The Risks of Relying on Carbon Capture & Sequestration for Industrial Decarbonization

Presentation to the Louisiana Climate Task Force

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August 31, 2021

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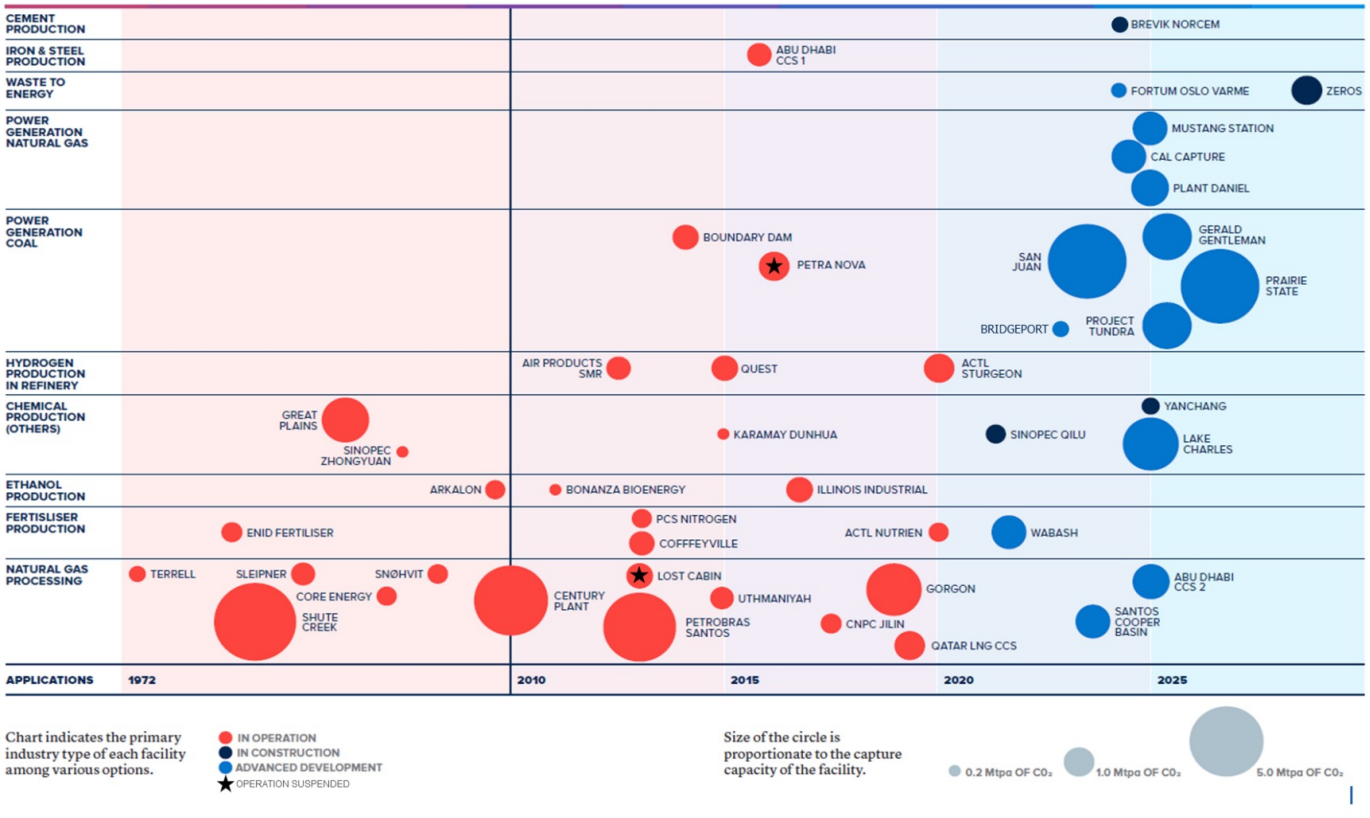
Key Industrial Sectors Show Limited Experience with CCS

CCS FACILITIES (ADVANCED DEVELOPMENT TO OPERATING- NEW CLASSIFICATION SYSTEM)

- 66 commercial CCS facilities: 26 operating, 4 under construction, 34 under development, 2 with operations suspended.
- Almost 40 million tonnes of CO_2 captured annually from 26 commercial CCS facilities currently in operation.



Source: Global CCS Institute Update, April 28, 2021

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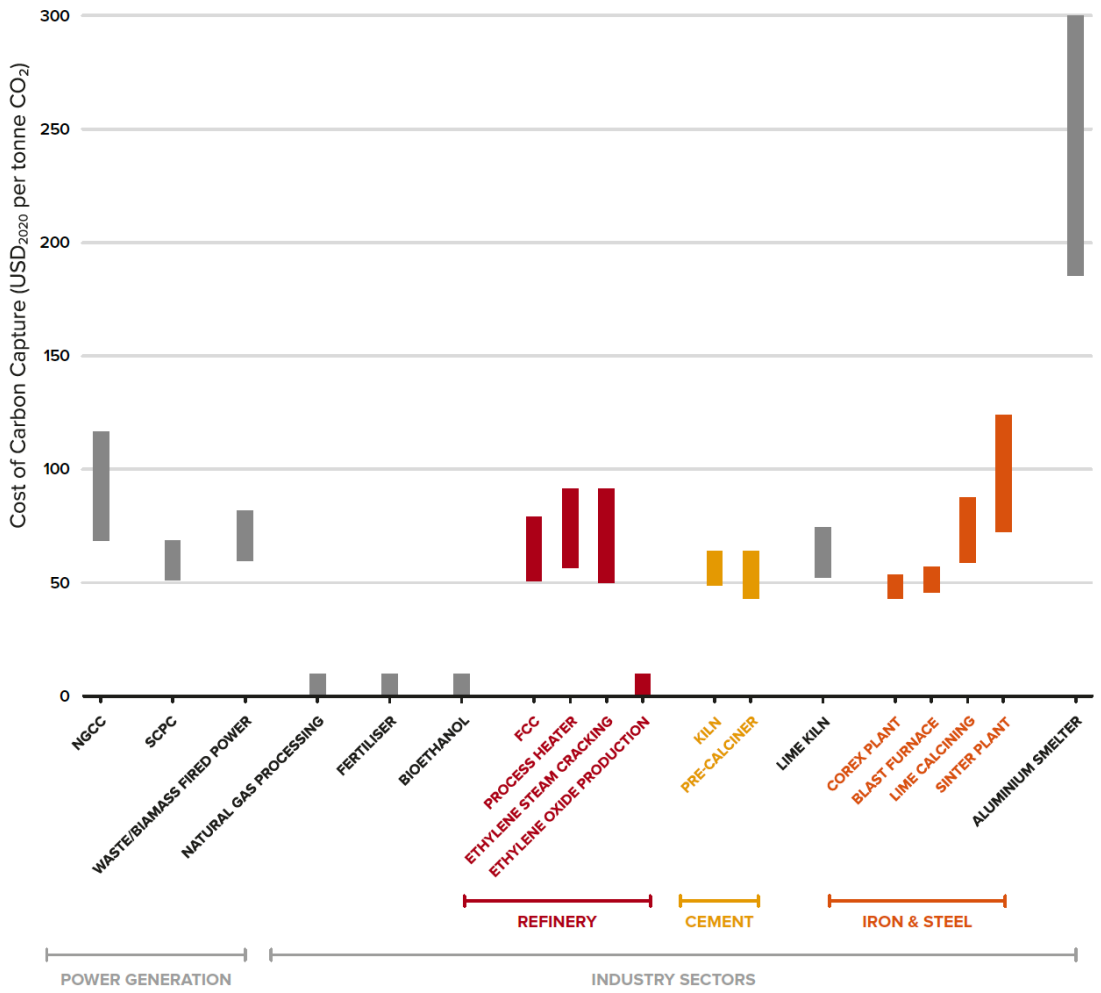
Estimates of How Much CCS Will Cost In Various Industrial Sectors Show Significant Uncertainty



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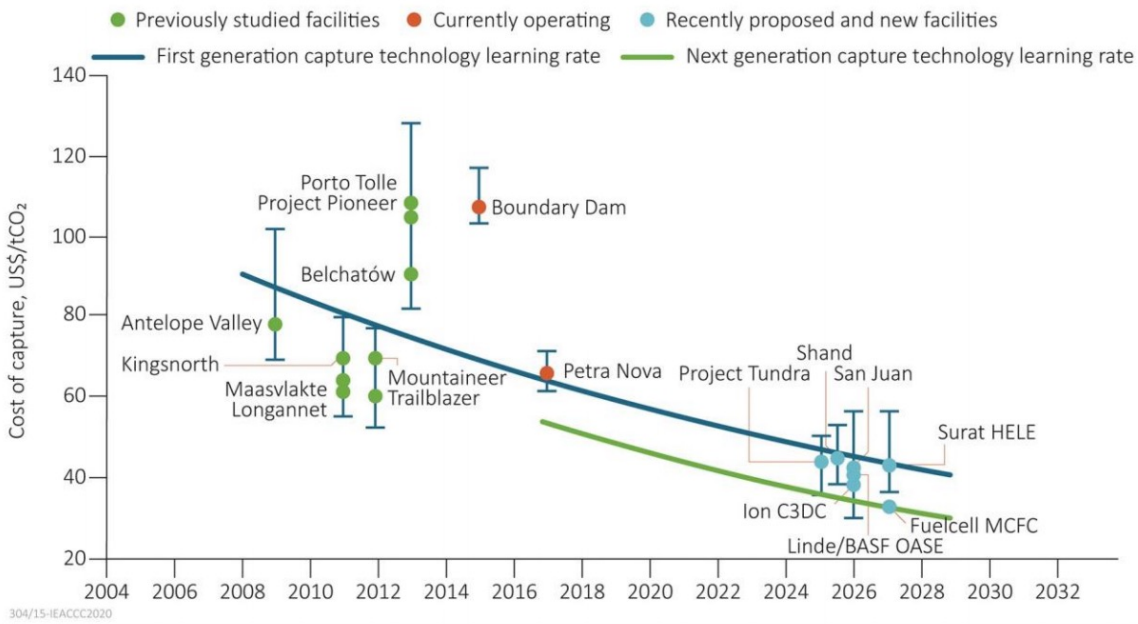
No Evidence Exists to Support the Claim that CCS Costs Will Decline Substantially Over Time

- U.S. Dept. of Energy and CCUS proponents report 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 must be reduced to about $30 per metric ton by 2030 to be financially viable.
- CCUS have used charts like this to claim there already is a declining trend in the cost of capturing CO_2 – however, this chart is misleading.
- Only the estimates of future CO_2 capture costs have declined. No new projects capturing CO_2 from coal plants have been built.
- CO_2 concentration in flue gas from gas plant is much lower (~4%) than from a coal plant (~14-15%). Therefore, can be expected to me more expensive.



GCCSI analysis based on 8% discount rate, 30 years project life, 2.5 years construction time, capacity factor of 85%. Fuel prices were based on the reported data in the project feasibility and FEED reports. Cost data normalised to 2017 values.

Figure 15 Levelised cost of electricity for large-scale coal power generation plant with post-combustion carbon capture (Zapantis and others, 2019)

Note: These capture costs estimates do not include the costs for drilling, compressing, injecting and monitoring geologically stored CO_2 – which have been estimated to add another $20-$25 per ton to the total cost of capture and storage

Key Points

1. Time matters -- this summer once again has shown the dramatic need to reduce CO_2 emissions as quickly as possible, including those from the key emitting industrial sectors – steel, petrochemical and cement.
2. Although proponents claim that 26 CCS projects are operating in the world, only one project in the world captures CO_2 from a steel plant – and no public information is available on how effectively that project captures CO_2 (its "capture rate") or what it costs at that plant to capture the CO_2.
3. There are no projects in operation that capture CO_2 from a cement plant and the first such system is not projected to be in service for another five years or later.
4. No public information appears to be available on the actual CO_2 capture rates at the operating projects that capture CO_2 during chemical production, fertilizer production or natural gas processing. All I can find is information on the total tonnes of CO_2 that each project captures or that it was designed to capture.

Key Points

5. There is uncertainty as to the actual costs of capturing CO_2 at any of the currently operating projects other than the acknowledgement by CCS proponents and the U.S. Department of Energy that the capture cost at the now-mothballed Petra Nova Project was about $60-$65/tonne and the actual cost of capture at Boundary Dam is significantly higher. No information is available on the actual costs of compressing, transporting, injecting and monitoring the captured CO_2 that has been injected into underground repositories other than an estimate that this cost is somewhere in the range of $20/tonne.

6. A 90% capture rate is the Holy Grail for carbon capture. However, there is no evidence that any CCUS facilities have achieved a 90% capture rate over the long-term, or even for any length of time.

   - Boundary Dam Unit 3 in Saskatchewan, Canada has captured about 55%-60% of the CO_2 it has produced since its carbon capture project went into service in the fall of 2014.
   - The Petra Nova project in Texas captured about 70%-75% of the CO_2 it processed before it was indefinitely mothballed in early May 2020. This captured CO_2 was used for Enhanced Oil Recovery. (EOR)

Key Points

- The Gorgon project in Western Australia has captured and injected underground only 30% of the CO_2 it produced during its first five years of operation—far below the 80% goal that project developers promised when seeking government funding assistance.
- The Shell Quest project in Alberta, Canada has reported capturing and injecting underground 78%-80% of the CO_2 it produces.

7. The emissions impact of the power source used to run the projects' carbon capture equipment and the equipment used to compress, transport and inject the captured CO_2 into the ground raises additional uncertainties. If the project uses fossil fuels to run this equipment, the CO_2 emissions from the burning of these fuels will offset, perhaps to a significant degree, the tonnes of CO_2 captured and stored by the carbon capture system itself.
   - For example, if the CO_2 emissions from the dedicated combustion turbine used to power Petra Nova's carbon capture facility are considered, the project's overall CO_2 capture rate was only 60% or lower – not the 70% to 75% suggested by the data that the owners have provided to the DOE.

Key Points

8. Roughly 2/3 to 3/4 of the 26 CCUS projects in operation today use captured CO_2 for EOR. To some degree, the additional CO_2 emissions produced by the burning of the extra oil produced with EOR (or its use as a petrochemical feedstock), offset the reported amounts of CO_2 captured at these projects. Thus, the actual net reductions in CO_2 emissions due to CCUS at these projects is uncertain.
9. There also is uncertainty about the profitability of using CCUS to capture and process CO_2 as information on project profitability only has been made publicly available for the Petra Nova project. From this information, it is clear that the project was not profitable because NRG (one of the two owners of the plant) wrote off all of its $300 million investment in the project several years before it was indefinitely mothballed in May 2020. Similarly, the Dakota Gasification Company, the owner of the Great Plains Synfuels Plant that captures, compresses, and transports CO_2 from a coal gasification process, reported over $750 million in losses between 2015 and June 2021.

Key Points

10. There is great uncertainty regarding how long it will take to design, build, test, and then bring a new industrial CCS facility on-line and operating effectively. This process should be expected to take at least 5 years, but possibly longer. Thus, new facilities to capture industrial CO_2 should not be expected to be in service until 2026, if not later.
11. It also is unknown how adding new carbon capture equipment and processes to what is perhaps aging industrial infrastructure will affect the reliability, operating performance and production costs of the industrial facilities.
12. Finally, some legal and political issues need to be addressed:
    - Will communities be willing to accept the siting of the large number of new pipelines that will be needed to carry the captured CO_2 from the industrial facility where it is emitted to where it will be injected underground. Recent struggles regarding proposed natural gas pipelines suggest this may be a problem.
    - Who will be responsible for monitoring and preventing leakage of the stored CO_2 underground? And for the liabilities associated with major leaks?

Conclusion

While CCS may eventually become a vital contributor for reducing CO_2 emissions in the industrial sector, it will likely be years before we know how much of a contributor it can be—and at what cost. Continued studies can and should be pursued.

But time is of the essence: The world needs to reduce CO_2 emissions immediately.

Measures that can be undertaken and completed more quickly need to be implemented now. These measures include, but aren't limited to, energy efficiency measures, demand management (strategic timing of industrial processes with high energy use to avoid peak energy use times of day), and fuel-switching from fossil fuels to renewable sources.

For More Information

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