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Oil, Gas and Global Energy Transitions

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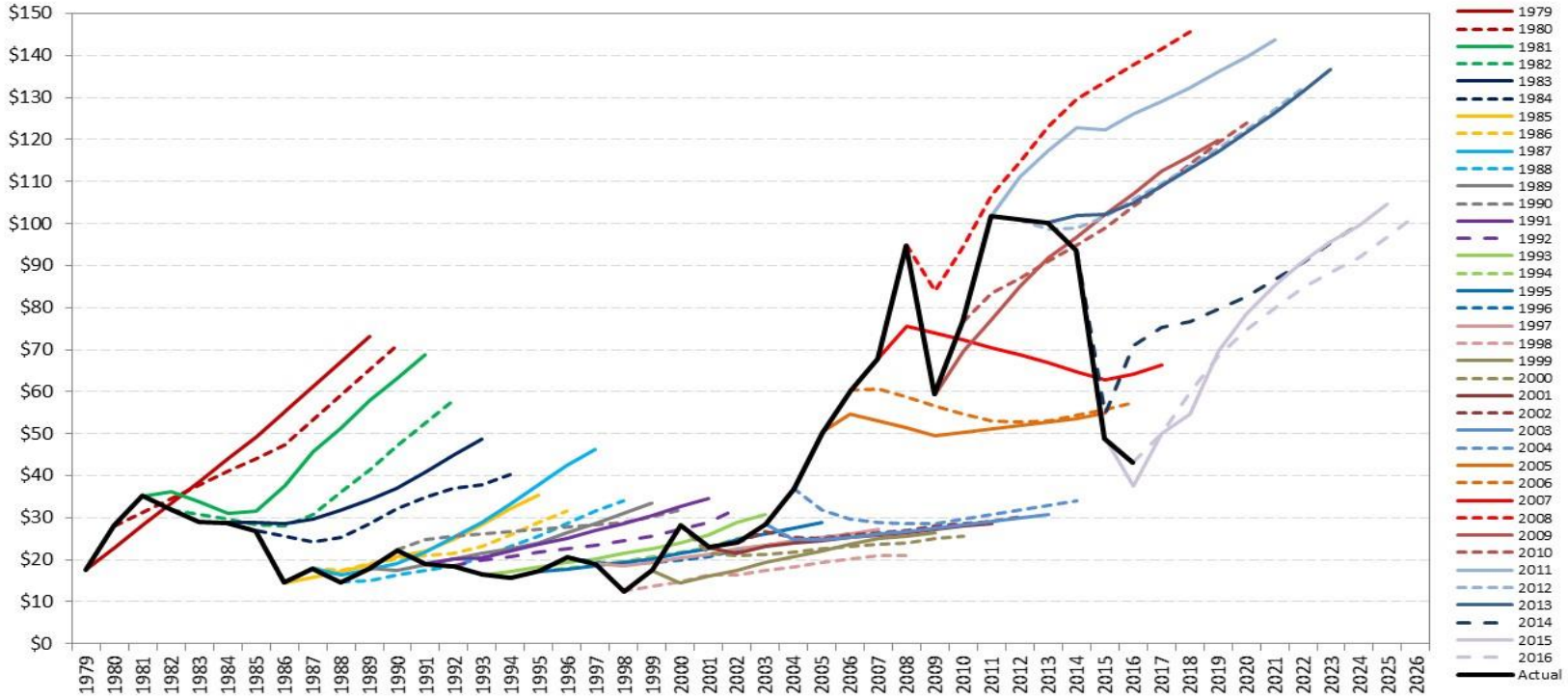
Disclaimer: Forecasting 101 – Precision is Folly!

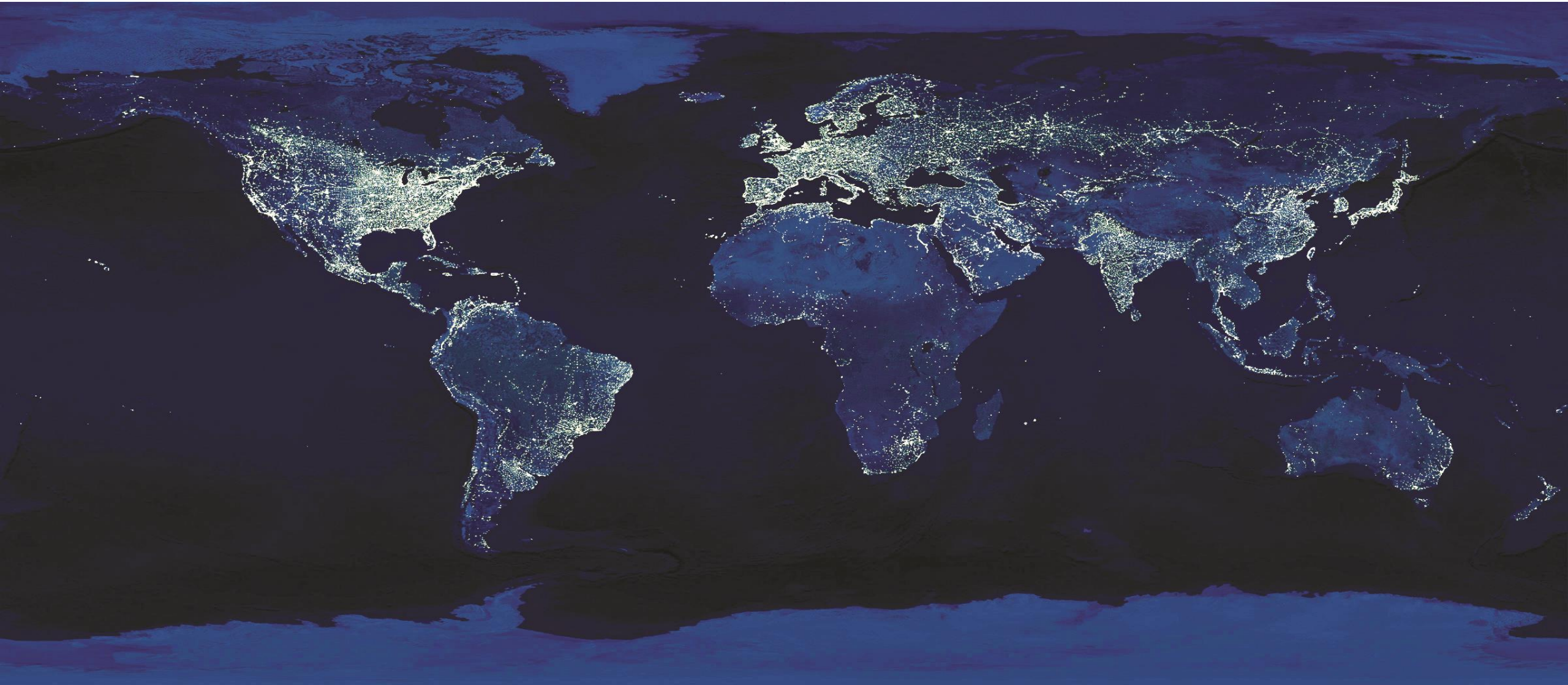
- Long term price projections are rarely accurate, and appear adaptive and myopic.
- "The best cure for high (low) prices is high (low) prices"



Source: Data from US EIA

- **Critical point:** Markets react along many margins. This is what we must understand!

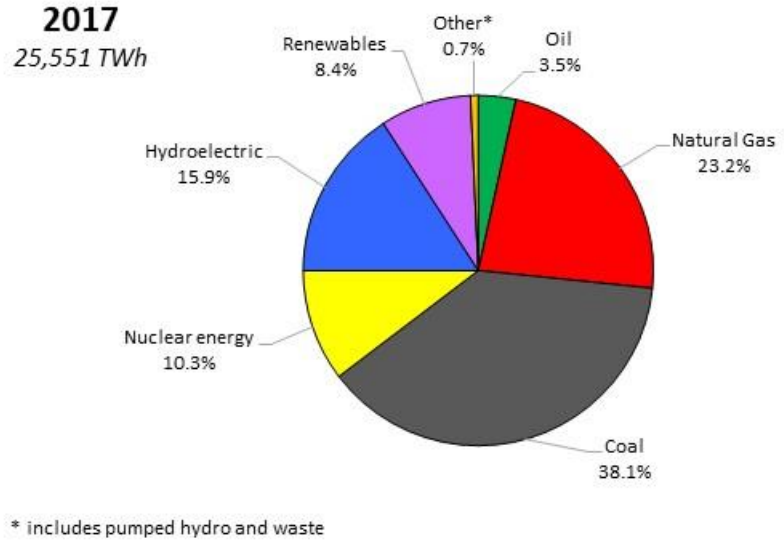
This conversation begins with the future of energy



The current energy landscape

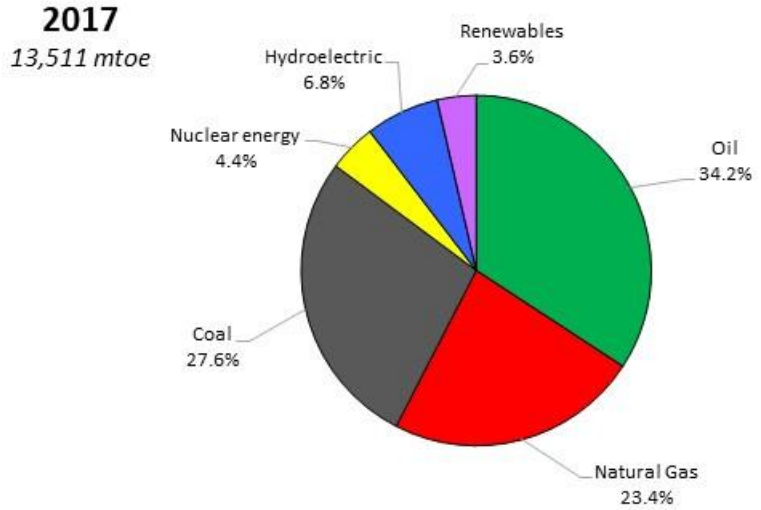
- Renewables are a major focus of the energy transition discussion, and they are growing. In 2017, they represented a 8.4% of global electric generation and 3.6% of total energy, which is up from 0.9% and 0.3%, respectively, in 2007…

Global Power Generation



* includes pumped hydro and waste

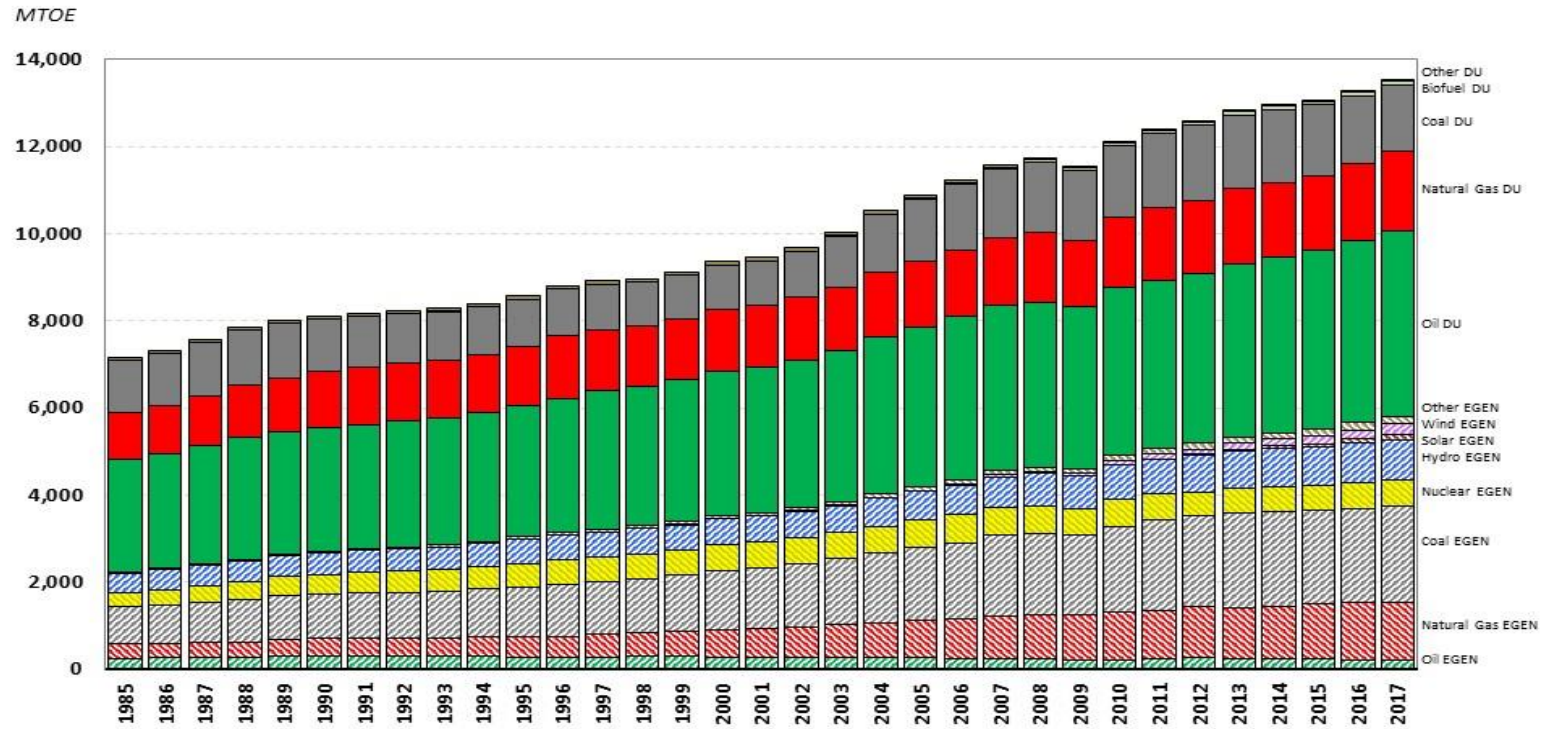
Global Primary Energy



Data Source: BP, 2018

The energy landscape and the reality of "scale"

- … but even with double-digit year-on-year percentage increases for the last 20 years, they are still a relatively small proportion of the total energy mix.
  - Total demand continues to grow. So, incumbent fuels must be displaced and new demand simultaneously met.
  - This becomes even more challenging when postulating greater electrification.



Data Source: BP, 2018

"Energy Transitions"
The Roles of Legacy, Scale and Technology

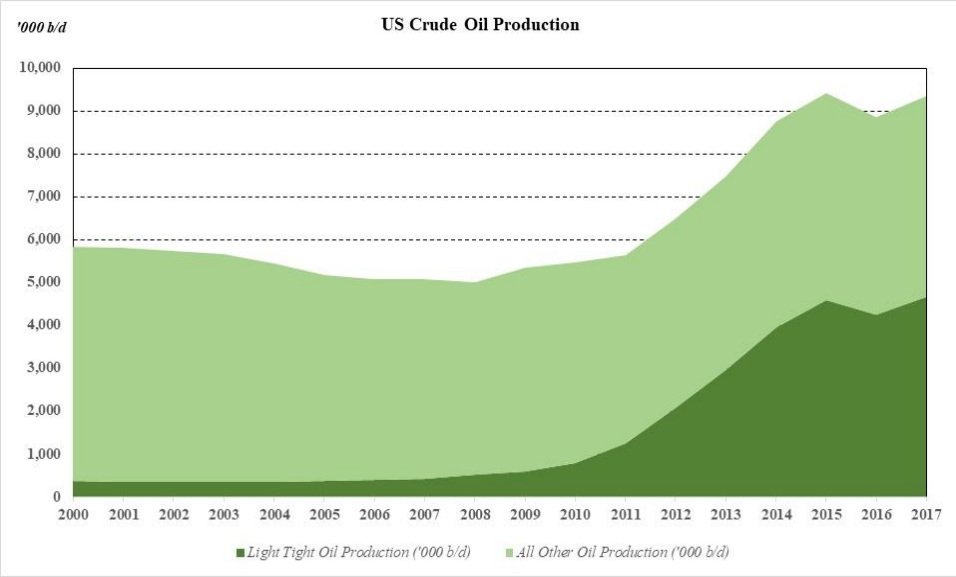
- **Energy ALWAYS transitions. Three important words: Legacy, Scale and Technology.**
- Technology, scale and legacy are each important factors.
  - Technology signals how fuels will ultimately compete. This can work in multiple, sometimes competing, directions by raising the efficiency of use of existing fuels *and* by introducing new competitive energy sources. Importantly, capital is a vehicle for technology deployment!
  - Scale matters because energy systems are large and must accommodate growth and expanding access.
  - Legacy of infrastructure and energy delivery systems is the footprint for change. Legacy is different everywhere – the contrasting cases of the US and China – and is set in a lumpy but continuous manner.
- Economics matter. The cost-benefit must be favorable for sustainable diffusion of new technology.
- Finally, policy and geopolitics shape, and are shaped, by all of the above.
- **The most impactful yet oft understated "transitions" affecting energy markets in the last 15 years have been the shale revolution in the US and economic growth in Asia.**

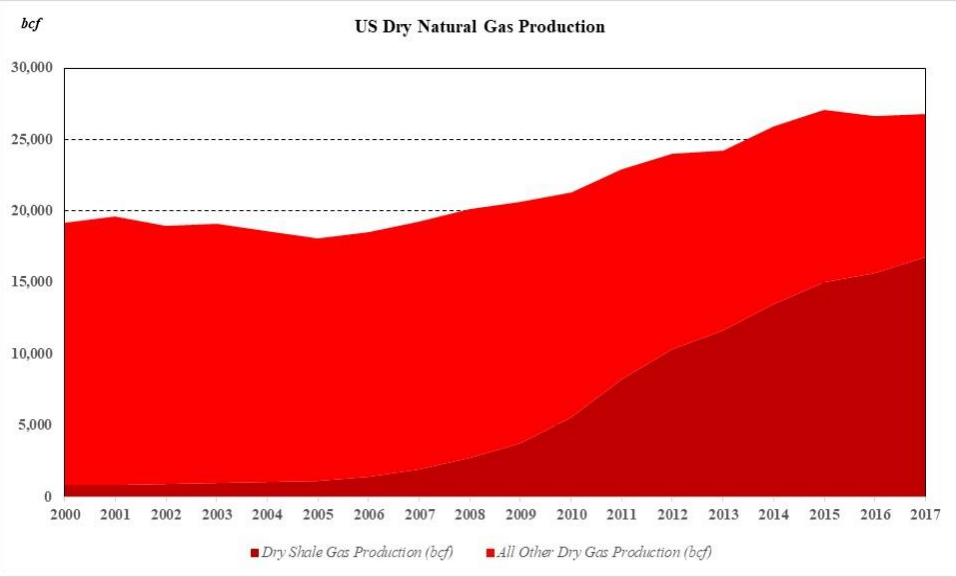
Oft unmentioned aspects of the last decade as it pertains to the "current" energy transition:

(1) US Shale and (2) Demand growth in Asia

Shale has driven an increase in US oil and gas production…

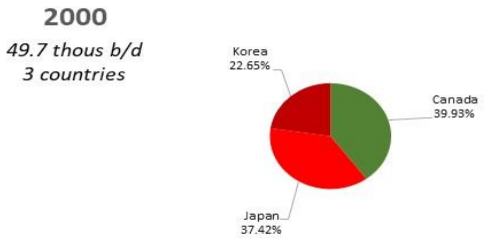
- The last 10 years has borne witness to a dramatic shift in US oil and gas production and stimulated a very different view of the future.
  - Light tight oil production is now about 50% of domestic output and is Texas-centric, coming from the Permian (40%), Eagle Ford (23%), Bakken (23%), Others (14%).
  - Shale gas production now accounts for about 63% of all domestic dry gas production, and is heavily concentrated in the Mid-Atlantic and Gulf Coast regions, coming from Marcellus/Utica (49%), Barnett/Haynesville/Eagle Ford/Permian (35%), Others (16%).



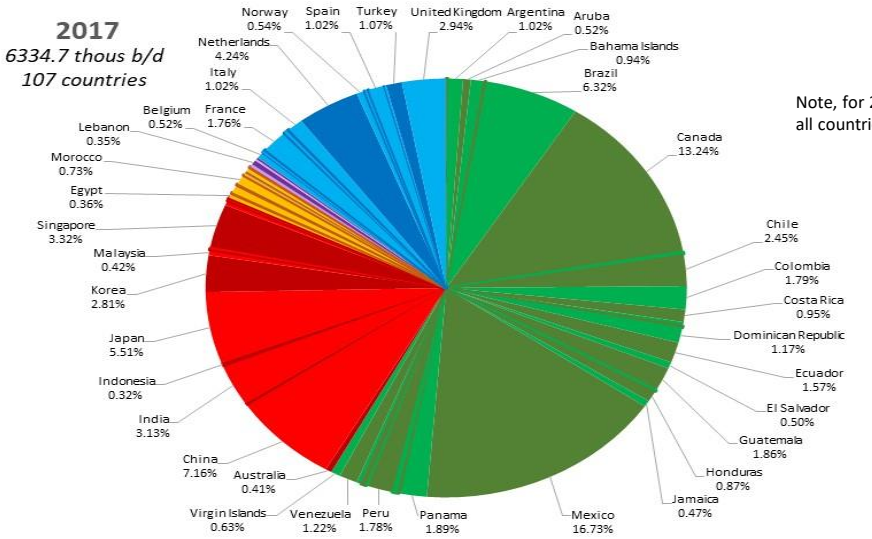


Source: Data from US EIA

… pushing export growth with expanding geographic reach.

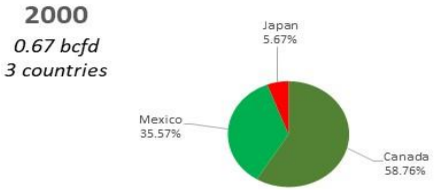


Crude Oil and Petroleum Products Exports

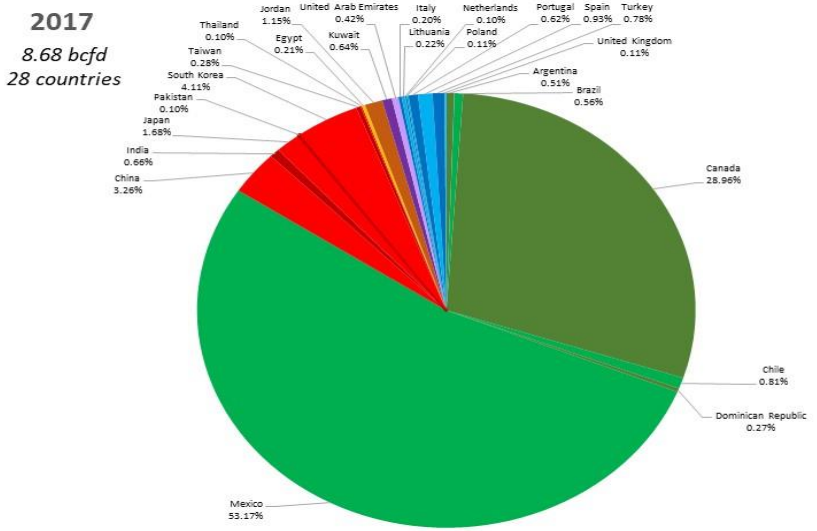


Note, for 2017 petroleum, not all countries are labeled.

Note, in 2008, crude oil and petroleum product exports totaled 1428.5 thous b/d to 87 different countries.



Natural Gas Exports

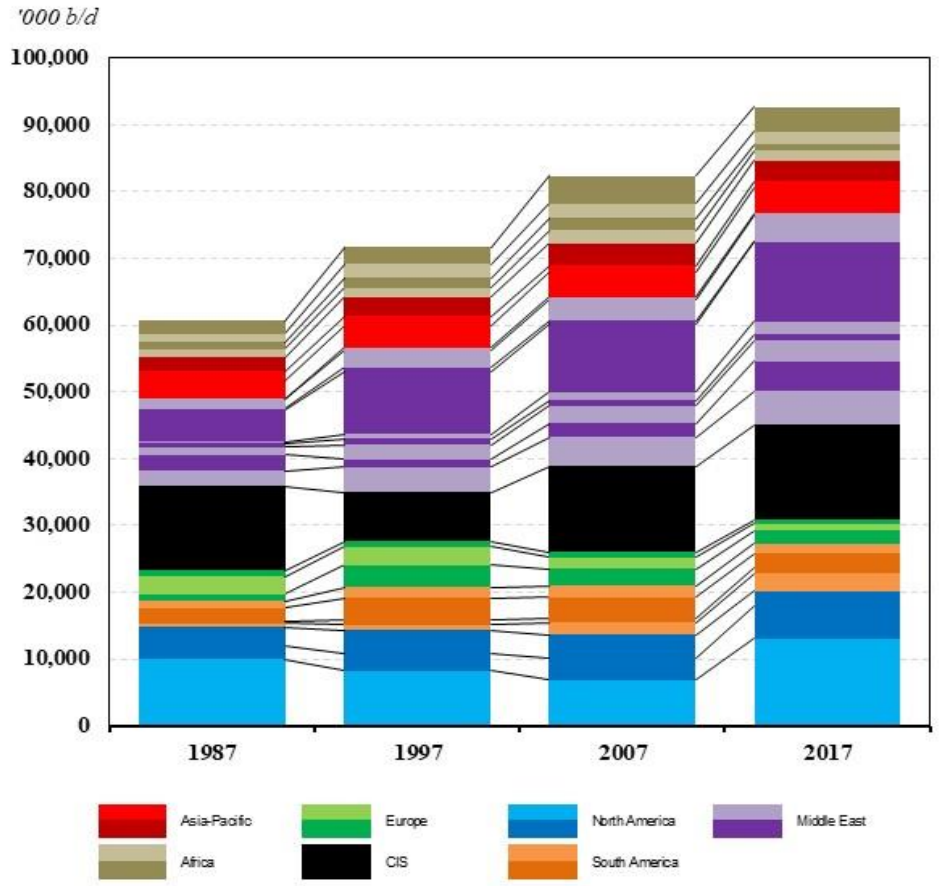


Note, in 2008, natural gas exports totaled 2.59 bcfd to 4 different countries.

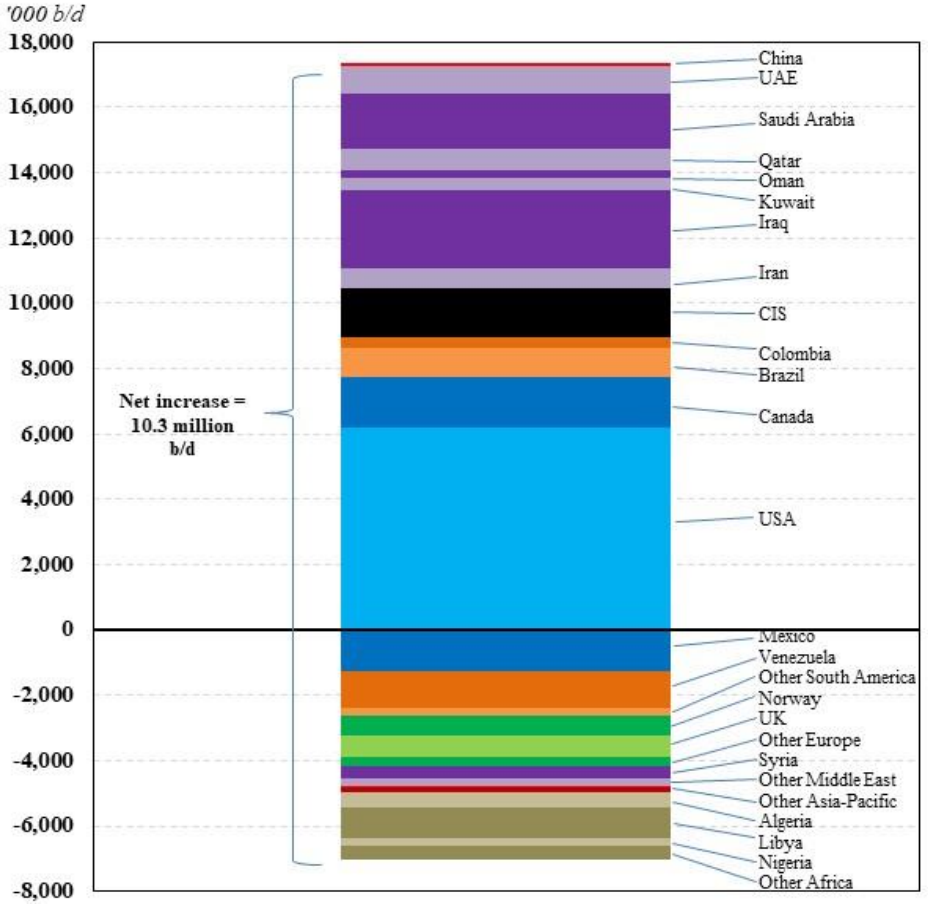
Source: Data from EIA

Global oil supply growth has been consistent since the mid-1980s, but shale has had the largest impact in the last decade…

Global Oil Supply, 1987-2017



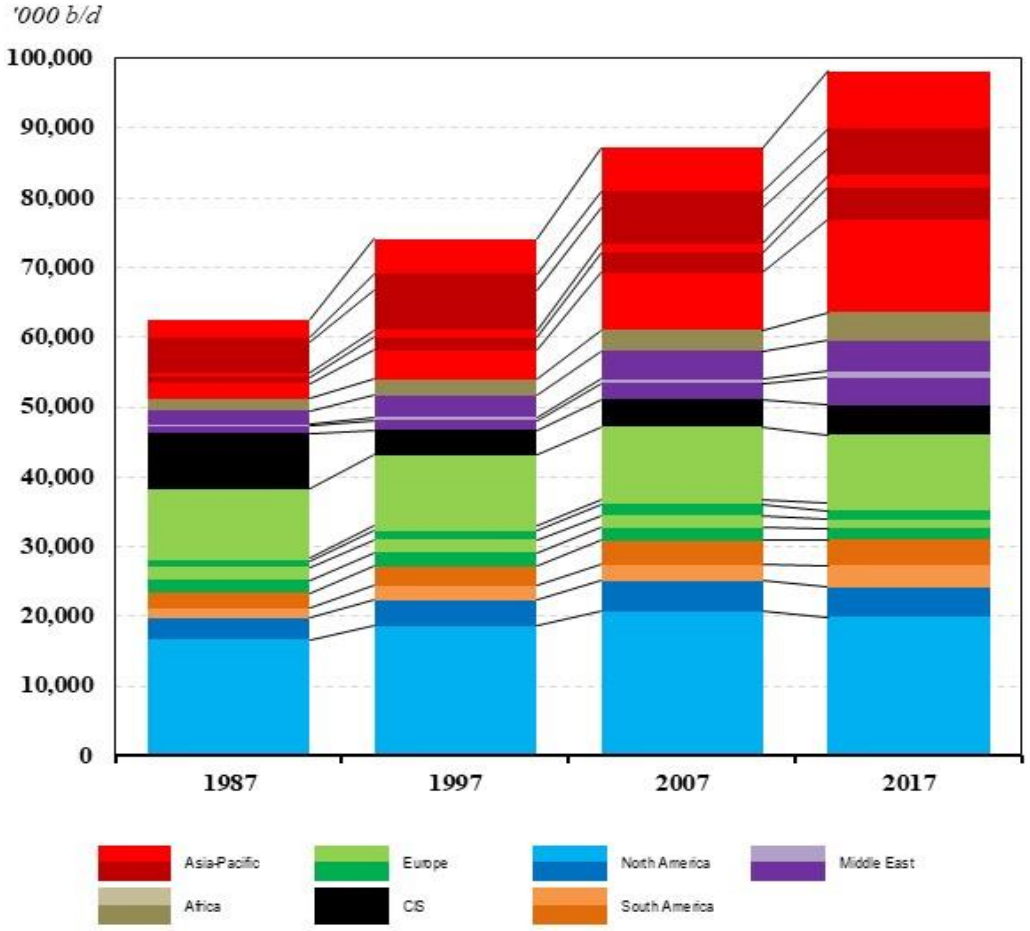
Change in Global Oil Supply, 2007-2017



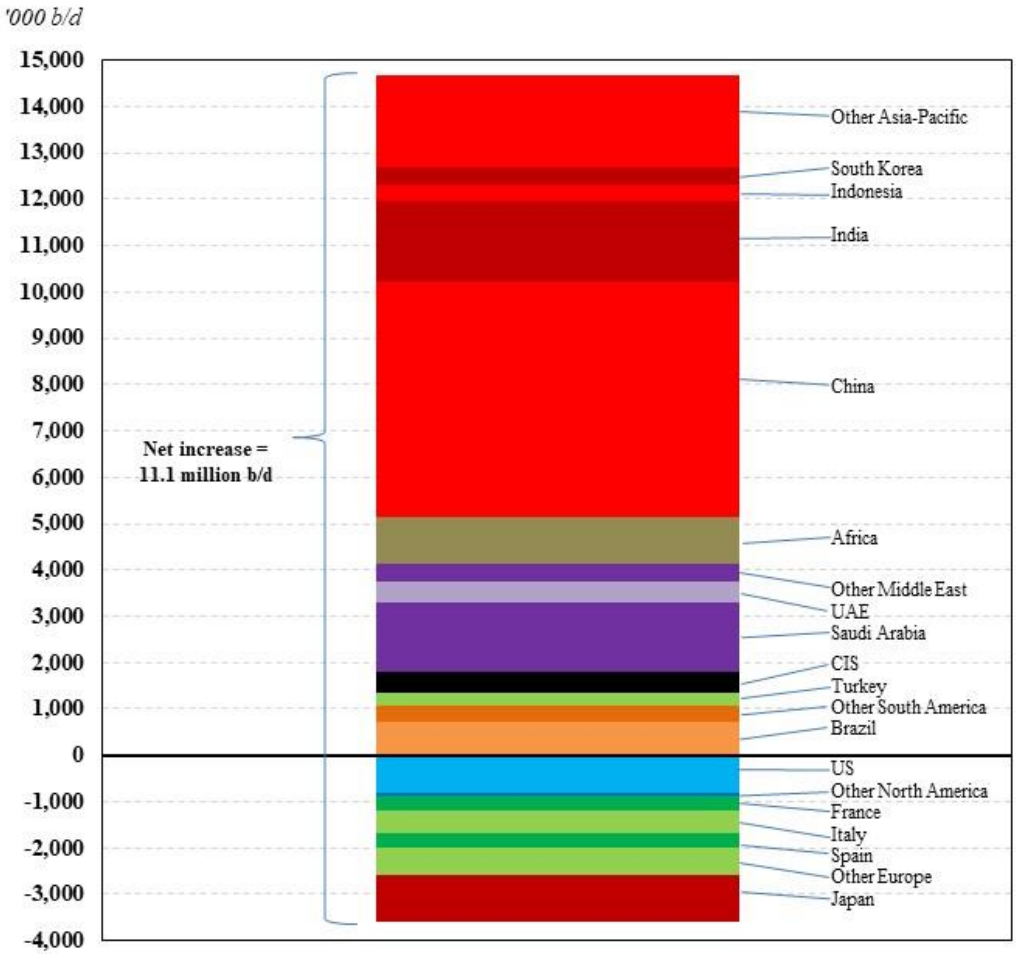
Data Source: BP, 2018

… and is much needed for new demands in developing regions.

Global Oil Demand, 1987-2017



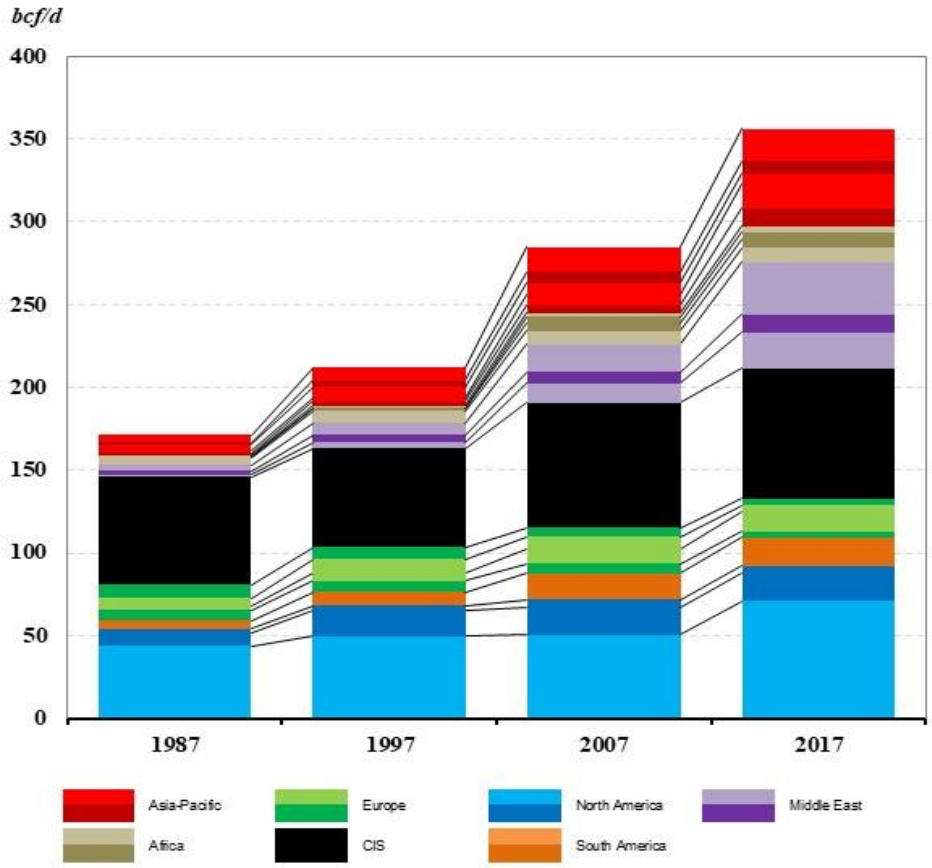
Change in Global Oil Demand, 2007-2017



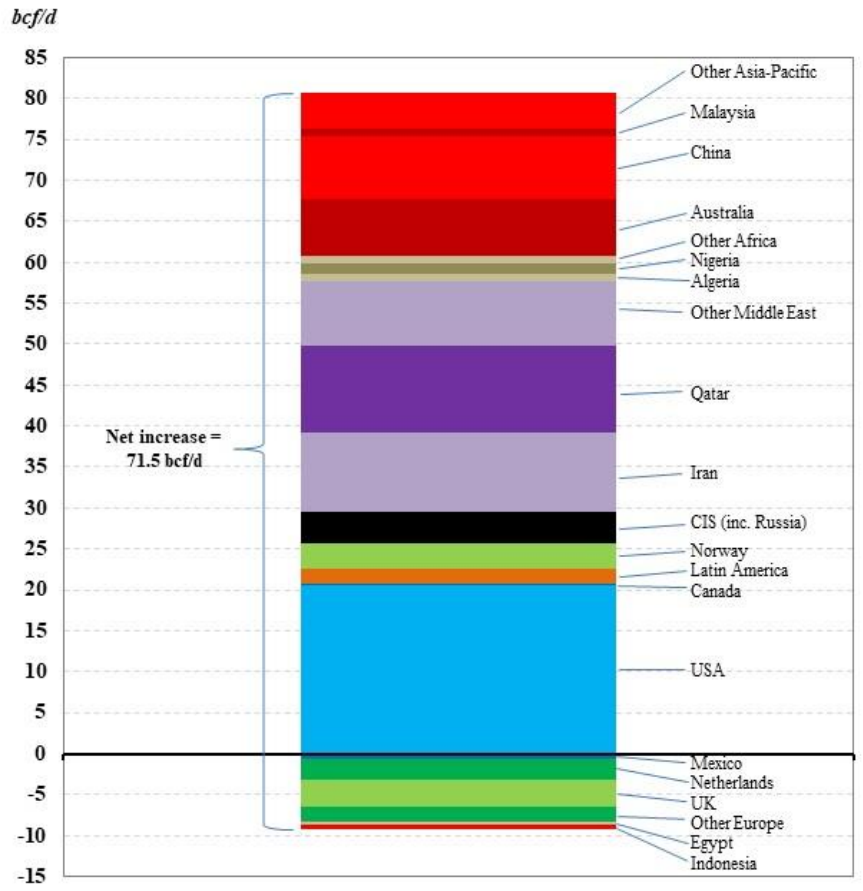
Data Source: BP, 2018

Global gas supply growth has been strong, but, similar to oil, shale has had the largest impact in the last decade…

Global Gas Supply, 1987-2017



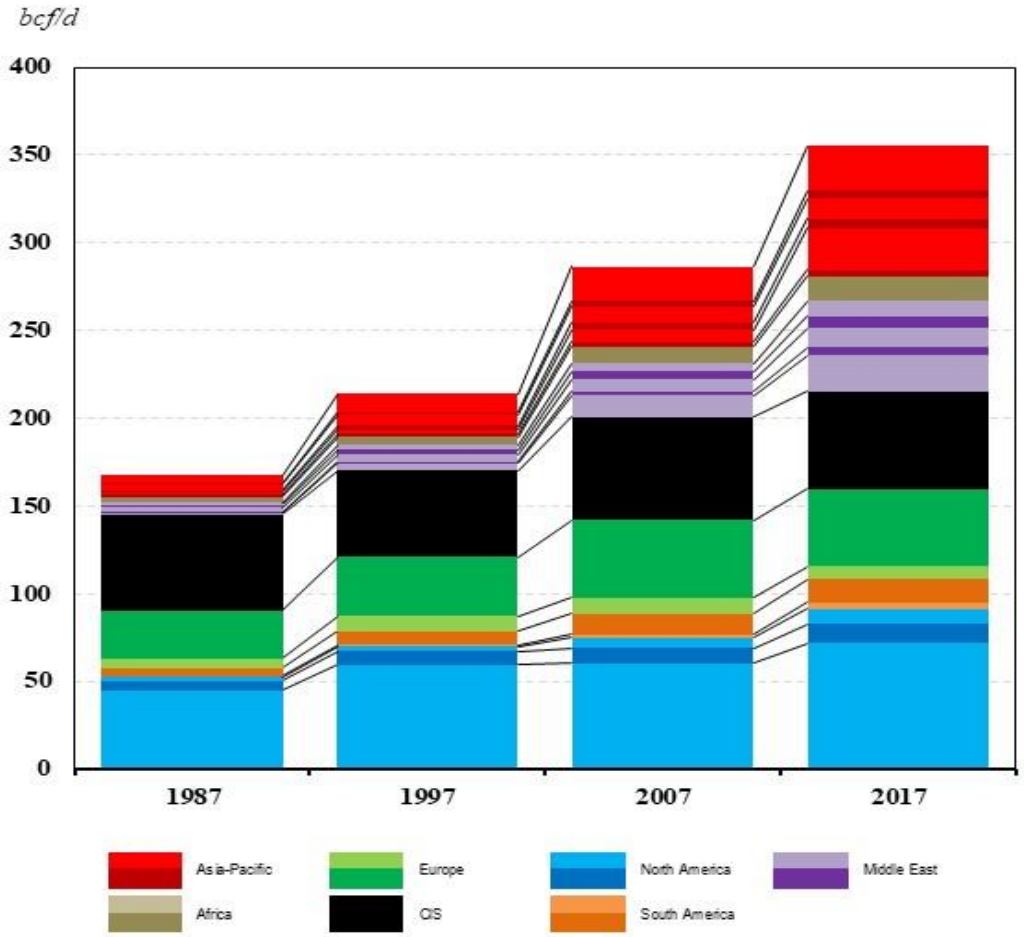
Change in Global Gas Supply, 2007-2017



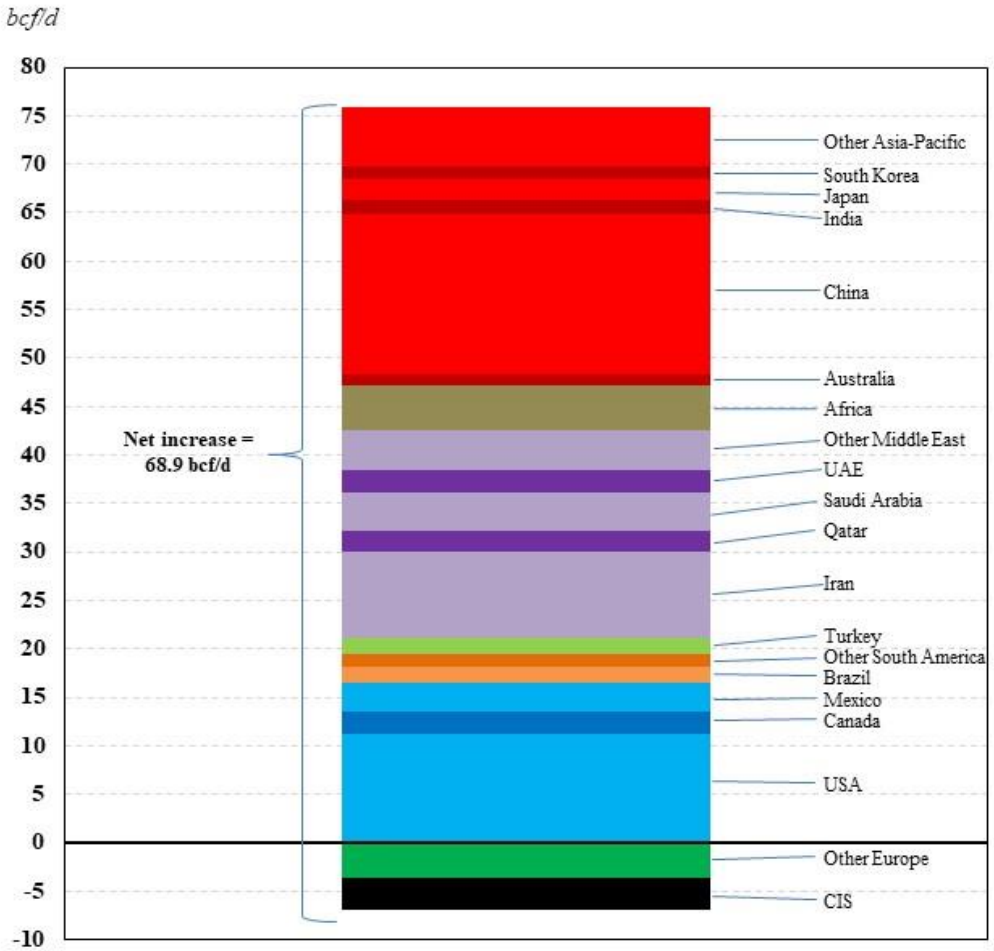
Data Source: BP, 2018

… and is much needed for new demands almost everywhere.

Global Gas Demand, 1987-2017



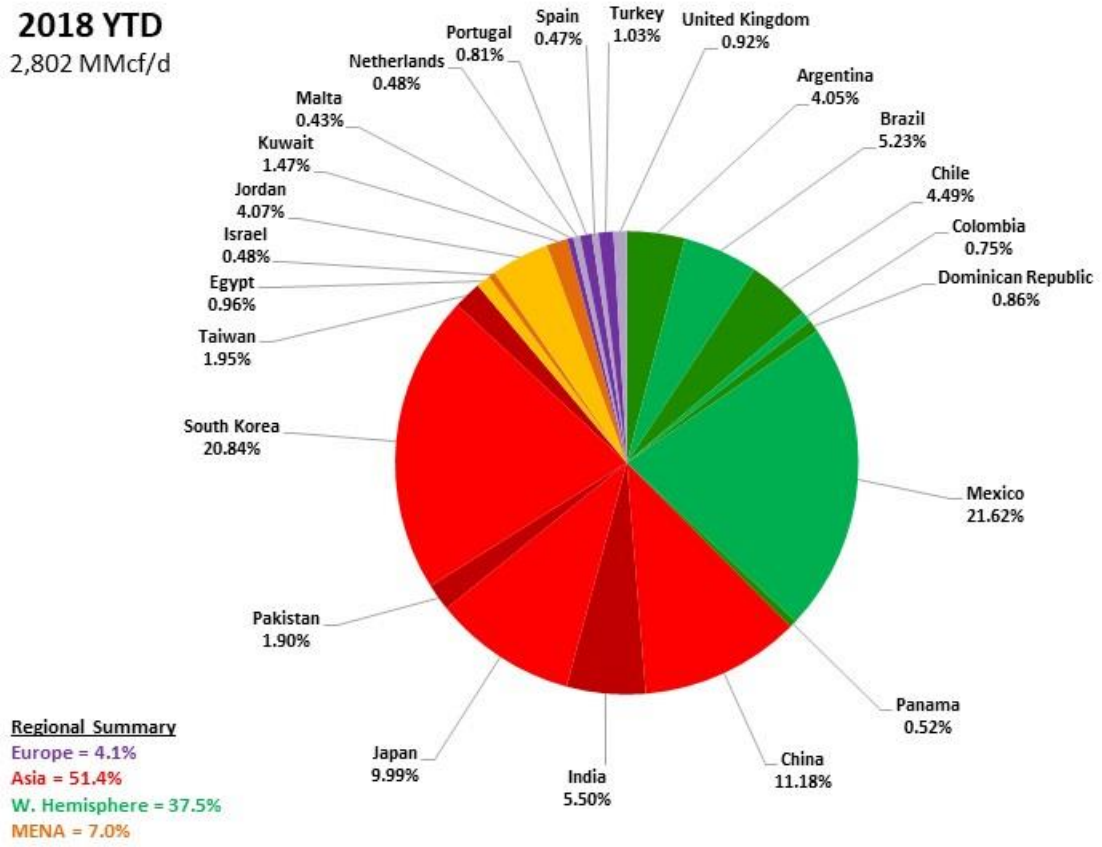
Change in Global Gas Demand, 2007-2017



Data Source: BP, 2018

US LNG is at the center of a larger "transition" in gas markets…

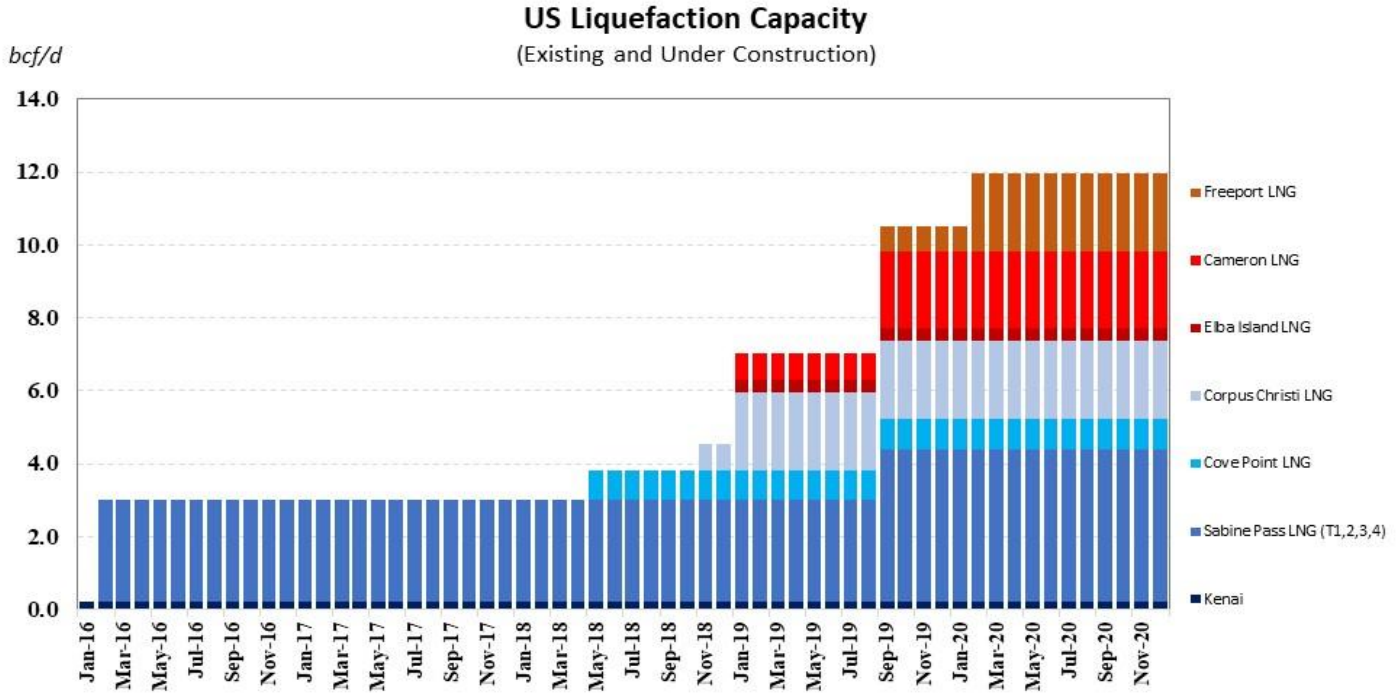
- US LNG exports have averaged over 2,800 mmcf/d in 2018, and reached over 3,100 mmcf/d in July, which represents a 35x increase in 3 years.



Source: Data from US DOE

… and they are poised to grow even more…

- There exists 3.8 bcf/d of LNG export capacity between Sabine Pass, Cove Point and Kenai.
- There is another 8.1 bcf/d of capacity under construction, setting the stage for a potential surge of exports, the vast majority of which will come from the US Gulf Coast.
- Notably, there is another 6.8 bcf/d approved and 23.6 bcf/d with applications pending.



Source: Data from US FERC and US EIA; Start dates for new capacity are speculative.

- Of course, capacity does not guarantee volume. But, the reality being forged in the Permian Basin has huge implications. Oil-directed activity is bringing large associated gas volumes, and could open new opportunities. Infrastructure constraints exist, but they are being alleviated.

… with long term market altering implications.

- Physical connectedness with the global market will have implications for market liquidity, pricing and investment paradigms.
- Long-term contracts will remain important because they are "bankable", especially when debt-financing is considered.
- However, take-or-pay clauses will be eroded by the "real option" value associated with capacity rights that are tradable.
- Hence, the chicken-and-egg paradigm…
  - Real option value is greater initially, but as parties begin to capture this value it erodes because trading frequency increases.
  - However, an increase in trading frequency drives greater price discovery, which establishes more market transparency and liquidity.
  - This, in turn, alters the risk associated with market entry, or new investment, because a liquid market mitigates uptake and offtake risk.
  - Liquidity also provides elements of energy security to both producers and consumers because access is not easily compromised.

Source: Ongoing Baker Institute CES research

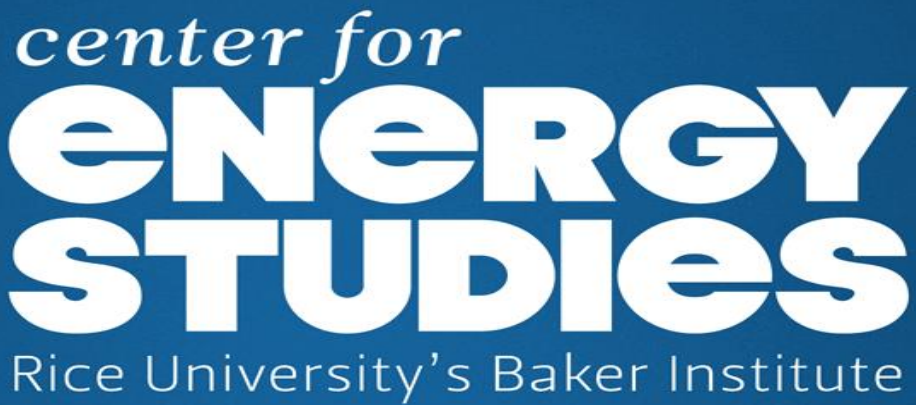
Something to ponder…

Does history repeat itself?

- The early 1980s was a period of robust promise for renewable energy and distributed generation. Why?
  - High oil prices and energy security.
  - Natural gas supply concerns.
- What happened?
  - Fuel costs fell and efficiency increased.
  - Fixed costs of adoption matter.
  - Coal expanded.
- How is the present different?
  - Renewables costs are lower and coal is encumbered, each aided by policy.
  - Energy *and* environmental security.
  - Natural gas supply is robust.
- Are recent developments lasting?
  - Drivers today are different…

Final thought:
Innovation is the key to long term prosperity, and today's youth will change the world… for all energy sources!

- Hydrocarbons will continue to be in the energy future, but the challenges of the day must be addressed.
  - https://www.forbes.com/sites/thebakersinstitute/2018/11/05/millennials-oil-and-gas-and-the-energy-transition/#786ecbde65dc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