

CORNERSTONE RESEARCH

Economic and Financial Consulting and Expert Testimony

Characteristics of U.S. Natural Gas Transactions

Insights from FERC Form 552 Submissions as of June 5, 2018

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The views expressed in this report are solely those of the authors, who are responsible for the content, and do not necessarily represent the views of Cornerstone Research.

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The Federal Energy Regulatory Commission (FERC) receives and compiles the most comprehensive information on trading activity and pricing methods in U.S. natural gas trading markets. The information, collected from market participants’ FERC Form 552 submissions, provides a database of trading activity that spans both physical and financial trading by a range of companies, from producers to end users.

By supplementing the data with proprietary classifications of market participants, Cornerstone Research adds deeper insight into market activities and characteristics across the various types of participants. See Appendix 1 for additional information.

2017 Executive Summary

Despite a drop in the number of Form 552 submissions, total trading volume increased for the third year in a row, rising to a level not seen since 2011. Aggregate exchange trading of natural gas contracts also rose in 2017, as trading on CME increased for the third consecutive year.

The percentage of Form 552 volume based on next-day transactions was the highest in 10 years. At the same time, the natural gas fixed-price volume potentially reported to price-index publishers experienced the largest year-on-year drop since 2014.

FERC Submissions

- Trading activity in 2017 totaled 131,296 tBtu, approximately 1 percent greater than in 2016.¹ (page 5)
- In 2017, there were 678 respondents, 33 fewer than in 2016.² (page 5)

Exchange Trading Activity

- Aggregate exchange trading of natural gas contracts increased slightly on the two main futures exchanges: CME Group Inc. (CME) and Intercontinental Exchange (ICE). (page 6)
- CME's volume increased for the third year in a row (approximately 9 percent) while ICE's volume declined 3.5 percent. (page 6)

Market Participants

- The top 20 companies accounted for approximately 44 percent of reported volume. (page 9)
- The portion of companies reporting to price-index publishers varied significantly across industry segments. (page 15)

Reporting to Price-Index Publishers

- Index-priced transactions comprised almost 80 percent of all Form 552 transactions. (page 10)
- Next-month transactions have declined by more than 5 percentage points since 2008. (page 11)
- For the third consecutive year, companies that chose not to report represented more than half of the reportable fixed-price volume. (page 13)
- In 2017, approximately 14 percent of Form 552 respondents reported transaction information to the price-index publishers for themselves or at least one affiliate. (page 13)

“In 2017, we saw the largest volume of index-priced transactions and the lowest volume potentially reported to indices since FERC began reporting Form 552 data.”

*Greg Leonard
Cornerstone Research*

- The volume of these reported transactions indicates that, on average, a molecule of natural gas was traded through approximately 2.3 transactions from production to consumption.³

Trends in Natural Gas Production and Consumption

The United States became a net exporter of natural gas for the first time in nearly 60 years as liquefied natural gas (LNG) exports continued to increase. While only slightly higher than the previous year, marketed production of natural gas reached a record high in 2017.

The U.S. Energy Information Administration (EIA) projects natural gas production will increase by approximately 6 percent annually through 2020.⁴ Production from shale gas and tight oil plays, which has increased substantially since 2010, will continue to drive growth in dry natural gas production as extraction techniques and practices rapidly evolve.⁵

Domestic Market

- Annual marketed production of natural gas has remained stable for the last three years, hovering around 32,000 tBtu.
- The EIA expects U.S. natural gas consumption to increase 8.8 percent over the next five years. The majority of this growth is driven by industrial use and electric power.⁶
- The EIA projects that U.S. natural gas production growth will continue to outperform domestic consumption growth.⁷

“In 2017, U.S. LNG exports were almost four times higher than in 2016, as more liquefaction terminals began or expanded operations during 2017.”

Nicole Moran
Cornerstone Research

LNG Exports

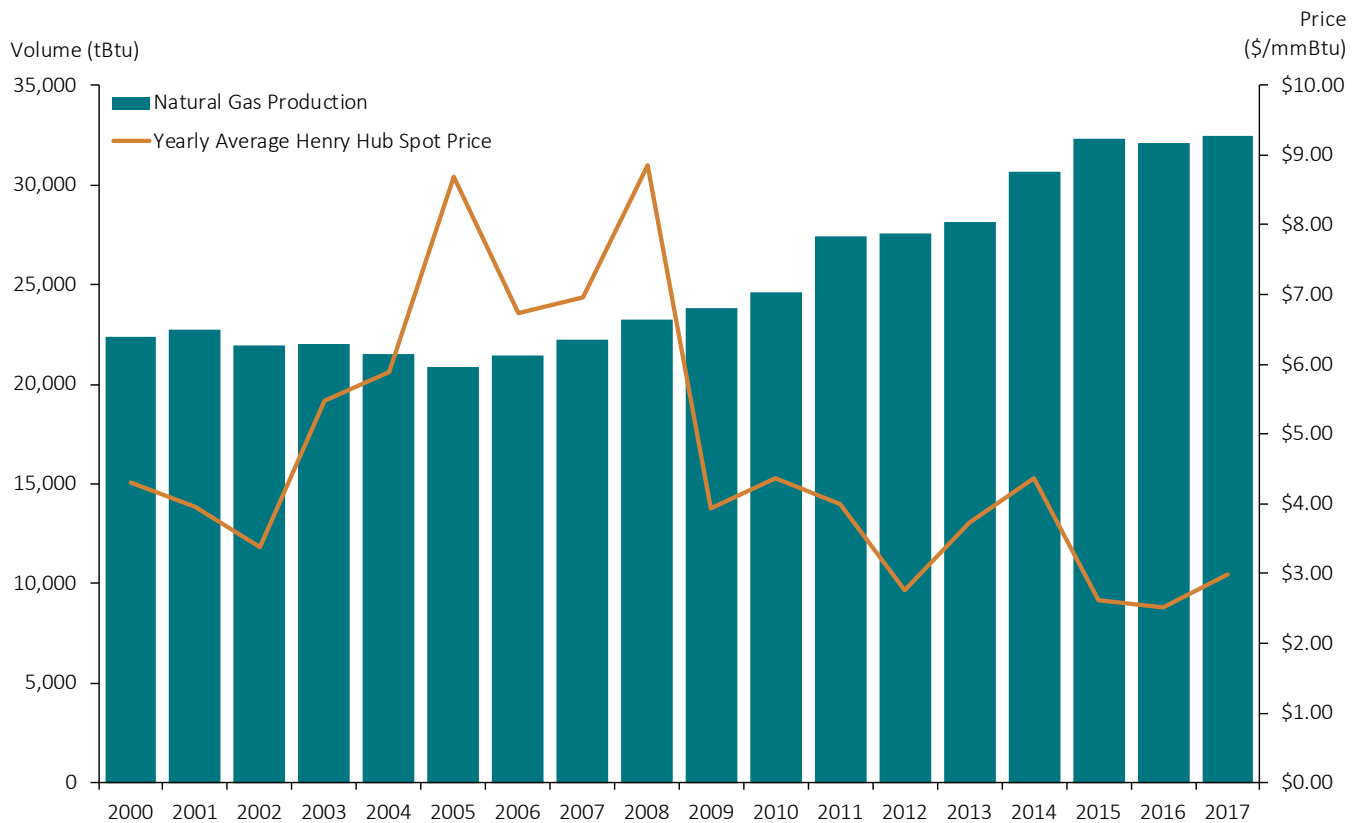
- LNG’s share of total U.S. natural gas exports rose to 22 percent in 2017 from 8 percent in 2016. The remaining 78 percent was exported via natural gas pipeline.
- The United States is projected to export on net over 4 trillion cubic feet of natural gas by 2022. Almost two-thirds of this growth is expected to be driven by LNG exports.⁸
- In 2017, more than 75 percent of U.S. LNG exports went to Asia and Latin America.
- Although all shipborne LNG exports in 2017 originated at the Sabine Pass Terminal, which is fully contracted with long-term contracts, flexibility in contract clauses generally allows U.S. LNG to be exported across the world to any market.⁹

Natural Gas

- Annual marketed production has remained stable for the last three years, up just 1.2 percent in 2017. While only a slight increase over 2016, marketed production set a record high in 2017 (32,476 tBtu).
- In 2017, the United States became a net exporter of natural gas for the first time in nearly 60 years. Two of the three measures of natural gas production used by the EIA, gross withdrawals and marketed natural gas production, set records in 2017.¹⁰
- Additionally, after reaching its lowest level in two decades in 2016, the annual average Henry Hub price increased by 18.7 percent in 2017. The EIA expects Henry Hub spot prices to increase approximately another 20 percent over the next five years.¹¹

Marketed production reached a record high in 2017.

Figure 1: U.S. Natural Gas Marketed Production and Natural Gas Price 2000–2017



Source: U.S. Energy Information Administration (EIA)

Note: One tBtu equals one million mmBtu.

Liquefied Natural Gas

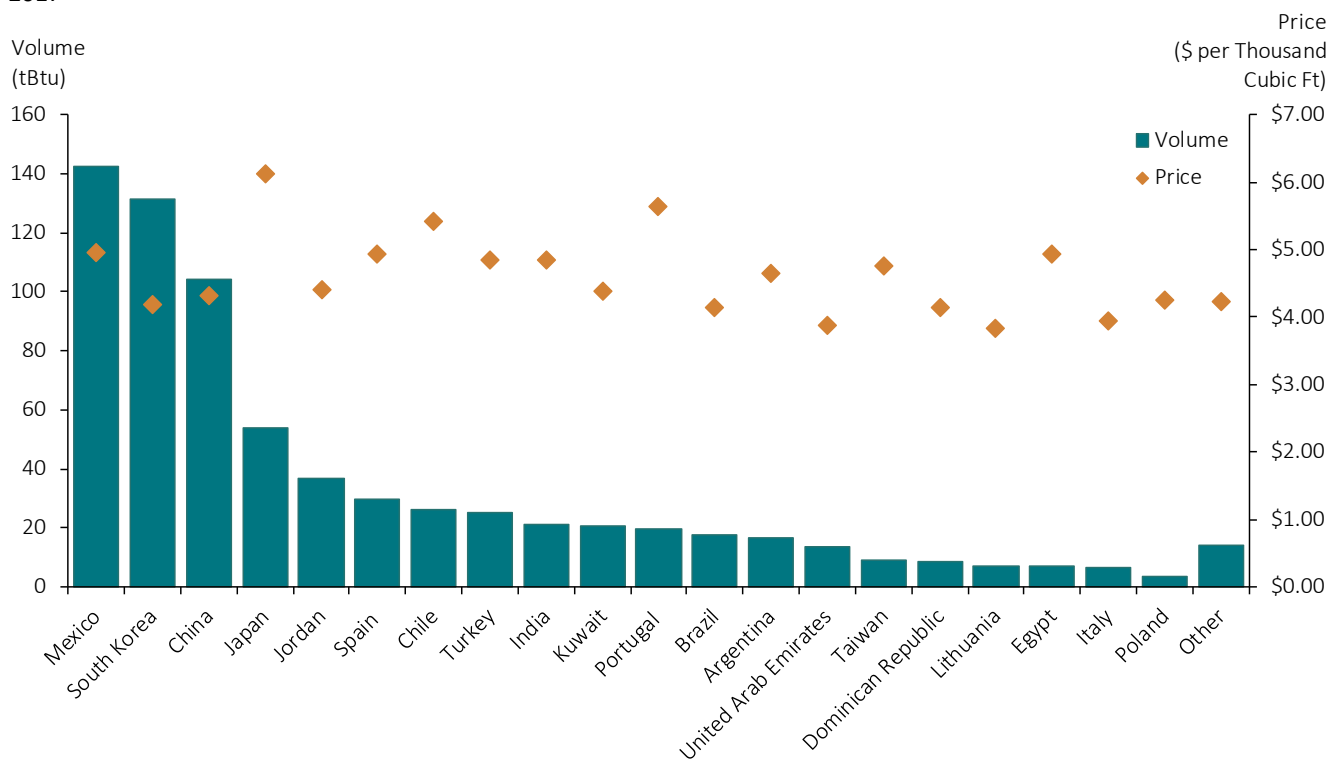
Cheniere Energy’s Sabine Pass Terminal in Louisiana began operations in 2016, and now has four operating liquefaction units. In March 2018, the Cove Point LNG facility in Maryland became the second operating LNG export facility in the United States.¹² As a result of these facilities and other ongoing construction, U.S. liquefaction capacity is expected to almost triple by the beginning of 2020.¹³

With four additional facilities expected to become operational by 2020, the United States is predicted to become the third-largest exporter of LNG in the world, trailing only Australia and Qatar.¹⁴

The United States is predicted to become the world’s third-largest exporter of LNG by 2020.

- The United States exported approximately 707 billion cubic feet of LNG in 2017, increasing LNG’s share of total U.S. natural gas exports to 22 percent, up from 8 percent in 2016.¹⁵ The remaining 78 percent was exported via natural gas pipeline.
- U.S. LNG exports to Asia increased to 46 percent from 30 percent the prior year. The next-largest importer was Latin America with a share of 30 percent, primarily driven by Mexico.¹⁶
- South Korea increased imports of U.S. LNG by 121.1 tBtu compared to 2016, by far the largest increase of any country. South Korea utilities KOGAS and KEPCO also entered into long-term contracts with Cheniere Energy and Shell.¹⁷

Figure 2: U.S. Liquefied Natural Gas Exports and LNG Prices by Country 2017



Source: U.S. Energy Information Administration (EIA)

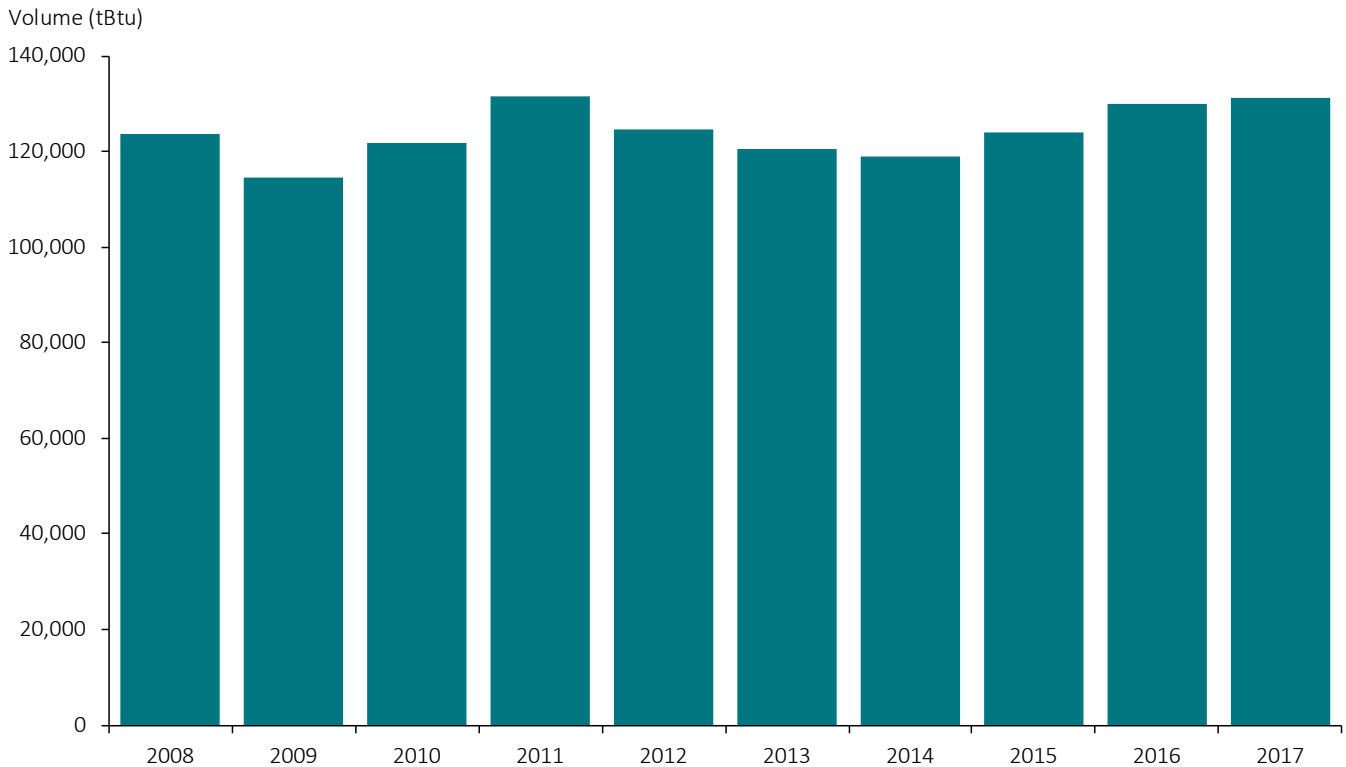
Note: tBtu conversion uses 2017 Btu per cubic foot for Natural Gas Exports Heat Content. Volumes are converted from millions of cubic feet to tBtu using the Natural Gas Exports Heat Content reported by the EIA. LNG prices are export-location specific. Mexico includes Mexico Vessel Exports and Mexico Truck Exports. Other includes Vessel Exports to the United Kingdom, Pakistan, Thailand, the Netherlands, Malta, Barbados, the Bahamas, and Canada Truck Exports.

Market Volume

- Total Form 552 volume grew about 1 percent in 2017, marking the third consecutive annual increase.
- The 2017 trading activity reported in the Form 552 submissions totaled 131,296 tBtu, transacted by 678 respondents. This is 33 fewer respondents than those that submitted in 2016.
- Form 552 volumes in 2017 represented a minimum of 65,648 tBtu of trading volume.¹⁸

Despite a drop in the number of Form 552 submissions, total volume increased for the third year in a row.

**Figure 3: Total Reported Volume
2008–2017**



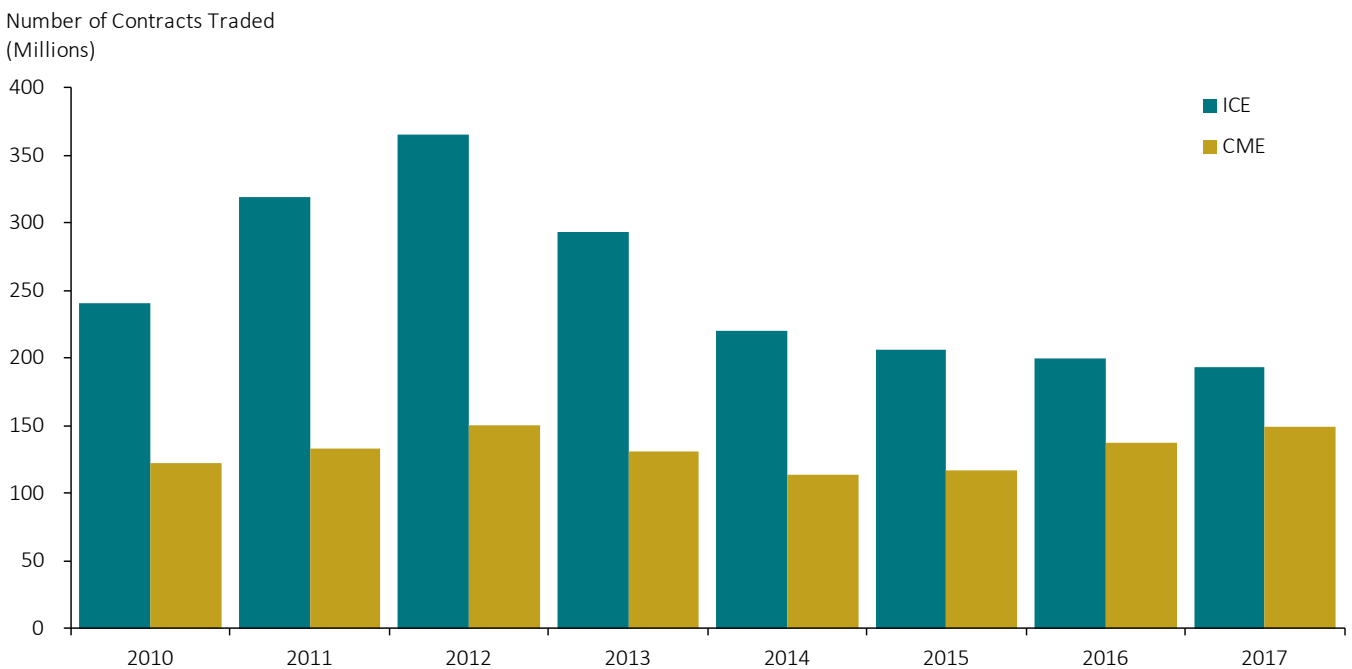
Source: FERC Form 552 submissions as of June 5, 2018
Note: One tBtu equals one million mmBtu.

Exchange Trading

- For the second time in the past three years, aggregate exchange trading of natural gas contracts rose, due to continued increases in trading on CME.
- In 2017, trading on CME was 8.7 percent more than 2016. This marks the third straight year of increased CME trading, expanding on the 17 percent increase in contracts traded between 2015 and 2016.¹⁹
- The CME attributed the rise in natural gas contracts traded on its platform to “higher price volatility caused by shifts in supply and demand in the underlying markets.”²⁰
- ICE natural gas contract volume declined for the fifth consecutive year, falling 3.5 percent from 2016 to 2017. Since its peak in 2012, the number of contracts traded on ICE has decreased by almost half.
- Natural gas is also traded on other platforms, including NASDAQ.²¹ Natural gas contracts traded on NASDAQ in 2017 represented less than 1 percent of volumes traded on ICE or CME.²²

CME’s volume increased for the third year in a row, while ICE’s volume continued its steady decline since 2012.

Figure 4: ICE and CME Natural Gas Contracts Traded 2010–2017



Source: ICE Form 10-Ks; ICE Market Data Report Center; CME Form 10-Ks

Note: ICE’s volume includes natural gas futures, options, cleared OTC contracts, and block trades. Following a change in its 2012 10-K volume reporting methodology, ICE provides comparable totals for 2011 and 2010 to reflect the 2012 reclassification which are used here. The figures reflect only North America contract volume for all years except 2012, which reflects worldwide contract volume. In 2012, the contract volume outside North America accounted for less than 3 percent of total contracts traded. Values from 2013 onward are sourced from the Historical Monthly Volumes Section of the Market Data available from ICE. The figures reported by CME represent the average daily volume of its natural gas products and exclude OTC products. They have been multiplied by 250 to convert them to annual values. The contract sizes between ICE and CME are not directly comparable. Contract sizes may differ across products, for example the CME Henry Hub Natural Gas Futures contract is 10,000 mmBtu and the ICE Henry LD1 Fixed Price Future contract is 2,500 mmBtu.

Cornerstone Research Proprietary Classification of Market Participants

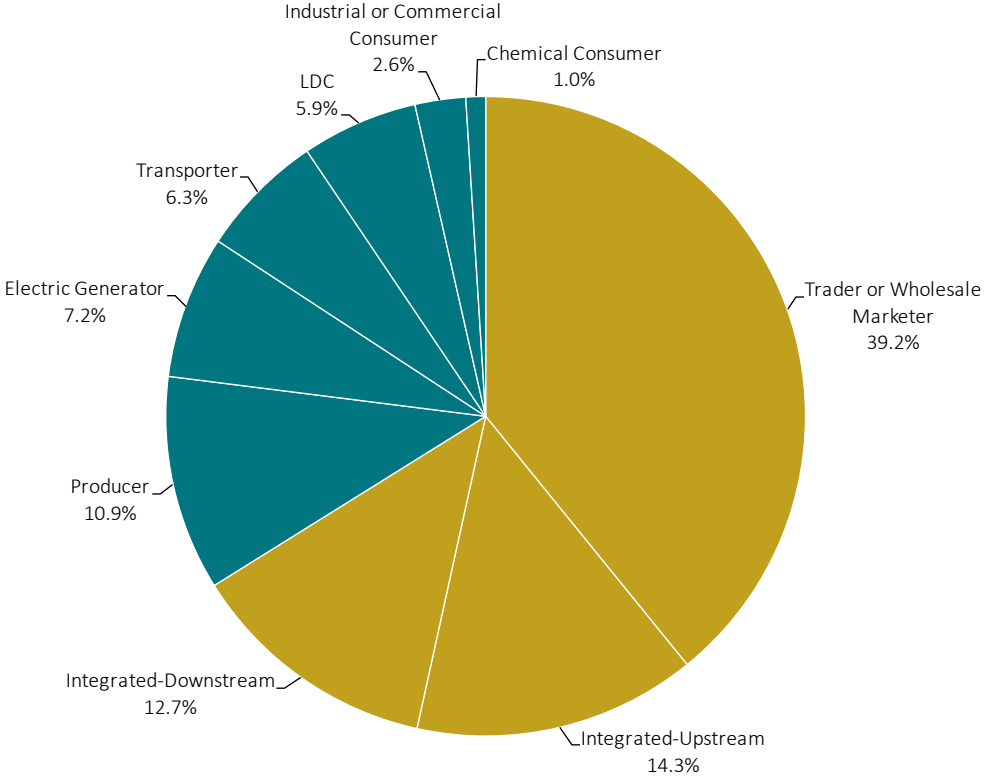
Transaction Volume

Cornerstone Research supplements FERC Form 552 data with proprietary research that classifies the respondent companies by industry segments. Companies are classified by their primary natural gas business activity, yielding unique insights into the natural gas market.

- Generally, the shares of trading volume attributed to each industry segment of market participant have remained relative stable over recent years.
- Large integrated-upstream and integrated-downstream companies and traders or wholesale marketers accounted for approximately 66 percent of Form 552 natural gas volume in 2017.
- In contrast, industrial or commercial consumers and chemical consumers accounted for less than 4 percent of the 2017 Form 552 volume.

Not surprisingly, the industry segments with the largest and generally most-sophisticated gas trading expertise made up the majority of the trading volume.

Figure 5: Transaction Volume by Industry Segment 2017



Source: FERC Form 552 submissions as of June 5, 2018
 Note: Percentages may not add up to 100 percent due to rounding.

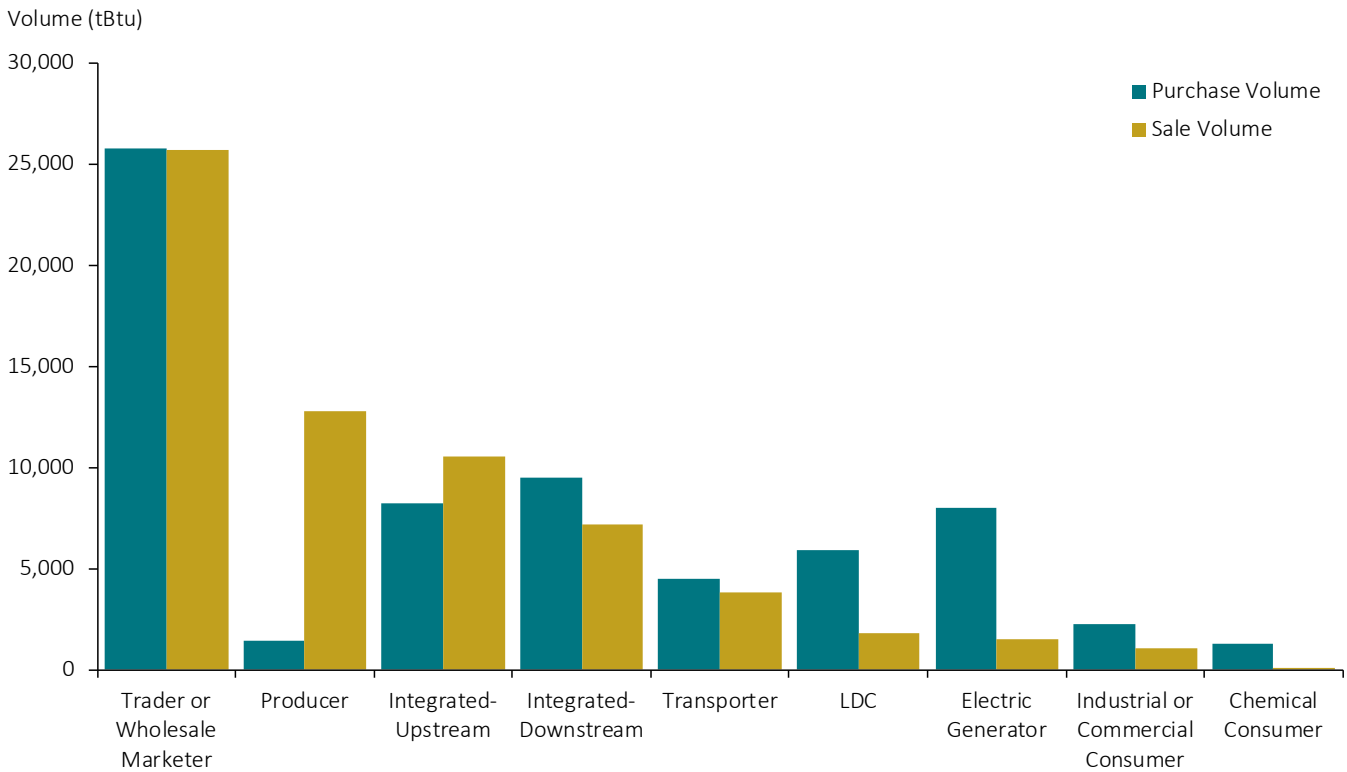
Purchase and Sale Volume

As would be expected, companies primarily engaging in “upstream” or “downstream” activities are net sellers or buyers of natural gas, respectively, while “midstream” companies buy and sell in approximately equal amounts.

Electric generators and LDCs remained the largest net purchasers of natural gas.

- The breakdown of Form 552 purchases and sales by industry segment showed that producers and integrated-upstream companies sold more natural gas than they purchased in 2017.
- Integrated-downstream companies, local distribution companies (LDCs), electric generators, industrial or commercial consumers, and chemical consumers purchased more than they sold.
- Consistent with their business models, traders or wholesale marketers and transporters purchased and sold approximately equal amounts.

Figure 6: Purchase and Sale Volume by Industry Segment 2017



Source: FERC Form 552 submissions as of June 5, 2018

Note: One tBtu equals one million mmBtu.

Top Twenty Companies

The list of 20 companies with the largest total transaction volumes indicates that the U.S. natural gas market continues to have a large number of diverse participants. These 20 companies tend to be consistent from year to year—18 of the top 20 companies in 2017 were also among the leading companies in 2016.

- The top 20 companies accounted for 57,938 tBtu out of 131,296 tBtu, or approximately 44 percent of volume reported on Form 552 submissions in 2017. This share of volume is consistent with recent years, although it is down slightly from the 2011–2012 average of 47 percent.
- BP Energy Company had the largest physical volumes for the 10th consecutive year at 8,221 tBtu, approximately a 5 percent decrease from 2016. Its volume was more than 60 percent higher than the second-largest trader.

- Two companies fell from the top 20: Chesapeake Energy Corporation, ranked 17 last year, had not filed a Form 552 when the analysis was completed; and Pacific Summit Energy LLC dropped from 20 to 22 as a result of its natural gas volumes decreasing slightly.
- Only nine out of the top 20 companies reported to price-index publishers.
- MIECO Inc. and Enterprise Products Partners L.P. entered the top 20 this year.

The top 20 companies accounted for 44 percent of total volume.

Figure 7: Top 20 Companies by Total Reported Volume 2017 (Sorted by Total Transaction Volume, in tBtu)

Company Name	Any Affiliates Report to Index Publishers	Total Buy Volume	Total Sale Volume	Net Volume	Total Transaction Volume	Volume Reportable to Indices
BP Energy Company	Y	3,959	4,263	-304	8,221	1,796
Tenaska Marketing Ventures	Y	2,577	2,525	52	5,102	1,328
Macquarie Energy LLC	Y	2,456	2,365	91	4,821	1,096
Shell Energy North America (US) L.P.	Y	2,336	2,447	-111	4,782	727
Southern Company Gas	N	2,240	1,757	483	3,996	721
ConocoPhillips Company	Y	1,870	1,973	-103	3,843	471
Twin Eagle Resource Management LLC	N	1,153	1,301	-149	2,454	347
Mercuria Energy America Inc.	N	1,116	1,218	-102	2,334	417
ICE NGX Canada Inc.	N	1,147	1,147	0	2,295	904
CenterPoint Energy Inc.	N	1,261	991	270	2,252	138
Chevron U.S.A. Inc.	Y	962	1,115	-153	2,077	322
DTE Energy Trading Inc.	N	1,024	1,046	-22	2,069	299
J. Aron & Company LLC	Y	1,017	991	26	2,008	592
Concord Energy LLC	Y	1,024	914	110	1,938	259
Exelon Generation Company LLC	N	1,110	801	309	1,912	650
EDF Trading North America LLC	N	838	885	-47	1,723	468
Energy Transfer Partners L.P.	Y	707	1,001	-294	1,707	324
Direct Energy Marketing Inc.	N	947	576	370	1,523	349
Enterprise Products Partners L.P.	N	763	695	69	1,458	163
MIECO Inc.	N	712	710	2	1,422	465
Top 20 Companies by Total Volume		29,217	28,721	497	57,938	11,836
All Other Companies		37,587	35,771	1,815	73,358	13,041
Total for All Companies		66,804	64,492	2,312	131,296	24,877

Source: FERC Form 552 submissions as of June 5, 2018

Note: Numbers may not add up to totals due to rounding. One tBtu equals one million mmBtu. Volume Reportable to Indices includes the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552. Natural Gas Exchange Inc. was purchased by ICE in 2017 and renamed ICE NGX Canada Inc.; it moved up from rank 12 to 9.

Transaction Types

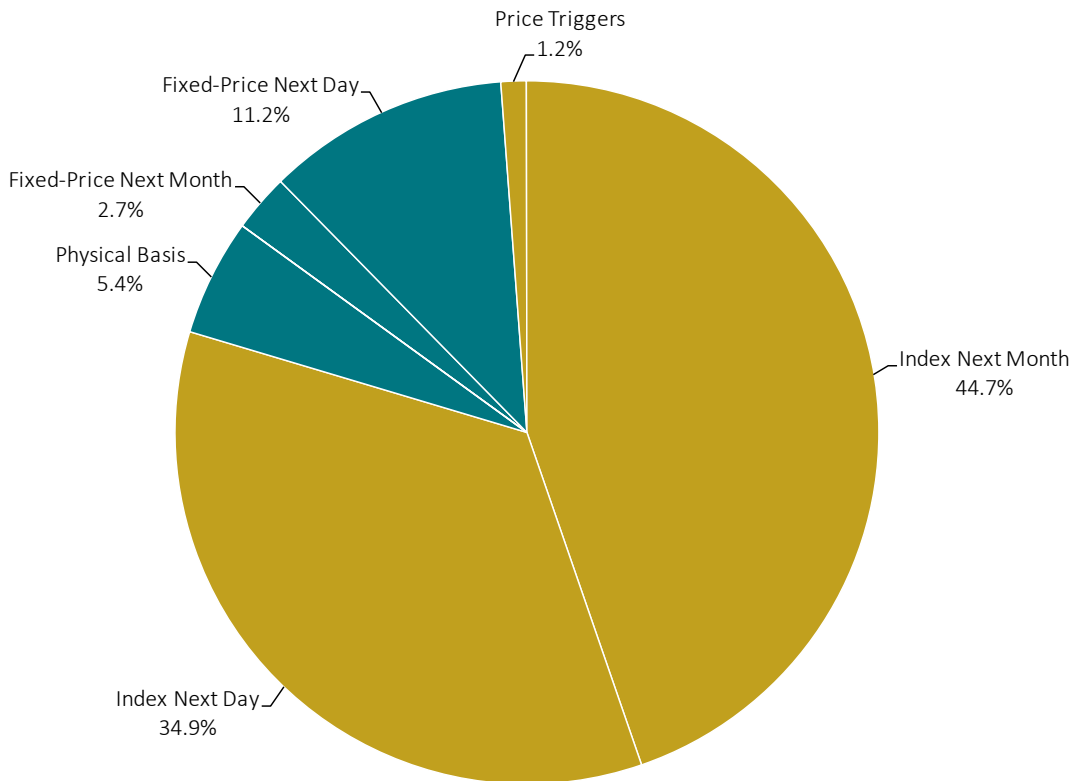
- From 2012 to 2017, index-priced transactions increased from approximately 72 percent to 80 percent of all Form 552 transactions. This increase was largely driven by next-day transactions.²³
- In 2017, next-day index-priced transaction volume increased from 63 percent to 74 percent of total next-day volume.
- Next-month index-priced transaction volume, already at 90 percent in 2012, increased to 94 percent of total next-month transaction volume in 2017.
- Since 2008, transactions that reference the monthly index have been the most prevalent among index-priced transactions and accounted for nearly 45 percent of all Form 552 transactions in 2017.
- Combined fixed-price and index-priced transactions covered by Form 552 were split relatively equally between next-month transactions (47 percent) and next-day transactions (46 percent).²⁴
- Price triggers remained the least prevalent transaction type, comprising approximately 1 percent of Form 552 transactions.

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Since 2008, index-priced transactions have comprised an increasing share of overall Form 552 transactions while the portion of transactions with fixed prices has steadily declined.

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Figure 8: Transaction Volume by Transaction Type 2017



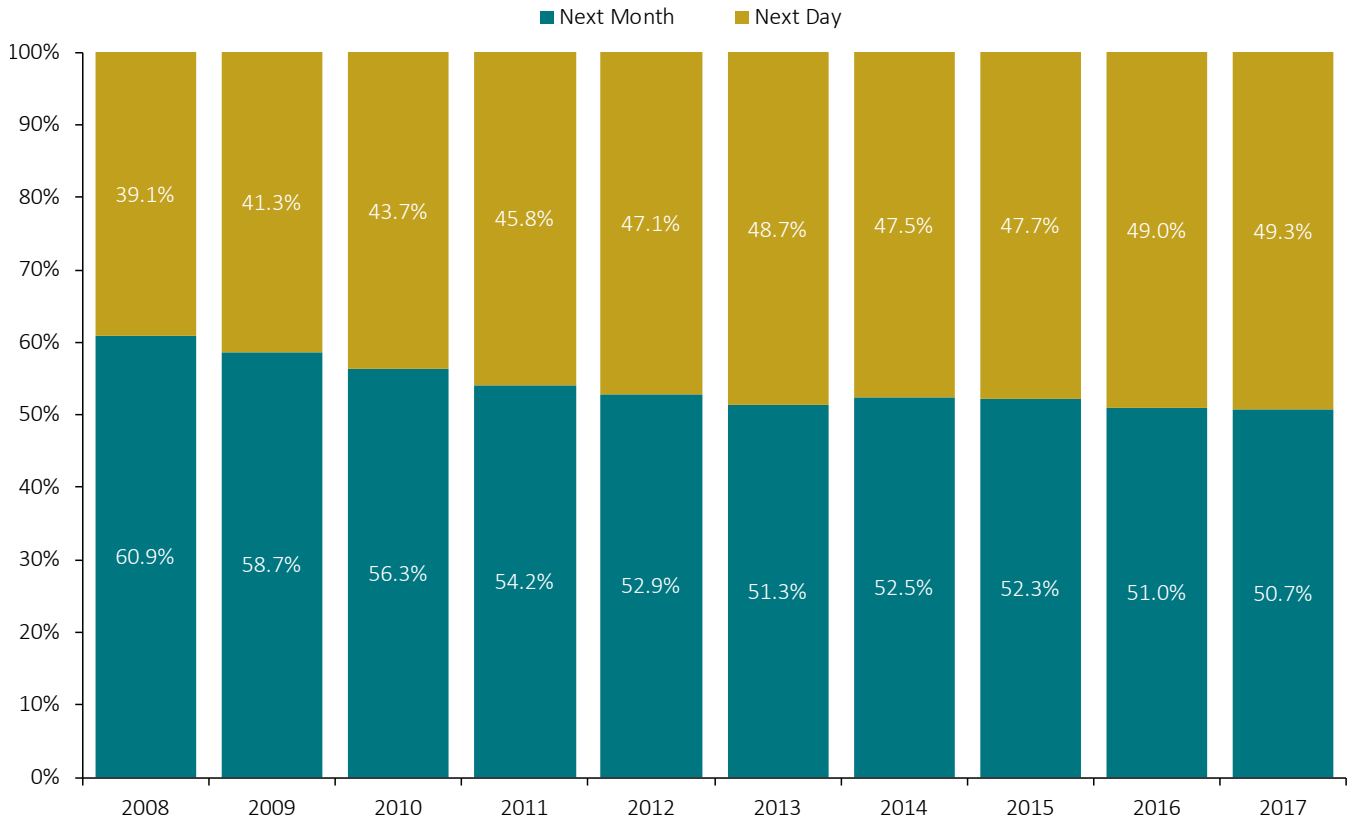
Source: FERC Form 552 submissions as of June 5, 2018
 Note: Percentages may not add up to 100 due to rounding.

Next-day transactions have increased as a percentage of total transaction volume²⁵ since 2008, while the volume of next-month transactions has declined relative to fixed-price transactions.

- The percentage of volume based on next-month transactions has decreased by slightly more than 10 percentage points from 2008 to 2017 (from 61 percent to 51 percent).
- The breakdown between next-day and next-month transactions remained essentially unchanged from the prior year with next-day transactions comprising 49 percent of the pool of daily and monthly transactions. This breakdown is significantly different from the 39 percent of next-day transactions observed in 2008.

The long-term relative growth in next-day transactions seems to indicate a shift in industry contracting and risk management practices.

Figure 9: Next-Month and Next-Day Transaction Volume across Both Fixed-Price and Index-Priced Transactions 2008–2017



Source: FERC Form 552 submissions as of June 5, 2018

Note: Percentages may not add up to 100 due to rounding.

Volume and Depth of Reporting to Price-Index Publishers

In Order 704, FERC commented that understanding the relative sizes of the volume of index-priced transactions and reporting-eligible, fixed-price transactions was a core purpose of mandating Form 552 submissions.²⁶

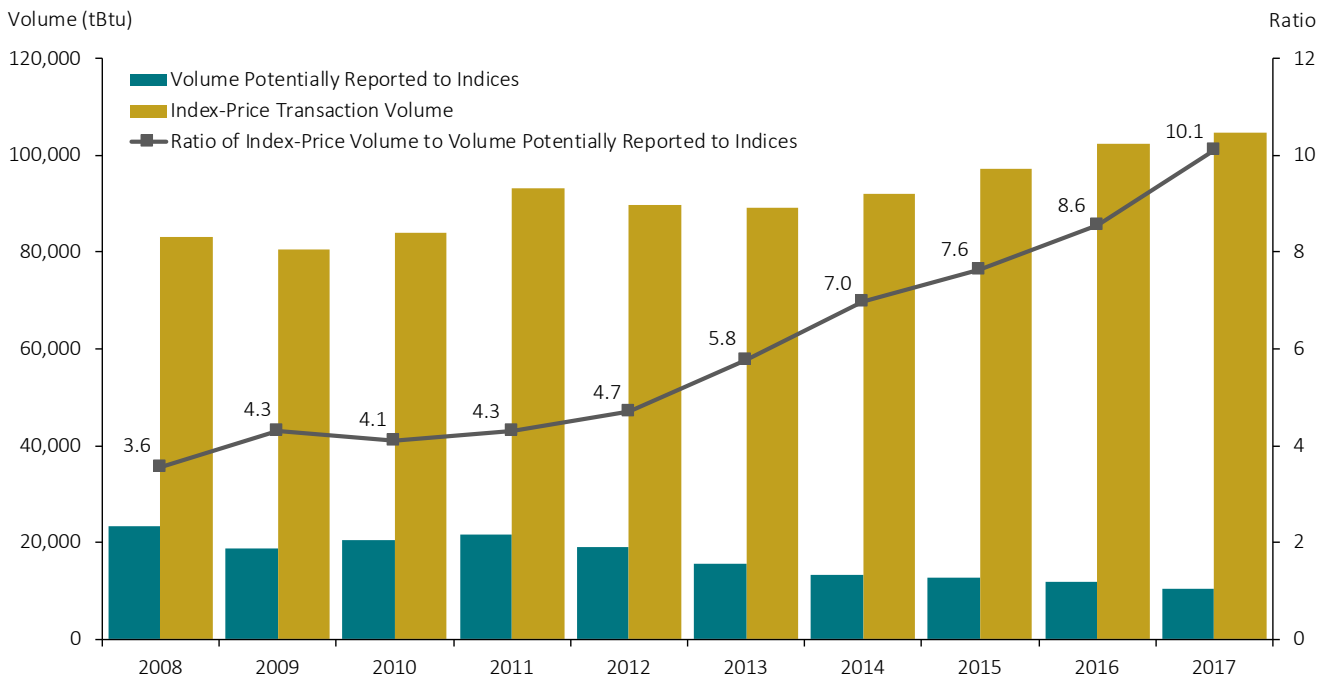
- For the seventh year in a row, the 552 data show an increase in the ratio of index-priced volume dependent on indices to volume potentially reported to indices.²⁷
- The growth in this ratio resulted from a 2 percent increase in the volume of index-priced transactions, and a 13 percent decrease in the fixed-price volume potentially reportable to indices.

“We have had a...shift from fixed-price gas at the companies that report to indexed-priced gas.... [T]hat is a vote of confidence in those indices by the folks who have money at stake [who are using the indices to price gas].”

Greg Leonard speaking at the 2017 FERC Technical Conference²⁸

- The year 2017 witnessed both the largest volume of index-priced transactions and the lowest volume potentially reported to indices since the inception of Form 552 reporting.
- In 2017, the ratio of index-priced transactions to potentially reported fixed-price transactions was the largest since Form 552 data were first collected for 2008. The ratio increased for both day-ahead and month-ahead contracts.
- In 2017, price-index publisher Platts entered into an agreement with ICE to receive anonymized natural gas transactions from ICE’s platform for use in Platts’s daily natural gas assessments.²⁹ Platts began incorporating ICE’s physical gas trades into the price assessments in late May 2017.³⁰ With this agreement, a company does not actually need to report to index publishers in order to have its trades incorporated into an index. It is important to note that while these additional transactions enter into the index-formation process, these data are not included in the Form 552 reporting requirements.

Figure 10: Total Volumes Potentially Reported to Indices versus Transaction Volumes Priced Based on Indices 2008–2017



Source: FERC Form 552 submissions as of June 5, 2018

Note: Reportable volume is the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552. Companies that did not enter information regarding their price reporting were assumed to not report. One tBtu equals one million mmBtu.

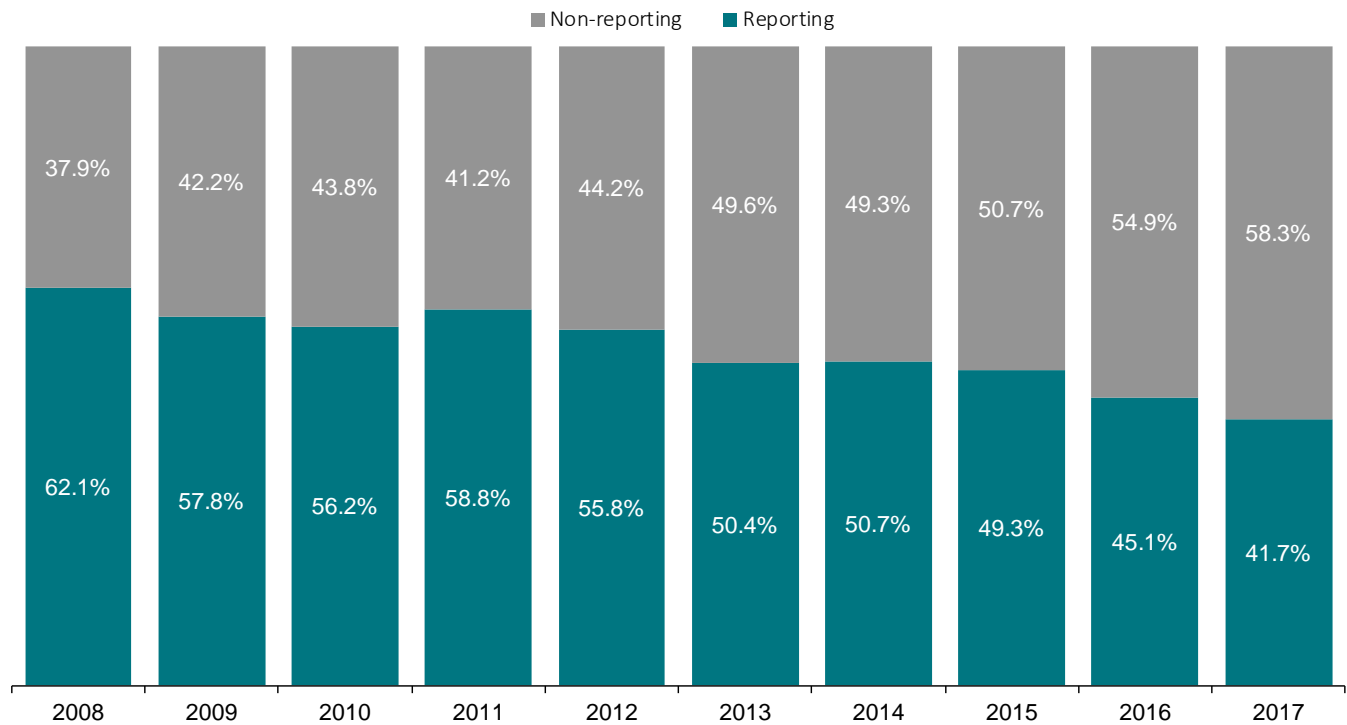
Form 552 submissions also provide information on which companies had volume eligible to be reported (i.e., fixed-price transactions³¹) and whether they reported that volume to the indices.

- The percentage of fixed-price volume transacted by non-reporting companies increased by more than 3 percentage points from 2016 to 2017. This is the third consecutive year that companies that chose not to report fixed-price volume to the indices comprised a larger share of fixed-price volume than did companies that chose to report.
- Of the 678 respondents in 2017, 93 (about 14 percent) reported transaction information to the price-index publishers for themselves or at least one affiliate.
- The reporting companies accounted for 42 percent of the reporting-eligible, fixed-price volume in 2017, compared to over 60 percent in 2008.

- During the 2017 FERC Technical Conference on natural gas index liquidity and transparency, multiple reasons were hypothesized as to why companies did not report to indices, including (1) the FERC Safe Harbor provision not being safe enough to protect against inadvertent errors, and (2) costs associated with internal systems and regulatory risk being too high.³²

For the third consecutive year, companies that chose not to report fixed-price volume to the indices comprised a larger share of fixed-price volume than reporting companies.

Figure 11: Fixed-Price Volume by Reporting versus Non-reporting Companies 2008–2017



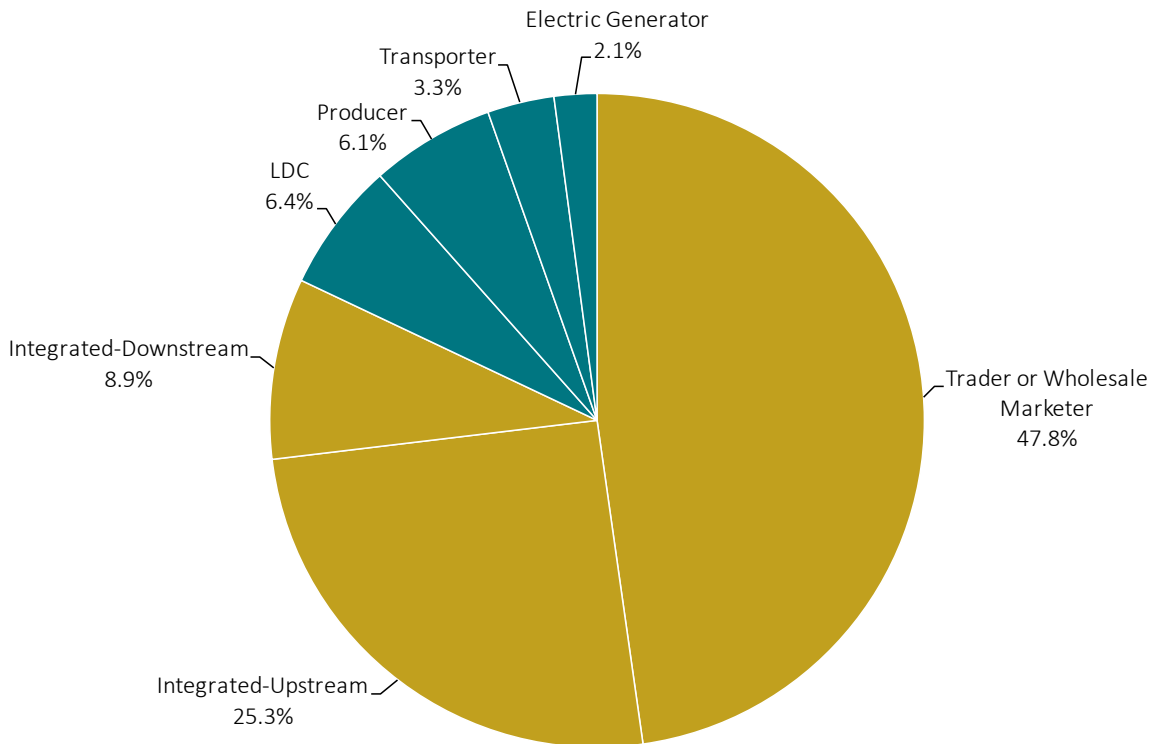
Source: FERC Form 552 submissions as of June 5, 2018

Note: Reportable volume is the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552. Companies that did not enter information regarding their price reporting were assumed to not report. Percentages may not add up to 100 due to rounding.

- Integrated-upstream companies and traders or wholesale marketers accounted for approximately 73 percent³³ of the fixed-price volume potentially reported to the price-index publishers in 2017.
- As in 2016, in 2017 nine of the top 20 companies by volume reported to index publishers.
- These nine companies accounted for 67 percent³⁴ of the fixed-price volume potentially reported to price-index publishers.

Traders or wholesale marketers and integrated-upstream firms traded the majority of the potentially reported fixed-price volume.

Figure 12: Fixed-Price Volume for Entities Reporting to Price-Index Publishers by Company Type 2017



Source: FERC Form 552 submissions as of June 5, 2018

Note: Industrial or commercial consumer and chemical consumer companies reporting less than 0.20 percent of reportable volume and are excluded. Percentages may not add up to 100 due to rounding.

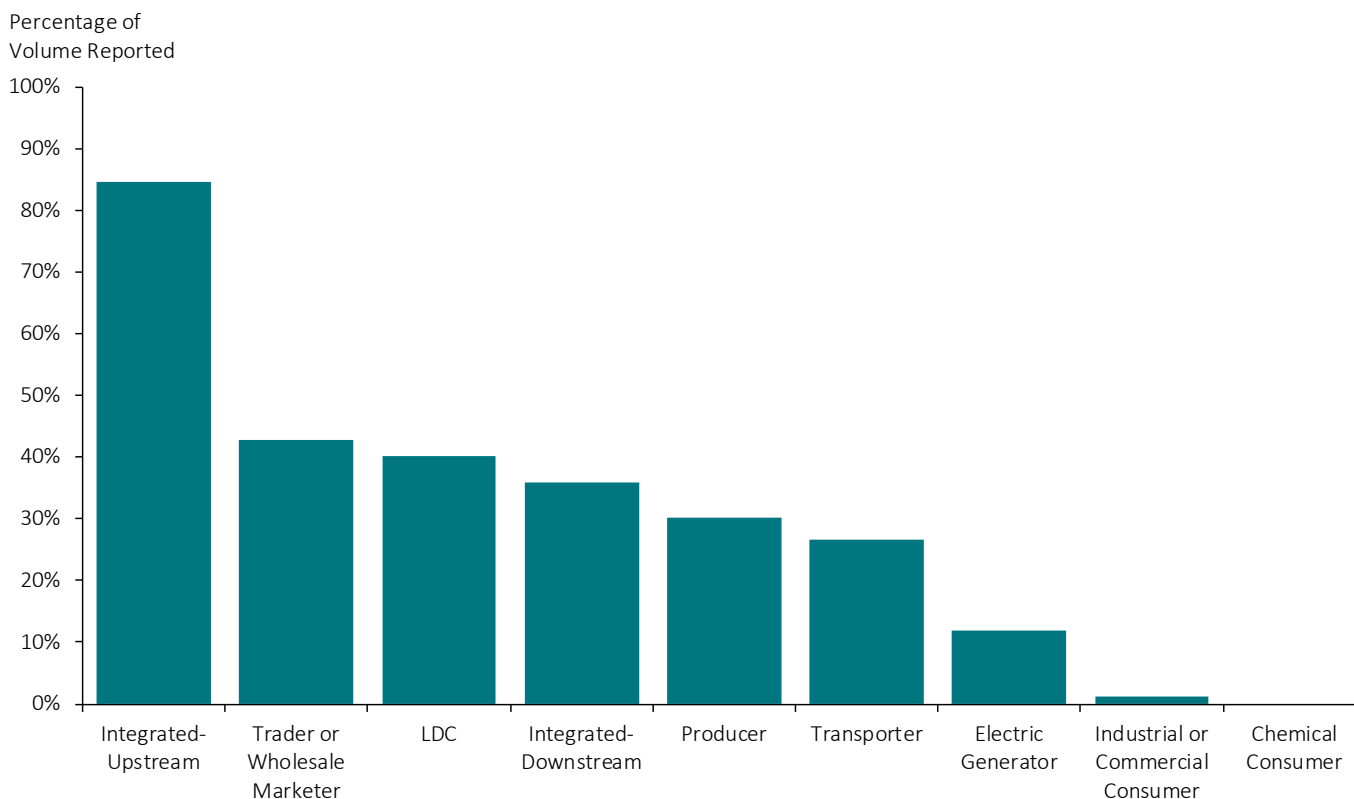
The proportion of volume reported by each industry segment in 2017 has remained generally consistent by category rank for the last three years.

- The vast majority of transactions (85 percent) executed by integrated-upstream companies took place at companies that report to price-index publishers. This share is up from 78 percent of transactions in the prior year.

Fixed-price transactions reported by integrated-upstream companies rebounded in 2017.

- Fixed-price transactions reported by integrated-upstream companies rebounded by 7 percentage points in 2017 following a 10 percentage point drop last year.
- Traders or wholesale marketers, LDCs, integrated-downstream companies, and producers reported between 30 percent and 50 percent of fixed-price transaction volume to indices.
- Companies with a primary business outside the natural gas markets—such as industrial or commercial consumers, and chemical consumers—reported only about 1 percent of their combined fixed-price transaction volume to indices.

Figure 13: Percentage of Fixed-Price Volume Reported to Price-Index Publishers by Industry Segment 2017



Source: FERC Form 552 submissions as of June 5, 2018

Note: Of the 678 respondents in 2017, 93 indicated they reported transaction information to price-index publishers for themselves or at least one affiliate.

Glossary

Btu: A British thermal unit (Btu) is the amount of heat energy needed to raise the temperature of one pound of water by one degree Fahrenheit. Millions of this unit are written as mmBtu, and trillions as tBtu.

CME Group Inc. (CME): A “diverse derivatives marketplace... The company provides a marketplace for buyers and sellers, bringing together individuals, companies and institutions that need to manage risk or that want to profit by accepting risk.”

<https://www.cmegroup.com/company/history/>

Downstream: “A term used in the petroleum industry referring to the refining, transportation, and marketing side of the business.”

<http://www.energy.ca.gov/glossary/glossary-d.html>

EIA: U.S. Energy Information Administration. “EIA provides a wide range of information and data products covering energy production, stocks, demand, imports, exports, and prices; and prepares analyses and special reports on topics of current interest.”

<http://www.eia.gov/about/>

FERC Form 552: Annual Report of Natural Gas Transactions. “FERC Form No. 552 collects transactional information from natural gas market participants. The filing of this information is necessary to provide information regarding physical natural gas transactions that use an index and transactions that contribute to, or may contribute to gas price indices. This form is considered to be a non-confidential public use form.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Fixed price: “A ‘Physical Natural Gas Transaction’ price determined by agreement between buyer and seller and not benchmarked to any other source of information.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Fixed-price, next-day transaction: “[D]elivery of natural gas pursuant to a transaction executed prior to NAESB [North American Energy Standards Board] nomination deadline (11:30 am Central Prevailing Time) on one day for uniform physical delivery over the next pipeline day.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Fixed-price, next-month transaction: “[D]elivery of natural gas pursuant to a transaction executed during the last five business days of one month (bidweek) for uniform physical delivery over the next month.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Gross withdrawals: “Full well stream volume from both oil and gas wells, including all natural gas plant liquids and nonhydrocarbon gases after oil, lease condensate, and water have been removed. Also includes production delivered as royalty payments and production used as fuel on the lease.”

https://www.eia.gov/tools/glossary/?id=gross_withdrawals

Henry Hub: A principal natural gas trading hub in North America, with connections to nine interstate and four intrastate pipelines. Henry Hub serves as the delivery point for the U.S. natural gas futures contract traded on the New York Mercantile Exchange (NYMEX).

https://www.theice.com/publicdocs/ICE_NatGas_Brochure.pdf; http://www.cmegroup.com/trading/energy/natural-gas/natural-gas_contract_specifications.html

Intercontinental Exchange Inc. (ICE): A “network of regulated exchanges and clearing houses for financial and commodity markets.”

<https://www.intercontinentalexchange.com/index>

Index price: “A price obtained from an industry publication, which is intended to represent an average price of gas delivered to a specific point on the pipeline at or during a specified period of time.”

<http://www.uniongas.com/storage-and-transportation/resources/additional-info/glossary>

Liquefied natural gas (LNG): Natural gas (primarily methane) that has been liquefied by reducing its temperature to negative 260 degrees Fahrenheit at atmospheric pressure.

<http://www.eia.gov/tools/glossary/index.cfm?id=L>

Local distribution company (LDC): “A legal entity engaged primarily in the retail sale and/or delivery of natural gas through a distribution system that includes main lines (that is, pipelines designed to carry large volumes of gas, usually located under roads or other major right-of-ways) and laterals (that is, pipelines of smaller diameter that connect the end user to the mainline). Since [the] structuring of the gas industry, the sale of gas and/or delivery arrangements may be handled by other agents, such as producers, brokers, and marketers that are referred to as ‘non-LDC.’”

<http://www.eia.gov/tools/glossary/index.cfm?id=L>

Marketed production: “Gross withdrawals less gas used for repressuring, quantities vented and flared, and nonhydrocarbon gases removed in treating or processing operations. Includes all quantities of gas used in field and processing plant operations.”

https://www.eia.gov/tools/glossary/?id=marketed_production

Midstream: Activity involving “pipelines, processing plants, and storage facilities.”

<http://www.ferc.gov/market-oversight/guide/energy-primer.pdf>

Physical-basis transactions: “[T]ransactions in which the basis value is negotiated on one of the first three days of bidweek and the price is set by the final closing value of the near-month NYMEX Natural Gas Futures contract plus or minus the negotiated basis. These transactions are for uniform physical delivery over the next month.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Price trigger: According to FERC Form 552, a trigger agreement is “a NYMEX trigger transaction that is contingent upon a futures contract that trades on an exchange, resulting in an automatic physical trade at an agreed upon price.”

<https://www.ferc.gov/docs-filing/forms/form-552/form-552.pdf>

Shale gas: “Natural gas produced from wells that are open to shale formations. Shale is a fine-grained, sedimentary rock composed of mud from flakes of clay minerals and tiny fragments (silt-sized particles) of other materials. The shale acts as both the source and the reservoir for the natural gas.”

<https://www.eia.gov/tools/glossary/index.php?id=S>

Tight gas: “Tight gas refers to natural gas reservoirs locked in extraordinarily impermeable, hard rock, making the underground formation extremely ‘tight.’”

http://www.rigzone.com/training/insight.asp?insight_id=346

Tight oil: “Oil produced from petroleum-bearing formations with low permeability such as the Eagle Ford, the Bakken, and other formations that must be hydraulically fractured to produce oil at commercial rates.”

<http://www.eia.gov/tools/glossary/index.cfm?id=T>

Upstream: “A term used in the petroleum industry referring to the exploration and production side of the business.”

<http://www.energy.ca.gov/glossary/glossary-u.html>

Appendices

Appendix 1: Energy Policy Act of 2005, Form 552 Submissions, and Cornerstone Research’s Proprietary Analysis

In 2005, Congress passed the Energy Policy Act of 2005 (EPAAct 2005), which authorized FERC to “facilitate price transparency in markets for the sale or transportation of physical natural gas in interstate commerce” (§ 316). The EPAAct 2005 allowed FERC to issue rules to “provide for the dissemination, on a timely basis, of information about the availability and prices of natural gas sold at wholesale and in interstate commerce to the Commission, State commissions, buyers and sellers of wholesale natural gas, and the public” (§ 316). After an extensive rule-making process, FERC issued Order 704-A, which established reporting requirements.

In the summer of 2009, FERC received the first round of Form 552 submissions covering 2008 natural gas transactions from more than 1,121 respondents. On June 17, 2010, FERC issued Order 704-C, which provides for slightly revised reporting rules that ease some reporting requirements.³⁵ For 2017 natural gas transactions, Form 552 submissions covered 678 firms.

The data contained on the Form 552 submissions, described more fully in Appendix 2, provide a unique view into the size and nature of the physical natural gas market. First, these forms quantify the number of trade participants and trade volumes of firms that report to the price-index publishers. Second, the data provide insight into the relative proportion of fixed-price and index-priced transactions. Third, while FERC did not request information on all natural gas transactions, the data yield an outline of the size of the physical natural gas market, especially at the trading and wholesale levels.

Cornerstone Research supplements the FERC Form 552 data with proprietary research that classifies the respondent companies by industry segments. These industry segments are producer, transporter, electric generator, industrial or commercial consumer, chemical consumer, trader or wholesale marketer, LDC, integrated-downstream, and integrated-upstream.³⁶ The latter two categories capture companies that span multiple industry segments.³⁷

Appendix 2: Data Submitted to FERC

Order 704-C requires natural gas market participants with purchases or sales of physical “reportable” natural gas of at least 2.2 tBtu in the prior calendar year to report these activities on Form 552. Specifically, these market participants must submit volumes of physical natural gas transactions that “are only those transactions that refer to an index, or that contribute to, or could contribute to the formation of a gas index during the calendar year.”³⁸ Order 704-A (p. 9) further clarifies that the transactions that could be reported to an index publisher means any “bilateral, arms-length, fixed-price physical natural gas transactions between nonaffiliated companies at all trading locations.”

Order 704-C excludes any transaction that does not depend on a published price index or that could not be reported to an index-price publisher. The criteria for reporting to an index-price publisher specifically exclude transactions for balance-of-month supply, intraday trades consummated after the pipeline nomination deadline, monthly fixed-price transactions conducted prior to bidweek, fixed-price

transactions for terms longer than one month, and fixed-price transactions including other services or features (such as volume flexibility) that would render them ineligible for price reporting. Further, Order 704-C excludes transactions by affiliates from the submission requirements.

While respondents aggregate their reported transaction volumes across locations and for the entire calendar year, they must submit purchase and sale volumes separately for each of the following types of transactions: fixed-price for next-day delivery, index-price referencing next-day indices, fixed-price for next-month delivery, index-price referencing next-month indices, transactions with price triggers,³⁹ and physical-basis transactions.⁴⁰ In addition to volumes of physical transactions, market participants are required to state whether or not they report transaction information to the price-index publishers.

Endnotes

- ¹ Data as of June 5, 2018, were used for all respondents.
- ² A respondent is considered to be a unique reporting company-respondent combination as reported on the FERC Form 552.
- ³ Calculated as minimum trading volume of 64,492 tBtu from Figure 7 divided by 28,093 tBtu EIA natural gas delivered to consumers. “U.S. Natural Gas Consumption by End Use,” EIA, http://www.eia.gov/dnav/ng/NG_CONS_SUM_DCU_NUS_A.htm. Converted to trillion Btu (tBtu) from million cubic feet (MMcf). 1 cubic foot = 1,037 Btu, the annual Total Consumption conversion factor in the EIA time series “Approximate Heat Content of Natural Gas (Btu per Cubic Foot),” https://www.eia.gov/dnav/ng/ng_cons_heat_dcu_nus_a.htm.
- ⁴ “Annual Energy Outlook 2018,” EIA, February 6, 2018, p. 62, <https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf>.
- ⁵ Ibid., p. 32.
- ⁶ Table 63, Natural Gas Consumption by End-Use Sector and Census Division, “Annual Energy Outlook 2018,” EIA, February 6, 2018, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=77-AEO2018&cases=ref2018&sourcekey=0>.
- ⁷ “Annual Energy Outlook 2018,” EIA, February 6, 2018, pp. 61–62, <https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf>.
- ⁸ Table 62, Natural Gas Imports and Exports, “Annual Energy Outlook 2018,” EIA, February 6, 2018, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=76-AEO2018&cases=ref2018&sourcekey=0>.
- ⁹ “U.S. Liquefied Natural Gas Exports Quadrupled in 2017,” EIA, March 27, 2018, <https://www.eia.gov/todayinenergy/detail.php?id=35512>.
- ¹⁰ “By Some Measures, U.S. Natural Gas Production Set a Record in 2017,” EIA, April 10, 2018, <https://www.eia.gov/todayinenergy/detail.php?id=35712>.
- ¹¹ Table 13, Natural Gas Supply, Disposition, and Prices, “Annual Energy Outlook 2018,” EIA, February 6, 2018, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=13-AEO2018&cases=ref2018&sourcekey=0>.
- ¹² “The United States Exported More Natural Gas Than It Imported in 2017,” EIA, March 19, 2018, <https://www.eia.gov/todayinenergy/detail.php?id=35392>.
- ¹³ “U.S. Liquefied Natural Gas Exports Quadrupled in 2017,” EIA, March 27, 2018, <https://www.eia.gov/todayinenergy/detail.php?id=35512>.
- ¹⁴ Ibid.
- ¹⁵ Total U.S. natural gas exports in 2017 were 3,167 Billion Cubic Feet (3196.4 tBtu). “U.S. Natural Gas Exports and Re-Exports by Country,” EIA, https://www.eia.gov/dnav/ng/NG_MOVE_EXPC_S1_A.htm.
- ¹⁶ Latin American countries include Mexico, Argentina, Brazil, the Dominican Republic, and Chile. Asian countries include China, India, Japan, Taiwan, Pakistan, Thailand, and South Korea.
- ¹⁷ “U.S. Liquefied Natural Gas Exports Quadrupled in 2017,” EIA, March 27, 2018, <https://www.eia.gov/todayinenergy/detail.php?id=35512>.
- ¹⁸ To the extent that both parties to a transaction submit a Form 552, the total submitted volume will be double the volume of that transaction. For example, a trade for 10,000 mmBtu between two companies, each submitting a Form 552, will add 20,000 mmBtu to the total volume. The minimum volume that could be represented by Form 552 is the maximum of the buy and sale totals shown in Figure 7. Adding the buy and sale volume can double count transactions if both the buyer and seller file a Form 552. A potential limitation of this is that estimating volume with only sales or only purchases may underrepresent the volume of transactions represented by Form 552, since some transactions involve market participants that do not submit a Form 552.
- ¹⁹ The figures reported by CME represent the average daily volume of its natural gas products, and they have been multiplied by 250 to convert them to annual values. CME reports the total number of contracts, and the volume represented by each contract may vary in size. See CME Form 10-Ks.
- ²⁰ CME 2017 10-K, p. 38.

- ²¹ “Nasdaq Futures Products,” NASDAQ, <http://business.nasdaq.com/nasdaq-futures/products>.
- ²² “Exchange Volume by Class,” OCC, <https://www.theocc.com/webapps/volbyclass-reports>.
- ²³ Data do not cover all transactions in the OTC market, since Form 552 excludes certain types of non-index-priced transactions. See Appendix 2.
- ²⁴ Calculated based on Figure 8, index next month plus fixed-price next month: 44.7 percent + 2.7 percent = 47.4 percent; index next day plus fixed-price next day: 34.9 percent + 11.2 percent = 46.1 percent.
- ²⁵ Physical basis and price trigger trades are not included in this analysis.
- ²⁶ Order 704 (Appendix 1, p. 4) states that Form 552 submissions should be used “to determine important volumetric relationships between (a) the fixed price, day-ahead or month-ahead transactions that form price indices; and (b) transactions that use price indices. Without the most basic information about these volumetric relationships, the Commission has been hampered in its oversight and its ability to assess the adequacy of price-forming transactions.”
- ²⁷ Calculated based on Figure 10, volume potentially reported to index publishers divided by the volume of index-priced transactions: $104,777 \div 10,371 = 10.1$.
- ²⁸ FERC Technical Conference, Developments in Natural Gas Index Liquidity and Transparency, June 29, 2017, Docket No. AD17-12-000, 197:15-198:13.
- ²⁹ “S&P Global Platts & Intercontinental Exchange (ICE) to Improve Natural Gas Price Transparency and Bolster North America Benchmarks,” S&P Global Platts, November 21, 2016, <https://www.prnewswire.com/news-releases/sp-global-platts--intercontinental-exchange-ice-to-improve-natural-gas-price-transparency-and-bolster-north-america-benchmarks-300366468.html>; Alexander Osipovich, “ICE, Platts Shore Up Shaky Natural Gas Indexes,” *Wall Street Journal*, November 21, 2016, <https://www.wsj.com/articles/ice-platts-shore-up-shaky-natural-gas-indexes-1479733201?mg=id-wsj>.
- ³⁰ “S&P Global Platts Announces North America Natural Gas Assessment Methodology Details Following Its Agreement with Intercontinental Exchange to Improve Price Transparency and Bolster Benchmarks,” S&P Global Platts, February 9, 2017, <https://www.prnewswire.com/news-releases/sp-global-platts-announces-north-america-natural-gas-assessment-methodology-details-following-its-agreement-with-intercontinental-exchange-to-improve-price-transparency-and-bolster-benchmarks-300405153.html>.
- ³¹ For the purposes of this analysis, Physical Basis transactions are also included in the category of fixed-priced volume.
- ³² FERC Technical Conference, Developments in Natural Gas Index Liquidity and Transparency, June 29, 2017, Docket No. AD17-12-000, 25:19:25; 151-9:23.
- ³³ Calculated based on Figure 12, integrated-upstream plus traders or wholesale marketers: 25.3 percent + 47.8 percent = 73.1 percent.
- ³⁴ Calculated based on Figures 7 and 10, top 20 companies with volume reportable to indices and an affiliate that reports to index publishers divided by total volume potentially reported to index publishers: $6,917 \div 10,372 = 66.7$ percent. From Figure 7, nine of the top 20 companies have any affiliates that report to index publishers, which totals 6,917. From Figure 10, the 2016 volume potentially reported to indices represented by the smaller bar totals 10,372.
- ³⁵ Among other minor revisions, Order 704-C exempts transactions involving unprocessed natural gas as well as cash-out and imbalance transactions. Further, for 2009, companies that hold blanket marketing certificates, but do not meet the minimum transaction volume threshold, are no longer required to file a Form 552. For 2008, more than 300 companies filed a Form 552 and did not report any transaction volume. For 2009, only 16 companies filed a Form 552 without reporting transaction volumes.
- ³⁶ The categorization process is necessarily judgmental and was based on company websites and financial filings. Companies were categorized as closely as possible to their most significant natural gas market activity.
- ³⁷ Since these integrated companies typically have a focus at either the industry segment that is upstream (such as production, gathering, or processing) or downstream (such as electric generation, marketing to wholesale users, or industrial consumption), two categories were created to allow for investigation of any differences between these types of companies.
- ³⁸ FERC Form 552 (2016 version). Note that Form 552 covers only physical natural gas transactions. Financial transactions, such as swaps and options, are excluded, as are futures contracts, whether or not they are taken to physical delivery.
- ³⁹ FERC includes NYMEX plus contracts among trigger contracts. In these contracts, the price is typically set at a specified index value as a default. The buyer, however, has the option to fix (or trigger) the price at any given point in time based on the prevailing market prices.

Typically, the buyer can fix the price at the prevailing NYMEX price for the delivery month plus a predetermined premium. When they are triggered, these contracts become fixed-price trades. Thus, while trigger contracts are initially dependent on an index price, they often shed this dependence and give the buyer the price certainty of a fixed-price transaction.

⁴⁰ Physical-basis transactions are physical transactions that have prices set as a predetermined amount plus the NYMEX settlement price. The price-index publishers state that they incorporate physical-basis transactions into their price assessments.

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