Cost and Performance Baseline for Fossil Energy Plants – Volume 1: Bituminous Coal and Natural Gas to Electricity: *May 2025*

NATIONAL ENERGY TECHNOLOGY LABORATORY

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Agenda

- Baseline: Purpose
- Major Updates
- Case Studies
- PC Cost and LCOE Comparison
- NGCC Cost and LCOE Comparison
- Summary of Results: 2022 to 2025
- Tableau Dashboard

Baseline Report: Purpose

- Detailed cost and performance of fossil generation technologies/CCS which can be used by others for comparison purposes.
- Aim is to provide a document which provide transparent methodology, cost, performance, and all assumptions for public use.
- This report is applicable only for Greenfield plants, example site location 'Midwest'.
- The cost and performance of the Turbines, HRSG, Carbon Capture system are obtained from vendors, and EPC provided the BOP and O&M information.
- Sensitivity analysis of different parameters on the Levelized Cost of Electricity (LCOE) is an important aspect of the report.
- There are other NETL reports/tools which focus on retrofits and site-specific sensitivities.

Major Updates

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❖ Updates to the 2022 study:

- Updated the year-dollar basis from December 2018 to January 2023.
- Updated natural gas combined cycle cost and performance (F-Class and H-Class).
- Added a new set of 1x1 H-Class cases.
- Pulverized coal (PC) cases received a year-dollar update only—scaled using cost indices and PC did not receive a performance update.
- The CO_2 capture system from the older study was retained, updated for year-dollar only.
- Integrated gasification combined cycle (IGCC) has been removed from the Baseline.
- Five Quality Guidelines for Energy Systems Studies (QGESS) reports were updated.
- Individual transport and storage costs were determined for each case based on the average annual CO_2 injected from each plant.
- In this version, the cost of electricity (COE) is reported on a nominal (aka current dollar) basis instead of real (aka constant dollar) basis.

Case Studies

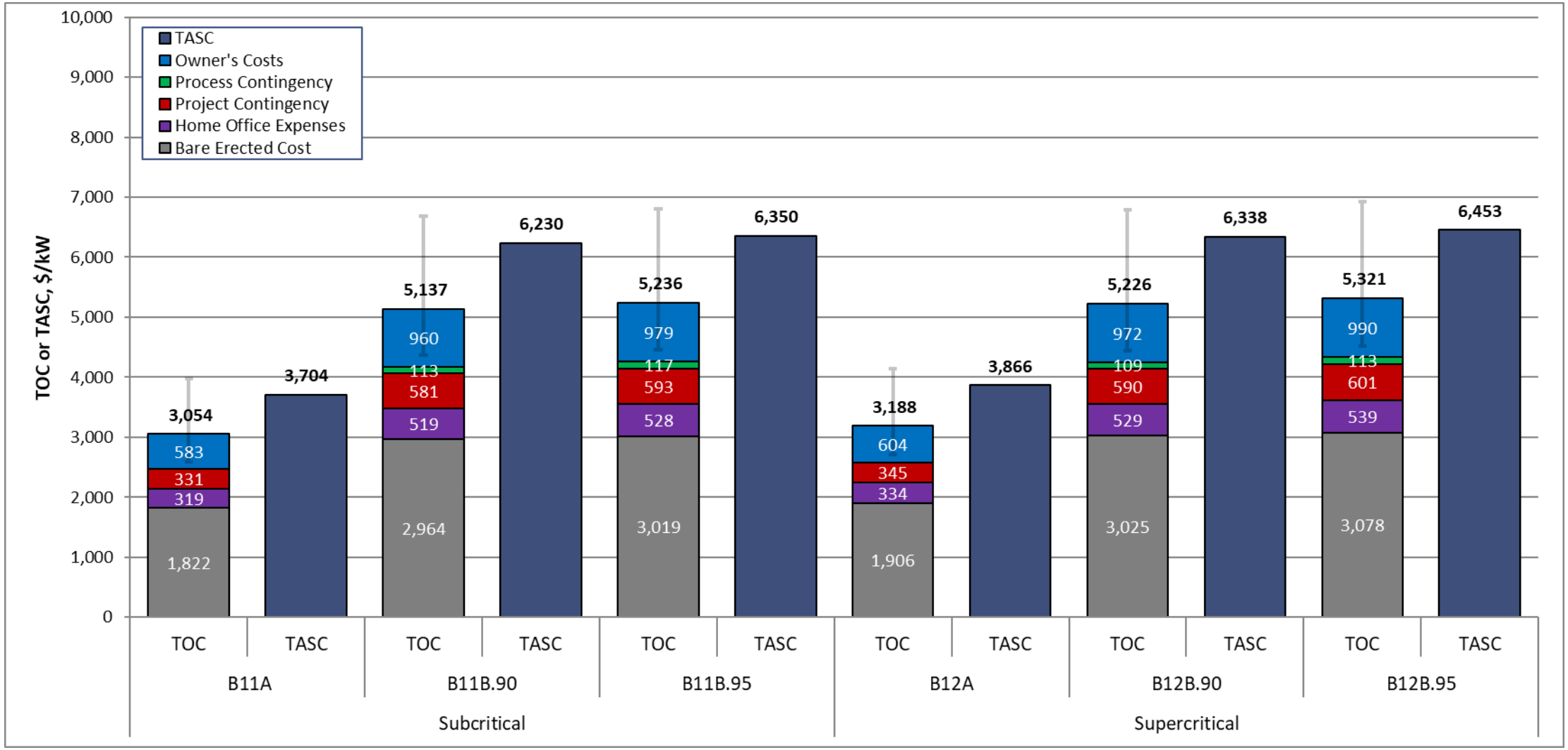
- Site characteristics, ambient conditions, fuel characteristics, and regulated emission limits are unchanged from last update.

Case	Plant Type	Steam Cycle, psig/°F/°F	Combustion Turbine	Gasifier/Boiler Technology	H_2S Separation	Sulfur Removal	Particulate Matter Control	CO_2 Separation	Capture Rate	Process Water Treatment
B11A	PC	2400/1050/1050	N/A	Subcritical PC	N/A	Wet Flue Gas Desulfurization/Gypsum	Baghouse	N/A	N/A	Spray dryer evaporator
B11B.90								CANSOLV	90%	
B11B.95									95%	
B12A		3500/1100/1100		Supercritical PC				N/A	N/A	
B12B.90								CANSOLV	90%	
B12B.95									95%	
B31A	NGCC	2494/1085/1085	2 x State-of-the-art 2023 F-Class	HRSG	N/A	N/A	N/A	N/A	N/A	N/A
B31B.90								CANSOLV	90%	
B31B.95									95%	
B32A.1		2501/1085/1085 *New case compared to 2022*	1 x State-of-the-art 2023 H-Class					N/A	N/A	
B32B.1.90								CANSOLV	90%	
B32B.1.95									95%	
B32A.2		2494/1085/1085	2 x State-of-the-art 2023 H-Class					N/A	N/A	
B32B.2.90								CANSOLV	90%	
B32B.2.95									95%	

PC Cost Results

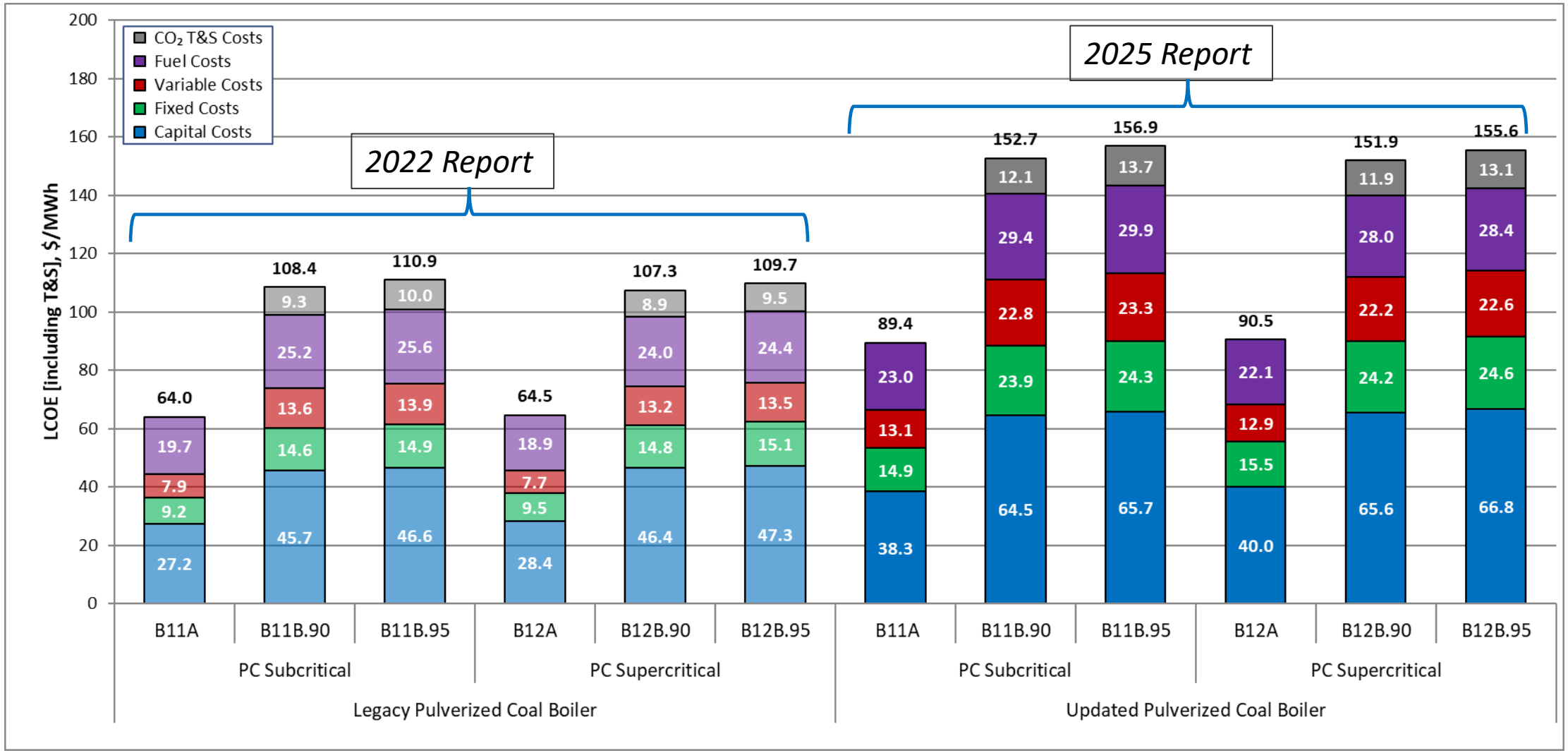
Plant Capital Costs

PC



LCOE Comparison: 2022 to 2025 report

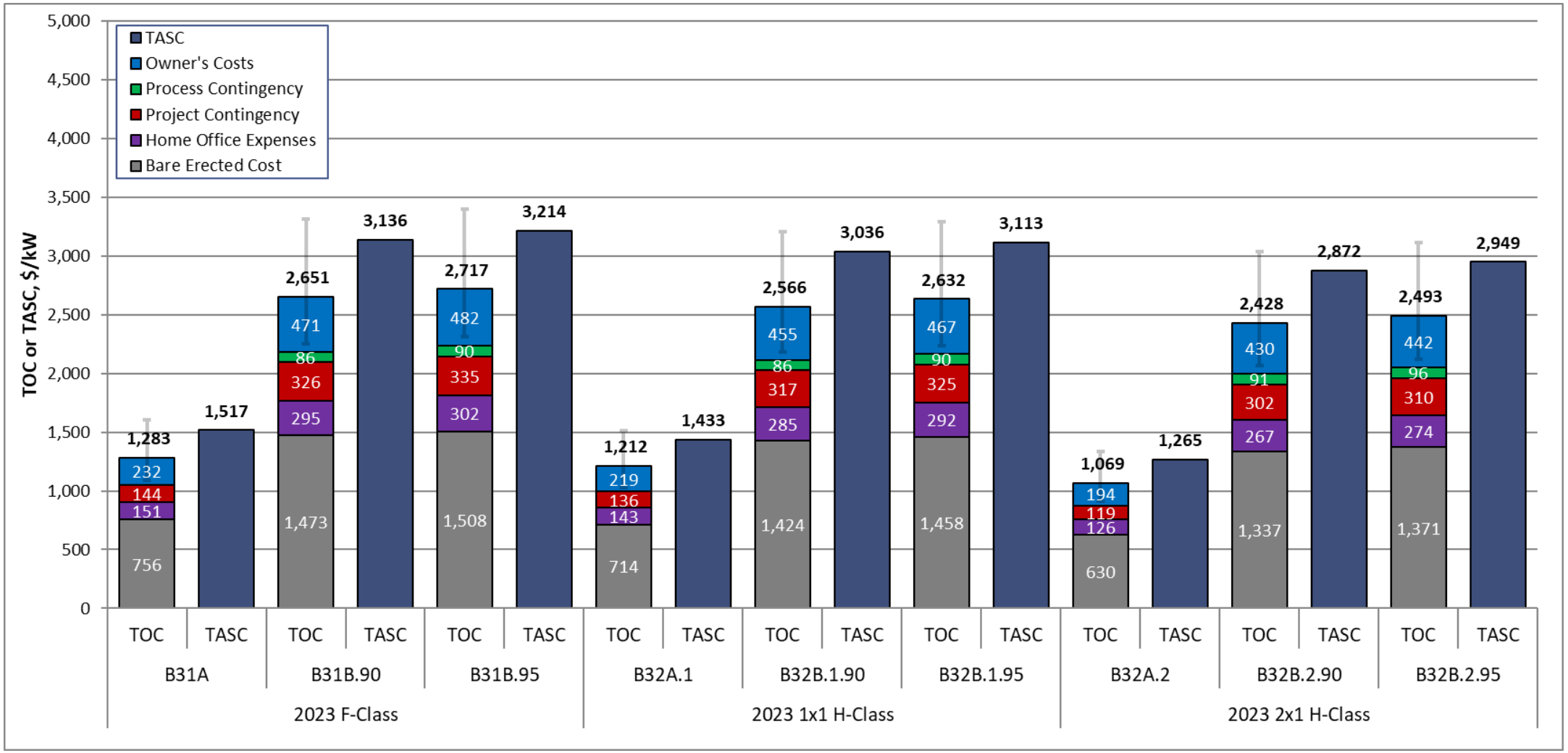
PC



NGCC Cost Results

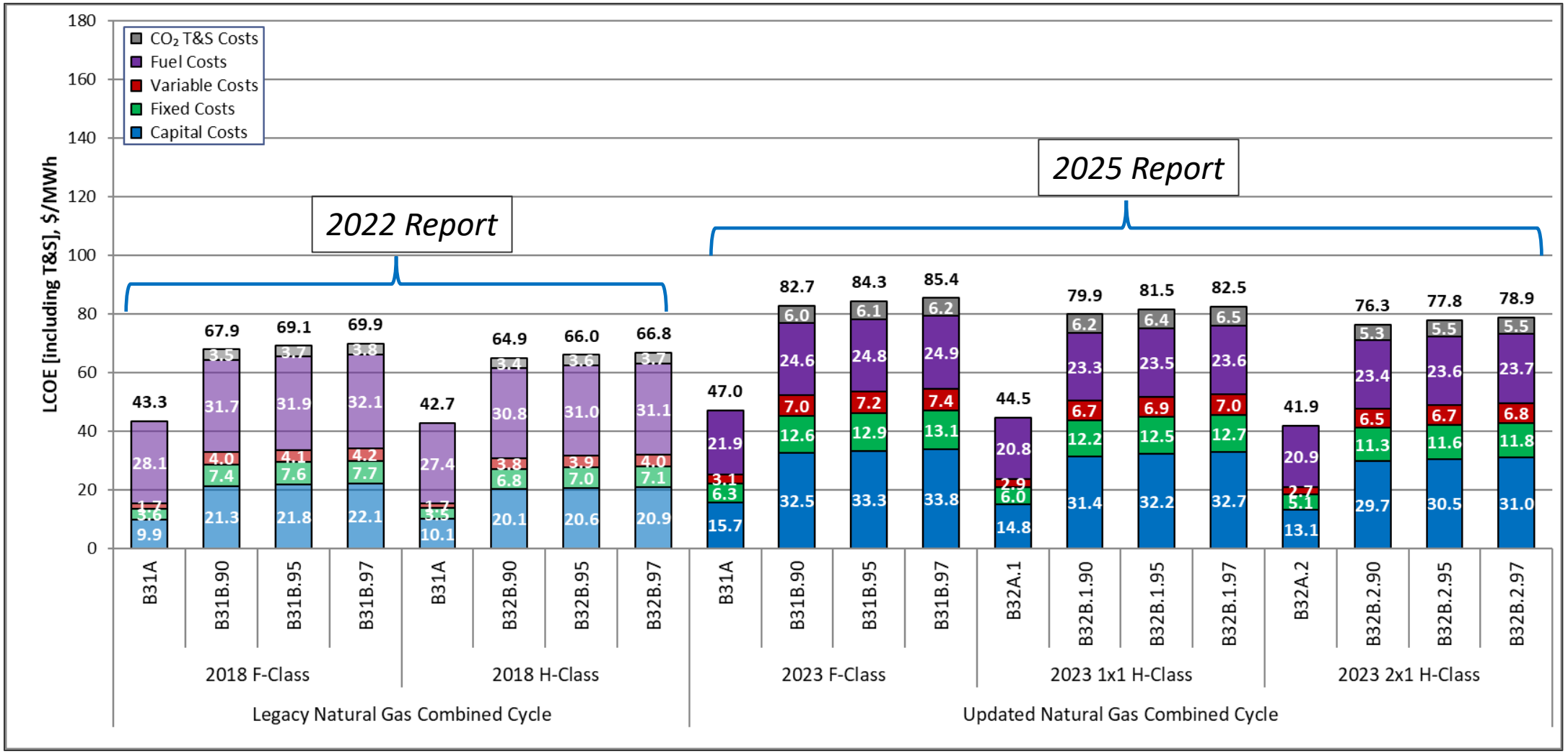
Plant Capital Costs

NGCC



LCOE Comparison: 2022 to 2025 report

NGCC



Summary of Results: 2022 to 2025

Results: 2022 vs 2025

- The 1x1 H-Class case uses a more advanced version of the combustion turbine, with even higher output and efficiency than the version used in the 2x1 H-Class cases. The H-Class 1x1 configuration of the advanced H-Class combustion turbine provides a comparable output to PC and F-Class cases.

- The 2x1 H-Class cases use the same type of combustion turbine as those in the 2022 report but reflects the improved output and efficiency of 2023 commercial offerings.

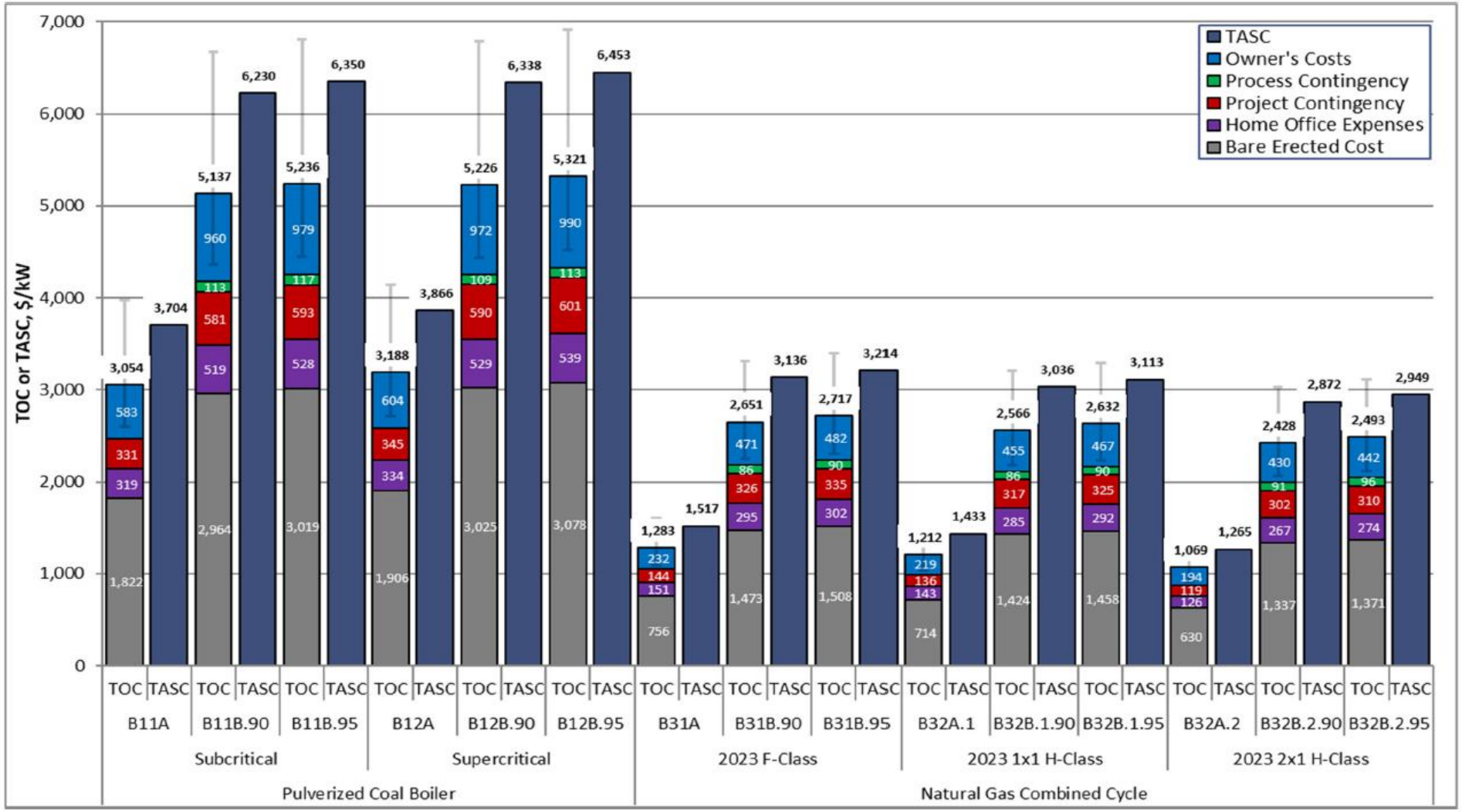
- The 2x1 H-Class cases have a significantly larger flue gas volumetric flow compared to 2X1 F-Class and 1X1 H-Class. A single absorber would not be economical due to the large diameter of the absorber for the 2X1 H-Class case.

- The 2x1 H-Class cases in this report include two parallel CO_2 capture trains, each treating 50 percent of the flue gas, rather than the single 100 percent CO_2 capture train used in version 2022.

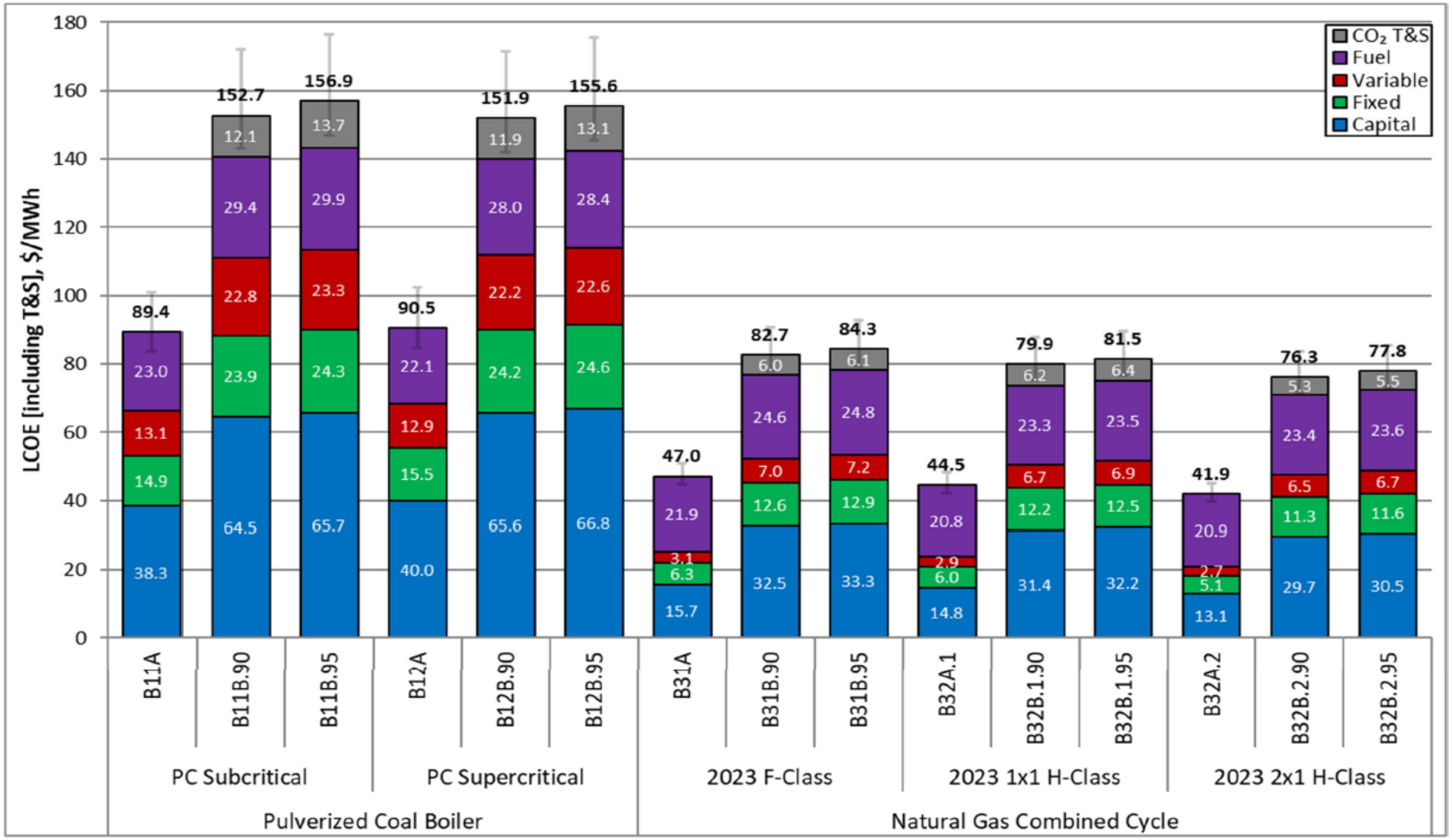
Results: 2022 vs 2025

- The net plant efficiency of the 1x1 H-Class NGCC cases is 1.1–1.2% points higher than the H-Class cases reported in 2022 report.
- For 2x1 H-Class NGCC cases, efficiency improved, and net plant output increased by 114–126 MW.
- The TOC ($/kW), increased by 23% in the PC cases, 29–35% in the F-Class NGCC cases, and 10–26% in the 2x1 H-Class NGCC cases.
  - ❖ For 2x1 H-Class NGCC cases, the TOC ($/kW) of the CO_2 capture cases increased more than the non-capture cases (26% vs 10%) due to the shift from single train capture assumed in 2022 to parallel train capture in 2025 study.
- The LCOE increased by 40–42% in PC cases, 9–22% in F-Class NGCC cases, and -2–18% in 2x1 H-Class NGCC cases.
  - ❖ Although costs increased from 2018 to 2023 dollars due to inflation, the LCOE of the non-capture 2x1 H-Class NGCC case decreased by 5% relative to 2022 study due to the reduced levelized fuel price ($3.42/MMBtu versus $4.42/MMBtu), increased net plant output (1,118 MWh versus 992 MWh), and higher net plant efficiency (55.8% vs 55.1%).

Plant Capital Cost Comparison

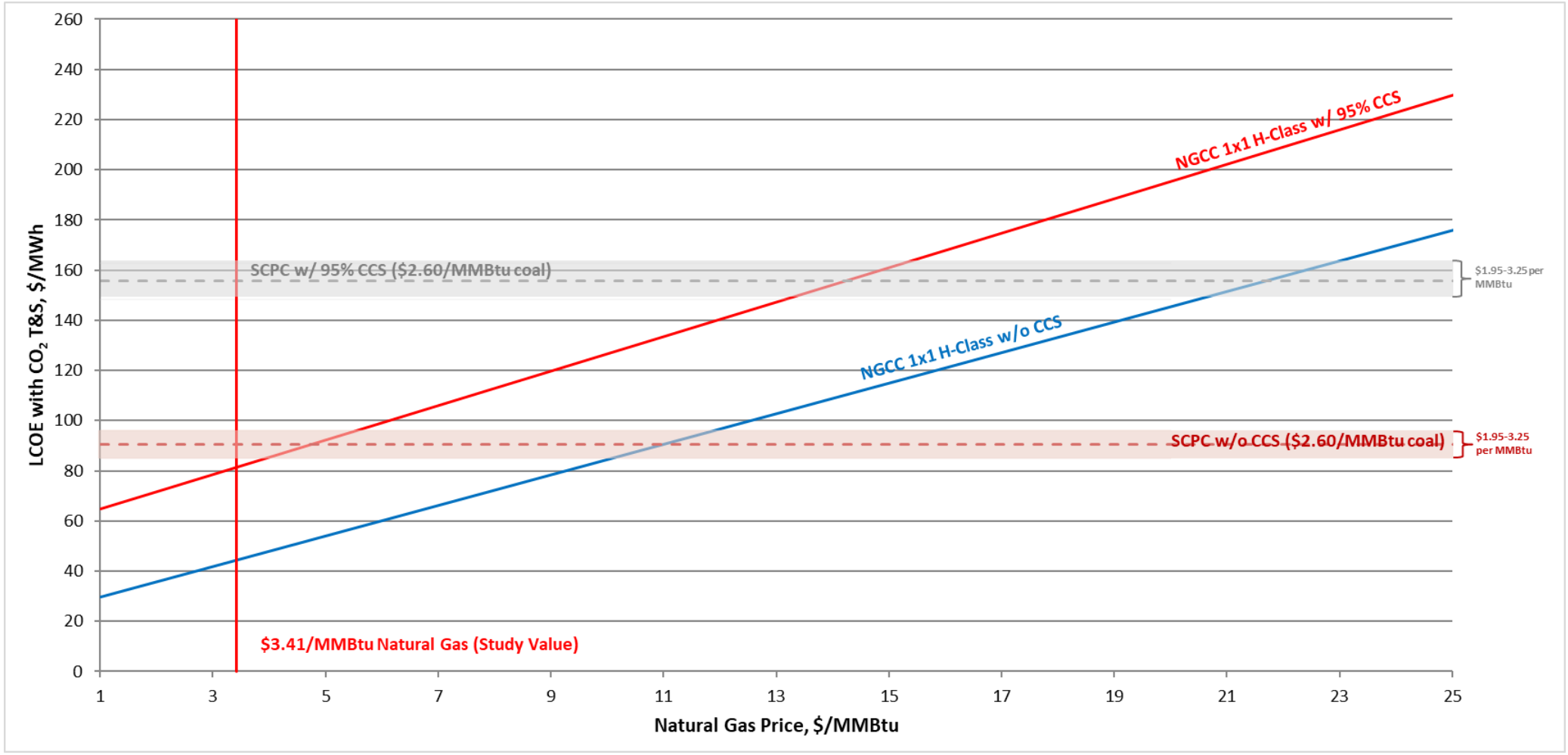


Plant LCOE Comparison



Note: Financing structures are presented in the QGESS report, "Cost Estimation Methodology for NETL Techno-economic Assessments" (NETL, 2025b)

Sensitivity to Natural Gas Price



Baseline Tool

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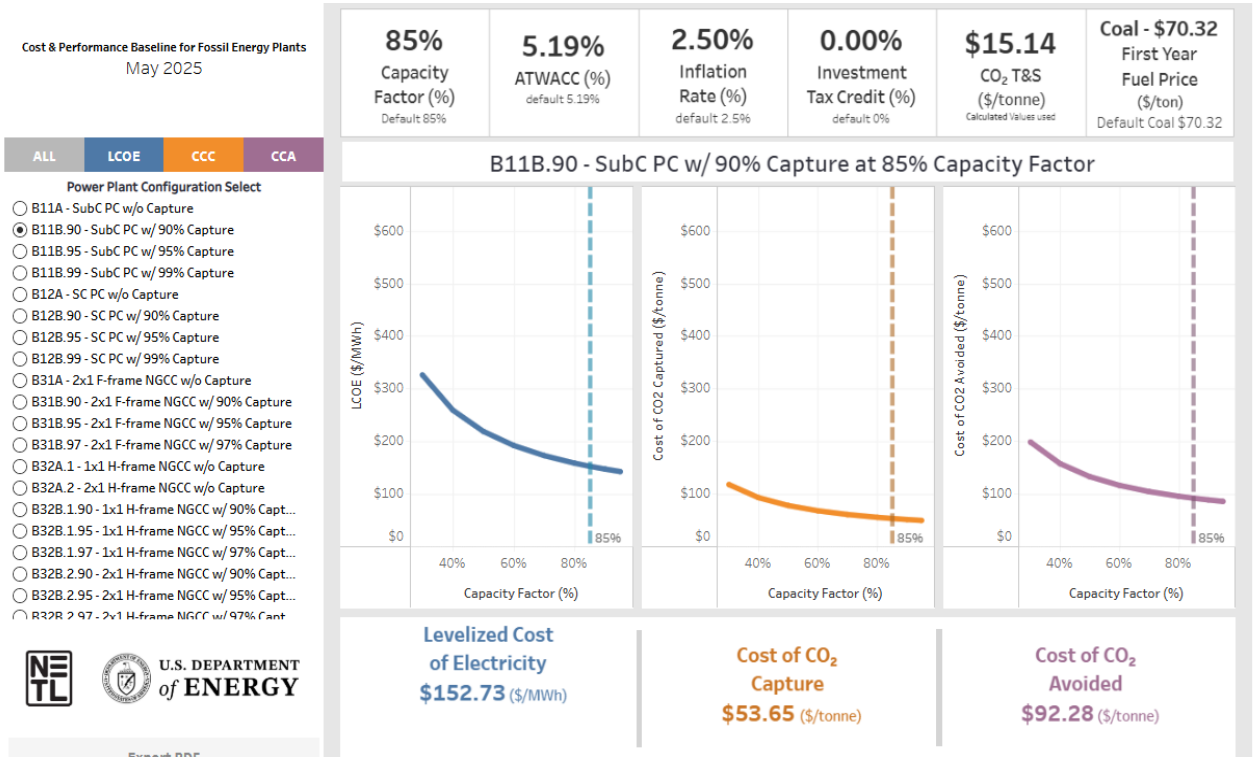
QR Code :

Tableau Dashboard

Baseline Studies Overview | netl.doe.gov

NETL's Cost and Performance Baseline for Fossil Energy Plants | netl.doe.gov

- Parametric analysis
- User can vary six key parameters
- Impact is observed in three key metrics
- User can download data or figures



Reference: *M. Turner, S. Leptinsky, M. Woods, I. Bhattacharya. "Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity." National Energy Technology Laboratory. Pittsburgh, May 21, 2025.*

Questions?

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