



The Shale Revolution

*The Ultimate Mulligan For the United States and U.S.
Manufacturing*

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February 28, 2023

Perspective – A trip down memory lane – Summer 2008

Summer 2008 -- Beijing Olympics

Crude Oil -- \$144/bbl

Natural gas -- \$14/Mmbtu

PJM Wholesale Electric Power \$150/MWH

Summer 2008 U.S. Energy Narrative

“Peak Oil”

“Peak Gas”

“Long Run Decline to Zero”

Build New LNG *import* terminals

Shut down/relocate U.S. petrochemical/refining infrastructure

“Energy Poor – Hopelessly Dependent on Foreign sources

Offshoring U.S. investment in oil & gas

Shale Commencement

2008 – The Natural Gas Shale
Revolution Begins

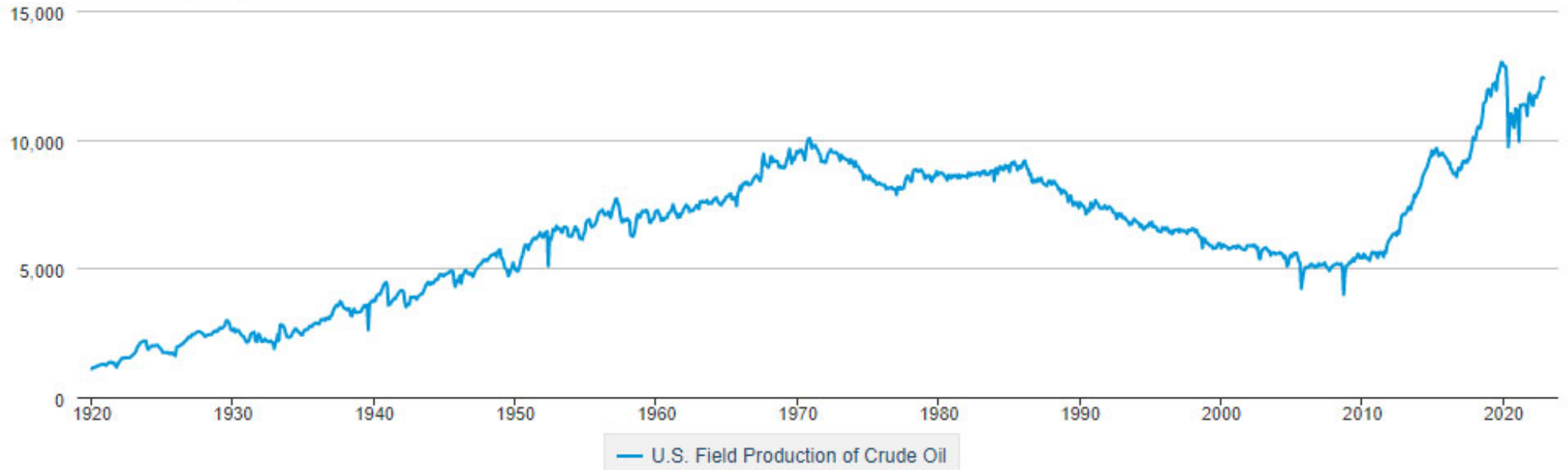
2010 – The Natural Gas Shale
Revolution Extends to Crude Oil

Shale Revolution -- U.S. Crude Oil Production – 2.7X Increase

U.S. Field Production of Crude Oil

DOWNLOAD

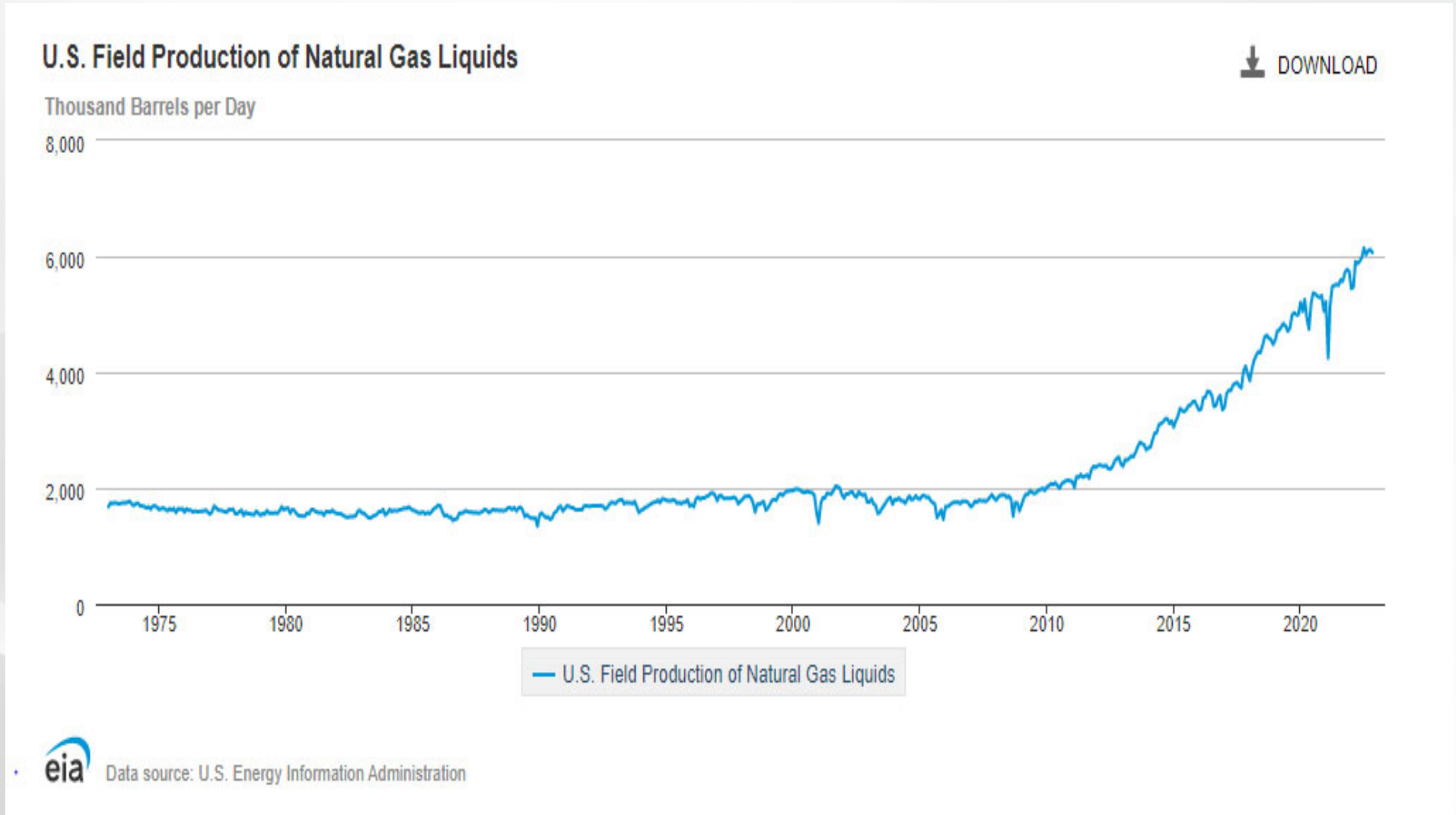
Thousand Barrels per Day



eia Data source: U.S. Energy Information Administration

Source: Energy Information Agency

Shale Revolution -- Natural Gas Liquids Production – 3X Increase




Source: EIA

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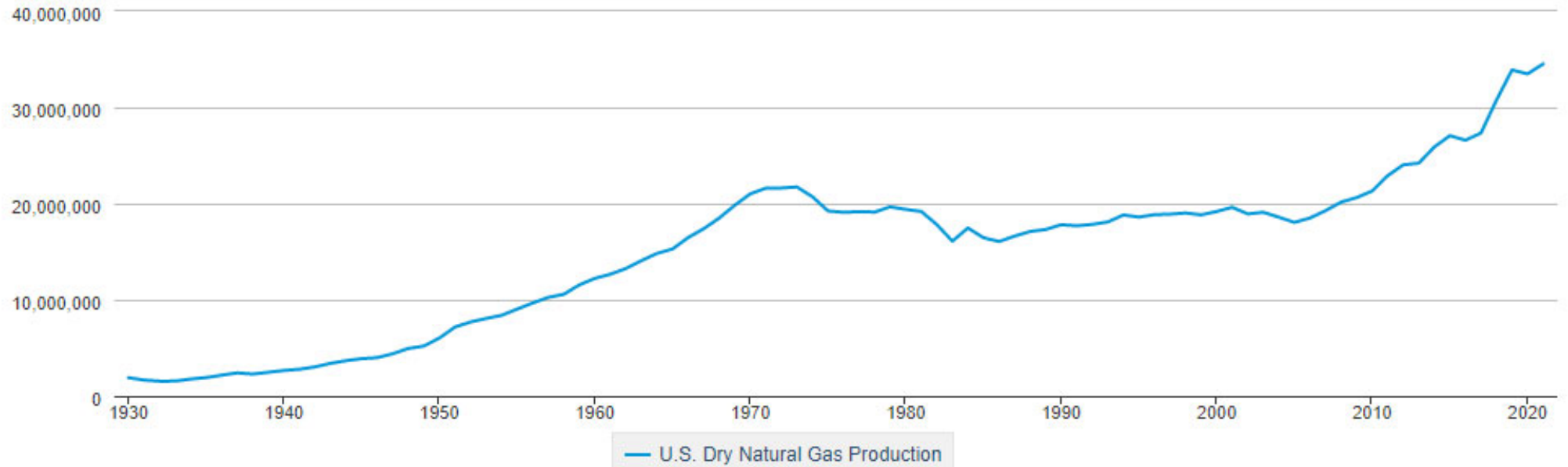
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Shale Revolution – U.S. Natural Gas Production – 2X Increase

U.S. Dry Natural Gas Production

 [DOWNLOAD](#)

Million Cubic Feet




Data source: U.S. Energy Information Administration

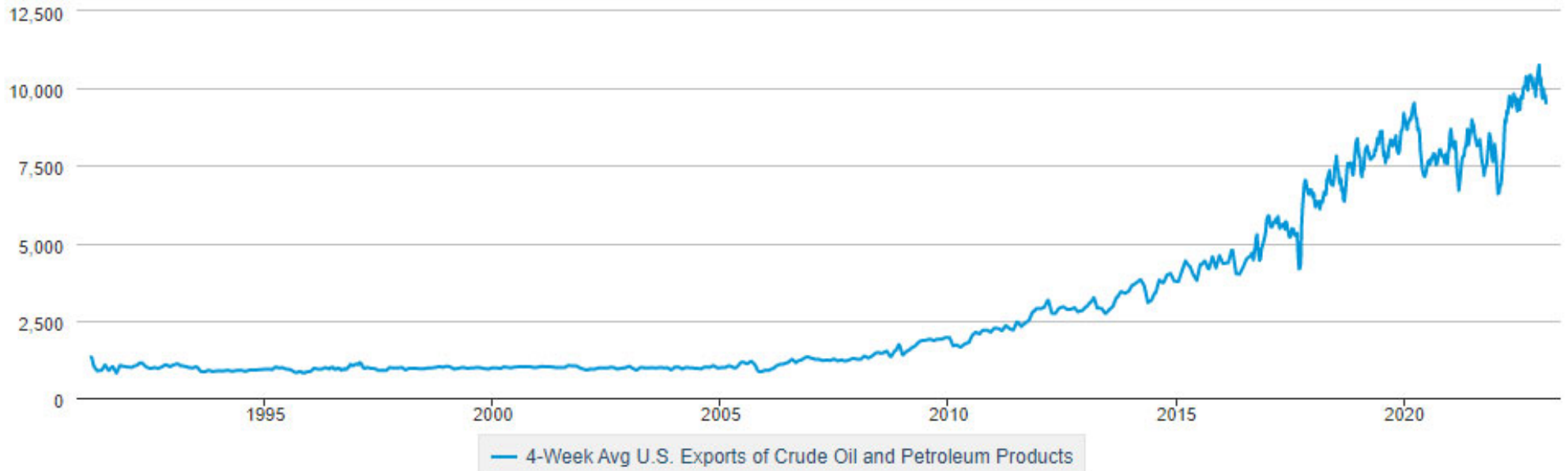
Source: EIA, Baker Hughes

Shale Revolution – U.S. Exports of Crude Oil and Refined Products – 8X Increase

4-Week Avg U.S. Exports of Crude Oil and Petroleum Products

 DOWNLOAD

Thousand Barrels per Day



Data source: U.S. Energy Information Administration

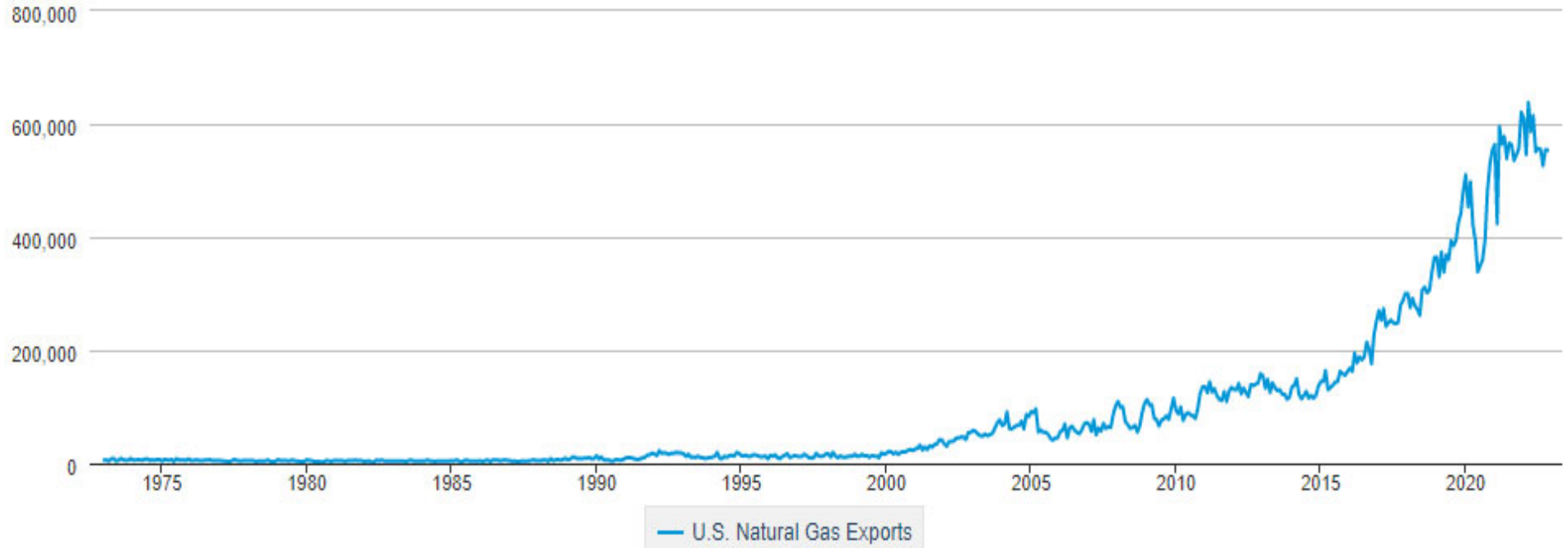
Source: EIA, DOE

Shale Revolution – U.S. Natural Gas Exports – 10X Increase

U.S. Natural Gas Exports

↓ DOWNLOAD

Million Cubic Feet



Data source: U.S. Energy Information Administration

Source: EIA

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Shale Has Changed the U.S. and Global Energy Landscape

Shale -- Transformed the U.S. – From Energy poor to the emergent global hydrocarbon superpower

Shale – The most significant addition to global energy supply in Human history
8 million bbls/day crude, 4 million bbls/day NGL, 50 Bcf/day natural gas

Shale – Major force in significantly driving down U.S. CO2 emissions

Shale – Makes U.S. Energy the cheapest BTU on the planet – Major long-term economic competitive advantage

Shale – Transformed U.S. petrochemicals and refined products industries – long-term economic competitive advantage

Shale – Changed the energy geopolitical landscape – War in Ukraine Accelerated This Exponentially

Shale – Transformed U.S. into largest energy exporter in the world in one decade

The Shale Revolution is Transformative, But – Caveat Emptor

- The Era of \$2 gas forever is over
- Future price volatility will be very high (think past two years)
- U.S. LNG exports to double by 2028 – second ramp up begins in earnest next year
- Producers can and will respond to price signals much faster than the past 15 years
- U.S. natural gas prices are now heavily influenced by global LNG markets – this trend increases greatly in the next five years
- Natural gas prices are below their five year and ten year average adjusted for inflation
- Risk is on in energy – focus on managing risk and ensuring supply longer term
- We are in the midst of a decadal energy crisis in the industrialized world

Thank You

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Disclaimer

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U.S. Market Update February 2023



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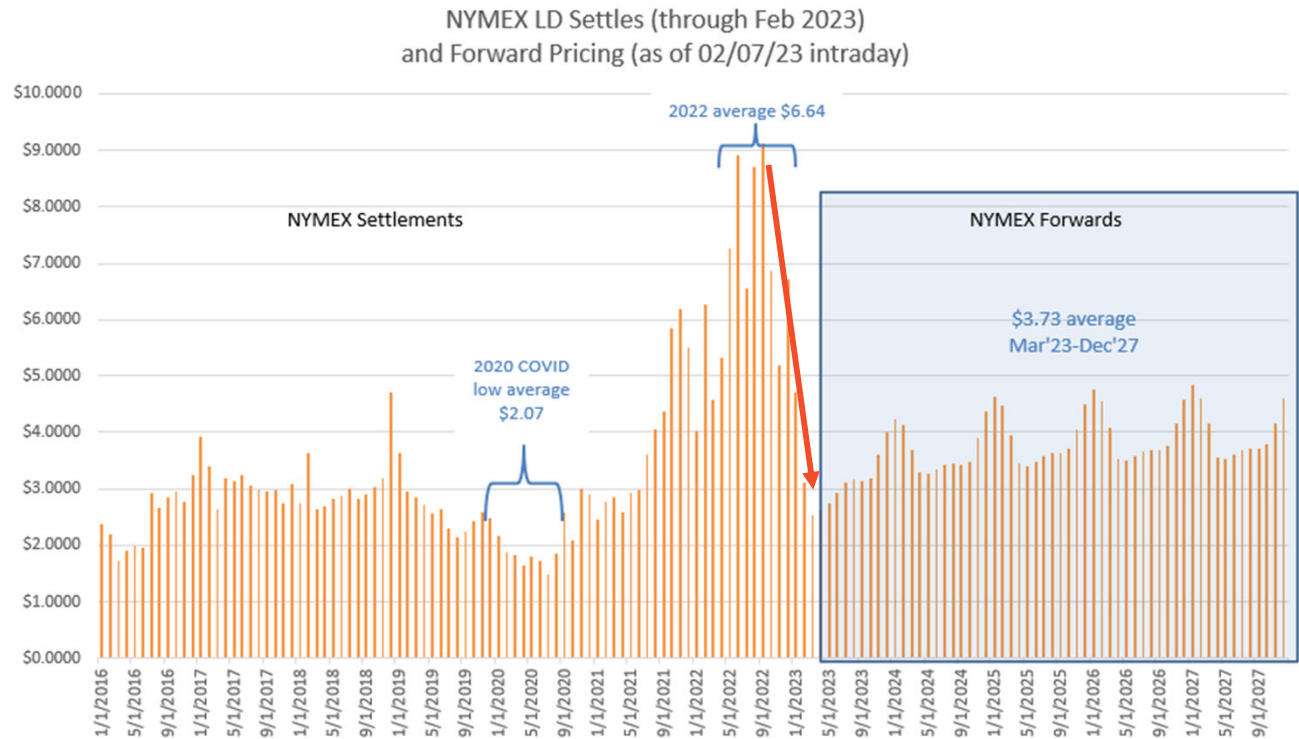
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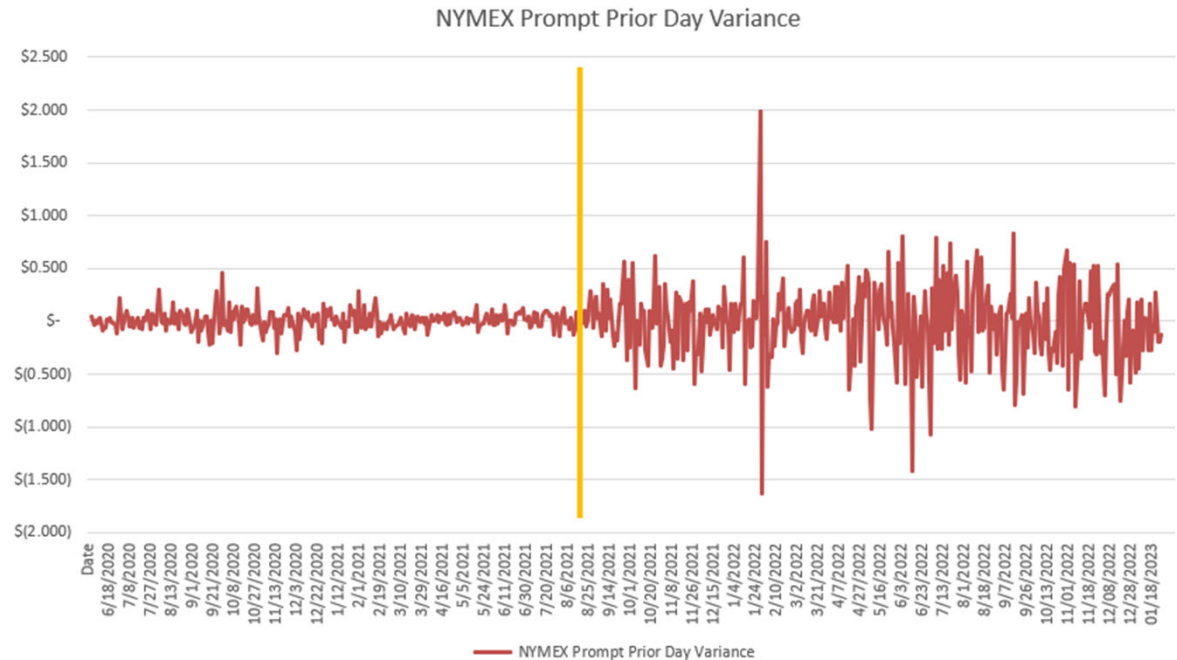
NYMEX History/ Forwards

- After decades low Covid demand destruction year of 2020 of \$2.07/MMBtu, 2022 averaged \$6.64
- Recent NYMEX price drop off peak settle of \$9.35 for Sept 2022 contract to Feb 2023 settle of \$3.10



NYMEX Prompt Forward Price Volatility

- NYMEX Natural Gas pricing experiencing extreme price swings since mid-August 2021
- Absolute average daily price variance June 2020- mid Aug 2021= \$0.064/MMBtu
- August 2021- December 2022: \$0.265/MMBtu
- So far in 2023: \$0.194/MMBtu (through 1/26/2023)
- What caused the extreme increase in 2022 and the almost equal decrease the past 6 months?

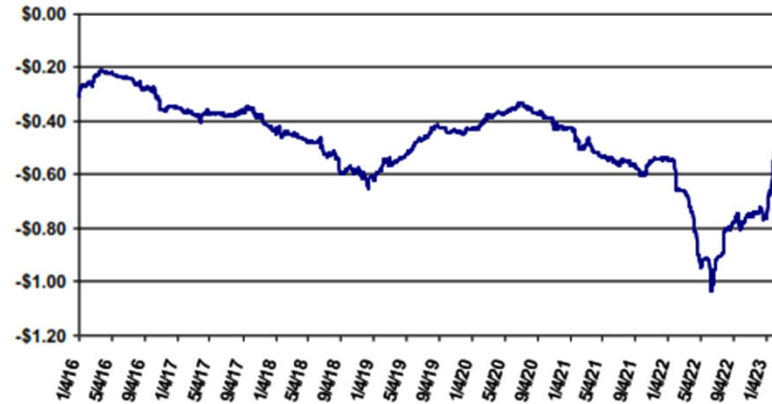


Market Update

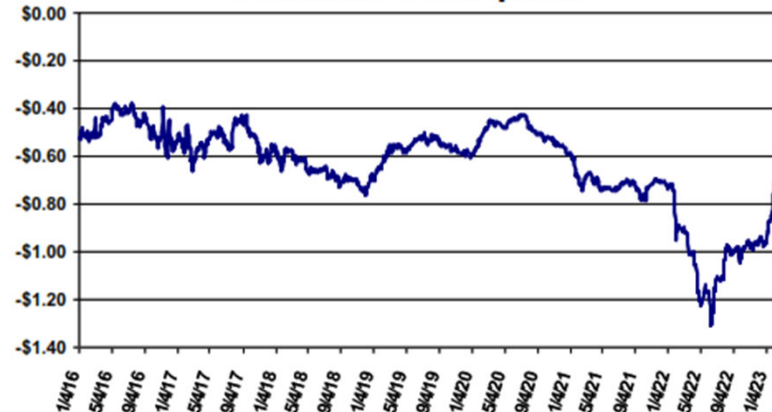
Basis Price Volatility- Appalachia (March 2023- February 2024 history)

- Even Appalachian Basis pricing has had pretty wide swings
- TCO Basis ~\$0.80 /MMBtu range
- EGTS (Dominion South) ~\$0.90 /MMBtu range

TCO

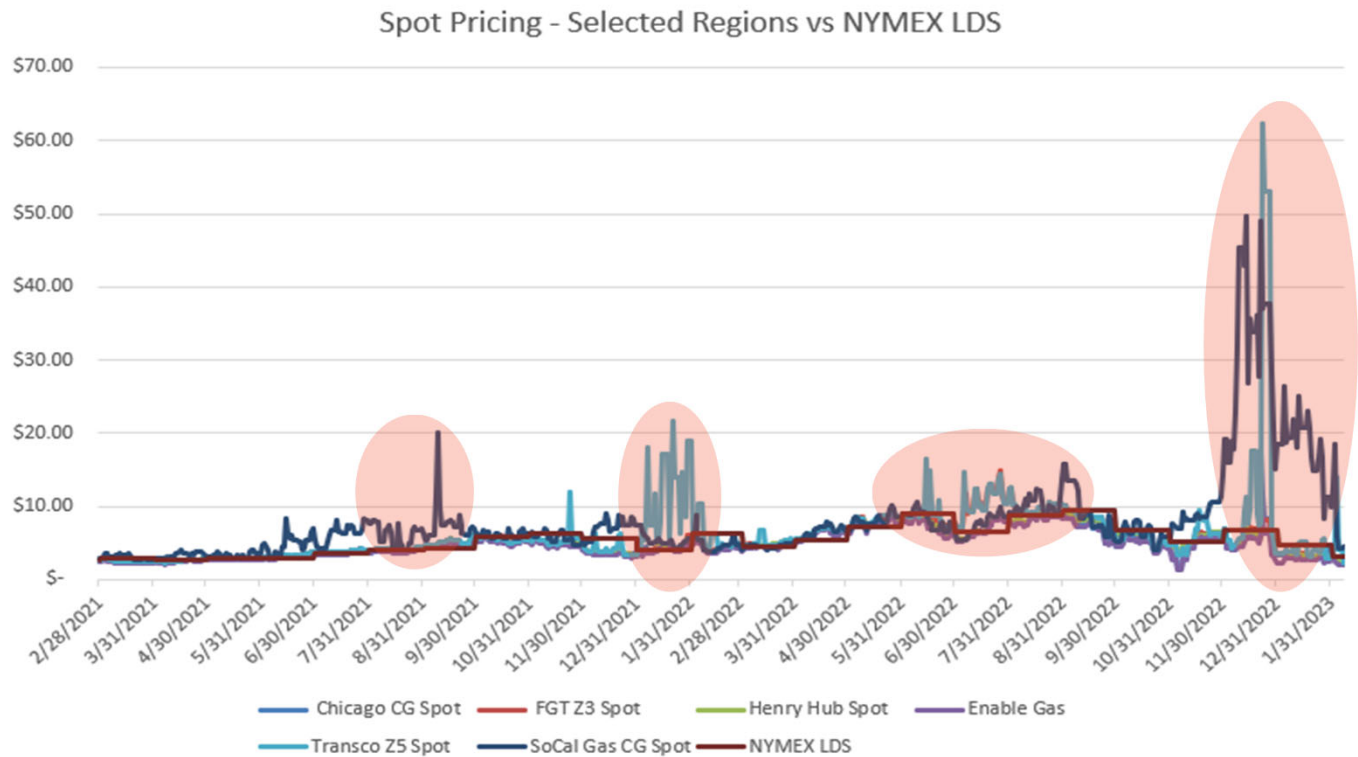


Dominion Southpoint



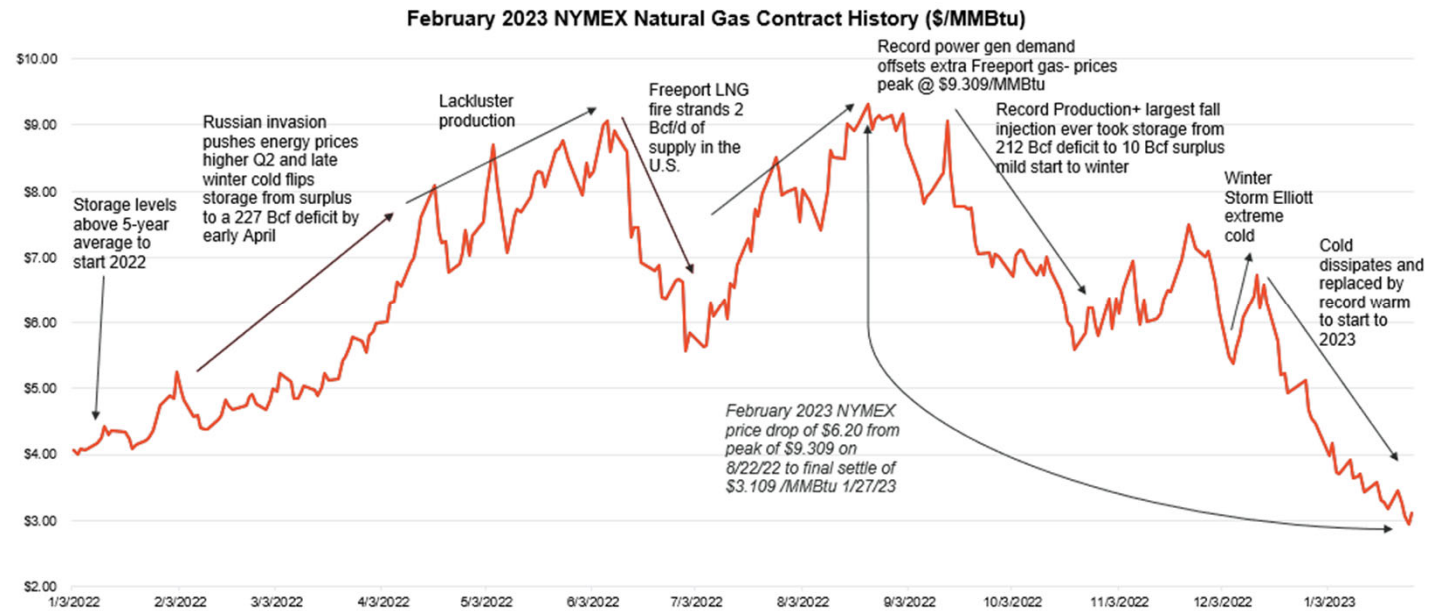
Gas Daily Volatility – Selected Indices

- Spot price risk increasing in certain regions
- Extreme weather only a portion of the cause
- Limitations of natural gas infrastructure a growing concern as intermittent supply of power replaces dispatchable coal



February 2023 NYMEX Price Movement

- Extreme market swings last year
- None could have been predicted to occur but each having a significant impact on natural gas prices for the February 2023 NYMEX contract
- What will be influencing 2024 pricing this year?

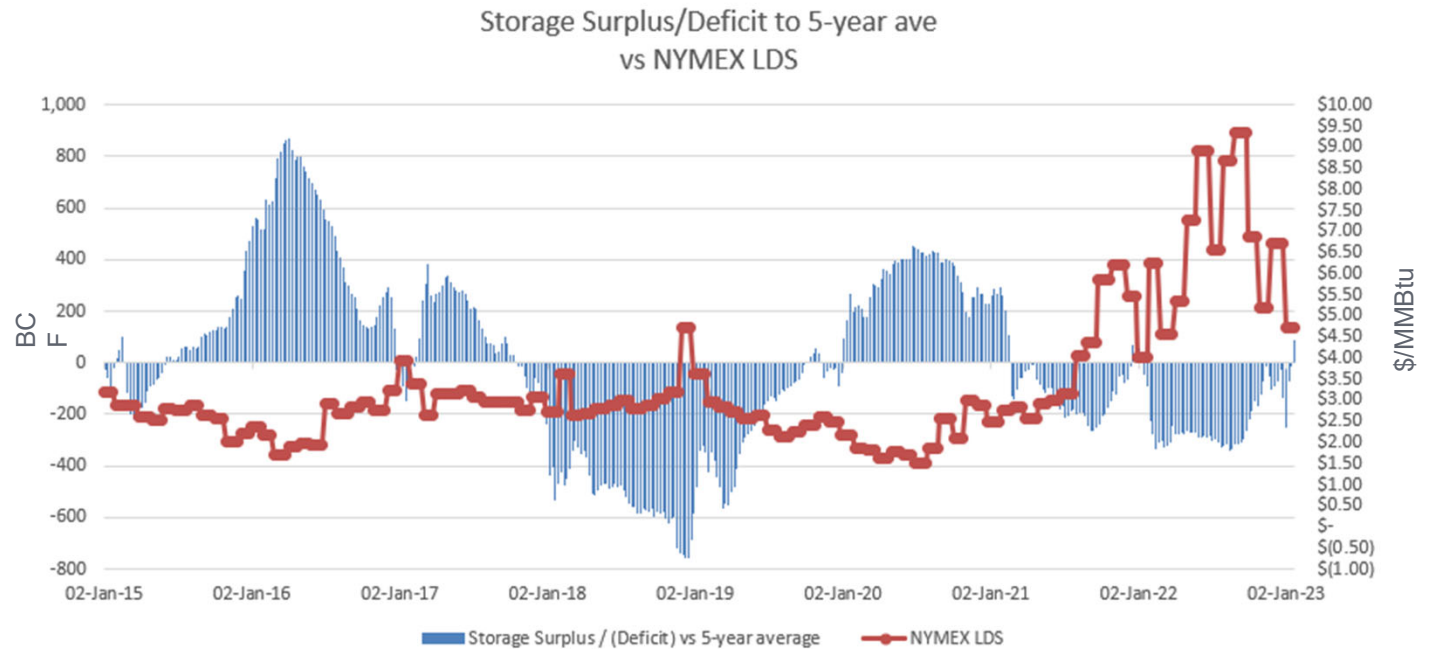


Source: Bloomberg & Edison

Market Update

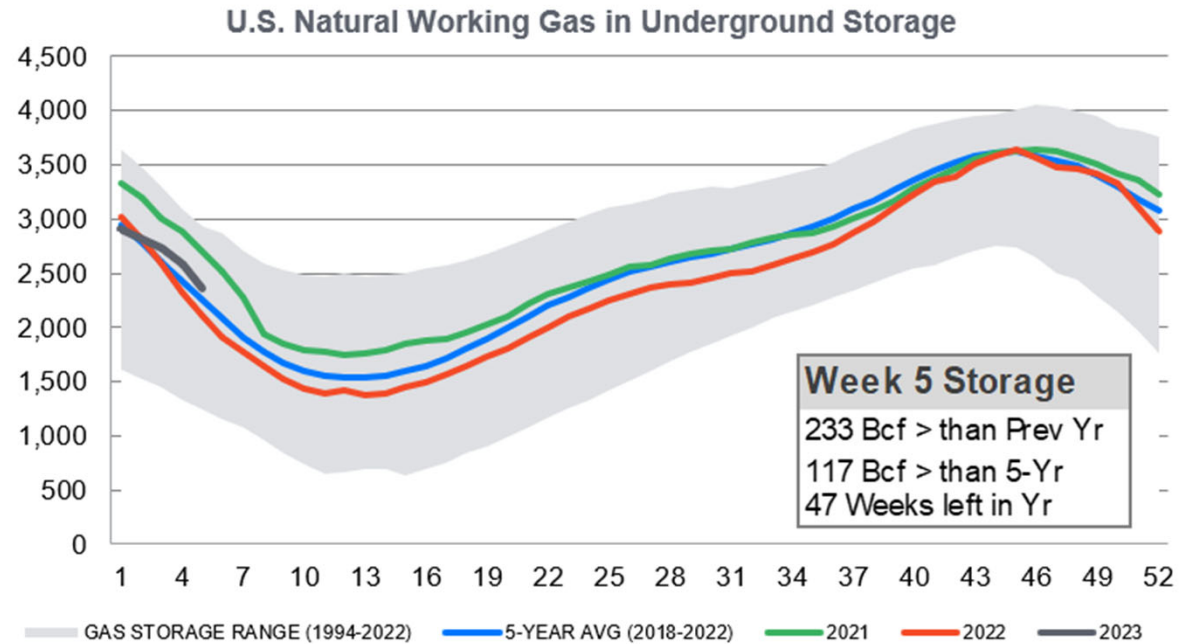
Storage Surplus/Deficit Correlation to NYMEX Pricing

- Status of storage is a primary driver to NYMEX price trends
- Inversely correlated to each other
- Surplus storage levels to 5-year average tend to make NYMEX pricing drop
- Deficit to 5-year average storage levels increase NYMEX gas prices



U.S. Natural Gas Storage (week 5)

- Current storage levels are at 2.366 Tcf
- 233 Bcf surplus to last year and 117 Bcf surplus to the 5-year average
- Anticipated to increase surplus
- East, Midwest, and South-Central regions all above historical norms but Pacific region inventories well below year ago (-32%) and 5-year (-40%)
- Overall storage levels and timing of surplus driving recent NYMEX drop



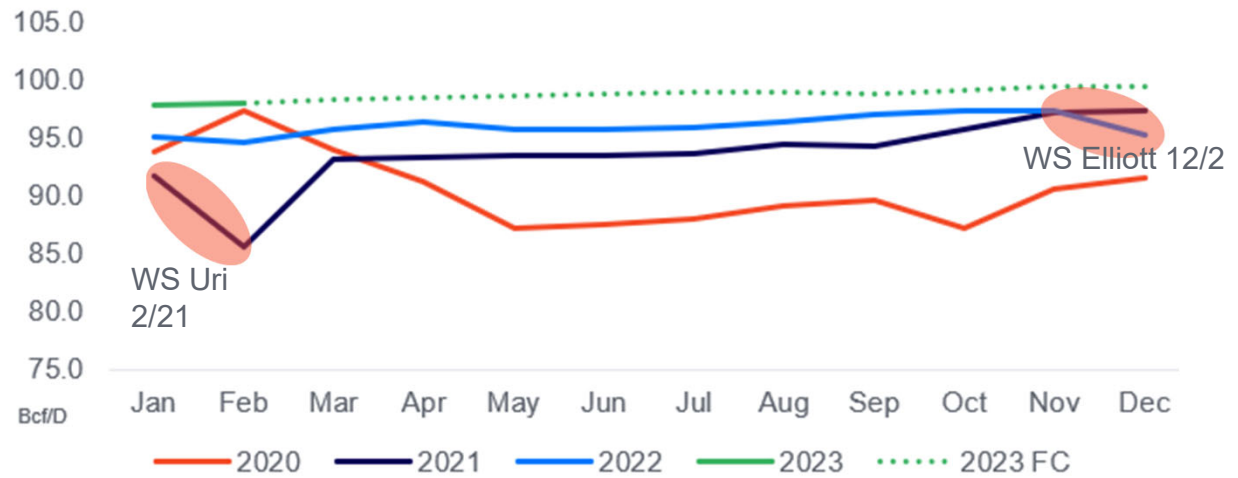
Source: EIA Data

Market Update

Natural Gas Production

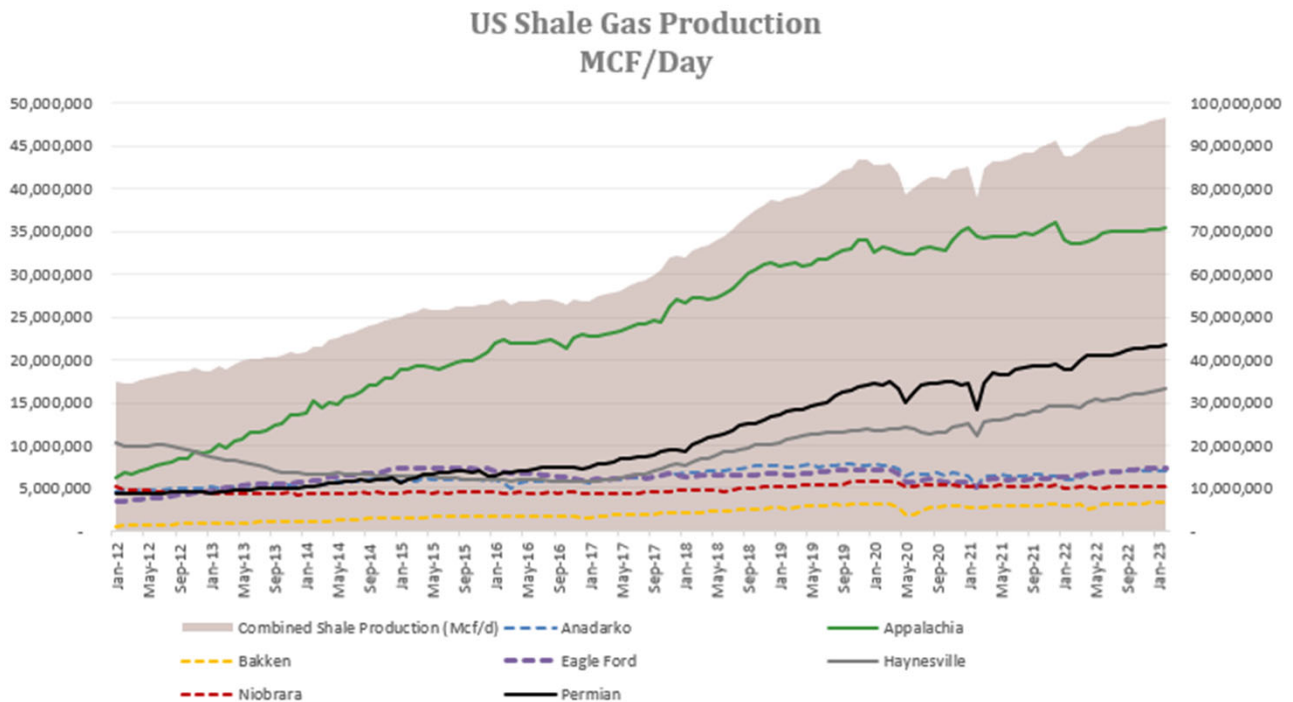
- Dry gas production averaged 97.76 Bcf/day in January, a record
- An increase of 2.55 Bcf/day from December
- Extreme cold impacts winter production levels with freeze offs of wells – Feb 2021 Winter storm Uri & Dec 2022 winter storm Elliott

US Dry Gas Production



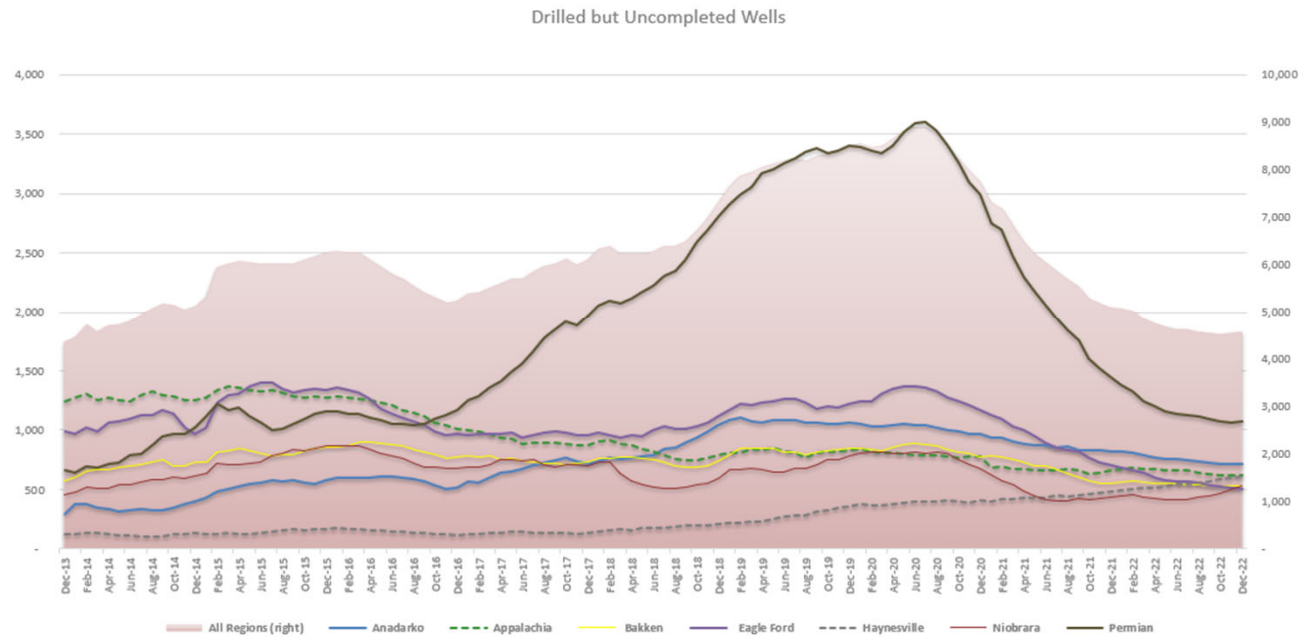
Regional Shale Gas Production

- Major shale gas production has increased 9.1 Bcf/day from year ago
- Largest gainers
 - Permian + 2.78 Bcf/d
 - Haynesville +2.017
 - Appalachia +1.73
 - Eagle Ford +1.08

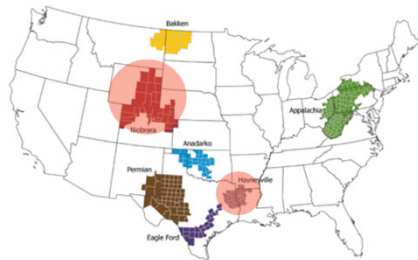


But Drilled but UnCompleted (DUC) Wells

- Overall DUCs have increased for the second consecutive month and now stand at 4,443 wells
- Haynesville (gas) and Niobrara (oil & gas) regions added a combined 41 DUCs over the past month and 217 over the past year
- Every other region lost a total of 739 last 12 months
- Both Exxon and Chevron mentioned the need to replenish DUCs in Permian this year



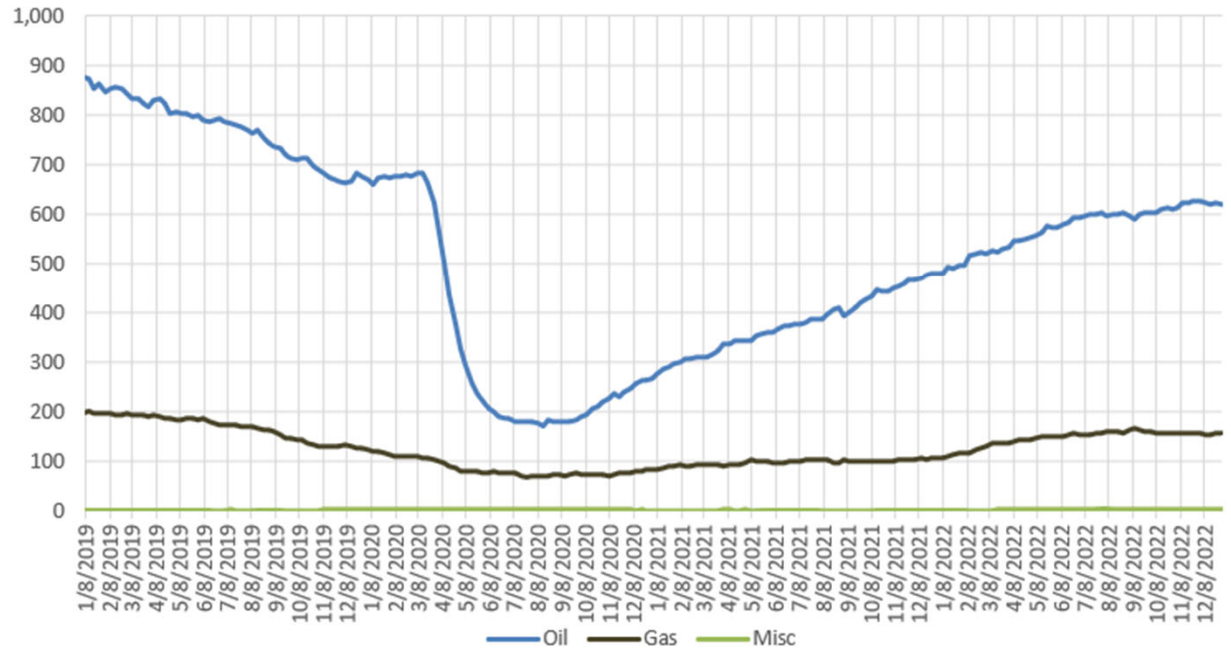
Source: EIA Data



Rig Counts

- After a recent peak of 784 combined rigs for both oil and natural in late November '22, overall rig counts have dropped 13 since and now stand at 771
- Oil directed at 609 rigs, down 4 for the week ending 1/27/23
- Gas directed at 160, up 4 from a month ago
- Miscellaneous remained at 2 rigs

US Drilling Rig Count
(Baker Hughes Data)

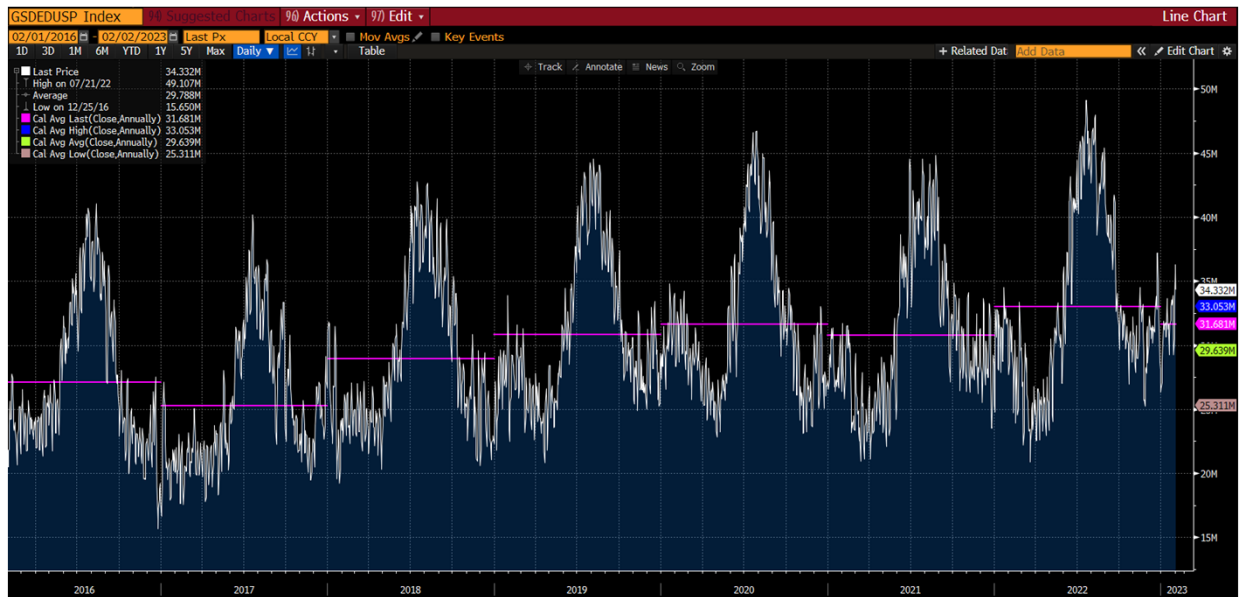


Source: Baker Hughes

Market Update

Natural Gas Power Burn 2016-2022 (Bcf/day)

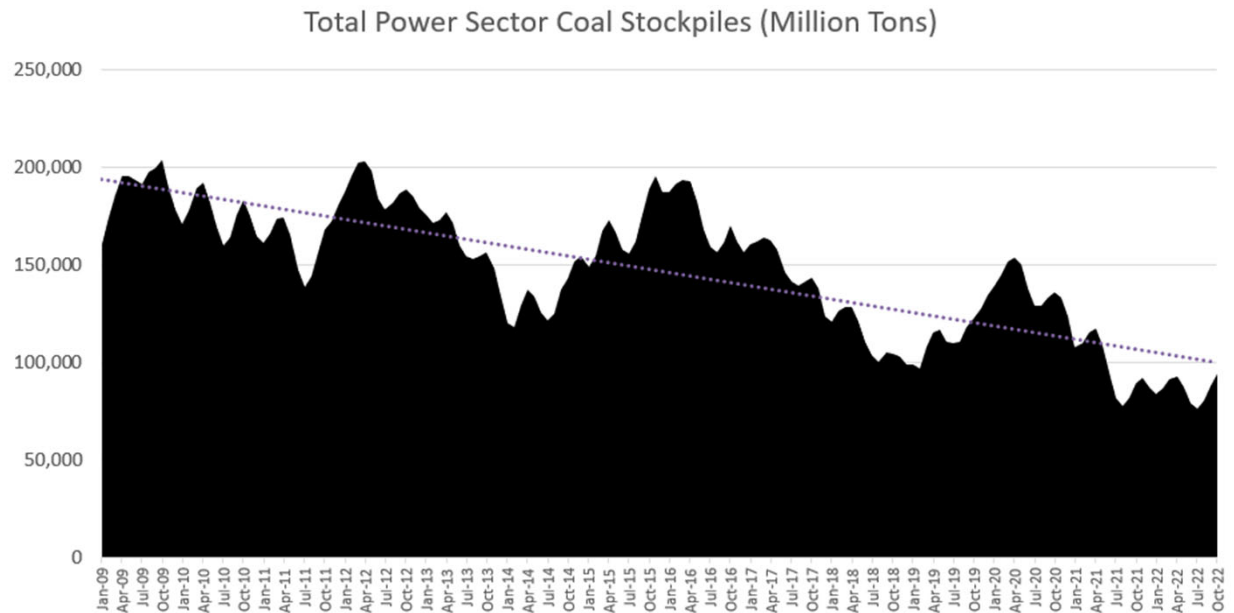
- Gas fired power burn averaged 29.7 Bcf/day in January '23 despite being one of the warmest on record
- Gas fired power generation demand continues to increase; in 2022, power demand averaged 33.05 Bcf per day, 2.2 Bcf/day higher than 2021 even as prices increased an average of \$2.80 / MMBtu YOY
- Gas price inelasticity with continued removal of coal?



Source: Bloomberg

Coal Stockpiles for Power Gen

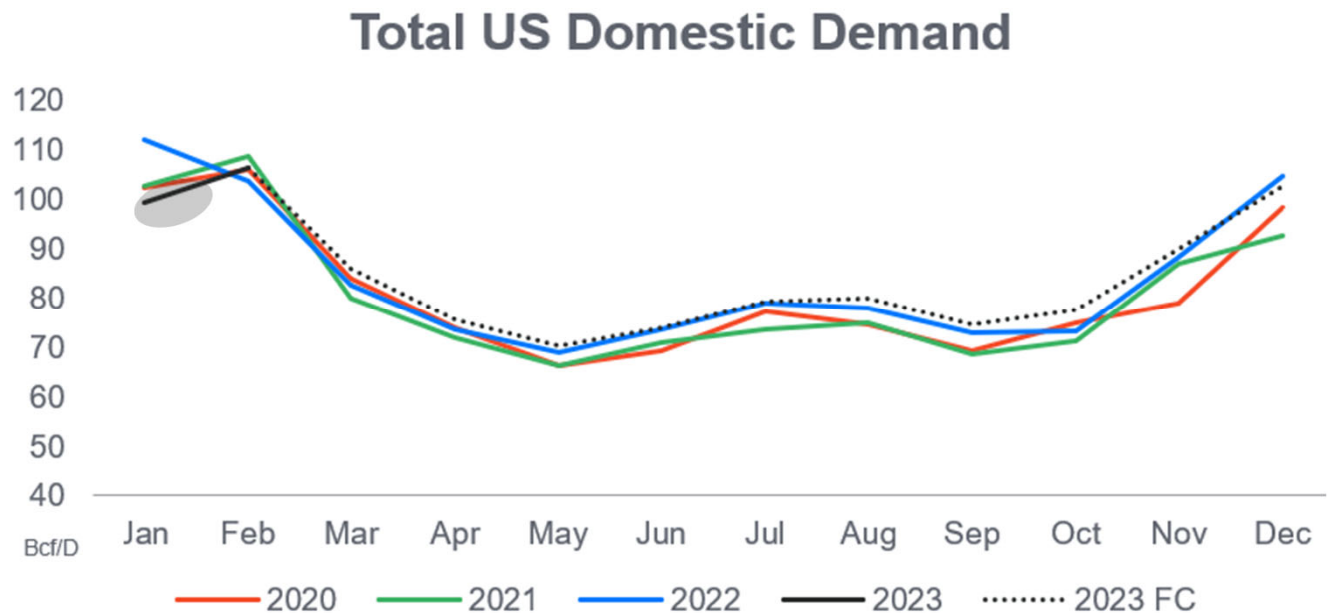
- Power sector coal stockpiles continue the trend down YOY in 2022
- Stockpiles now stand at 94,076 Million Tons
- Placing more of the dispatchable load on natural gas
- The congressionally settled labor agreement kept railroads working and coal moving in Q4 2022 avoiding a potential disaster for winter fuel supplies
- International coal demand will hit an all time high in 2022, which is estimated to be 8 Billion tons, the result of Russia's invasion of Ukraine and the significant gas to coal switching that resulted



Source: EIA Data

Total Natural Gas Demand (Domestic)

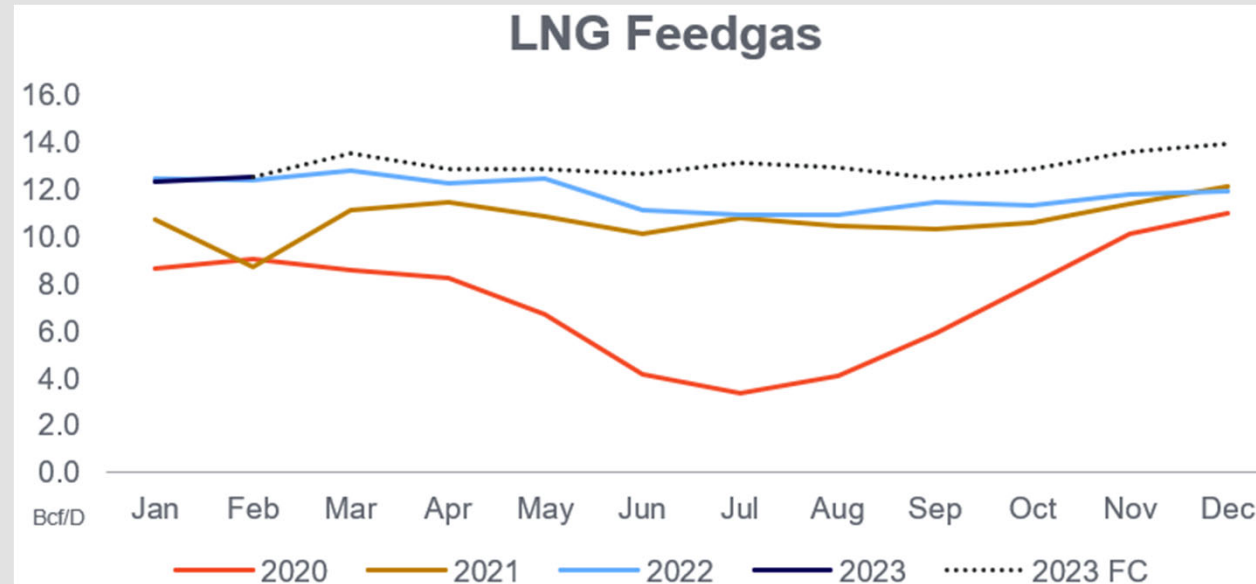
- Total domestic demand for natural gas averaged 99.5 Bcf/day in January
- Down 12.5 Bcf per day (387 Bcf month) vs January year ago! (blue line)
- Largest YOY demand reduction from Res/Comm – dropped 9.6 Bcf/day (Industrial -1.3)



Source: Bloomberg

U.S. LNG Feedgas

- Freeport LNG accident June 2022 took ~2 Bcf/d export capacity offline, remains offline but recently getting a few of many approvals from DOE & PHMSA to restart
- Estimated 400-500 Bcf/day of supply available for U.S. demand / storage as a result
- LNG feedgas to export facilities just 0.12 Bcf/day lower in January '23 vs January '22
- Very little new coming online in 2023 . . . but ~5.7 Bcf/day coming 2024-2026



International LNG Pricing (02/07/2023)

- Natural gas prices have declined nearly everywhere as markets get more comfortable each day about this winter
- U.S. Henry Hub (Mar '23) pricing ~\$2.50/MMBtu
- International pricing still 7 times the U.S. benchmark
- TTF - \$17.83
- NBP - \$17.26
- JKM - \$18.50

Historical LNG Futures Prices
\$/MMBtu



Source: Bloomberg

Market Update

Crude Oil Implications- Mar '23 Contract (02/07/23)

- March 2023 WTI Crude now at \$74.96/barrel, a drop of ~\$14 last 3 months
- Crude pricing volatile as Russian sanctions and crude price cap and Chinese demand recovery timing causing turbulence in the market
- Forward pricing - 2023- \$74.86 2024- \$71.36; 2025- \$67.83
- Still profitable for most U.S. producers



Source: Bloomberg

Summer '23 NYMEX Strip (as of 02/07/23)

- Apr-Oct '23 NYMEX Strip trading @ \$2.96/MMBtu
- Dropping \$2.46 /MMBtu since 12/13/22
- Storage flip from deficit to surplus
- Smashing through the 50-day 100 and 200-day moving average support levels



Source: Bloomberg

Winter '23-'24 NYMEX Strip (as of 02/07/23)

- Nov'23-Mar'24 NYMEX Strip trading @ \$3.90/MMBtu
- Dropping \$1.82 /MMBtu since 12/13/22
- Absent extreme heat this summer, market believes storage will be full headed into winter



Source: Bloomberg

Cal 2024– NYMEX (as of 2/7/2023)

- Calendar year 2024 NYMEX trading @ \$3.65 /MMBtu
- Down \$0.52 over the past month and \$1.10 since 12/16/22



Source: Bloomberg

Cal 2025– NYMEX (as of 2/7/2023)

- Calendar year 2025 NYMEX trading @ \$3.89 /MMBtu
- Down \$0.75 since 12/19



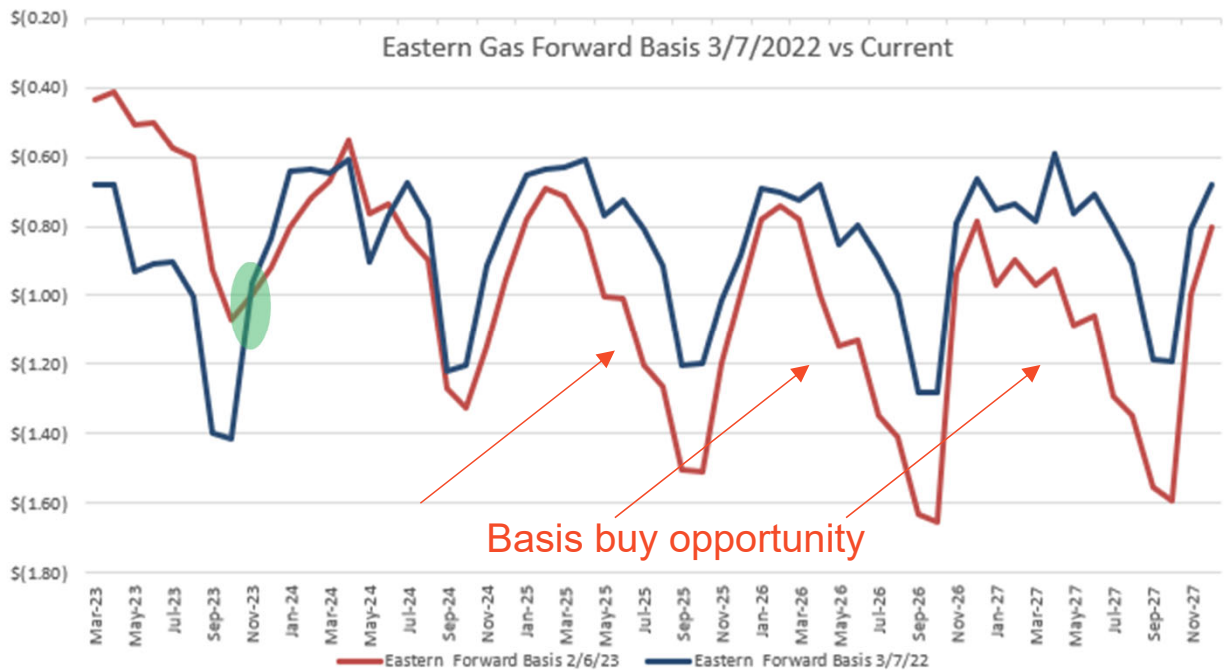
Source: Bloomberg

Market Update

Eastern Gas South Forward Basis

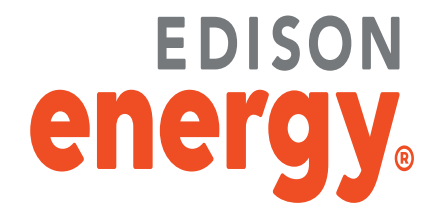
(2/6/2023 vs year ago)

- Eastern Gas (Dominion South) Basis price inversely correlated to current NYMEX price drop opportunity
- Opportunity to buy Eastern Gas Basis is past 2024 (\$0.35-.40/MMBtu better in 2025-2027)
- Rem 2023 ave– minus \$.70
- Cal 2024 ave– minus \$.88
- Cal 2025 ave- minus \$1.05
- Cal 2026 ave- minus \$1.11
- Cal 2027 ave- minus \$1.12



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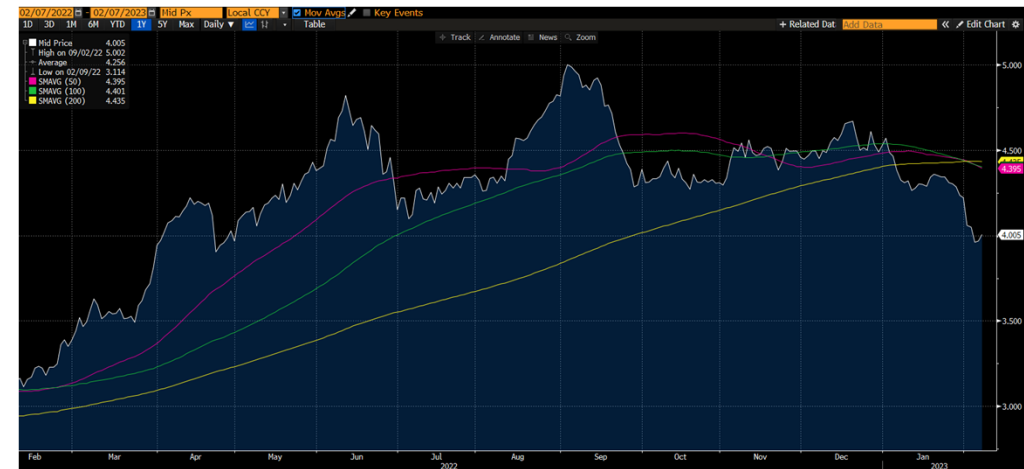
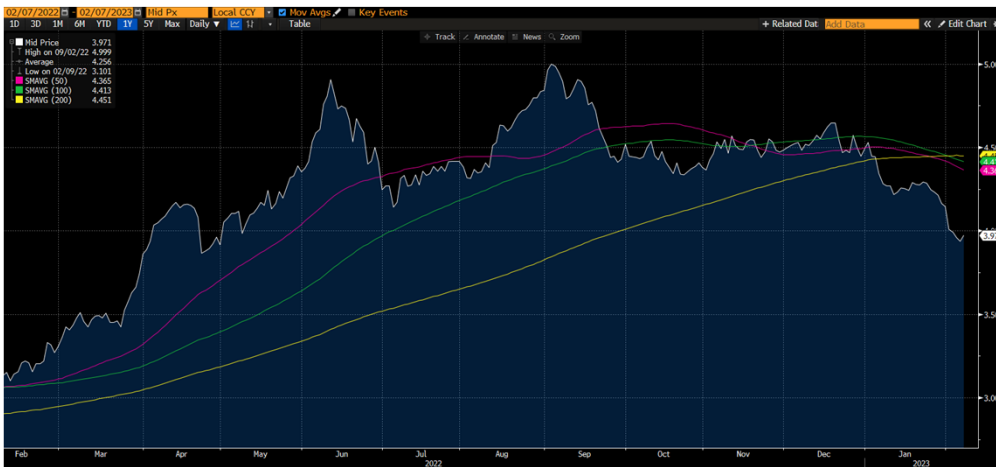
Backup Slides



Cal 2026/2027– NYMEX (as of 02/07/23)

- Cal 2027 NYMEX trading @ 4.02

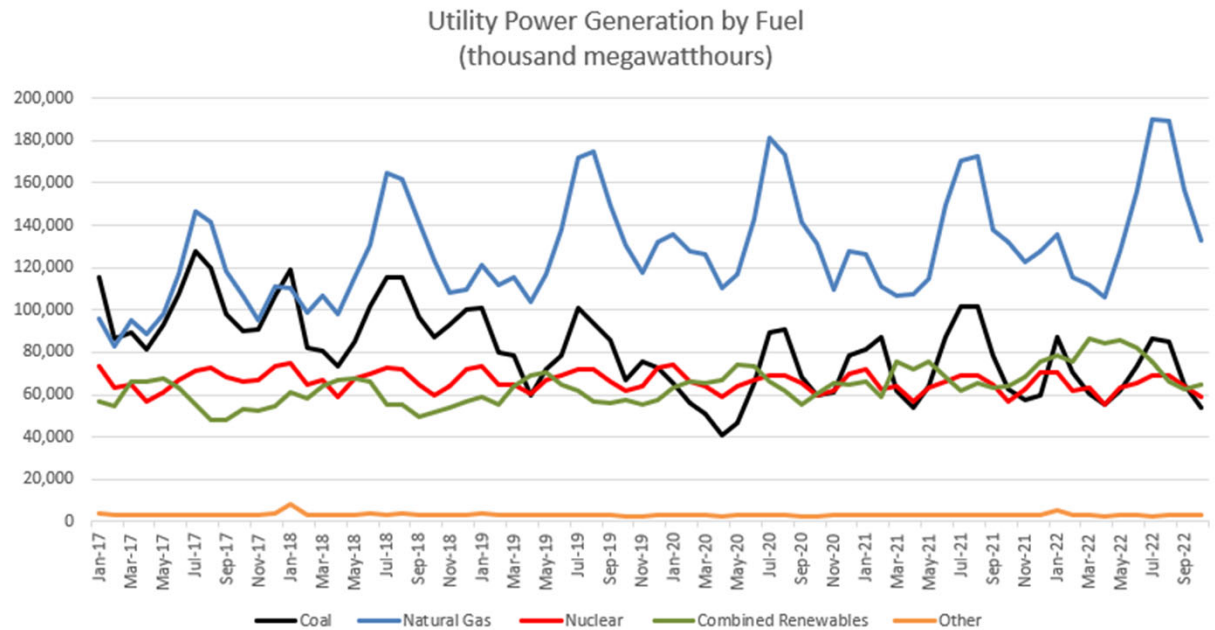
- Cal 2026 NYMEX trading @ \$3.98



Source: Bloomberg

Power Generation by Fuel

- Overall demand for power continues to grow in the U.S. Gas fueled power generation continues to grow, increasing by 74,119 thousand MWh since 2017
- Fuel mix continues to change with coal losing most. Largest increases 2017-2021
 - Natural gas +282,918 thousand MWh
 - Renewables +128,680 thousand MWh
- Ten months ended YTD 2022 vs 2021, overall demand increased 100,049 MWh which was met by natural gas and renewables almost evenly



Source: EIA Data

BIOGRAPHICAL INFORMATION

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Brian Habacivch began his career in the natural gas industry as the Associate Editor of Gas Daily, the nation's leading natural gas industry information service and price index. Brian covered the natural gas spot market compiling the daily pricing indices for traders, brokers, producers and end-users of natural gas and regulatory matters at the Federal Energy Regulatory Commission in Washington, D.C.

Brian has worked in natural gas sales and marketing, business development, energy project development, energy consulting and management, and energy market intelligence at Allegheny Energy, Sprague Energy Corp., Fellon-McCord and Associates, and Constellation. Brian was in charge of energy market intelligence, risk, and publications for one of the leading energy consulting firms in the U.S. providing risk management services to a large portfolio of the nation's leading manufacturers and institutional end-users in the U.S. and E.U. Brian's comments on energy markets have been featured in The Wall Street Journal, Barron's, and Industry Week.

Today, Brian is Principal, Commodities Management Group with Constellation Energy Corp (Nasdaq CEG). Constellation is among the leading U.S. electric power generators and is the largest supplier of electric power and natural gas to industrial, commercial, and institutional consumers of energy. Constellation is the largest generator of carbon free energy in the U.S. and operates the largest fleet of nuclear-power generation in the country. The Commodities Management Group, within Constellation, is the energy-market-intelligence function of the company covering electric power, natural gas, crude, coal, and other inputs that affect the direction and pricing of energy markets.

Brian has spoken at hundreds of industry events during his career both in the United States and the European Union and interacts with thousands of industrial, commercial, and institutional consumers of energy. Brian is a past member of the Petrochemical Refiners Association Shale Energy Committee, The Aluminum Association of America, and works closely with The Energy Professionals Association.

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Jeff joined Edison Energy's team of energy experts in 2001. He actively develops and manages energy assets and strategies for many of our clients in the automotive, chemical, aluminum, glass, and plastics industries. He works closely with clients to thoroughly understand how natural gas is used in operations, and how to define success as it relates to their energy plan. He also interprets, develops, and publishes regular market intelligence pieces for use by internal and external users and utilizes market signals to position clients where they desire to be in the future. Prior to joining Edison, Jeff worked for a regulated interstate pipeline as well as a deregulated natural gas marketing company. Jeff is a graduate of Mount Vernon Nazarene University with a bachelor's degree in accounting.