# Carbon Capture from Coal Plants

## Not Economic, Not Effective and Not Environmentally Beneficial

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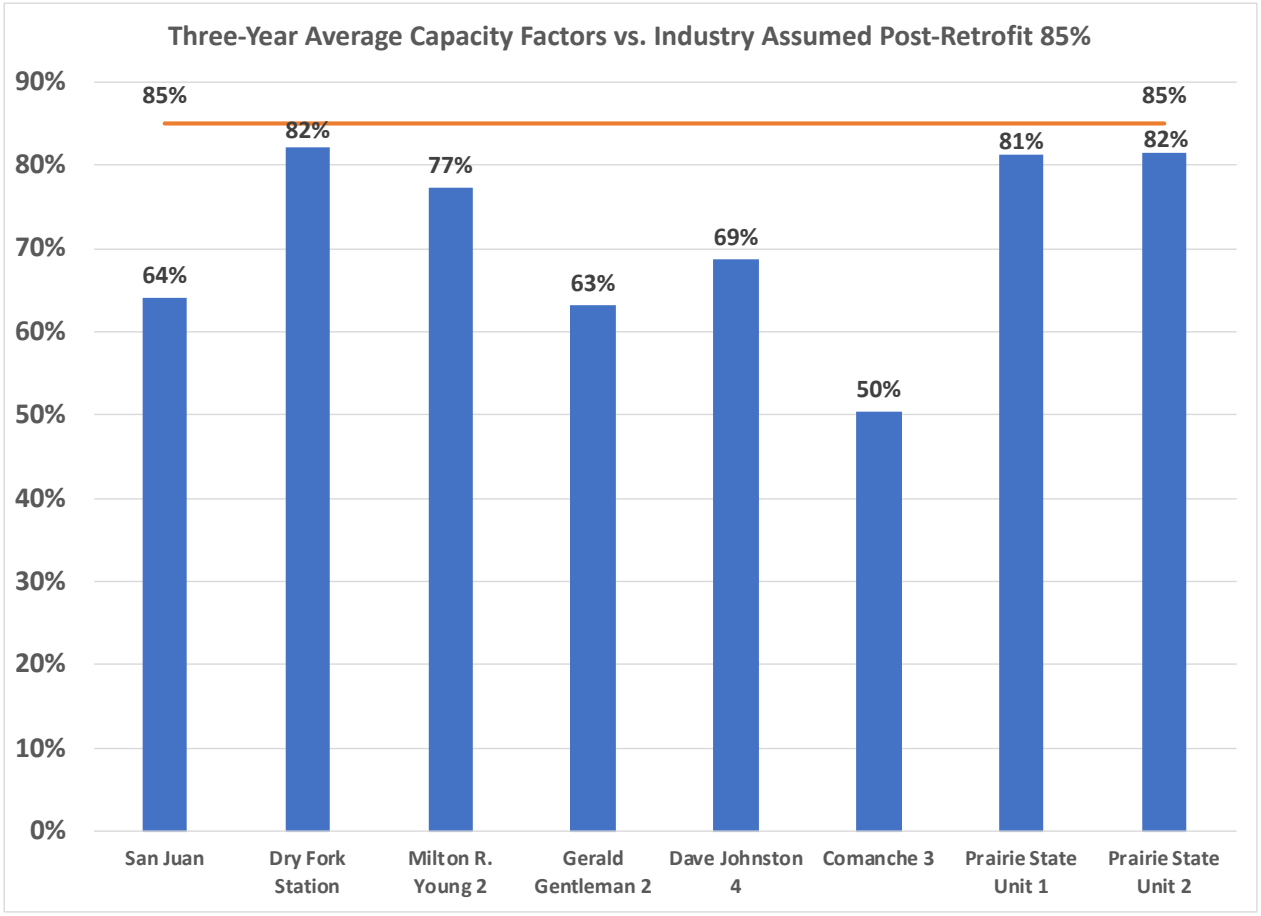
# Introduction

- The federal government has funded studies of the potential retrofitting of some coal- or gas-fired generators to capture carbon.
  - San Juan Generating Station (NM); Milton R. Young Unit 2 (ND); Gerald Gentleman Unit 2 (NE); Prairie State Energy Campus (IL); Dry Fork Station (WY); Kemper (MS); Plant Daniel (MS) and Plant Miller (AL)
- Other carbon capture retrofits have been discussed for Comanche Unit 3 (CO) and Dave Johnston Unit 4 (WY).
- Only 2 carbon capture projects in the world have captured the $CO_2$ from commercial-scale coal-fired power plants:
  - Boundary Dam Unit 3 in Saskatchewan, Canada
  - Petra Nova near Houston, TX, which was designed to capture the $CO_2$ from a 240 MW portion of the flue gas from W.A. Parish Unit 8.
- Petra Nova was mothballed in May 2020 after operating for 3 1/3 years because continued operation was not economic.
- Boundary Dam 3 has been capturing $CO_2$ for 6 ½ years.
- No existing carbon capture projects have captured the $CO_2$ from operating gas-fired generators.

# Proposed CCS Projects Face Key Risks

1. Uncertainty about how much $CO_2$ each project will produce.
2. Uncertainty about how much $CO_2$ each project will capture.
3. Uncertainty over the cost of retrofitting an existing coal unit for carbon capture.
4. Uncertainty due to the scaling up new technologies that have only been tested at very small sizes.
5. Uncertainty over the impact of aging on retrofitted coal plant operating costs and performance.
6. Uncertainty concerning the cost of capturing and sequestering the $CO_2$.
7. Increasing competition from declining cost renewables and battery storage resources.
8. Significant market uncertainties cloud the outlook for both enhanced oil recovery-dependent carbon capture and geologic storage.
9. Uncertainty about who will bear the liabilities associated with underground storage of captured $CO_2$.

# Risk 1: Uncertainty About How Much $CO_2$ Each Project Would Produce

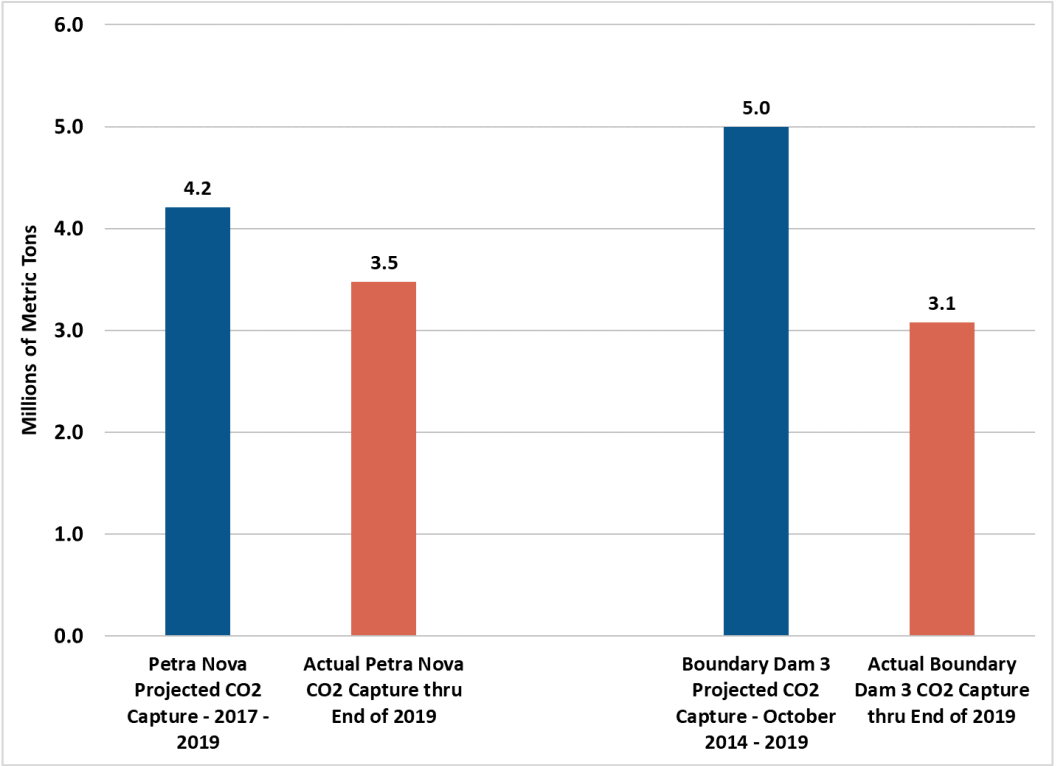



If not being done already, post retrofit coal plants will have to be designated "must run."

- To be financially viable, a project must capture enough $CO_2$ to produce strong revenue streams from (1) federal 45Q tax credits and (2) possible sale of captured $CO_2$ for EOR.
- That means the coal plant first must produce enough $CO_2$ by burning a lot of coal – paradoxically, this typically means running more and producing more $CO_2$ than in the past.
- Industry analyses generally assume after being retrofitted for carbon capture, coal plants will achieve 85% average capacity factors.

# Risk 2: Uncertainty Over How Much $CO_2$ Each Project Will Capture

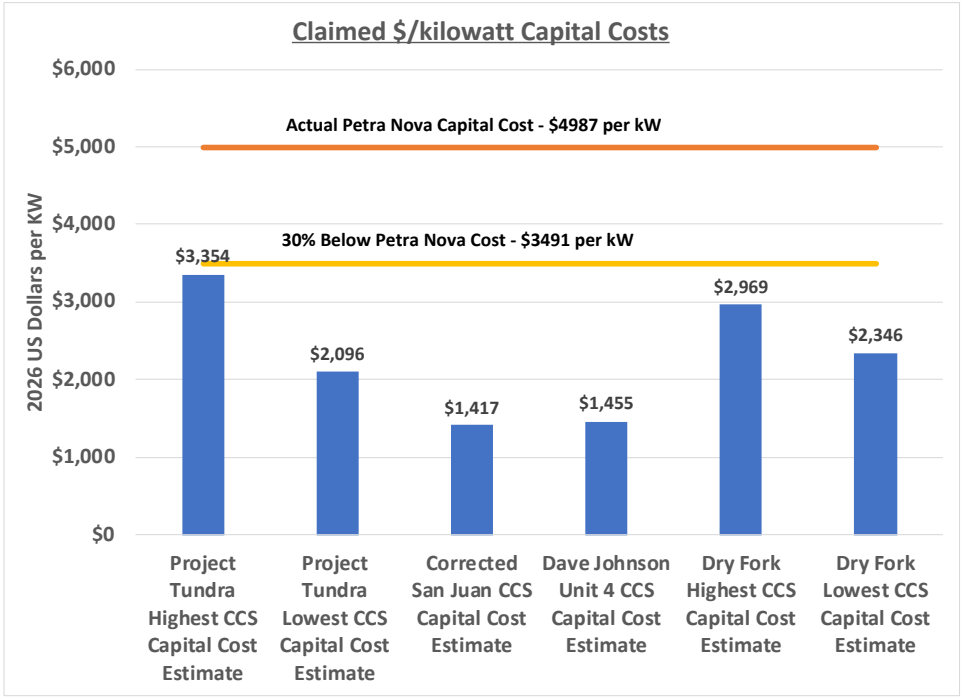
- 90% capture is the goal for carbon capture. But achieving this goal over the long-term has not been proven at either of the two existing coal plant projects.
- It was claimed that Boundary Dam 3 would capture 1 million metric tons of $CO_2$ a year.
- It was claimed that Petra Nova would capture 1.4 million metric tons of $CO_2$ each year.
- Neither project has achieved its goal.

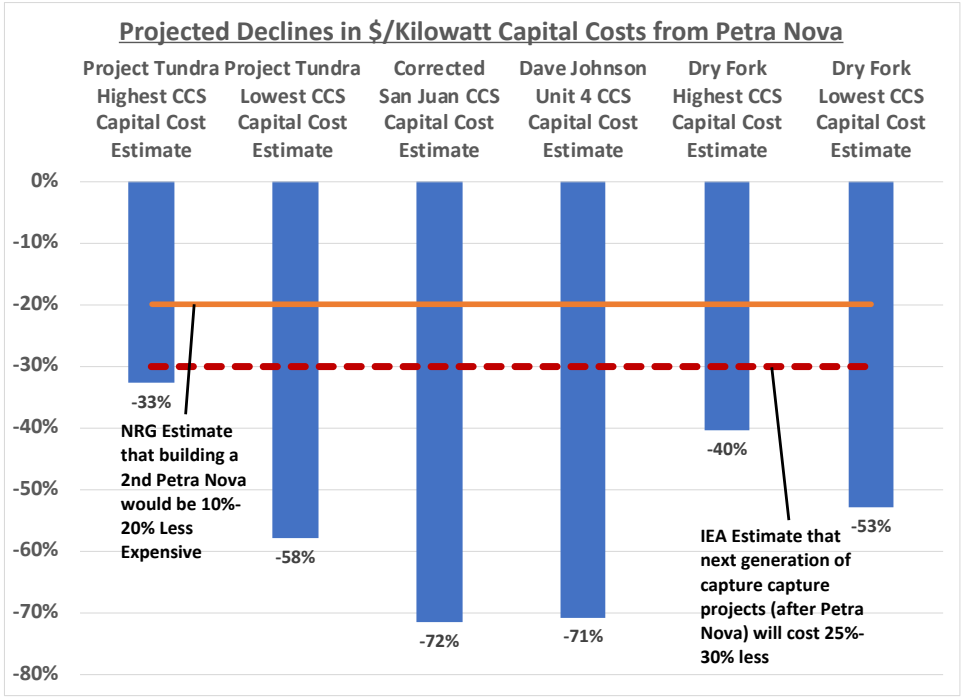



Actual Petra Nova $CO_2$ capture rate between 2017-2019 was ~75% The project was mothballed in May 2020. Actual Boundary Dam capture rate has been ~55%-60%.

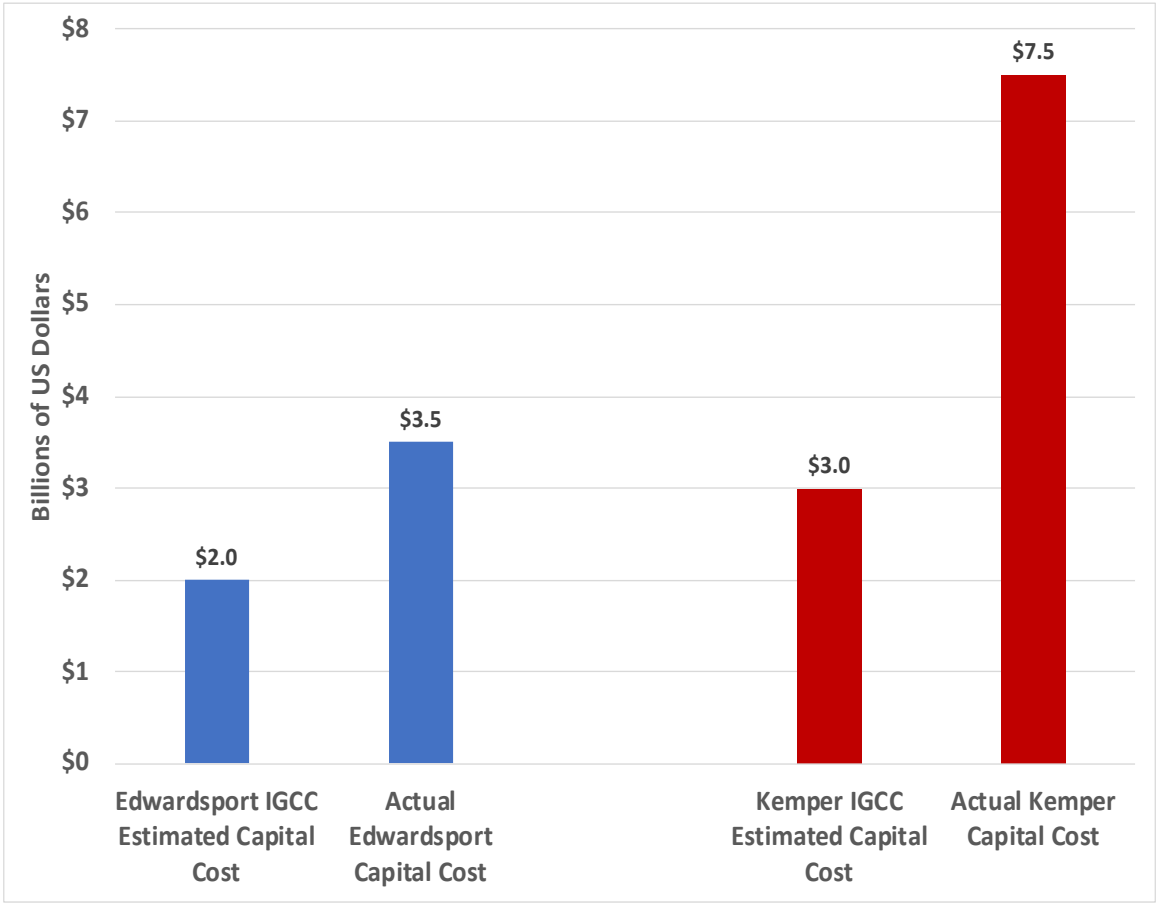
# Risk 3: Current Retrofit Proposals Assume Dramatic and Rapid Reductions in Capital Costs

The coal industry and promoters of carbon capture claim that major reductions have been achieved in the capital cost of retrofits. Untrue. No new retrofits of coal units for carbon capture have been done since Petra Nova in 2017. Only the estimates of the future capital costs of retrofits have declined.



# Risk 4: Scaling Up New Technologies Always Leads to Unanticipated Problems and Additional Costs, Both During Construction and Operation




Edwardsport promised an average 82% capacity factor but has achieved only 60% in the 8 years since it went into service.

Kemper promised coal gasification and carbon capture but the gasification process was so unreliable during testing that neither it nor carbon capture are used.

# Risk 6: Uncertainty Regarding $CO_2$ Capture Costs

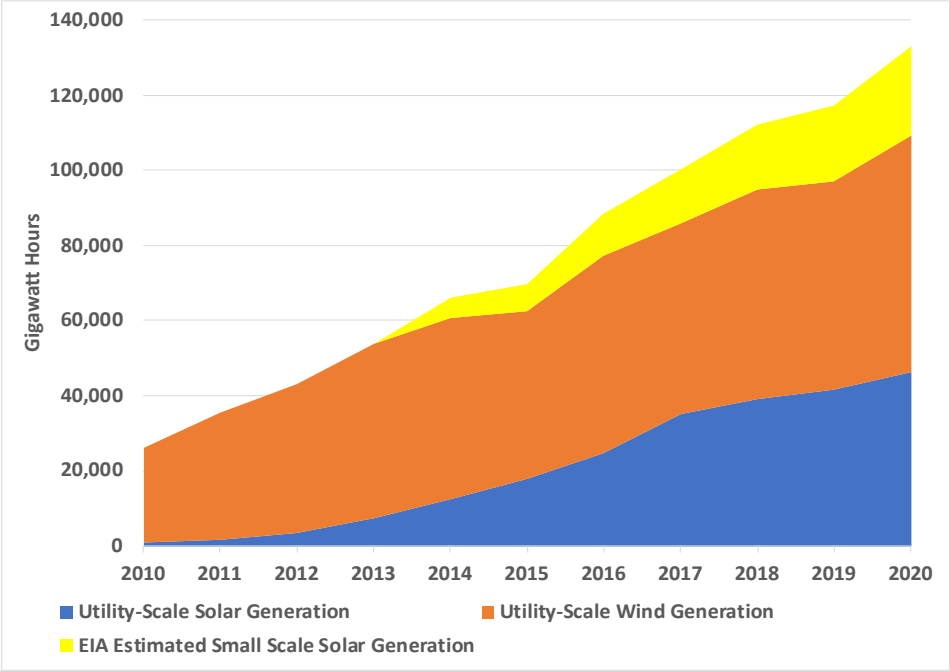
- U.S. Department of Energy and CCUS proponents report that the actual cost of capturing $CO_2$ from coal plants has been $60-$65 per metric ton.
- CCUS supporters admit this cost is far too high and say this must be reduced to about $30 per metric ton by 2030 for CCUS to be financially viable.
- Proponents of CCUS use the following chart to claim that there already is a declining trend in the cost of capturing $CO_2$ – however, this chart is misleading.
- Only the <u>estimates</u> of future $CO_2$ capture costs have declined. No new projects capturing $CO_2$ from coal plants have been built.


Levelised cost of electricity for large-scale coal power generation plant with post-combustion $CO_2$ capture

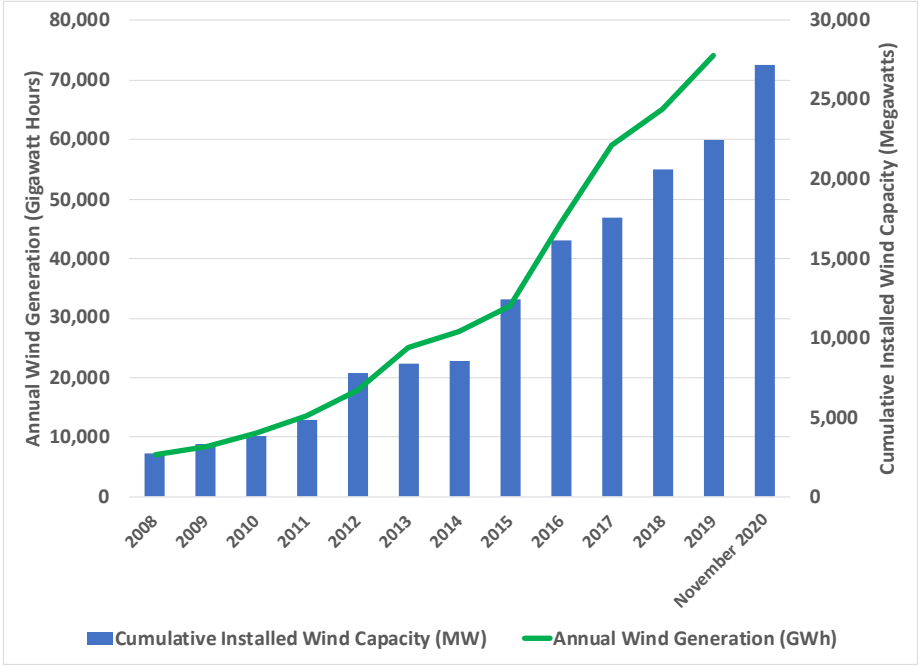
Note that these <u>capture</u> costs estimates do not include any costs for drilling, compressing, injecting and monitoring geologically stored $CO_2$ which are estimated to be in the range of an additional $20-$25 per ton.

# Risk 7: Carbon Capture Projects Face Increasing Competition from Declining Cost Renewable Resources and Battery Storage

Increasing Solar and Wind Generation in Western U.S.




Increasing Wind Capacity and Generation in Southwest Power Pool




In ERCOT, covering 90% of Texas, wind topped coal generation and **wind and solar combined topped 25%** of the market in 2020. That will grow substantially over time.

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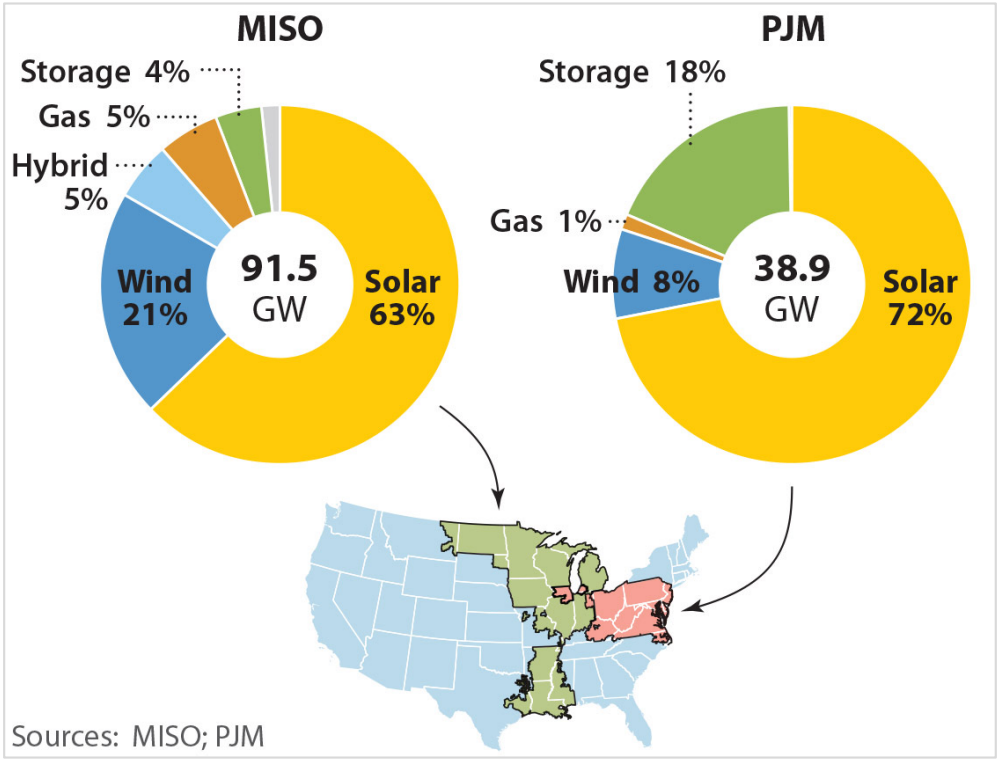


More renewable resources and battery storage are on the way.

- MISO, ERCOT, SPP and PJM all show the same trend—solar and wind dominate planned capacity additions; low to no growth for gas.
- Same is true for western U.S. and most of the South.

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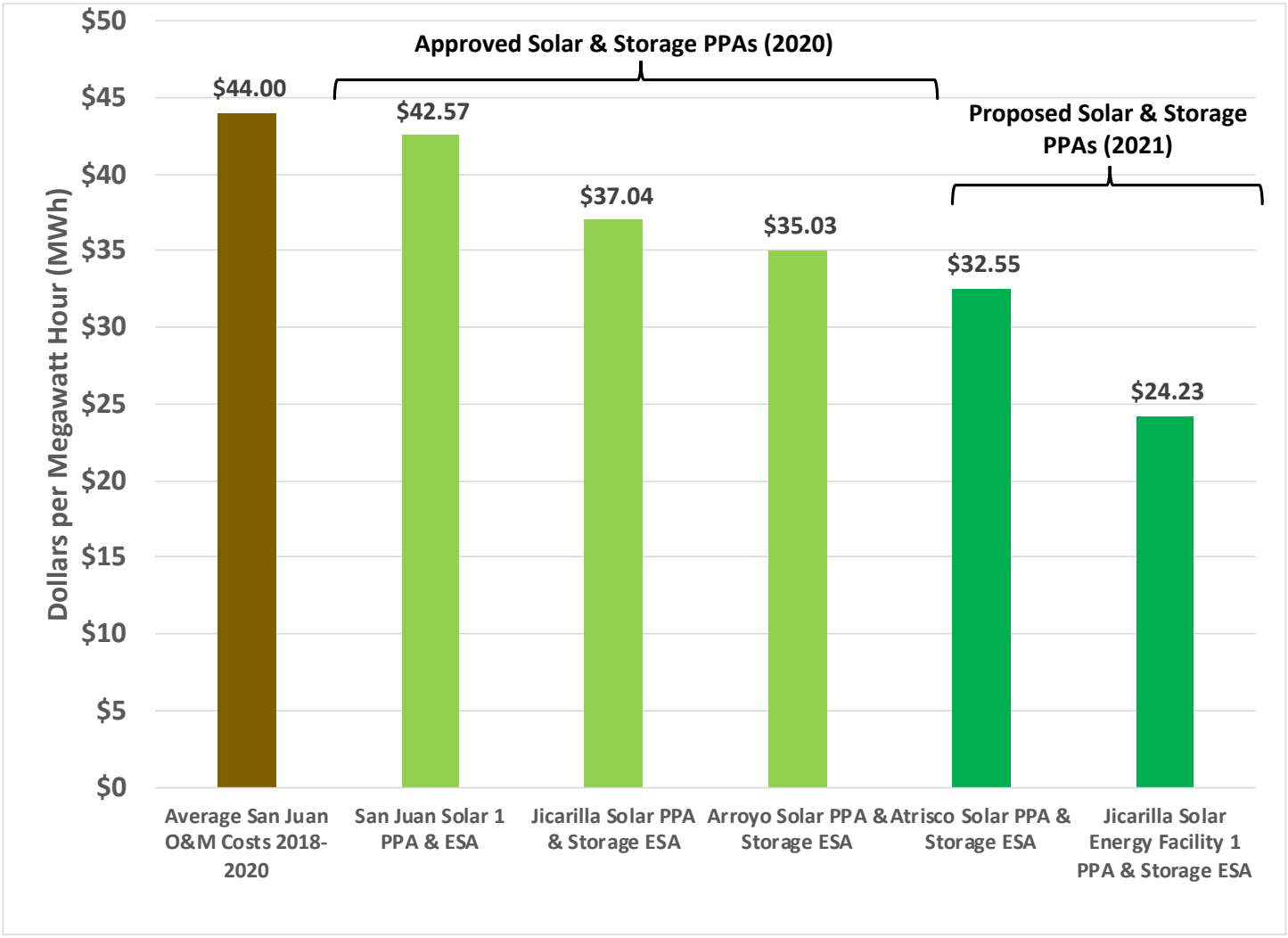

# Risk 8: Market Uncertainties Cloud the Outlook for Enhanced Oil Recovery-Dependent Carbon Capture *and* Geologic Storage

- Mothballing of Petra Nova in July 2020 - due to low oil prices - shows financial risk of relying on revenues from EOR.
- But even before, NRG, 50% owner of Petra Nova, had written down all its investment in the project.
- Profitability of using captured $CO_2$ from future capture projects for EOR will depend on actual and expected oil prices and by competition among $CO_2$ sources. Oil prices are inherently volatile. Overall demand declining.
- Also, the reality is that using captured $CO_2$ for EOR produces additional oil that, in turn, releases more $CO_2$ into the atmosphere when burned or used as a chemical feedstock – so it is unclear by how much $CO_2$ emissions actually are reduced.
- Uncertainties also cloud the outlook for geologic storage of captured $CO_2$ – cost and location of suitable storage sites.

# For More Information

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