Energy Outlook….

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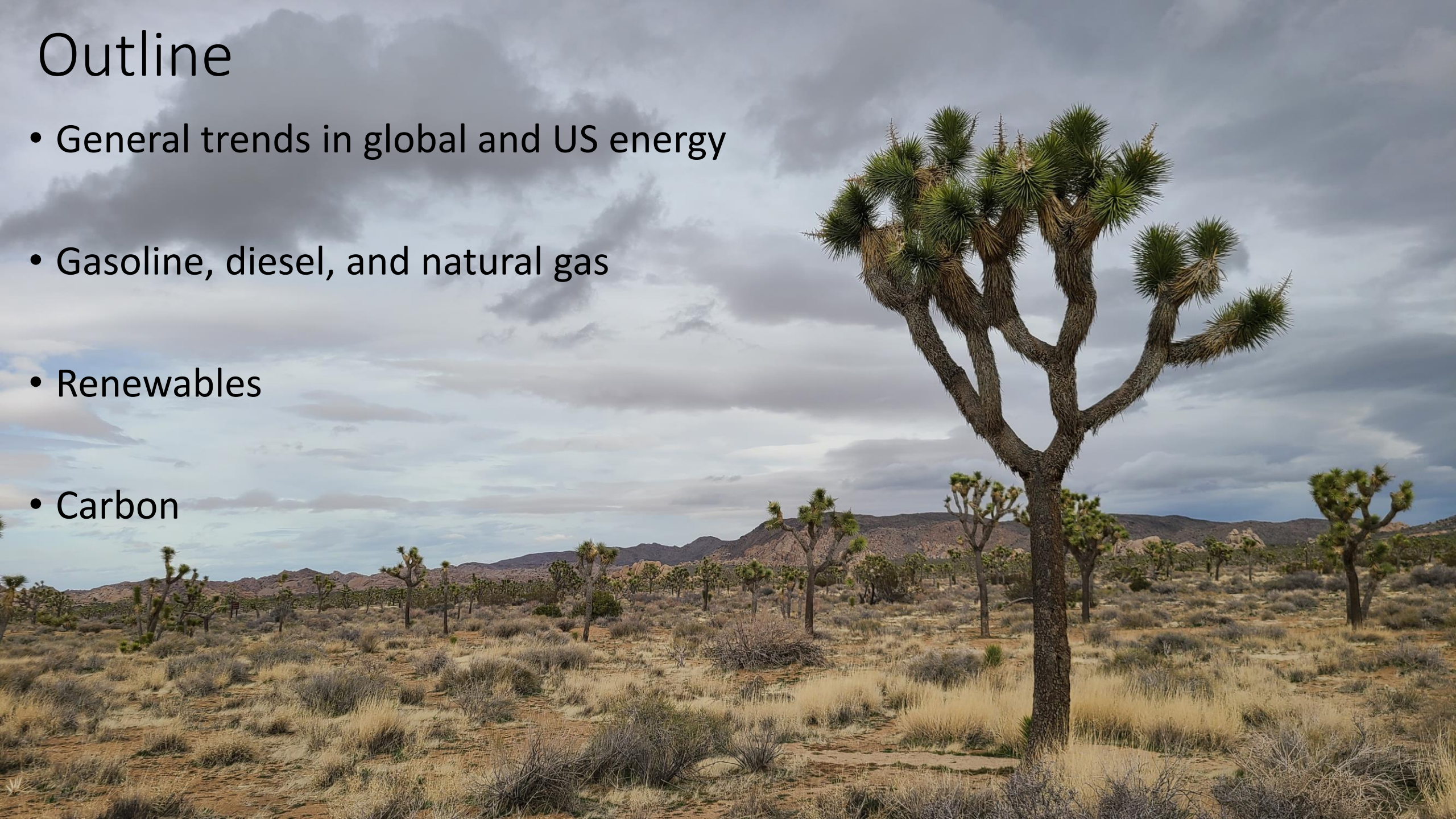
Outline

- General trends in global and US energy
- Gasoline, diesel, and natural gas
- Renewables
- Carbon

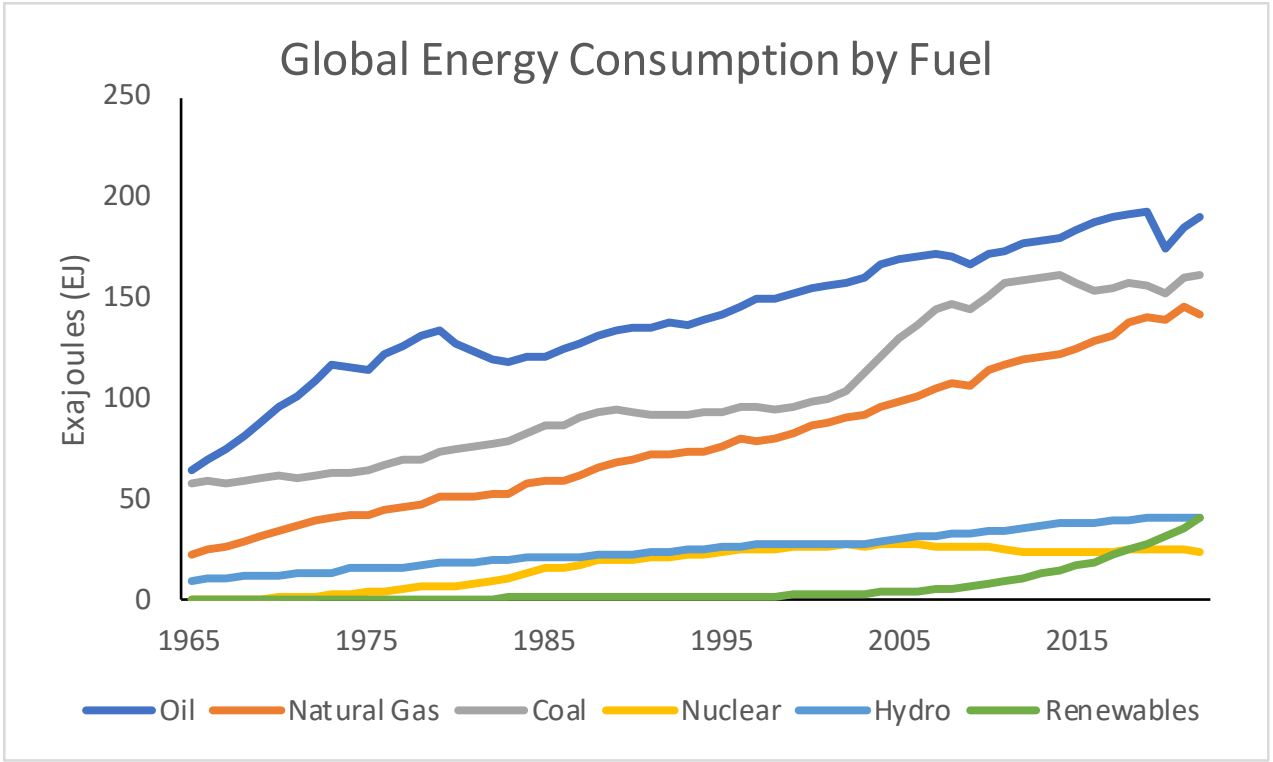


Global Energy Trends

Total energy consumption is up 1.4% per year over last decade.

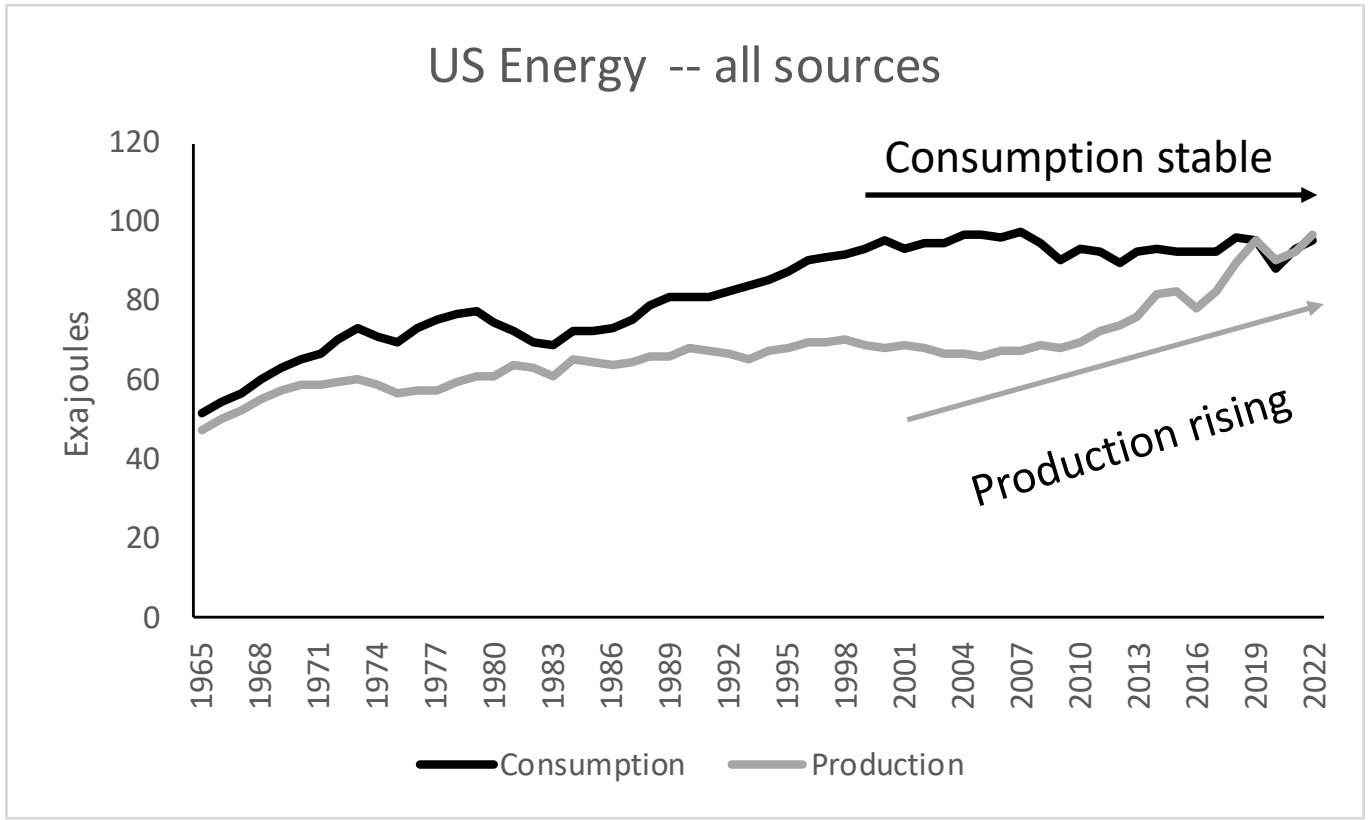
Largest gains have occurred in renewables, mainly wind and solar, which overtook hydro in 2022.

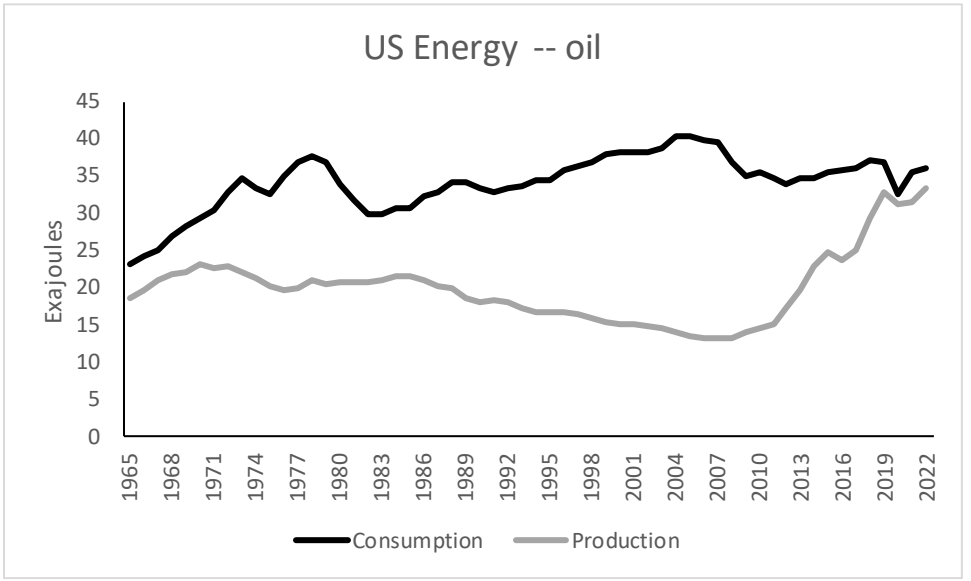
Global expansion in coal slowed earlier in 21st century, but picked up steam in 2022. Is this just temporary due to Russia's invasion.

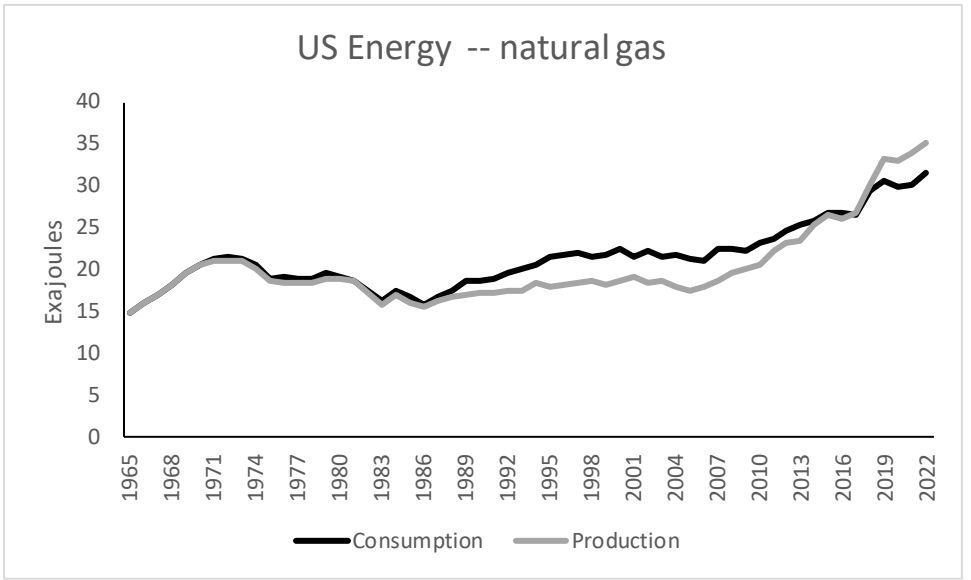


Data: Statistical Review of World Energy

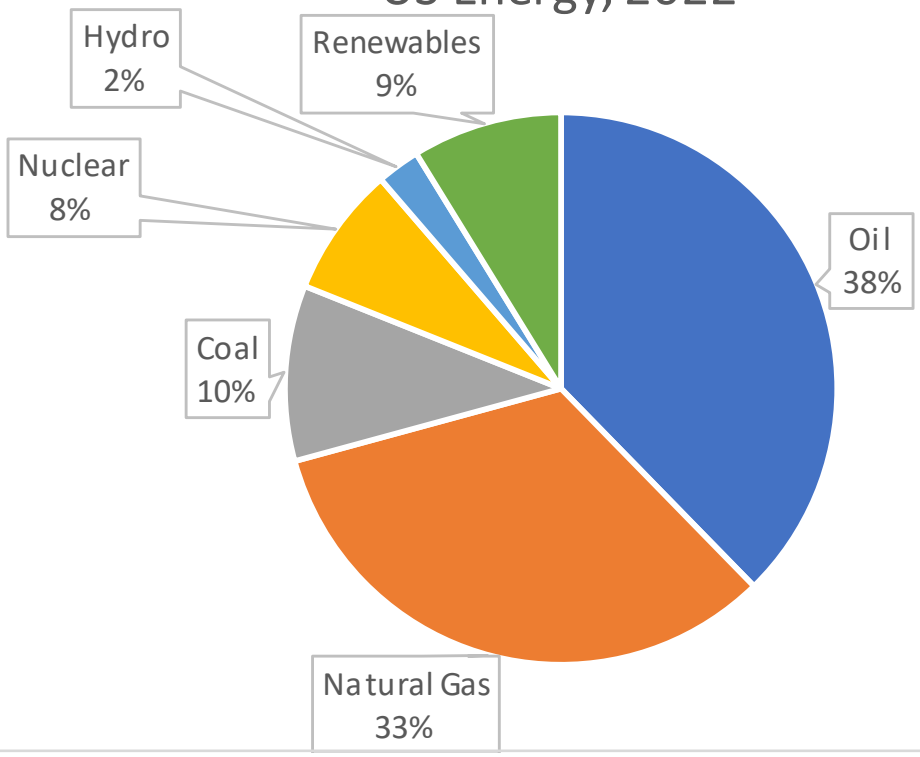
US Energy Consumption and Production

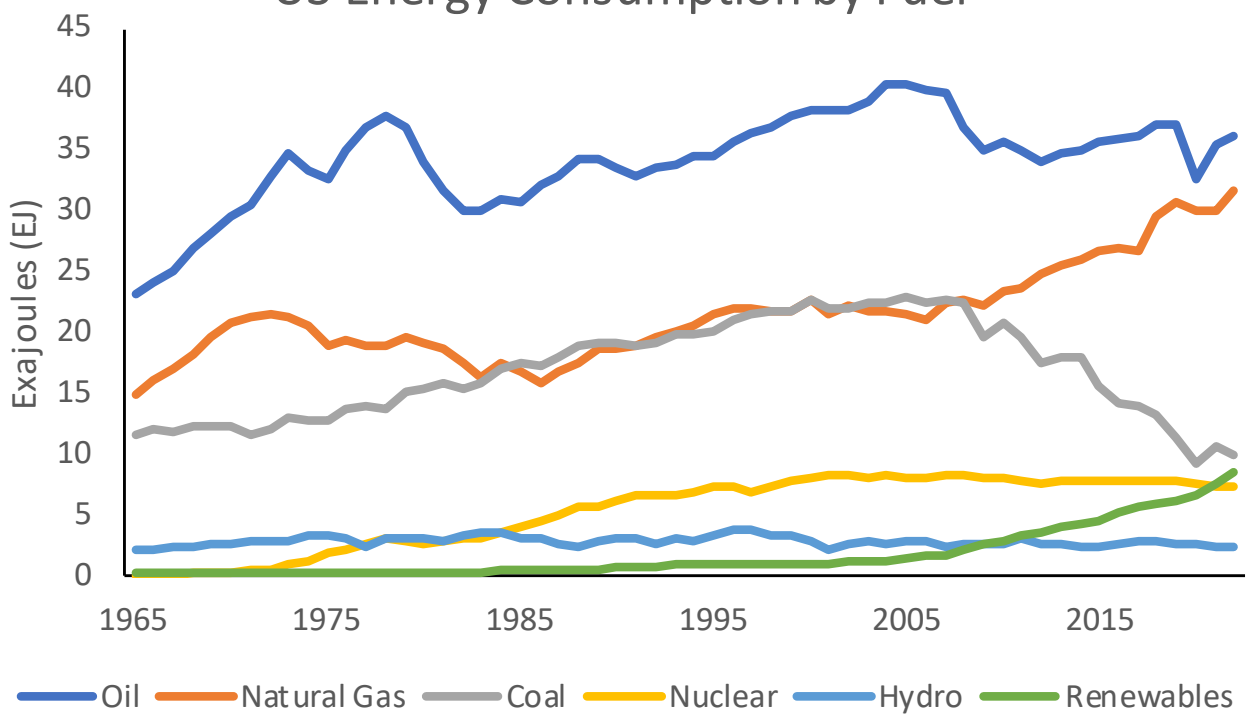






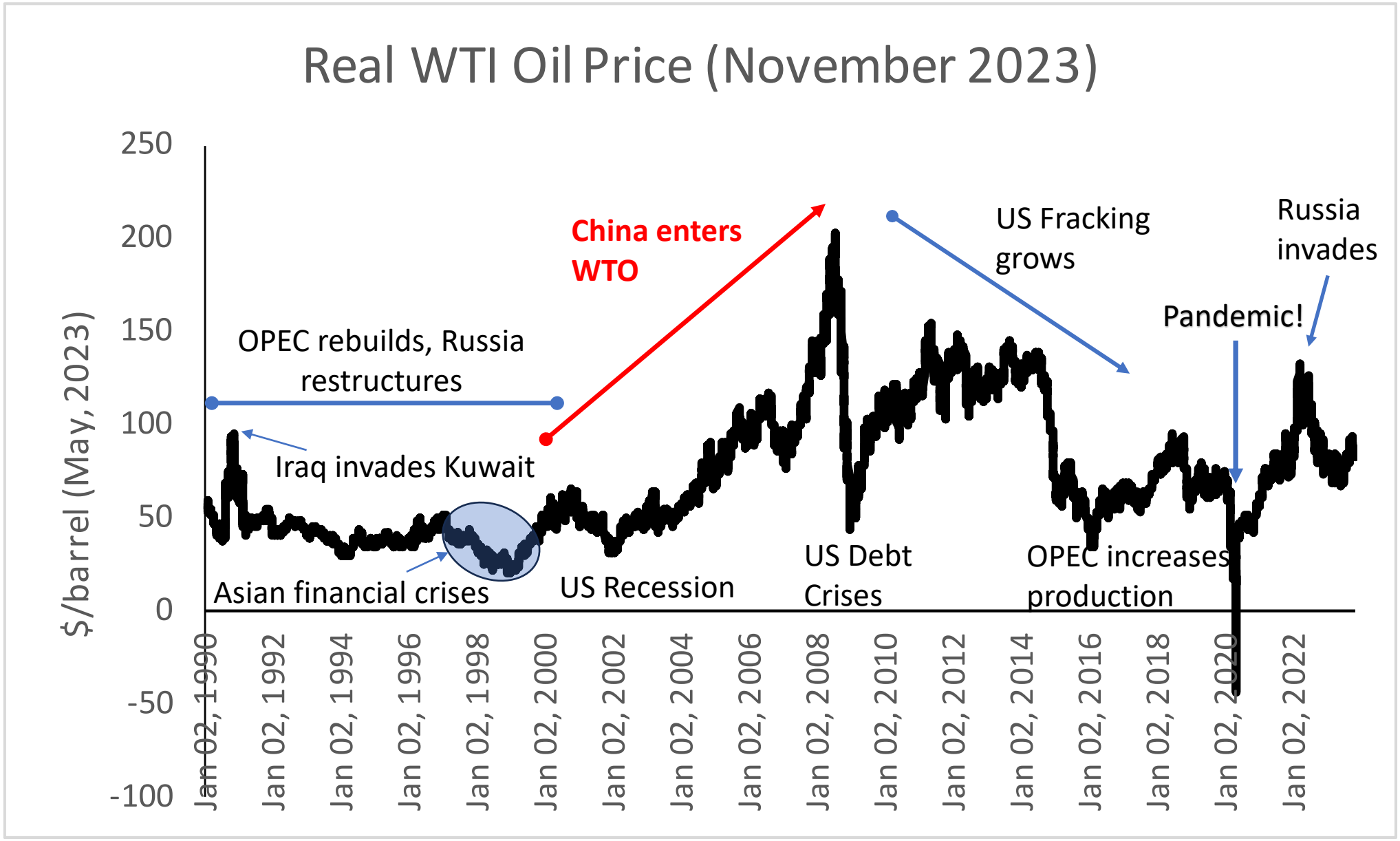
More energy from renewables than coal in 2022





Data: Statistical Review of World Energy

Oil prices: The tree rings of the world economy.



What does this mean for gasoline and diesel?

US gasoline and diesel prices have fallen from their 2022 highs, but both are above their averages from recent years.

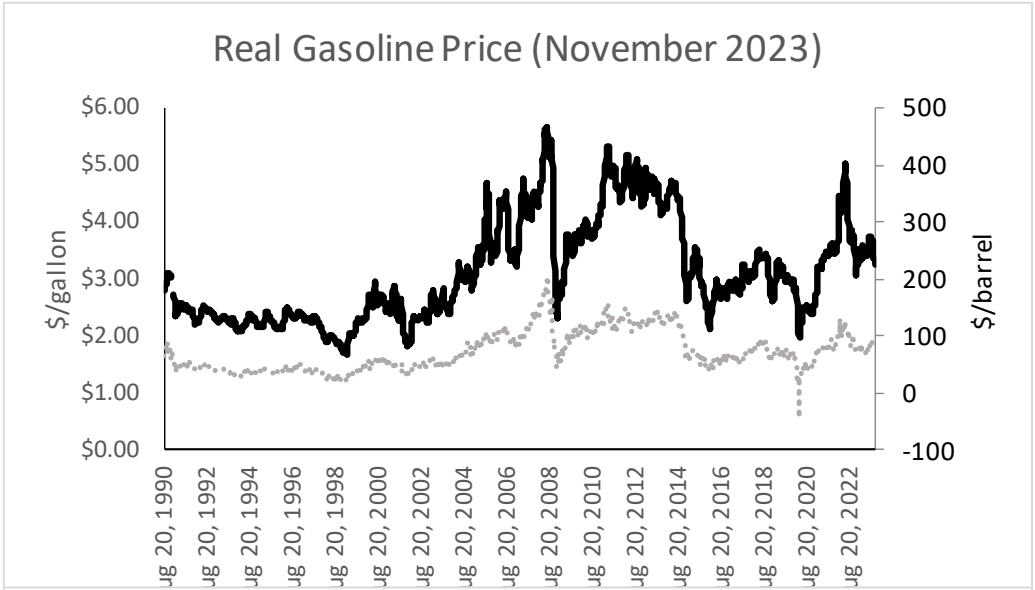
Over the next 6-12 months…

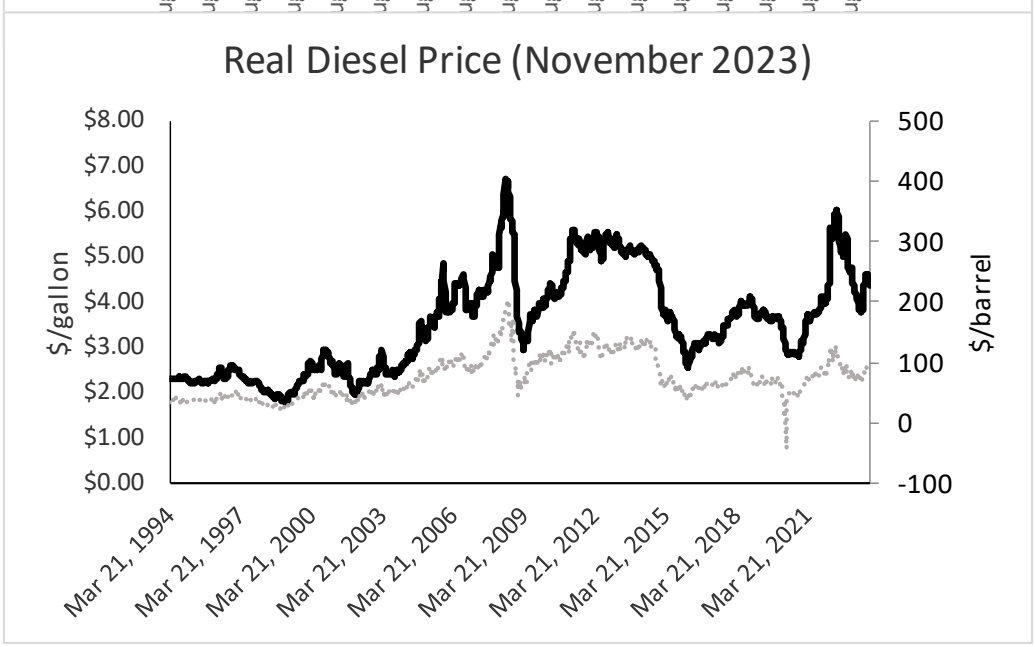
<u>Questions that will affect prices</u>:

- OPEC production cuts… more to come?
- What is Russia's next move?
- What changes will arise in the Middle East?
- Where will global growth come from?

<u>Trends:</u>

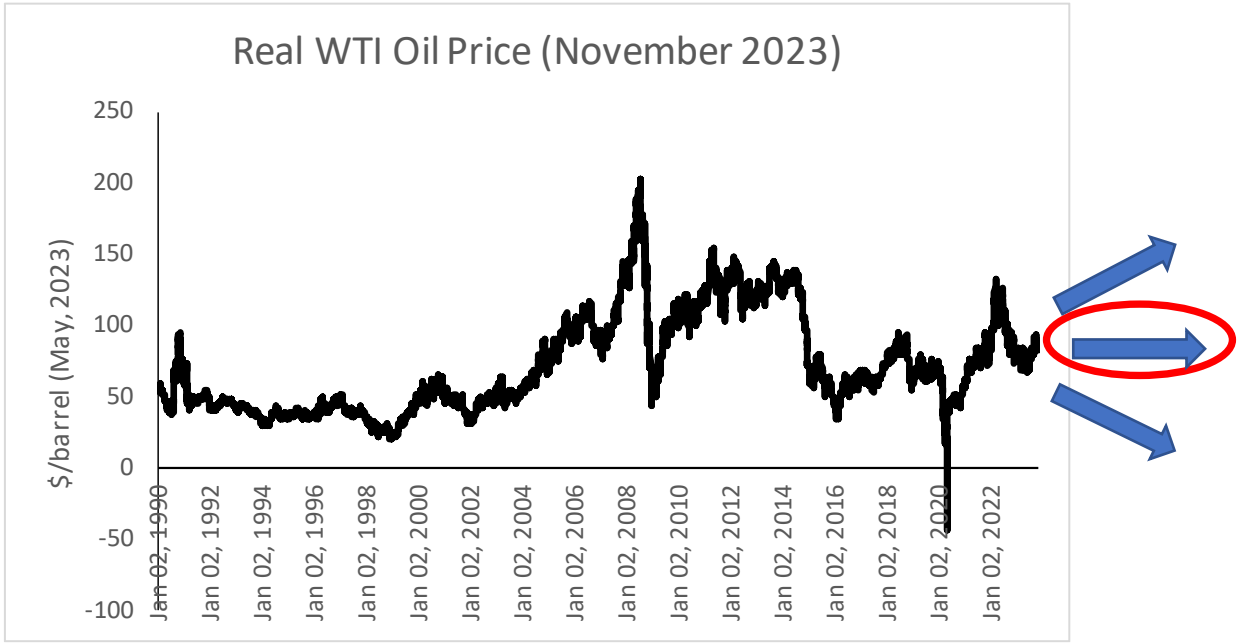
- US Shale rebounds in Permian basin (TX/NM) driven by productivity gains with fewer rigs.
- New supplies: Guyana
- Mergers signal re-investment in traditional fossil: Exxon-Pioneer; Chevron-Hess





Source: Energy Information Administration

Oil/diesel/gasoline prices in next 6-12 months?

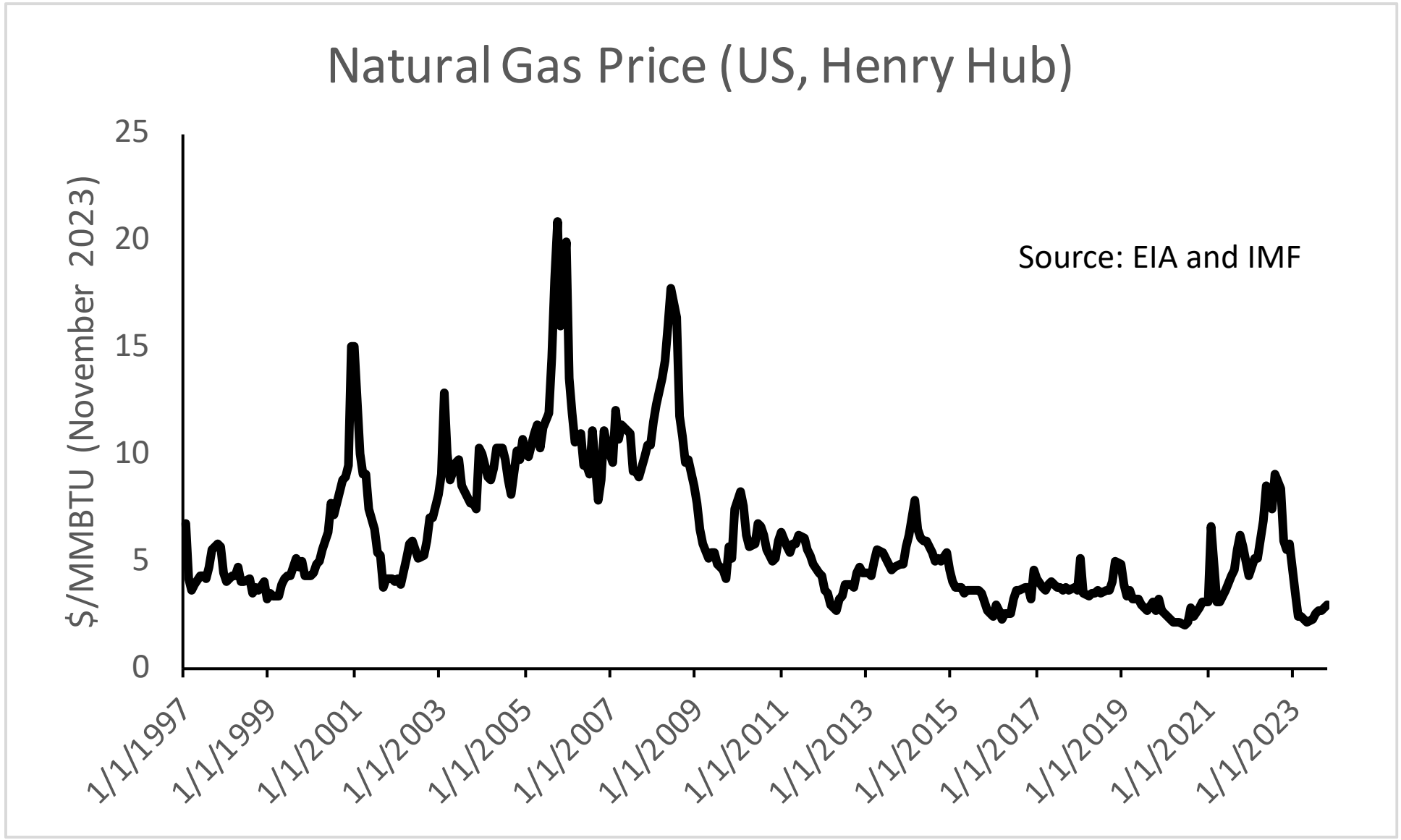


- **Oil** More of the same.
  - OPEC adjusts output to keep revenues >$3 billion/day.
  - New finds grow, and Venezuela slowly rebuilds.
  - US production edges upward.

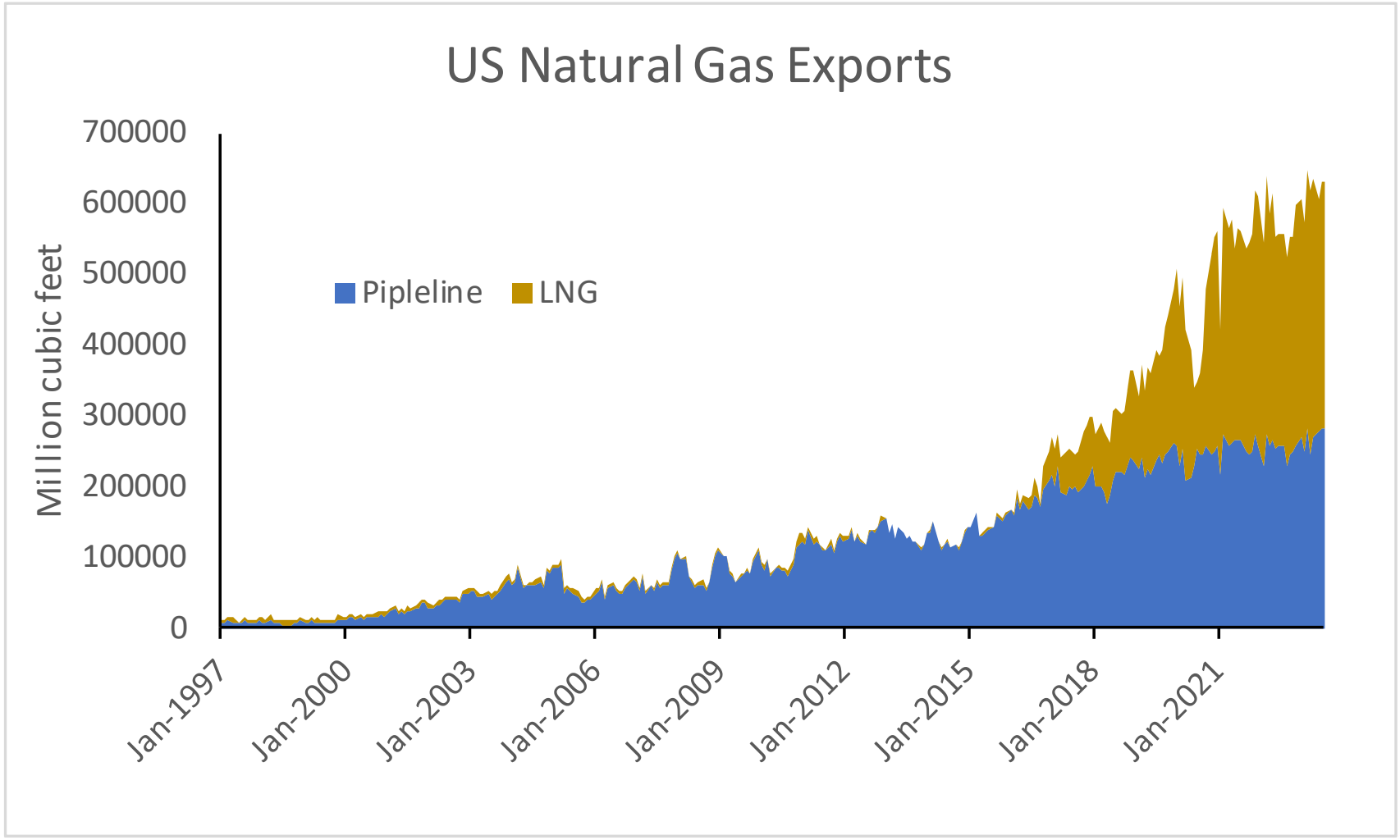
- **Gasoline/Diesel** prices remain in their 12-month range
  - Gasoline: $3.00 - $3.70 per gallon
  - Diesel: $3.80-$5.25 per gallon

- **Short-term uncertainty** = economic growth/Middle East.
- **Longer-term uncertainty** = electric cars/political resolution in Middle East.

Natural gas: Prices back at relatively low levels.



Natural gas: LNG exports have increased



Source: EIA and IMF

Nitrogen/Ammonia: Prices down, will they stay down?

Fertilizer prices have fallen but not all the way back to the mid-2010's prices.

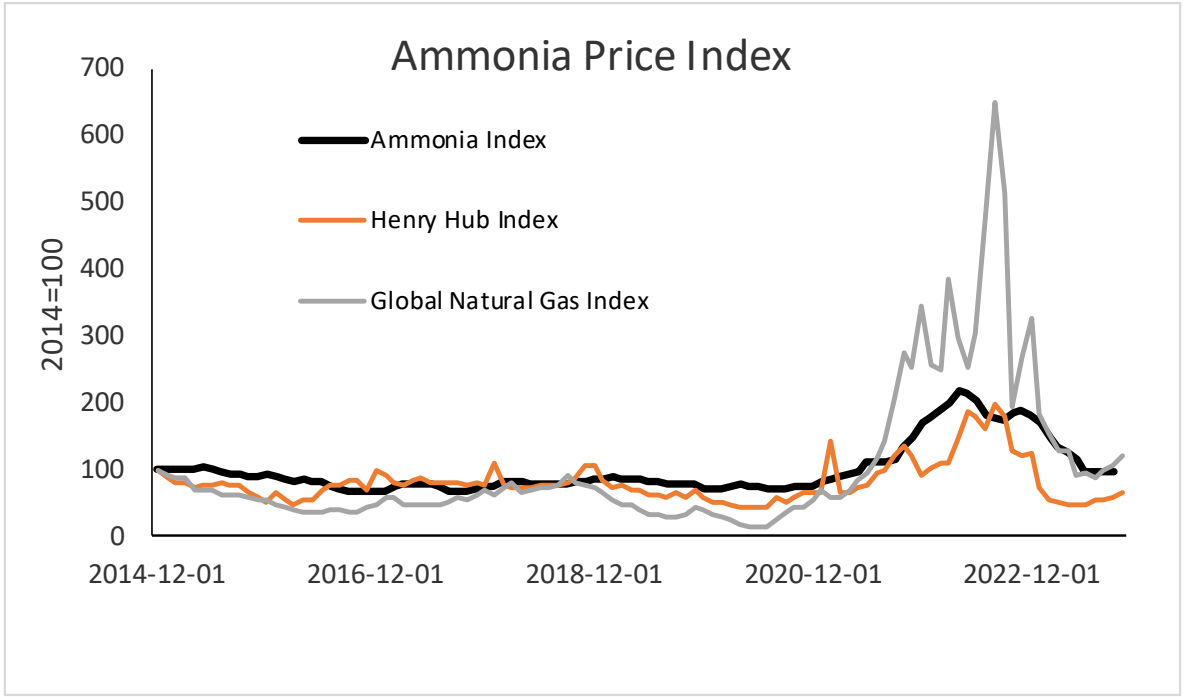
- A bit of relief on prices as natural gas prices have fallen
- Imports down a bit in 2023, probably due to rising production.

US imports about 15% of its ammonia consumption, down from 35% a decade ago.

- US is the third largest producer, behind China and Russia, and just ahead of India.

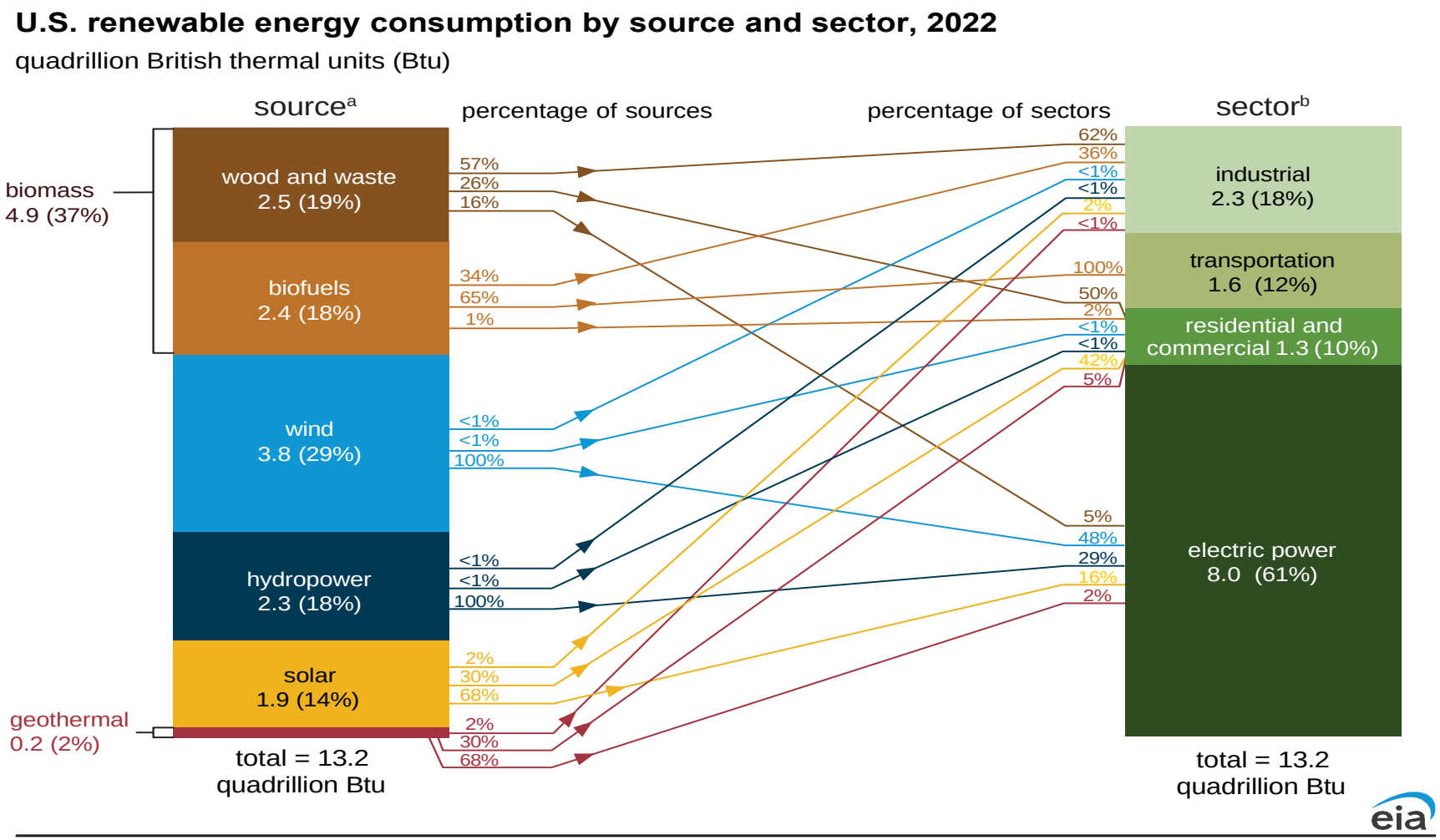
New ammonia plants being built in South to take advantage of IRA funding and supply.

- Trend toward increasing ammonia and hydrogen use in the broader economy likely to continue.



Source: Saint Louis Federal Reserve Bank, EIA, and IMF

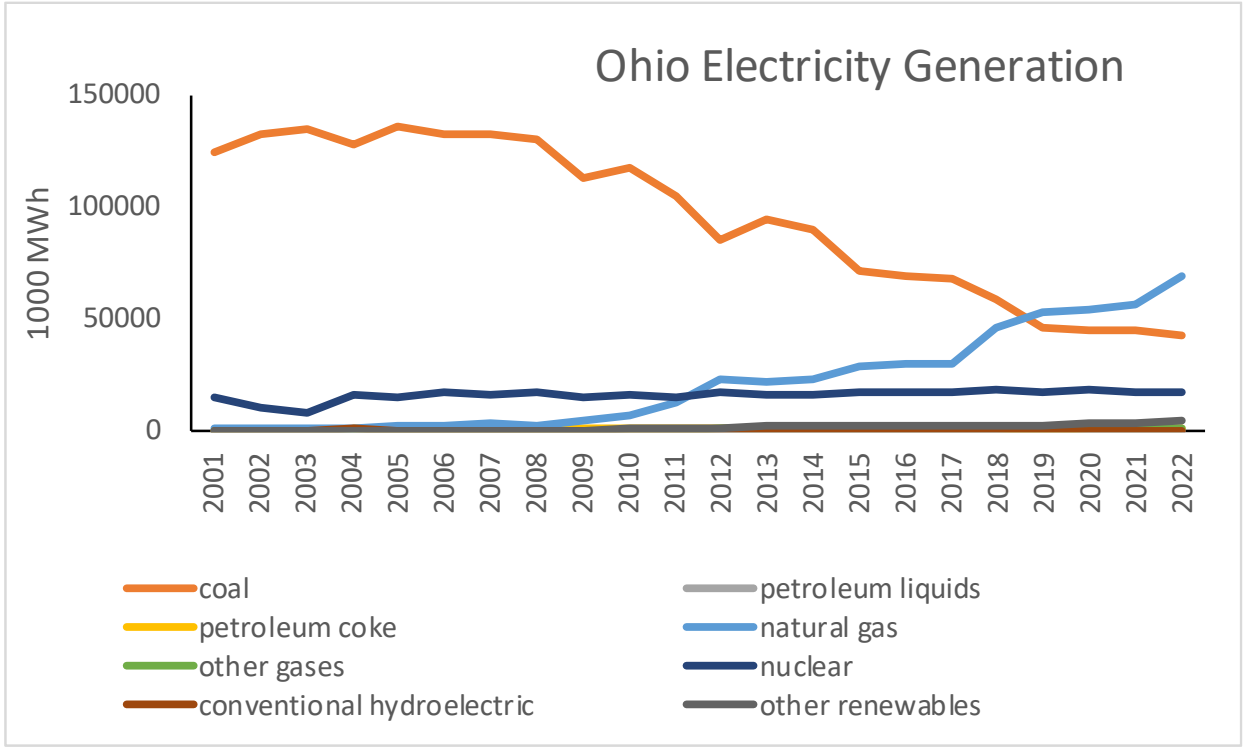
Renewables from a variety of sources, used widely



Sources: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (April 2023), Tables 10.1, 10.2a, 10.2b, and 10.2c.
Note: Sum of components may not equal total due to independent rounding. See "Extended Chart Notes" on next page.
[a] Each energy source is measured in different physical units and converted to common British thermal units (Btu). See EIA's *Monthly Energy Review (MER)*, Appendix A. Noncombustible renewable energy sources are converted to Btu using the "Fossil Fuel Equivalency Approach," see MER Appendix E.
[b] Industrial, commercial, and electric power sectors include primary energy consumption by combined-heat-and-power (CHP) and electricity-only plants in the sector. Energy consumed by these plants reflects the approximate heat rates for electricity in MER Appendix A.

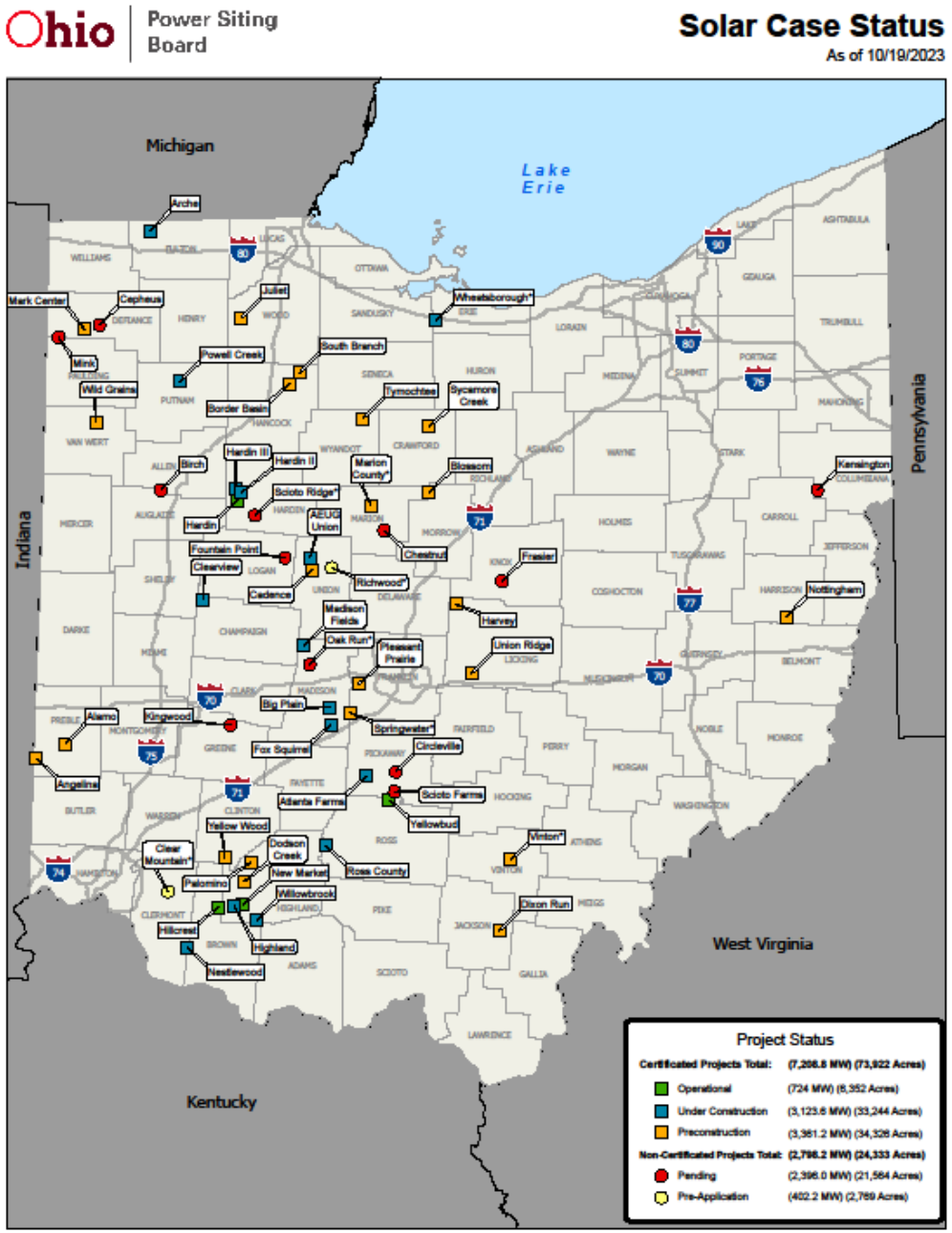
Renewables in Ohio…

- Growing: 4% of electricity in 2022.
- Mostly wind, but utility-scale solar is the fastest growing source
  - Wind increasing 12%/yr
  - Solar increasing 32%/yr
- Projections for 10-12% in the next decade.



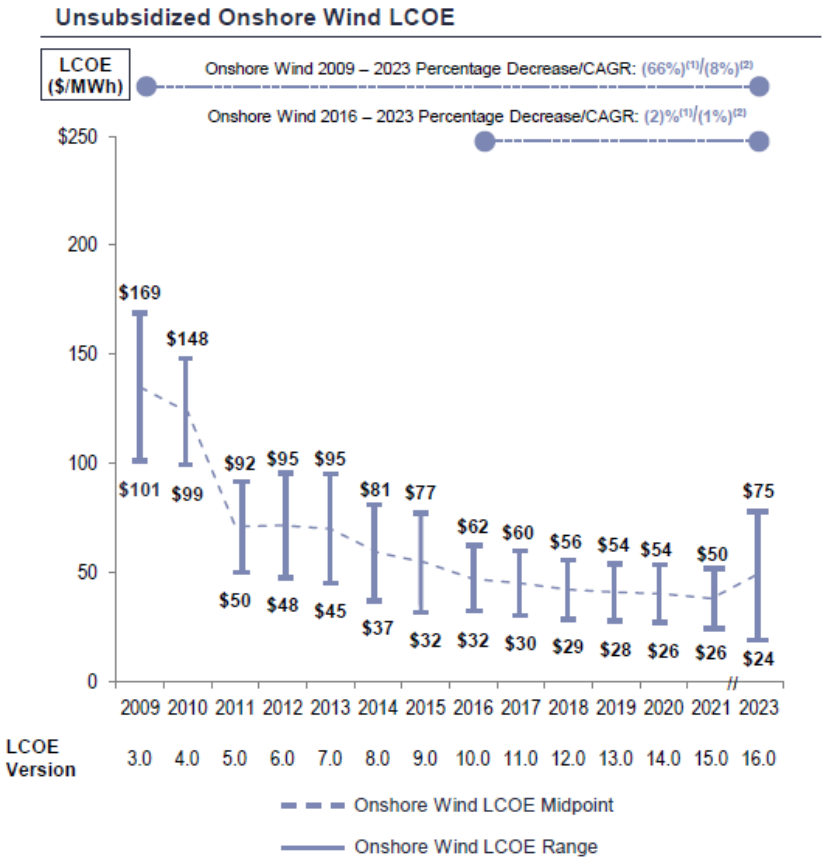
Solar status

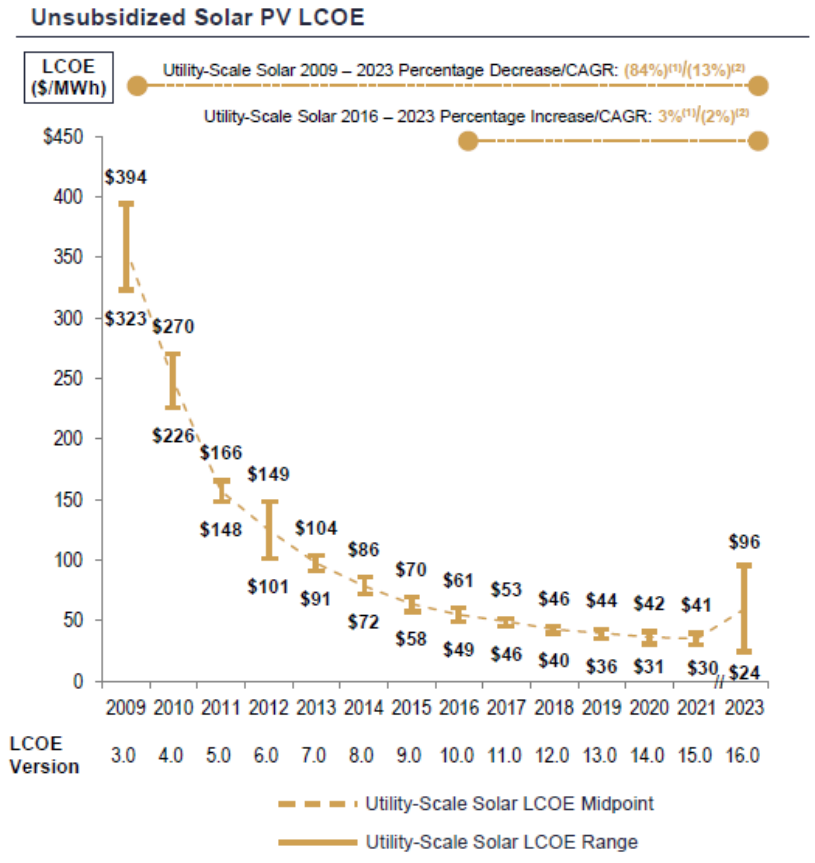
- Certified: 7,209 MW over 74,000 acres
  - About 10% operational
- About the same footprint as the fracking industry.
  - 0.5% of farmland in Ohio.
- The value of solar could be as high as $2000/acre/yr, and is increasing.
  - Rising capital costs tied to inflation and higher interest rates are having an impact.



What's driving renewables?

- Long run economics have driven costs down
- Recent inflation has reversed the trend. Is it permanent?

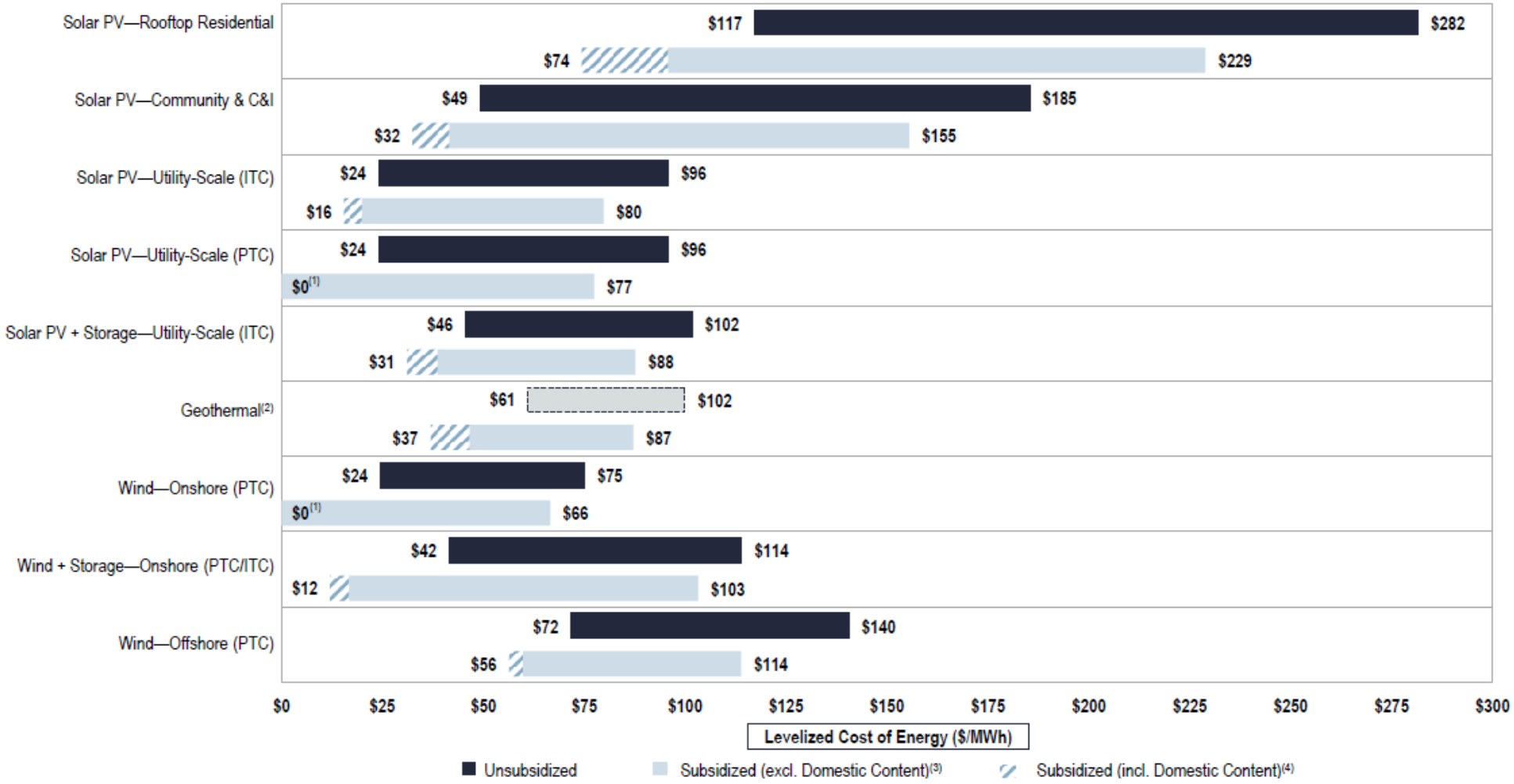


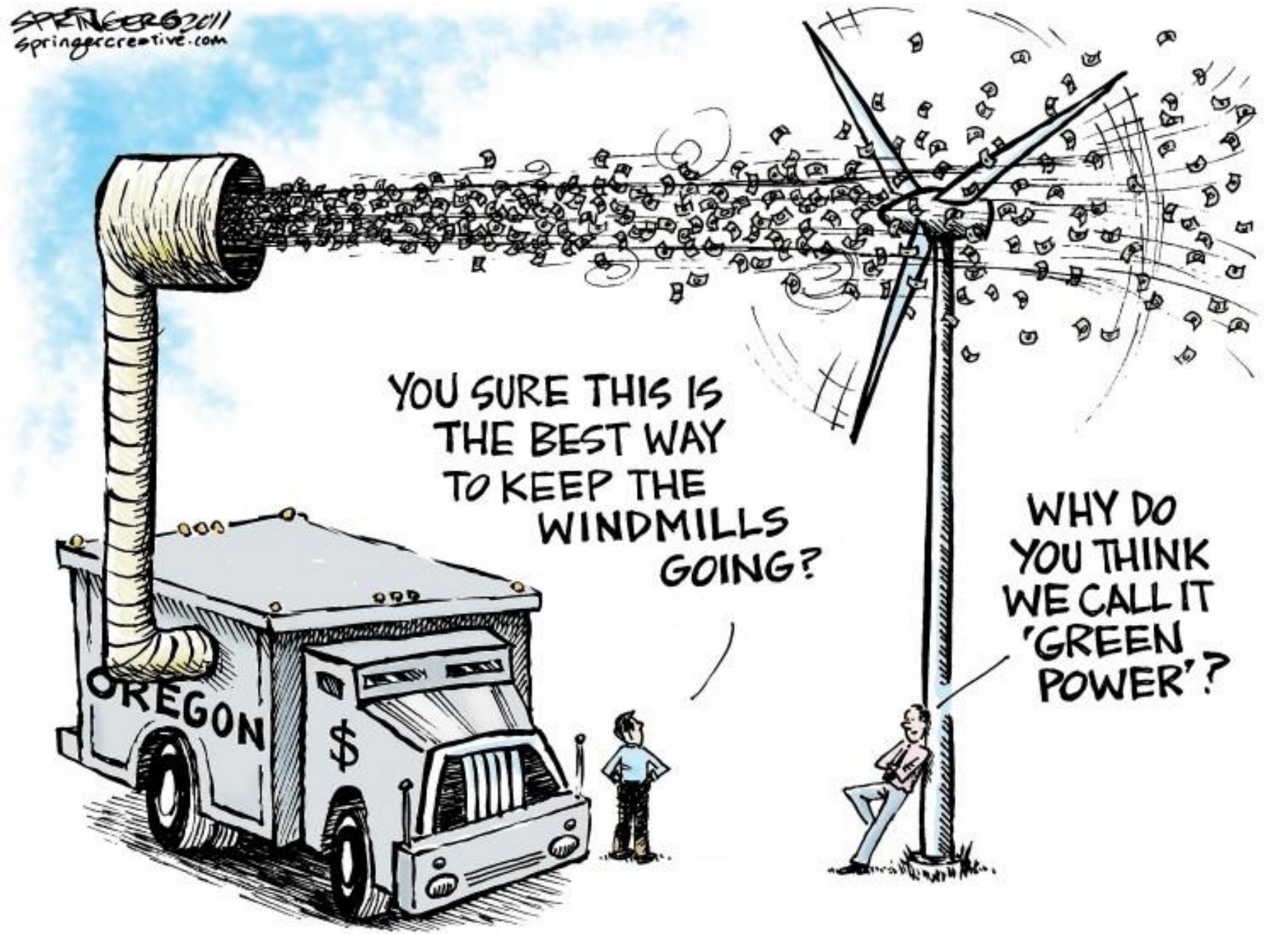


Source: Lazard's Levelized Cost of Electricity Analysis

What's driving renewables?

- Inflation Reduction Act (IRA)
  - Production Tax Credit/Investment Tax Credit lower costs by 25-50%

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WHY DO YOU THINK WE CALL IT 'GREEN POWER'?
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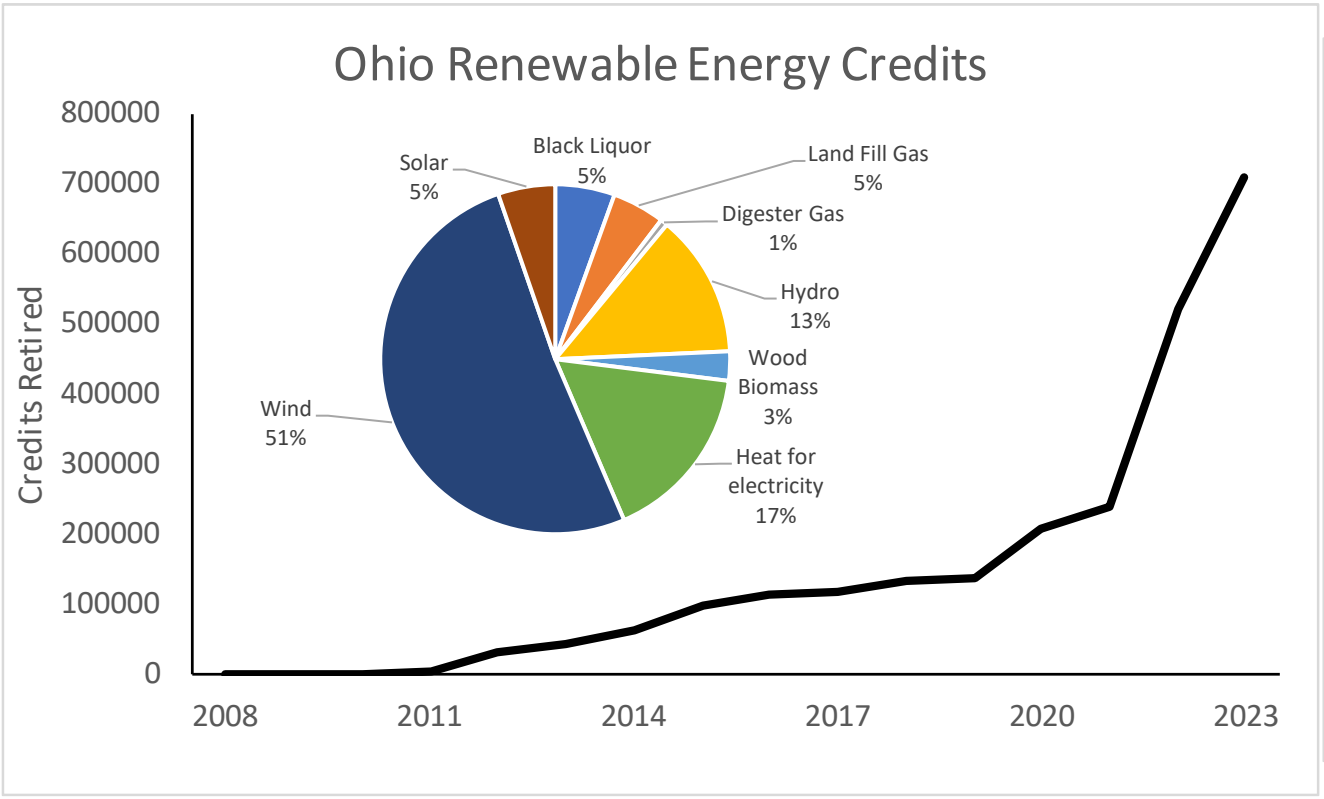
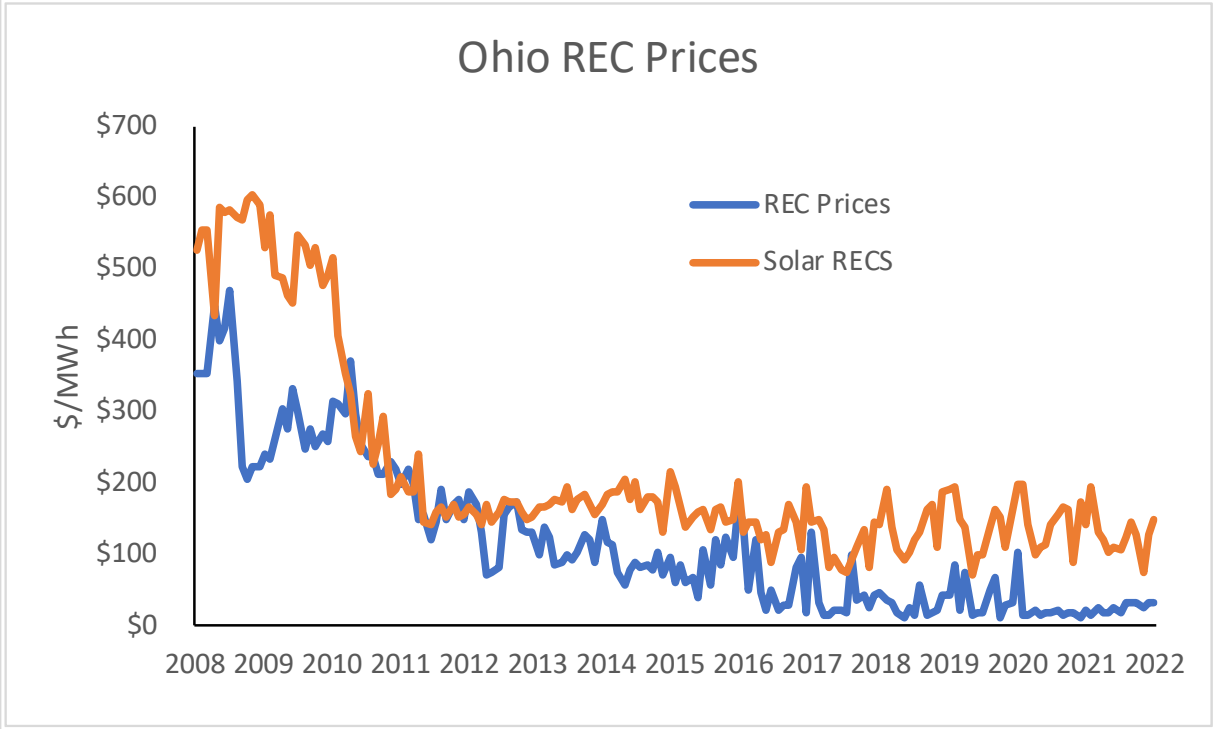
What's driving renewables?

- Renewable energy credits: Ohio's Renewable Portfolio Standard





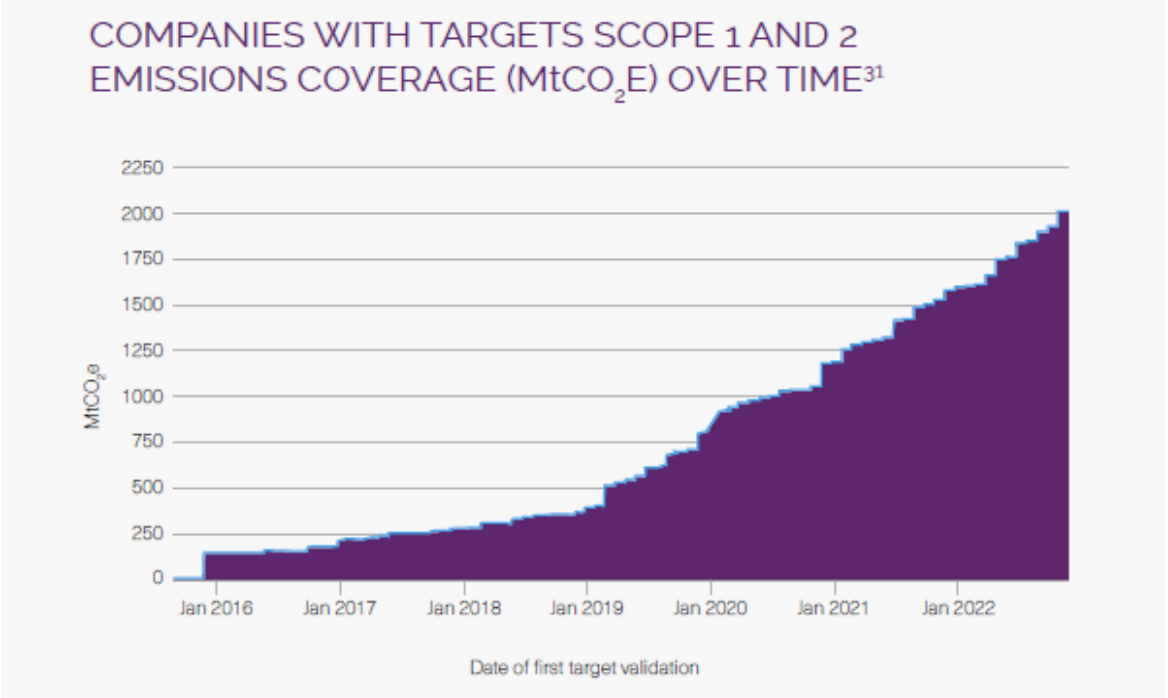
What's driving renewables?

Voluntary Commitments

- Emissions by companies with SBTi commitments have increased 300 – 500 Mt CO_2/yr due to increased number of commitments.

- Suggests
  - 2020
    - Emissions covered: 1200 Mt
    - Emissions reduced: 151 Mt
  - 2030
    - Emissions covered: 5200 Mt
    - Emissions reduced: 2,839 Mt

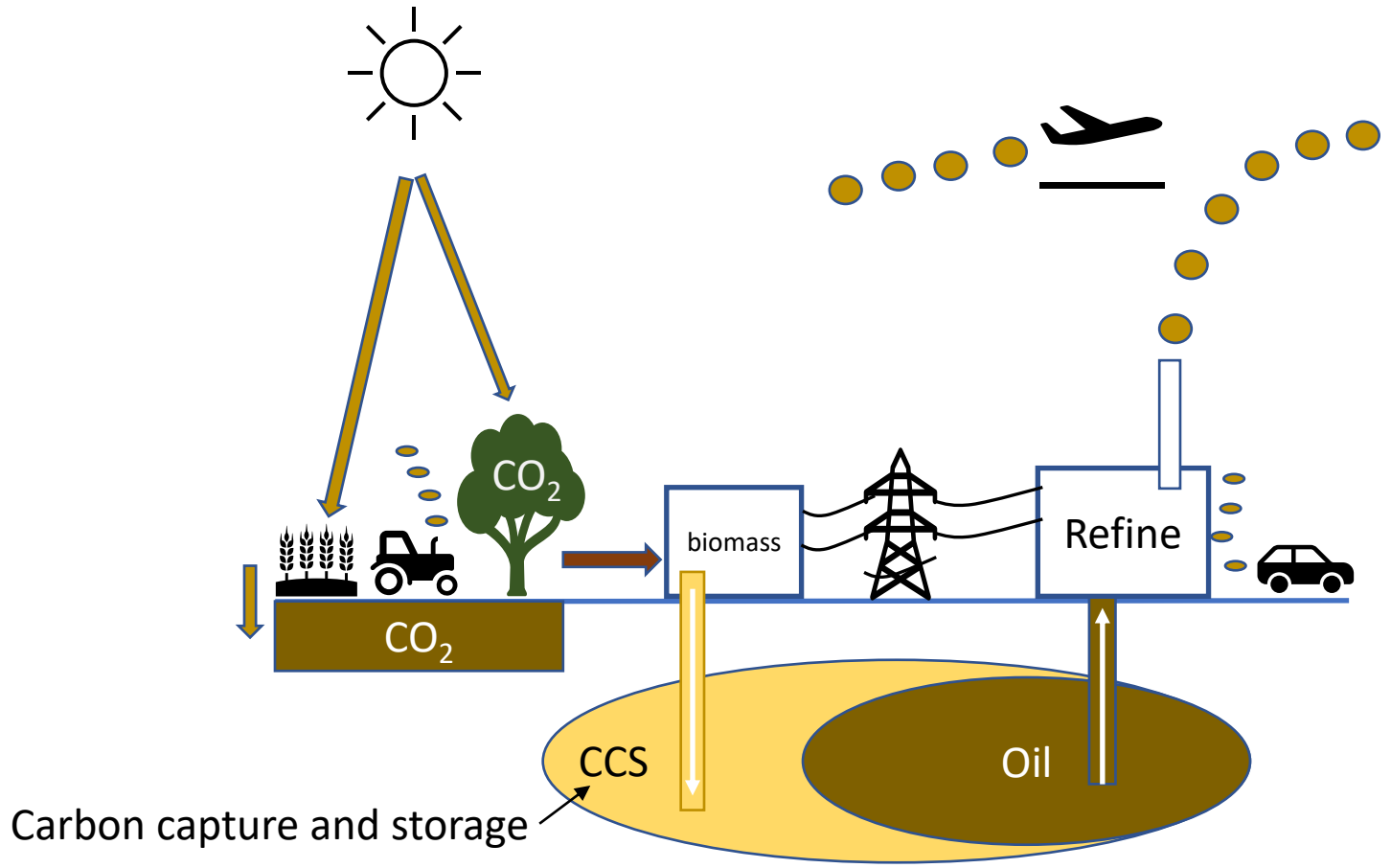
SBTi companies covered 2 billion t CO_2 emissions
By EOY 2022

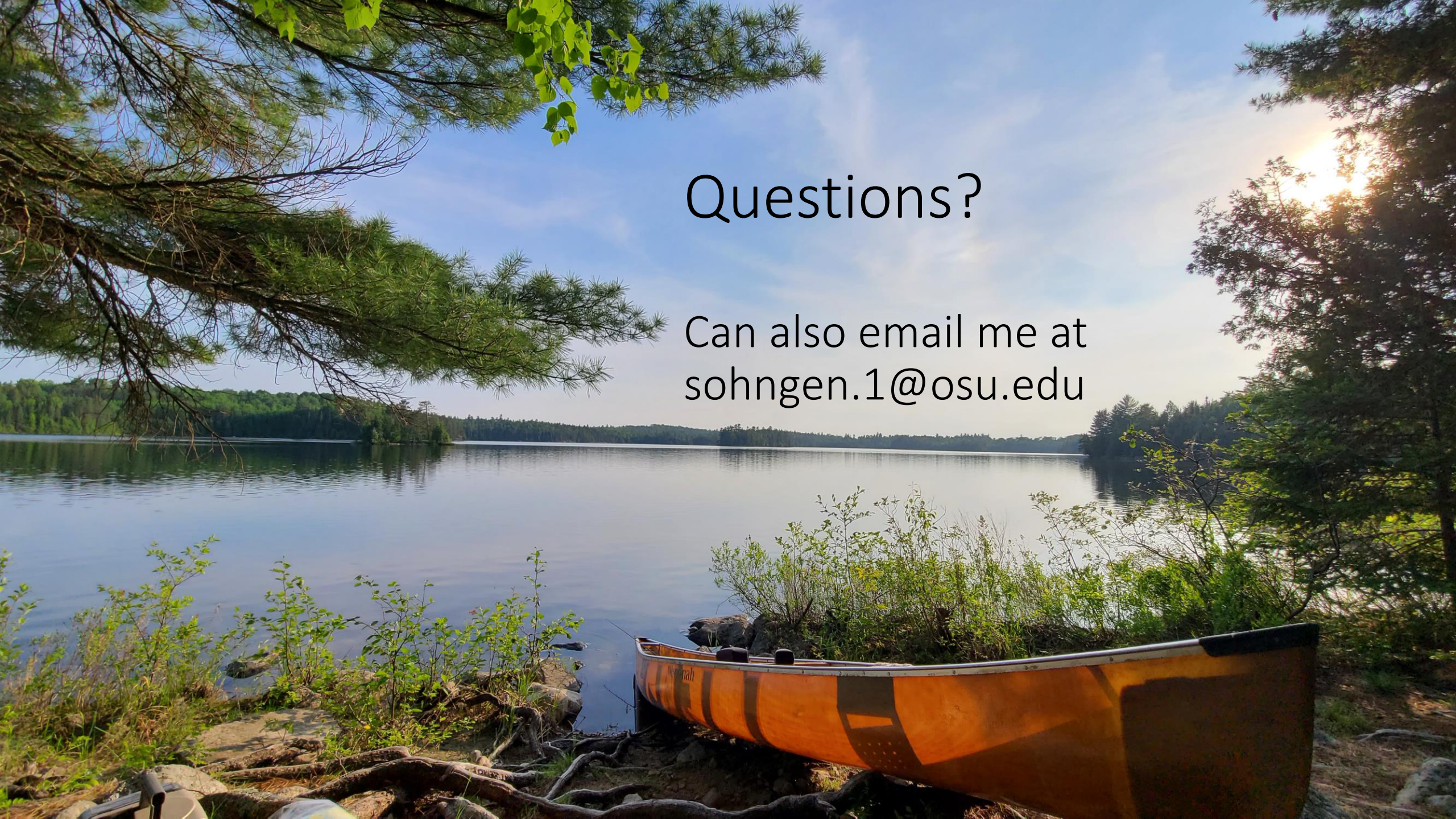


What's happening with carbon offsets?

- Market remains stuck with concerns over additionality, permanence, and accounting issues.

- Some people just really want to make sure that the only solutions adopted are those that eliminate fossil fuels.




Questions?
Can also email me at
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