Interstate Oil and Gas Compact Commission Presentation
Natural Gas Production and Grid Reliability

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North Dakota Public Service Commission

NORTH Dakota

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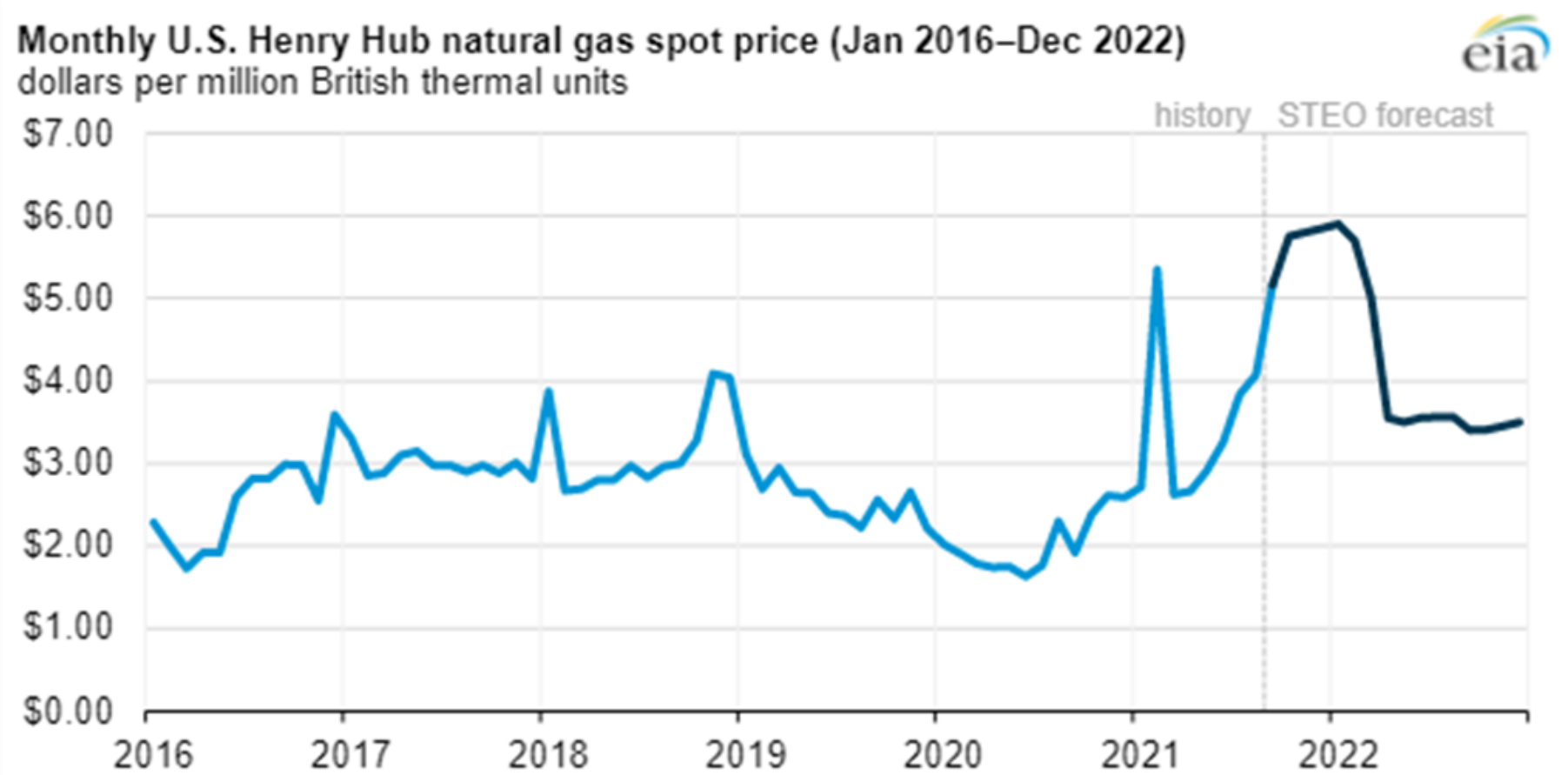
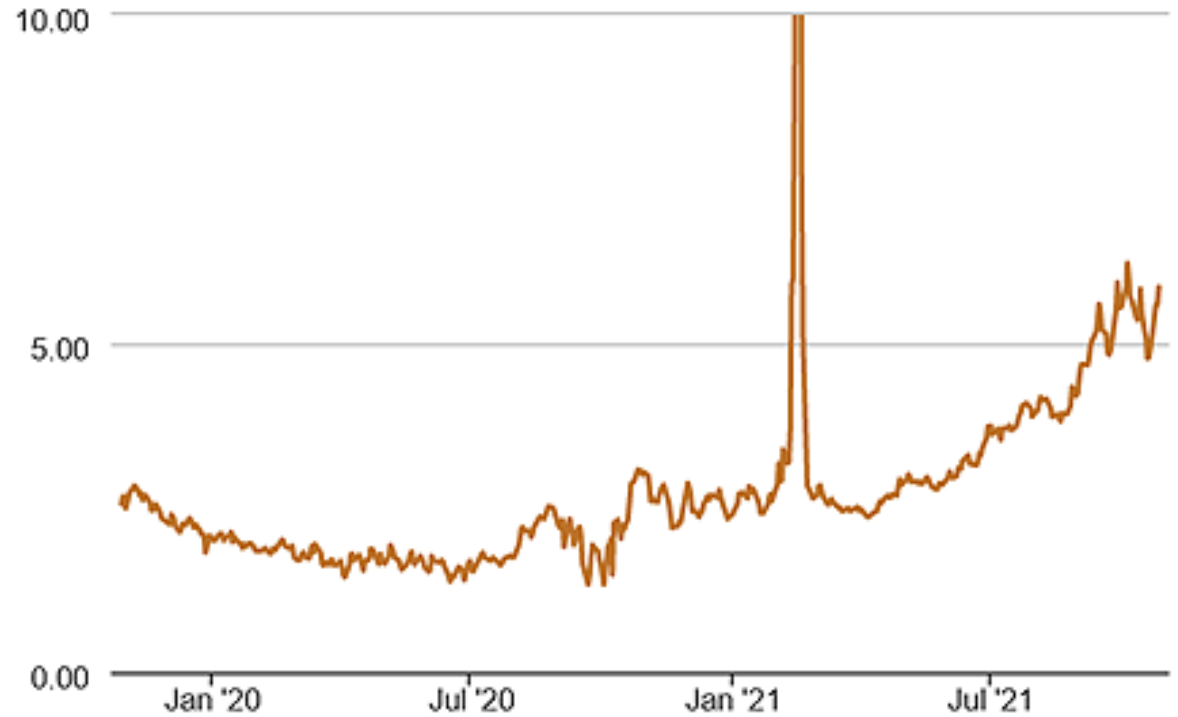
Natural Gas Prices Have Surged



Natural gas spot prices (Henry Hub)

dollars per million British thermal units



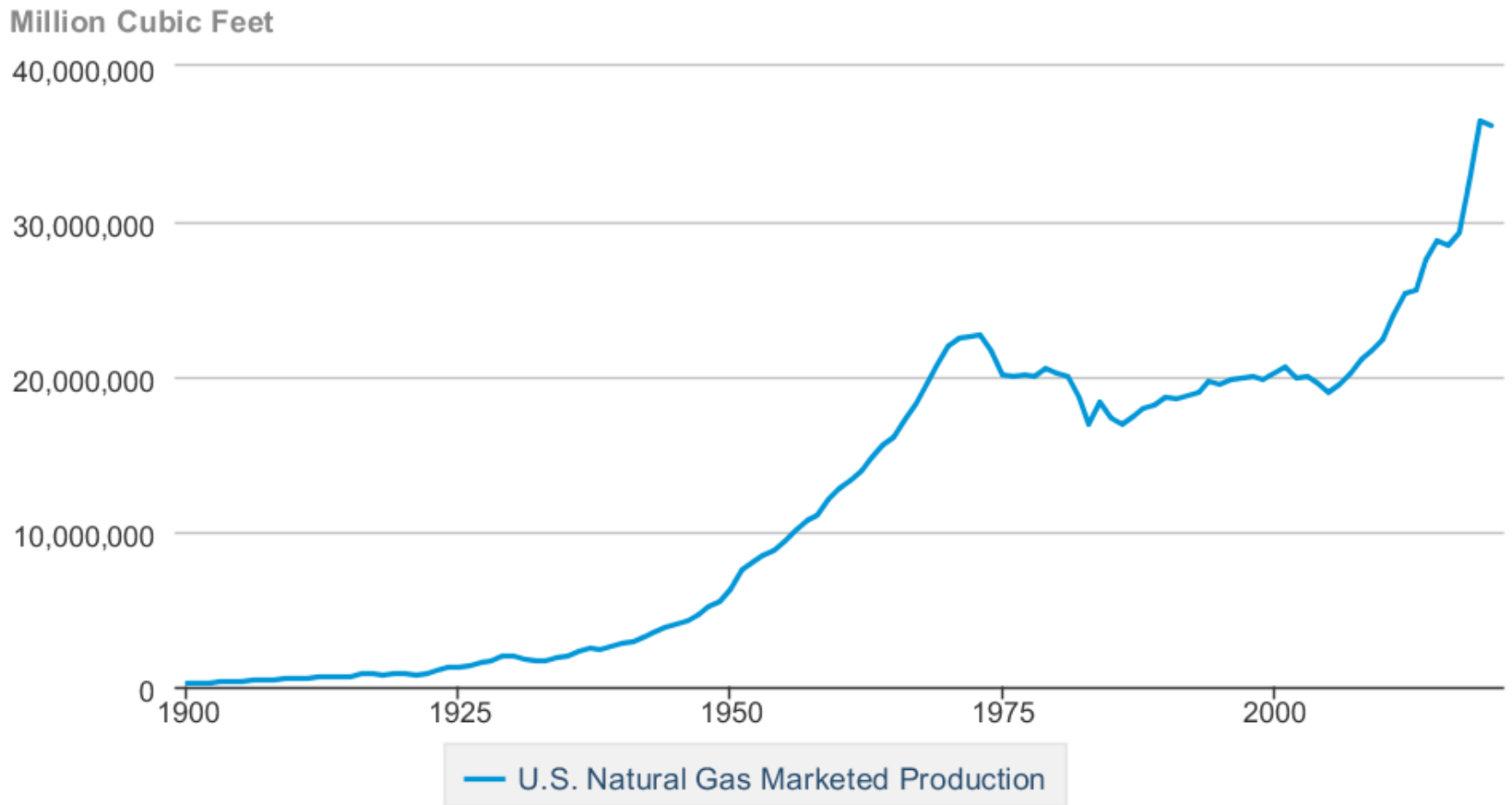
Source: Graph by the U.S. Energy Information Administration (EIA), based on data from Natural Gas Intelligence

Note: Henry Hub prices reported for February 16 and 17, 2021, exceeded the published range, averaging $16.96/MMBtu and $23.61/MMBtu, respectively.

Market Forces Impacting Natural Gas Pricing

- In 2020, total annual U.S. natural gas exports were 5.28 Tcf — the highest on record — and the U.S. was a net exporter of NG for fourth year in a row
- Approximately 55% of total U.S. natural gas exports in 2020 were by pipeline to Mexico (69%) and Canada (31%)
- Since summer, global gas prices have risen to record highs as European utilities work to refill low stockpiles
- Rising demand in Asia
- Energy shortfalls have caused power blackouts in China
- At the beginning of Nov., U.S. NG futures fell on rising output, lower demand than previously projected and growing expectations the U.S. will have adequate gas in storage for the winter heating season

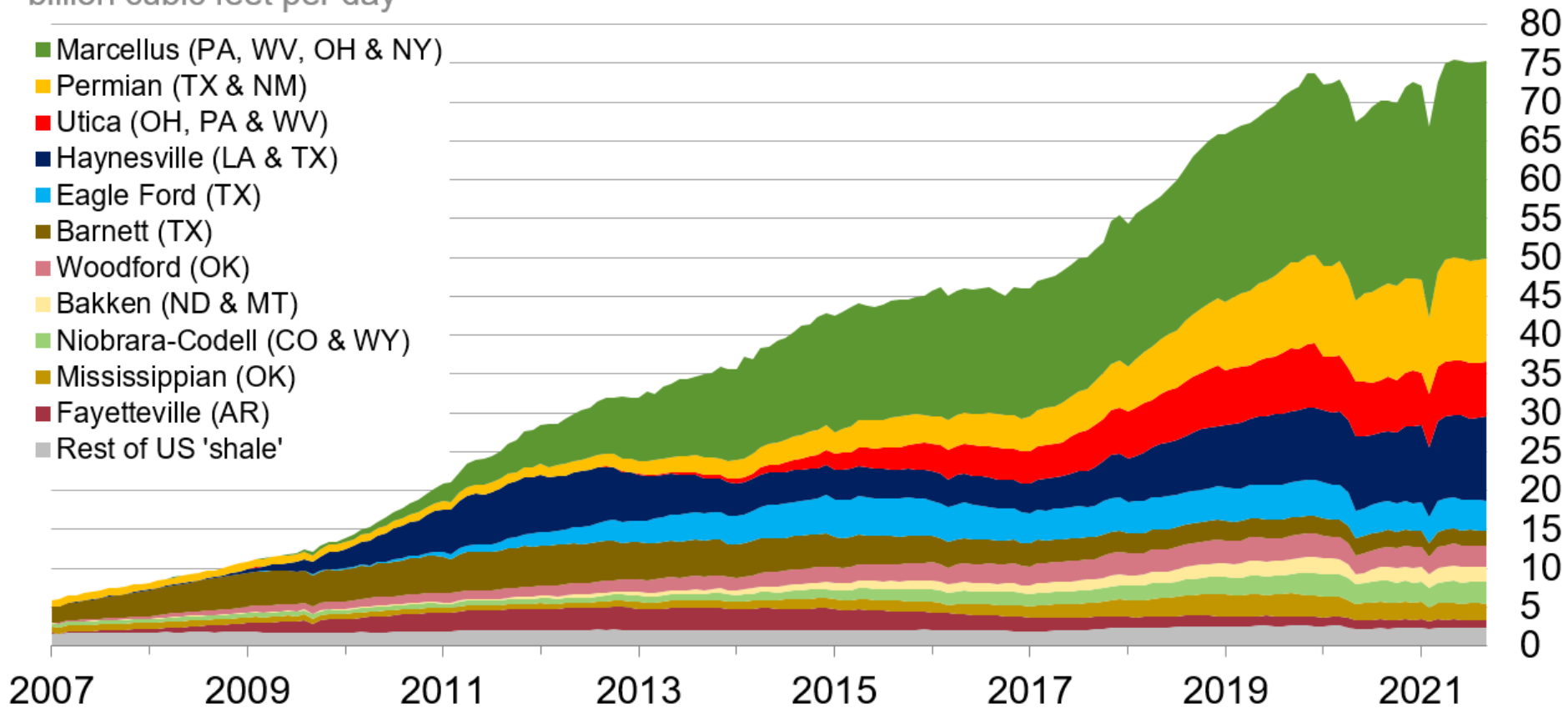
U.S. Natural Gas Marketed Production



Source: U.S. Energy Information Administration

Monthly dry shale gas production

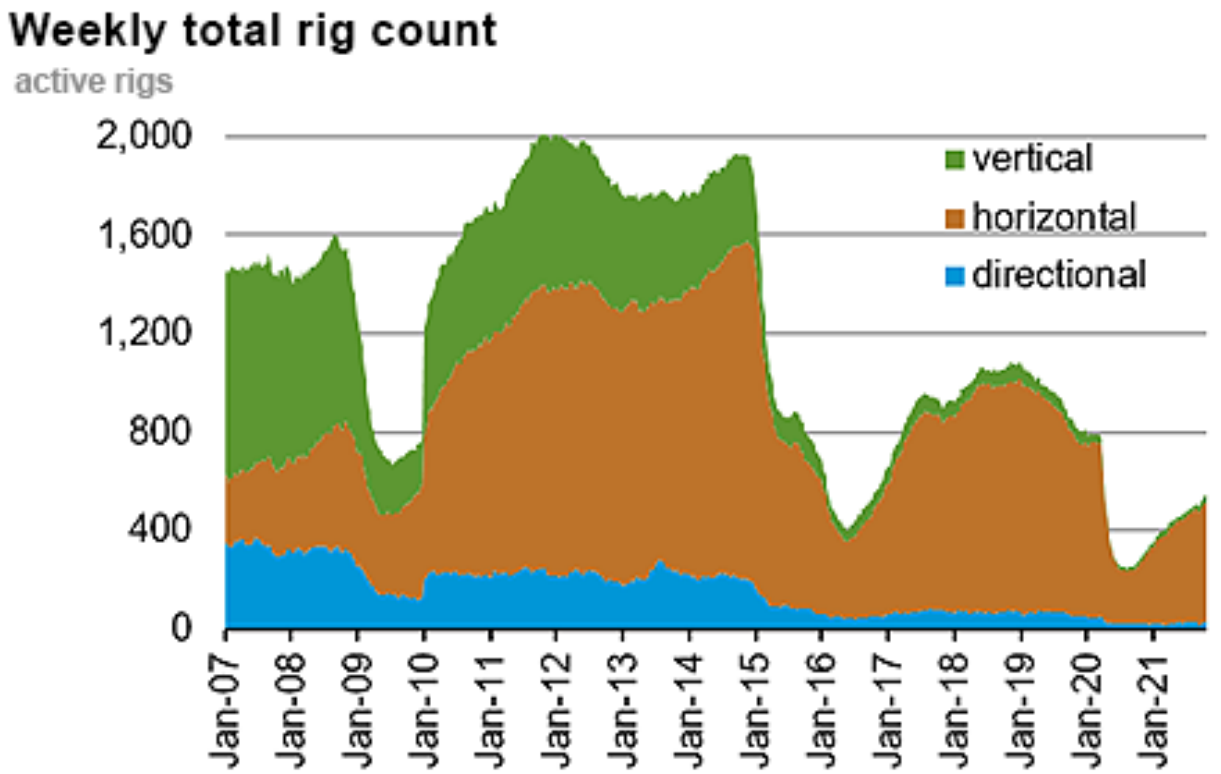
billion cubic feet per day



Source: Graph by the U.S. Energy Information Administration (EIA) based on state administrative data collected by Enverus. Data are through September 2021 and represent EIA's official tight gas estimates, but are not survey data. State abbreviations indicate primary state(s).

Note: Improvements to play identification methods have altered production volumes of between various plays.

Rig Count



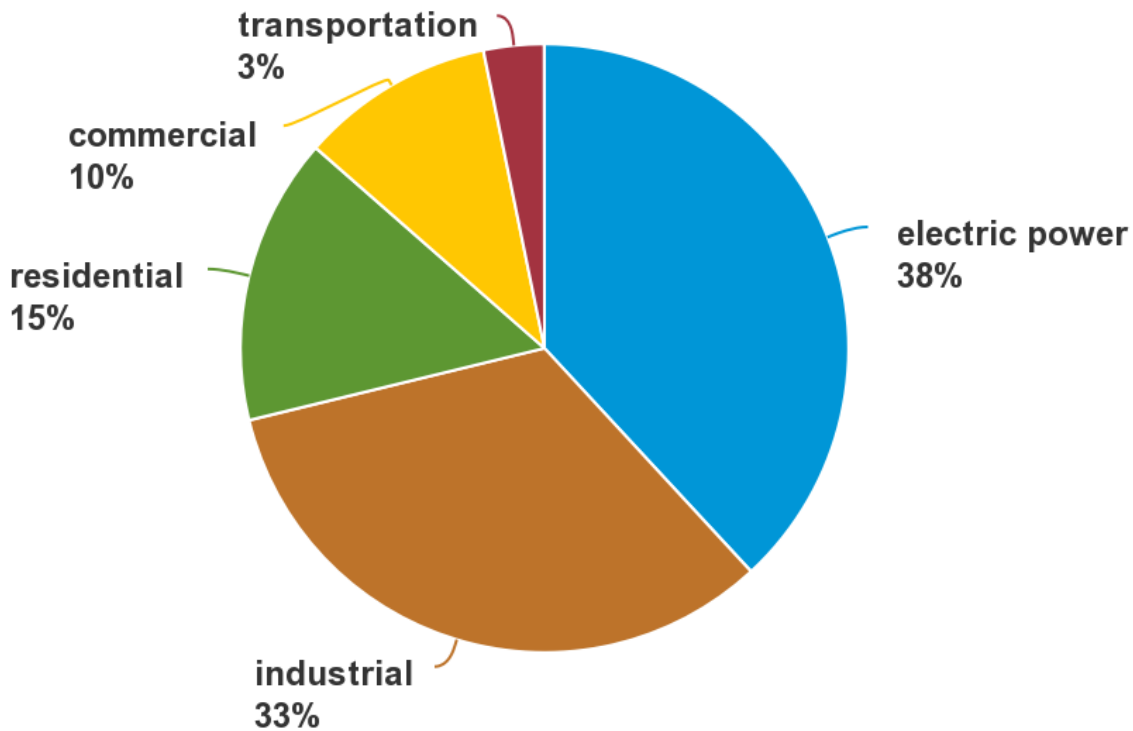
Source: Graph by the U.S. Energy Information Administration (EIA), based on data from Baker Hughes Company

Drilling Efficiencies Continue to Evolve and Improve

- Surging U.S. crude oil and natural gas production over the last decade has been driven by dramatic improvements in drilling efficiency
- Increases in drilling efficiency mean rig count is no longer the traditional method used to estimate production
- Oil and gas output each hit all-time highs in 2019 while the average monthly rig count and number of wells drilled per month were among the lowest in the last 45 years
- Horizontal wells averaged 18,000 feet of lateral length in 2019, up from about 10,000 feet in the early 2000s
- Horizontal wells' share of total wells drilled rose to 75% in 2019 from 2% in 1990

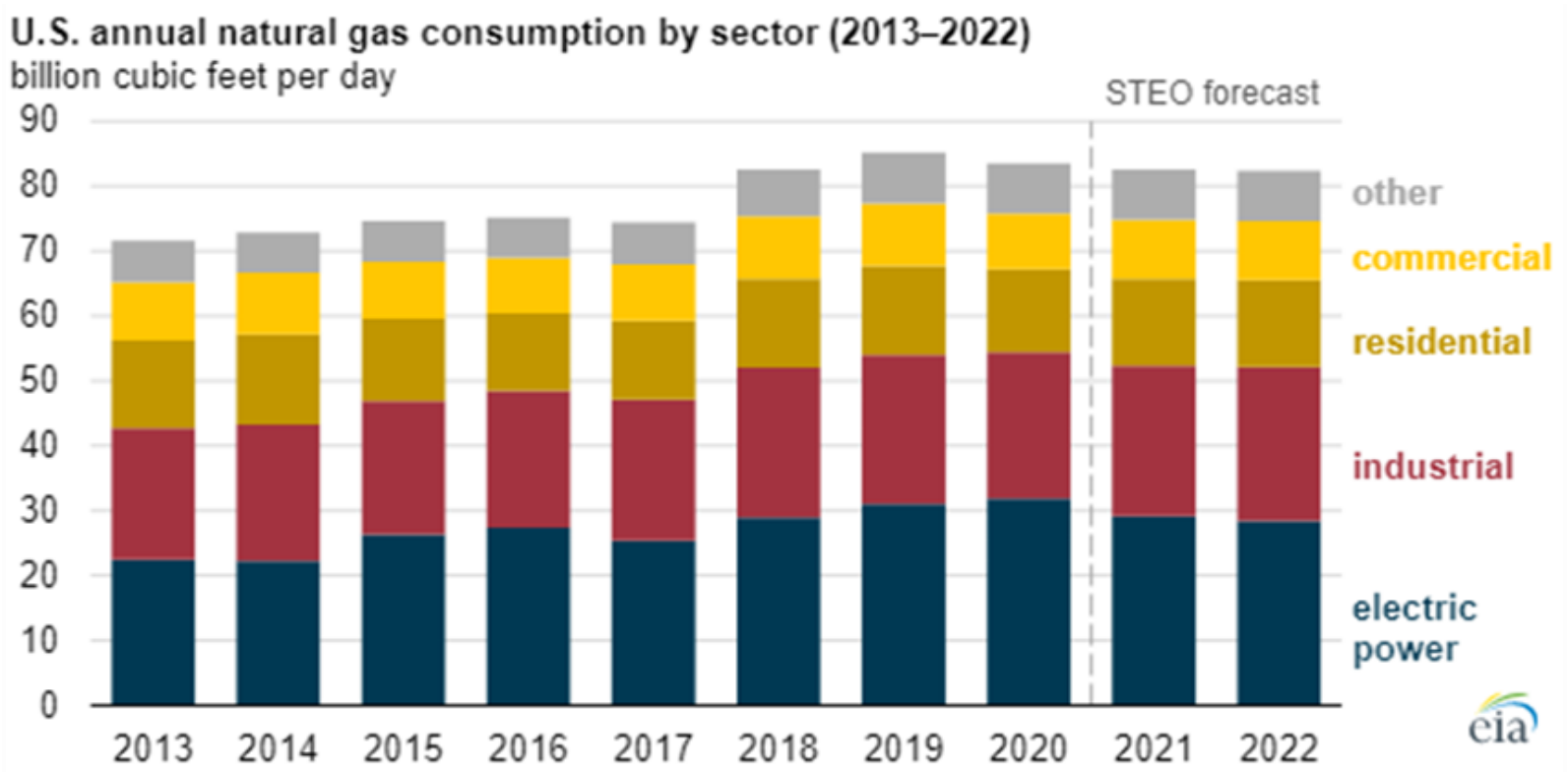
U.S. natural gas consumption by sector, 2020

Total = 30.48 trillion cubic feet

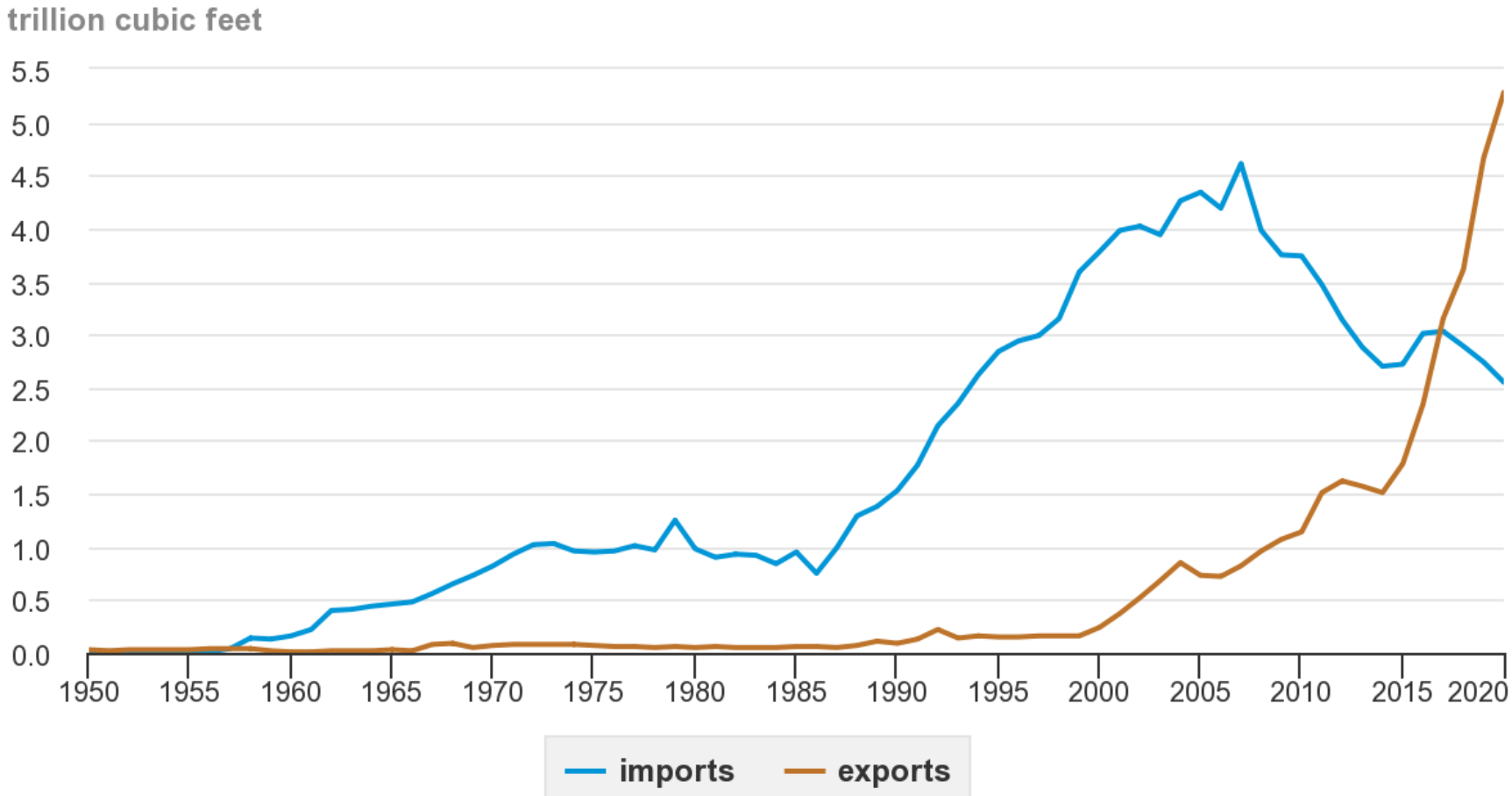


Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 4.3, April 2021, preliminary data
Note: Transportation includes pipeline and distribution use and vehicle fuel.

U.S. Natural Gas Consumption Trends

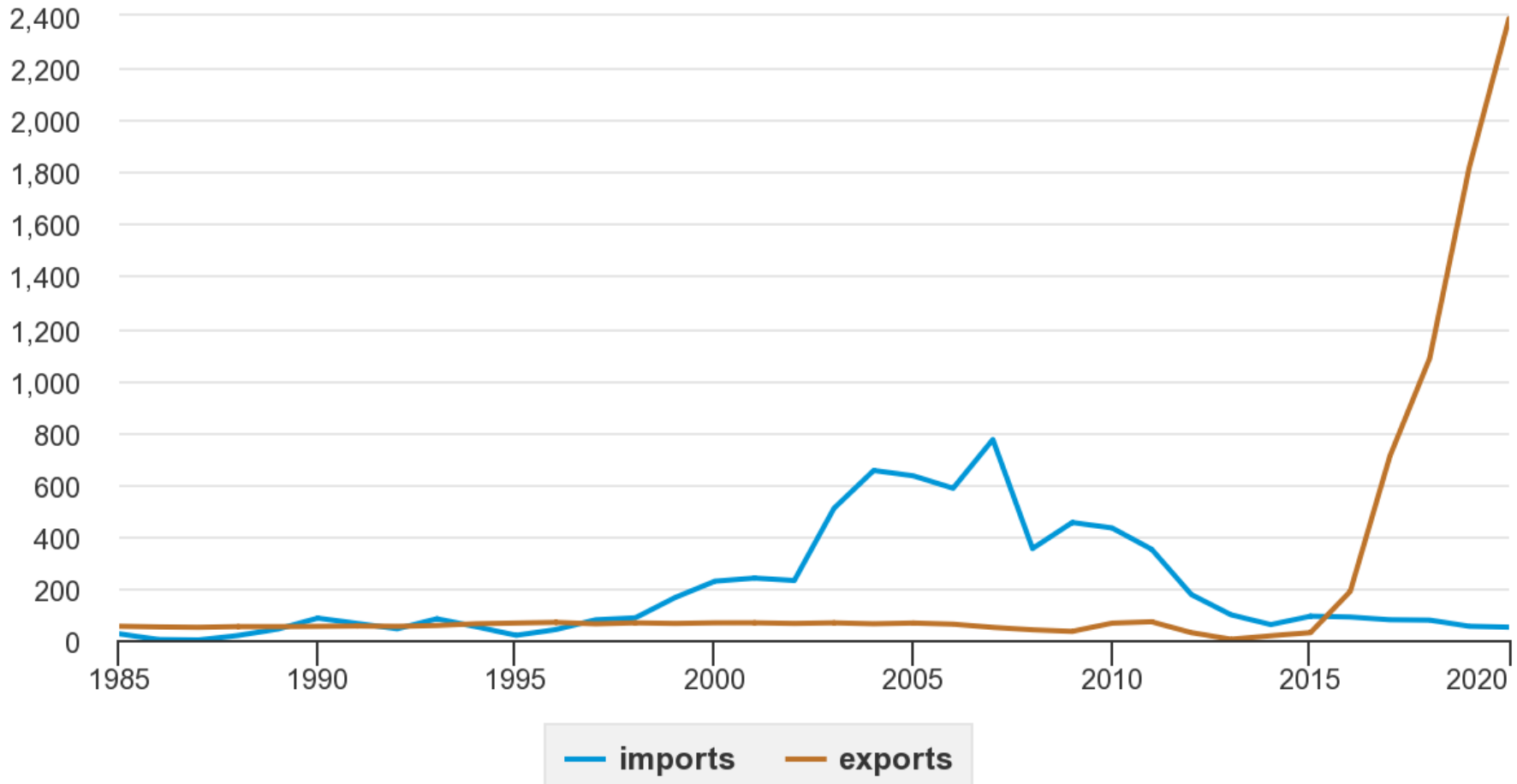


U.S. natural gas imports and exports, 1950-2020



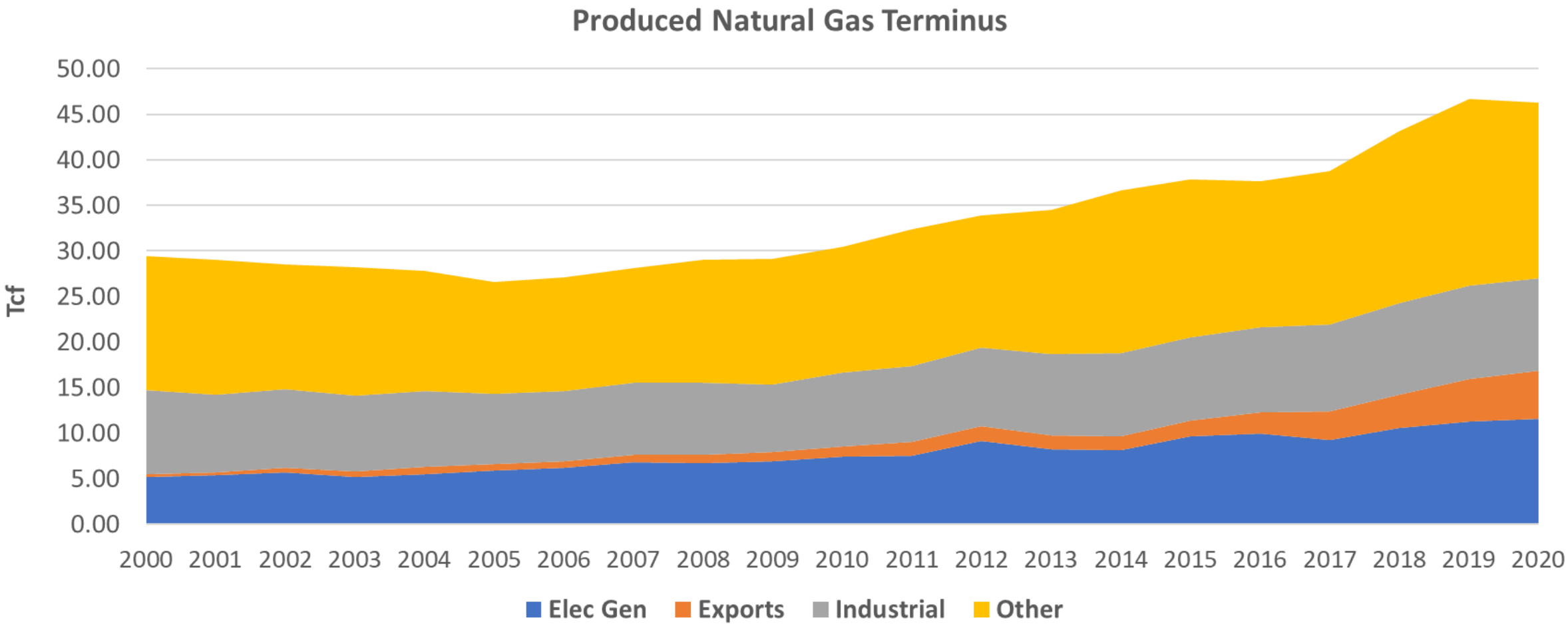
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 4.1, May 2021, preliminary data for 2020

U.S. LNG imports and exports, 1985-2020



Source: U.S. Energy Information Administration, *Natural Gas Monthly*, May 2021

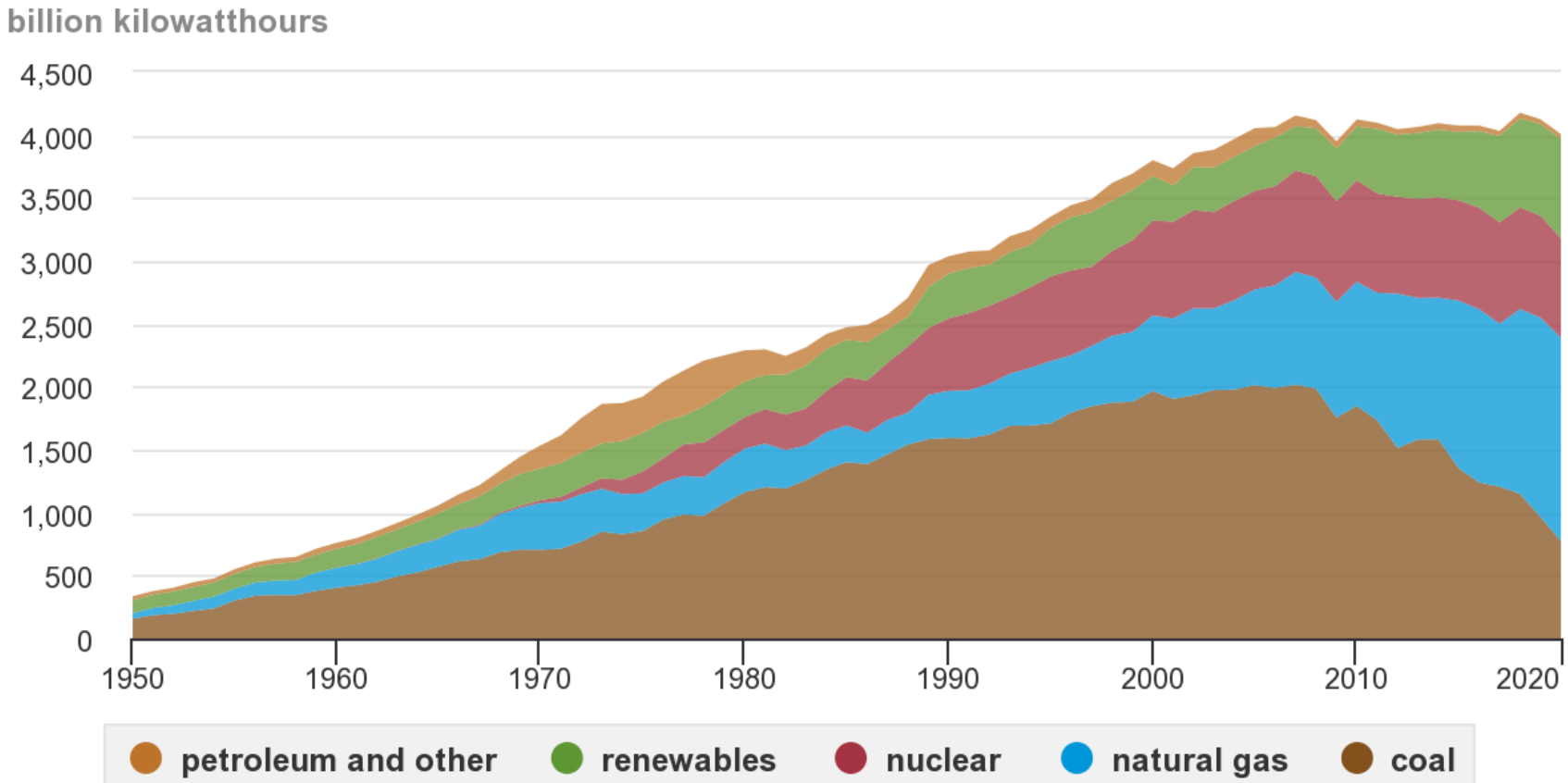
20-Year U.S. Natural Gas Usage Trend



Electron Manufacturing and Fulfillment

- Grid reliability begins with generation
- You can have the best transportation system imaginable but without adequate manufacturing capacity, reliability suffers
- However, it still “takes two,” generation and transmission
- Electrons are virtually the only commodity manufactured and delivered instantaneously
  - In its ideal state, electricity moves at the speed of light
  - Through a wire, electricity moves at 186,000 miles or 299,338 kilometers per second
- “Electron factory” models vary greatly
  - Fossil fuels – Natural gas and coal
  - Nuclear
  - Intermittent – Wind and Solar
  - Hydro

U.S. electricity generation by major energy source, 1950-2020



Note: Electricity generation from utility-scale facilities.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 7.2a, January 2021 and *Electric Power Monthly*, February 2021, preliminary data for 2020

U.S. Natural Gas Generating Fleet

- In 2019 there were approximately 1,900 natural gas power stations in the U.S.
- NG produced 1,624 billion kWh in 2020 or 40.5% of total U.S. electric generation
- Coal, once the backbone of generation, produced 773 billion kWh or 19.3% in 2020

Looking Forward
NG's Role in Electric Generation

NG will play a key role in the generating sector

NG will be a continued feature of our energy mix for at least the next several decades

Important caveats to consider:

- Not all gas is created equal – suppliers with "certified low emissions" will disproportionately benefit
- Upward price shifts – demand destruction

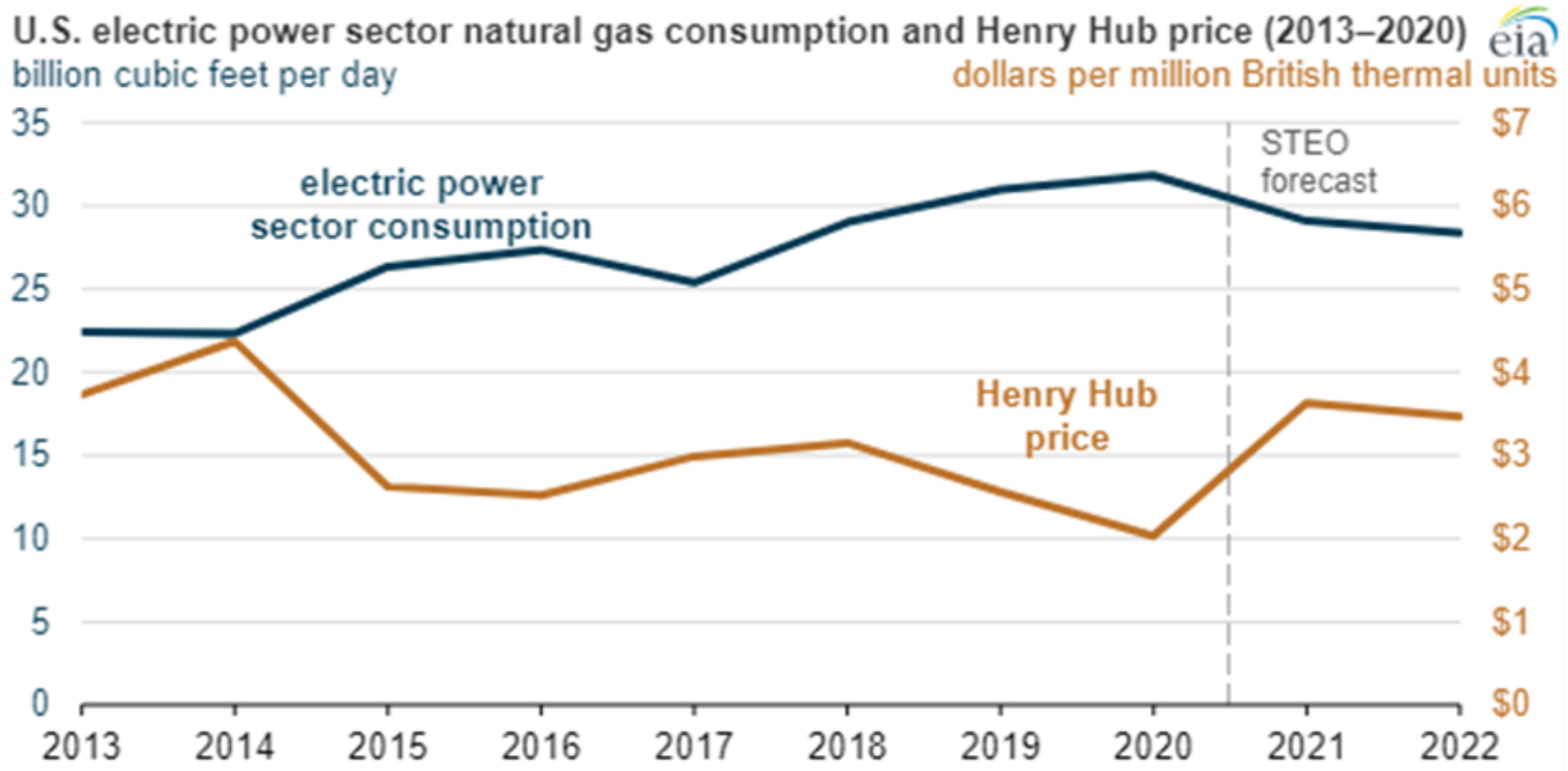
NG has numerous positive attributes

- Generation capacity
- Dispatchability
- Fast ramp rates
- Frequency response
- Complements intermittent energy resources

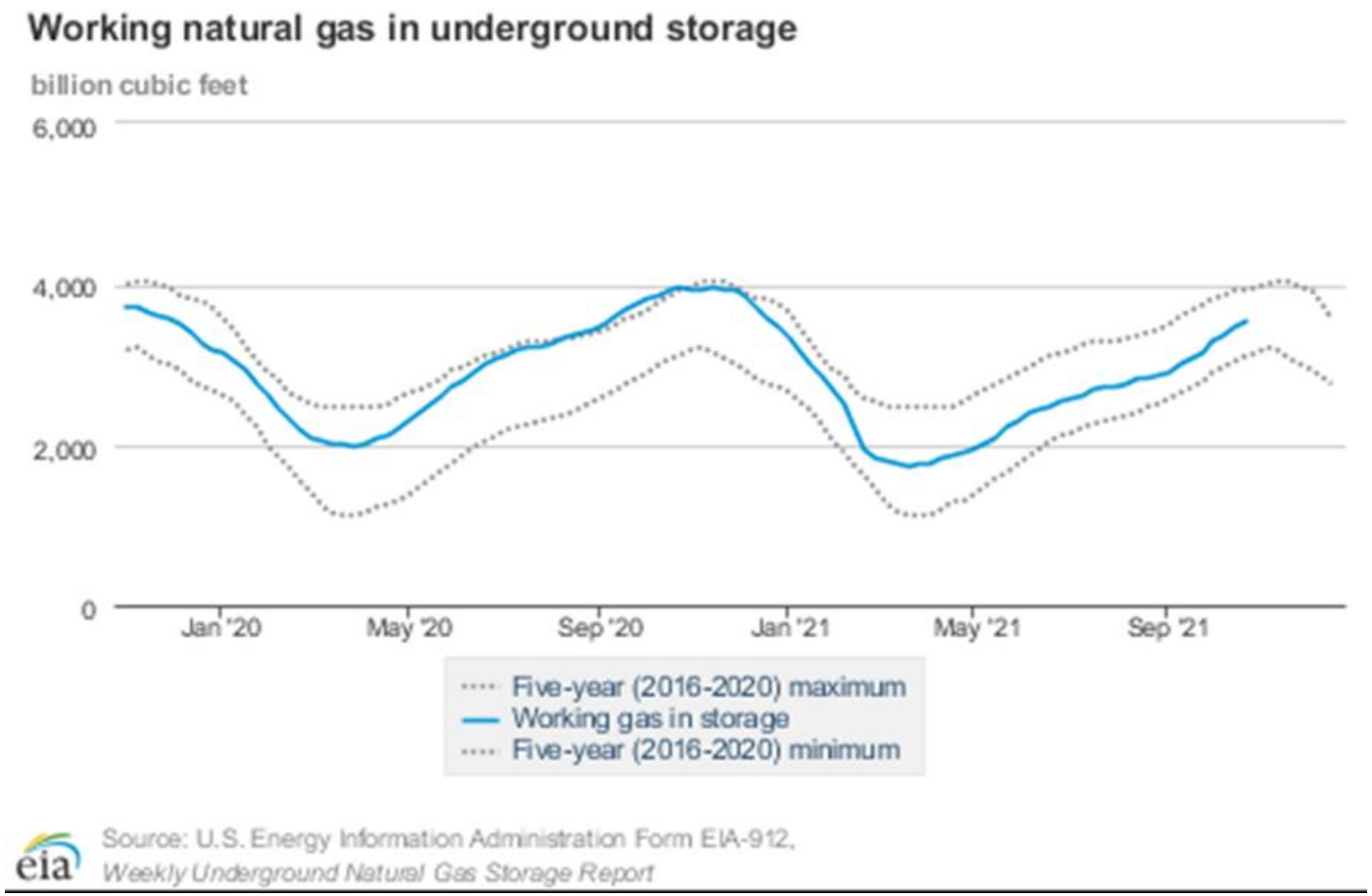
Natural Gas Usage Trends – Power Sector

- The convergence of low-priced NG, viewed as a “greener fossil fuel,” coinciding with a sharp increase in intermittent resources has driven placement of simple- and combined-cycle NG electricity generating units across the U.S.
- NG consumption in the largest consumer sector – electric power – rose 3% in 2020
- Share of NG-fired generation is expected to decrease in 2021
- EIA predicts intermittent and NG power resources will account for 70% of all U.S. electricity by 2050

Pricing Matters



Stored Gas Impacts Price



NG Challenges and Opportunities

- Competition from other energy sources
  - Nuclear – SMRs that mimic NG peaking unit attributes
  - Intermittent resources' ability to economically store energy
  - Hydrogen as a fuel source
- Storage development
- Advancement of carbon-capture technology
  - Coal is squarely in the crosshairs of environmentalists and policy makers; NG also under scrutiny
  - Can technology advance rapidly enough to make CCUS economically viable?
    - Will utilities be granted recovery for CCUS investment?
  - Will CCUS satisfy growing ESG scrutiny?

NG Challenges and Opportunities

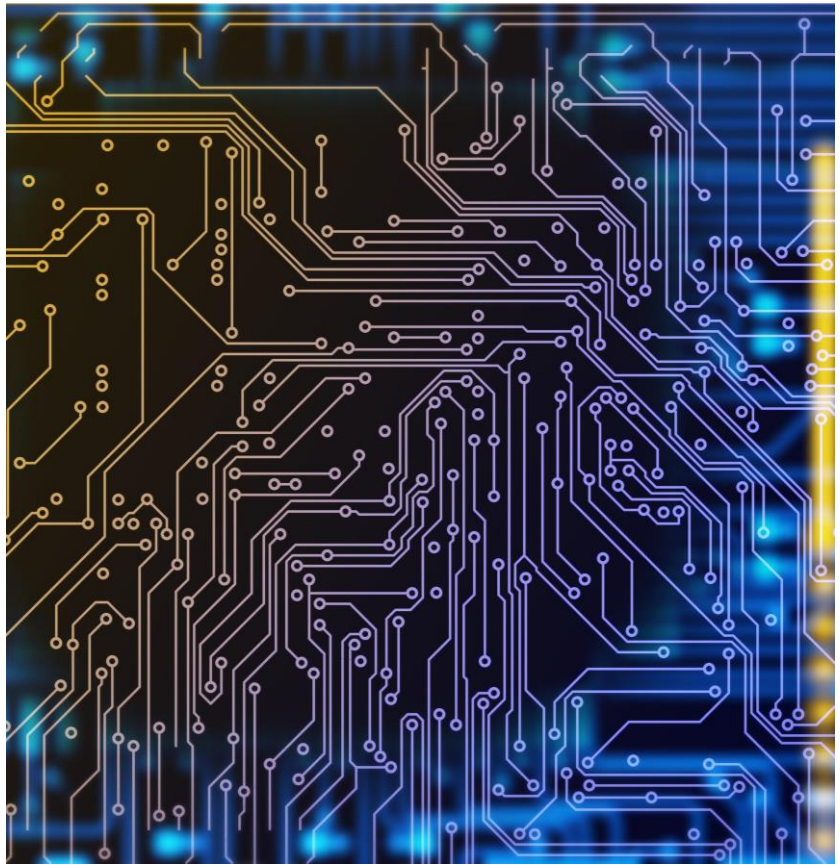
- Marketing
  - Changing public perception
- Race for economically scalable solutions
  - CCUS
  - Battery storage
  - Hydrogen generation
  - SMRs
- Political headwinds
  - Federal and state clean energy policy poses long-term challenges for NG

Lessons Learned From February

- Regulatory frameworks matter
- Weather event modeling is critical
  - Inputs are key
- Deficiencies exist for both generation (fuel source) and transmission
- We need better communication between generators and transmission operators (RTOs)
- Energy producers need to be incentivized to make capital investments to winterize systems
  - Utilities benefit from a “green transition” – Increased revenue base and subsequent ROE – Producers may not
- Working to enable the power grid to support variability
  - At times we have excess power production or instantaneous supply, outpacing consumption
  - Other times, consumption needs exceed available supply
  - Spikes in variability challenge current grid design

Future Realities From a Ratepayer Standpoint

- Future energy costs will continue to outpace the rate of inflation
- Significant transmission buildout will be necessary to accommodate the proposed future energy mix and ensure grid reliability
- Transmission buildout will be expensive, running in the trillions of dollars (borne by ratepayers)
- Low-income households and small businesses will be disproportionately impacted



Thank you

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