CORNERSTONE RESEARCH

Economic and Financial Consulting and Expert Testimony

Characteristics of U.S. Natural Gas Transactions

Insights from FERC Form 552 Submissions as of July 17, 2023

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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.

Executive Summary

Form 552 data for 2022 confirm the trends observed in recent years. Total trading volume increased for the eighth consecutive year, while the percentage of volume reported to indices as a share of reportable volume continued to decline.

The volume of index-priced transactions was 19 times higher than the volume potentially reported to indices in 2022—this ratio increased from 14.5 in 2020. The share of Form 552 index-priced transaction volume, and the breakdown between next-month and next-day transactions, remained stable.

FERC Submissions

- Trading activity in 2022 totaled 162,128 tBtu, approximately 2.5% higher than in 2021.[1] (page 7)
- In 2022, there were 671 respondents, slightly fewer than in 2021 (676 respondents).[2] (page 7)
- The top 20 companies accounted for approximately 40% of the total volume reported to FERC. (page 11)

Exchange Trading Activity

- Aggregate exchange trading of natural gas contracts increased by 24% on the Intercontinental Exchange (ICE) but decreased by 8% on the Chicago Mercantile Exchange (CME). (page 8)

U.S. Natural Gas

- U.S. liquefied natural gas (LNG) exports continued to increase, with exports to Europe increasing by 140% in 2022. (page 5)
- U.S. natural gas annual production reached a record high in 2022, up 6% year over year. (page 4)

"2022 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

Reporting to Price Index Publishers

- Index-priced transactions comprised approximately 84% of all Form 552 transactions, an increase of 17 percentage points since 2008. (page 12)
- The ratio of next-day to next-month transactions was nearly unchanged from 2021, with next-day equaling 52% and next-month at 48%. This represents a 13 percentage point decline in next-month transaction volume since 2008. (page 13)
- Between 2020 and 2022, the volume of index-priced transactions increased by 5% while the fixed-price volume potentially reportable to indices decreased by 19%. (page 14)
- For the eighth consecutive year, companies that chose not to report represented more than half of the reportable fixed-price volume (over 67% of volume in 2022). (page 15)
- In 2022, approximately 14% of Form 552 respondents reported transaction information to the price index publishers for themselves or at least one affiliate. These respondents accounted for 33% of the reporting-eligible, fixed-price volume in 2022, compared to 38% in 2020 and over 62% in 2008. (page 15)
- The volume of these reported transactions indicates that, on average, one molecule of natural gas was traded through approximately 2.70 transactions from production to consumption (slightly down from 2.78 in 2021).[3] (page 10)

Trends in Natural Gas Production and Consumption

Domestic production and demand for U.S. natural gas increased in 2022. The Ukraine War contributed to shifting flows of natural gas around the world, resulting in record U.S. LNG exports to Europe.

Domestic Production and Consumption

- Natural gas consumption increased by approximately 6.7% in 2022, from 35,336 to 37,714 tBtu. Demand for natural gas increased more than primary energy consumption, which increased by 3% between 2021 and 2022.[4]
- As of June 2022, the U.S. Energy Information Administration (EIA) had projected the U.S. annual natural gas marketed production to expand by 3.4% in 2022 and 5.4% in 2023.[5] As of October 2023, the EIA anticipates a 4.6% increase in 2023 following the higher-than-expected increase of 2022.[6]
- The EIA expects U.S. natural gas consumption to increase by 1% in 2023—with a 6.4% increase in the electric power sector and a 7.4% decrease in the residential sector—and decrease by 1% in 2024.[7]
- U.S. storage balances decreased for the second consecutive year, with U.S. net exports and U.S. consumption exceeding U.S. production and U.S. imports.

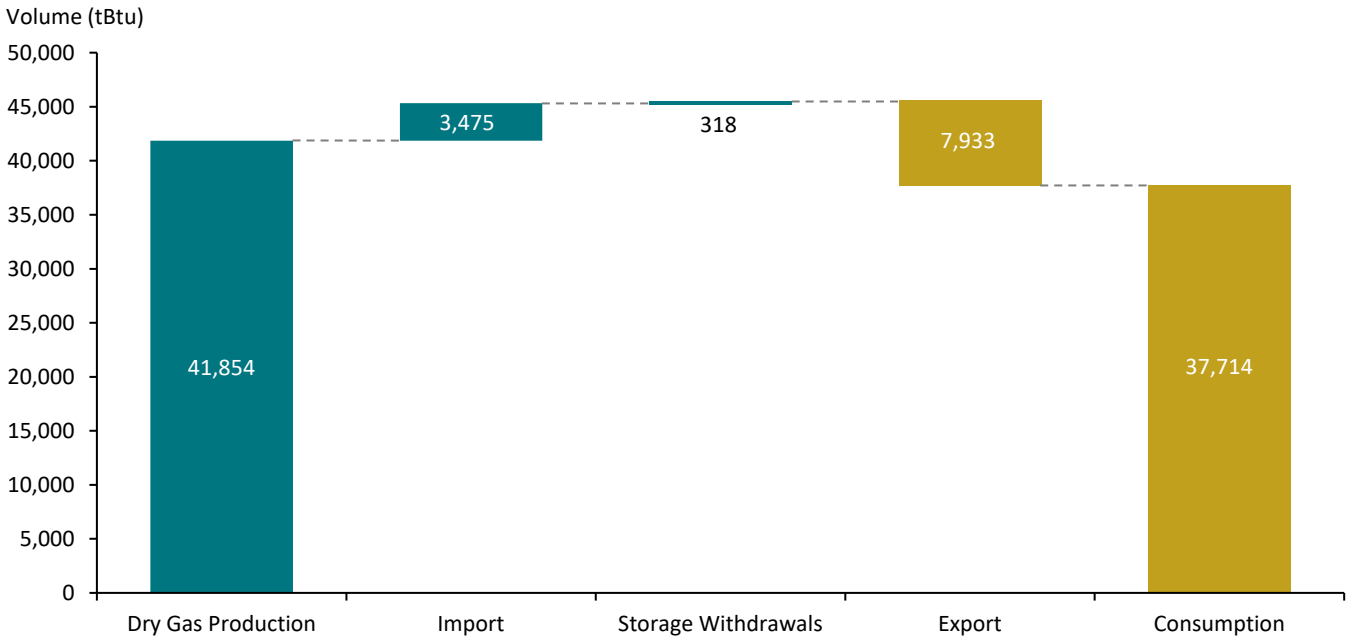
"Geopolitical tensions redrew the map of natural gas trade flows in 2022, with Europe becoming the main importer of U.S. LNG."

Nicole Moran, Cornerstone Research

Exports

- Global demand for natural gas decreased by an estimated 1.5% in 2022, driven by a relatively mild 2022/2023 winter in Europe and a switch from natural gas to coal due to sharp price increases following Russia's invasion of Ukraine.[8]
- Although global demand decreased, U.S. natural gas total exports increased by 3.8% between 2021 and 2022 and by almost 120% from 2017 to 2022, driven primarily by an increase in LNG exports.[9]
- LNG's share of total U.S. natural gas exports continued to rise in 2022, reaching 56%, up from 54% in 2021 and 22% in 2017. The remaining 44% was exported via pipeline.[10]
- The share of U.S. LNG exports to Europe more than doubled between 2021 and 2022, from 29% to 64%, driven by large differentials between European and U.S. prices.[11]
- Prior to the Ukraine War, the EIA projected that U.S. net LNG exports of natural gas would increase by 16.8% between 2021 and 2022.[12] In May 2022, the EIA revised its projection to 21.8% growth over the same period.[13]

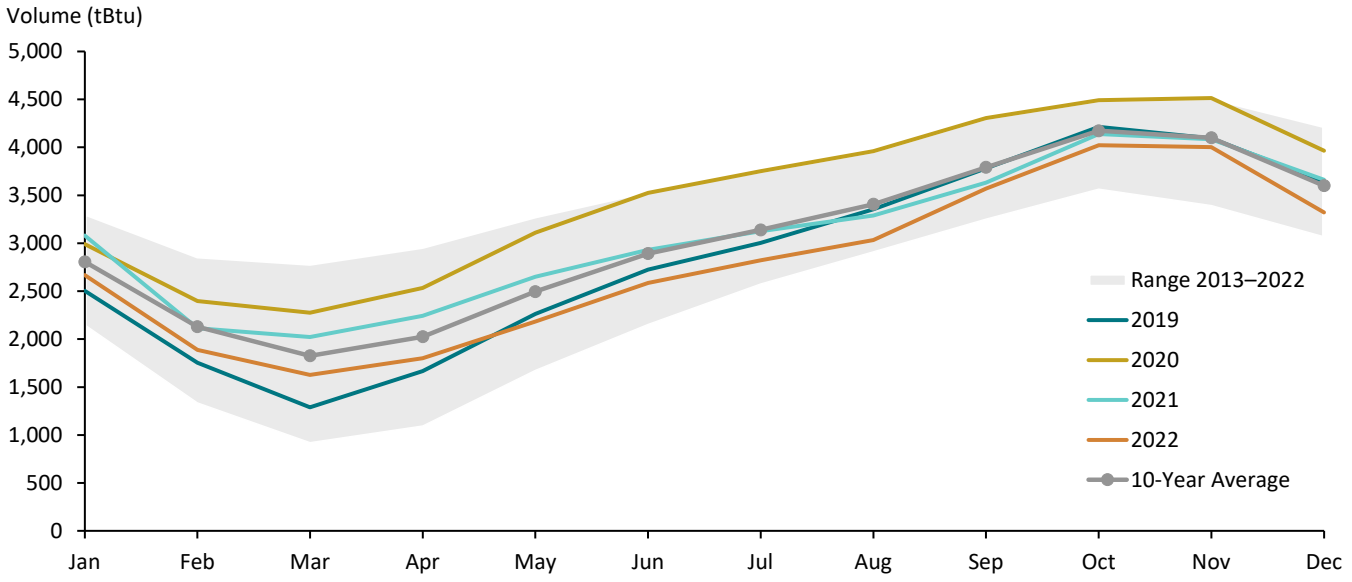
Figure 1: U.S. Natural Gas Balance Sheet
2022



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

Note: Values are converted using the 2022 Marketed Production conversion rate of 1,149 Btu per cubic foot of natural gas. Dry Gas Production is Marketed Production (45,387 tBtu) less NGPL Production (3,534 tBtu). The Dry Gas Production value also includes "Supplemental Gaseous Fuels." Consumption value also includes the "Balancing Item" used by the EIA to reconcile volume measurements.

Figure 2: U.S. Natural Gas in Underground Storage
2013–2022



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

Note: Volumes are converted from billions of cubic feet to tBtu using the Marketed Heat Content reported by the EIA. The recent 10-year average is calculated between the years 2013–2022. The 2013–2022 range is based on the weekly working gas inventory values and is converted to tBtu using the 2022 Marketed Heat Content.

Natural Gas Production and Consumption

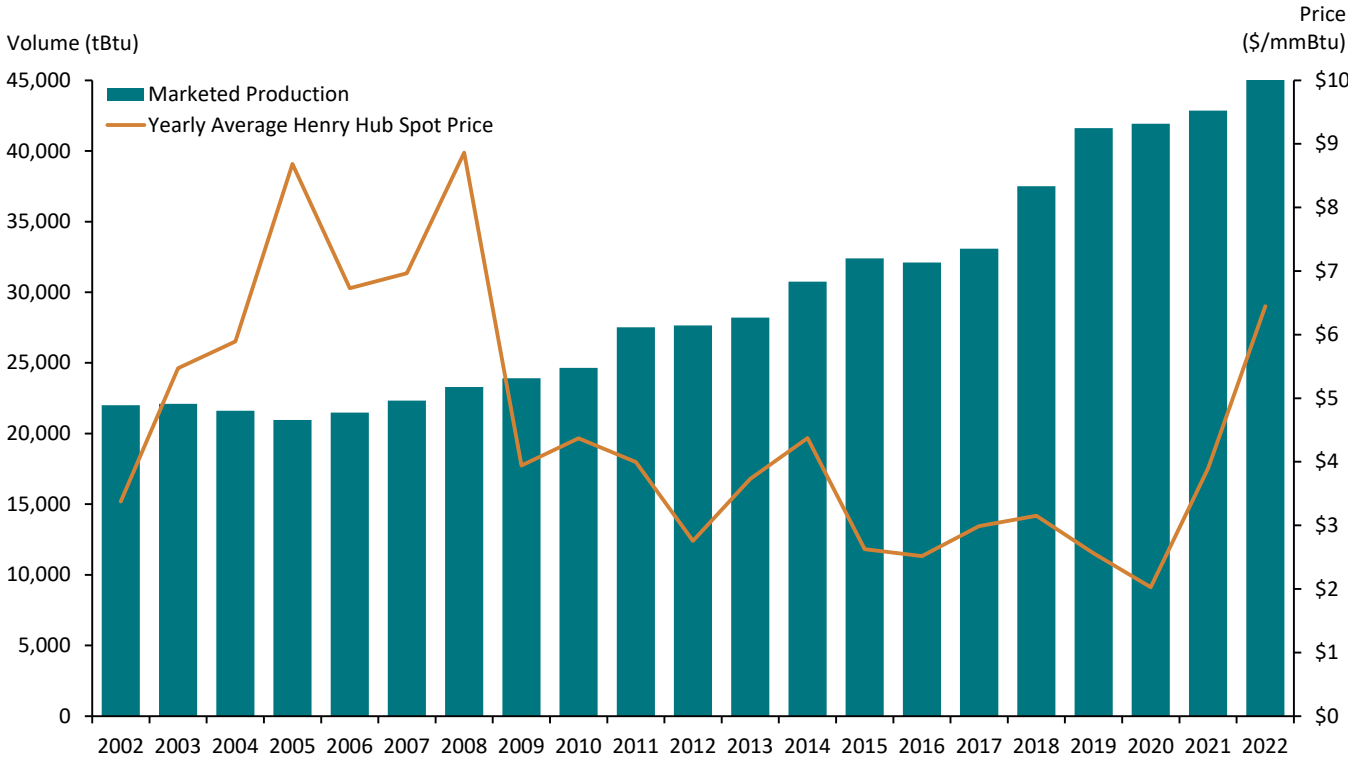
- Annual marketed production of natural gas increased by 6% in 2022 to 45,387 tBtu—a record high—driven by production increases in the Permian, Haynesville, and Eagle Ford regions. Production growth in the Appalachia Region slowed because of pipeline capacity constraints.[14]
- U.S. natural gas consumption reached a record 88.5 billion cubic feet per day in 2022, setting monthly records for nine of the 12 months of the year. This growth was influenced by robust cooling demand during the summer and heating demand in December. Natural gas consumption by the electric power sector increased by 8% in 2022 driven by high coal prices and low inventories.[15]
- Since September 2017, the U.S. has been a growing net exporter of natural gas, with LNG exports comprising most of this growth.[16]

"Rising tensions in Europe contributed to U.S. natural gas prices reaching their highest level in almost 15 years."

Sylvain Delalay, Cornerstone Research

- The share of natural gas gross withdrawals from shale gas wells increased from 73% to 74% between 2021 and 2022.[17] The development of hydraulic fracturing drove the shale gas share of withdrawals from 8% in 2007 to the all-time high of 2022.
- In 2022, the annual average Henry Hub price increased to levels unseen since the Global Financial Crisis amid geopolitical unrest and European demand for U.S. LNG.[18]

Figure 3: U.S. Natural Gas Marketed Production and Average Henry Hub Natural Gas Spot Price 2002–2022



Source: U.S. Energy Information Administration (EIA)
Note: One tBtu equals one million mmBtu.

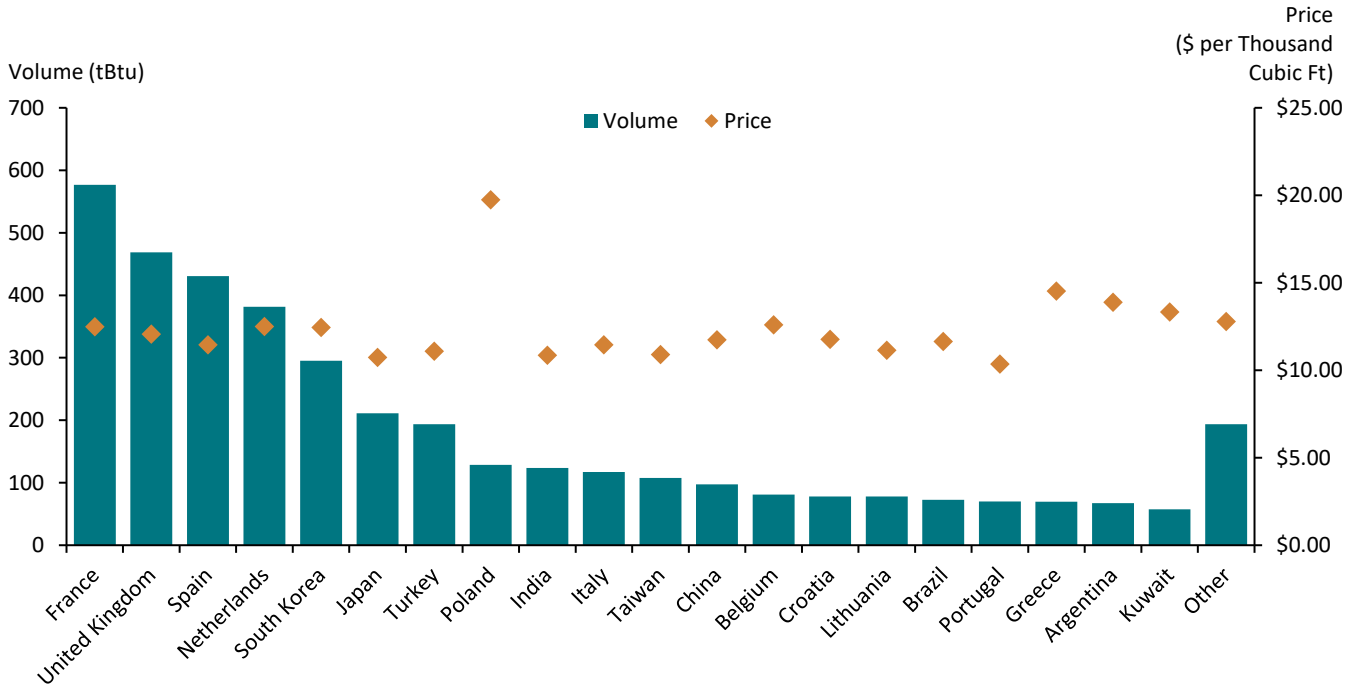
Liquefied Natural Gas

- Global natural gas demand declined by 1.5% in 2022, while the International Energy Agency estimated that global LNG trade grew by 5.4%. LNG imports increased by 63% in Europe amid a decrease in pipeline supply from Russia.[19]
- The U.S. exported more than 3,866 billion cubic feet of LNG in 2022, up 8.6% from 2021, trailing only Australia and Qatar in total exports.[20] U.S. exports increased despite the prolonged outage of the Freeport natural gas terminal due to an explosion in June 2022.[21]
- The growth in U.S. LNG exports was supported by price differentials between the U.S. and European markets and by a continued increase in LNG export terminal capacity.
- The U.S. now has seven facilities and 35 liquefaction units (referred to as "trains") in service.[22] Liquefaction capacity investments in the U.S. are continuing with four projects currently under construction and 10 projects awaiting a final investment decision.[23]
- About 64% of U.S. LNG exports went to Europe in 2022, 74% of which were shipped to terminals located in France, the UK, Spain, and the Netherlands.[24] Europe became once again the largest destination for U.S. LNG exports.
- U.S. LNG exports to Europe grew by 140% in 2022. For the first time, the U.S. exported LNG to terminals located in Germany and Finland in 2022.[25]

"The United States became the world's top LNG exporter in 2023 and is poised to remain in the lead for the foreseeable future."

Laurent Samuel, Cornerstone Research

Figure 4: U.S. Liquefied Natural Gas Exports and LNG Prices by Country
2022



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

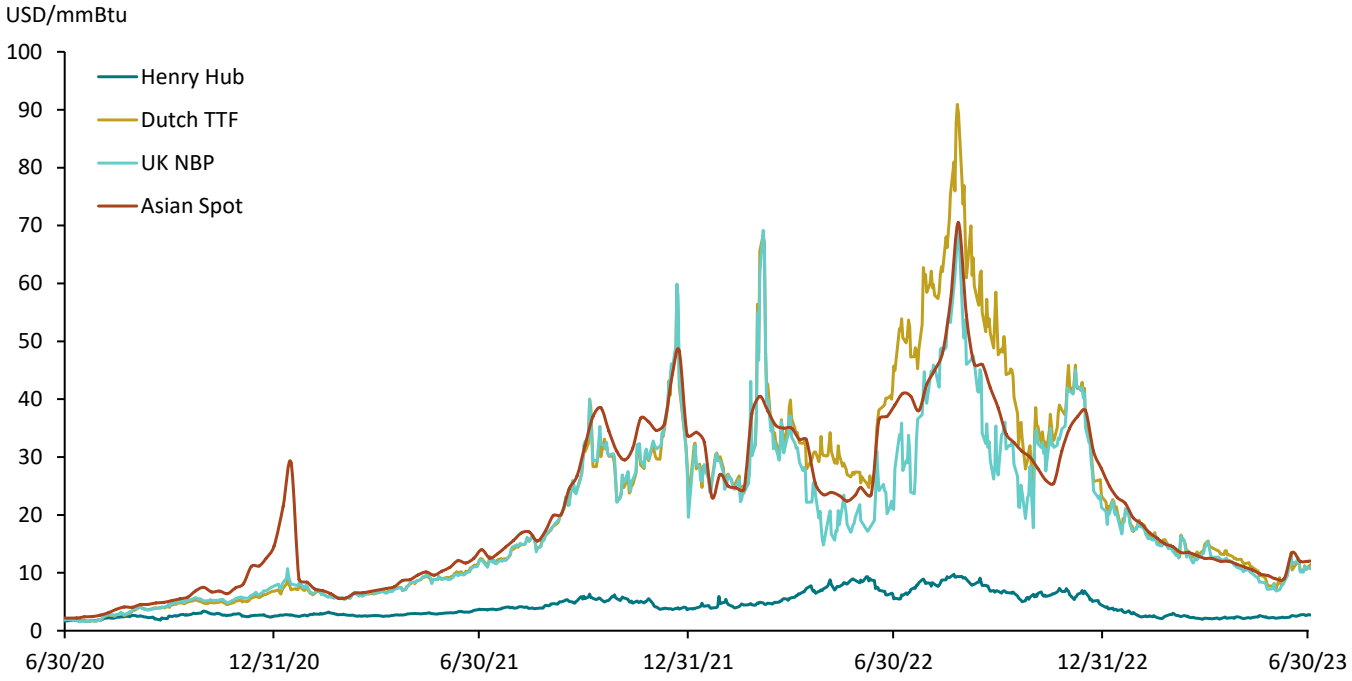
Note: tBtu conversion uses 2022 Btu per cubic foot for Natural Gas Exports Heat Content. Volumes are converted from millions of cubic feet to tBtu using the Natural Gas Export Heat content reported by the EIA. LNG prices are export-location specific. "Other" includes Truck Exports to Canada, Truck and Vessel Exports to Mexico, and Vessel Exports to Antigua and Barbuda, the Bahamas, Bangladesh, Barbados, Chile, Colombia, the Dominican Republic, Finland, Germany, Haiti, Indonesia, Jamaica, Jordan, Malta, Mexico, Pakistan, Panama, Singapore, Thailand, and the United Arab Emirates.

- U.S. LNG exports to Asia decreased by 46% in 2022. Exports to China decreased by 78.7% to 96.7 billion cubic feet because of reduced demand and high prices. Overall, the share of U.S. LNG exports to Asia dropped from 47% to 23% between 2021 and 2022.[26]
- U.S. LNG exports to the Caribbean and to Central and South America declined by approximately 60% in 2022. U.S. combined exports of natural gas to Mexico by vessel, truck, and pipeline increased by 4% in 2022.[27]
- The average export price of U.S. LNG jumped by 61% between 2021 and 2022, continuing a trend that started in 2017. Prices of U.S. LNG exports increased for every single destination in 2022, with Germany and Poland seeing the highest prices.[28]

High prices in Europe relative to Henry Hub increased opportunities for intercontinental arbitrage and bolstered demand for U.S. LNG.

- Asian and European prices increased during 2022 amid a decrease in pipeline deliveries from Russia and a rush to fill storage facilities before the winter. Dutch TTF prices reached almost $91/mmBtu at the end of August 2022.
- Asian and European price levels and volatility decreased in the first quarter of 2023 following a milder-than-expected winter and an increase in LNG imports.
- Driven by increased demand from LNG exporters, Henry Hub spot prices averaged $6.45/mmBtu in 2022, which represents a 65.8% increase from 2021 and the highest yearly average since 2008. Daily spot prices decreased by 33% in June 2022 following an explosion at the Freeport liquefaction terminal.[29]
- In January 2023, the monthly average price dropped by 41% to $3.27/mmBtu driven by mild temperatures across the United States and increased production. As of October 31, 2023, the Henry Hub average monthly price has remained below $3/mmBtu.

Figure 5: Evolution of Spot Gas Prices
June 2020–June 2023



Source: Refinitiv

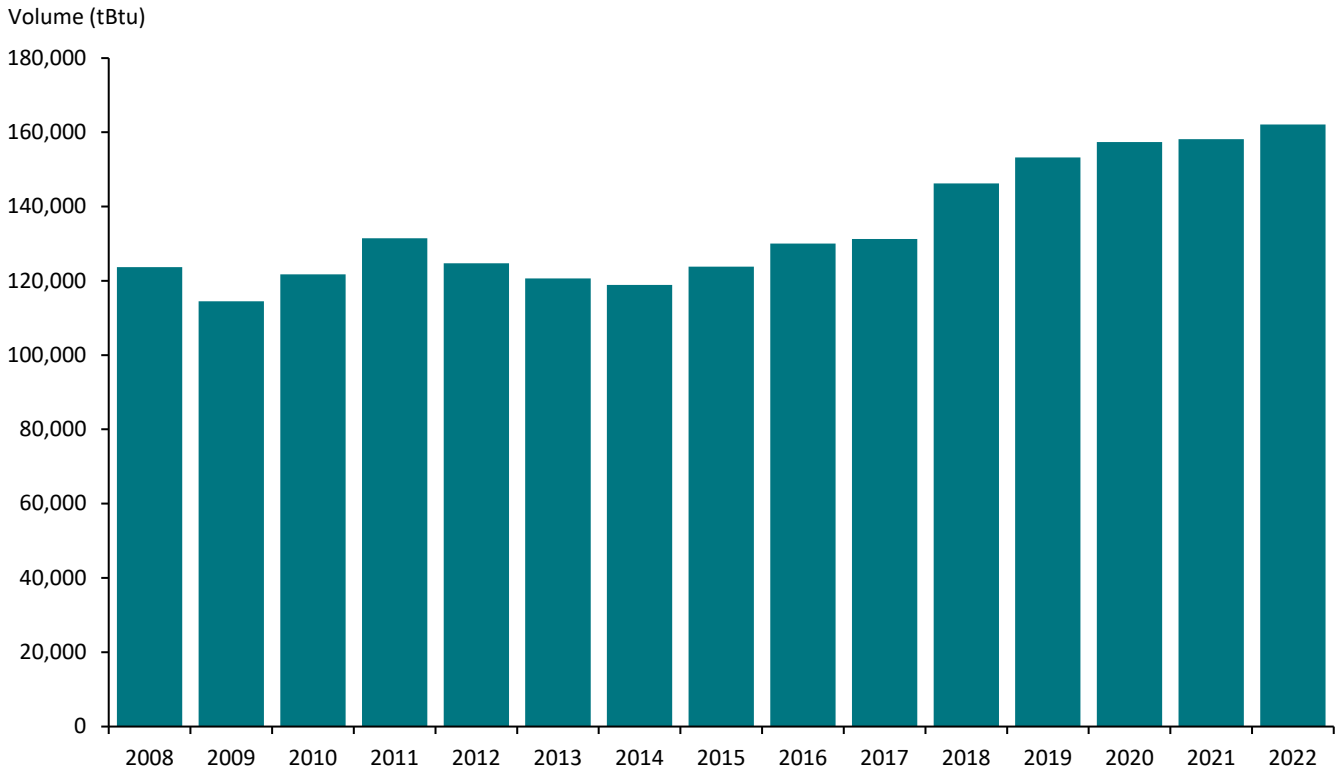
Note: The TTF front month price is converted from USD/MWh to USD/mmBtu using a conversion rate of 3.4121416331279 mmBtu per MWh. See https://www.aqua-calc.com/convert/energy/megawatt-hour-to-british-thermal-unit.

Market Volume

- Form 552 volumes increased for the eighth consecutive year in 2022, and did so at a faster rate than in 2021. Total reported volume grew about 2.5% between 2021 and 2022, compared to 0.5% between 2020 and 2021 and 2.7% between 2019 and 2020.
- Trading activity reported in Form 552 submissions in 2022 totaled 162,128 tBtu, transacted by 671 respondents. There were 676 respondents in 2021.
- Form 552 volumes in 2022 represented a minimum of 81,763 tBtu of trading volume, which is 1,946 tBtu more than the 2021 minimum trading volume of 79,817.[30]

Total volumes reported to FERC increased by 2.5% in 2022, reaching an all-time high of 162 quadrillion Btu. Total volumes have increased by 36% since 2014.

Figure 6: Total Reported Volume
2008–2022



Source: FERC Form 552 submissions as of July 17, 2023
Note: One tBtu equals one million mmBtu.

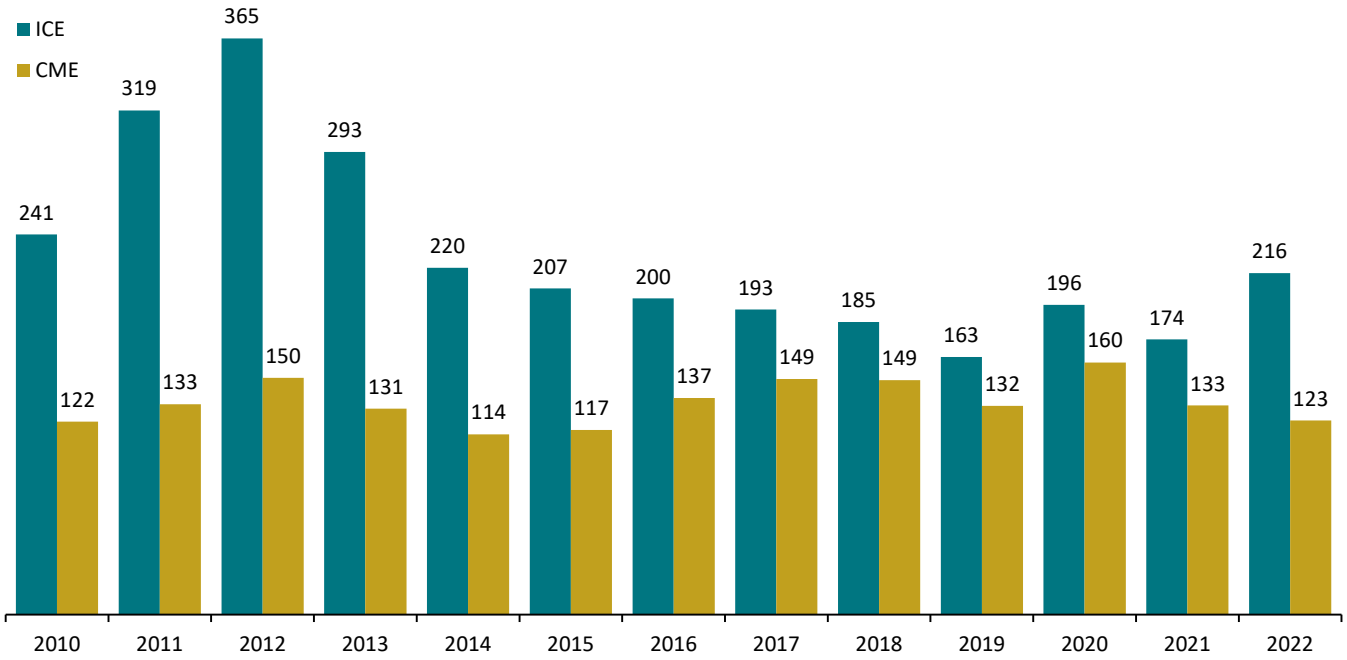
Exchange Trading

- Aggregate exchange trading of North American natural gas futures and options contracts rose in 2022 after a decline in 2021, with CME trading activity decreasing and ICE trading activity increasing.
- ICE North American natural gas contract volume increased by 24% in 2022 after declining by 11% in 2021. This reversed ICE's downward trend for the past decade (negative 41% between 2012 and 2022).
- In 2022, trading of North American natural gas products on CME decreased by 8%. This followed a decline of 17% in 2021.[31]
- In their 10-K filings for 2022, both exchanges highlighted the effect of the ongoing war in Ukraine on natural gas markets. CME mentioned that the war "continued to cause disruptions to the global energy markets,"[32] while ICE stated that the war created "elevated price volatility."[33]
- Global natural gas contracts are also traded on other platforms. For instance, UK NBP Natural Gas Futures and Dutch TTF Natural Gas Futures are listed on ICE's European platform. TOCOM launched an LNG futures contract in 2022.[34] NASDAQ ceased its natural gas derivatives operations in June 2020.[35]

Combined trading activity on ICE and CME increased by roughly 11% in 2022.

Figure 7: ICE and CME Natural Gas Contracts Traded
2010–2022

(Millions)



Source: ICE Form 10-Ks; ICE Market Data Report Center; CME Form 10-Ks; CME Group NYMEX/COMEX Exchange Volume Report – Monthly

Note: Due to ICE's conversion of swaps to futures in October 2012, the ICE 10-K reports an aggregated total of natural gas futures, options, and cleared over-the-counter (OTC) contracts. In its 2012 10-K, ICE provides comparable totals for 2011 and 2010 to reflect the 2012 reclassification. The figures reflect only North America contract volume for all years except 2012, which reflects worldwide contract volume. In 2012, the Non–North America contract volume accounts for less than 3% 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 they have been multiplied by 250 to convert them to annual values.

Transaction Volume

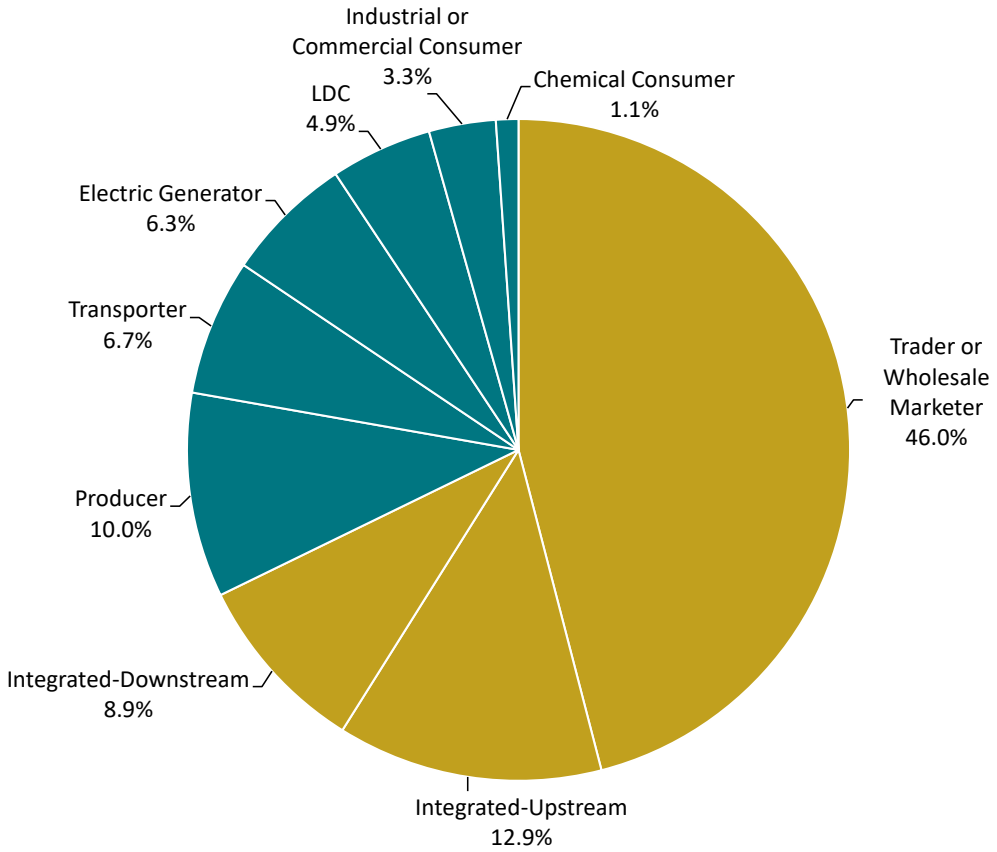
Cornerstone Research supplements FERC Form 552 data with proprietary research that classifies the respondent companies by industry segments. Companies are classified by their primary natural gas business activity, yielding unique insights into the natural gas market.

- Generally, the shares of trading volume attributed to each industry segment of market participant have remained relatively stable over recent years.
- The share of Form 552 natural gas volume attributed to large integrated-upstream and integrated-downstream companies and traders or wholesale marketers (shown in gold in the figure below) decreased between 2011 and 2022 (from 72% to 68% of all transaction volume).

The shares of trading volume attributed to each industry segment of market participants have remained relatively stable over recent years.

- Industrial or commercial consumers and chemical consumers accounted for about 4% of total 2022 Form 552 trading volume.

Figure 8: Transaction Volume by Industry Segment
2022



Source: FERC Form 552 submissions as of July 17, 2023
Note: Percentages may not add up to 100% due to rounding.

Purchase and Sale Volume

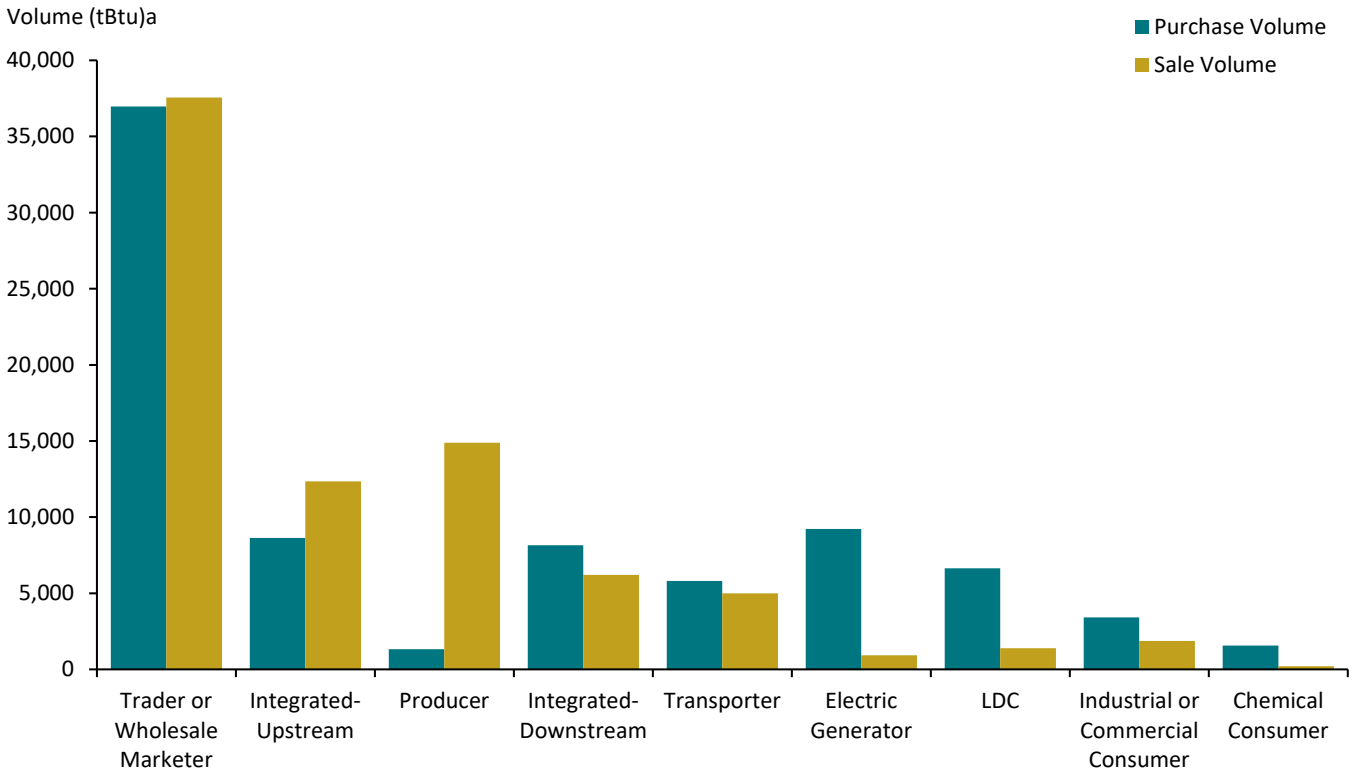
As would be expected, companies primarily engaging in "upstream" or "downstream" activities are net sellers or buyers of natural gas, respectively, while "midstream" companies buy and sell in approximately equal amounts.[36]

- The breakdown of Form 552 purchases and sales by industry segment shows that producers and integrated-upstream companies sold more natural gas than they purchased in 2022.

Electric generators and local distribution companies remained the largest net purchasers of natural gas.

- Although the total volume transacted increased, the number of times a molecule of natural gas was traded from production to consumption was lower in 2022 compared to 2021 (2.70 vs. 2.78).[37]
- Integrated-downstream companies, local distribution companies (LDCs), electric generators, industrial or commercial consumers, and chemical consumers purchased significantly more than they sold in 2022.
- Consistent with their business model, traders or wholesale marketers and transporters purchased and sold approximately equal amounts in 2022.
- The total purchased volume by producers has steadily decreased since 2020, with a 20% decrease from 2020 to 2021 and a 22% decrease from 2021 to 2022.

Figure 9: Purchase and Sale Volume by Industry Segment
2022



Source: FERC Form 552 submissions as of July 17, 2023
Note: One tBtu equals one million mmBtu.

Top 20 Companies

The list of 20 companies with the largest total transaction volumes indicates that the U.S. natural gas market continues to have a number of diverse participants. Eighteen of the top 20 companies in 2022 were among the leading 20 companies in 2021.

- The top 20 companies accounted for 65,479 tBtu of 162,128 tBtu, or approximately 40% of volume reported on Form 552 submissions in 2022. This share of volume is consistent with that of recent years.
- BP Energy Company had the highest physical volumes for the 15th consecutive year at 5,458 tBtu, an approximately 7% decrease from 2021. BP's volume was 4% higher than the second-largest trader.
- Two companies fell from the top 20: Trafigura Trading and CIMA Energy.
- EDF Trading North America and Sequent Energy Management entered the top 20 in 2022.
- Seven of the top 20 companies reported to price index publishers in 2022, the same number as in 2021. Fourteen of the top 20 companies reported to price index publishers in 2008 according to Form 552 submissions. However, the number of companies with transactions in the index assessments is likely higher than seven, since price index publisher Platts began incorporating anonymized transactions from ICE's trading platform in its daily assessments in 2017.[38]

The top 20 companies accounted for 40% of total volume reported to FERC.

Figure 10: Top 20 Companies by Total Reported Volume
2022 (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
1	BP Energy Company	Y	2,581	2,877	-296	5,458	933
2	Tenaska Marketing Ventures	Y	2,779	2,444	335	5,223	1,341
3	Macquarie Energy LLC	Y	2,377	2,319	58	4,696	910
4	ConocoPhillips Company	Y	2,233	2,373	-140	4,605	392
5	Shell Energy North America (US), L.P.	Y	2,281	2,070	211	4,351	587
6	Sequent Energy Management LLC	N	1,979	2,048	-70	4,027	490
7	Koch Energy Services, LLC	N	1,908	1,539	369	3,447	621
8	ICE NGX Canada Inc.	N	1,615	1,615	0	3,230	931
9	NextEra Energy Marketing, LLC	Y	1,433	1,675	-242	3,108	201
10	EQT Energy, LLC	N	563	2,526	-1,963	3,089	280
11	Citadel Energy Marketing LLC	N	1,439	1,395	44	2,834	822
12	DTE Energy Trading, Inc.	N	1,406	1,340	66	2,746	16
13	Morgan Stanley Capital Group Inc.	N	1,408	1,286	122	2,694	170
14	Vitol Inc.	N	1,322	1,277	45	2,599	415
15	Twin Eagle Resource Management, LLC	N	1,448	1,142	306	2,590	507
16	Chevron U.S.A. Inc.	N	1,118	1,300	-182	2,419	226
17	Mercuria Energy America, LLC	N	1,030	1,116	-86	2,146	372
18	Energy Transfer LP	Y	675	1,422	-747	2,097	206
19	EDF Trading North America, LLC	N	1,145	928	218	2,073	374
20	Direct Energy Marketing Inc.	N	1,440	609	830	2,049	181
	Top 20 Companies by Total Volume		32,179	33,300	-1,122	65,479	9,974
	All Other Companies		49,584	47,065	2,519	96,648	12,453
	Total for All Companies		81,763	80,365	1,398	162,128	22,427

Source: FERC Form 552 submissions as of July 17, 2023

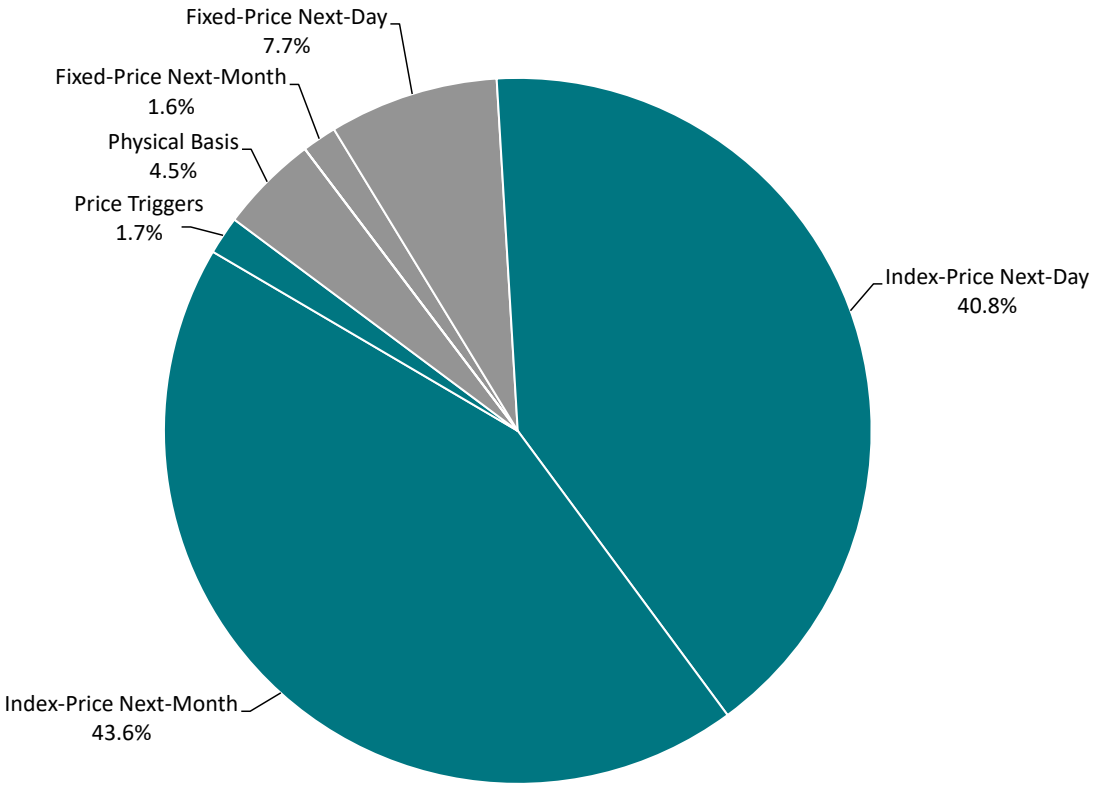
Note: Company-specific numbers may not add up to indicated totals due to rounding. One tBtu equals one million mmBtu. "Volume Reportable to Indices" includes the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552.

Transaction Types

- Between 2021 and 2022, index-priced next-day transactions remained constant at 41%, and index-priced next-month transactions remained stable at approximately 44%.[39]
- Over the same period, index-priced next-day transaction volume decreased slightly from 85% to 84% of total next-day volume.
- Index-priced next-month transaction volume comprised 96% of total next-month transaction volume in 2022.
- Since 2008, transactions that reference the monthly index have been the most prevalent among index-priced transactions.
- The share of index-priced transactions increased from 67% to 84% between 2008 and 2022.
- Between 2021 and 2022, the share of next-day transactions increased slightly from 48% to 49%. The share of next-month transactions decreased slightly, from 46% in 2021 to 45% in 2022.
- In 2022, fixed-price next-month transactions replaced price triggers as the least prevalent transaction type, comprising less than 2% of Form 552–reported transactions.

Since 2008, index-priced transactions have comprised an increasing share of Form 552–reported transactions, while the percentage of fixed-price transactions has steadily declined.

Figure 11: Transaction Volume by Transaction Type
2022

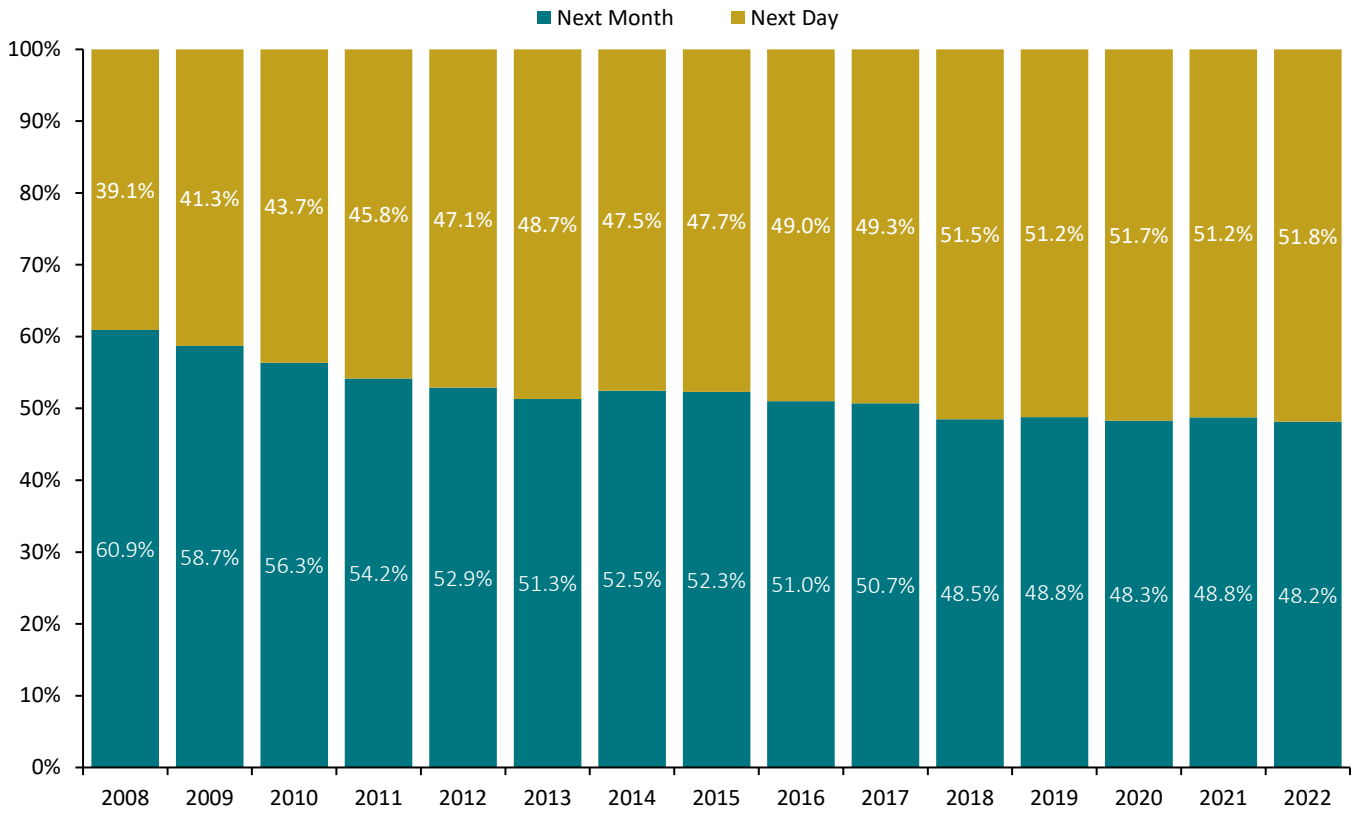


Source: FERC Form 552 submissions as of July 17, 2023
Note: Percentages may not add up to 100% due to rounding.

- Next-day transactions have increased relative to next-month transactions since 2008. Additionally, the volume of fixed-price transactions as a percentage of total transaction volume declined.[40]
- The percentage of volume based on next-month transactions compared to next-day transactions has decreased by 13 percentage points between 2008 and 2022 (from 61% to 48%). This percentage has remained stable and just below 50% since 2018.

The split between next-day and next-month index transactions is relatively even.

Figure 12: Next-Month and Next-Day Transaction Volume across Both Fixed-Price and Index-Priced Transactions 2008–2022



Source: FERC Form 552 submissions as of July 17, 2023
Note: Percentages may not add up to 100% due to rounding.

Reporting to Price Index Publishers

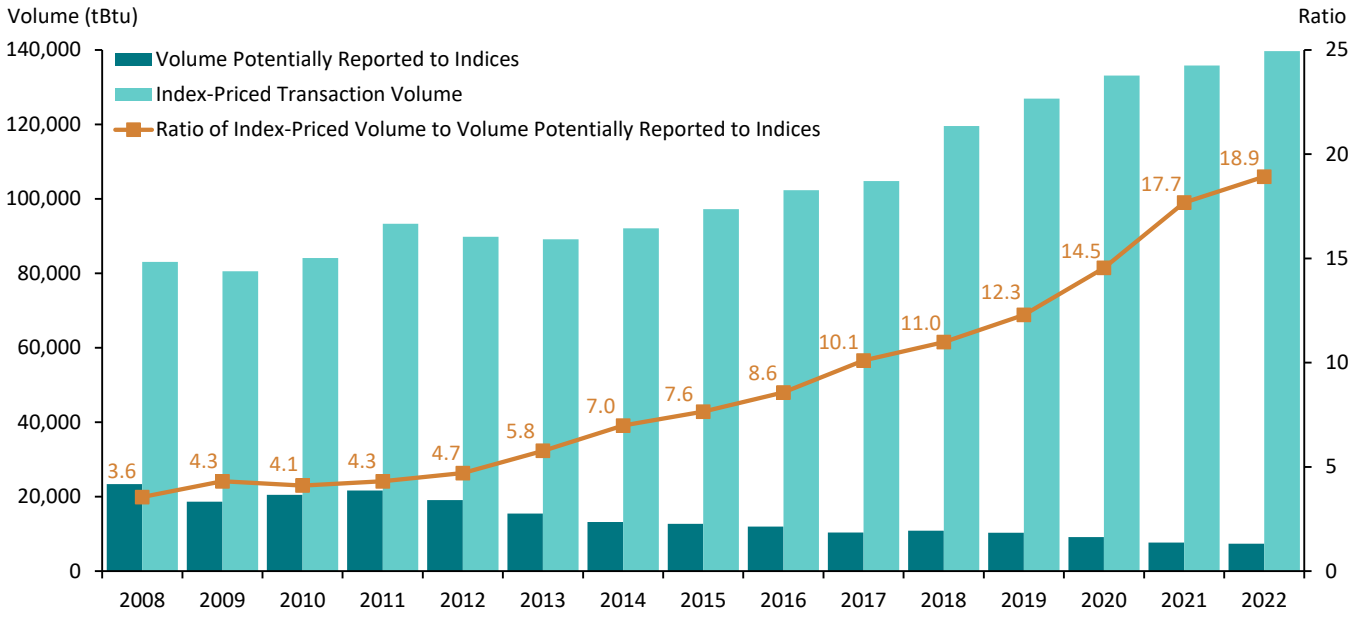
In Order 704, FERC commented that understanding the relative sizes of the volume of index-priced transactions and reporting-eligible, fixed-price transactions was a core objective of mandating Form 552 submissions.[41]

- For the 12th year in a row, the Form 552 data show an increase in the ratio of index-priced volume dependent on indices to volume potentially reportable to indices.
- The substantial increase in this ratio between 2020 and 2021 resulted from a 2% increase in the volume of index-priced transactions relative to a 16% decrease in the fixed-price volume potentially reportable to indices.
- Continuing a nine-year trend, 2022 saw the largest volume of index-priced transactions reported to indices since the inception of Form 552 reporting in 2008, representing a 3% increase compared to 2021. The volume potentially reportable decreased by 4% in 2022.
- In 2022, the ratio of index-priced transactions to potentially reportable fixed-price transactions was the largest since the inception of Form 552 reporting.
- Since 2017, price index publisher Platts has been incorporating anonymized natural gas transactions from the ICE platform in its daily natural gas assessments. A company does not necessarily 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 necessarily included in the Form 552 reporting requirements.

"The continued shift to index-priced natural gas relative to fixed-price is a vote of confidence by entities with money at stake."

Greg Leonard, Cornerstone Research

Figure 13: Total Volumes Potentially Reported to Indices versus Transaction Volumes Priced Based on Indices 2008–2022



Source: FERC Form 552 submissions as of July 17, 2023

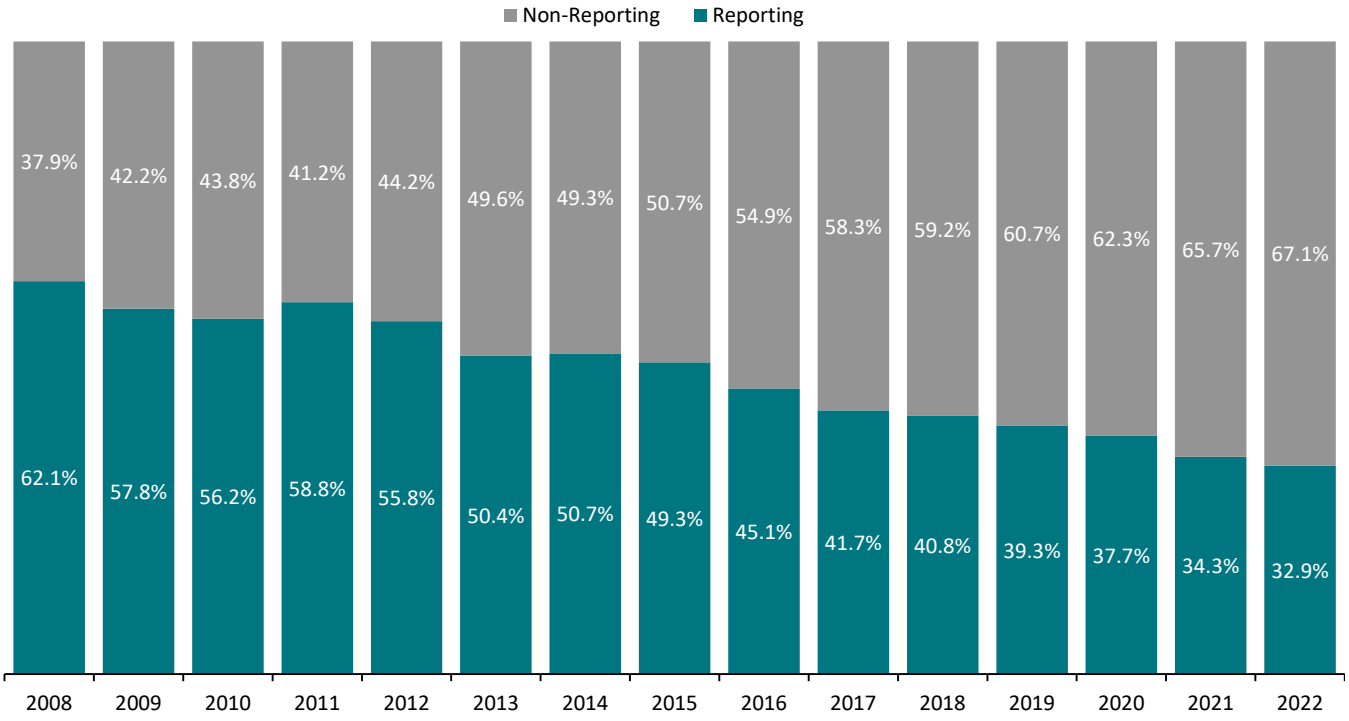
Note: Reportable volume is the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552. Companies that did not enter information regarding their price reporting are assumed to not report. One tBtu is equal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

Form 552 submissions also provide information on which companies had volume eligible to be reported (i.e., fixed-price transactions) and whether they reported that volume to the indices.[42]

- The percentage of fixed-price volume transacted by non-reporting companies increased slightly from 66% to 67% between 2021 and 2022.
- Of the 671 respondents in 2023, 95 (about 14%) reported transaction information to the price index publishers for themselves or at least one affiliate.
- The reporting companies accounted for 33% of the reporting-eligible, fixed-price volume in 2022, compared to more than 62% in 2008.
- Analysts have offered multiple hypotheses explaining why companies did not report to indices, including (1) the FERC safe harbor provision was not safe enough to protect against inadvertent errors, and (2) costs associated with internal systems and regulatory risk were too high.[43]

For the eighth 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 14: Fixed-Price Volume by Reporting versus Non-Reporting Companies
2008–2022



Source: FERC Form 552 submissions as of July 17, 2023

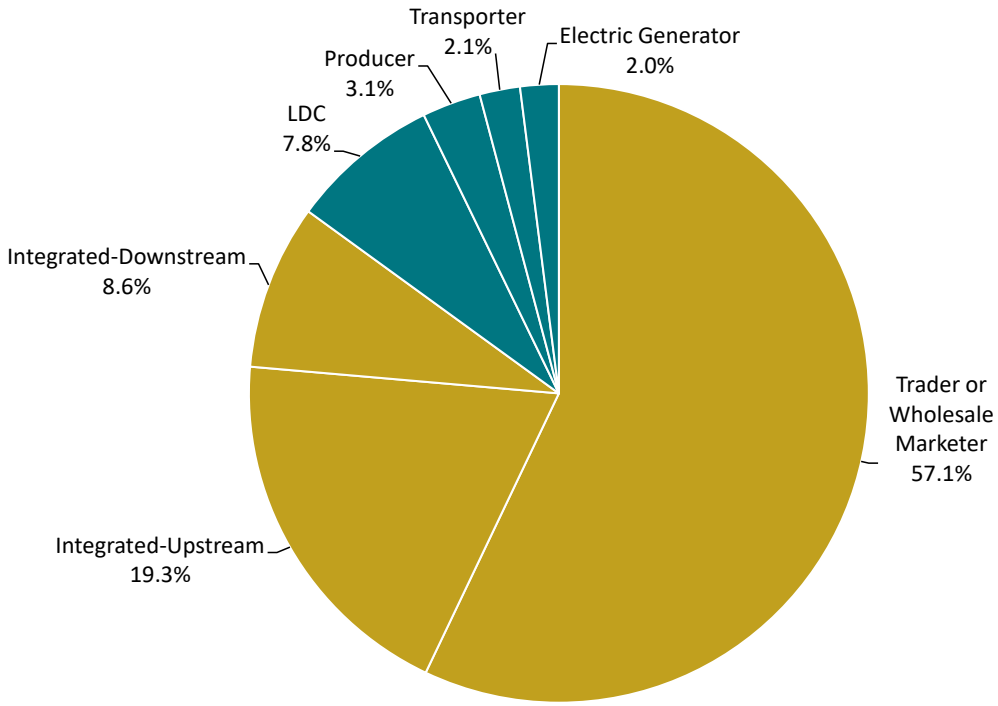
Note: Reportable volume is the sum of fixed-price next-month purchases and sales, fixed-price next-day purchases and sales, and physical-basis-transaction volume reported on Form 552. Companies that did not enter information regarding their price reporting were assumed to not report. Percentages may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

Fixed-Price Volume by Industry Segments

- Integrated-upstream companies, integrated-downstream companies, traders, and wholesale marketers (shown in gold in the figure below) accounted for approximately 85% of the fixed-price volume potentially reported to the price index publishers in 2022.[44]
- Seven of the top 20 companies by total transaction volume reported to index publishers in 2022. These seven companies accounted for 62% of the fixed-price volume potentially reported to price index publishers.[45]

Traders and wholesale marketers traded the majority of the potentially reported fixed-price volume.

Figure 15: Fixed-Price Volume for Entities Reporting to Price Index Publishers by Company Type
2022



Source: FERC Form 552 submissions as of July 17, 2023

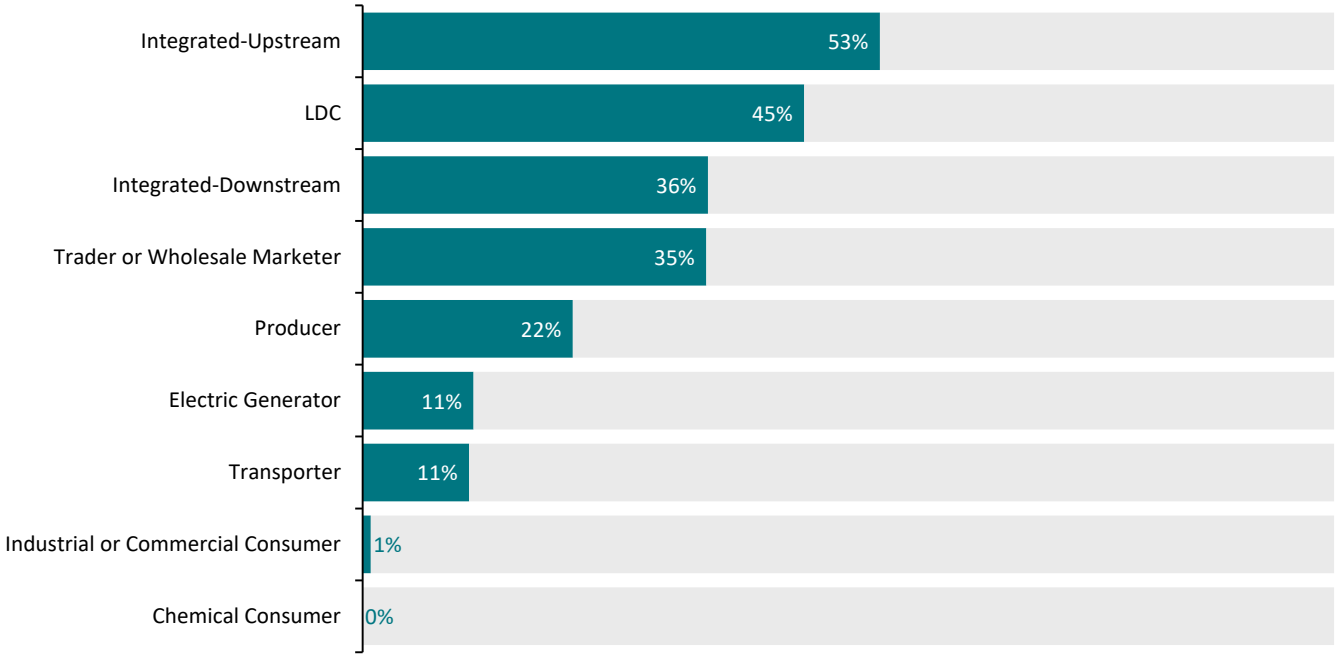
Note: Industrial or commercial consumer and chemical consumer companies reported less than 0.2% of reportable volume and are not included. Percentages may not add up to 100% due to rounding.

In 2022, the share of fixed-price volume reported by producers decreased from 37% to 22% compared to 2021. Integrated-downstream companies reported approximately 36% of fixed-price transaction volume to indices in 2022, an increase of about 5 percentage points compared to 2021.

- A majority of transactions (53%) executed by integrated-upstream companies took place at companies that report to price index publishers. In 2021, these companies' reported share of fixed-price volume was 56%.
- The share of fixed-price volume reported to index publishers by LDCs and traders or wholesale marketers remained stable in 2022, at 45% and 35%, compared to 44% and 36% in 2021, respectively.
- Companies with a primary business outside the natural gas markets—such as industrial or commercial consumers and chemical consumers—reported less than 1% of their combined fixed-price transaction volume to indices.

Fixed-price transactions reported by integrated-upstream companies decreased by 3 percentage points compared to 2021.

Figure 16: Percentage of Fixed-Price Volume Reported to Price Index Publishers by Industry Segment
2022



Source: FERC Form 552 submissions as of July 17, 2023
Note: Of the 671 respondents in 2022, 95 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 "leading derivatives marketplace" that offers "global benchmark products across all major asset classes" so that businesses can "manage risk and achieve growth." 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." https://www.energy.ca.gov/resources/energy-glossary

Dutch Title Transfer Facility (TTF): A principal natural gas trading hub in Europe. It is the virtual trading hub for the natural gas market in the Netherlands. https://www.cmegroup.com/rulebook/NYMEX/11/1159.pdf

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/media/form-552-cy-2022

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/media/form-552-cy-2022

Fixed-price, next-day delivery: "[D]elivery of natural gas pursuant to a transaction executed prior to NAESB [North American Energy Standards Board] nomination deadline (1:00 pm Central Prevailing Time) on one day for uniform physical delivery over the next pipeline day." https://www.ferc.gov/media/form-552-cy-2022

Fixed-price, next-month delivery: "[D]elivery of natural gas pursuant to a transaction executed during the last five (5) business days of one month (bidweek) for uniform physical delivery over the next month." https://www.ferc.gov/media/form-552-cy-2022

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): An electronic marketplace that connects participants in major markets and offers the ability to manage risk and make informed decisions. https://www.intercontinentalexchange.com/about

International Energy Agency (IEA): An autonomous intergovernmental organization that "recommends policies that enhance the reliability, affordability and sustainability of energy." https://www.iea.org/about/

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.

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/index.php?id=M

Midstream: Activity involving "transportation on intrastate and interstate pipeline systems that move natural gas through large-diameter pipelines to storage facilities and a variety of consumers."
https://www.ferc.gov/sites/default/files/2020-06/energy-primer-2020_Final.pdf

Natural gas plant liquids (NGPL): "Those hydrocarbons in natural gas that are separated as liquids at natural gas processing, fractionating, and cycling plants. Products obtained include ethane, liquefied petroleum gases (propane, normal butane, and isobutane), and natural gasoline."
https://www.eia.gov/tools/glossary/index.php?id=N

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/media/form-552-cy-2022

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/media/form-552-cy-2022

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

Upstream: "A term used in the petroleum industry referring to the exploration and production side of the business."
https://www.energy.ca.gov/resources/energy-glossary

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 (EPAct 2005), which authorized FERC to "facilitate price transparency in markets for the sale or transportation of physical natural gas in interstate commerce" (§ 316). The EPAct 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 1,100 respondents. On June 17, 2010, FERC issued Order 704-C, which provided for slightly revised reporting rules that eased some reporting requirements.[46] For 2022 natural gas transactions, Form 552 submissions covered 671 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.[47] The latter two categories capture companies that span multiple industry segments.[48]

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."[49] Order 704-A (p. 9) further defines the transactions that could be reported to an index publisher as any "bilateral, arms-length, fixed[-]price physical natural gas transactions between non-affiliated 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 a price index publisher. The criteria for reporting to a price index 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; and index-price referencing next-month indices, transactions with price triggers,[50] and physical-basis transactions.[51] In addition to volumes of physical transactions, market participants are required to state whether they report transaction information to the price index publishers.

Endnotes

[1] Data as of July 17, 2023, were used for all respondents.

[2] A respondent is defined as a unique reporting company-respondent combination as reported on FERC Form 552.

[3] Calculated as minimum trading volume of 81,763 tBtu from Figure 10 divided by 30,244 tBtu of natural gas delivered to consumers reported by the EIA. See Endnote 30 for an explanation of how minimum trading volume is calculated from Figure 10. See also "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). One cubic foot = 1,036 Btu, the annual Total Consumption conversion factor in the EIA time series "Approximate Heat Content of Natural Gas (Btu per Cubic Foot)," EIA, https://www.eia.gov/dnav/ng/ng_cons_heat_dcu_nus_a.htm.

[4] "Nonfossil Fuel Energy Sources Accounted for 21% of U.S. Energy Consumption in 2022," EIA, June 29, 2023, https://www.eia.gov/todayinenergy/detail.php?id=56980.

[5] "Short-Term Energy Outlook (STEO)," EIA, June 7, 2022, https://www.eia.gov/outlooks/steo/archives/jun22.pdf.

[6] "Short-Term Energy Outlook (STEO)," EIA, October 11, 2023, https://www.eia.gov/outlooks/steo/archives/oct23.pdf ("2023 October EIA STEO Report").

[7] 2023 October EIA STEO Report.

[8] "Gas Market Report Q2-2023," IEA, p. 5, https://iea.blob.core.windows.net/assets/6f2f0dcc-72af-4c01-bcc7-fbfe690ab521/GasMarketReportQ22023.pdf.

[9] "U.S. Natural Gas Exports and Re-Exports by Country," EIA, https://www.eia.gov/dnav/ng/NG_MOVE_EXPC_S1_A.htm ("EIA U.S. Natural Gas Exports Data").

[10] EIA U.S. Natural Gas Exports Data.

[11] EIA U.S. Natural Gas Exports Data.

[12] "Short-Term Energy Outlook (STEO)," EIA, January 11, 2022, https://www.eia.gov/outlooks/steo/archives/jan22.pdf.

[13] "Short-Term Energy Outlook (STEO)," EIA, May 10, 2022, https://www.eia.gov/outlooks/steo/archives/may22.pdf.

[14] "U.S. Natural Gas Production Grew by 4% in 2022," EIA, March 29, 2023, https://www.eia.gov/todayinenergy/detail.php?id=56000.

[15] "U.S. Natural Gas Consumption Set Nine Monthly Records and an Annual Record in 2022," EIA, March 14, 2023, https://www.eia.gov/todayinenergy/detail.php?id=55800.

[16] EIA U.S. Natural Gas Exports Data.

[17] "Natural Gas Gross Withdrawals and Production," EIA, https://www.eia.gov/dnav/ng/ng_prod_sum_dc_NUS_mmcf_a.htm.

[18] "Henry Hub Natural Gas Spot Price," EIA, https://www.eia.gov/dnav/ng/hist/rngwhhdA.htm.

[19] "Gas Market Report Q1-2023," IEA, https://iea.blob.core.windows.net/assets/c6ca64dc-240d-4a7c-b327-e1799201b98f/GasMarketReportQ12023.pdf ("IEA Gas Market Report Q1-2023"), p. 44.

[20] EIA U.S. Natural Gas Exports Data; IEA Gas Market Report Q1-2023, p. 44.

[21] "Today In Energy – Fire Causes Shutdown of Freeport Liquefied Natural Gas Export Terminal," EIA, June 23, 2022, https://www.energy.gov/sites/default/files/2022-11/1.%20EIA%2C%20Fire%20Causes%20Shutdown%20of%20Freeport%20LNG.pdf.

[22] "U.S. Liquefaction Capacity," EIA, June 29, 2023, https://www.eia.gov/naturalgas/importsexports/liquefactioncapacity/U.S.liquefactioncapacity_2023_2Q.xlsx.

[23] "U.S. Liquefaction Capacity," EIA, June 29, 2023, https://www.eia.gov/naturalgas/importsexports/liquefactioncapacity/U.S.liquefactioncapacity_2023_2Q.xlsx.

[24] "Europe Was the Main Destination for U.S. LNG Exports in 2022," EIA, March 22, 2023, https://www.eia.gov/todayinenergy/detail.php?id=55920.

[25] EIA U.S. Natural Gas Exports Data.

[26] Figures for Asia exclude Middle Eastern countries. See EIA U.S. Natural Gas Exports Data; "China's Natural Gas Consumption and LNG Imports Declined in 2022, amid Zero-Covid Policies," EIA, June 1, 2023, https://www.eia.gov/todayinenergy/detail.php?id=56680.

[27] EIA U.S. Natural Gas Exports Data.

[28] EIA U.S. Natural Gas Exports Data.

[29] "Henry Hub Natural Gas Spot Price," EIA, https://www.eia.gov/dnav/ng/hist/rngwhhdA.htm.

[30] If both parties to a transaction submit a Form 552, the total volume submitted to FERC 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 submitted volume. The minimum volume that could be represented by Form 552 is the maximum of the buy and sale totals shown in Figure 10. 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.

[31] The figures reported by CME represent the average daily volume of its natural gas products, and 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.

[32] CME 2022 10-K, p. 39, https://investor.cmegroup.com/static-files/23927416-aa79-45ec-812d-5dda37ed64df.

[33] ICE 2022 10-K, p. 51, https://ir.theice.com/financials/sec-filings/default.aspx.

[34] "Japan's TOCOM Starts Trial Listing of Cash-Settled LNG Futures," S&P Global Commodity Insights, April 4, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/lng/040422-japans-tocom-starts-trial-listing-of-cash-settled-lng-futures.

[35] "Notice of Termination of Operations," NasdaqTrader, June 4, 2020, https://www.nasdaqtrader.com/MicroNews.aspx?id=FTA2020-33.

[36] Midstream refers to integrated-upstream, integrated-downstream, and transporters. Traders and wholesale marketers also have nearly equal levels of buying and selling through their role in market-making.

[37] See Endnote 3 for an explanation of how to estimate the number of times one molecule of natural gas is traded through from production to consumption.

[38] "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; "Platts Market Data – Natural Gas," S&P Global Platts, https://www.spglobal.com/commodityinsights/en/products-services/natural-gas/market-data-natural-gas; 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; "Natural Gas Trade Activity Numbers Leap after ICE Agreement," S&P Global Platts, June 7, 2018, https://www.spglobal.com/commodityinsights/en/market-insights/blogs/natural-gas/060718-natural-gas-trade-activity-numbers-leap-after-ice-agreement.

[39] Data do not cover all transactions in the OTC market, since Form 552 excludes certain types of non-index-priced transactions. See Appendix 2.

[40] Physical basis and price trigger trades are not included in this analysis.

[41] Order 704 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." Order 704, p. 4. See also Appendix 1.

[42] For the purposes of this analysis, physical-basis transactions are also included in the category of fixed-priced volume.

[43] 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.

[44] Calculated based on Figure 15: integrated-downstream plus integrated-upstream plus traders or wholesale marketers.

[45] Calculated based on Figure 10 and Figure 13. From Figure 10: seven of the top 20 companies have any affiliates that report to index publishers, which totals 4,570 tBtu. From Figure 13: the 2022 volume potentially reported to indices totals 7,383 tBtu. The 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.

[46] 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.

[47] The categorization process was necessarily judgmental and based on company websites and financial filings. Companies were categorized as closely as possible to their most significant natural gas market activity.

[48] 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.

[49] FERC Form 552 (2019 version). Note that Form 552 covers only physical natural gas transactions. Financial transactions, such as swaps and options, are excluded, as are futures contracts, regardless of whether they are taken to physical delivery.

[50] 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.

[51] 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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