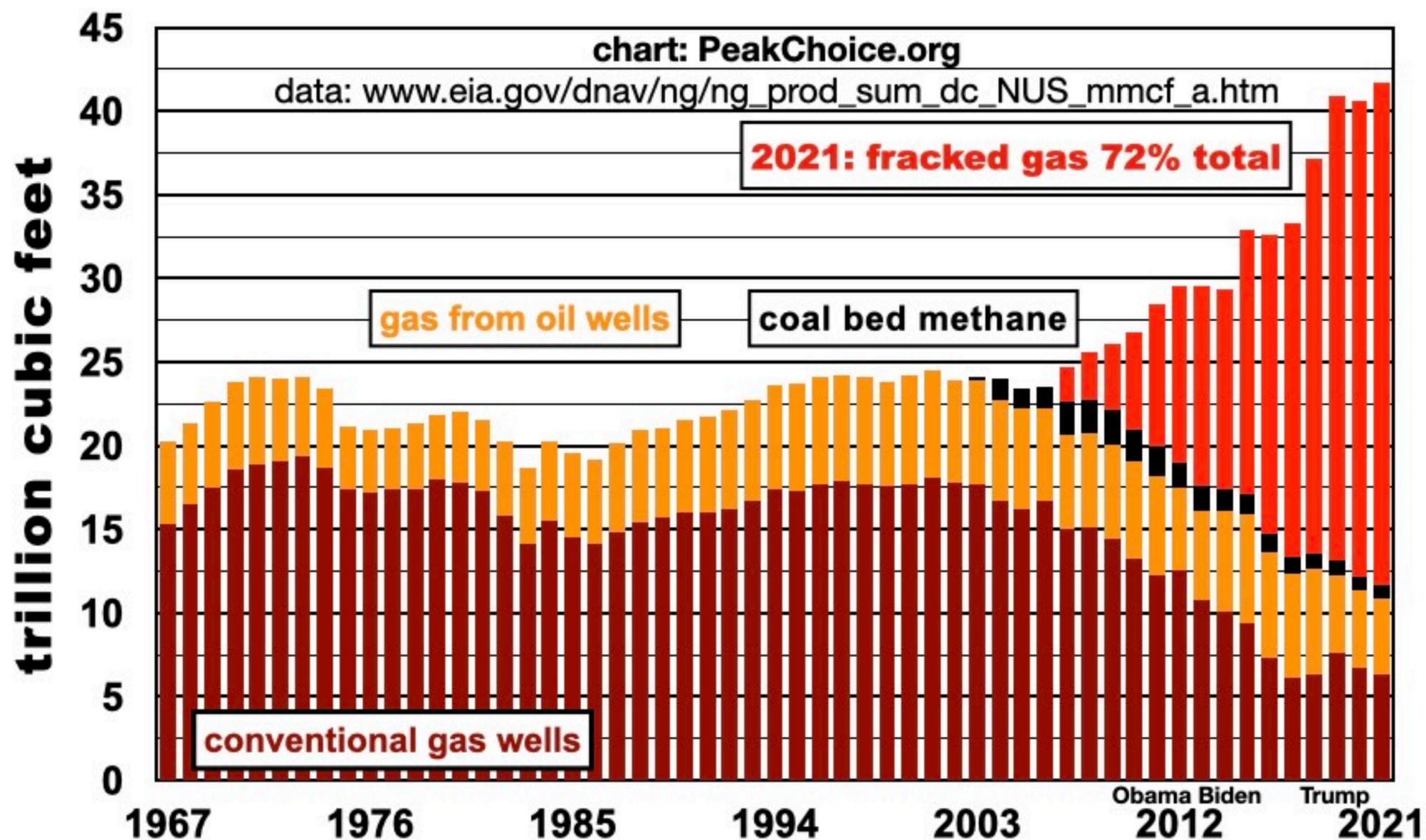


USA conventional unnatural gas peaked 1973

fracking postponed rationing

■ gas wells
 ■ gas from oil wells
 ■ coalbed methane
 ■ fracked gas

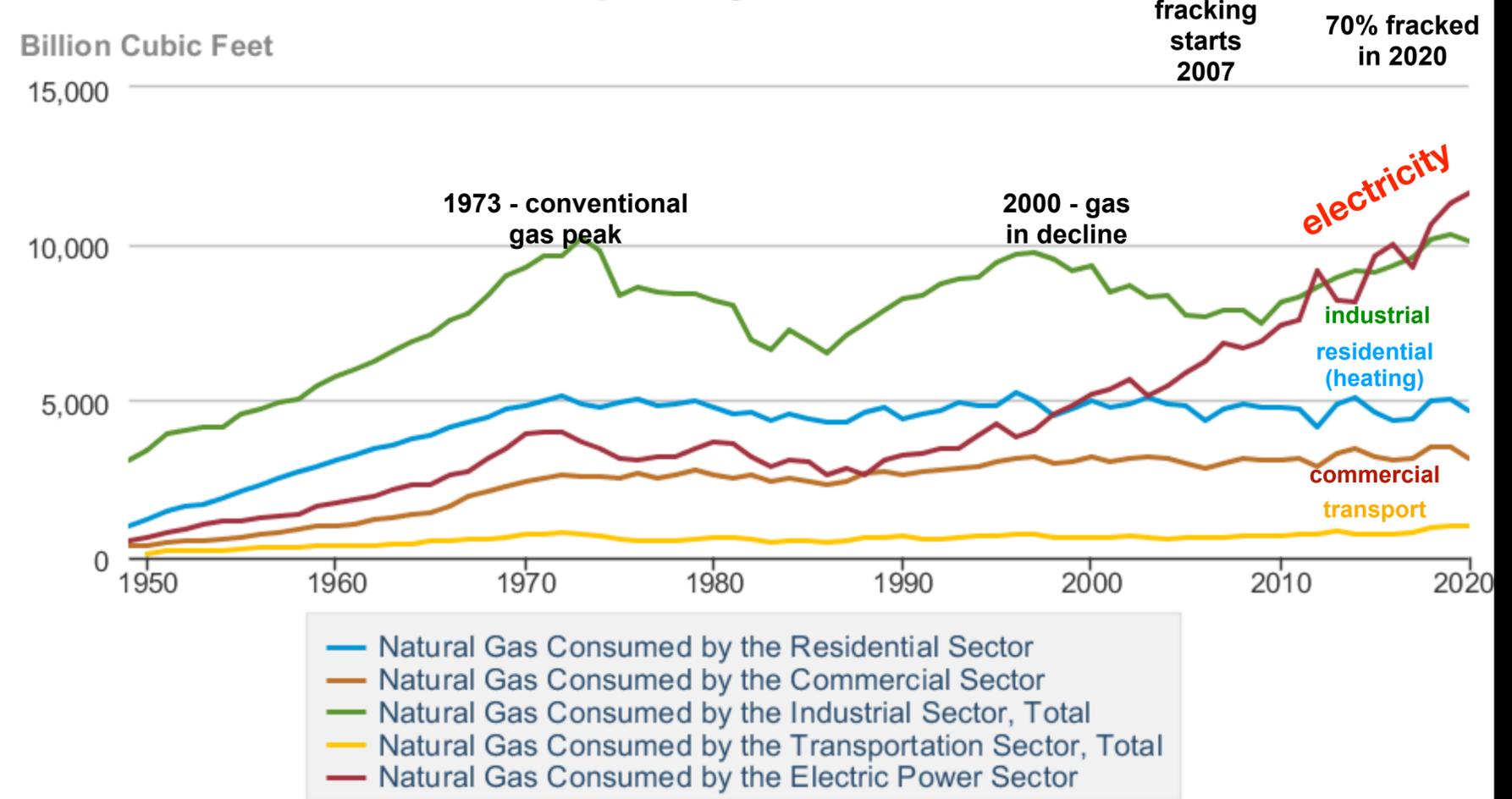


The main increase in the use of unnatural gas in the US in recent decades has been for electric grids.

Nat. gas generators are easier to approve under the Clean Air Act than coal burners (and coal is in permanent geologic decline, a physical fact obscured by discussion of its more obvious pollution problems). However, gas supplies were never sized to both power electricity and heat cold cities in the winter. Conventional gas decline has been mitigated by the sudden, sharp increase in fracked gas since 2008, but fracked gas is not only more toxic than conventional gas wells, it's also more expensive, takes more energy and talent. Fracked wells rise and fall faster than conventional drilling, so the fracking bubble is a short term boom and bust.

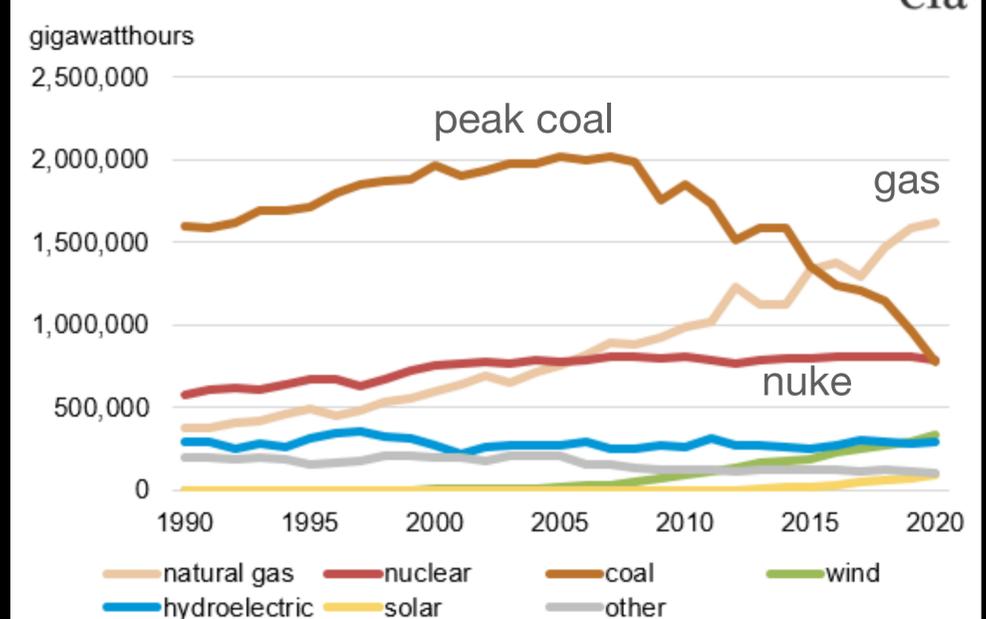
Campaigns to restrict nat. gas use in favor of more electricity ignore that gas is a primary power source for electricity. Here in Oregon, there has been a huge increase in nat. gas combustion east of the Cascades in Klamath Falls and Boardman, hard to notice in the liberal cities of Portland and Eugene, but gas is a key source of power. **Burning that gas and sending the electrons over the Cascade mountains might be less efficient than just burning the fuel closer to where the energy is wanted.** Using less energy, including less electricity, is usually belittled.

Table 4.3 Natural Gas Consumption by Sector



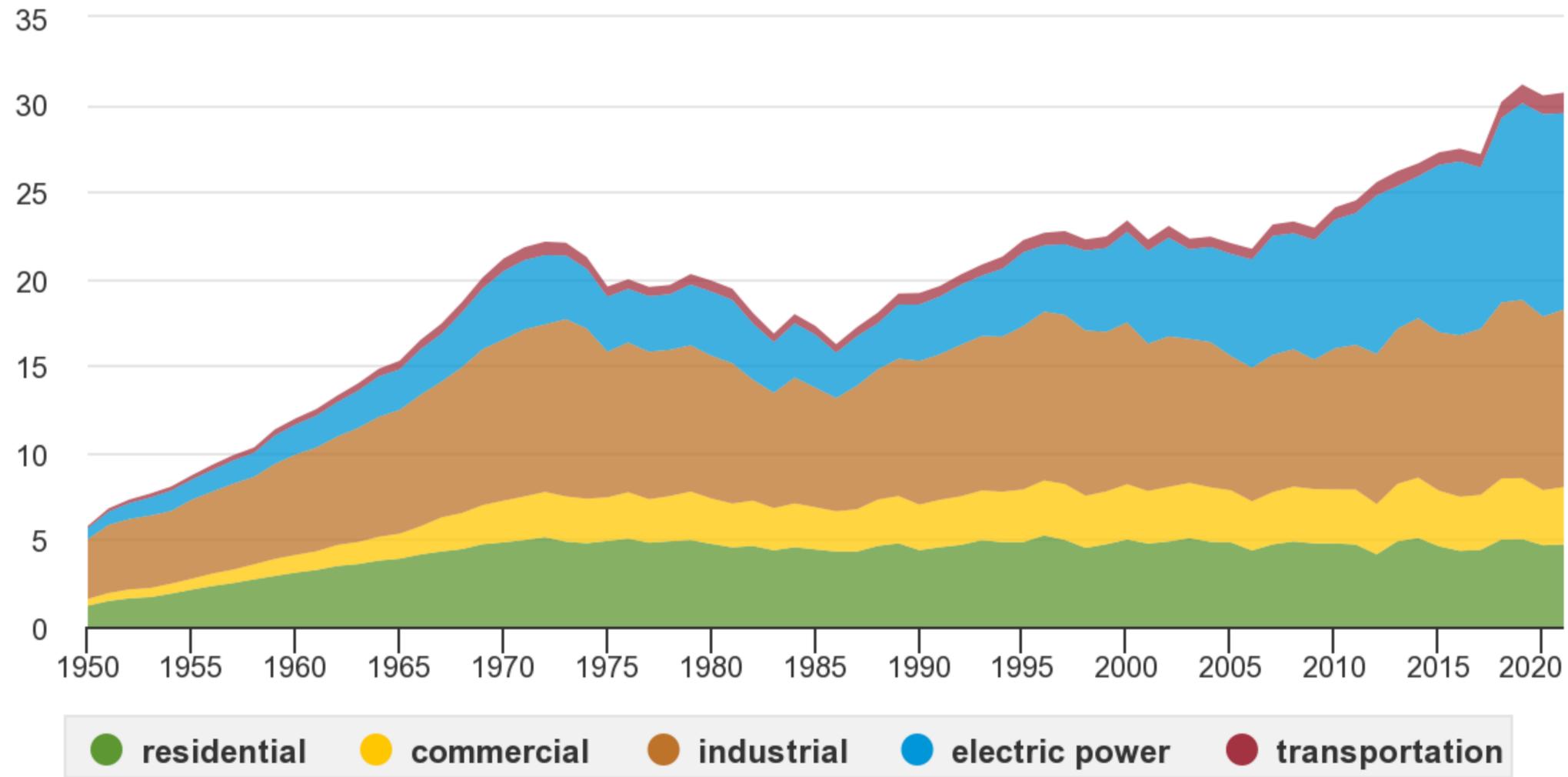
Source: U.S. Energy Information Administration

U.S. net generation by energy source, 1990–2020



U.S. natural gas consumption by sector, 1950-2021

trillion cubic feet

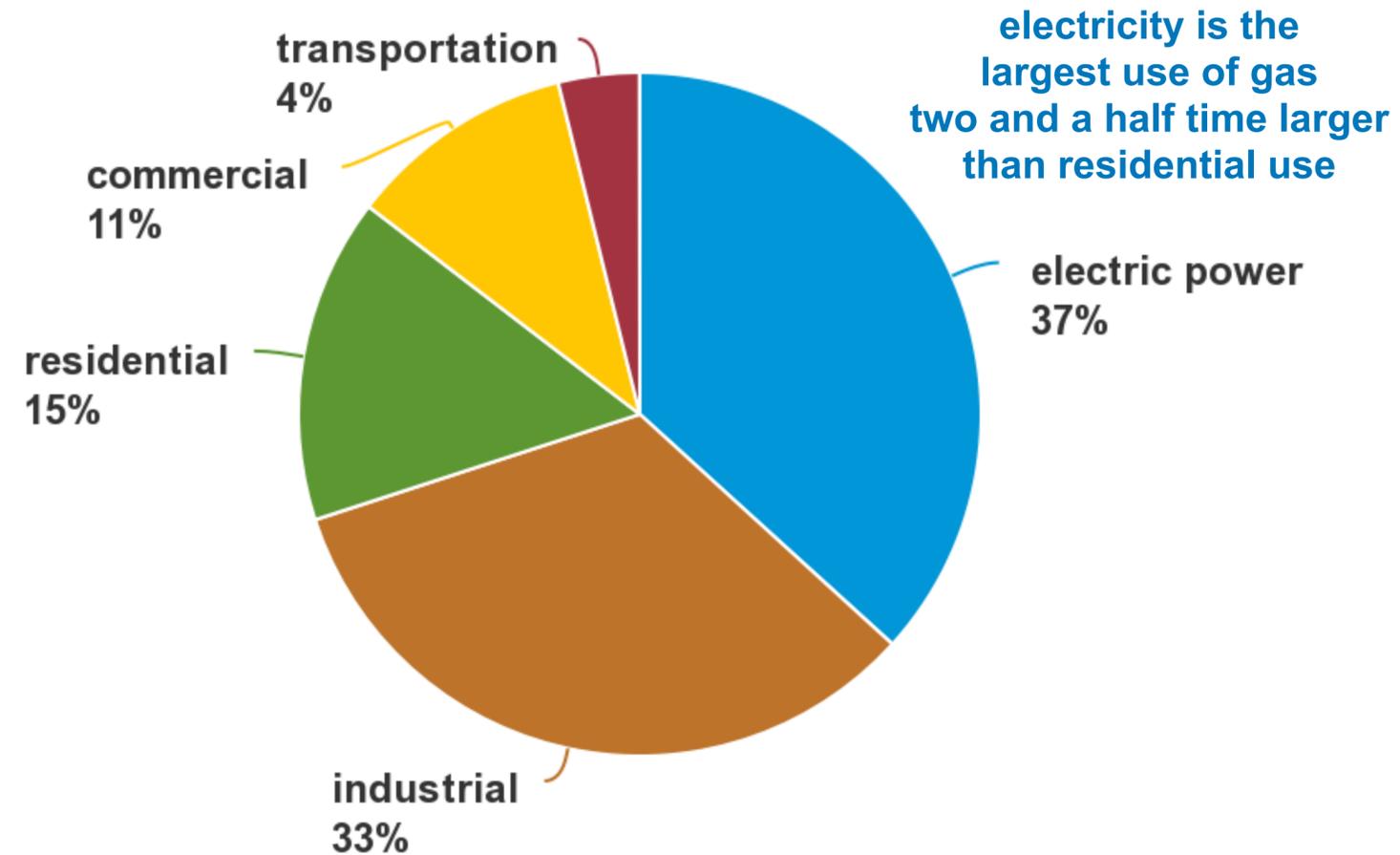


Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 4.3, October 2022

Note: Transportation includes pipeline and distribution use and vehicle fuel.

U.S. natural gas consumption by sector, 2021

Total = 30.66 trillion cubic feet



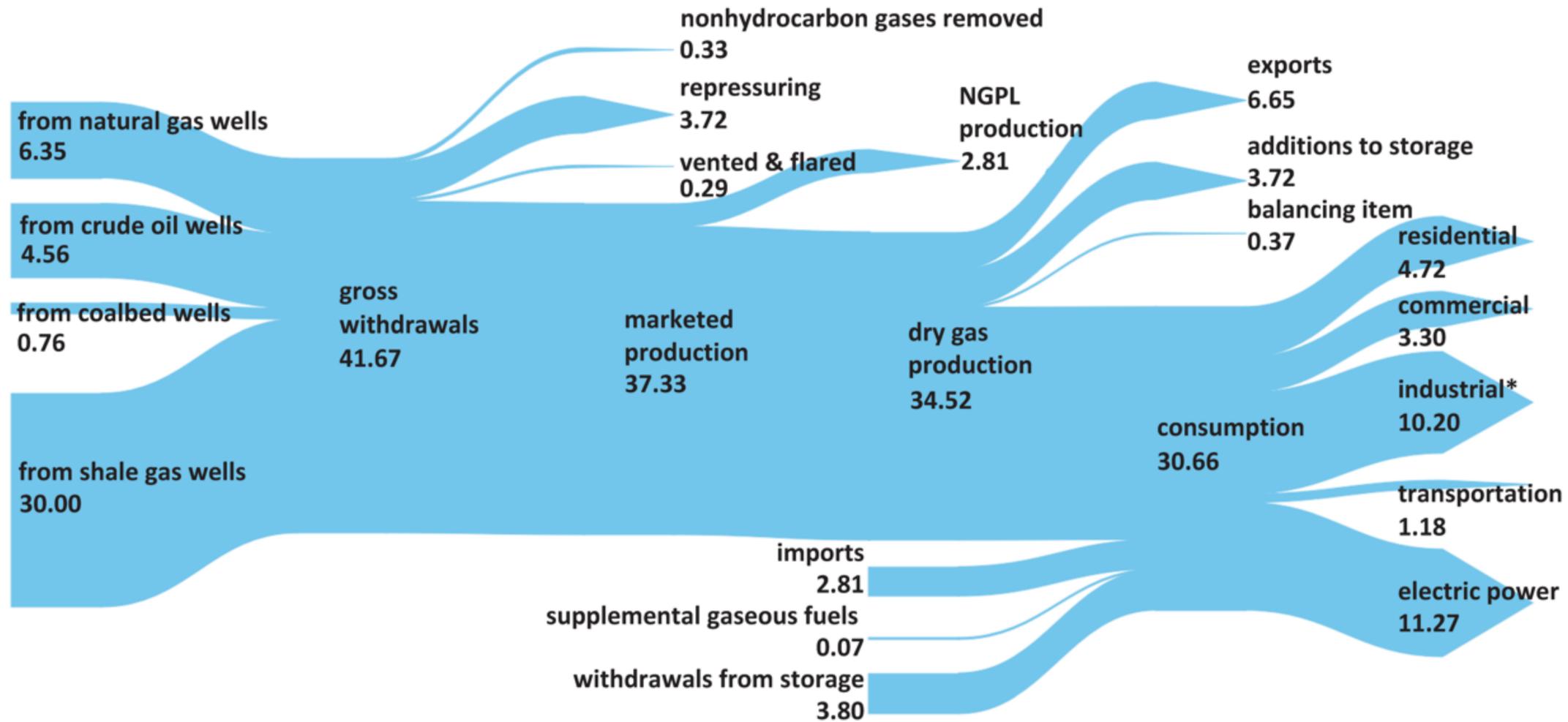
Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 4.3, October 2022



Note: Transportation includes pipeline and distribution use and vehicle fuel. Sum of shares may not equal total because of independent rounding of sector data.

Natural Gas Flow in the United States, 2021

trillion cubic feet



* Industrial includes lease and plant fuel.

Source: U.S. Energy Information Administration (EIA), Form EIA-176, *Annual Report of Natural and Supplemental Gas Supply and Disposition*; Form EIA-914, *Monthly Natural Gas Production Report*; Form EIA-857, *Monthly Report of Natural Gas Purchases and Deliveries to Consumers*; Form EIA-816, *Monthly Natural Gas Liquids Report*; Form EIA-64A, *Annual Report of the Origin of Natural Gas Liquids Production*; Form EIA-191, *Monthly Underground Gas Storage Report*; Form EIA-923, *Power Plant Operations Report*; Form EIA-23, *Annual Survey of Domestic Oil and Gas Reserves*; Office of Fossil Energy and Carbon Management, U.S. Department of Energy, *Natural Gas Imports and Exports*; the Bureau of Safety and Environmental Enforcement and predecessor agencies; state and federal agencies; IHS Markit; Enverus; and EIA estimates based on historical data.

Note: The balancing item is expressed in this flow diagram as an outflow and is therefore a positive number. In the *Natural Gas Annual* tables, it is expressed as -0.37 trillion cubic feet, as U.S. total supply is greater than disposition for 2021. Transportation includes vehicle fuel and pipeline and distribution use.

NATURAL GAS

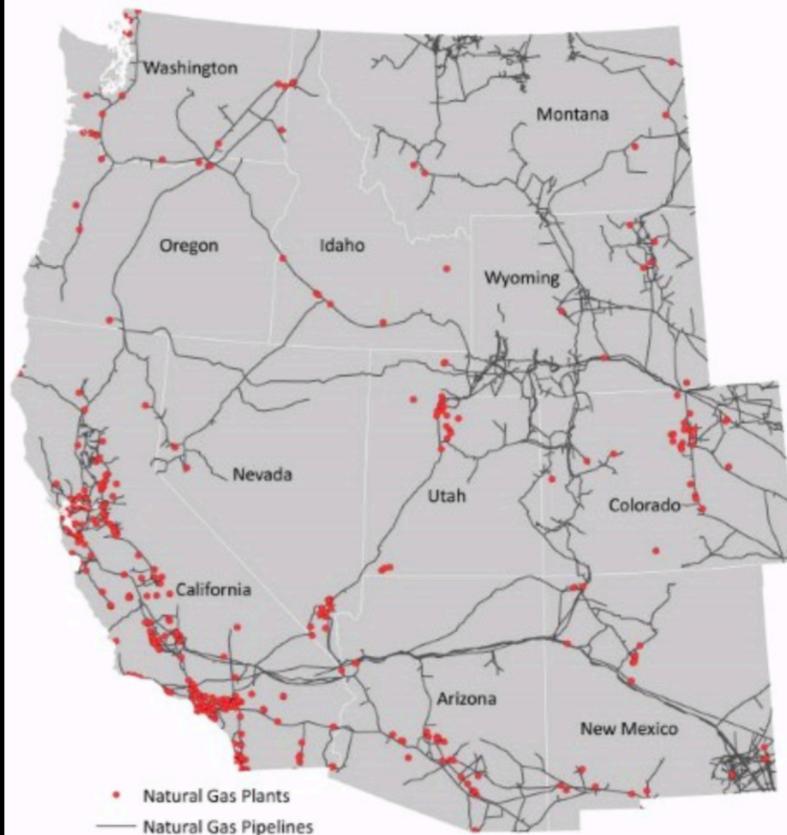
There is significant fluctuation from year to year in the consumption of natural gas for electric power generation. Consumption in other sectors is relatively steady.

Natural gas consumption for electric power generation is driven by the availability of other resources, especially hydroelectric and variable energy resources, and demand for electricity overall. As penetration of variable energy resources increases, the system relies more on natural gas resources for ramping, load-following and changes in generation associated with these variable resources.

Natural Gas Consumption by Sector (MMcf)



PIPELINES AND POWER PLANTS

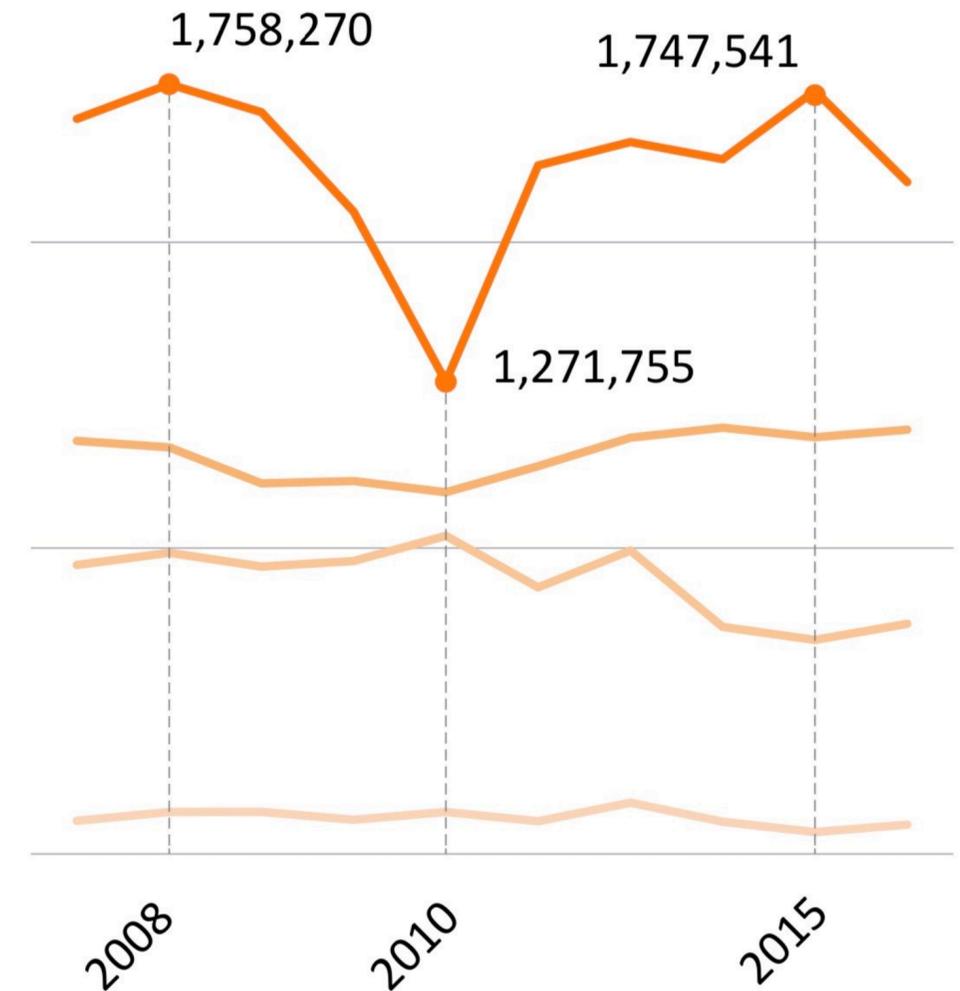


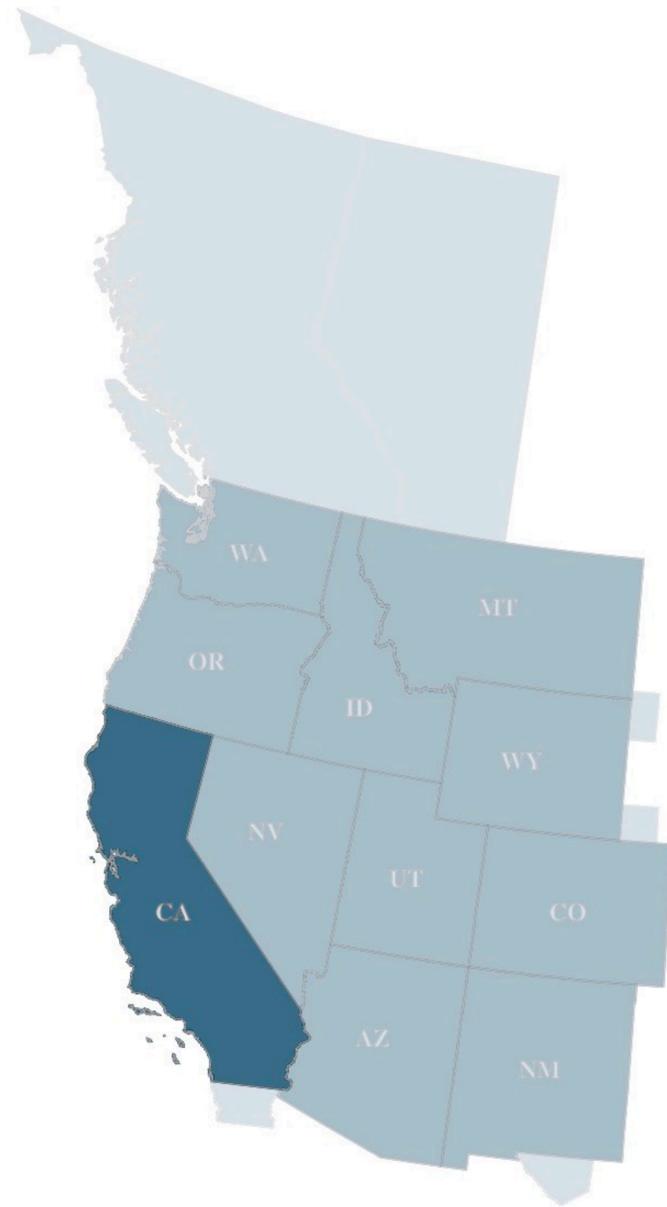
There are over 54,000 miles of natural gas pipeline in the Western United States. These pipelines carry gas long distances from production sites to consumers, including power plants.

California consumes more natural gas than any other state in the West. It is the primary fuel source for electric power generation in the state, as well as in Nevada. The amount of natural gas consumed for generation in California is expected to be steady or decrease in future years as the penetration of variable energy resources increases. However, natural gas and other conventional technologies that provide Essential Reliability Services remain critical for the reliability of the Western Interconnection.

Natural Gas Consumption by Sector (MMcf)

- Electric Power
- Industrial
- Residential
- Commercial



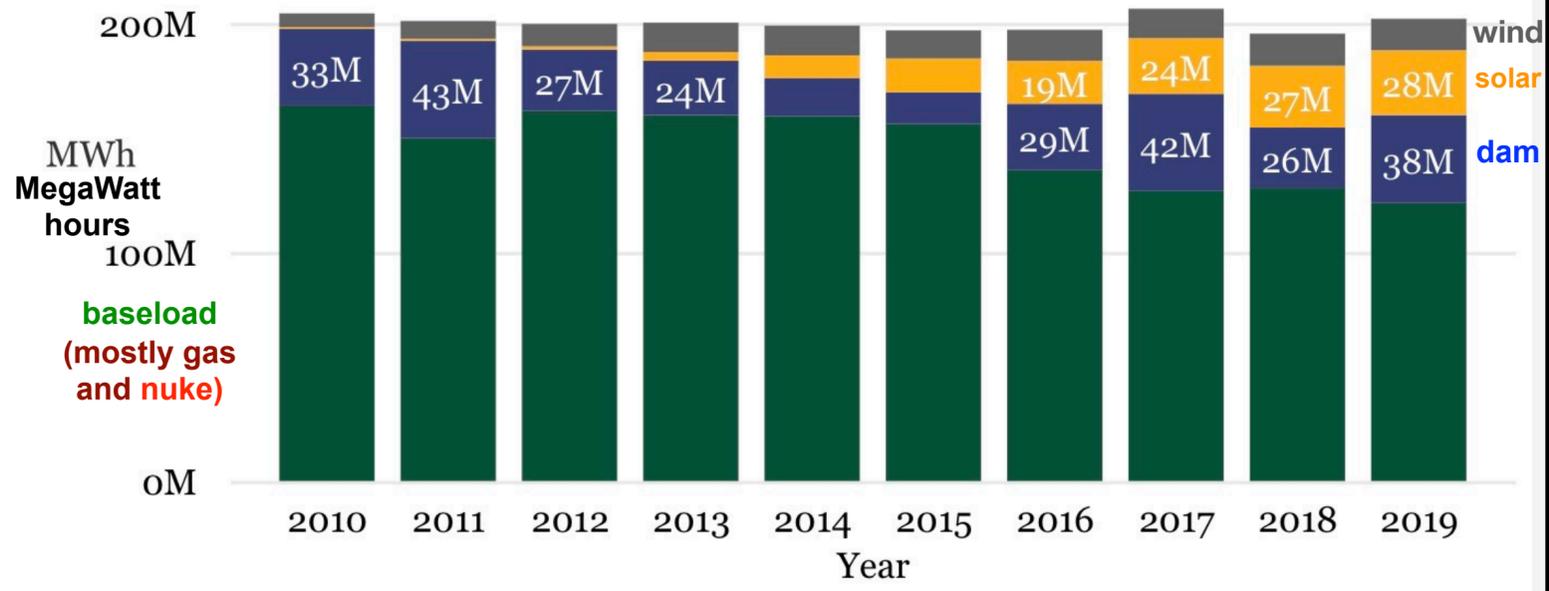


**Western
Electricity
Coordinating
Council**

“state of the interconnection”

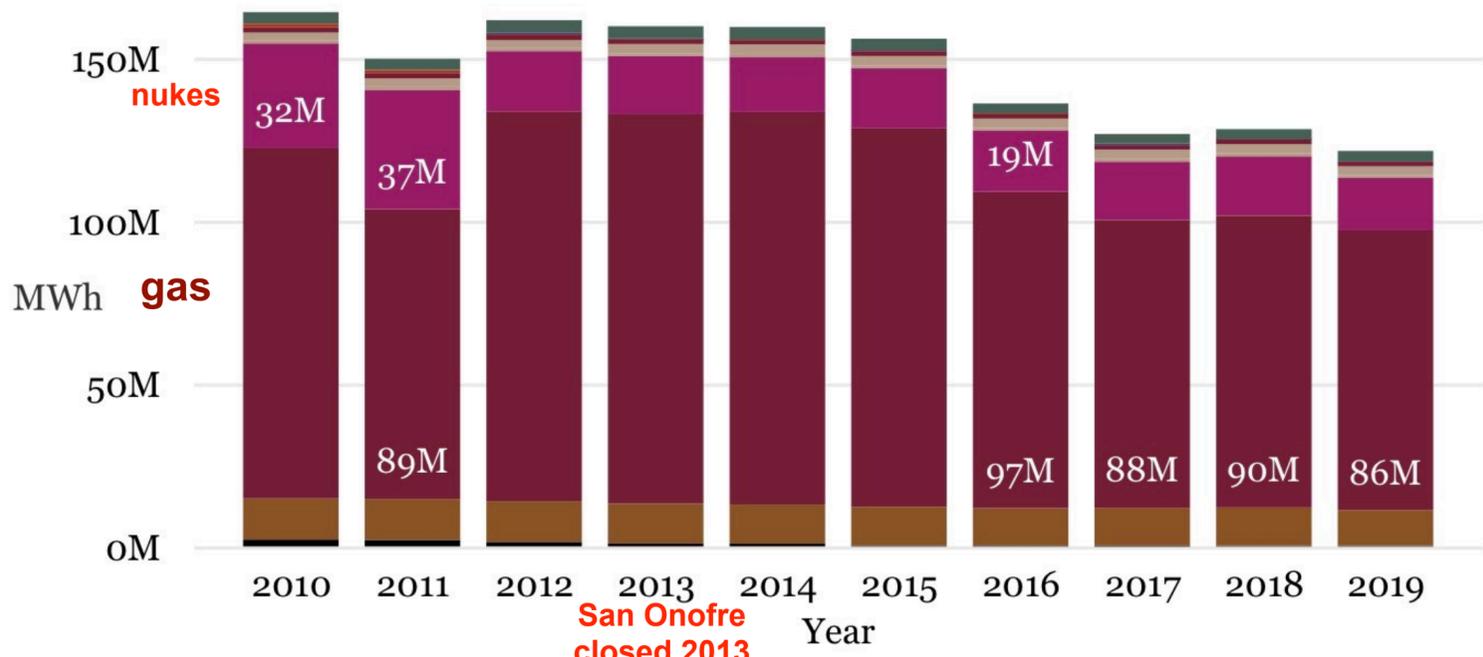
2010-2019 Generation by State

Fuel Types ● Baseload ● Hydroelectric ● Solar ● Wind



2010-2019 Generation Baseload Breakout by State

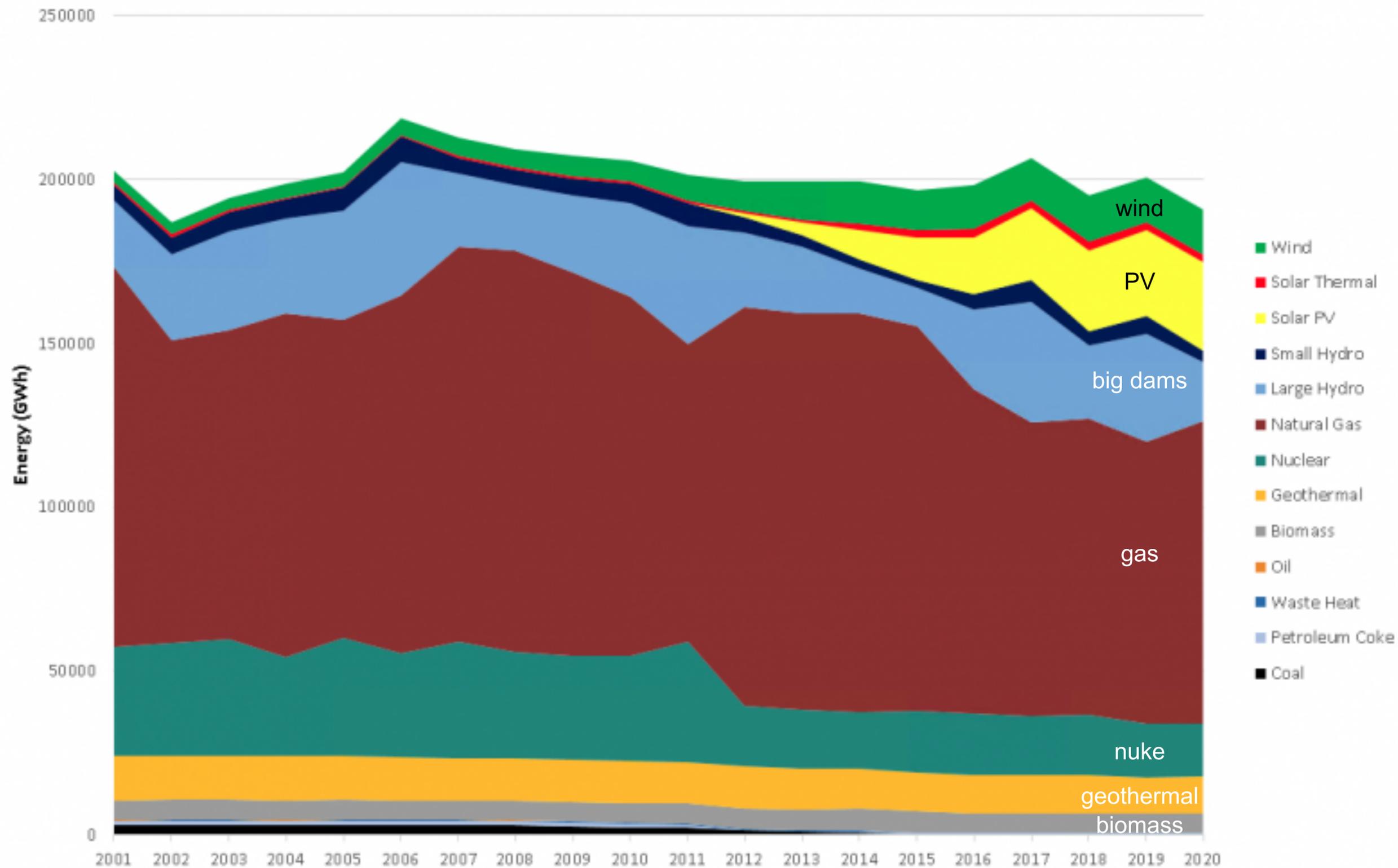
Fuel Types ● Battery ● Coal ● Geothermal ● Natural Gas ● Nuclear ● Other



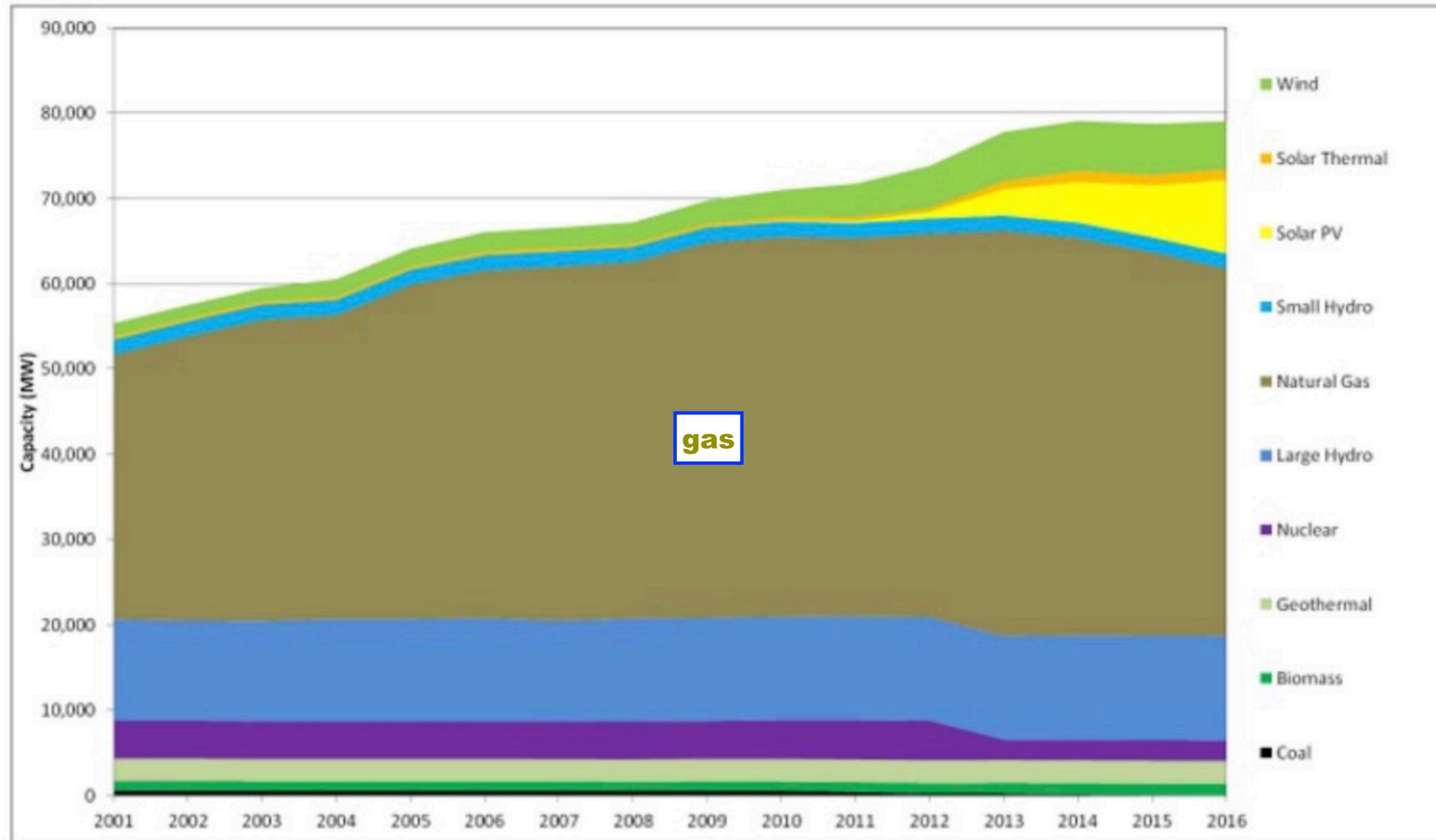
San Onofre closed 2013

In-State Electric Generation by Fuel Type

Source: Quarterly Fuels and Energy Reporting Regulations



California's Electric Generation by Fuel Type

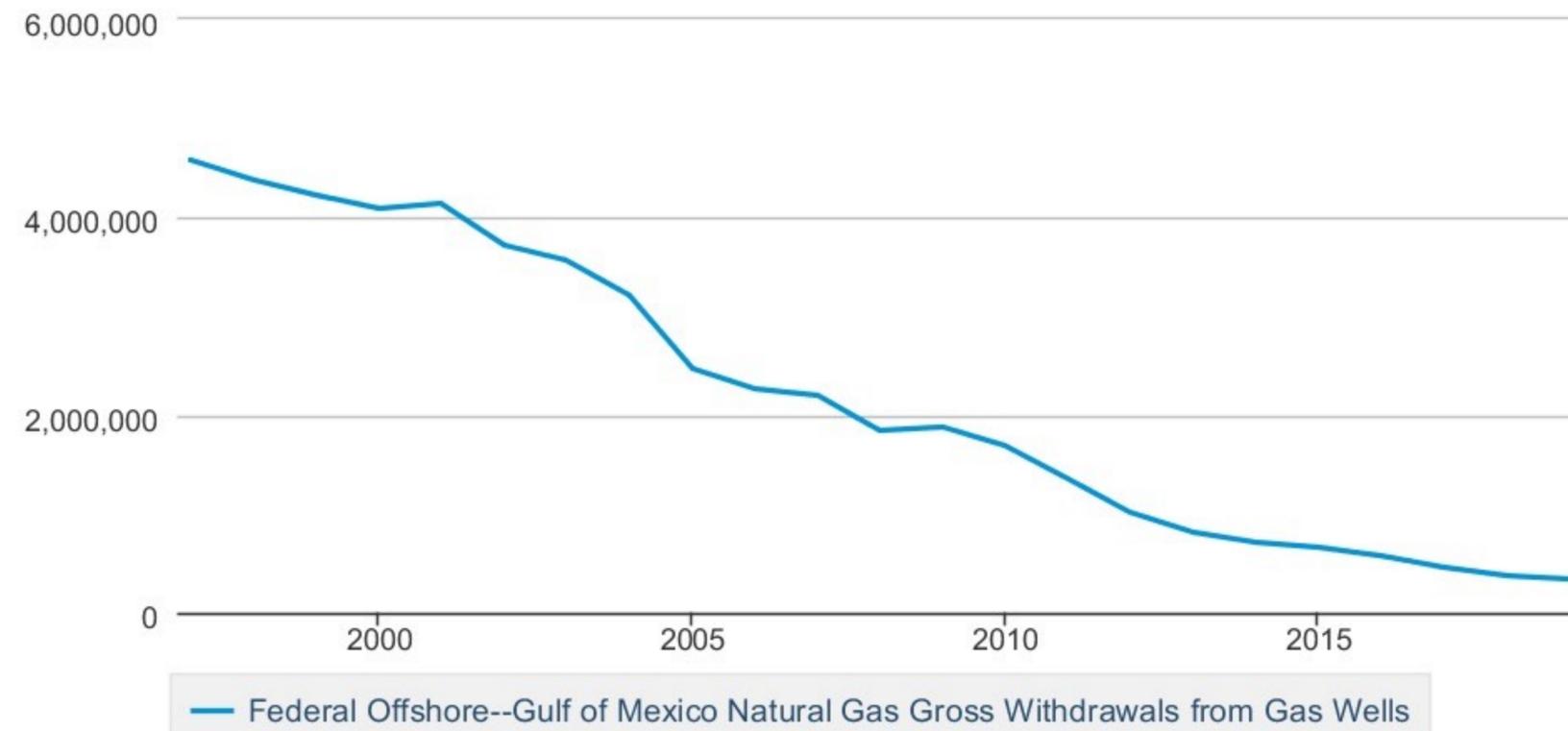


Source: California Energy Commission, CEC-1304 Power Plant Data Reporting.

https://www.wecc.org/_layouts/15/WopiFrame.aspx?sourcedoc=%2FAdministrative%2FCAISO%20%2D%20Gas%20Electric%20Forum%20Presentation%5FNovember%202019%2Epdf&action=view

Federal Offshore--Gulf of Mexico Natural Gas Gross Withdrawals from Gas Wells

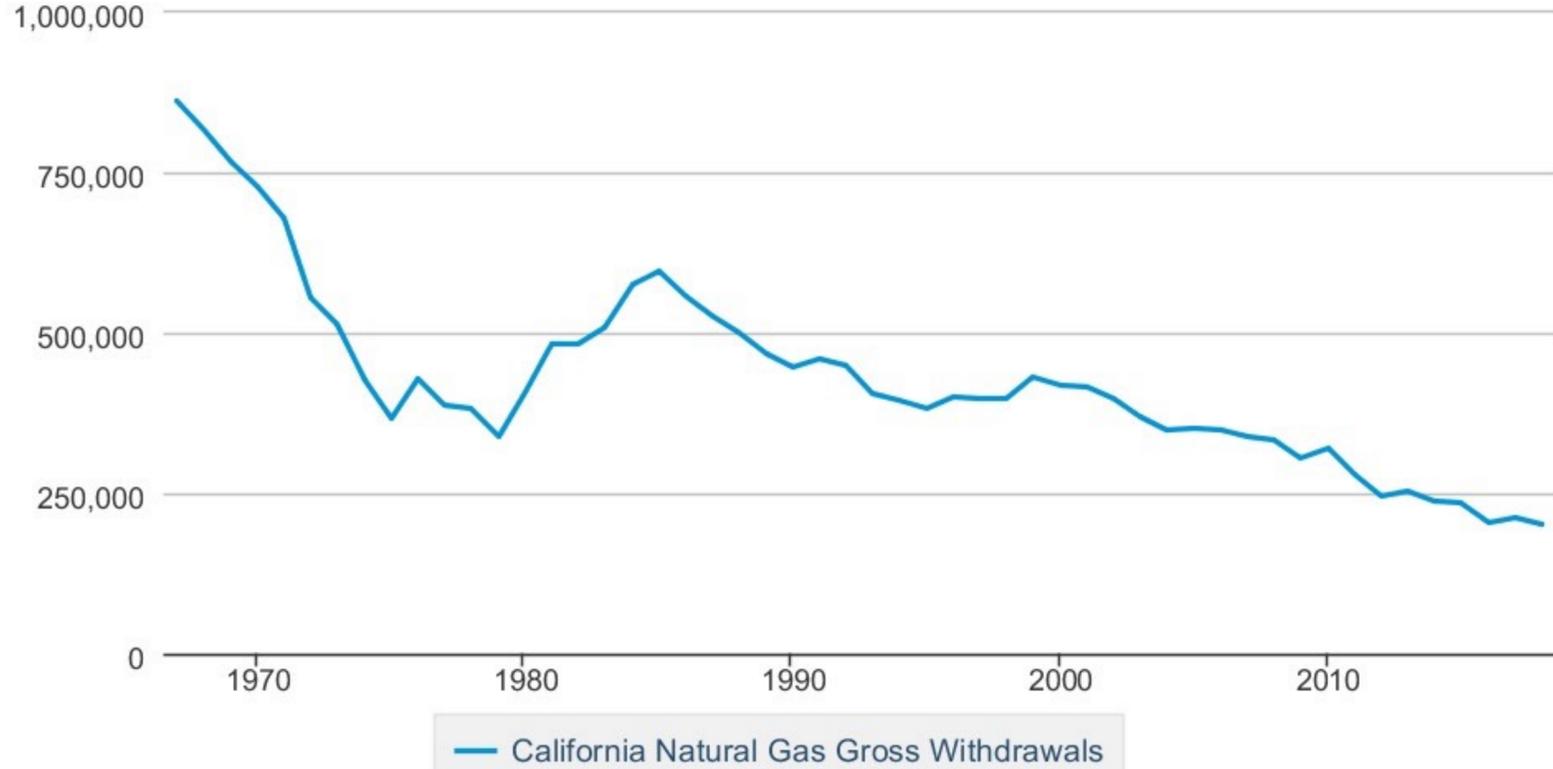
Million Cubic Feet



Source: U.S. Energy Information Administration

California Natural Gas Gross Withdrawals

Million Cubic Feet

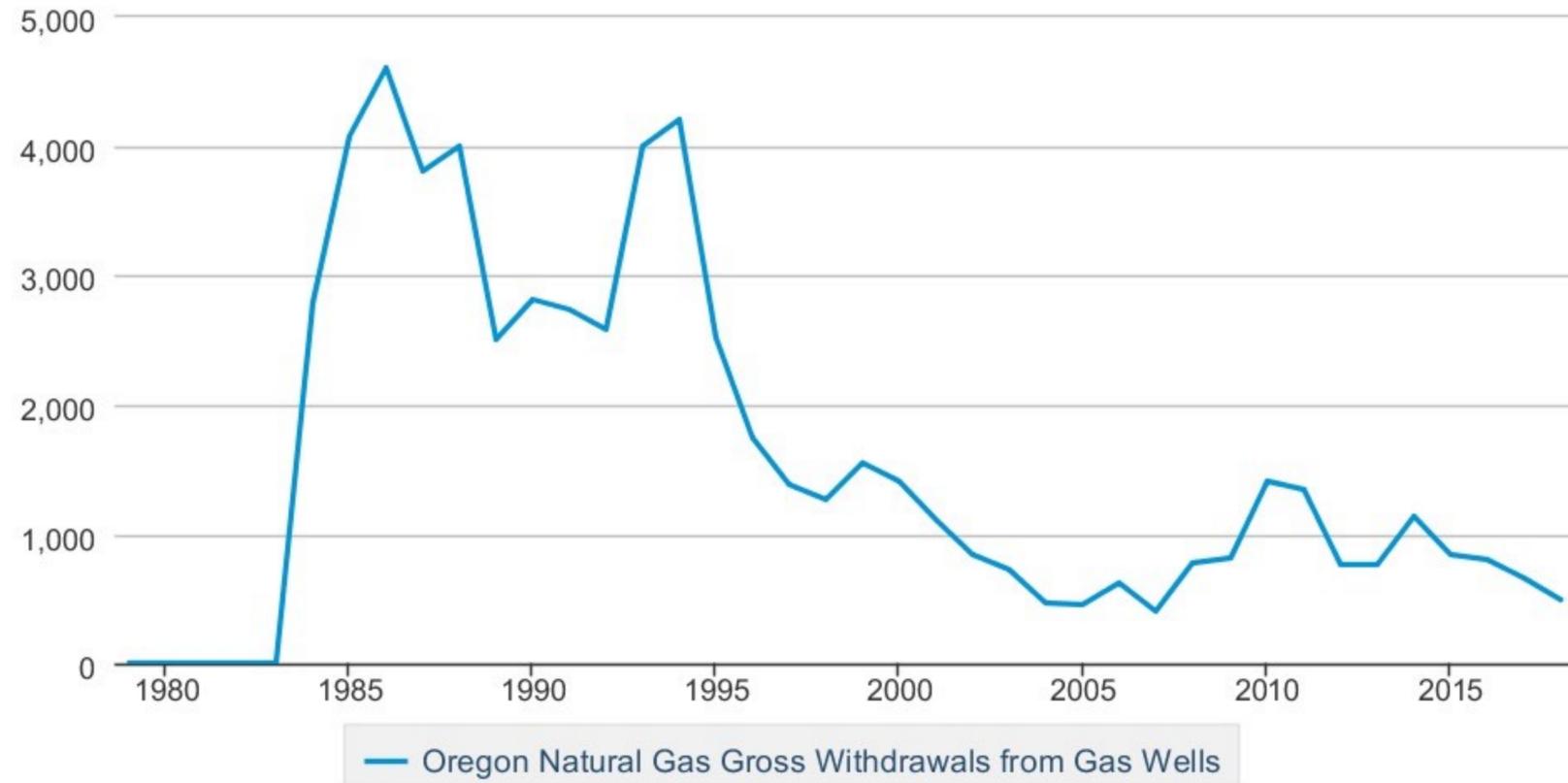


California Natural Gas Gross Withdrawals

Source: U.S. Energy Information Administration

Oregon Natural Gas Gross Withdrawals from Gas Wells

Million Cubic Feet

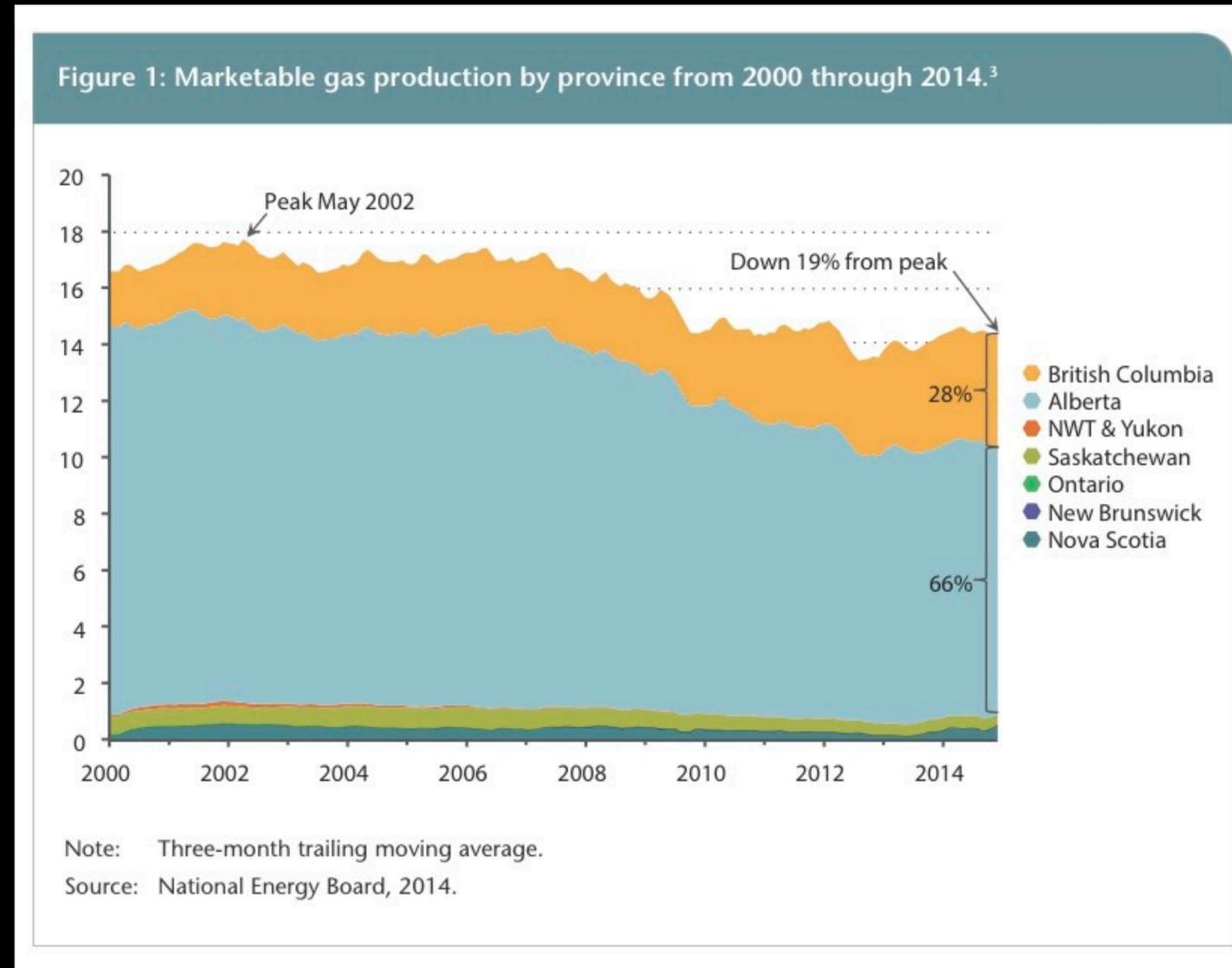


Oregon Natural Gas Gross Withdrawals from Gas Wells

Source: U.S. Energy Information Administration

Canadian gas peaked in 2002

<https://policyalternatives.ca/publications/reports/clear-look-bc-Ing>



Fracked "tight oil" and "shale gas" - two thirds of US totals

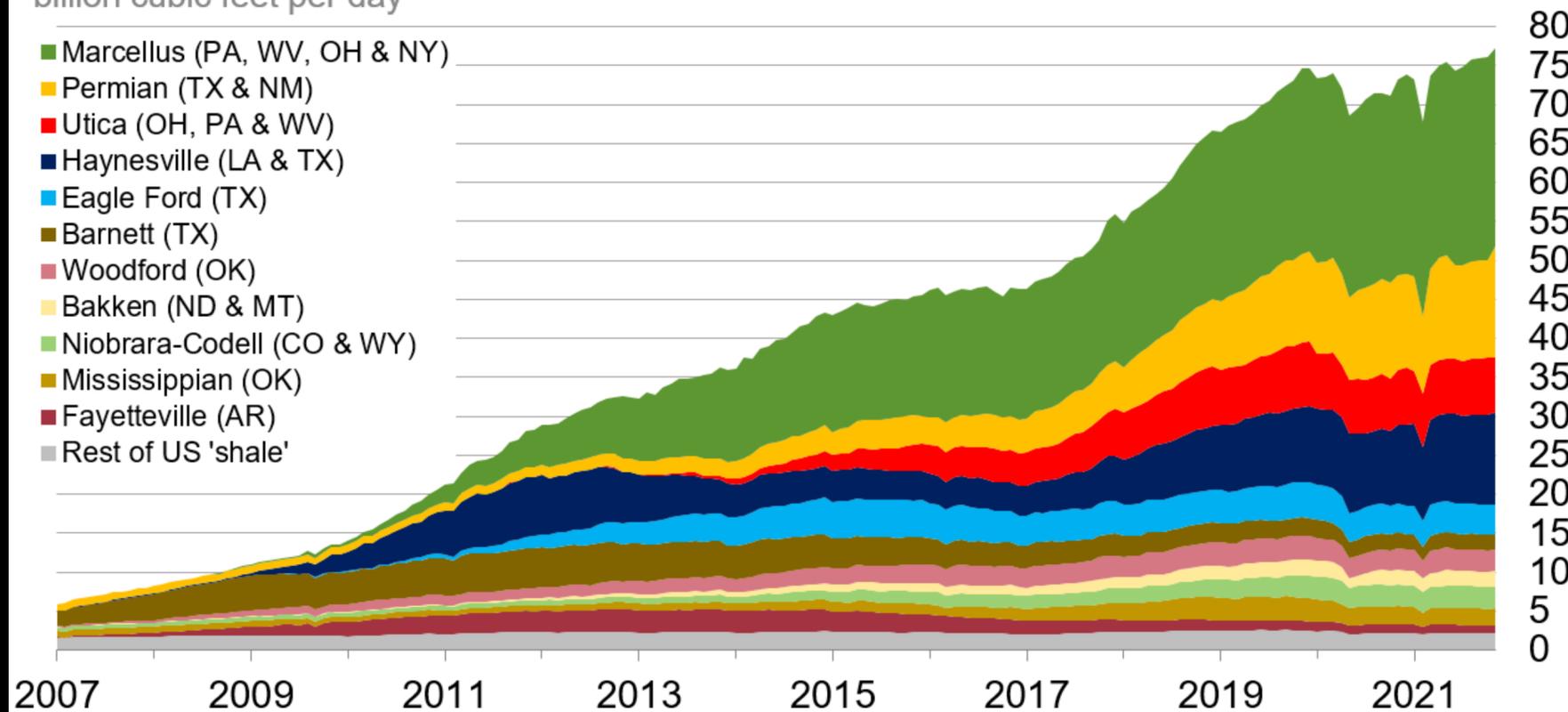
baseload for power grids, heat for cold cities, industrial uses

damned if we drill, damned if we stop, damned as it runs out

Monthly dry shale gas production

billion cubic feet per day

- Marcellus (PA, WV, OH & NY)
- Permian (TX & NM)
- Utica (OH, PA & WV)
- Haynesville (LA & TX)
- Eagle Ford (TX)
- Barnett (TX)
- Woodford (OK)
- Bakken (ND & MT)
- Niobrara-Codell (CO & WY)
- Mississippian (OK)
- Fayetteville (AR)
- Rest of US 'shale'

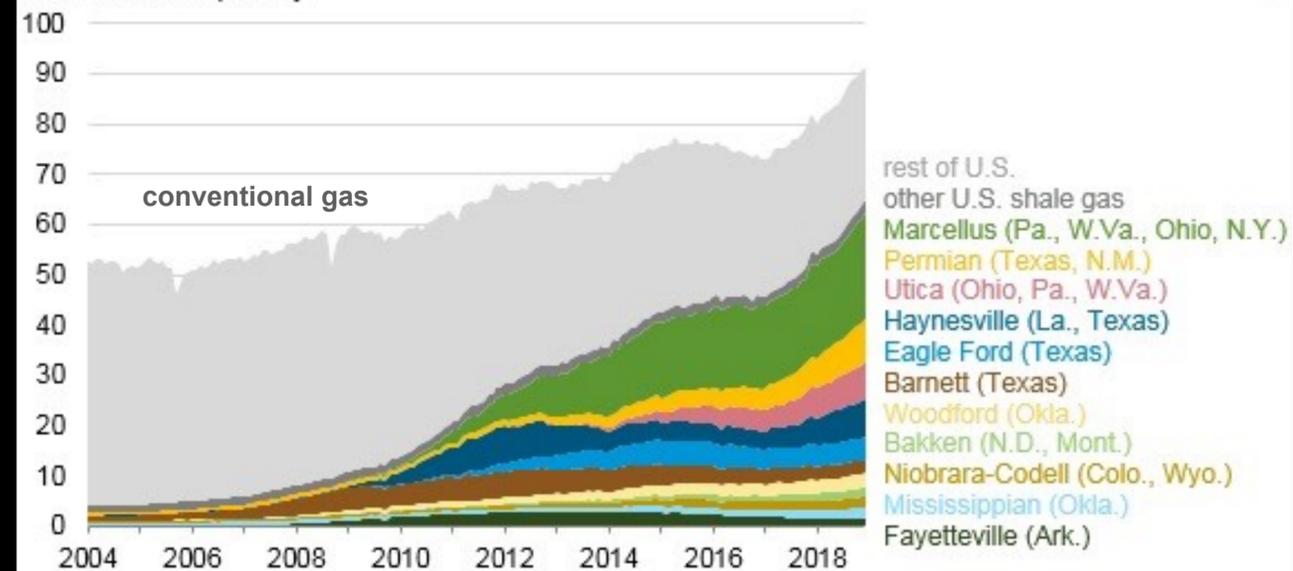


Source: Graph by the U.S. Energy Information Administration (EIA) based on state administrative data collected by Enverus. Data are through November 2021 and represent EIA's official tight gas estimates, but are not survey data. State abbreviations indicate primary state(s).

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

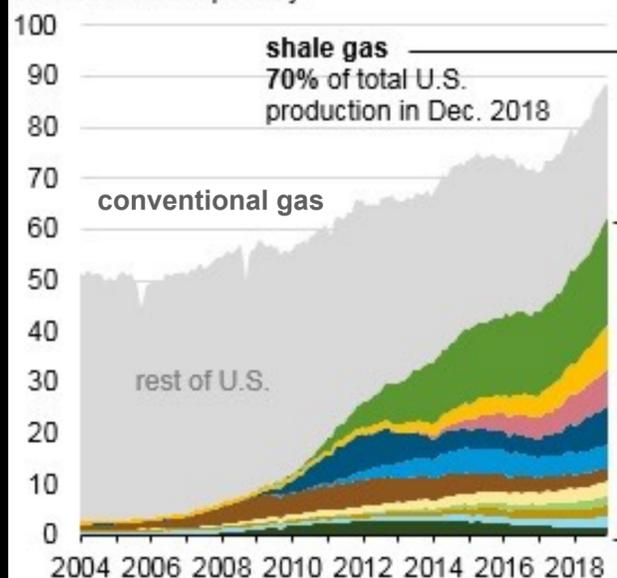
Monthly U.S. dry natural gas production (2004-2018)

billion cubic feet per day



U.S. dry natural gas production (2004-2018)

billion cubic feet per day



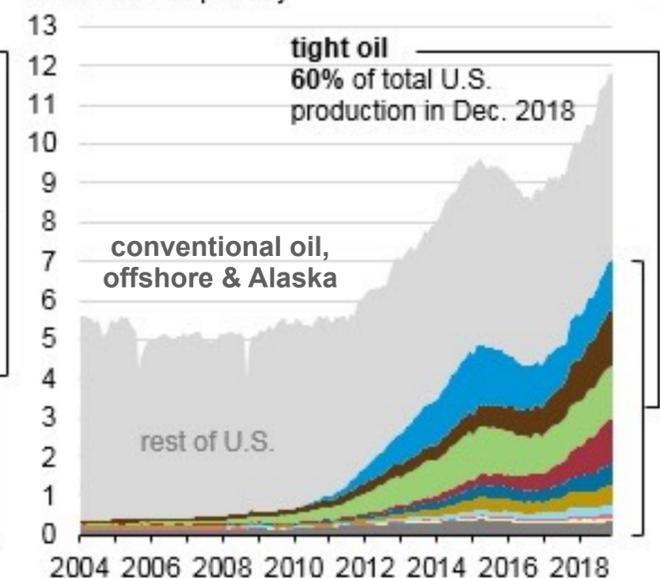
shale gas
70% of total U.S.
production in Dec. 2018

conventional gas

rest of U.S.

U.S. crude oil production (2004-2018)

million barrels per day



tight oil
60% of total U.S.
production in Dec. 2018

conventional oil,
offshore & Alaska

rest of U.S.



USA unnatural gas: percentage fracked

