Why Carbon Capture and Direct Air Capture Increase CO_2, Air Pollution, Fossil Mining, and Costs

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Webinar
March 24, 2025

Four Cases Across 149 Countries

BAU: Business-As-Usual

BAU-CC-BAU: Attach carbon capture (CC) to fossil & bioenergy stationary sources; Offset mobile & distributed CO_2 sources with direct air capture (DAC). Use BAU energy for CC/DAC.

BAU-CC-WWS: Same as BAU-CC-BAU but use WWS energy for CC/DAC

WWS: Electrify all non-electric BAU energy; provide electricity with WWS

Assumptions in Base Scenario

With CC/DAC, 2050 demand 6.74% below BAU due to efficiency improvements; WWS demand 54.4% lower due to electrification + effic.

9.8% of remaining 2050 BAU demand with CC/DAC comes from WWS; 2.3% comes from nuclear. Such sources are assumed to emit no CO_2e.

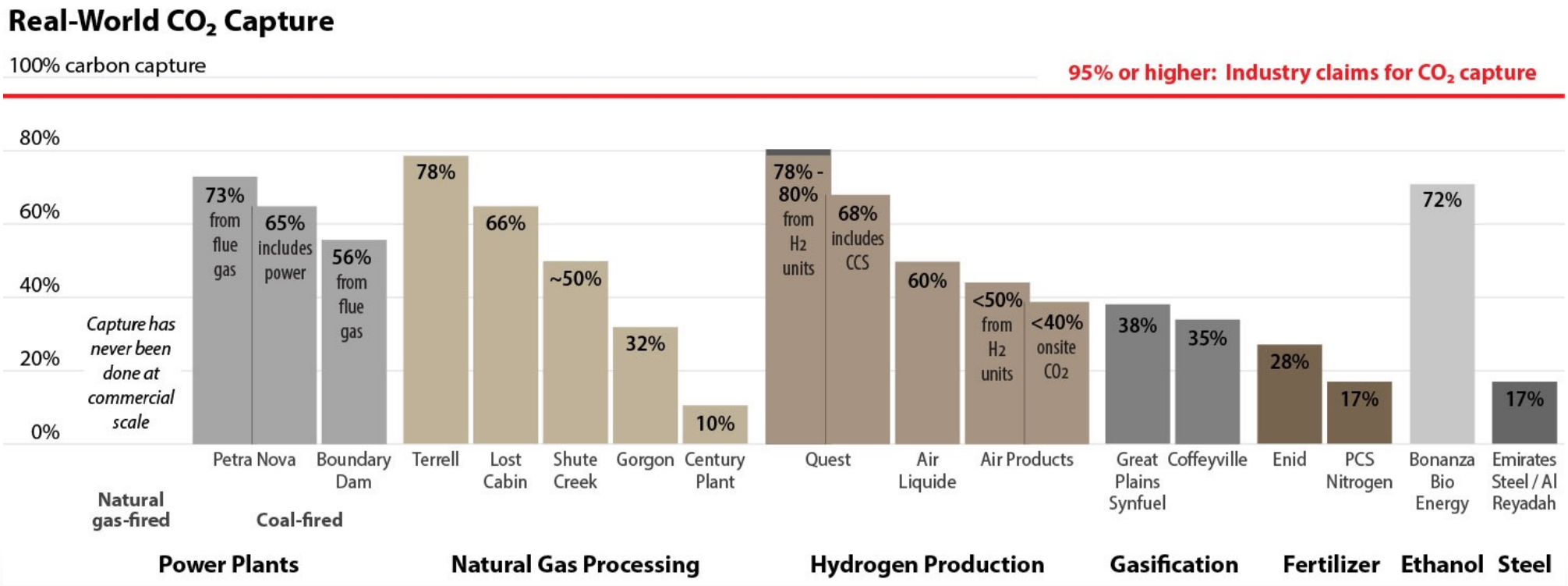
85% of remaining BAU CO_2e emissions are CO_2

80% efficiency of CC and DAC equipment (IEEFA: 10-80%)

25% more energy needed with CC (IPCC: 13-44%); 3000 kWh/t-CO_2 w/ DAC

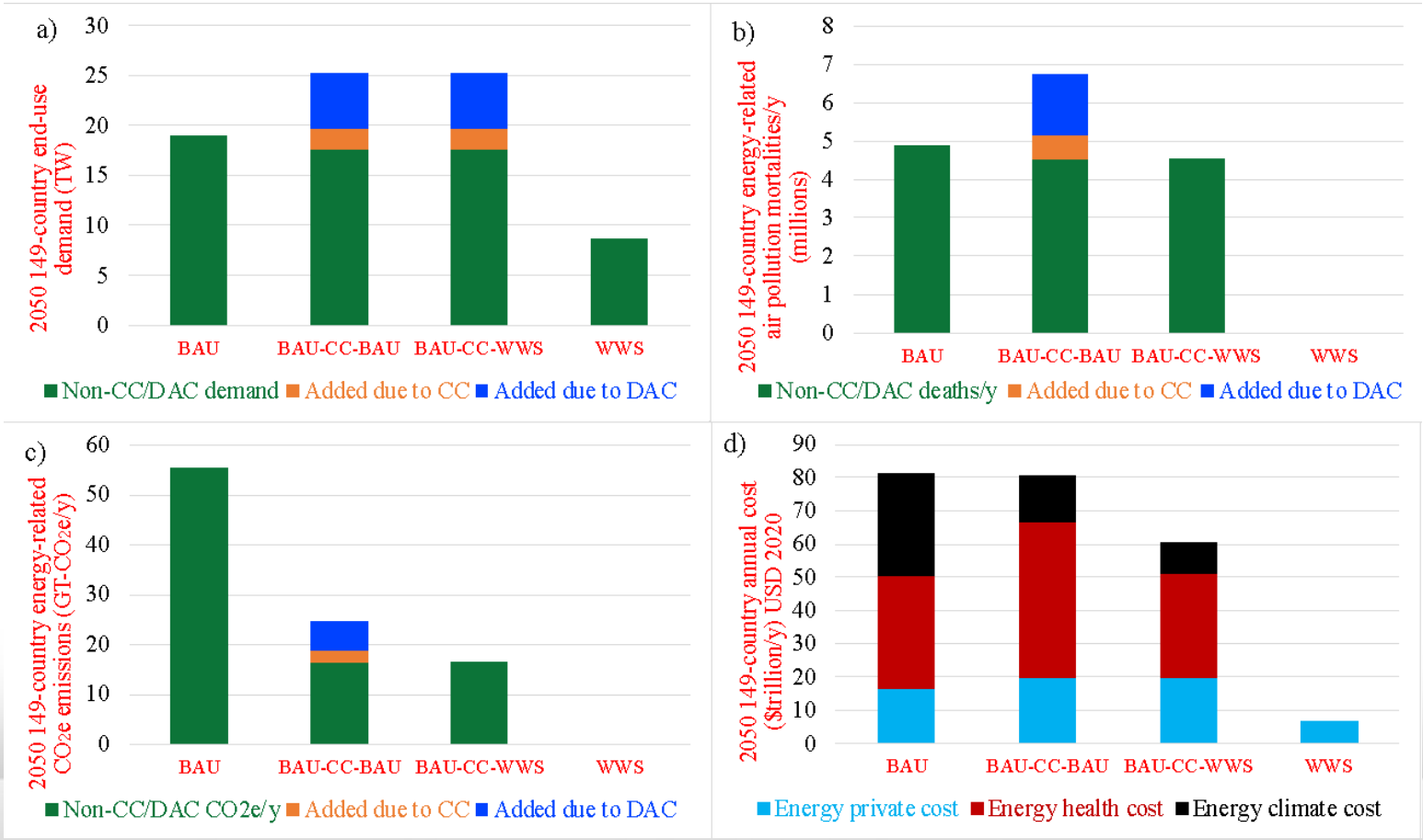
Assumes all CO_2 stored although 82% today used for EOR, which releases 30-40% back to air during EOR operations & 20-80% due to burning extra oil

Real-World CO_2 Capture Efficiency: 10-80%, Not 95%

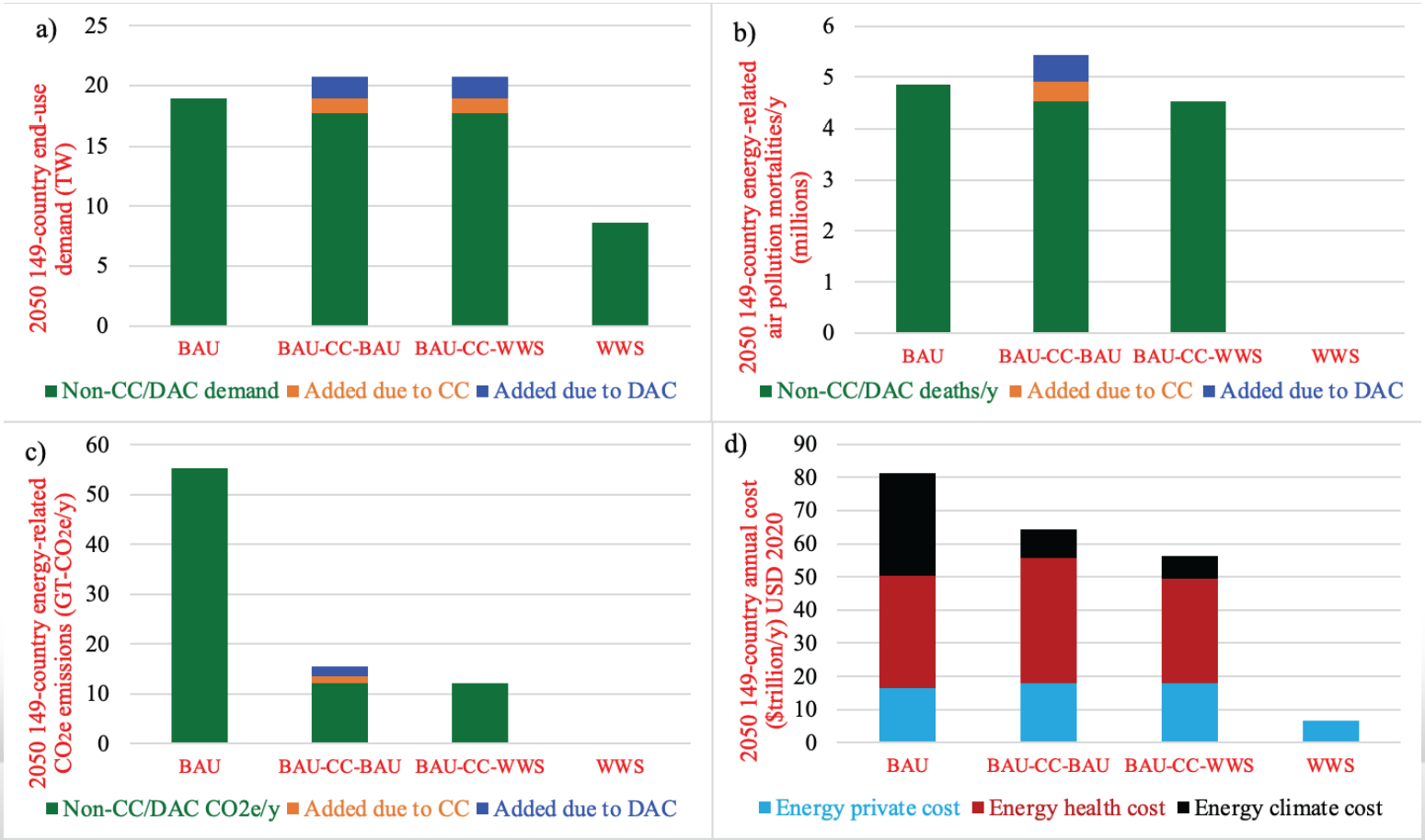


Schlissel, D., and A. Juhn (2023), IEEFA

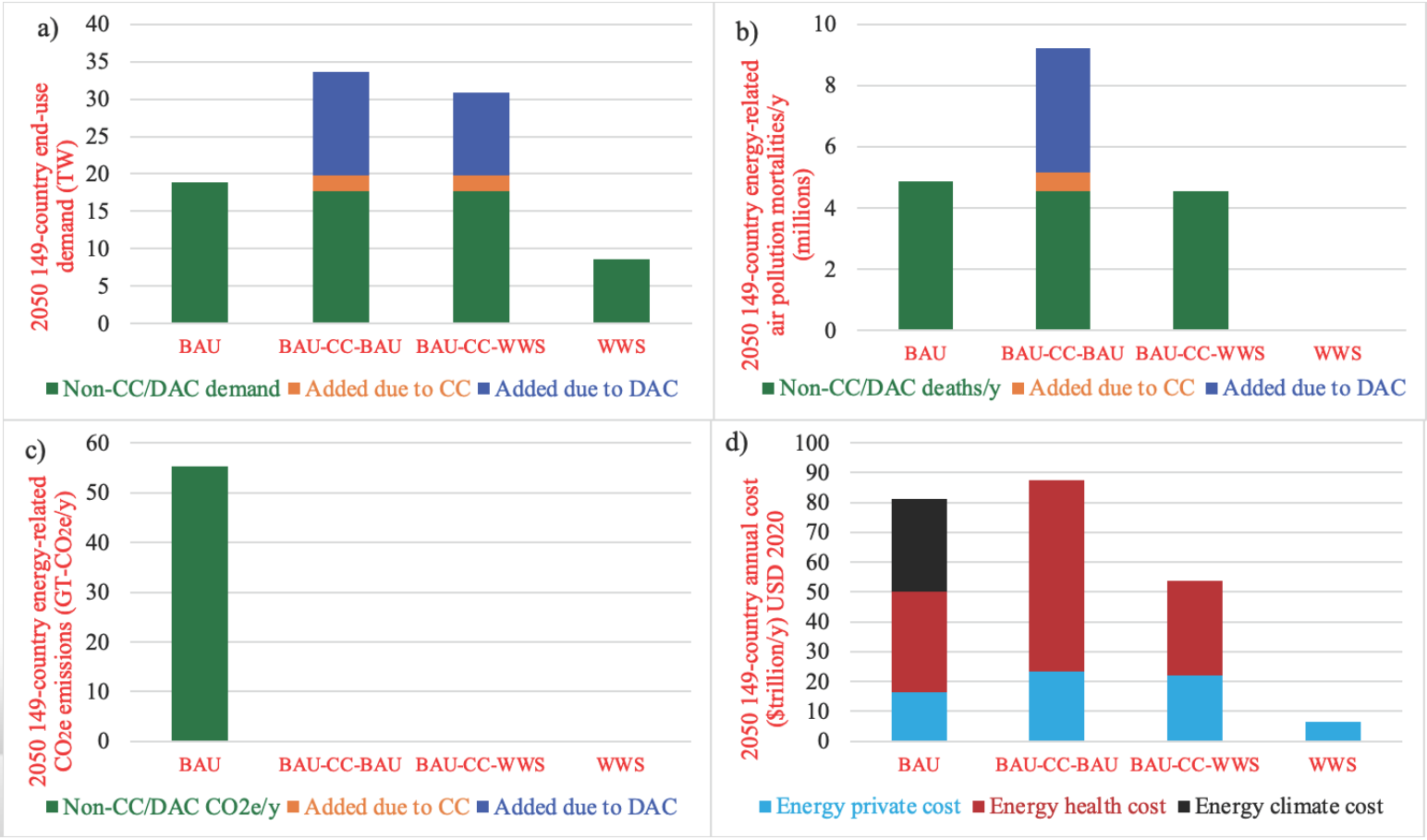
a) Energy Demand; b) Air Pollution Deaths/y; c) CO_2e/y; d) Social Cost Across 149 Countries in 4 Cases. CC/DAC Social Cost 9.1-12.1 x WWS Cost



Case Where 5 Parameters Changed to Strongly Favor CC/DAC. CC/DAC Social Cost Still 8.4-9.7 x That of WWS



Case With All Excess CO_2 Removed by DAC
CC/DAC Social Cost Still 8.1-13.1 x That of WWS



Conclusions on Carbon Capture/Direct Air Capture

Policies promoting CC and DAC increase air pollution, CO_2e emissions, energy needs, private energy costs, and social energy costs 9.1-12.1 times those of policies promoting 100% Wind-Water-Solar (WWS).

Result holds even when parameters chosen to strongly favor CC/DAC

Results hold for any level of carbon removal above zero.

CC and DAC may, in the limit, cause millions of unnecessary air pollution deaths each year worldwide and substantial climate damage in the short and long term.

As such, policies promoting CC and DAC should be abandoned.

Evaluation of Carbon Capture/Direct Air Capture (2025)

https://web.stanford.edu/group/efmh/jacobson/WWSStillNMN/SNMN-WhyNotCCorDAC.pdf

New Paper on Carbon Capture/Direct Air Capture (2025)

https://web.stanford.edu/group/efmh/jacobson/Articles/Others/25-CaliforniaWWS.pdf

How Green is Blue Hydrogen? (2021)

https://web.stanford.edu/group/efmh/jacobson/Articles/Others/21-GreenVsBlueH2.pdf

Health and Climate Effects of Carbon Capture and Direct Air Capture (2019)

https://web.stanford.edu/group/efmh/jacobson/Articles/Others/19-CCS-DAC.pdf

Book on all these issues "No Miracles Needed"

https://web.stanford.edu/group/efmh/jacobson/WWSNoMN/NoMiracles.html