

US-China Oil and Gas Industry Forum (OGIF) 2017

Gas Pipeline Development in the United States

A Discussion on the Regulatory Framework and Lessons Learned

15 November 2017 | Ningbo

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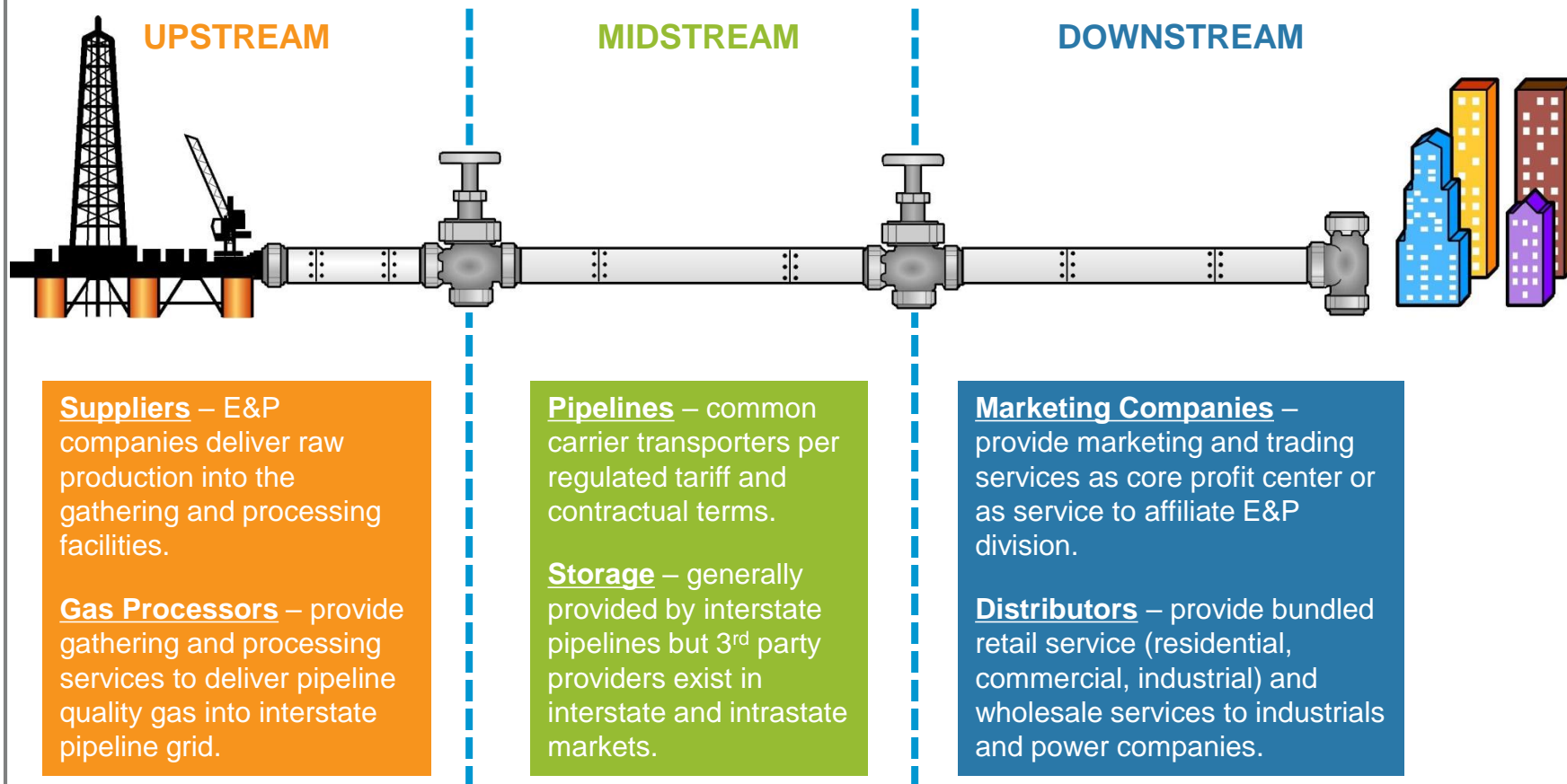
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Numerous players in every segment of gas value chain

Key players along the North American gas value chain

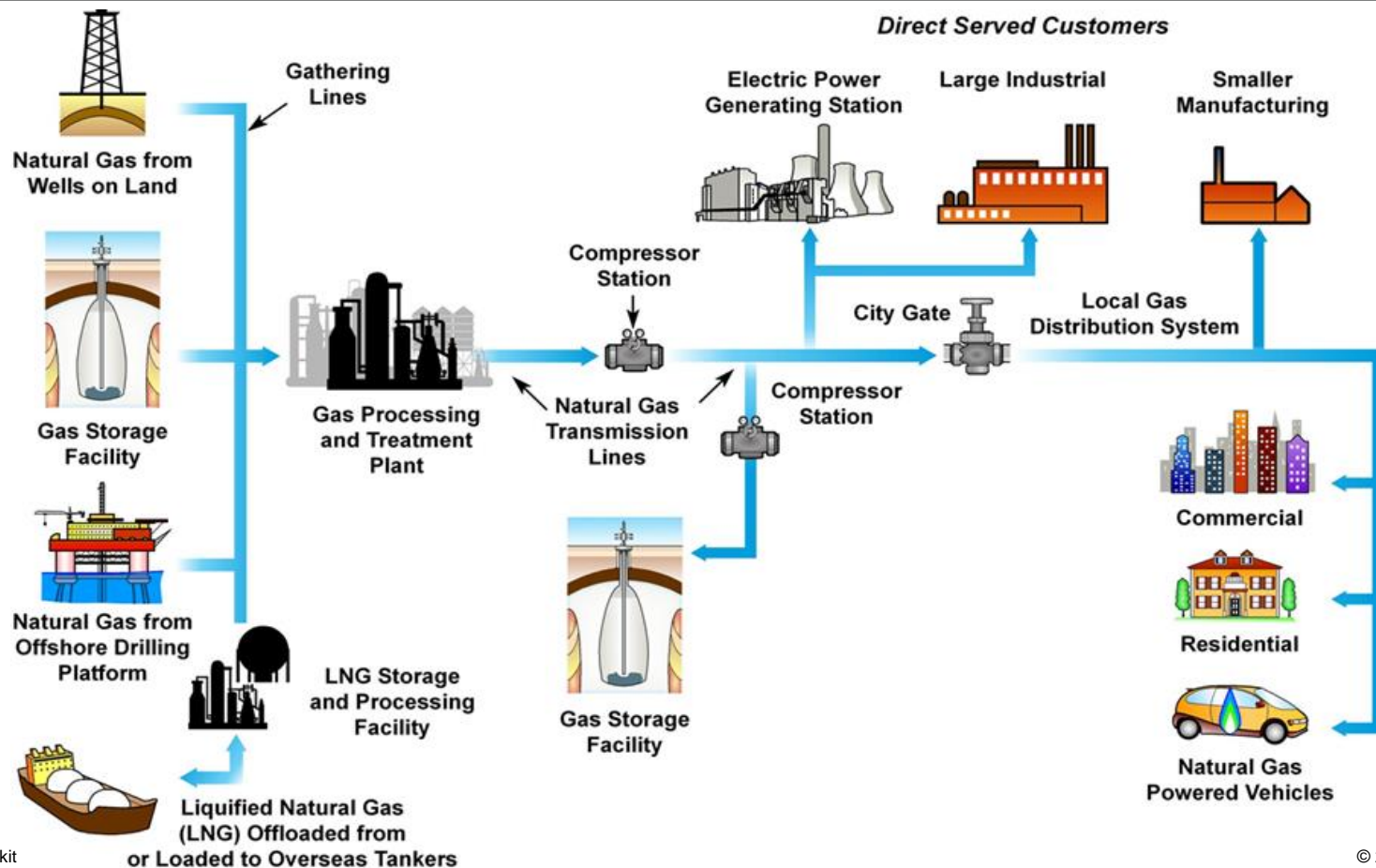


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Plenty of infrastructure in different parts of the gas business

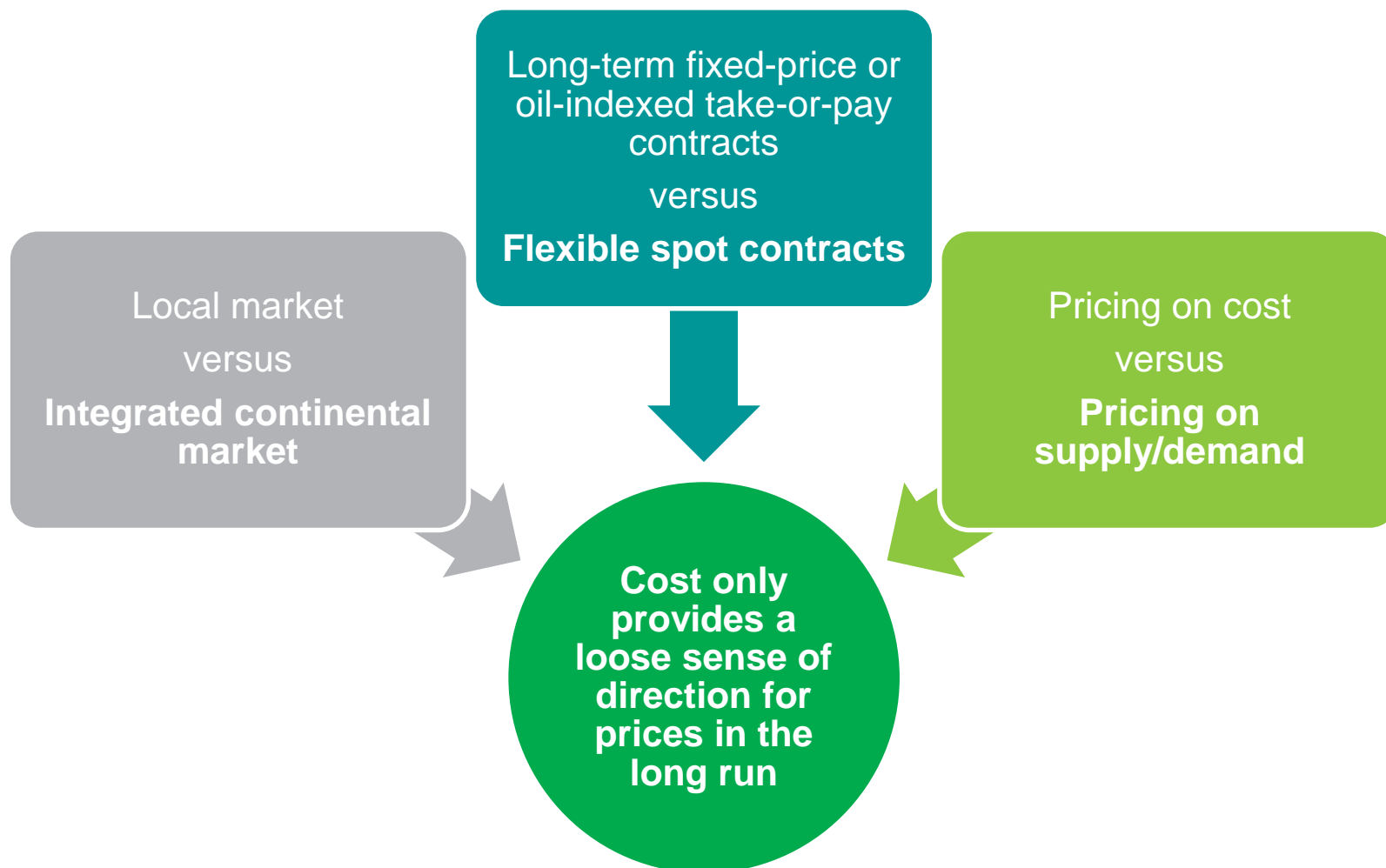
North American gas infrastructure



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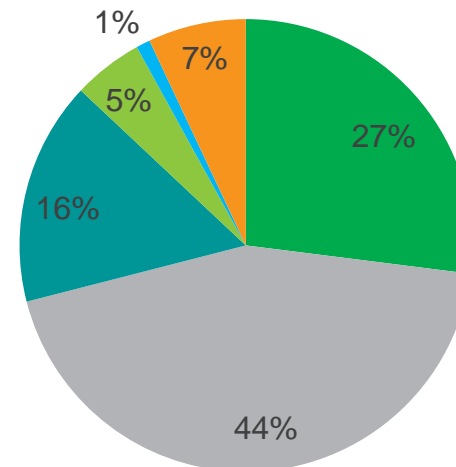
Common misconceptions about the North American gas market



Gas prices are determined by supply/demand fundamentals

Transaction volume breakdown by pricing mechanism

- Daily index
- Monthly index
- Fixed pricing next day delivery
- Fixed pricing next month delivery
- NYMEX trigger
- Physical basis



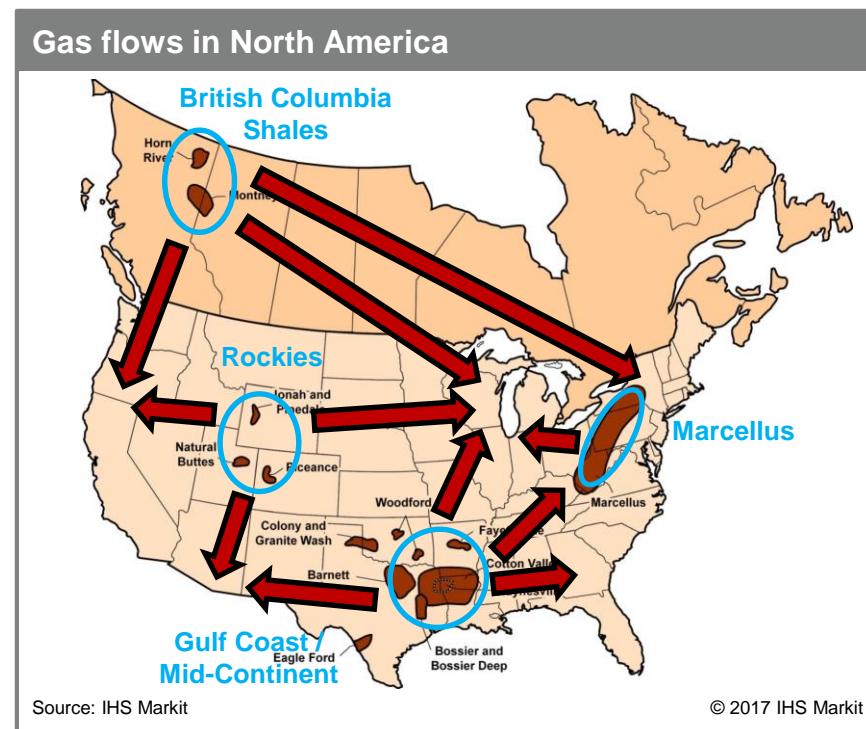
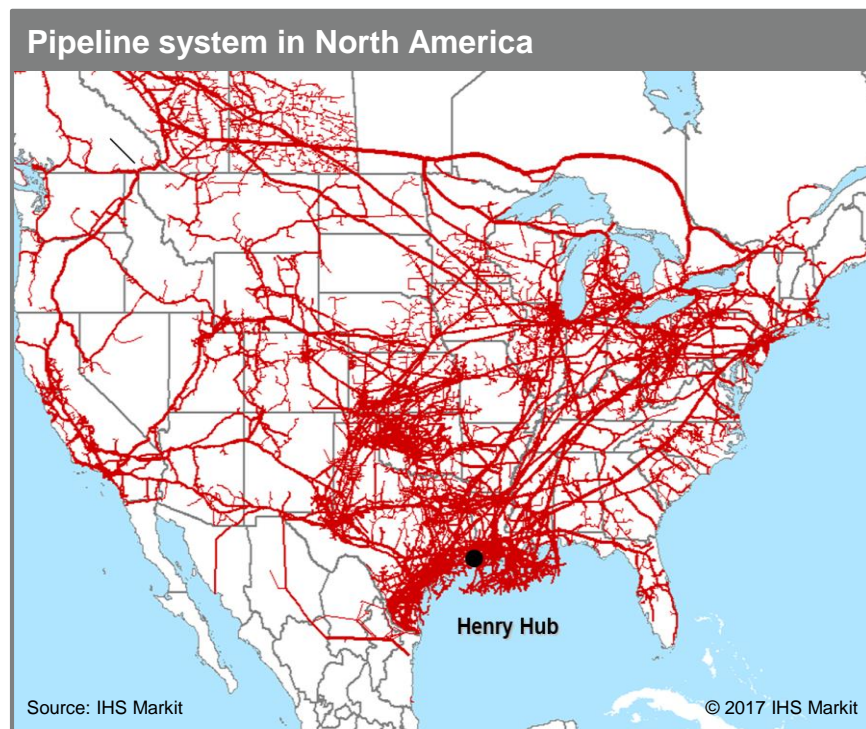
Note: Breakdown of FERC From 552 Reportable volumes for calendar year 2012, 123.9 Tcf or 339.4 Bcf per day.
Source: IHS Markit, FERC

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Gas is priced by trades

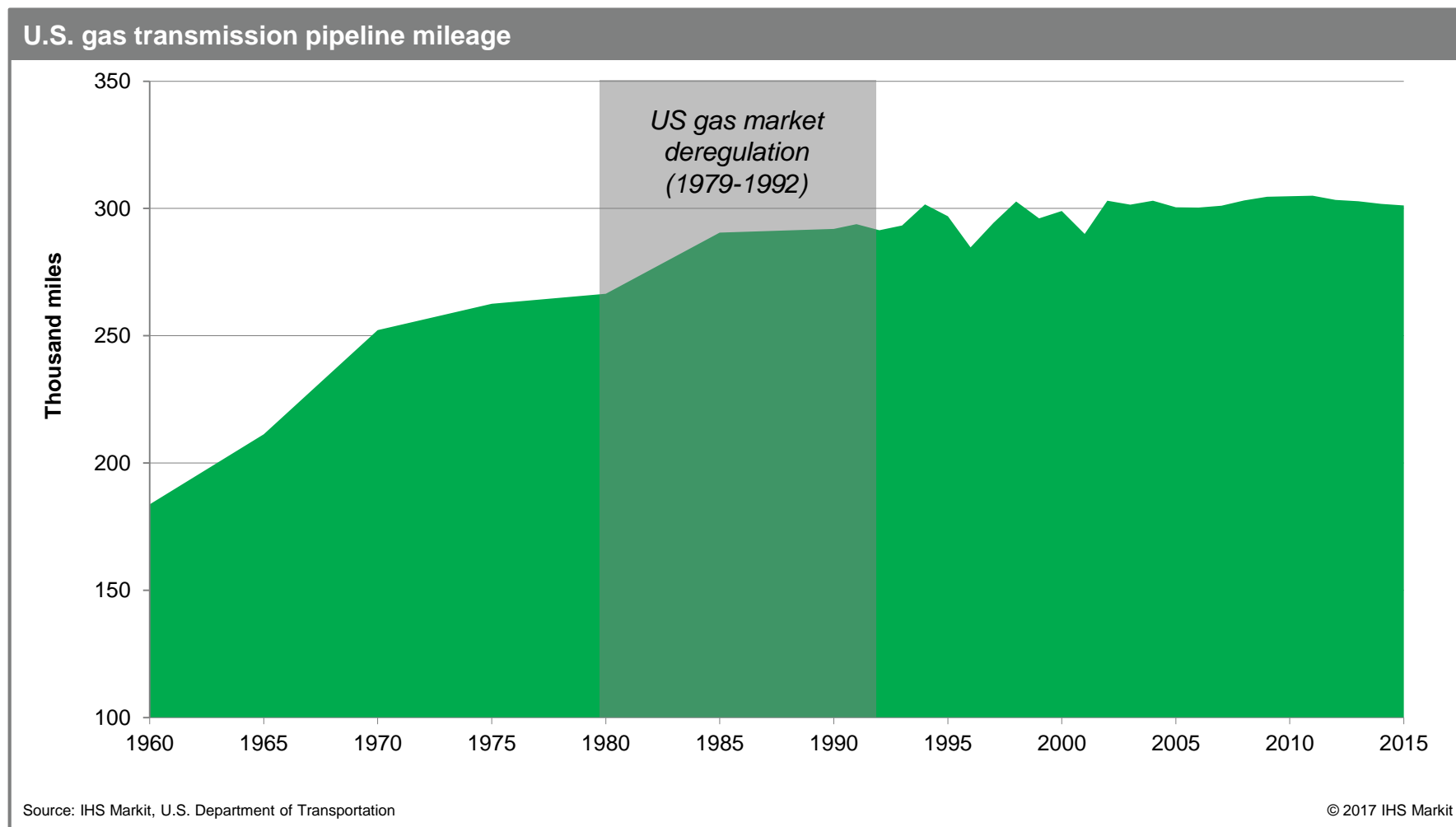
- Gas prices are set in real time by a combination of short-term fundamentals, expectations and market psychology.
- The market is liquid, supported by numerous players and universal access of pipeline service.
- But the liquidity is geographically diffuse because of transmission constraints.

Massive pipeline system supports the spot market and interregional gas flow

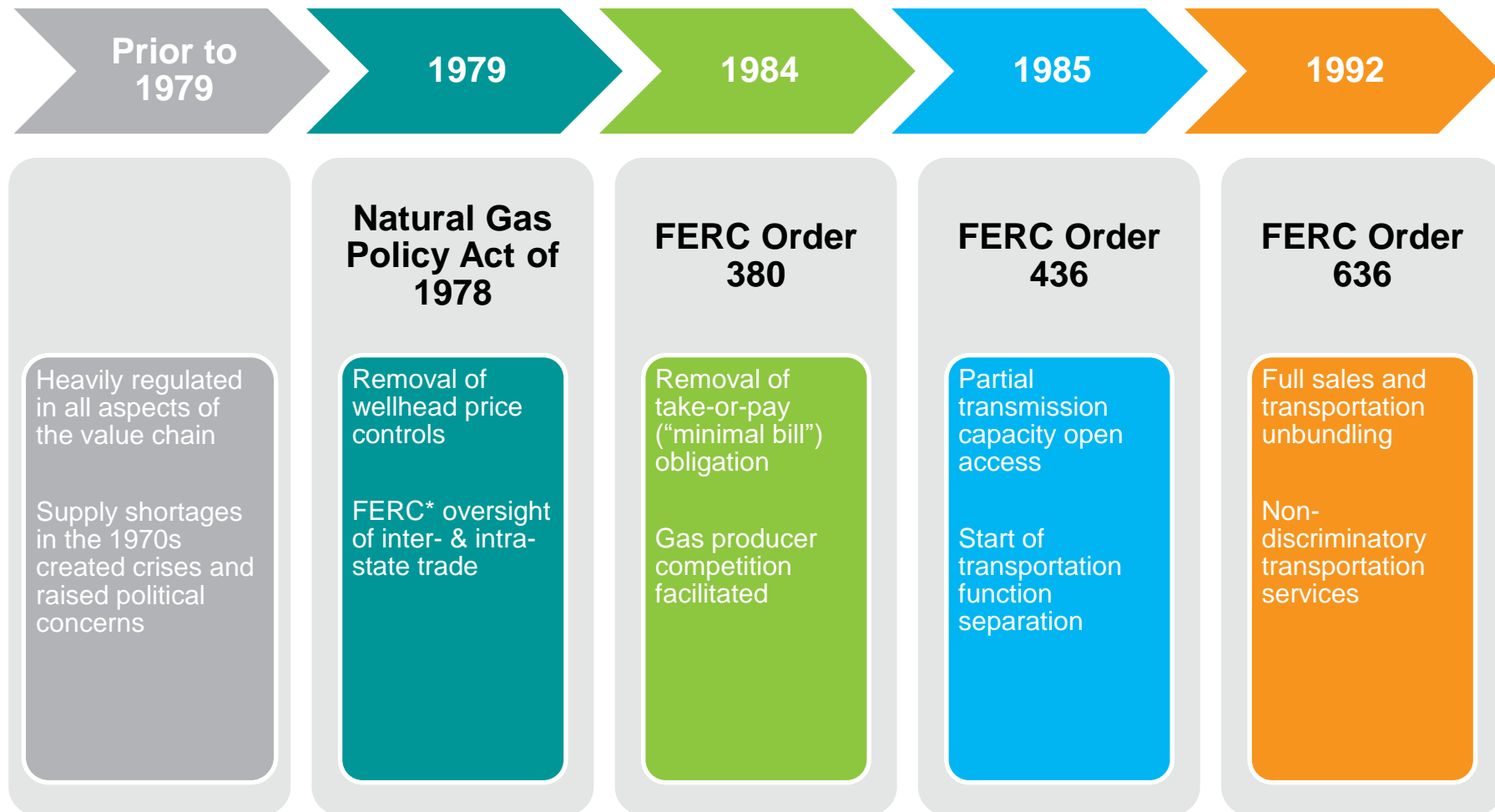


- The interstate pipelines in aggregate operate more than 300,000 miles (480,000 km) of pipeline.
- The huge increase in production from the Marcellus play in the Appalachian Basin has greatly affected pipeline flows.
- Between 2011 and 2015 the largest increases in flows were North to South. The largest declines in flows were from South to North.

Gas market reform occurred at a time when transmission pipeline network matured



Gradually policies over three decades enabled gas market liberalization and unbundled pipeline service



*FERC = Federal Energy Regulatory Commission

Pipeline transmission service is separated from commodity delivery, and regulated by government in an effective and transparent manner

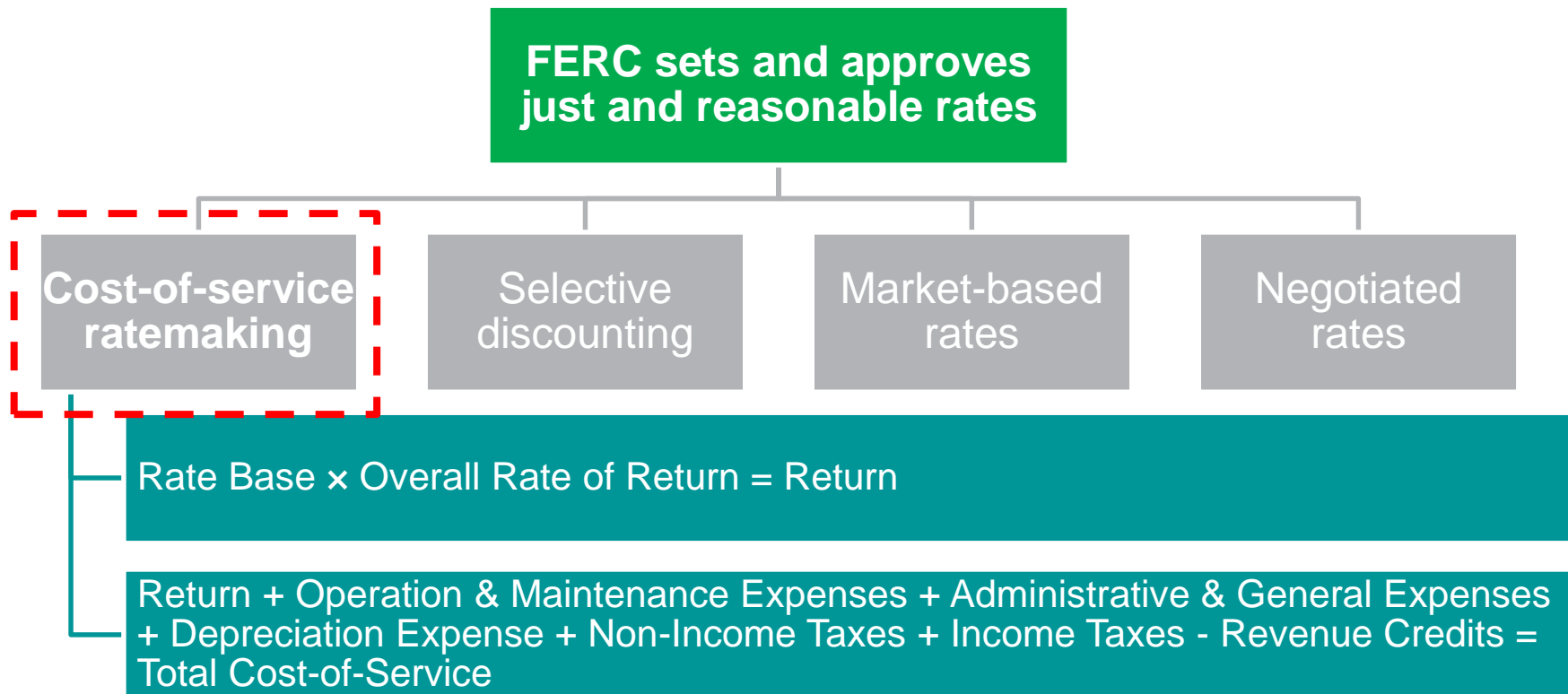
Transmission pipeline service

- Transportation services: firm (FT), interruptible (IT), and no-notice
- Park and Loan service (PAL)
- Balancing service
- Storage service

Transmission pipeline regulation

- Regulated by the Federal Energy Regulatory Commission (FERC)
- Provides a catalog of transportation-related services pursuant to the approved Terms and Conditions and rates specified in their tariff
- Does not take title to the gas commodity but provide transportation, balancing, storage, and park and loan services

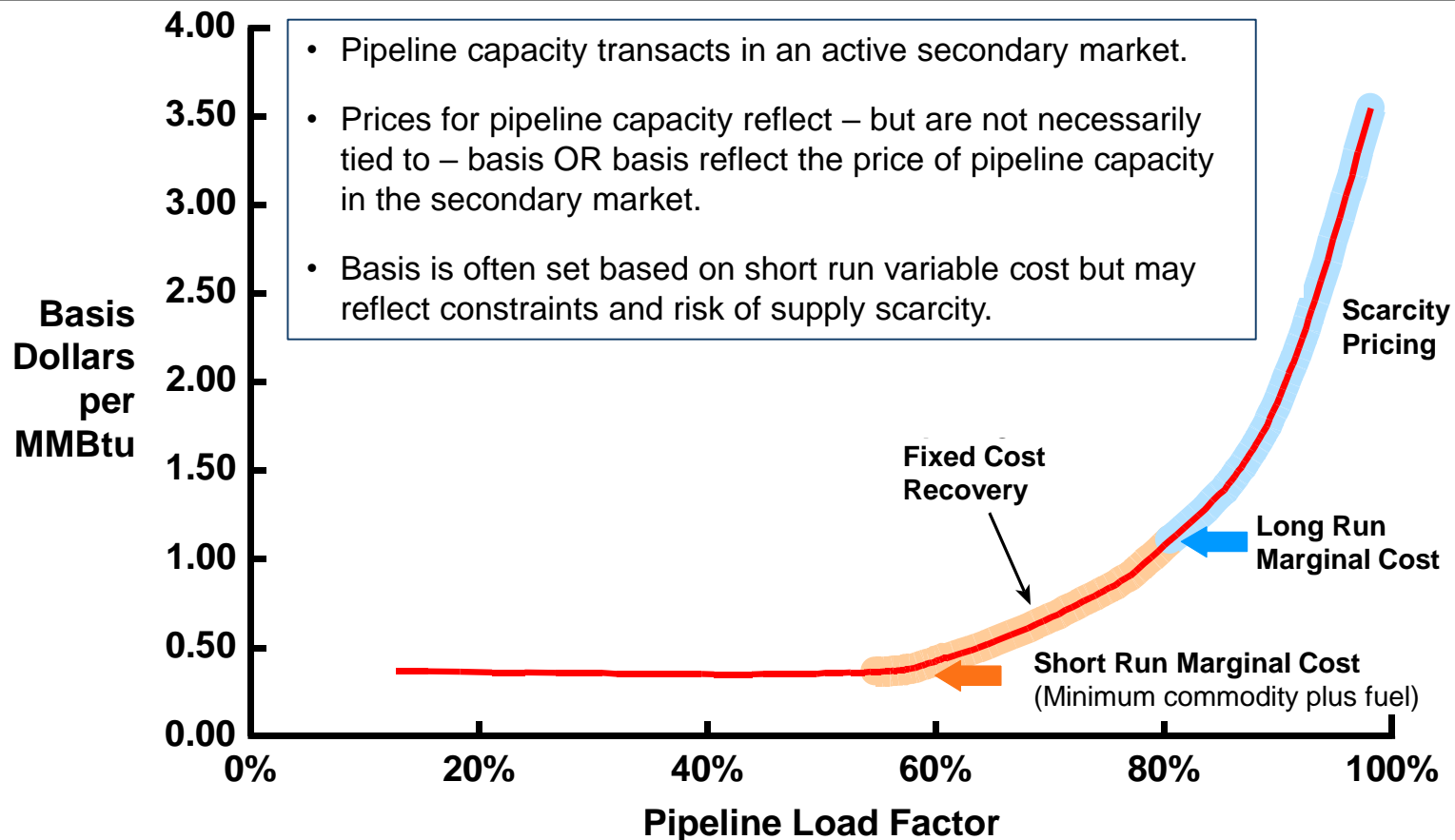
Cost-based mechanism is mainstream for setting transmission tariffs



- FERC Order 636 requires that pipeline rates be designed according to the **straight fixed-variable methodology**.
- Rate structures may be further adjusted to reflect any costs related to the distance gas is transported.

The pipeline pricing system also allows for scarcity pricing (in a secondary market) based on market demand to create incentives for pipeline investment

The relationship between basis and pipeline load factor

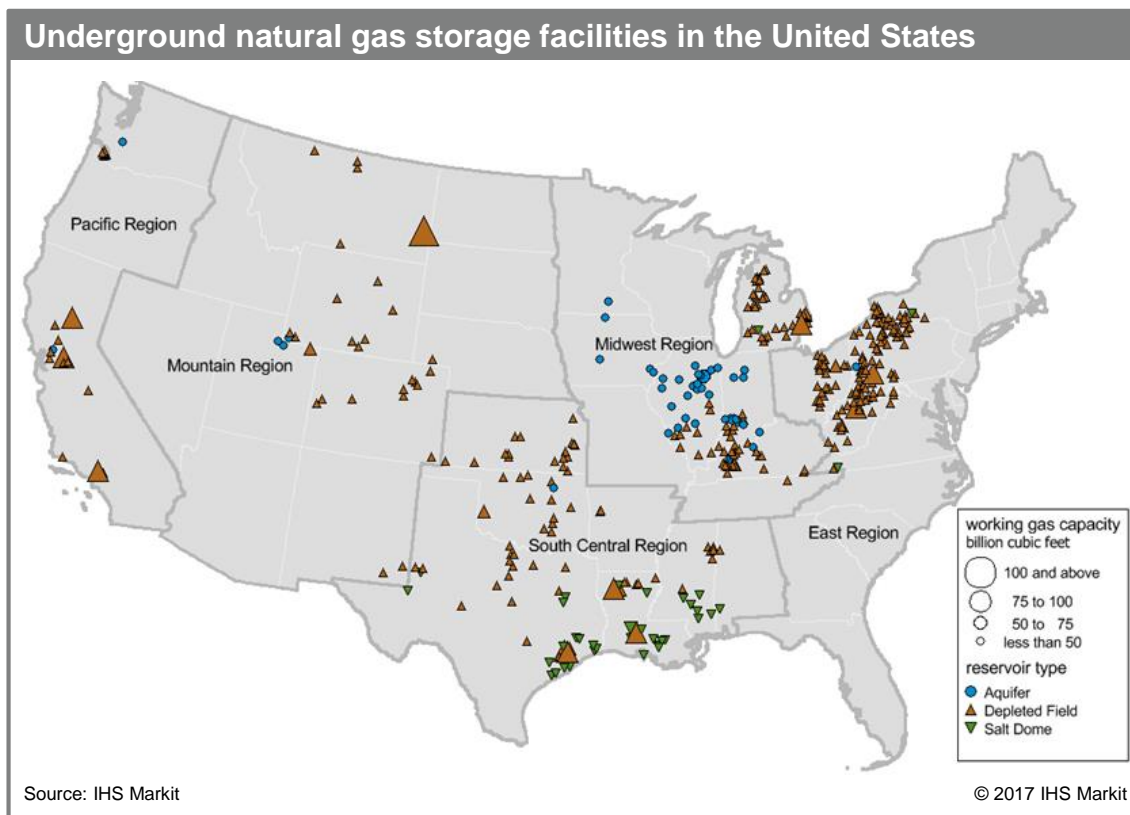


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Most gas storage facilities are also regulated

- 385 underground gas storage fields throughout the US Lower 48, with a total of 4,658 Bcf (132 Bcm) of design working capacity—80% in depleted reservoirs, 10% in aquifers, and 10% in salt caverns.
- FERC regulates the rates charged for the storage services of interstate pipeline companies.
 - Transmission supporting operations—costs are classified and allocated in the same manner as transmission costs.
 - Separately contracted storage services—fixed costs are divided equally between “Deliverability” and “Capacity” classifications while all variable costs are classified as “Injection/Withdrawal” costs.
 - Market-based rates may also be approved if the applicant can demonstrate that it has no market power.



Lessons learned

Numerous players in every part of the value chain help ensure that no single player can sway the market.

Developed pipeline network paved the way for market reform and midstream liberalization.

Open and transparent third-party access to infrastructure is a prerequisite for competition in upstream and downstream.

Deregulation could lead to high prices as well as high volatility, but adequate storage and pipeline capacity serve as an important tool to optimize seasonality in gas supply.

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