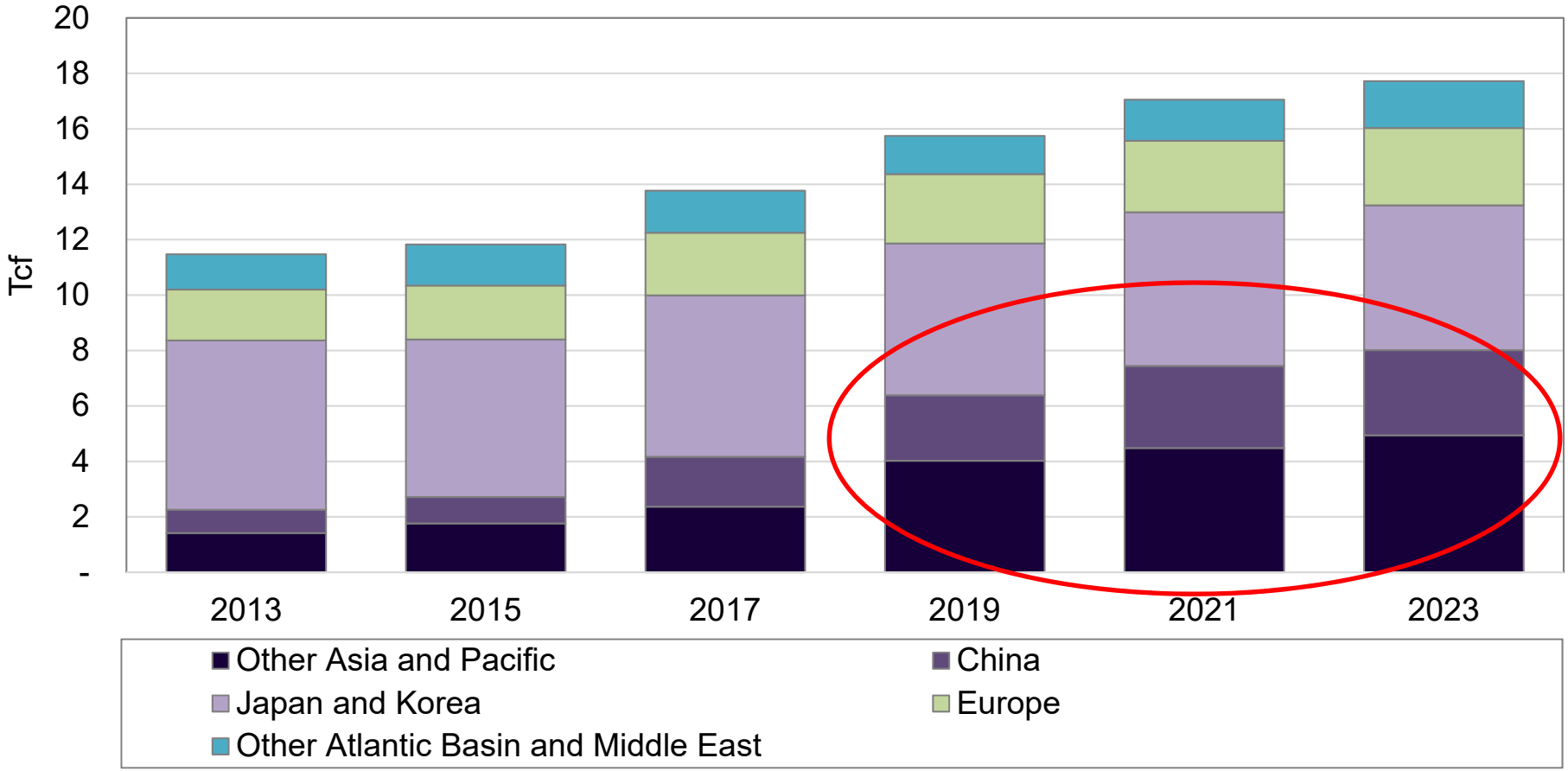


- Japan, 26%
- China, 17%
- S. Korea, 14%
- India, 7%
- Chinese Taipei, 5%
- Spain, 3%
- Turkey, 3%
- France, 3%
- Pakistan, 2%
- Italy, 2%
- Mexico, 2%
- UK, 2%
- Thailand, 1%
- Kuwait, 1%
- Chile, 1%
- Portugal, 1%
- U.S., 1%
- Singapore, 1%
- Argentina, 1%
- Jordan, 1%
- Belgium, 1%
- Egypt, 1%
- Other, 5%

Source: International Gas Union, 2019 World LNG Report.

LNG imports by region, 2013-2023.

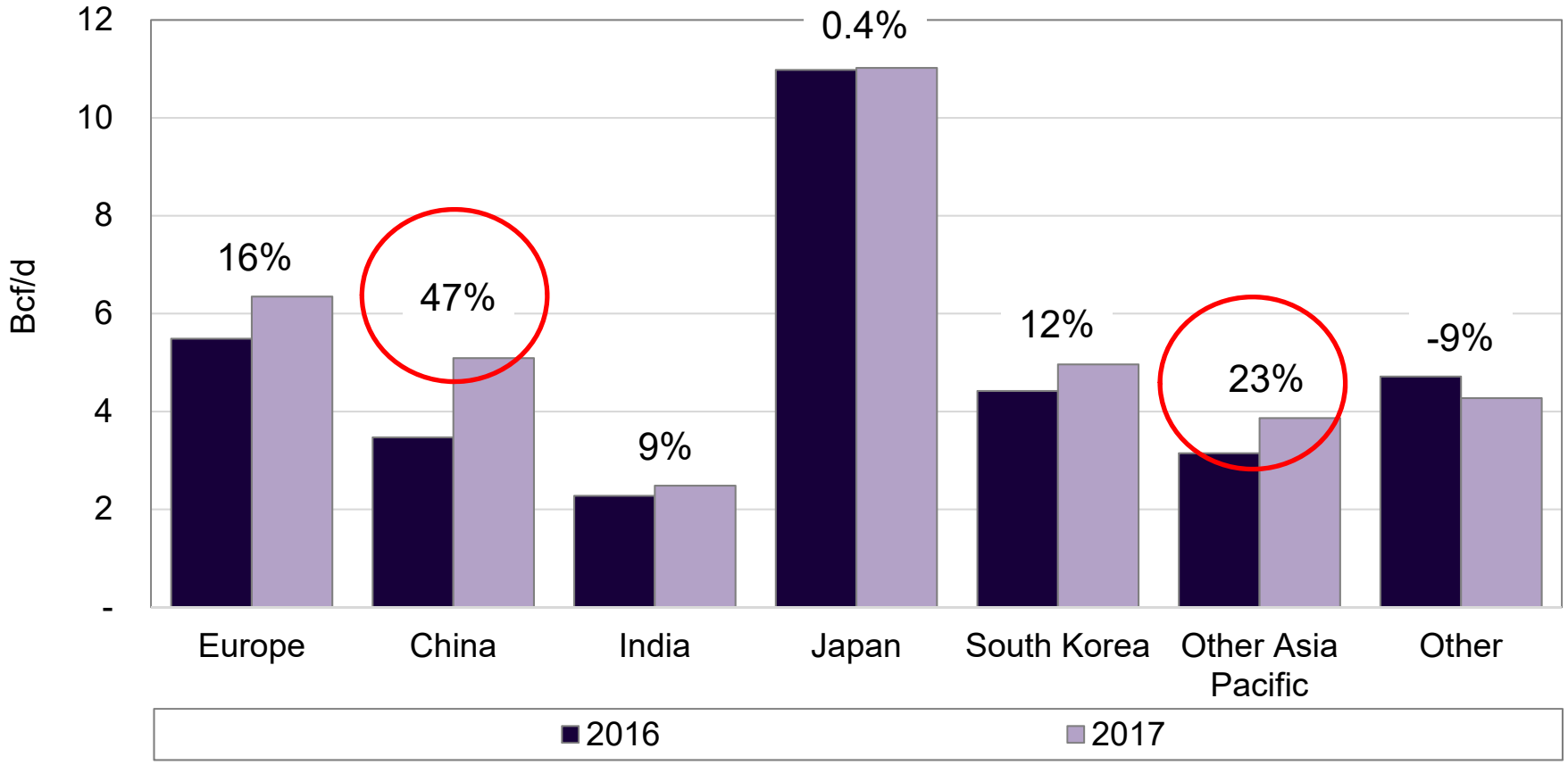
While Japan is the largest importer of LNG, China and other Asian markets will see their share of trade increase, **reaching 45 percent of total trade volumes by 2023**, more than **double their 2013 share** of 20 percent.



Source: International Energy Agency, Gas 2018.

LNG imports, 2016 vs. 2017.

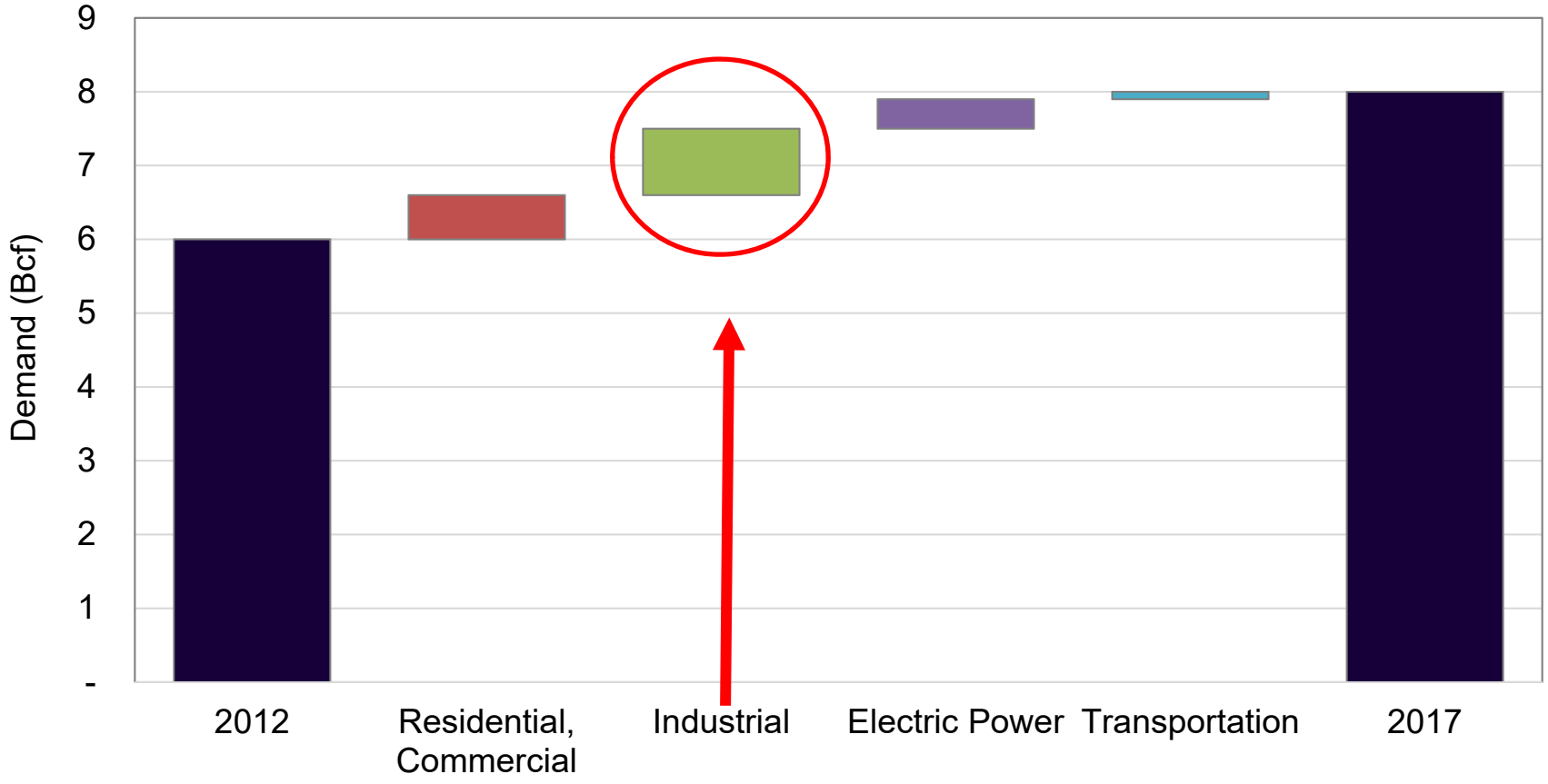
Large percentage increase (2016-2017) concentrated in Asian. **Japan**, while large in absolute, is **small in percentage growth.**



Source: BP Statistical Review of World Energy.

China's natural gas demand.

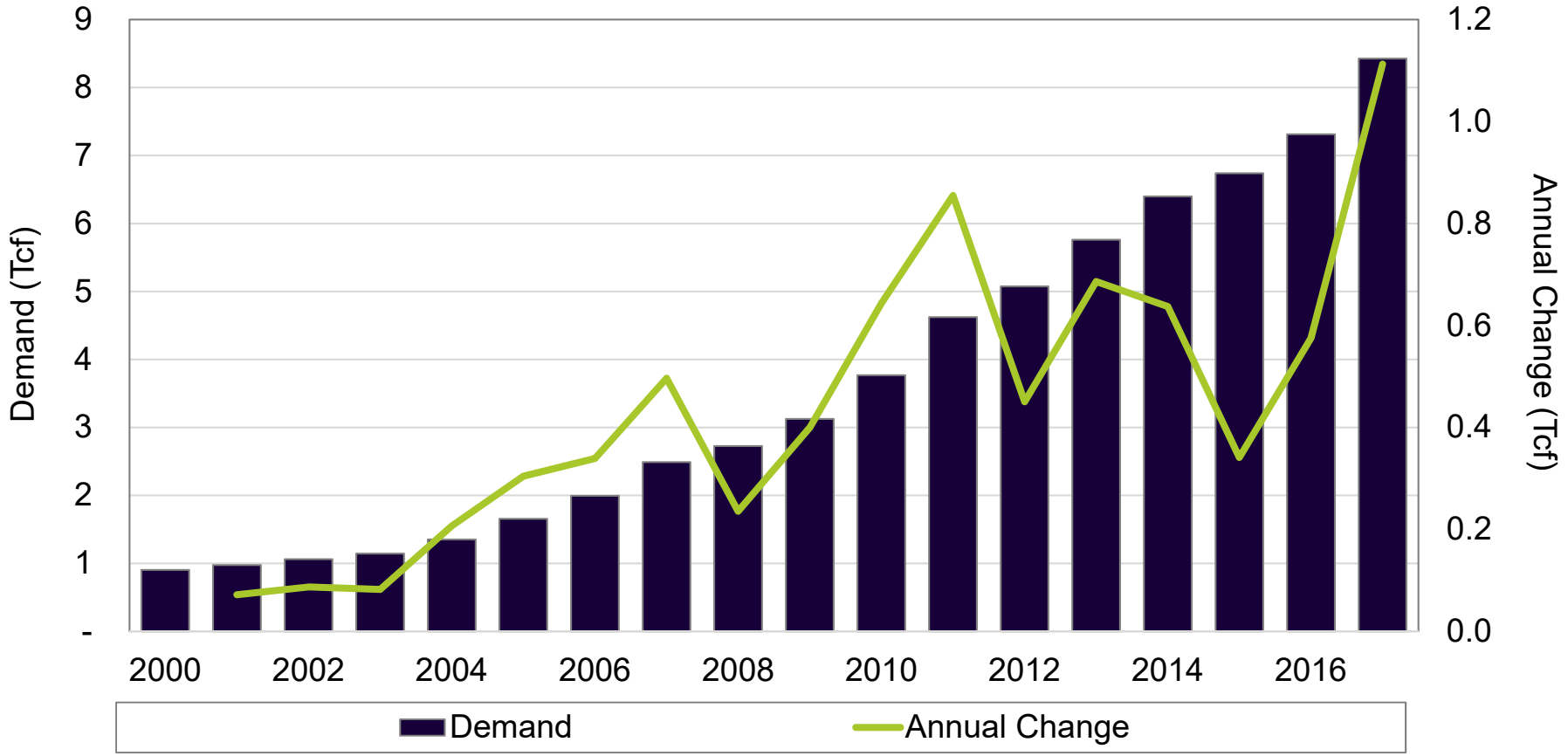
Over the last five years, **most of China's gas demand has been from the industrial sector**. Industrial consumption has **accounted for half of the demand growth**, and electric power made up 20 percent.



Source: U.S. Energy Information Administration.

China's natural gas demand.

China's natural gas demand has increased eight times in the last 18 years, and **66 percent in the last five years.**

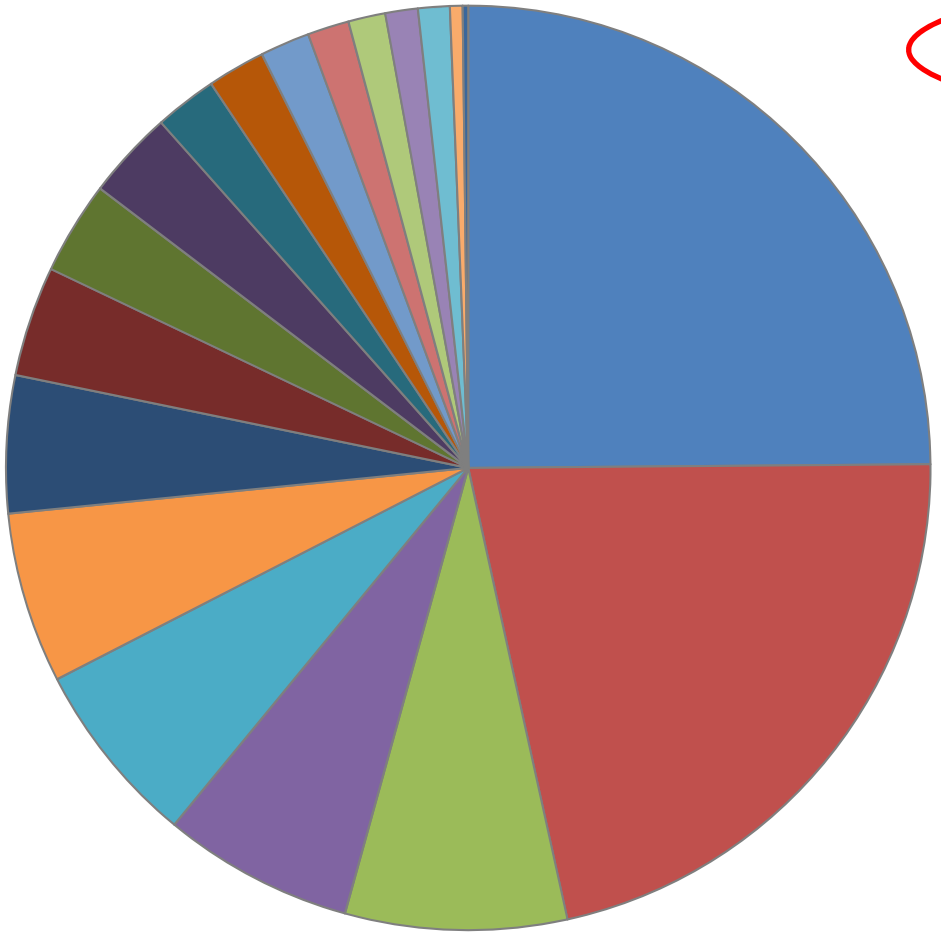


Source: U.S. Energy Information Administration.

Recent Market Trends:
LNG Exports, Capacity, & Prices

LNG exports and market share by country, 2018.

Qatar and Australia are the biggest competitors to U.S. LNG exports.

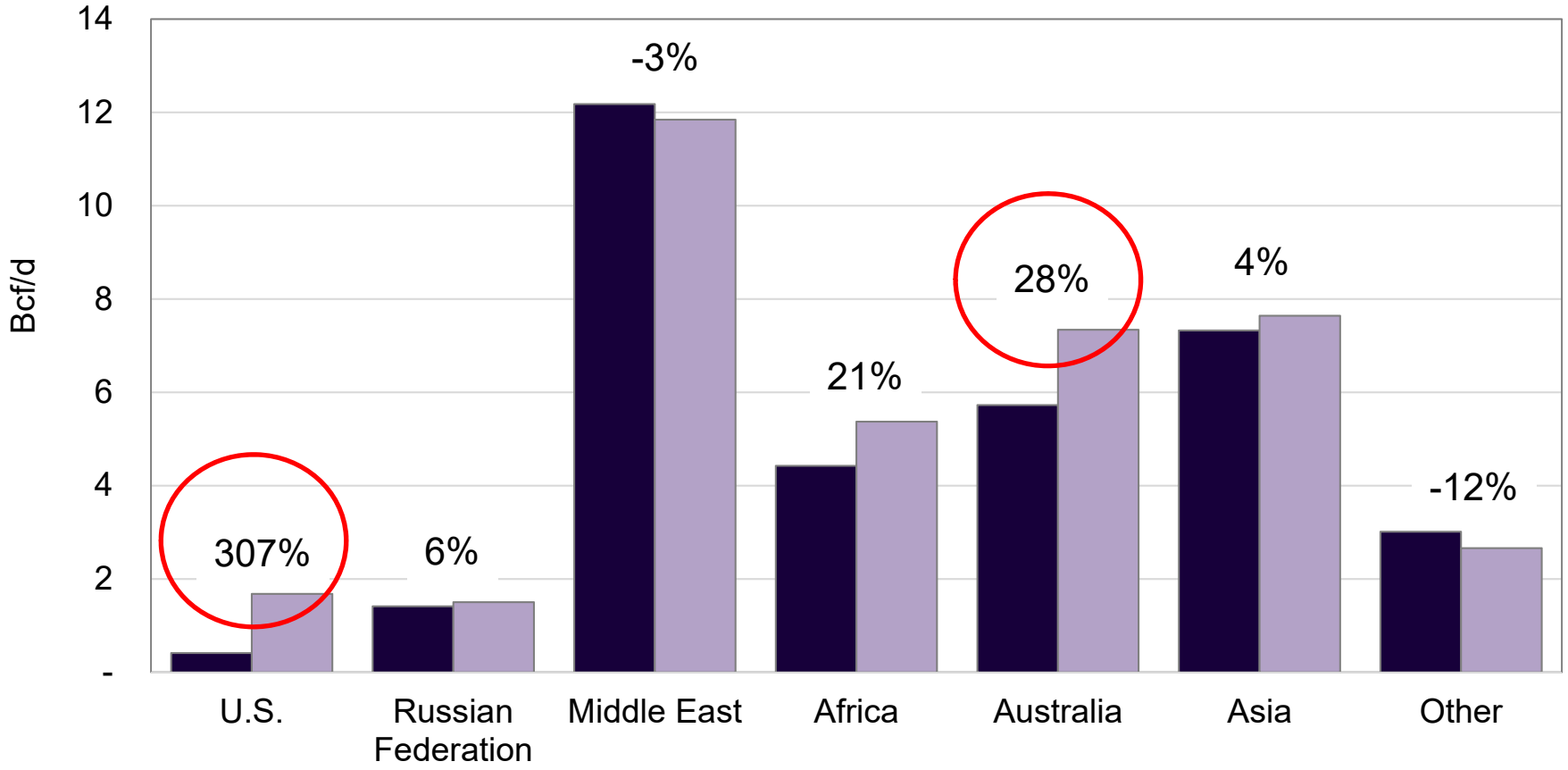


- Qatar, 25%
- Australia, 22%
- Malaysia, 8%
- U.S., 7%
- Nigeria, 6%
- Russia, 6%
- Indonesia, 5%
- Trinidad, 4%
- Algeria, 3%
- Oman, 3%
- PNG, 2%
- Brunei, 2%
- UAE, 2%
- Norway, 1%
- Angola, 1%
- Peru, 1%
- Eq. Guinea, 1%
- Egypt, 0.4%
- Cameroon, 0.2%

Source: International Gas Union, 2018 World LNG Report

LNG exports, 2016 vs. 2017.

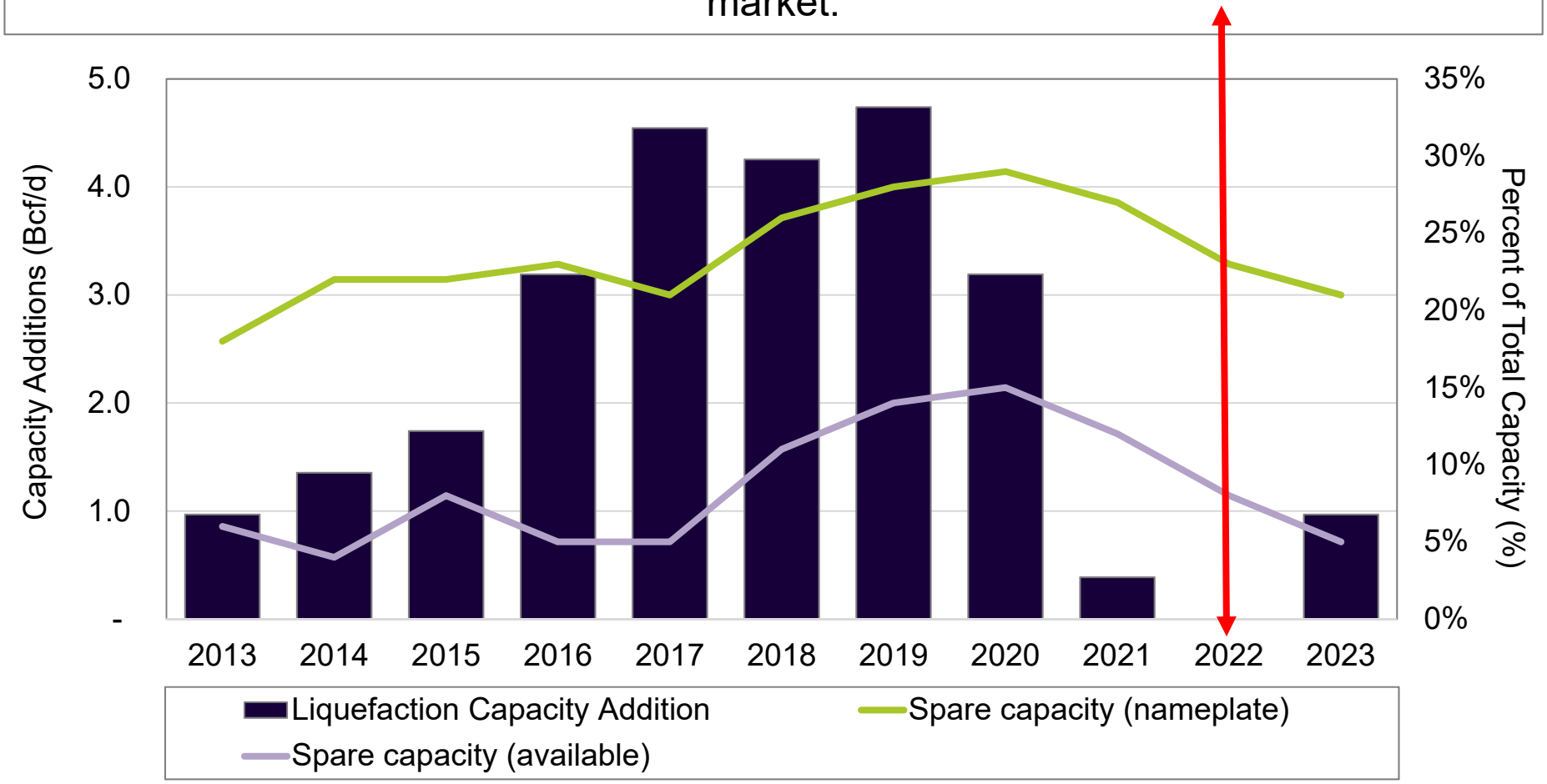
U.S. exports are up considerably (on percentage basis) but have a long way to go to match the Middle East, much less Australia. Middle east, however, appears to be losing market share to these other countries/basins.



Source: BP Statistical Review of World Energy.

LNG liquefaction capacity additions.

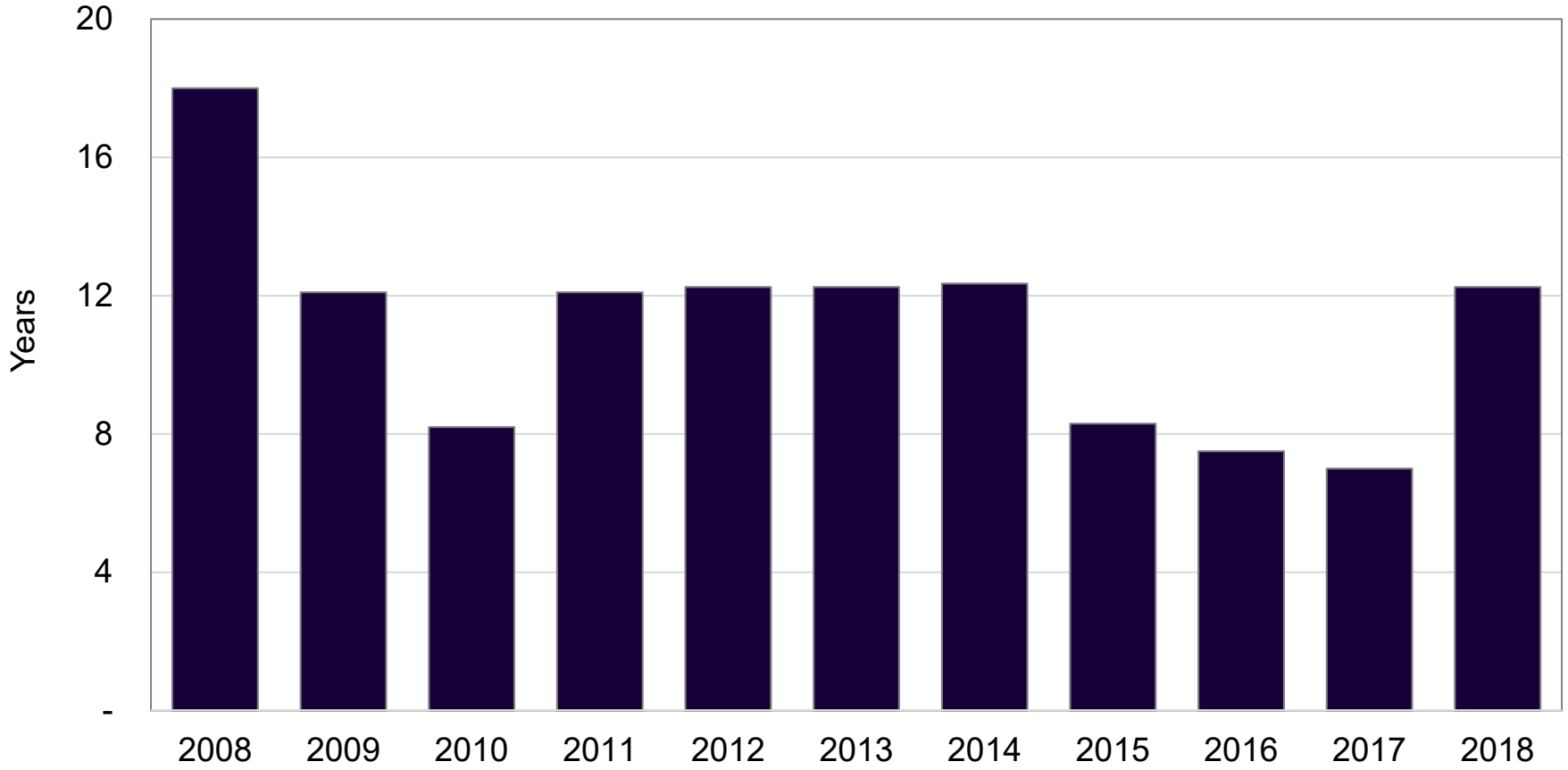
Excess capacity facilitating considerable competition – "nirvana" (for developers) is anticipated to arrive around **2021-2022** as capacity tightens and it becomes sellers' market.



Source: International Energy Agency, Gas 2018.

Average contract durations.

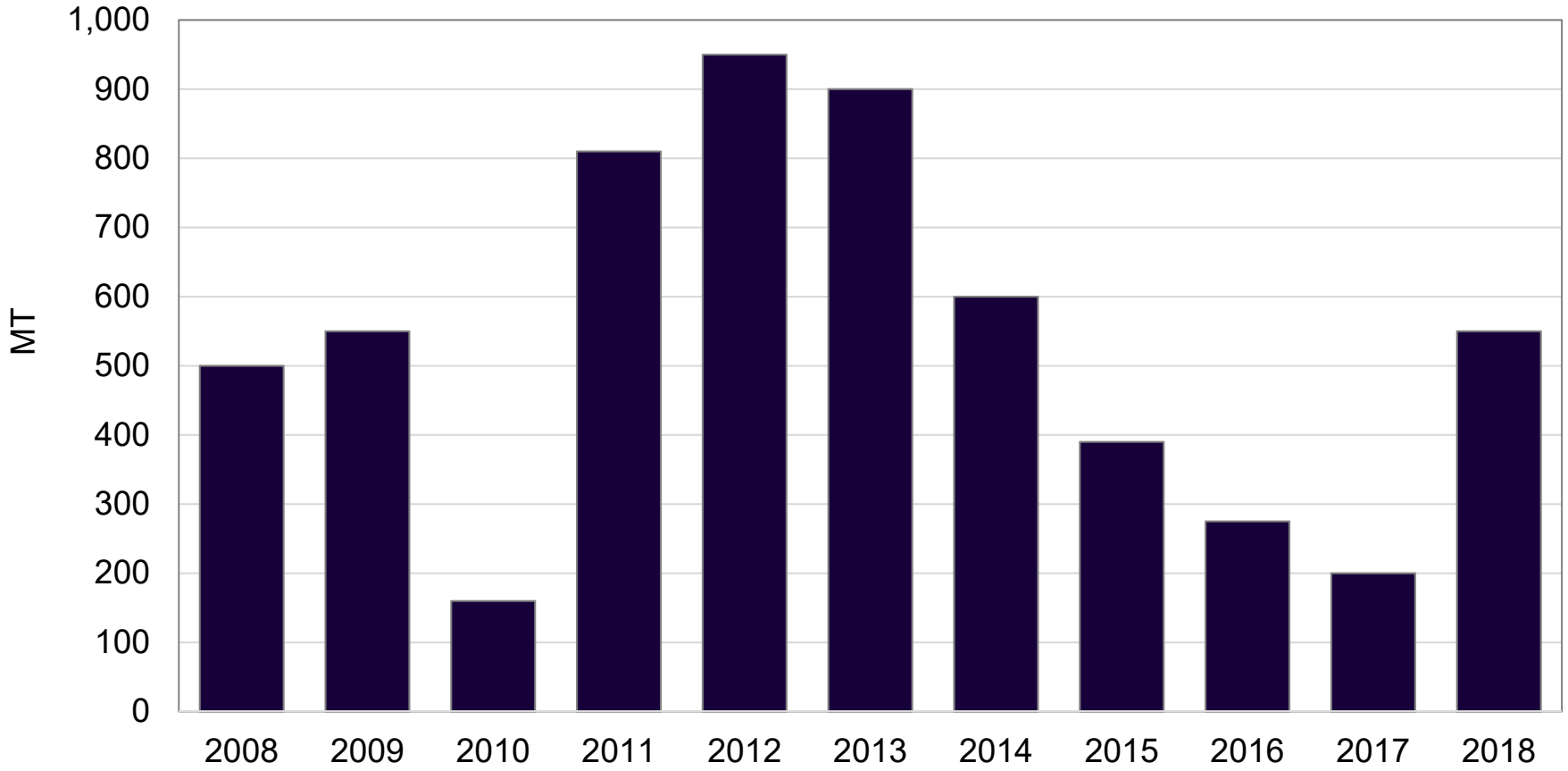
A more competitive market was reflected by **shorter average contract durations** – where buyers set contract duration terms, but a **resurgence in longer term contracts** will support new supply projects.



Note: Author's estimate from source.
Source: Shell LNG Outlook 2019.

Total contract volumes.

Total contract volumes decreased significantly in recent years contributing to excess supply conditions.

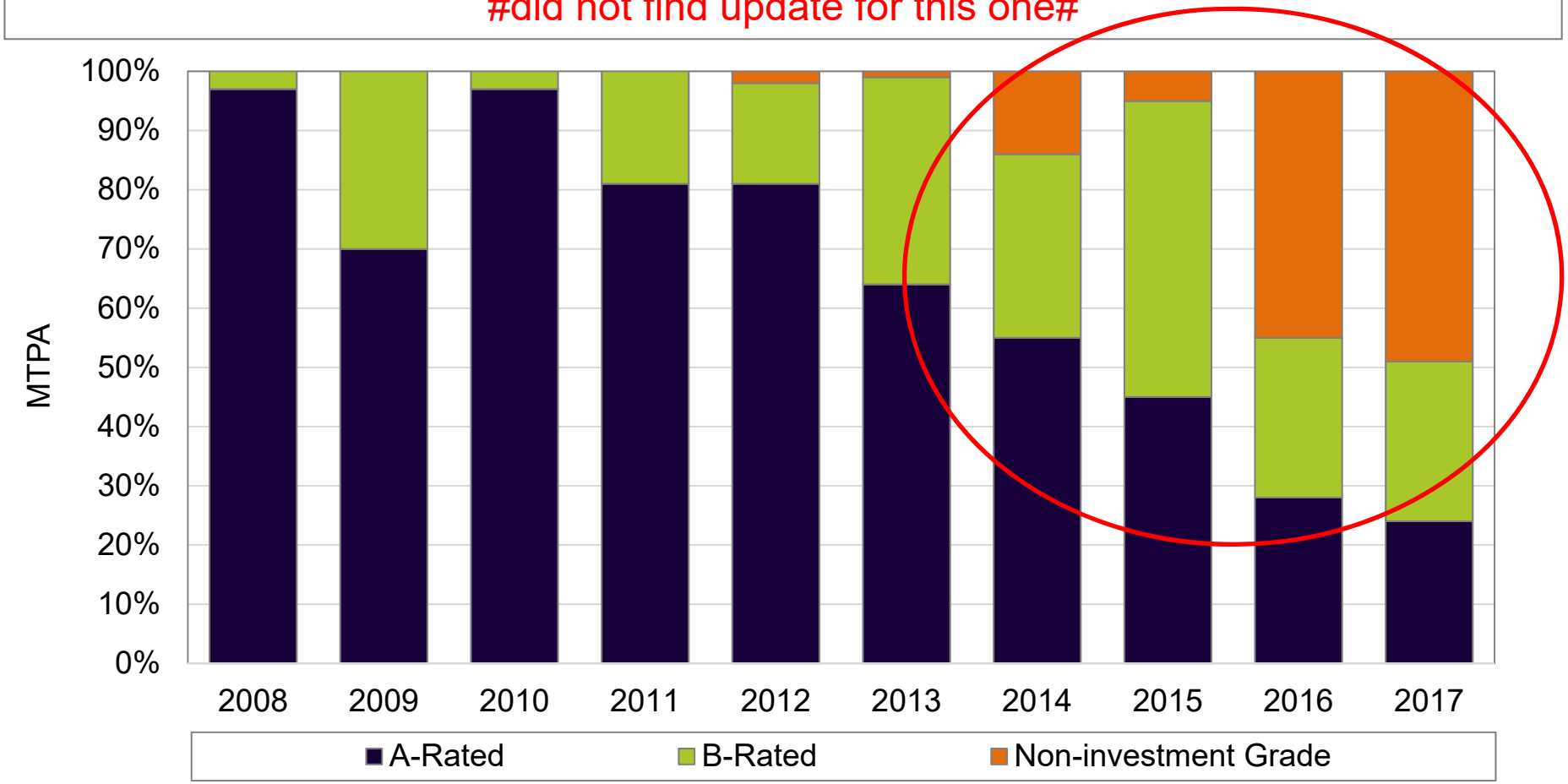


Note: Author's estimate from source.
Source: Shell LNG Outlook 2019.

New long-term contract credit rating.

Contracted sales becoming **increasingly more risky**, developers having to assume more contracting risk to get limited volumes to the market.

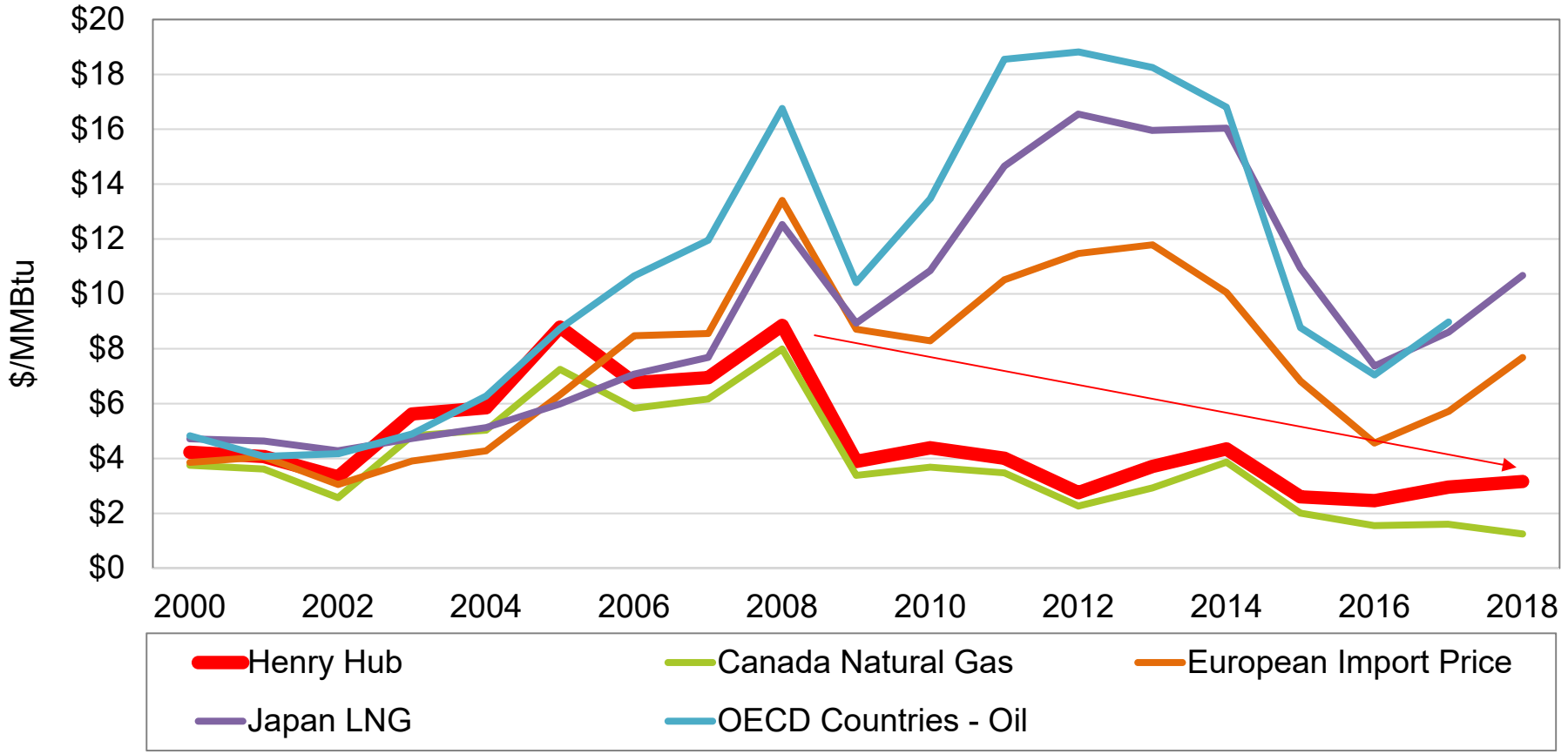
#did not find update for this one#



Note: Author's estimate from source.
Source: Shell LNG Outlook 2018.

World energy prices.

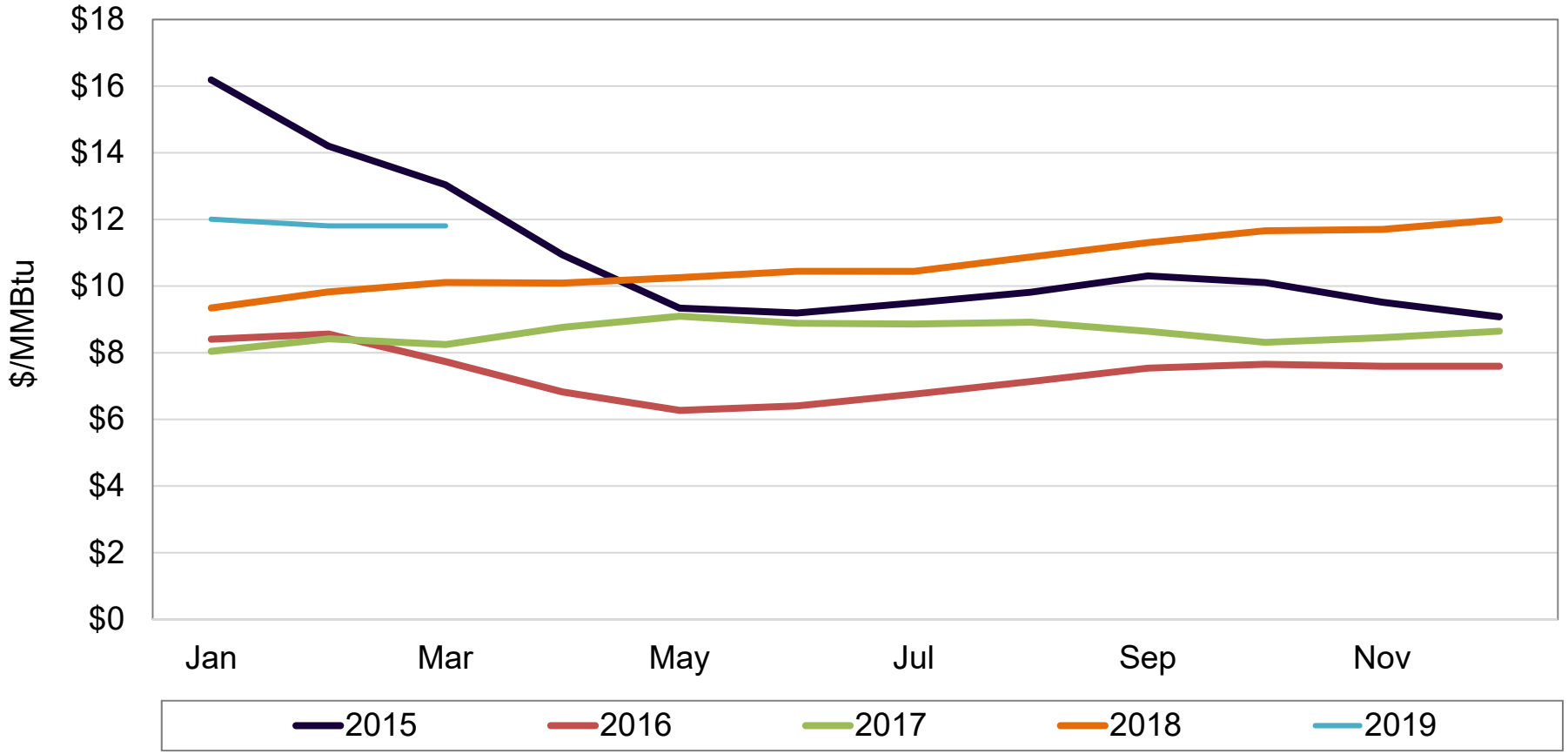
Law of one price: **energy prices moving to HH price, not vice versa**.



Source: World Bank Commodity Price Data.

Asian LNG price (Japan LNG).

Asian prices building over this past year (2018) **but will likely correct with recent crude oil corrections. #and are so far staying high?#**

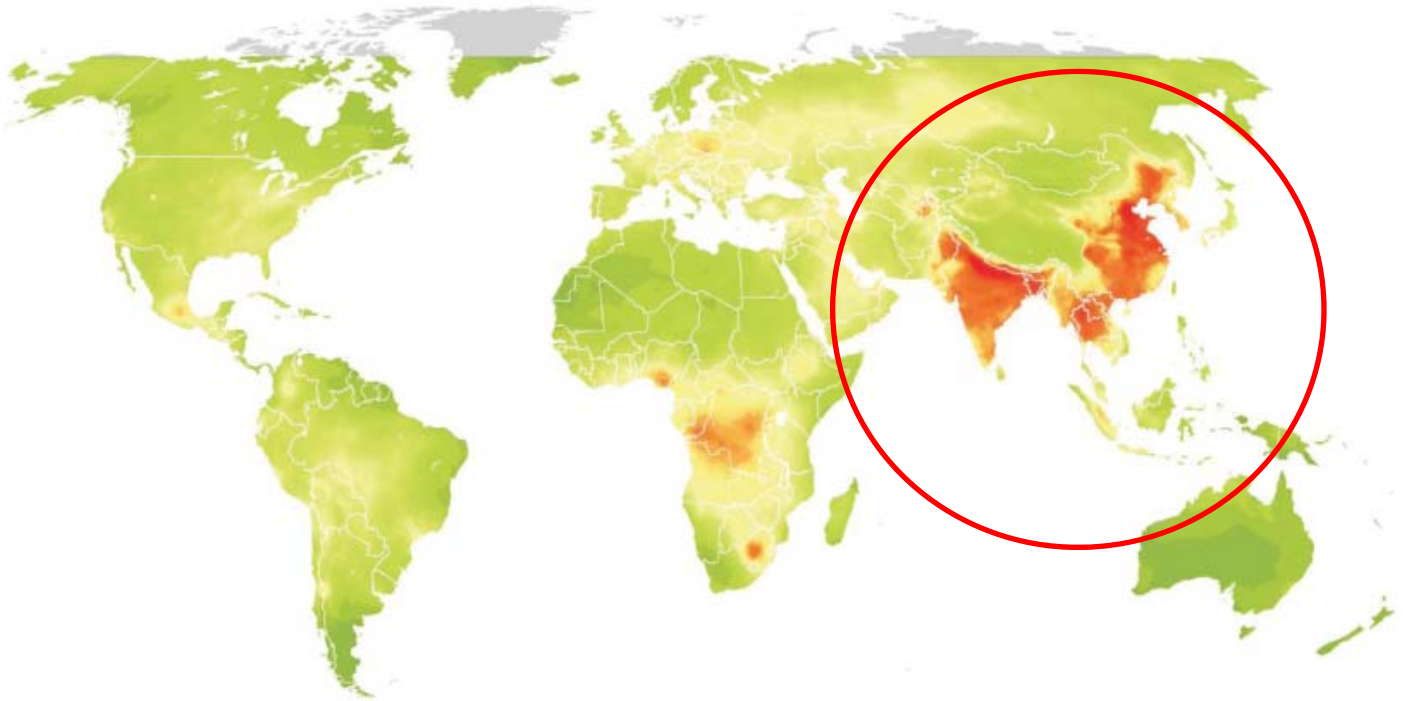


Source: World Bank Commodity Price Data.

Global LNG Forecast Drivers: Environmental Concerns

Air quality index, 2017.

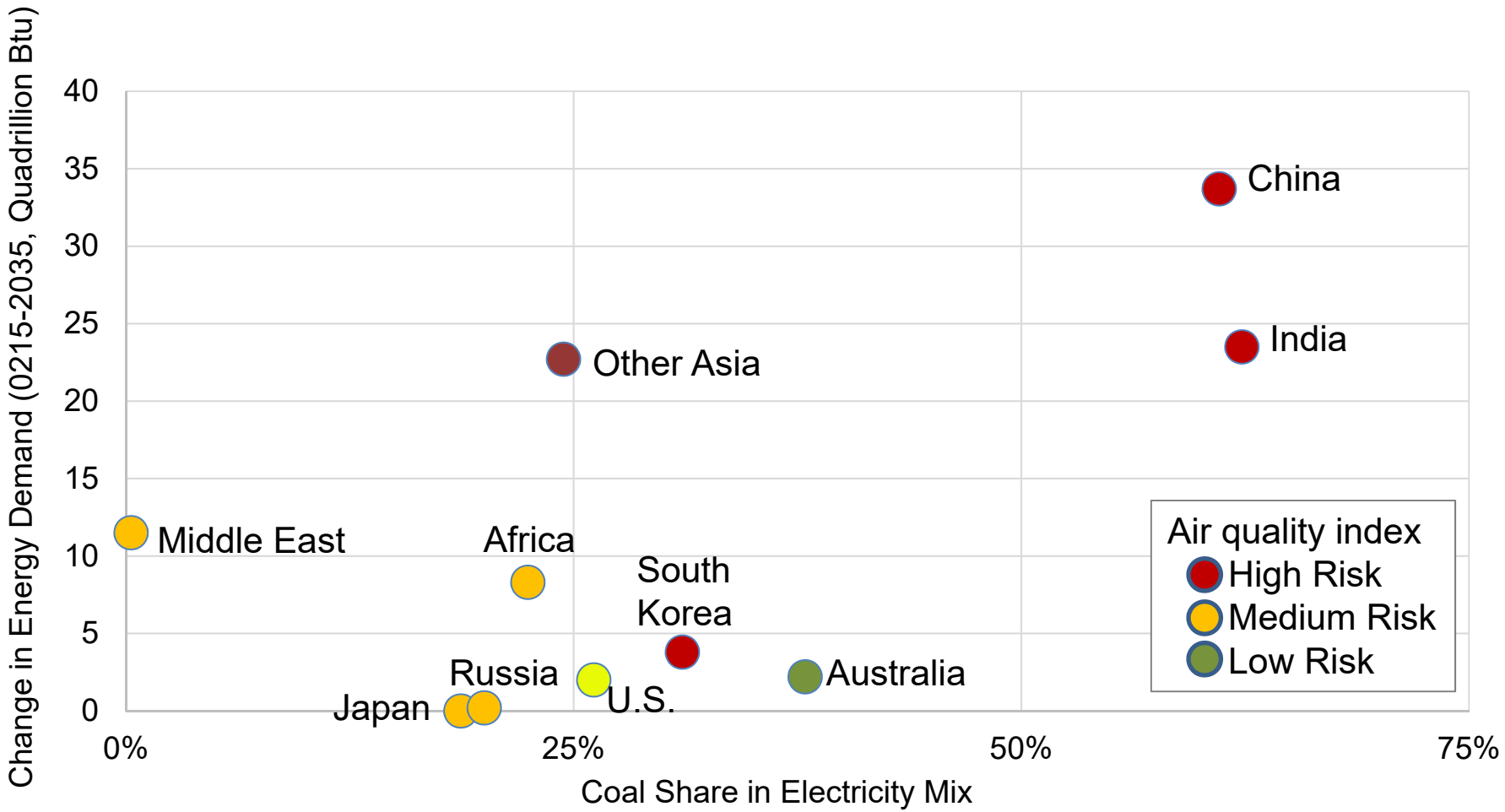
Environmental concerns (emission) will likely contribute significantly to the move to LNG.



Source: Shell LNG Outlook 2018.

Energy demand growth vs. coal share.

China and India represent the "trifecta" for greater LNG use: high energy demand; high coal shares; high environmental risk.



Source: U.S. Energy Information Administration; and Shell LNG Outlook 2018.

Policy actions for clean energy support gas and LNG.

GLOBAL

Increasing recognition of environmental benefits

G20 endorses the role of natural gas in energy transition

IEA credits levelling of global CO2 emissions to coal displacement

REGIONAL

EU policies supporting coal phase out

More than 10 countries announce coal phase-out ambitions – 25% of coal power capacity in EU

EU confirms reforms to strengthen EU Emissions Trading Scheme

NATIONAL

Policies favor gas and renewables

China reforms gas market to increase competitiveness of delivered gas

South Korea's 8th Basic Pan for Energy prioritizes renewables and gas, while not sanctioning new nuclear and coal

LOCAL

Policy makers targeting air quality

Berlin closes local coal-fired power plants to improve air quality

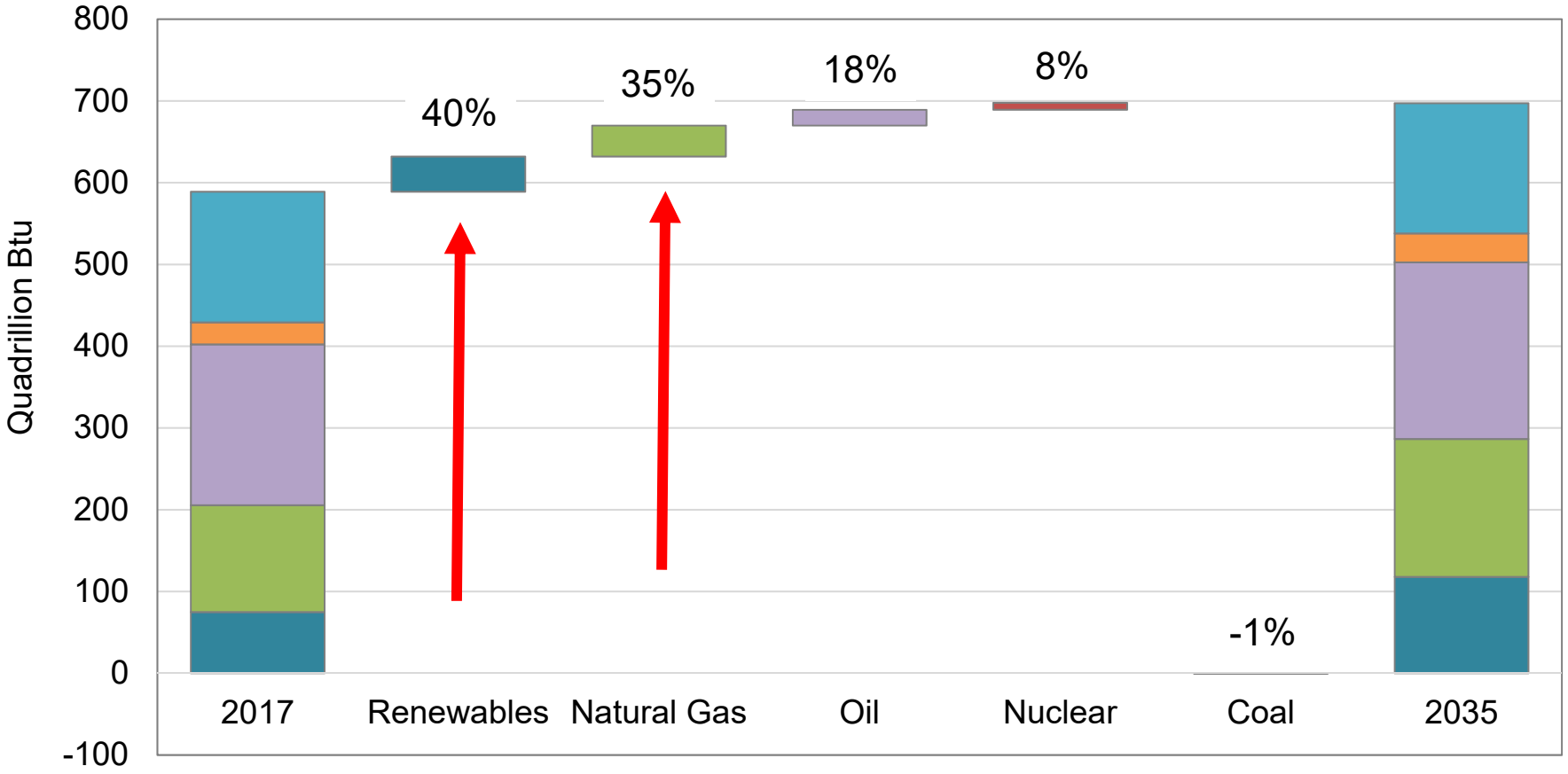
Beijing meets ambitious 2017 air quality targets, supported by coal to gas switching

Source: Shell LNG Outlook 2018.

Global LNG Forecast Drivers: Energy Demand Growth

World energy demand growth by fuel.

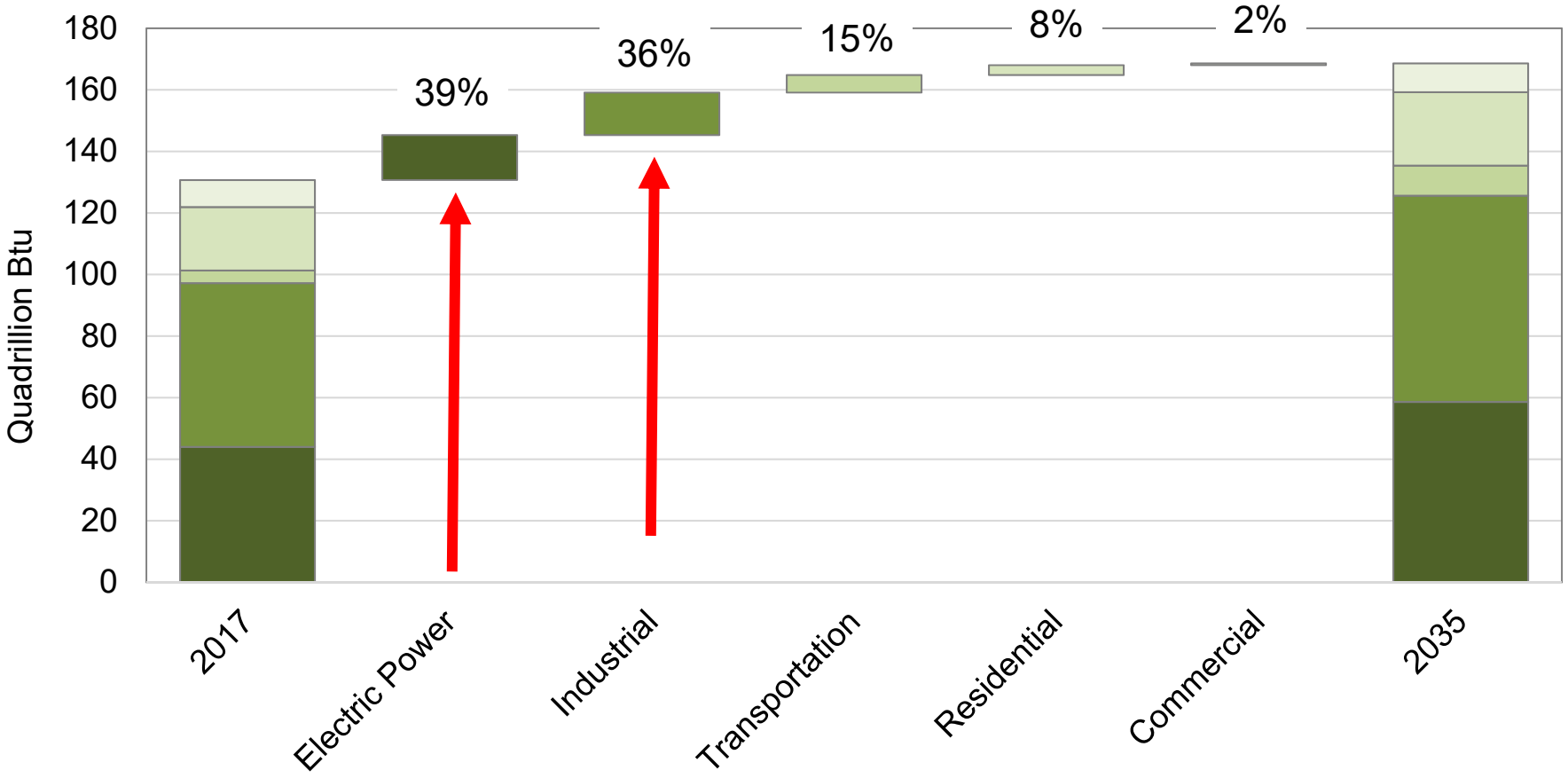
World energy demand is projected to increase at an average annual rate of one percent. **Renewables and natural gas** will account for most of this growth, followed by oil and nuclear. Coal demand is expected to decrease.



Source: U.S. Energy Information Administration.

World natural gas demand growth by sector.

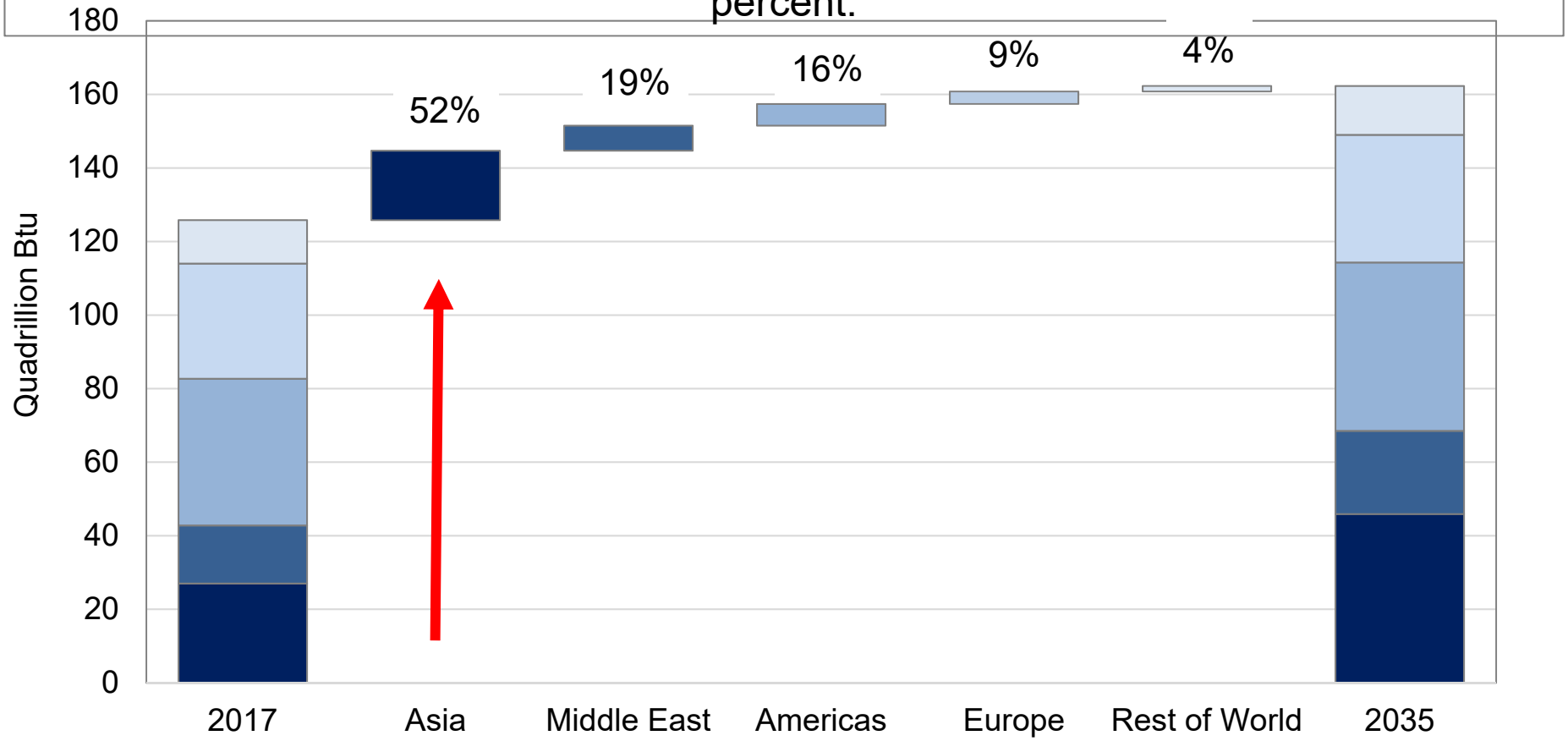
World natural gas demand is projected to increase almost 30 percent. Most of this demand growth will be in the **electric power (39%) and industrial (36%) sectors**, followed by transportation (15%), residential (8%) and commercial (2%).



Source: U.S. Energy Information Administration.

World natural gas demand growth by region.

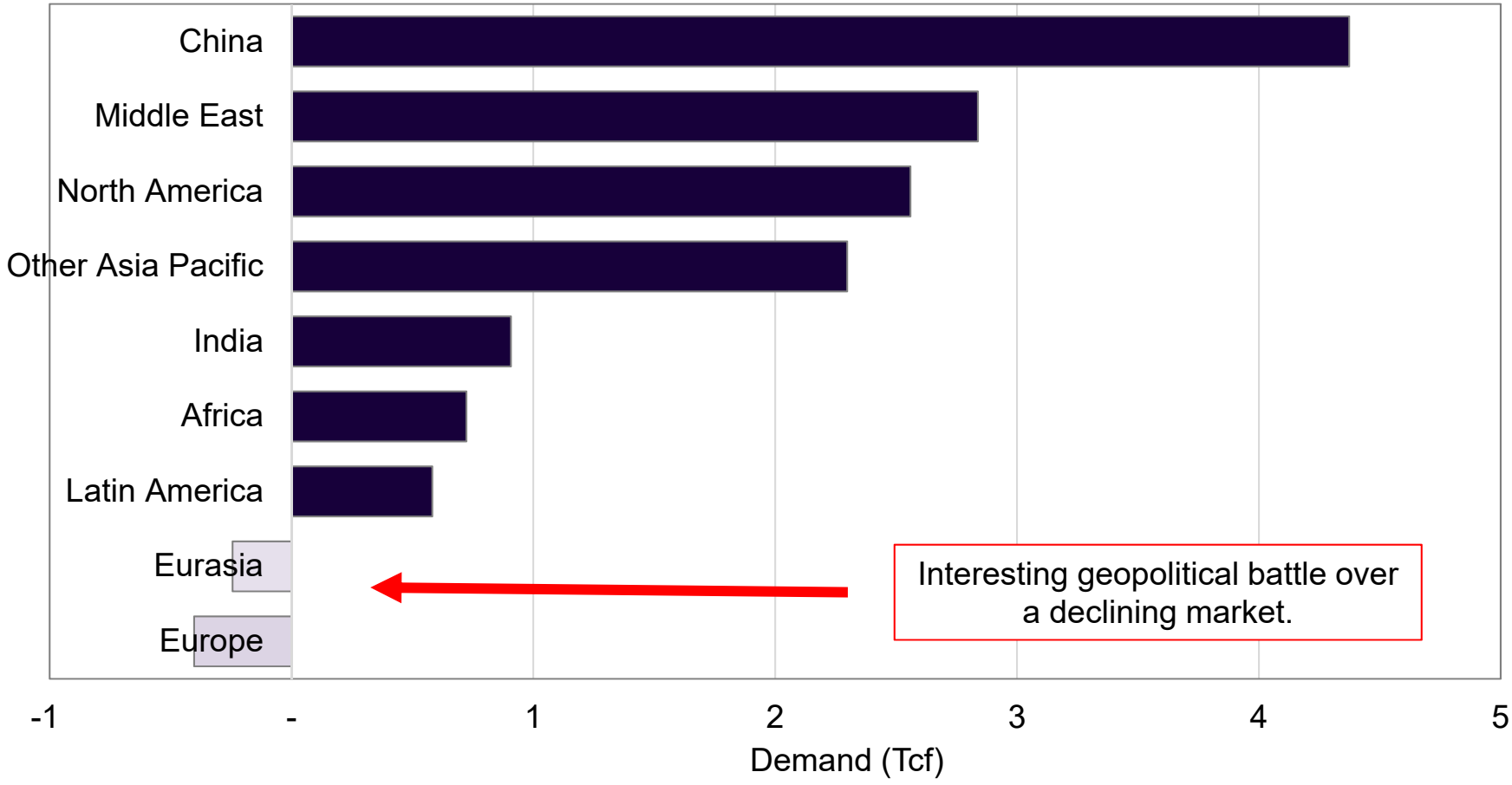
World natural gas demand is projected to increase almost 30 percent. Most of this **demand growth will be in Asia (52%)**, followed by the Middle East (19%) and the Americas (16%). Europe accounts for 9 percent and the rest of the world 4 percent.



Source: U.S. Energy Information Administration.

World natural gas demand growth, 2017-2023.

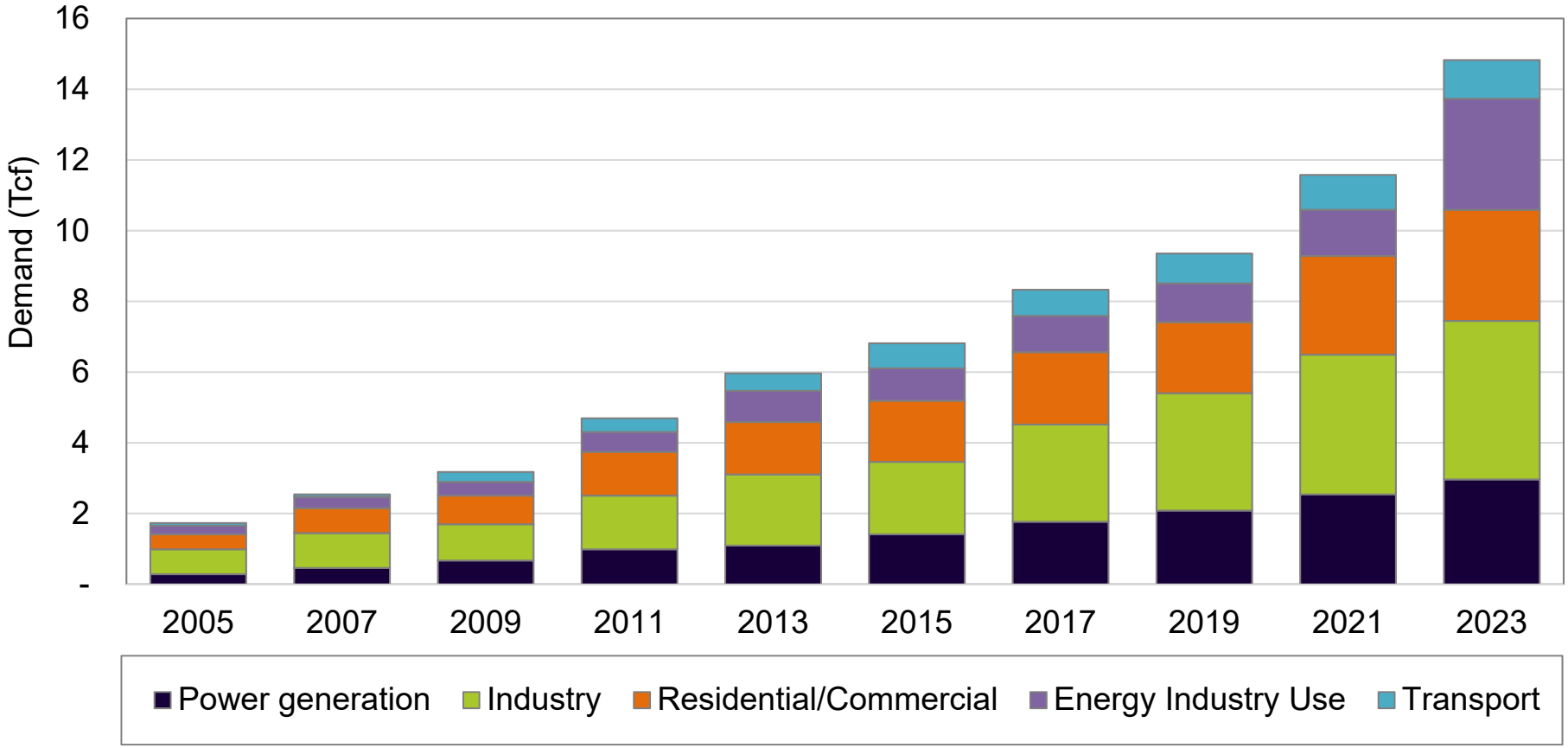
World natural gas demand is expected to increase at an **average annual rate of 1.6 percent over the next five years.** China accounts for one-third of this demand growth.



Source: International Energy Agency, Gas 2018.

China's natural gas demand by sector, 2005-2023.

Industrial usage will be the main driver for natural gas demand in China. Residential and commercial growth will also increase due to the ongoing coal-to-gas switch.



Source: International Energy Agency, Gas 2018.

Conclusions

Conclusions.

- LNG is an important part of **Louisiana's energy export economy.**
- These facilities represent **$9 billion to $12 billion** in capital investment.
- Large project announcements, **not all will get developed,** GOM will be a strongly preferred location**.**
- **Market is current in excess supply –** nirvana is supposed to come in the **2022** time period – there are, emerging storm clouds to this expected market shift.
- **Current trade disputes do not help LNG development.**
- To date, **world prices have moved down to Hub prices, and not vice versa –** how long will this last?

Questions, Comments and Discussion.

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