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Oil and Gas in 2018: Markets, Spending, Projects

Bob Tippee

Editor, Oil & Gas Journal

Rice Global E&C Forum

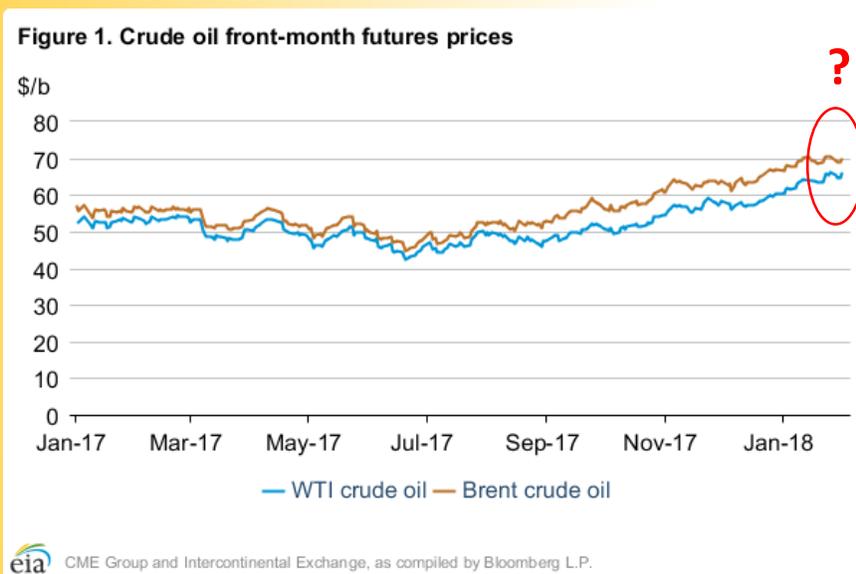
March 9, 2018

For discussion

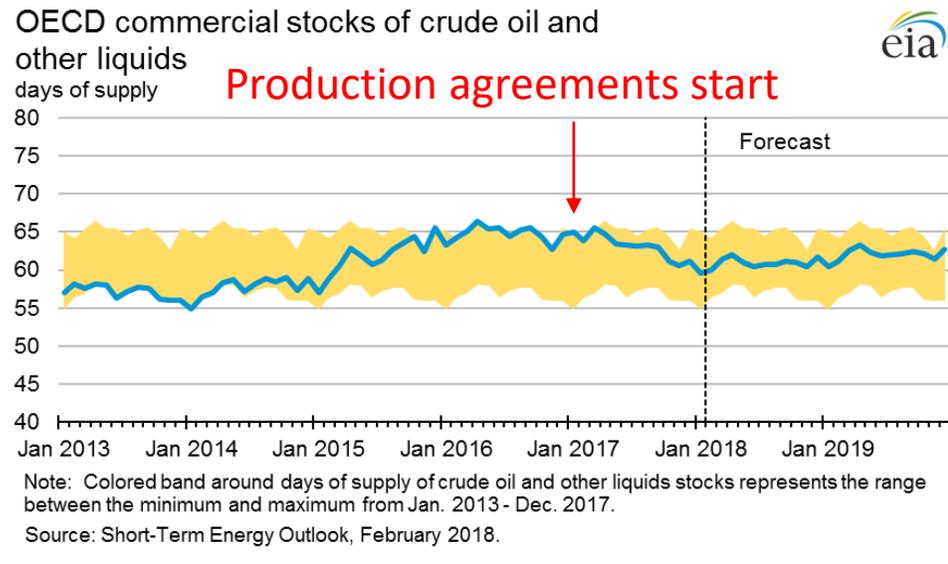
- Oil and gas markets will have a transformative year
 - OPEC wants to institutionalize production restraint
 - US LNG export capacity set to triple in two years
- US oil and gas companies will increase capital spending—cautiously—in 2018
- The oil and gas industry's approach to capital projects is evolving

Crude oil prices...

Increased in 2017 because...



Supply deal trimmed stocks, and...



- The Forties Pipeline closed Dec. 11-Jan. 2
- Production fell in Venezuela, was under question jeopardy in Iran, Libya, etc.
- Belief grew that the slump was ending

Source: Charts from US Energy Information Administration Short Term Energy Outlook, February 2018

The global oil balance (MMbd)

	Current view of		
	2018F	2017E	2016
Global demand	99.2	97.8	96.2
Non-OPEC supply	59.9	58.2	57.4
OPEC NGL	7.0	6.9	6.8
Need for OPEC crude	32.3	32.7	32.0
OPEC crude	32.3*	32.3*	32.8
Stock change & other	0*	-0.4*	+0.8

Supply-agreement compliance rates, average 2017	
OPEC 12	95%
Non-OPEC 10	82%
Source: IEA Oil Market Report, January 2018	

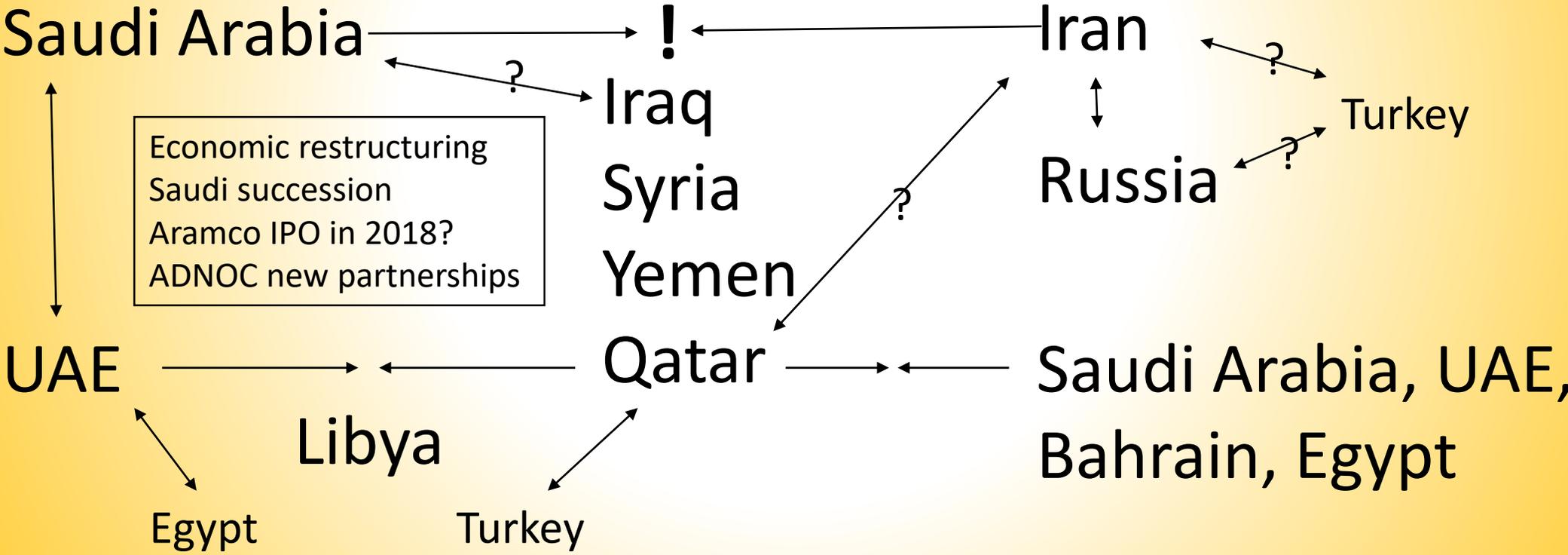
OPEC claims overall compliance of 107% in 2017

Source: International Energy Agency Oil Market Report, February 2017

*OPEC crude is IEA estimate for 2017 average; stock change calculated.

Supply management's geopolitical challenges

Friendly \longleftrightarrow
 Unfriendly $\longrightarrow \longleftarrow$

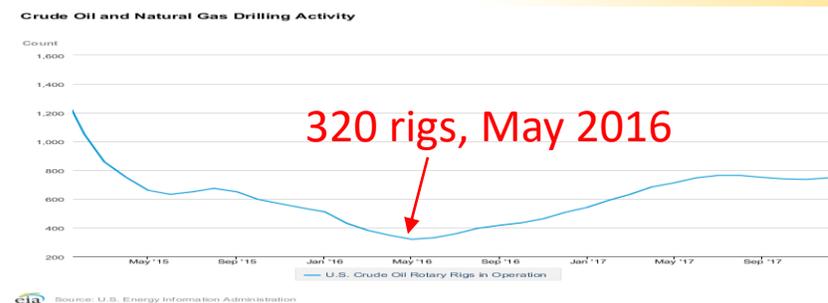


US oil supply flux: 2015-17

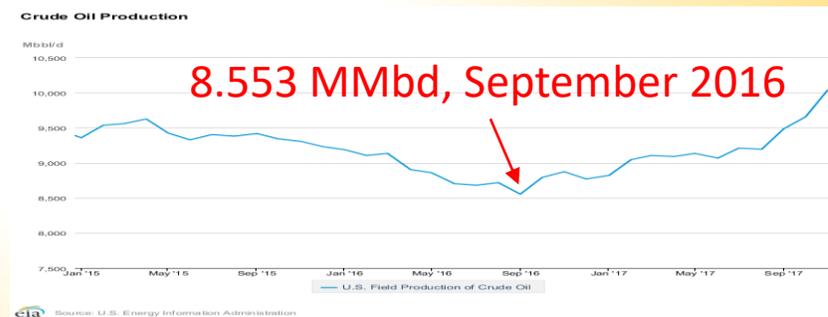
WTI near-month
futures price



Oil-well drilling



Crude oil production

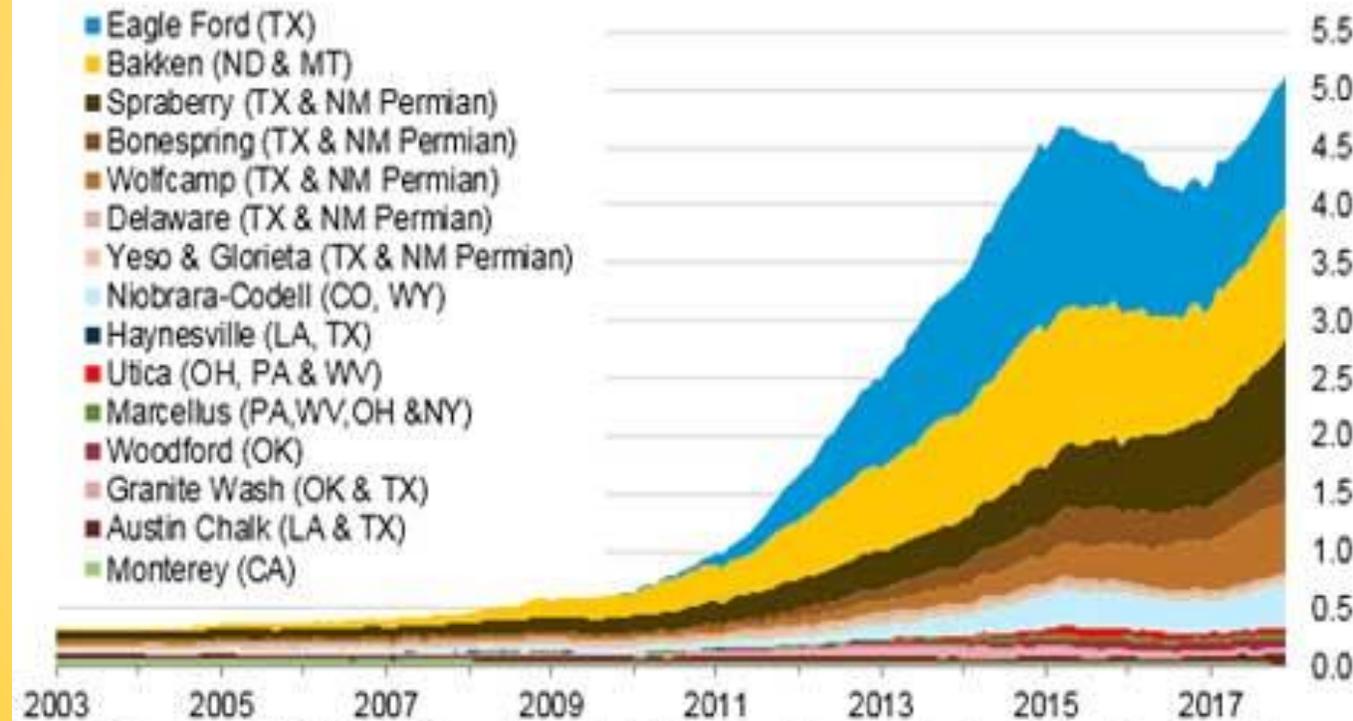


Source: US Energy Information
Administration

Tight-oil plays push US production

U.S. tight oil production—selected plays

million barrels of oil per day



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through December 2017 and represent EIA's official shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).



US production of crude oil and land lease condensate will set record above 10 million b/d this year:

EIA says 10.7 million b/d in 2018, 11.3 million b/d in 2019

OGJ says 10.1 million b/d in 2018

Can tight-oil production keep growing?

Why no?	Why yes?
Permian basin surge motivated by HBP drilling	Productivity, ultimate-recovery improvements continue
Resources (or sweet spots) have limits	The resource is (exponentially) huge
Operator refocus on free cash flow will moderate investment	Technical progress continues: <ul style="list-style-type: none">● Longer laterals, more frac stages, higher sand-fluid volumes and pressures, better lateral placement and frac monitoring with microseismic● Sand + slickwater vs. designer proppants + gels● High-grade to best rock● New completion design: denser fracs, closer to wellbore, tighter lateral spacing
Capacity contraction: equipment, supplies, workforce	
End of sacrificial pricing by contractors	

How big-data analytics leverages knowledge

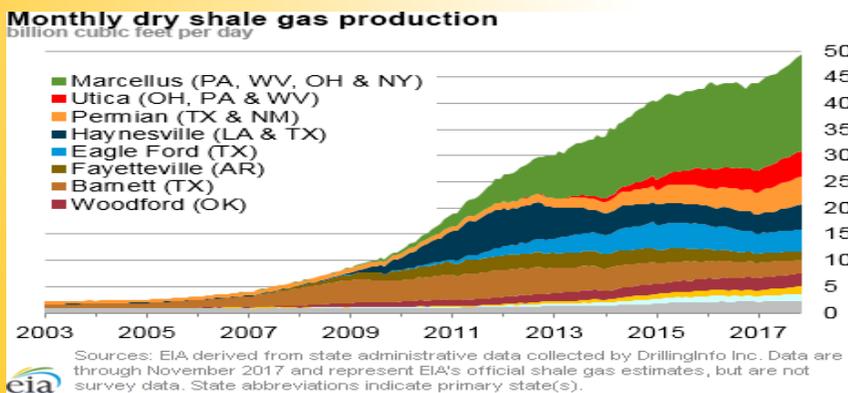
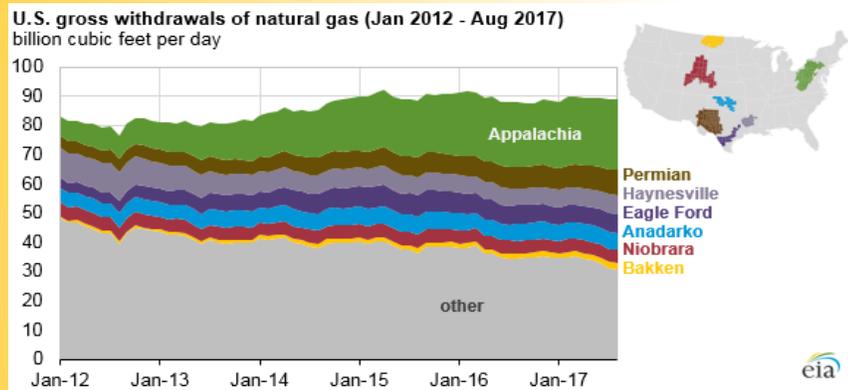
- Frac fluid analysis
- Proppant loading
- Perf cluster spacing
- Reservoir characterization
- Choke management
- Lateral length efficiency
- Formation targeting

Supply grows with improvements in knowledge and know-how
Analytical methods leverage knowledge and know-how

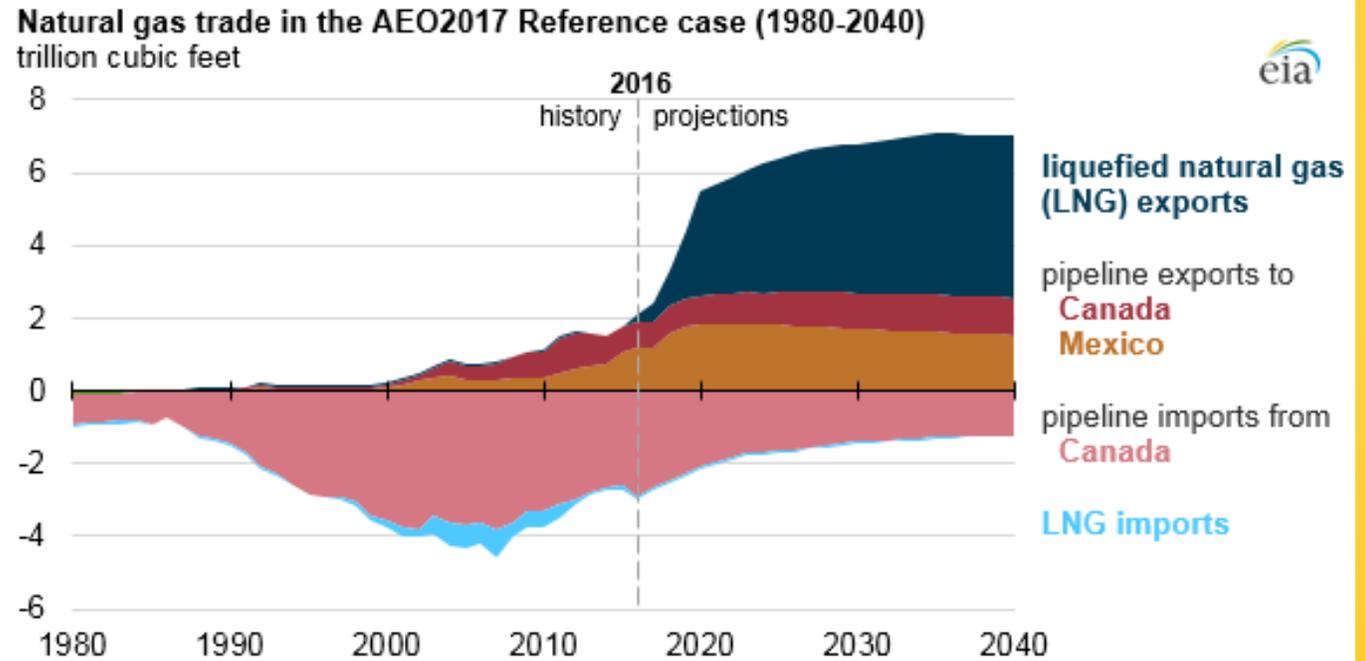
(Source: Chesapeake Energy corporate presentation)

Shale making US a major gas exporter

Supply trends to present...

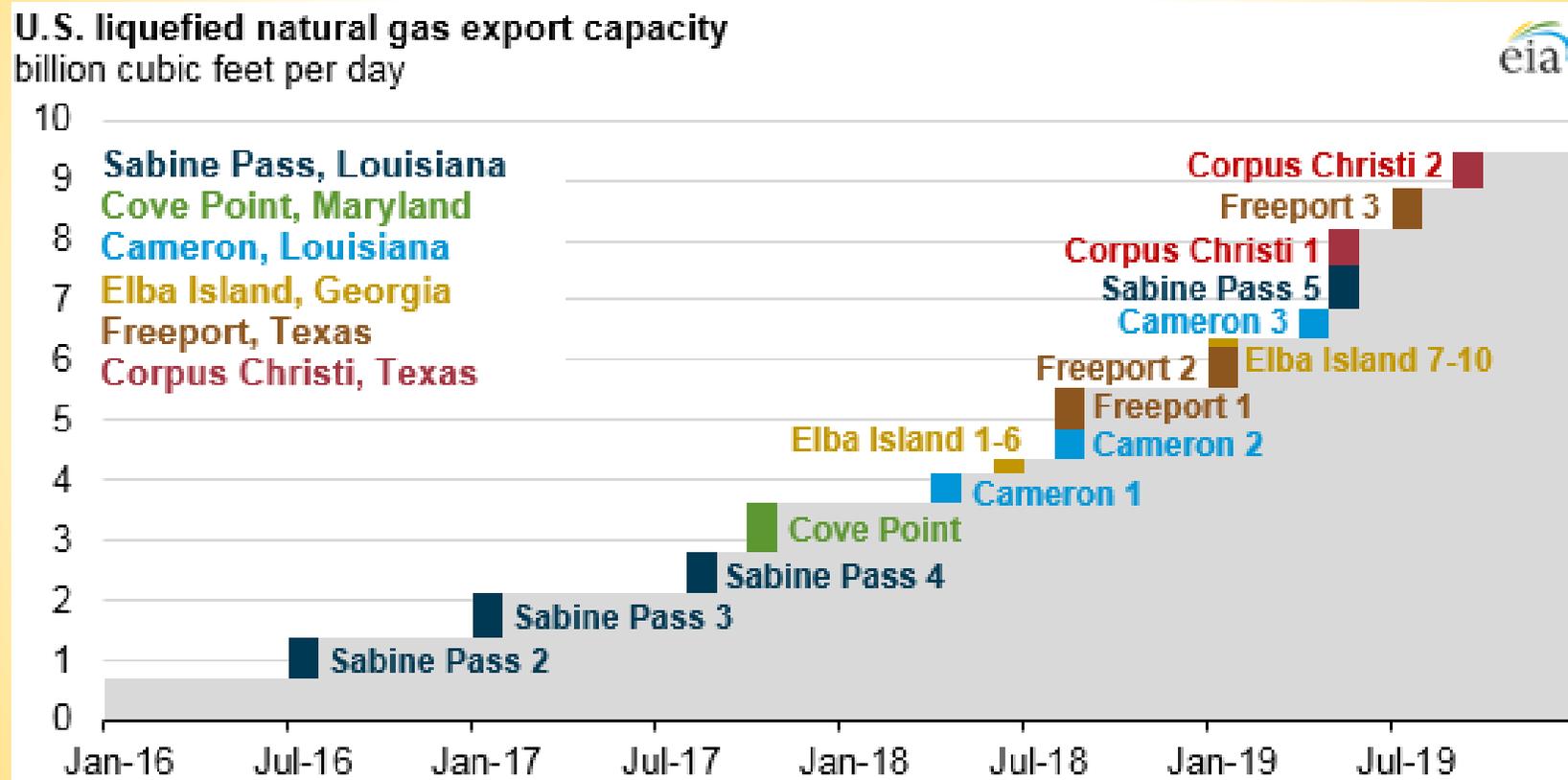


Assure US gas-trade growth



Source: EIA

US LNG export capacity ready to zoom



Source: EIA

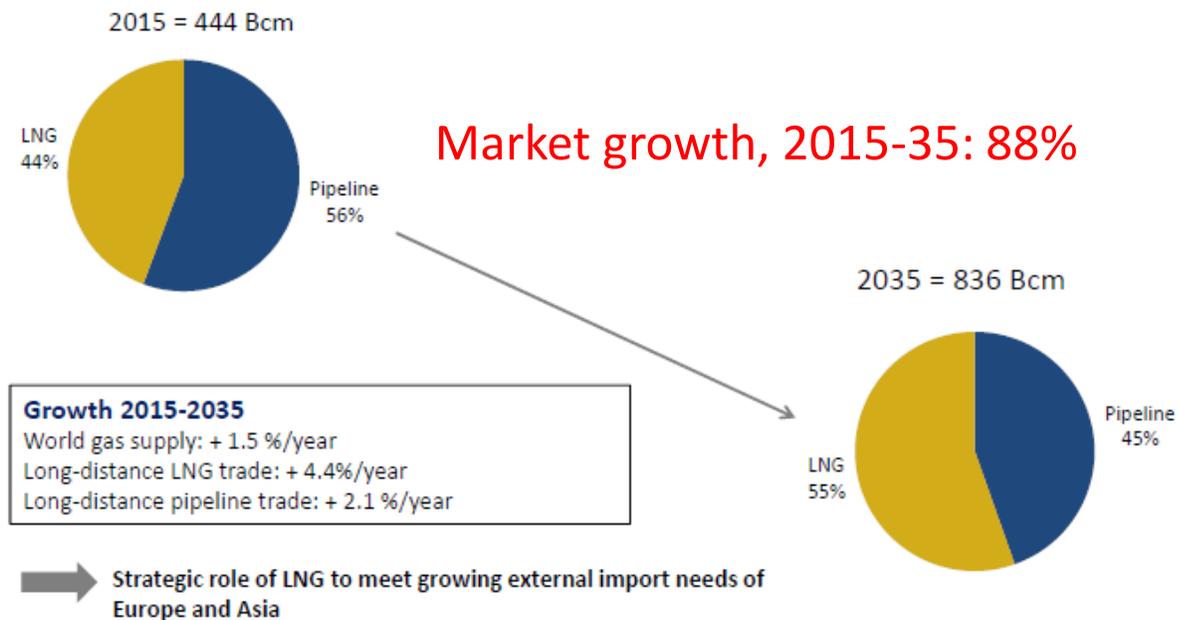
US LNG is changing the global market

- 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 FLNG increment in West Africa, 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
 - Gazprom dropped price to as low as \$4/MMbtu in 2016; now ~\$5/MMbtu
 - US LNG in Europe: >\$6/MMbtu (\$3/MMbtu Henry Hub + >\$3/MMbtu for liquefaction, transportation, regasification)*

*Center for Strategic and International Studies, October 2017

LNG to dominate gas trade (CEDIGAZ)

Interregional flows by pipeline and LNG



2015 = 444 bcm	2035 = 836 bcm
LNG 44%	LNG 55%
Pipeline 56%	Pipeline 45%

Result of shift from pipeline to LNG dominance of gas trade: increased flexibility of delivery and pricing

Gas will act more like oil.



US spending: Total (\$MM)

	2018	2017	2016
Exploration-production	132,504	121,501	88,238
Other	52,003	37,911	55,305
Total	184,507	159,412	143,543

Source: OGI Capital Spending Update, March 5, 2018

US spending: Exploration-production (\$MM)

	2018	2017	2016
Drilling-exploration	111,180	102,000	74,000
Production	21,124	19,380	14,060
OCS lease bonus	200	121	178
Total E-P	132,504	121,501	88,238

- Average rig count (Barclays): 925 in 2018 vs. 850 in 2017
- Generally assumed prices: \$50-55/bbl WTI crude; more than \$3/Mcf Henry Hub gas
- Overall emphasis on free cash flow vs. production growth—but production growing
- Big companies emphasizing low-cost, short-cycle onshore plays

Source: OGJ Capital Spending Update, Mar. 5, 2018 (BEFORE STEEL TARIFFS ANNOUNCED)

US spending: Other categories (\$MM)

	2018	2017	2016
Refining-marketing	13,860	13,200	13,100
Petrochemicals	8,667	8,100	7,700
Crude, product pipelines	2,676	2,327	22,130
Natural gas pipelines	18,751	7,685	6,475
Other transportation	4,300	3,600	3,500
Miscellaneous	3,750	3,000	2,400
Total	52,003	37,911	55,305

Source: OGI Capital Spending Update, March 5, 2018

Canadian spending overview (\$MM)

	2018	2017	2016
Oil sands*	11,424	13,600	15,400
E&P ex oil sands	28,665	27,300	19,500
Other	10,569	10,903	6,990
Total	50,668	51,803	41,890
*In situ, mining, and upgrading.			

- Petroleum Services Association of Canada: 7,900 wells in 2018 vs. 7,550 in 2018
- Most majors have withdrawn from oil sands
- Pipeline spending uncertain due to political opposition
- Insufficiency of pipeline take-away capacity widening WCS location discount to WTI

Source: OGI Capital Spending Update, March 5, 2017

Summary: Oil & Gas Project Cost Reduction Insights Global Survey—4th Quarter 2017

- Cost of project funded today is 10-25% less than what it would have been in 2014
 - Most savings due to market conditions favoring buyer
- Project funded in 2020 likely to be 10% more than one funded today
 - Mostly from market changes favoring seller
 - Non-market drivers: environmental regs and permitting delays, scope changes, increasing project complexity
- 85% see economic and market risks as moderate to significant, mainly due to uncertainty in global economy

Survey summary—2

- Paradox: 90% have front-end development process, but...
- Highest cost-reduction priorities for owners:
 - Improving scope definition
 - Reducing number of changes during execution
 - Engaging contractors earlier in scope definition
- Highest cost-reduction priorities for contractors and suppliers:
 - Provide owners with more-realistic risk assessments
 - Offer more off-the-shelf designs
 - Increase skills of project managers and teams

Survey summary—3

- 20% set budgets at 50-50 probability point
- 40% fund projects at lower, “aggressive” target cost levels (these typically <\$500 million)
- 40% fund projects at higher levels to avoid supplemental funding (these typically >\$5 billion)
- 60% say bias to optimism, over confidence significantly affects project approval
- Most use internal and/or external third parties to validate cost estimates and schedules—especially with large or strategic projects

Survey summary—4

- 70% make moderate to extensive use of technical innovation to reduce cost
- They expect future cost reductions related to innovation to be moderate to significant
- Greatest expected benefit: “transforming the way we design and execute projects;” scored higher than:
 - “Digital technology advancement”
 - “Internally developed new technologies and solutions”

Survey summary—5

- 80% make moderate to extensive use of standardization to...
 - Reduce cost of engineering custom solutions for each project
 - Utilize off-the-shelf components and systems
 - Simplify specifications and design requirements
 - Gain learning-curve efficiencies through repetition
- They expect future cost reductions related to standardization to be moderate to significant
- Greatest opportunities:
 - “Using industry standards in place of costlier owner-specific standards”
 - Using a “design one, build many” strategy

Survey summary—6

- 75%: Performance risks have moderate to significant impact
- Costs can increase due to ineffective leadership, poor planning and decision-making, and ineffective cost control
- 50%: Loss of experience due to retirements, downsizing a major problem
- More than half concerned about consolidation among engineering contractors and suppliers
- More than half of contractors have “downsized and reorganized to be leaner and more efficient”

Contact information

Bob Tippee
Editor, Oil & Gas Journal
713 963 6242
bobt@ogjonline.com



To subscribe: www.ogjsub@pennwell.com
800-633-1657