Oil & Gas Journal's 2019 Worldwide Pipeline Outlook

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OGJ special reports

- Annual Forecast & Review (Jan. 7)
  - Conglin Xu and Laura Bell
- Worldwide Pipeline Construction (Feb. 4)
  - Chris Smith
- Midyear Forecast (Jul. 1)
  - Conglin Xu and Laura Bell
- Pipeline Economics (Oct. 7)
  - Chris Smith

Market summary

- Market softer despite OPEC cuts (US shale)
- Record US production of crude, natural gas, and NGL
- Abundance dominates the market while global demand forecasts soften

Geopolitical variables in the oil price

- Developments that would lower supply and increase the crude price:
  - Expiration of Iran sanctions waivers (late April-early May)
  - Venezuela's collapse
  - Libya sinks further into civil conflict

- Development that would raise supply and lower the crude price:
  - Expansion of US-China trade conflict (Mar. 2 deadline)
    - Wouldn't raise supply, but would lower demand
    - Smaller US-China trade could slow global economic growth, further dampening demand

    Japan (#3) already forecasting earnings drop for its largest companies

OGJ F&R: US gas outlook 2019 (tcf)

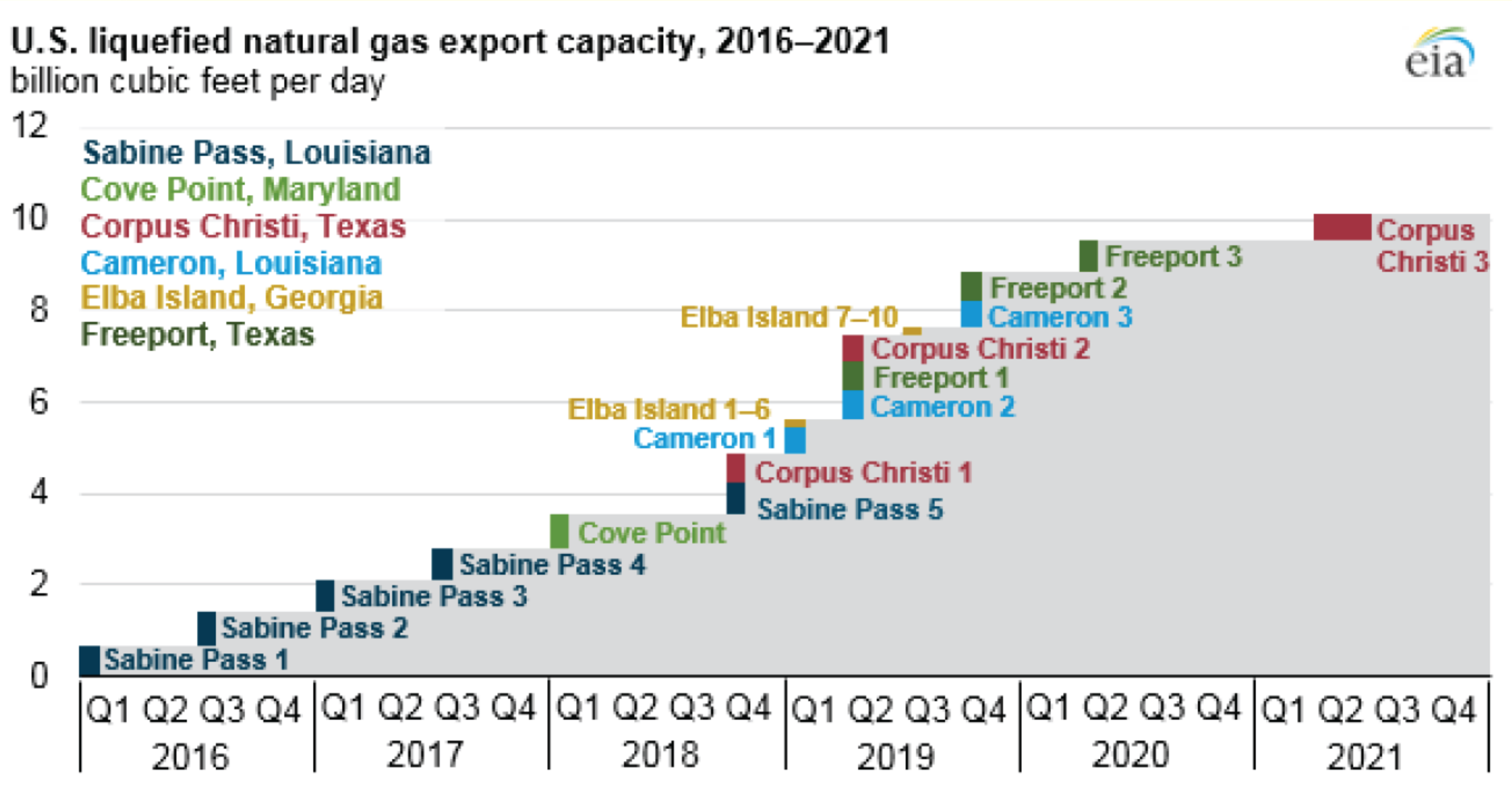
Consumption	30.217	+1.1%
Production	35.697	**+9.1%**
Imports	2.685	-8.1%
Exports	5.110	**+36.6%**
Not shown: supplemental gas, losses, storage		

Gas trade					
IMPORTS			EXPORTS		
LNG	0.073	5.3%	LNG	2.044	**+89.8%**
Pipeline	2.612	-8.4%	Pipeline	3.066	**+15.1%**

US LNG is changing the global market

- Price linked to Henry Hub rather than indexed to oil
- Contracts free of destination restrictions
- Combines with new supply from Australia, imminent supply from East Africa, small supplies from West Africa and elsewhere to challenge traditional trade dominated by Qatar
- Competitive so far in Middle East, North Africa, Asia, South America
- Struggling to compete in Europe vs. pipeline gas from Russia

US LNG export capacity, 2016-21



OGJ pipeline construction: 2019 only (miles)*

• Global - 14,387 miles

Flat from 2018 but maintaining a return to 2013 levels

• US – 6,334 miles, +79%

NGL = 1,315 (21%)

Land pipeline construction costs:

2018, $9.95-million/mile

2017, $5.94-million/mile

*Projects planned to be completed in 2019.

OGJ pipeline construction: 2019 and beyond (miles)*

- Global – 31,917 miles, -5%

Continuing general decline since 2009

- US, Canada – 10,396 miles, -4.7%

Natural gas = 4,865 (46.8%)

Crude = 4,115

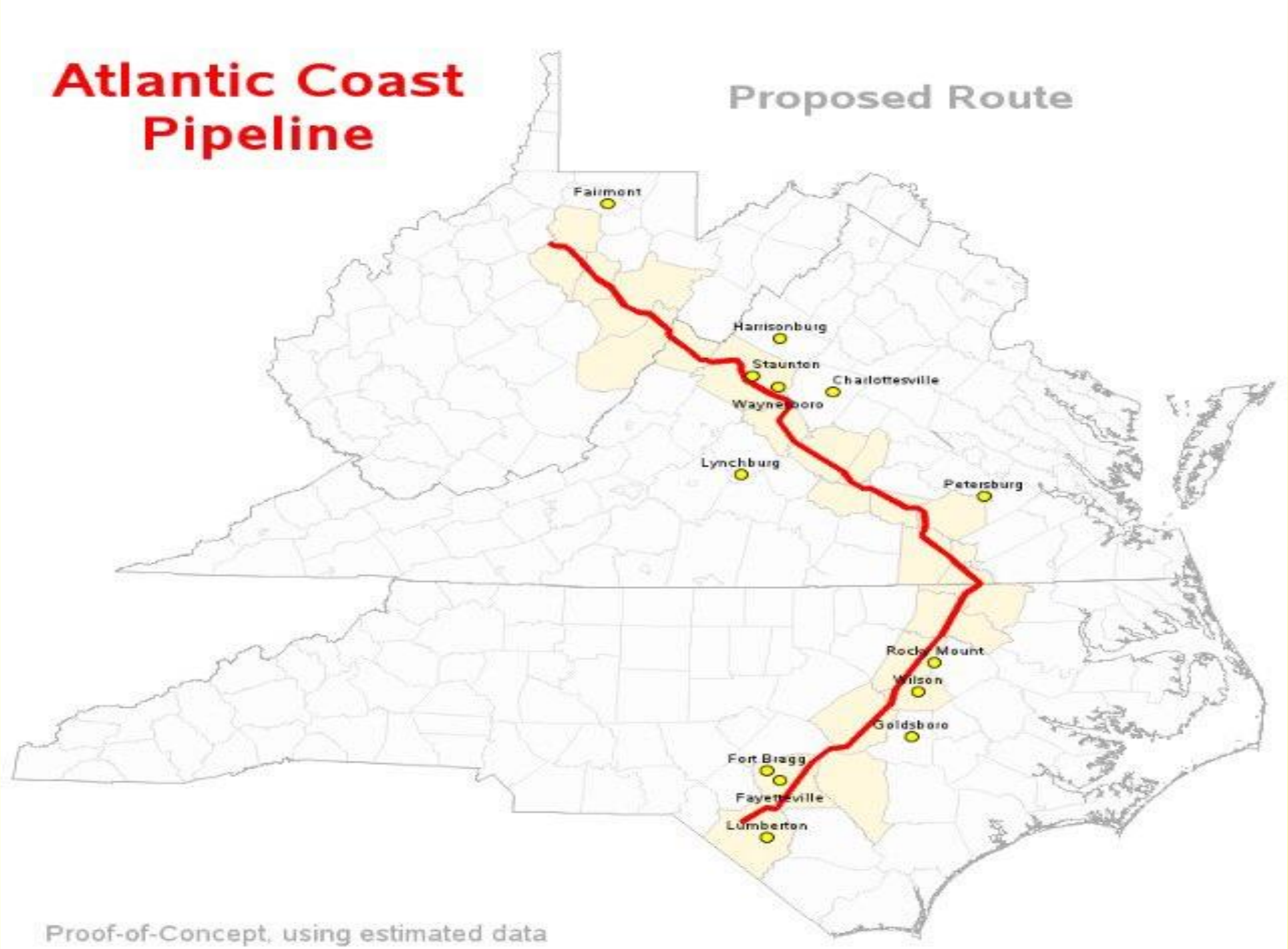
Products = 1,416

*Projects under way at start of or set to begin in 2019 and be completed after 2019. Also includes some large projects not yet under construction but expected to advance.

East coast natural gas pipeline delays

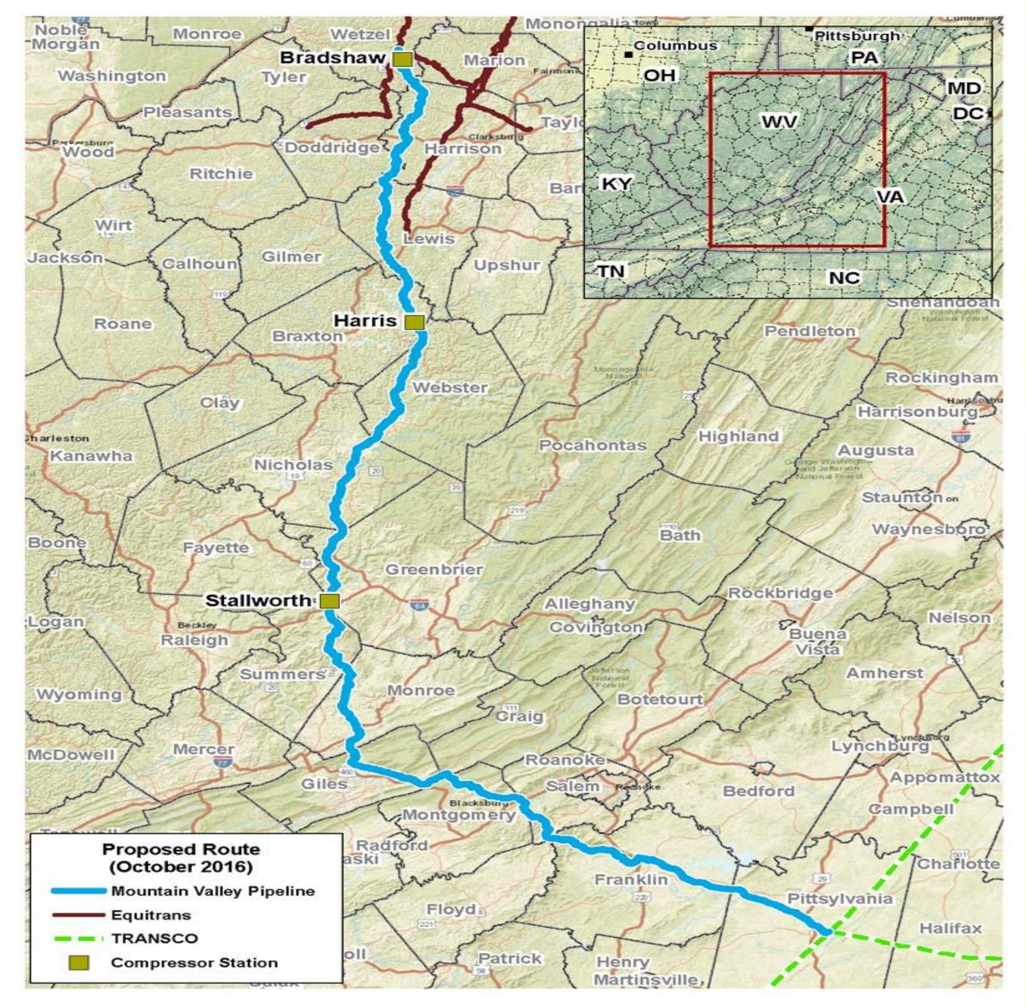
- Northern Access (97 miles, Pennsylvania-NY) approved early 2017, blocked by NY court
- PennEast (115 miles, Pennsylvania-NJ) approved Jan. 2018, NJ judge OKs imminent domain
- Mountain Valley (303 miles, WV-Virginia) approved Oct. 2017, 70% complete, Virginia AG filed suit, year-end 2019 in-service
- Atlantic Coast (600 miles, WV-NC) approved Oct. 2017, work halted after Virginia court stays F&WS permit

Atlantic Coast (Dominion)



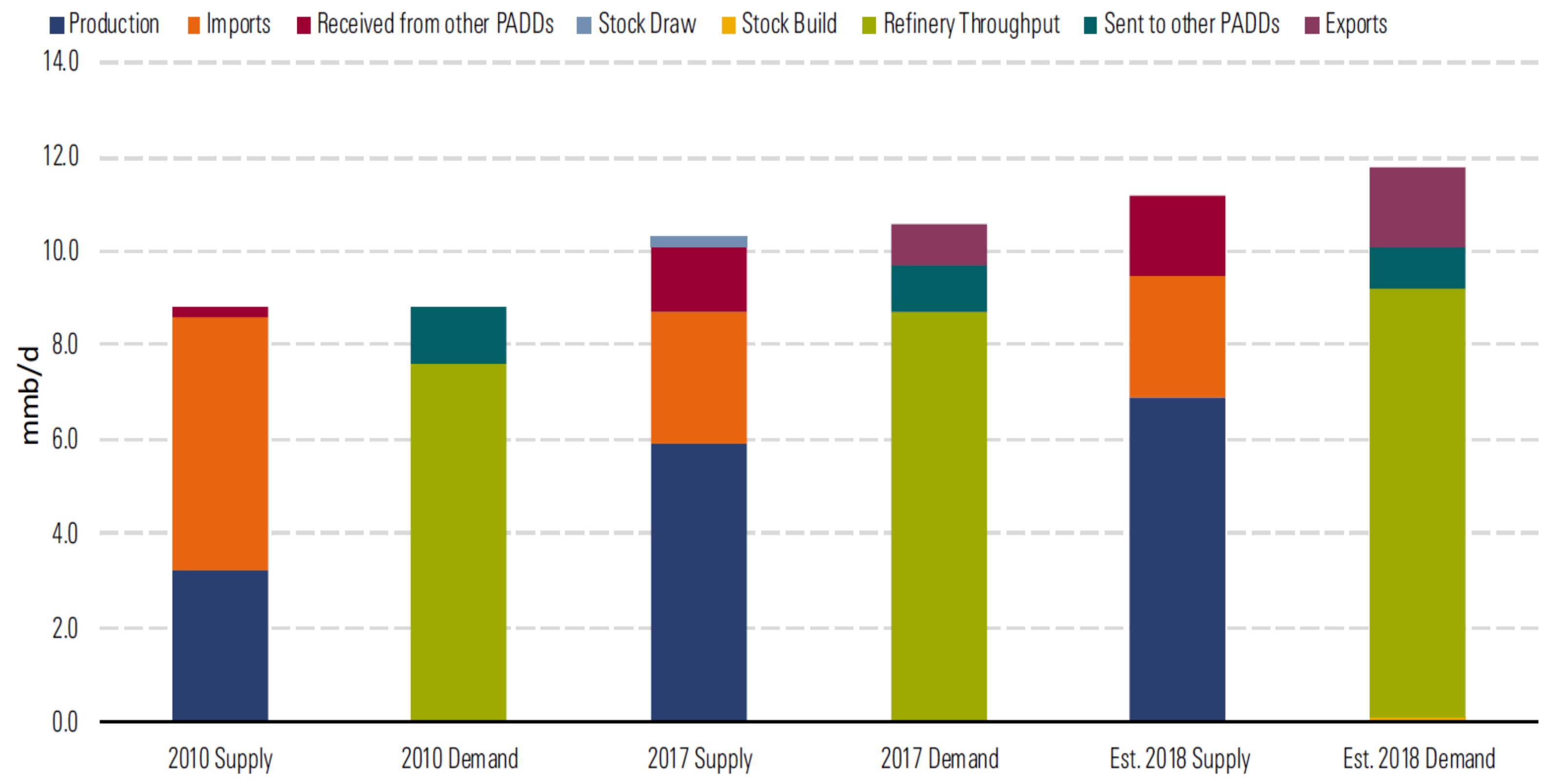
Source: Marcellus Drilling News

Mountain Valley (EQM Midstream)



Source: Mountain Valley Pipeline

Escape from the Permian: USGC Crude

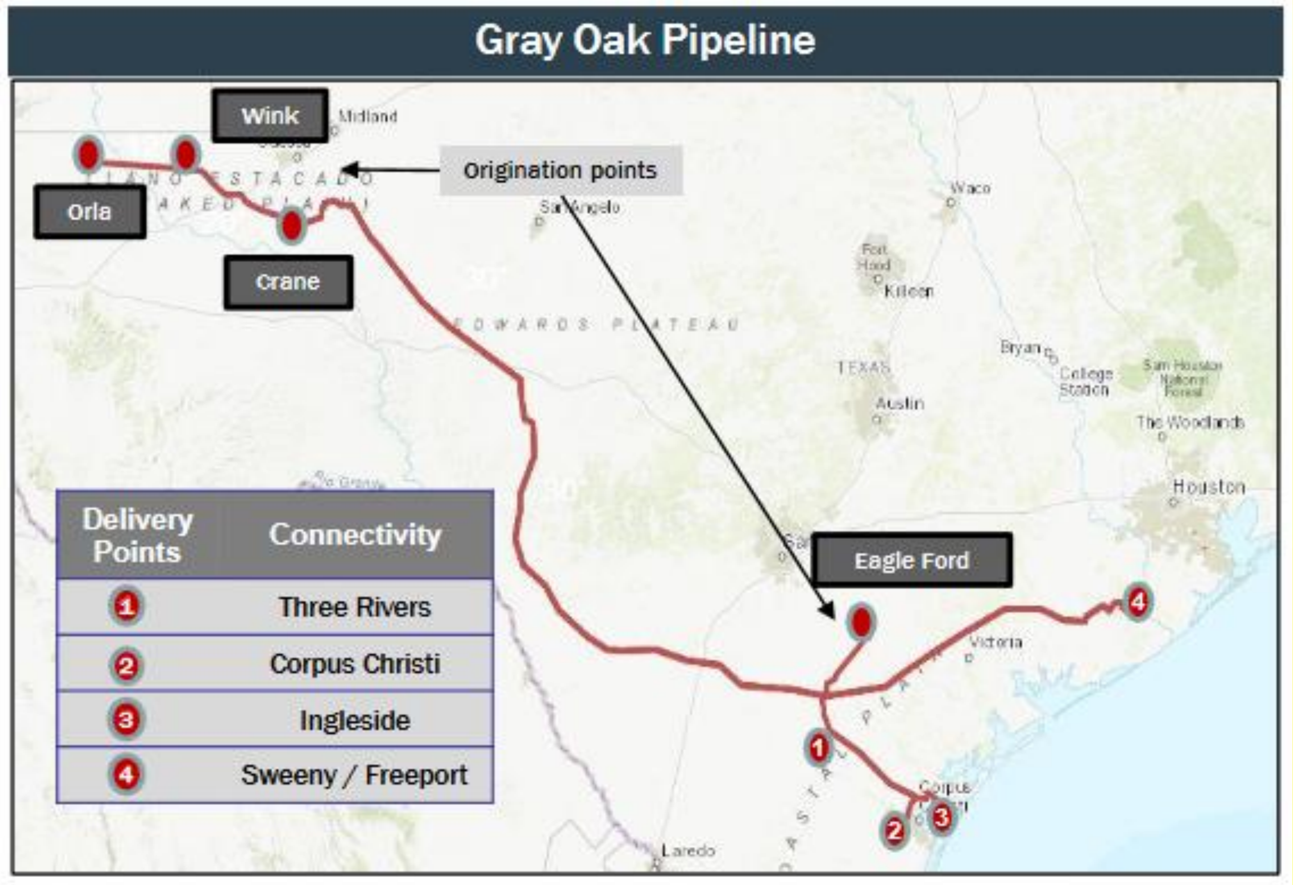


Source: Morningstar, EIA.

Escape from the Permian: Crude projects

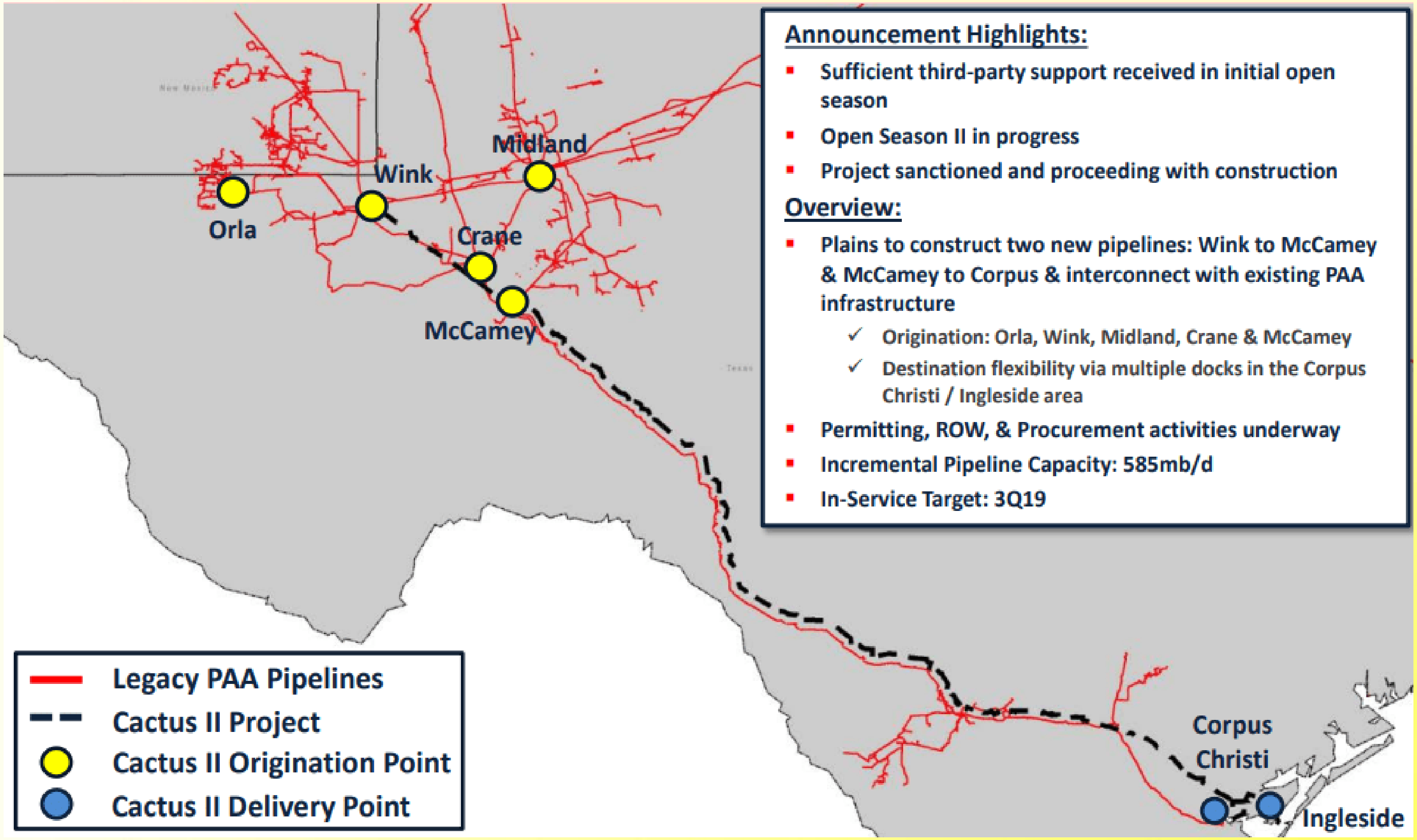
- Phillips 66, Enbridge; Gray Oak, 385,000 b/d to Corpus, Freeport, Houston, 2019
- EPIC Crude; 700-mile, 550,000 b/d, 2019, to Corpus
- Magellan; 600-mile, 24-in. OD, 350,000 b/d, to Nederland/East Houston, 2020
- PAA; Cactus II, 515-mile, 24-in. OD, Wink-to-McCamey-Ingleside/Corpus, 585,000 b/d, 2019
- JupiterMLP; 650-mile, to Brownsville, 2020
- ExxonMobil, PAA, Lotus, Midland-to-Houston/Beaumont

Gray Oak



Source: Phillips 66 Partners

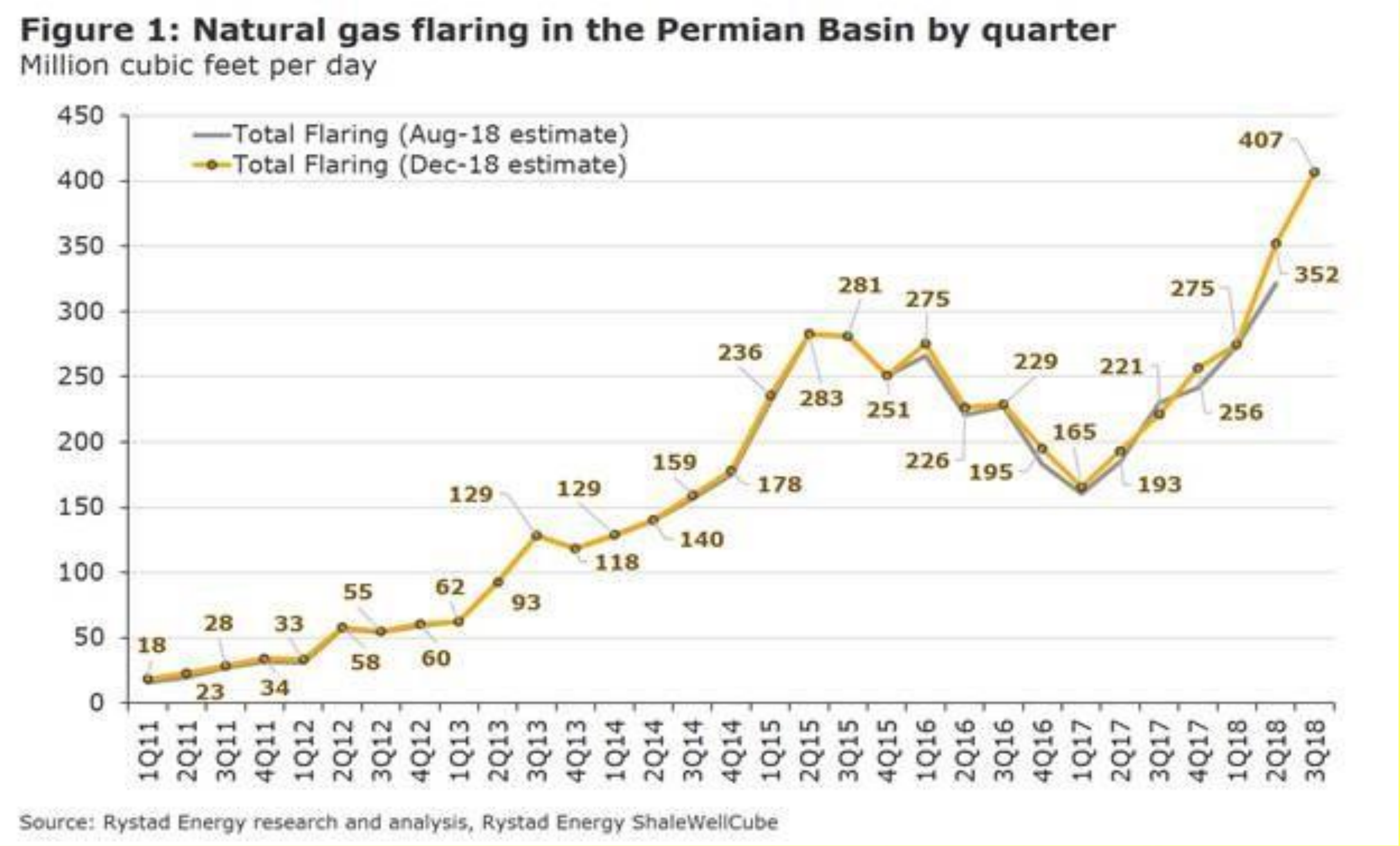
Cactus II



Source: Plains All American Pipeline LP

EPIC Crude and Y-Grade Pipelines

Escape from the Permian: Gas, NGL



Escape from the Permian: Gas, NGL

- NAmerico Partners; Pecos Trail, 468-mile 1.85 bcfd to Corpus, 2020
- Kinder Morgan, DCP, Targa; Gulf Coast Express, 430-mile, Waha to Agua Dulce, 1.92 bcfd, October 2019
- Sempra, Boardwalk; Permian-Katy, 470-mile, 2 bcfd, phased in starting December 2019
- Tellurian; Permian Global Access, Waha to Gillis, La., 625-mile, 2 bcfd, 2022
- Targa, NextEra, MPLX; Whistler, Waha to Agua Dulce, 450-mile, 2 bcfd, 2020

Escape from the Permian: Gas, NGL

- Kinder Morgan, ExxonMobil; Permian Highway, Waha-to-Katy, 430-mile, 2 bcfd, 2020

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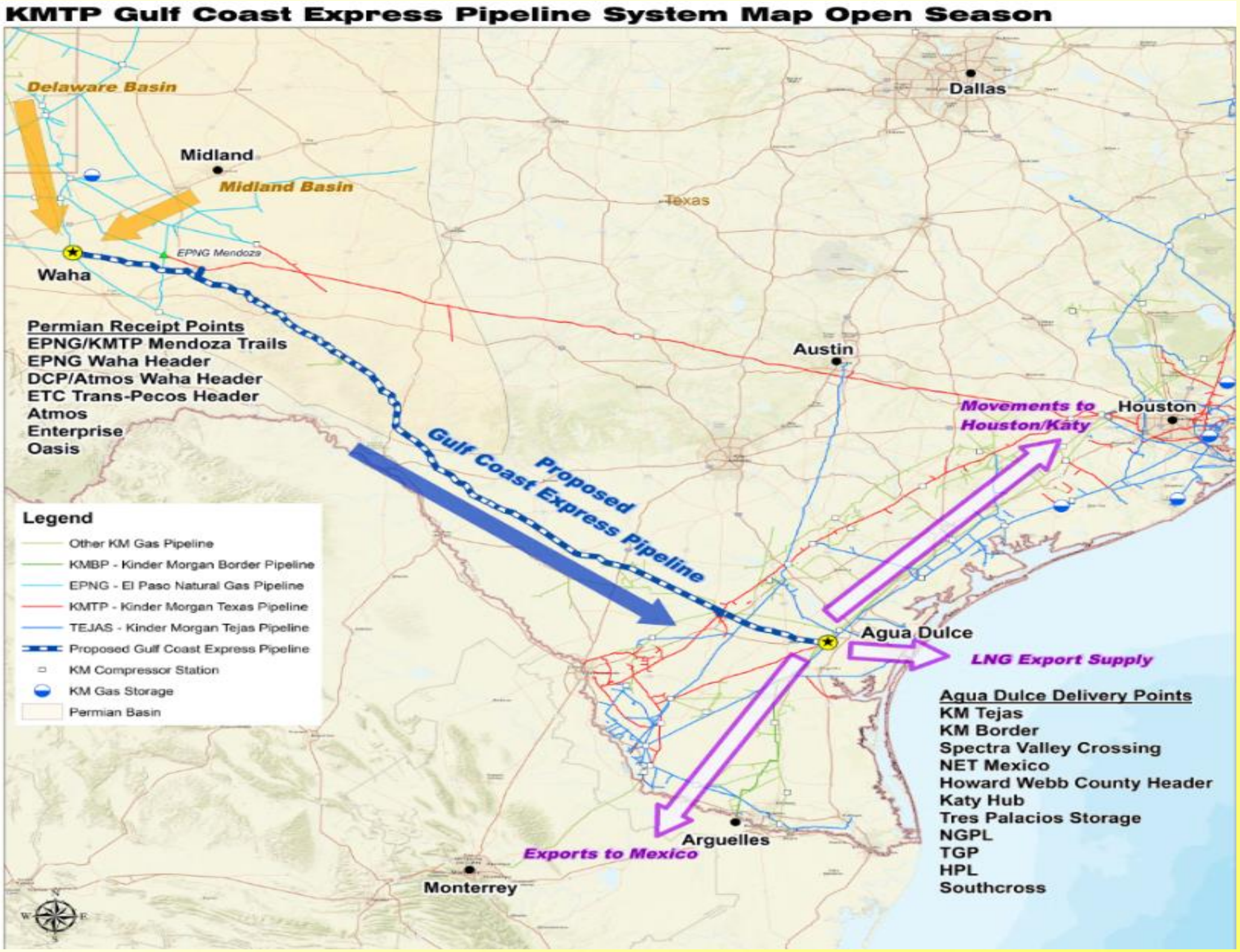
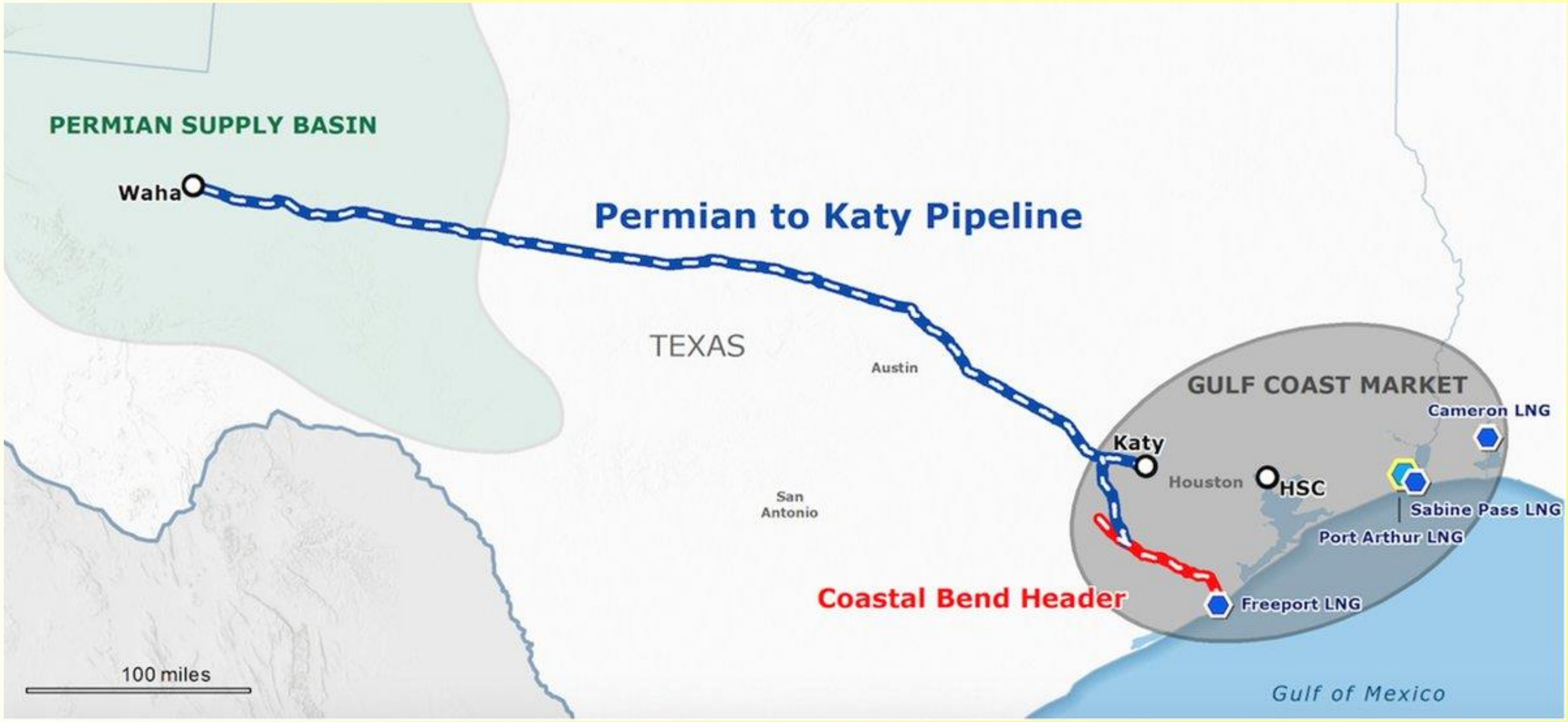
- EPIC Y Grade; 650-mile, DLK Black River to Corpus Christi 220,000 b/d, 2019
- Enterprise; Shin Oak, 571-mile, Hobbs to Mont Belvieu 250,000 b/d, 2019
- Permico Energia; Companero, 510-mile, to Corpus Christi, 300,000 b/d, 2020
- Energy Transfer; Lone Star Express extension, 352-mile, Wink to Fort Worth interconnect, Q4 2020
- Targa; Grand Prix, Permian and Oklahoma to Mont Belvieu

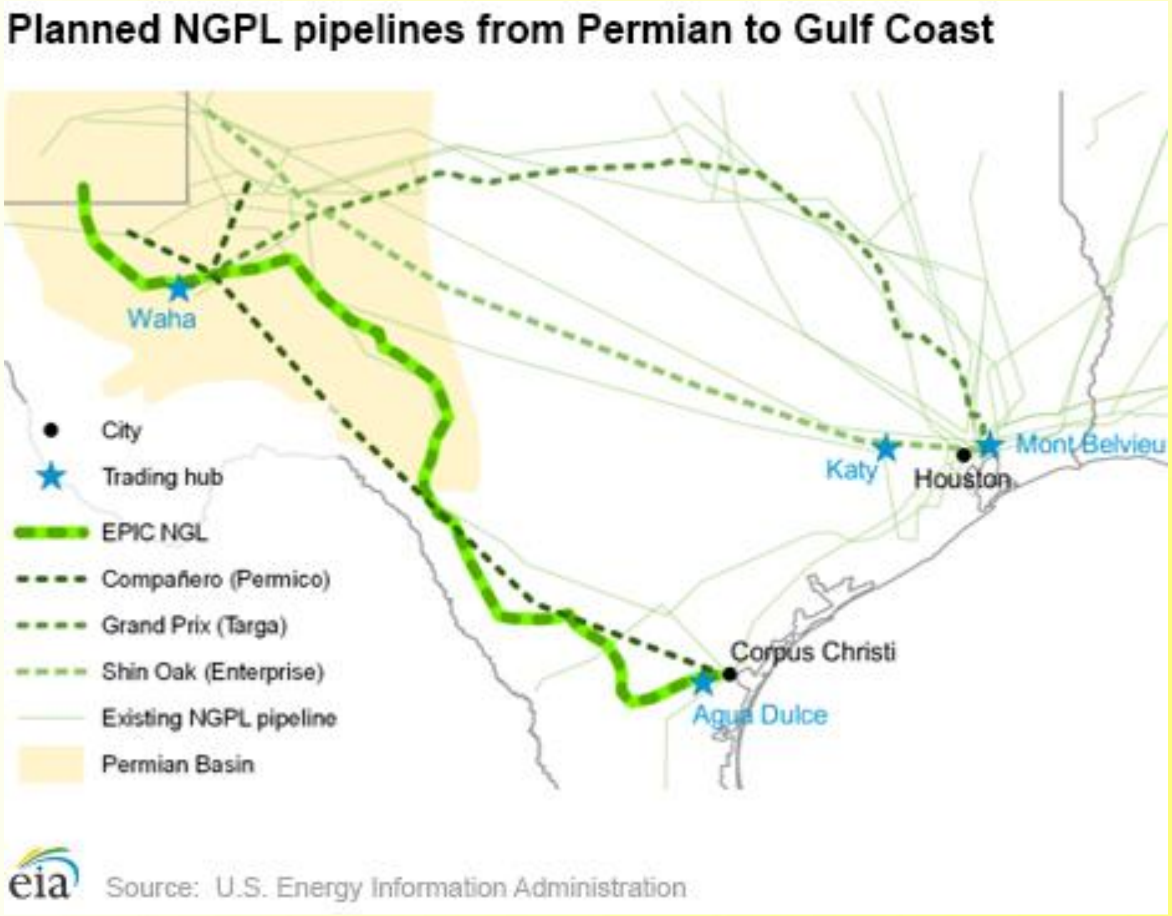
Kinder Morgan Gulf Coast Express



Permian-to-Katy (P2K)



Permian-to-Gulf NGL pipelines



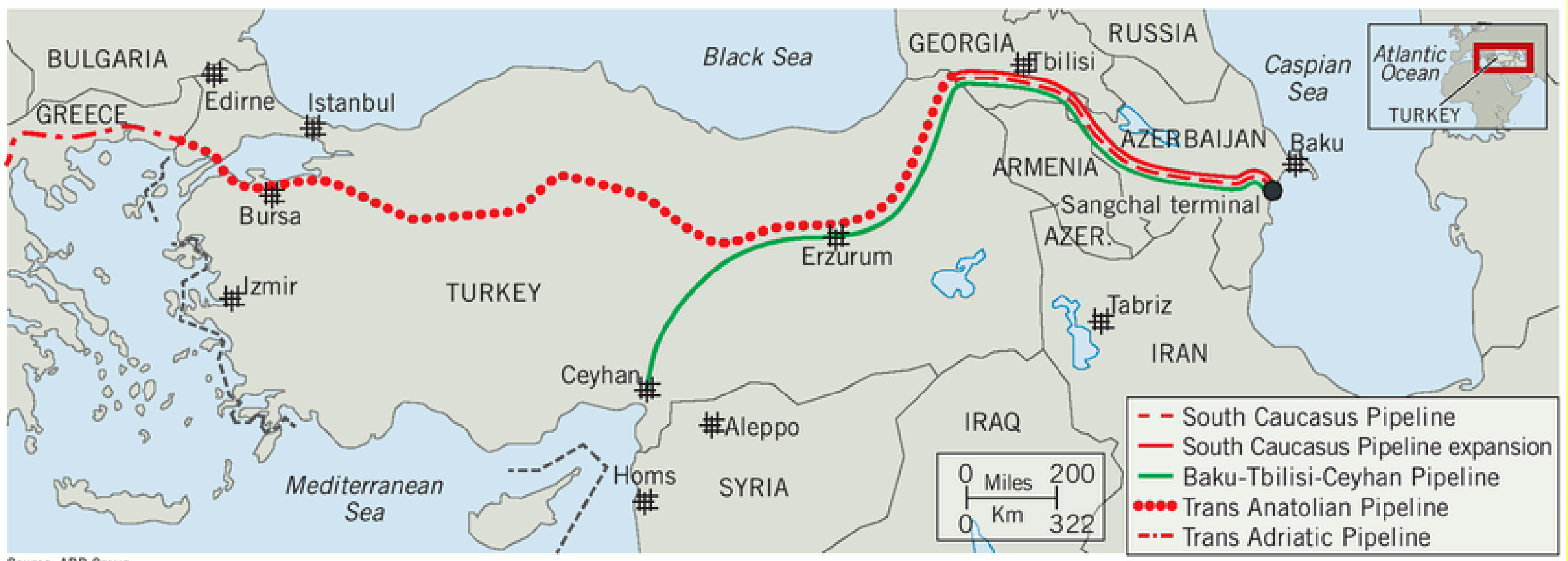
Global crude

- Liberty (Phillips 66, Bridger) – Bakken-to-Corpus, 1,300 miles, 2020
- Basra-Aqaba – Export Iraqi crude – 1,043 miles, 2020
- Uganda-Indian Ocean – roughly 930 miles, 2020
- Keystone XL?

Global natural gas projects

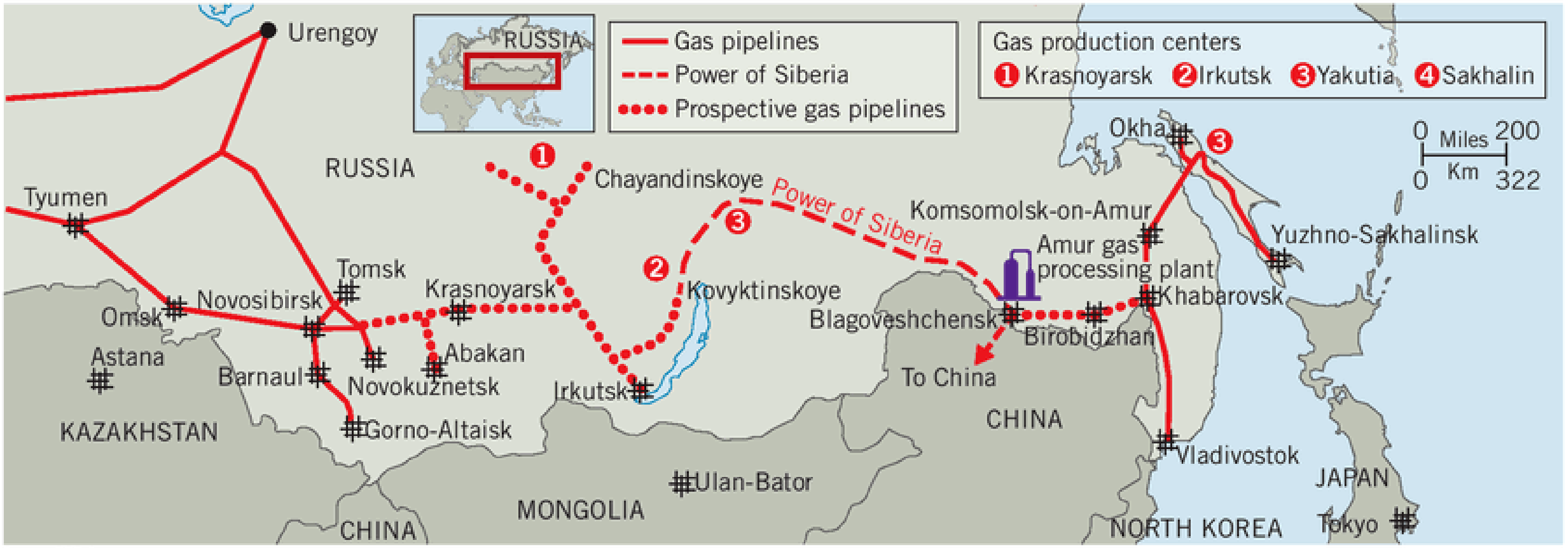
- SCP/TANAP/TAP (Shah Deniz II) – Caspian to Europe
  - TAP = 800 km, incl. 115 offshore, 2020
- Xinjiang to Guangdong-Zhejiang (Sinopec) – Gasified coal to market – 5563 miles, 2020
- Power of Siberia (CNPC, Gazprom) – Russian gas to China – 2,465 miles, 2019
- Trans Alaska Gas Pipeline?

SCP, TANAP, TAP – Shah Deniz to Europe



Source: ABB Group

Russian gas pipelines, Power of Siberia



Source: PSC Gazprom

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