

La part des renouvelables dans le mix énergétique en 2050

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Pleasure to join virtually

- ◆ **Thanks to Jean Pierre Favennec for the invite**
- ◆ **Apologies for speaking in English**

Zero Net Emissions by 2050?

- ◆ **Is it possible?**
 - EU?
 - USA?
 - OECD?
 - China?
 - Globally?
- ◆ **More important**
 - Should we try?
- ◆ **The implications?**
 - For renewables, fossil fuels, storage, electricity grids, etc.



Is it possible?

- ◆ **“If there is a will, there is a way”**
 - Humans have achieved many incredible feats in the past
 - D-Day amphibious landing on Normandy
 - Manhattan project – Oppenheimer movie
 - JFK’s moonshot
- ◆ **Only if the decision could to be made by a single, informed global decisionmaker**
 - Not easy; nor impossible
 - IEA’s Net Zero Scenario 2050 shows how

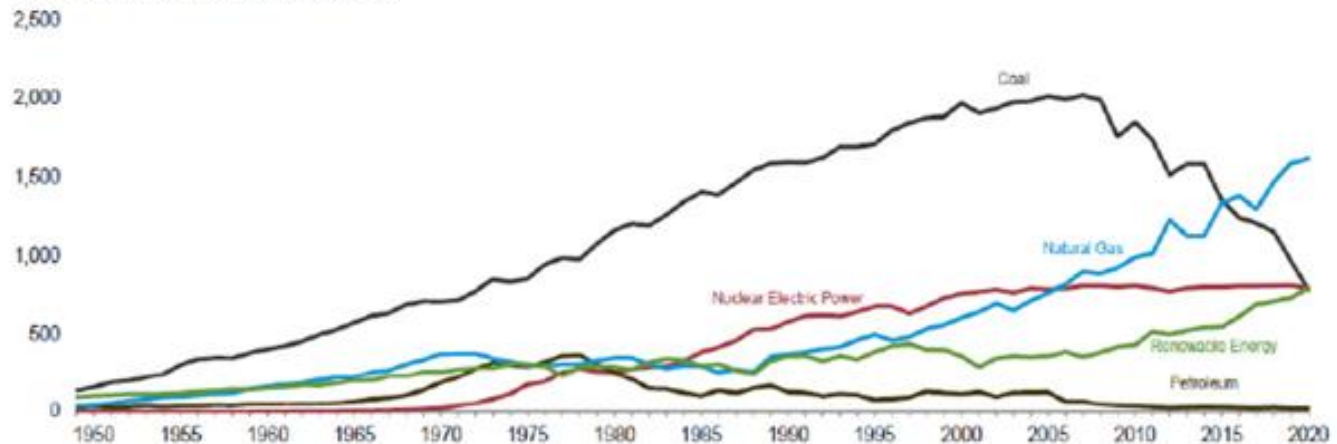
EU, US, China, globally?

- ◆ **Developed economies well-positioned**
 - UK: 38% reduction in emissions since 1980
 - US: 35-43% reduction by 2030 due to IRA
- ◆ **China's emissions already peaked?**
- ◆ **Developed economies?**
 - Other pressing priorities
- ◆ **Globally?**
 - Not so sure
 - Future population growth in “global south”

Can be accelerated

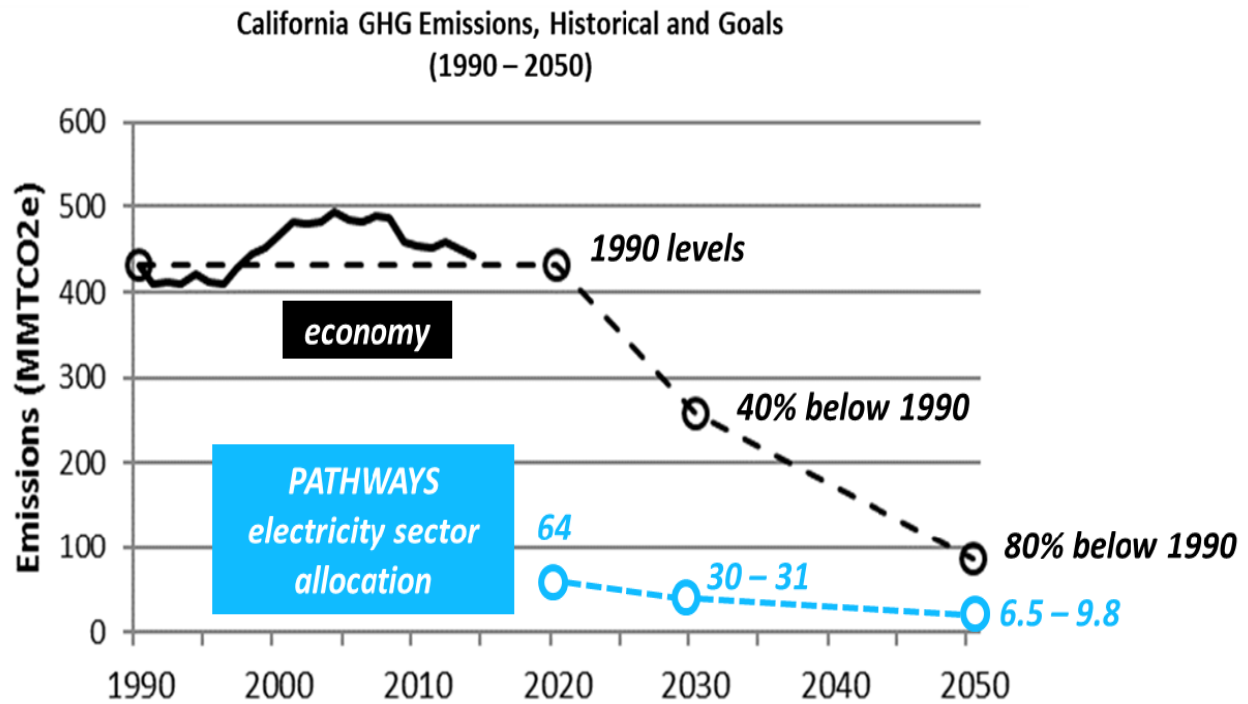
Renewables are gradually eating into coal's market share

Total (All Sectors), Major Sources, 1949-2020



Source: Resilient Power Best Practices for Critical Facilities and Sites, CISA Nov 2022

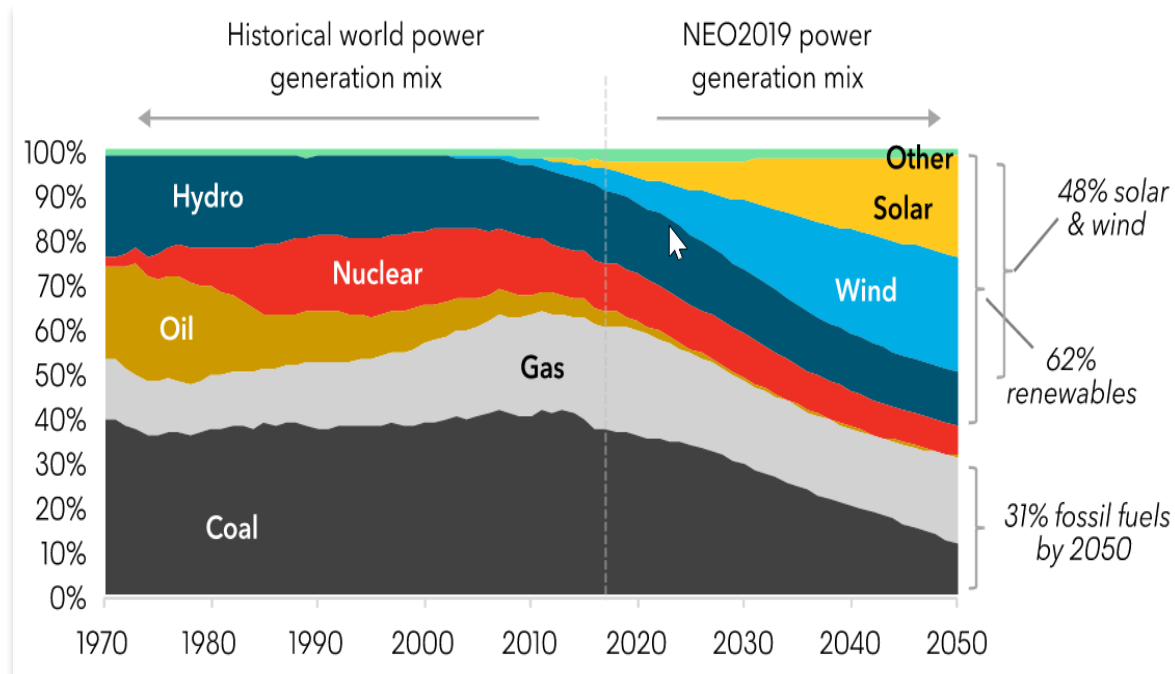
California has a plan



Source: Long-run resource adequacy under deep de-carbonization pathways for California, Energy & Environmental Economics, June 2019

50 by 50

Bloomberg: Renewables 50% of global capacity by 2050



Source: Bloomberg NEF

Should we try?

- ◆ **Costs vs. benefits**
 - **Costs: Non-trivial; paid by current generation**
 - **Benefits: Non-trivial; enjoyed by future generations**
- ◆ **Balance?**
 - **Significant uncertainties**
 - **Cost of capital/discount rate**

2023 hottest on record



Source: Getty Images

BNEF: Few anecdotes

- ◆ Renewable capacity tripled by 2030
- ◆ EVs 100% of sales by 2034
- ◆ Huge increase in CCS
- ◆ Cost: \$5.4 trillion/yr thru 2030
- ◆ \$1.8 trillion spent on low-carbon technologies in 2023
- ◆ Solar/wind 80% of global generation capacity additions
- ◆ Reversal of roles
 - Clean energy: \$2.7 trillion/yr
 - Fossil fuels: \$0.9 trillion/yr

Ascent of Renewables

- ◆ Cumulative global installed solar capacity > 1.4 TW
 - 10 times larger in 10 yrs; doubling every 3 years
- ◆ Global solar capacity > nuclear in 2017
- ◆ > wind in 2022 > hydro in 2023
- ◆ At current growth rates
 - Solar > gas in 2024 > coal in 2025
 - 9 TW in 2031
 - More solar generation capacity than all combined

Implications?

- ◆ **Significant investment in**
- ◆ **Renewable generation** **Relatively easy**
- ◆ **Electricity grids** **Not easy**
- ◆ **Storage** **Not easy**

Sun shines everywhere



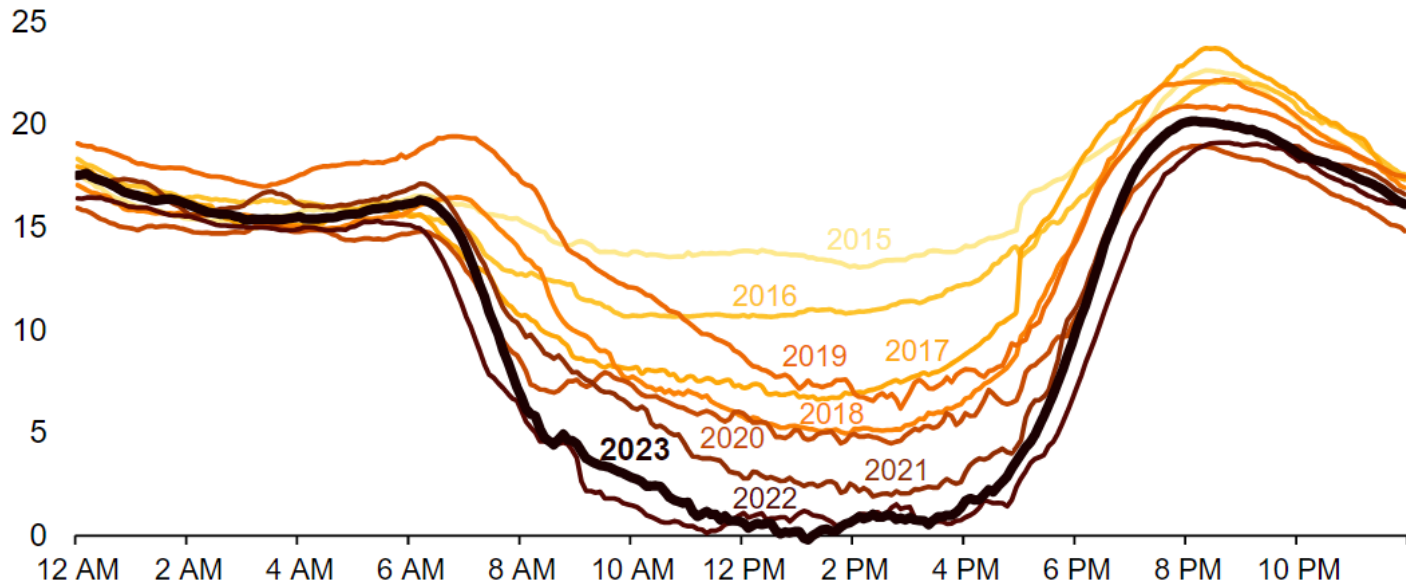
https://img.energytech.com/files/base/ebm/energytech/image/2023/01/Silicon_Ranch.63b73286ecd8b.png?auto=format,compress&w=1050&h=590&fit=clip

Negative net load

Unlike oil, electricity cannot be easily stored

California's duck curve is getting deeper

CAISO lowest net load day each spring (March–May, 2015–2023), gigawatts

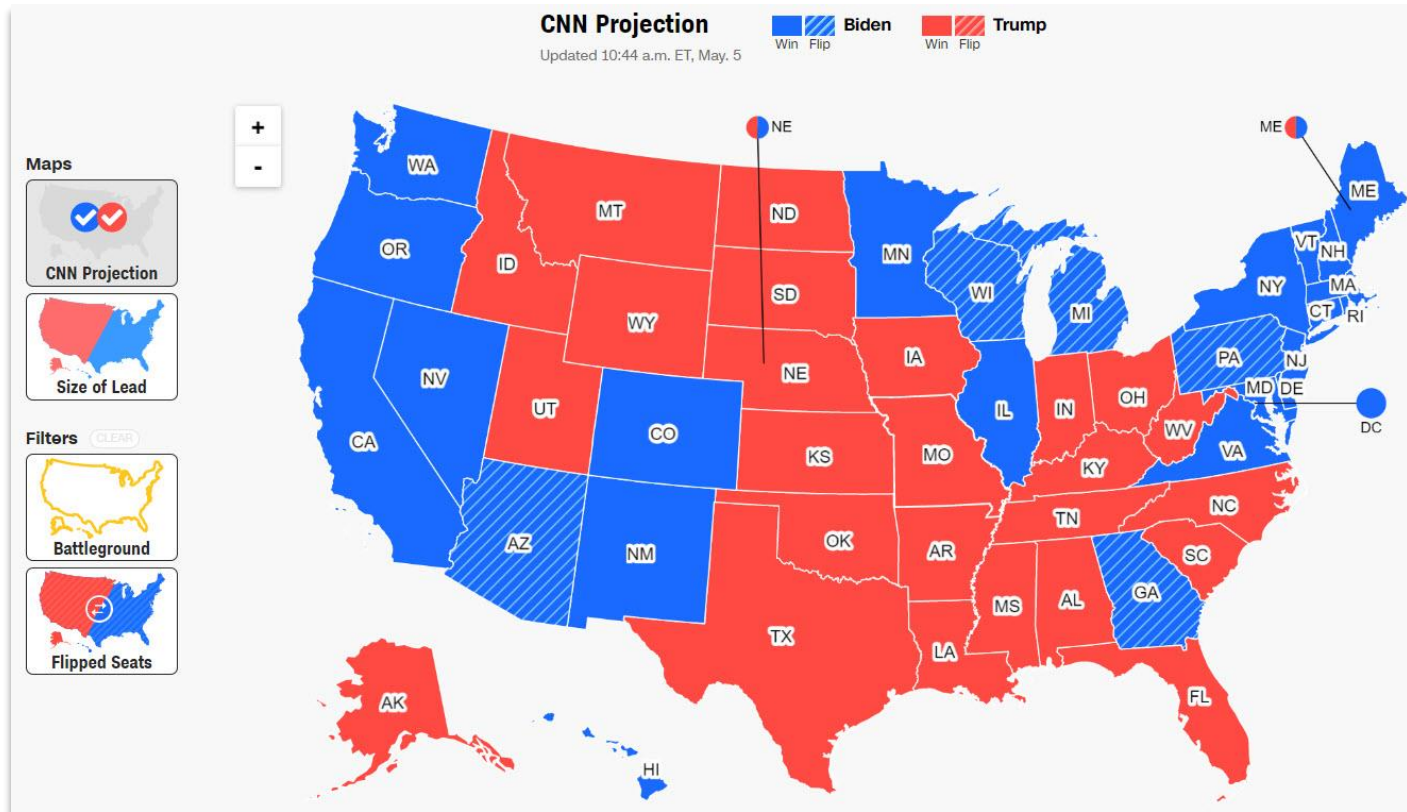


Data source: [California Independent System Operator \(CAISO\)](#)

Will he get re-elected in Nov?



2020 election has left US divided



Conclusions?

◆ My observations

- Traditional energy paradigm is unsustainable
- Time is of the essence for energy transition

◆ If “agreed”

- Electrify (virtually) everything
- Supplied (mostly) from renewables
- Handle “residual” issues as best as possible

◆ Implications?

- Electricity (gradually) emerges as main energy carrier
- Renewables major supplier of electricity
- New ways must be found to manage variability
- Storage, hydrogen, etc.
- CCS/direct carbon capture most likely required for net zero carbon



Thank you

- ◆ **Happy to answer questions**