NETL's Updated Performance and Cost Estimates for Power Generation Facilities Equipped with Carbon Capture

NATIONAL ENERGY TECHNOLOGY LABORATORY

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2023 USEA Webinar
February 2, 2023

U.S. DEPARTMENT OF ENERGY

Purpose of Study

- Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity – Revision 4a
  - Published October 2022, available at https://www.osti.gov/biblio/1893822
- Generate an independent, public assessment of the cost and performance of select, state-of-the-art, fossil-fueled power-generation systems with and without CO_2 capture using a systematic, transparent, technical and economic approach
  - Primarily used for research and development (R&D) guidance and evaluation
  - Increasingly used directly by various organizations for system modeling efforts
  - Provides state-of-the-art reference data for regulators and policy makers

Limitations of Study Data

- Real projects will have a variety of location-specific factors that affect costs and require more extensive analysis and study (e.g., front-end engineering design (FEED) studies) to reduce uncertainty
  - Recently completed NETL funded FEED studies on CO_2 capture retrofits of natural gas power plants:
    - Bechtel (March 2022), available at https://www.osti.gov/biblio/1836563
    - Southern Company (September 2022), available at https://www.osti.gov/biblio/1890156
- Initial deployments of plants that include technologies that are not yet fully mature may incur costs higher than those reflected within this report (e.g., plants with Carbon Capture)

Overview

- Revision 4a
  - Incorporates recent (2021) post-combustion capture system performance and cost data from Shell CANSOLV
    - Revises 90 percent capture cases for pulverized coal (PC) and natural gas combined cycle (NGCC) plants
    - Adds higher capture rate cases to PC and NGCC plants
  - Adds H-class NGCC cases with and without capture
  - Includes miscellaneous minor updates to the cost and performance models

Study Assumptions

- Design basis is consistent with Revision 4 assumptions, including:
  - Location – Generic Midwest site with International Organization for Standardization (ISO) ambient conditions
  - Applicable air and water regulations
  - 2018-dollar basis
  - Capacity Factors: PC and NGCC – 85%
  - Capital cost estimation methodology,[1] fuel compositions,[2,3] fuel costs,[4] and CO_2 transport and storage (T&S) prices[5]
    - Fuel Costs:
      - Natural Gas – $4.19/GJ ($4.42/MMBtu), on a higher heating value (HHV) basis
      - Illinois No. 6 Coal – $2.11/GJ ($2.23/MMBtu), on an HHV basis
    - T&S Costs – $10 per tonne ($9/ton) of CO_2

[1] NETL, "Quality Guidelines for Energy System Studies (QGESS): Cost Estimation Methodology for NETL Assessments of Power Plant Performance," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1567736
[2] NETL, "QGESS: Detailed Coal Specifications," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1567737
[3] NETL, "QGESS: Specification for Selected Feedstocks," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1557271
[4] NETL, "QGESS: Fuel Prices for Selected Feedstocks in NETL Studies," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1557270
[5] NETL, "QGESS: Carbon Dioxide Transport and Storage Costs in NETL Studies," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1567735

Cost Estimation Methodology[1]

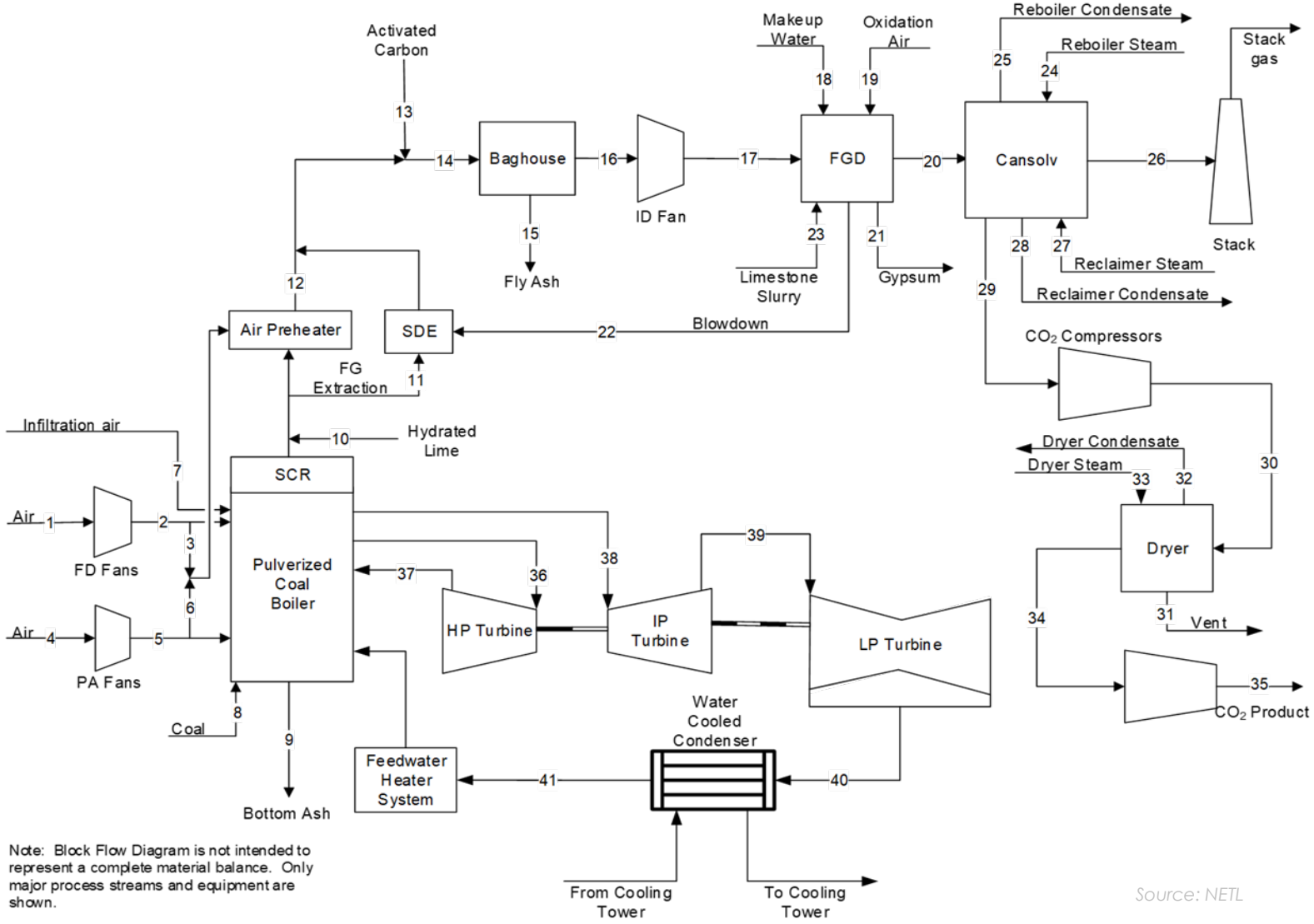
- Vendor-provided cost data for Shell's CANSOLV CO_2 capture system was adjusted for year dollar basis and scaled on capacity
- Vendor-provided cost data for H-class NGCC cases were adjusted for year dollar basis and consistency with F-class cost estimating methodology
- Balance of plant capital cost estimates for Revision 4a were scaled from those in the 2019 Revision 4 report using the methodology established in the relevant NETL QGESS[2] documents
- American Association of Cost Engineers (AACE) Class 4 estimate with an uncertainty range of -15/+30% for PC cases and -15/+25% for NGCC cases

[1] NETL, "QGESS: Cost Estimation Methodology for NETL Assessments of Power Plant Performance," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1567736
[2] NETL, "QGESS: Capital Cost Scaling Methodology," U.S. Department of Energy, Pittsburgh, PA, 2019. https://www.osti.gov/biblio/1893821

PC and NGCC Case Configuration Summary

Case	Plant Type	Steam Cycle, psig/°F/°F	Combustion Turbine	Gasifier/Boiler Technology	Sulfur Removal	Particulate Matter Control	CO_2 Separation	Capture Rate	Process Water Treatment
B11A	PC	2400/1050/1050	N/A	Subcritical (SubC) PC	Wet Flue Gas Desulfurization/ Gypsum	Baghouse	N/A	N/A	Spray Dryer Evaporator
B11B.90							CANSOLV	90%	
B11B.95								95%	
B11B.99								99%	
B12A		3500/1100/1100		Supercritical (SC) PC			N/A	N/A	
B12B.90							CANSOLV	90%	
B12B.95								95%	
B12B.99								99%	
B31A	NGCC	2378/1085/1084	2 x State-of-the-art 2017 F-Class	HRSG	N/A	N/A	N/A	N/A	N/A
B31B.90							CANSOLV	90%	
B31B.95								95%	
B31B.97								97%	
B32A		2668/1085/1044	2 x State-of-the-art 2017 H-Class				N/A	N/A	
B32B.90							CANSOLV	90%	
B32B.95								95%	
B32B.97								97%	

Block Flow Diagram – PC with CO_2 Capture

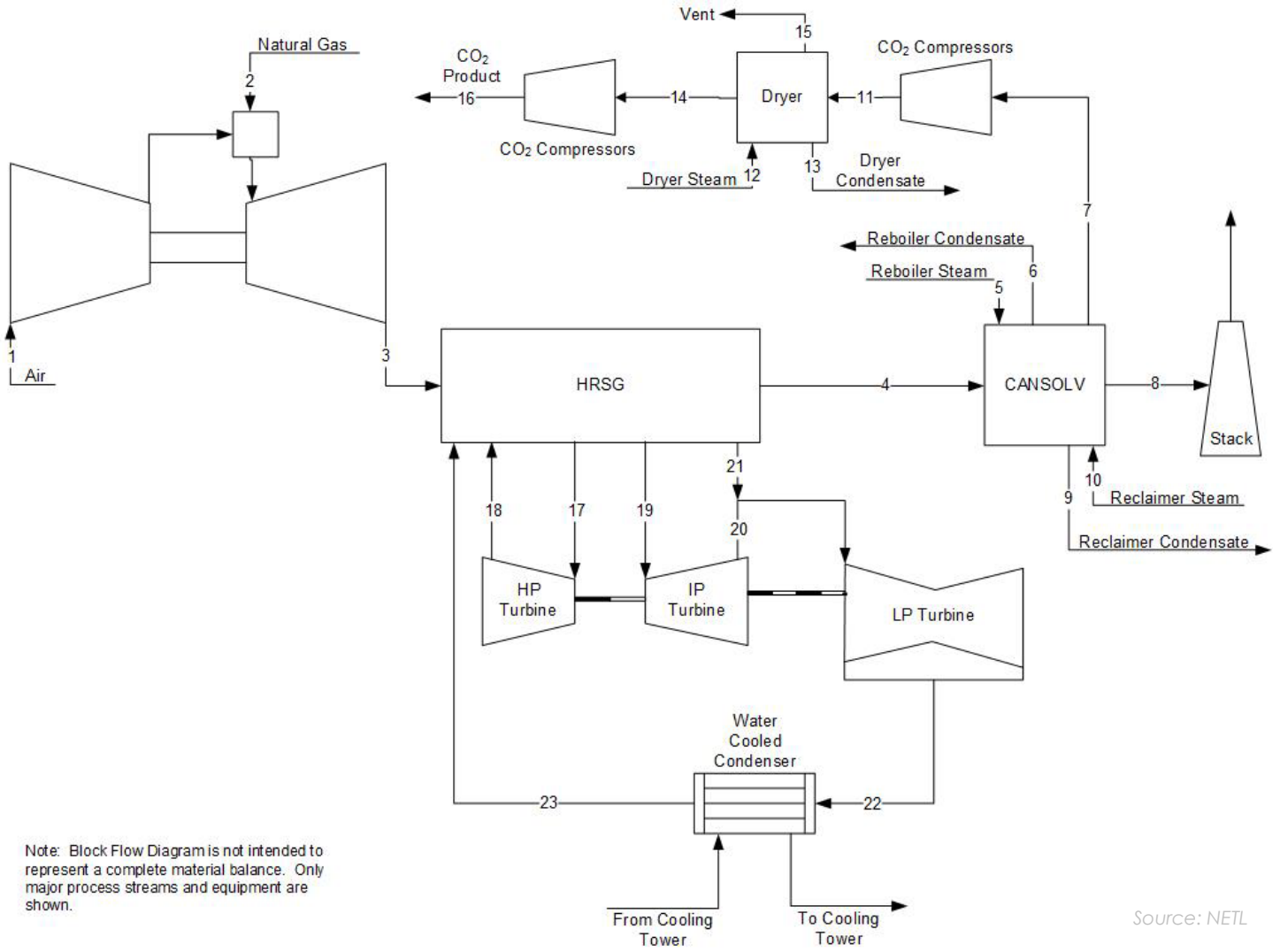


Note: Block Flow Diagram is not intended to represent a complete material balance. Only major process streams and equipment are shown.

Source: NETL

ID = induced draft
FGD = flue gas desulfurization
SDE = spray dryer evaporator
FG = flue gas
SCR = selective catalytic reduction
FD = forced draft
PA = primary air
HP = high pressure
IP = intermediate pressure
LP = low pressure

Block Flow Diagram – NGCC with CO_2 Capture

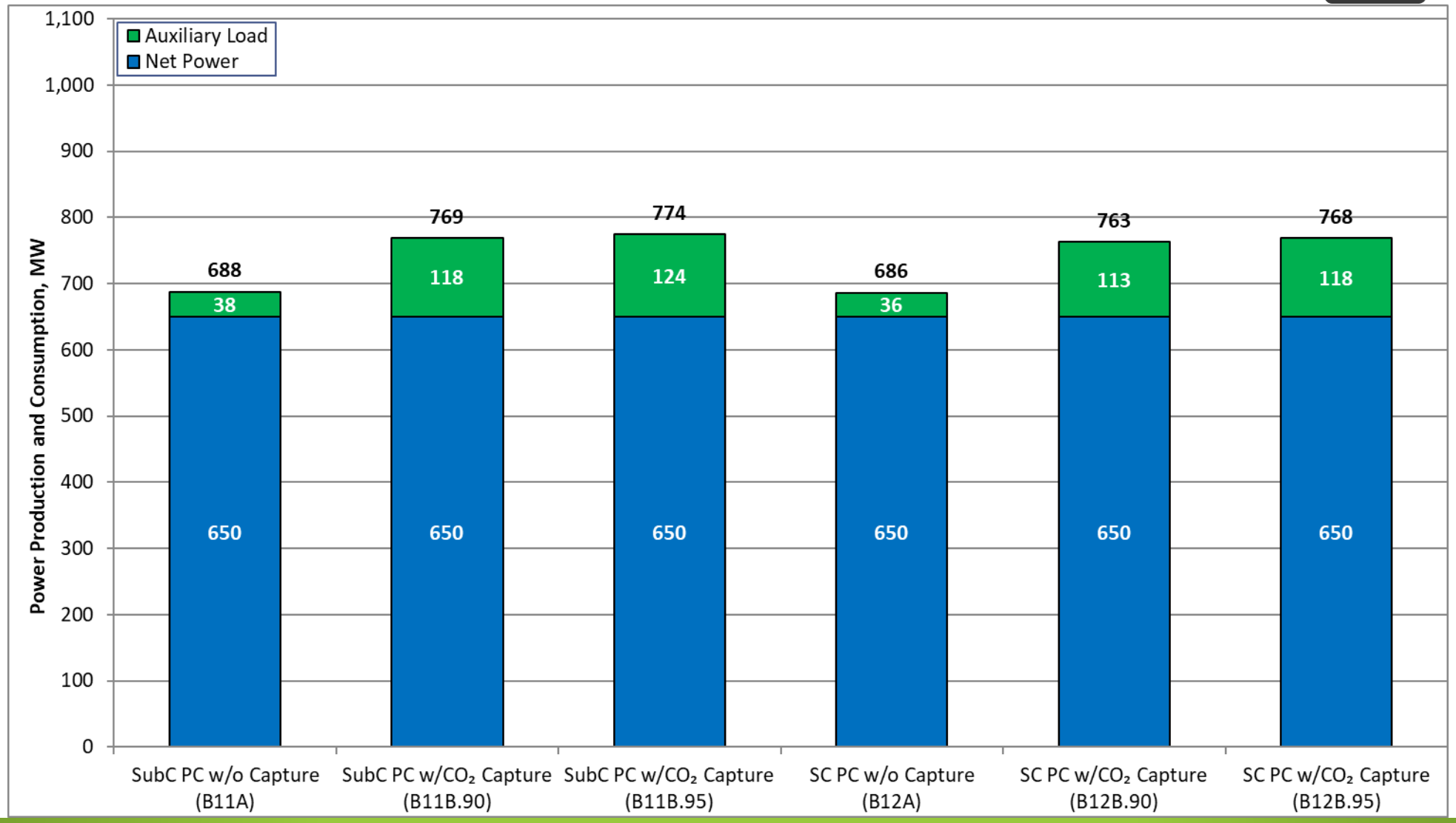


Note: Block Flow Diagram is not intended to represent a complete material balance. Only major process streams and equipment are shown.

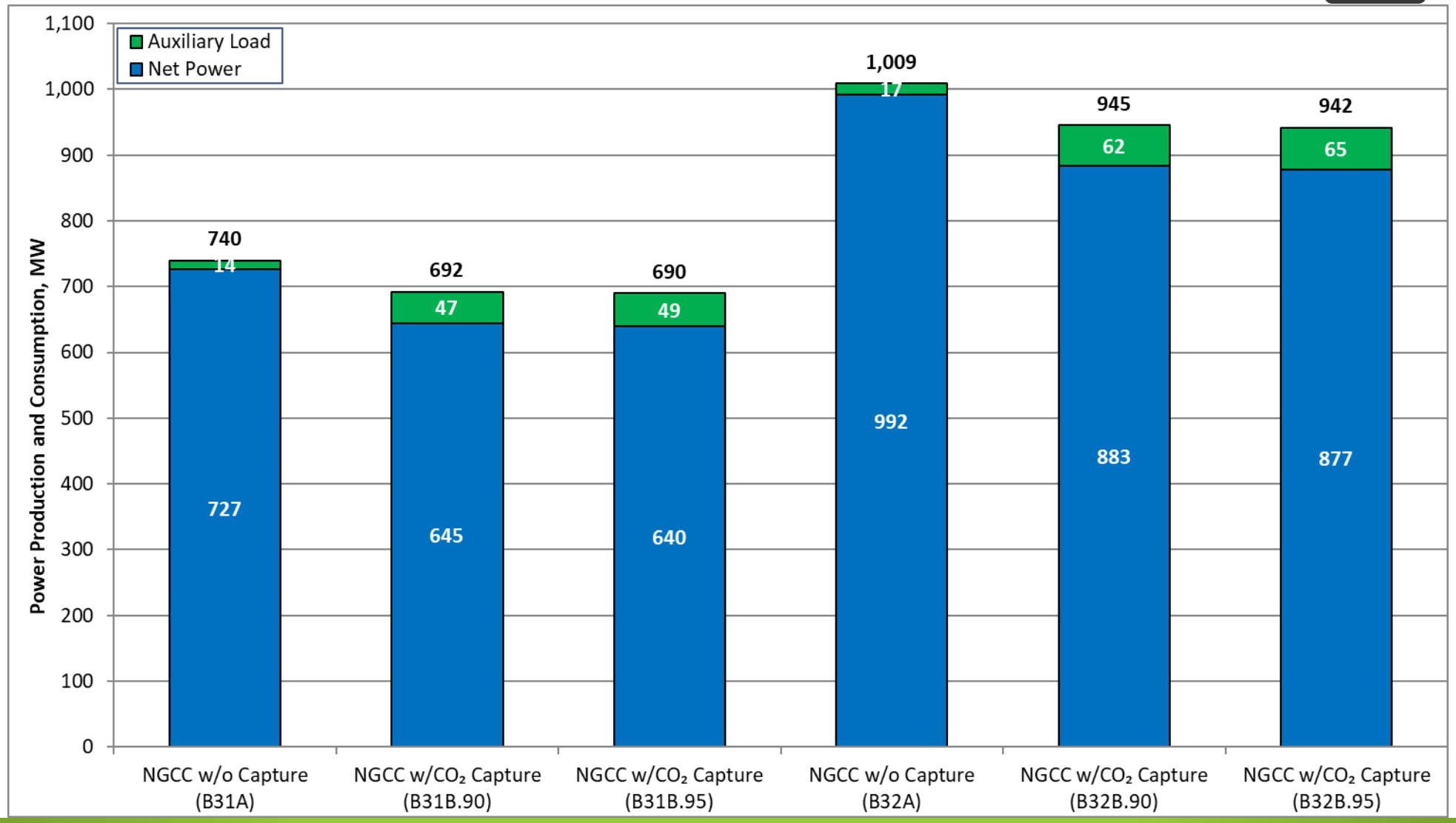
Source: NETL

HRSG = heat recovery steam generator

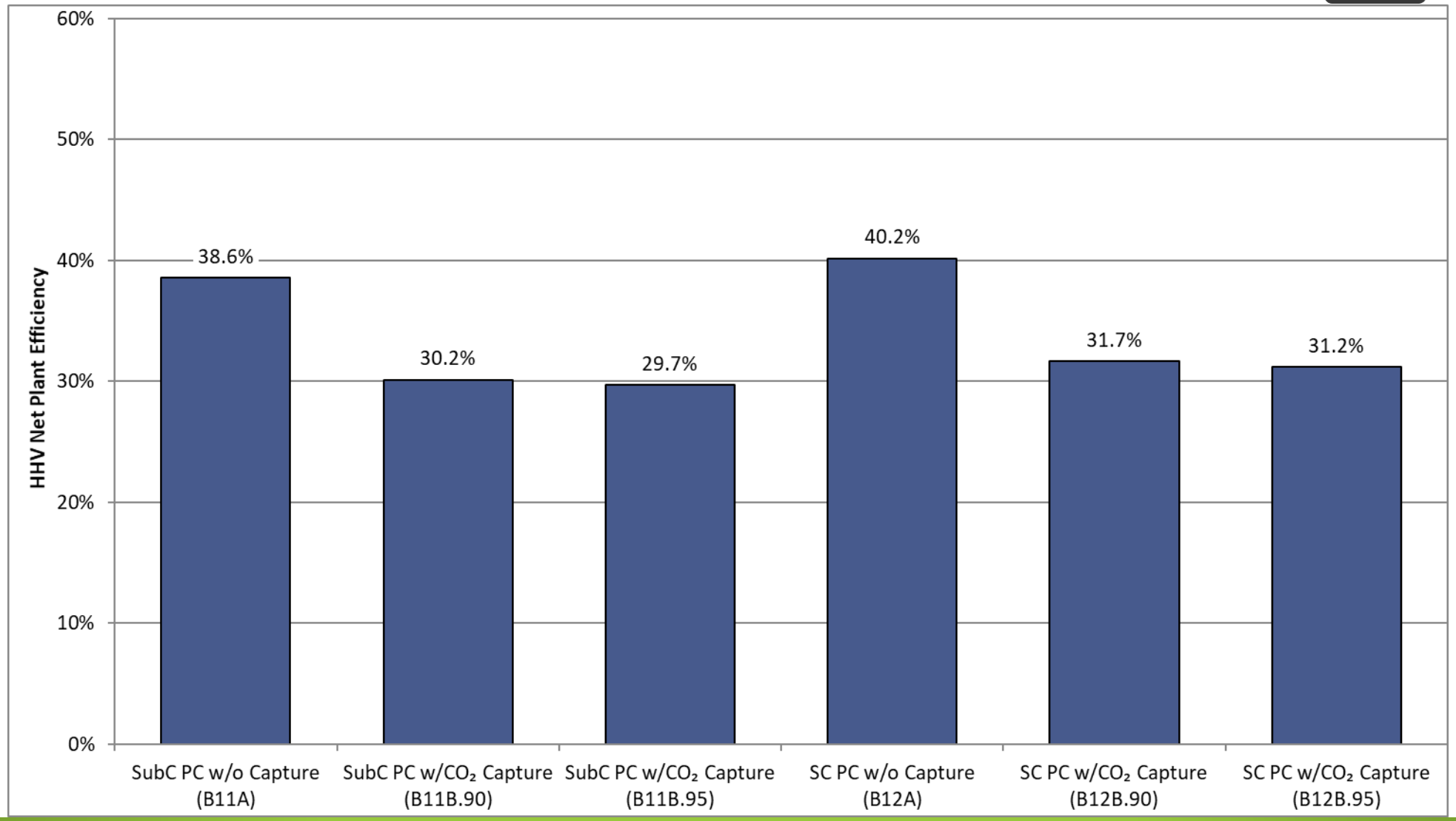
PC Power Summary



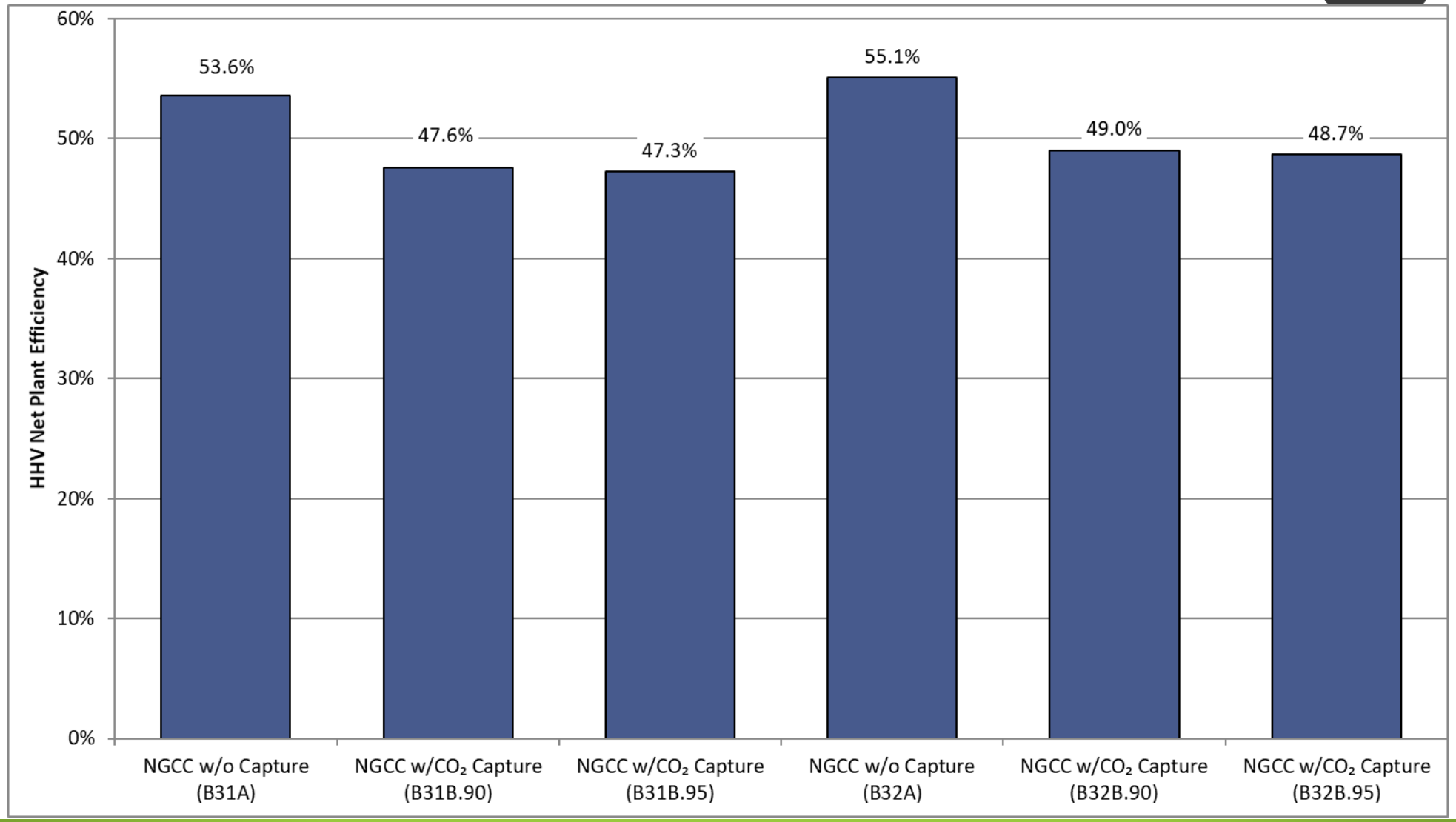
NGCC Power Summary



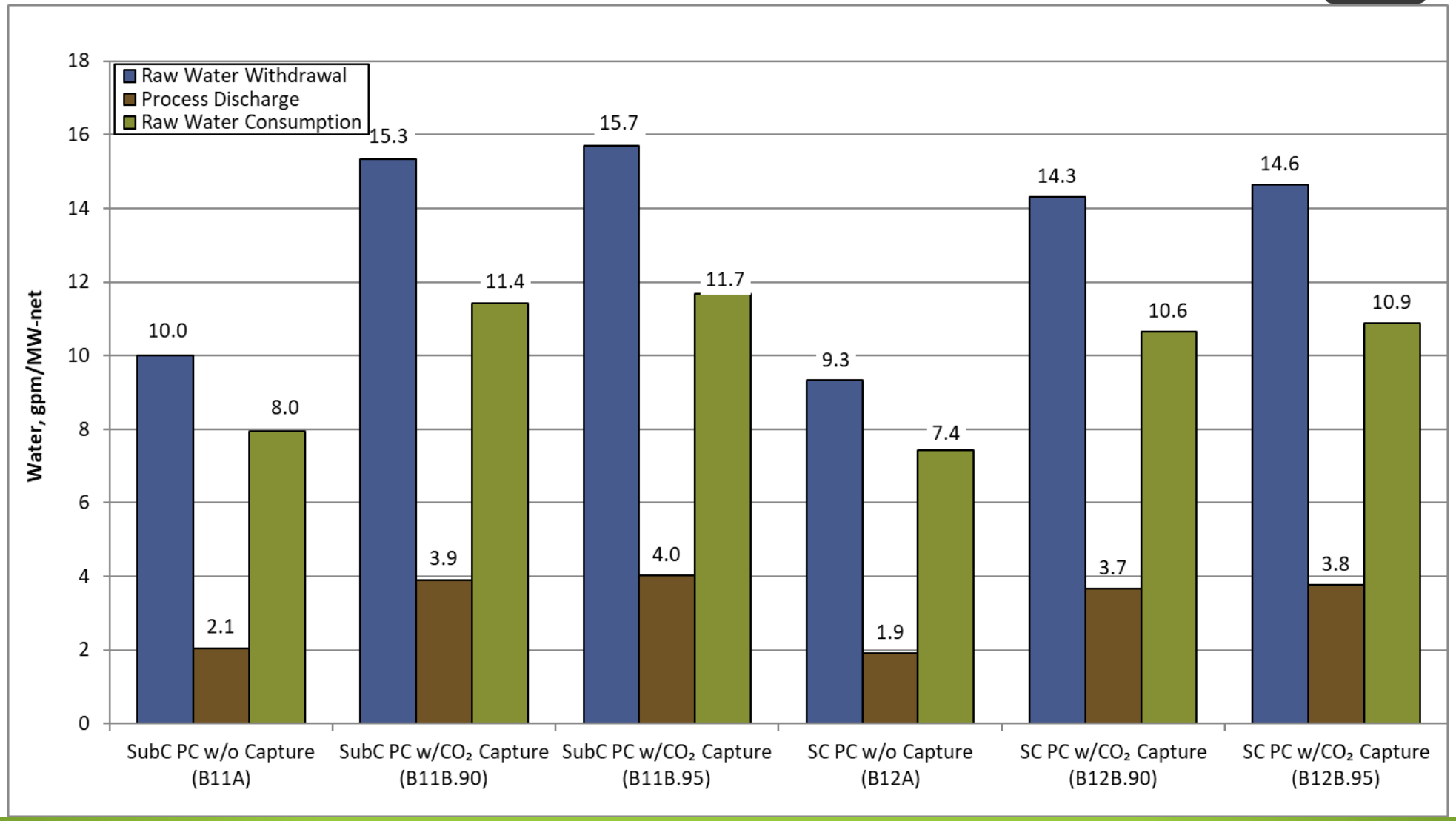
PC Net Plant Efficiency Summary



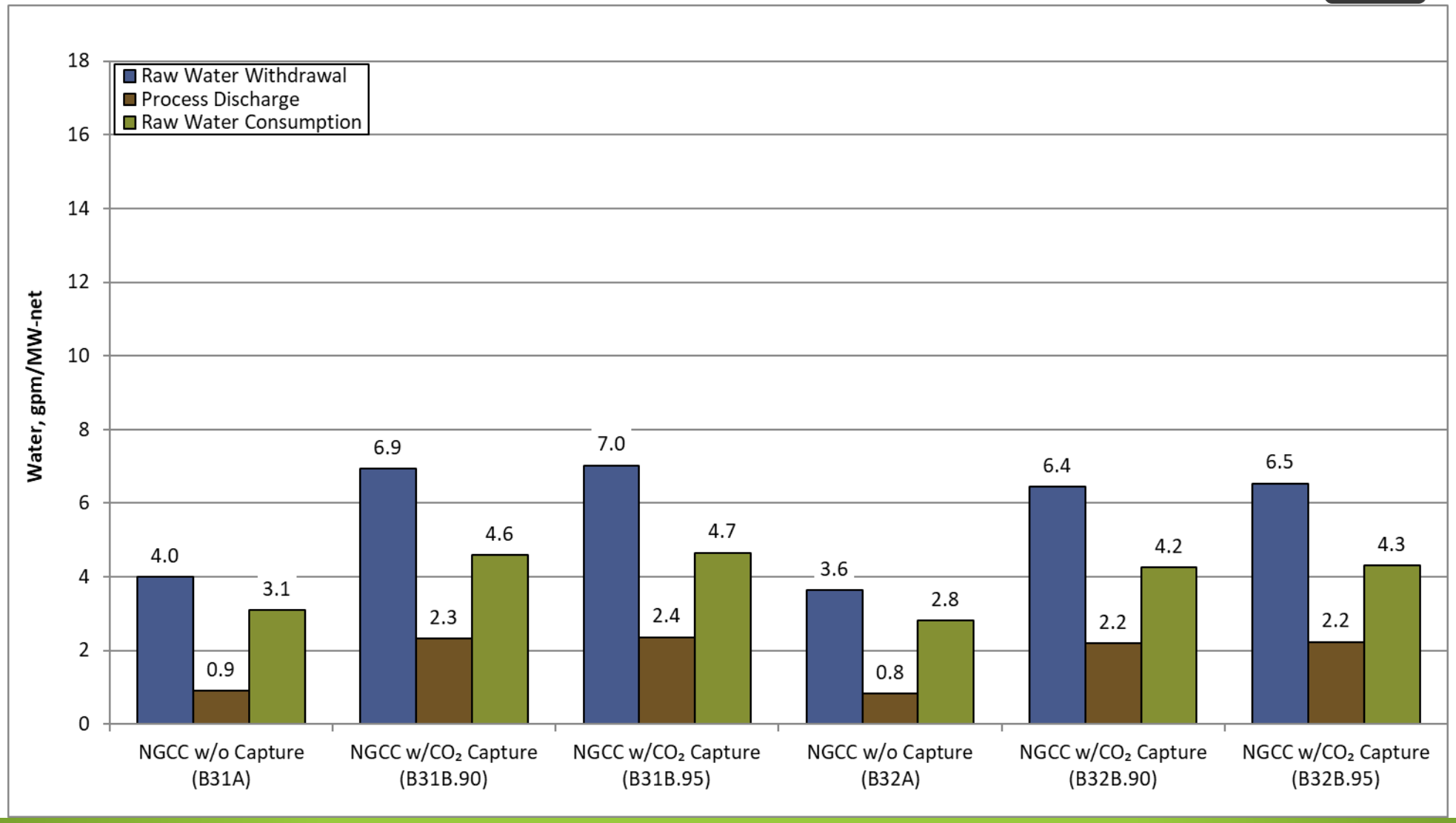
NGCC Net Plant Efficiency Summary



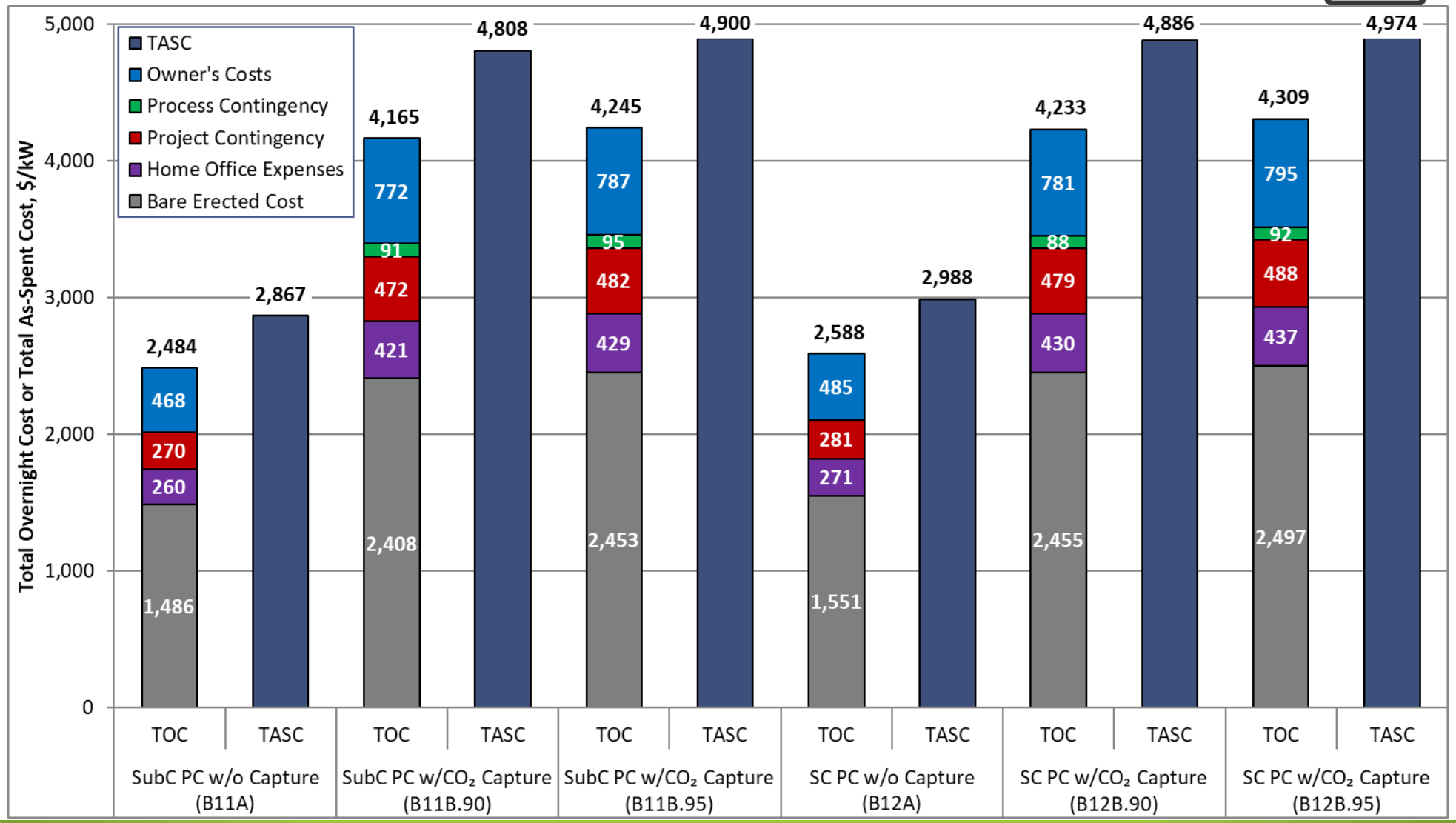
PC Water Summary



NGCC Water Summary

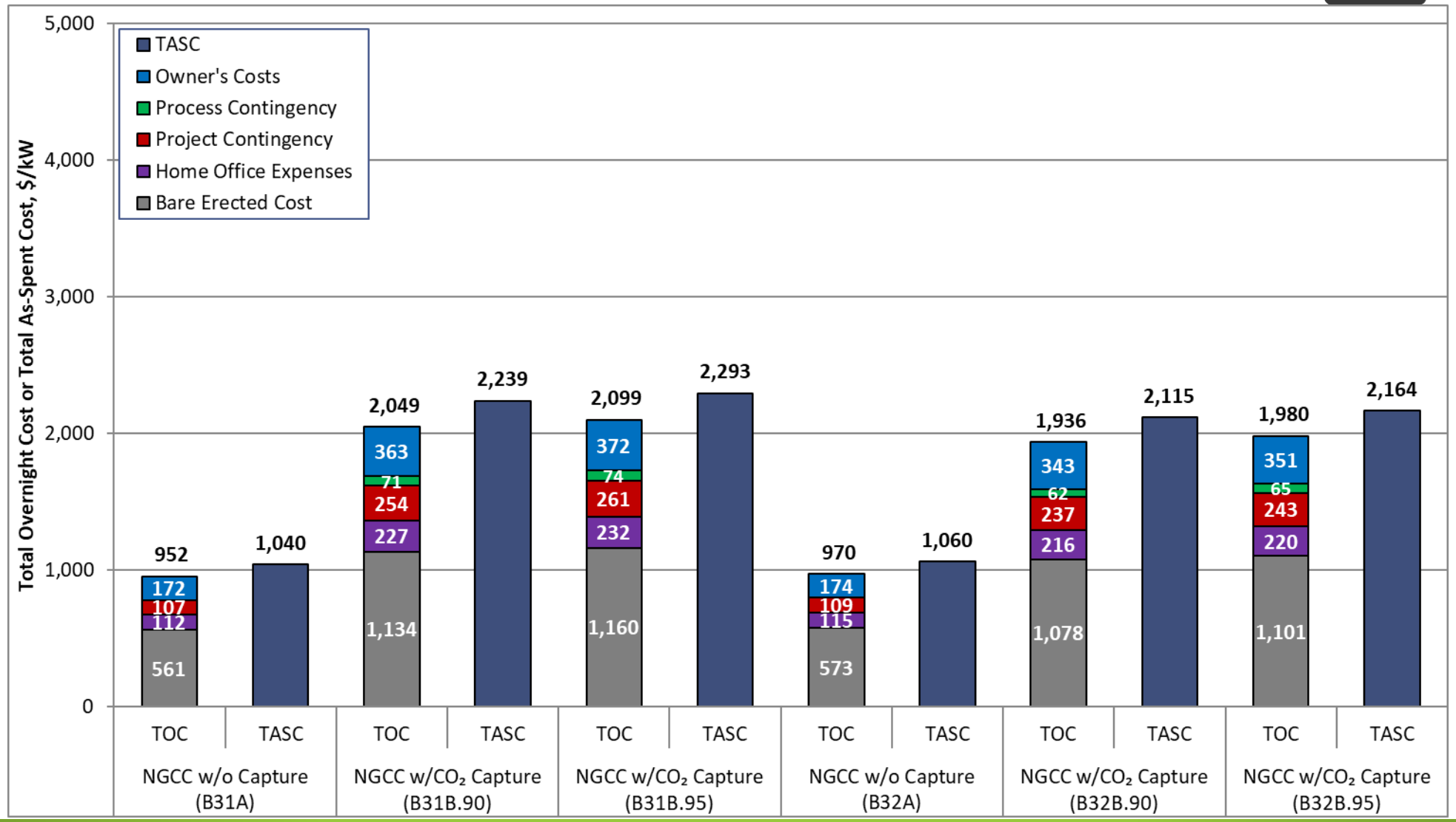


PC Capital Cost Summary

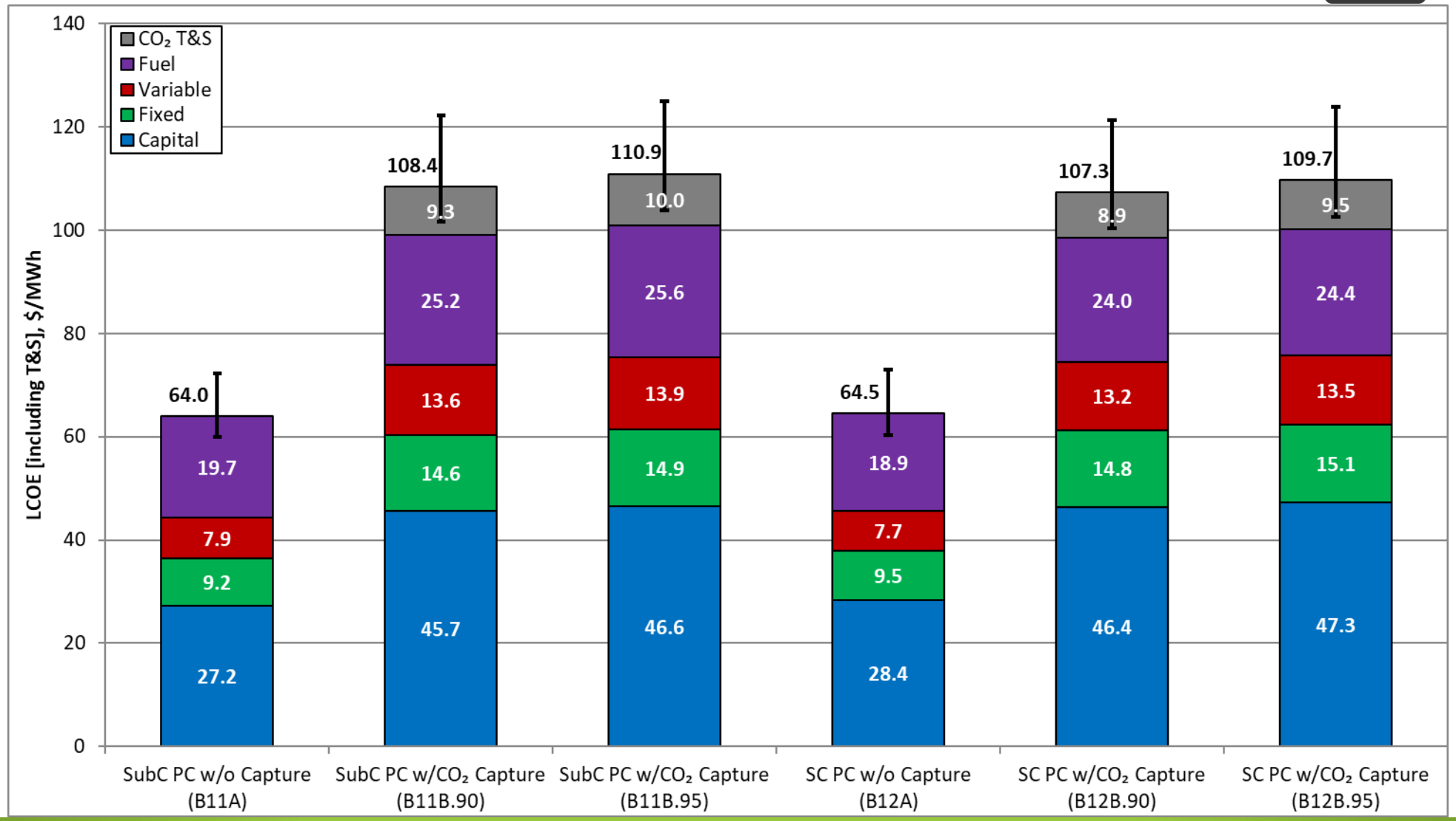


TOC = total overnight costs
TASC = total as-spent costs

NGCC Capital Cost Summary

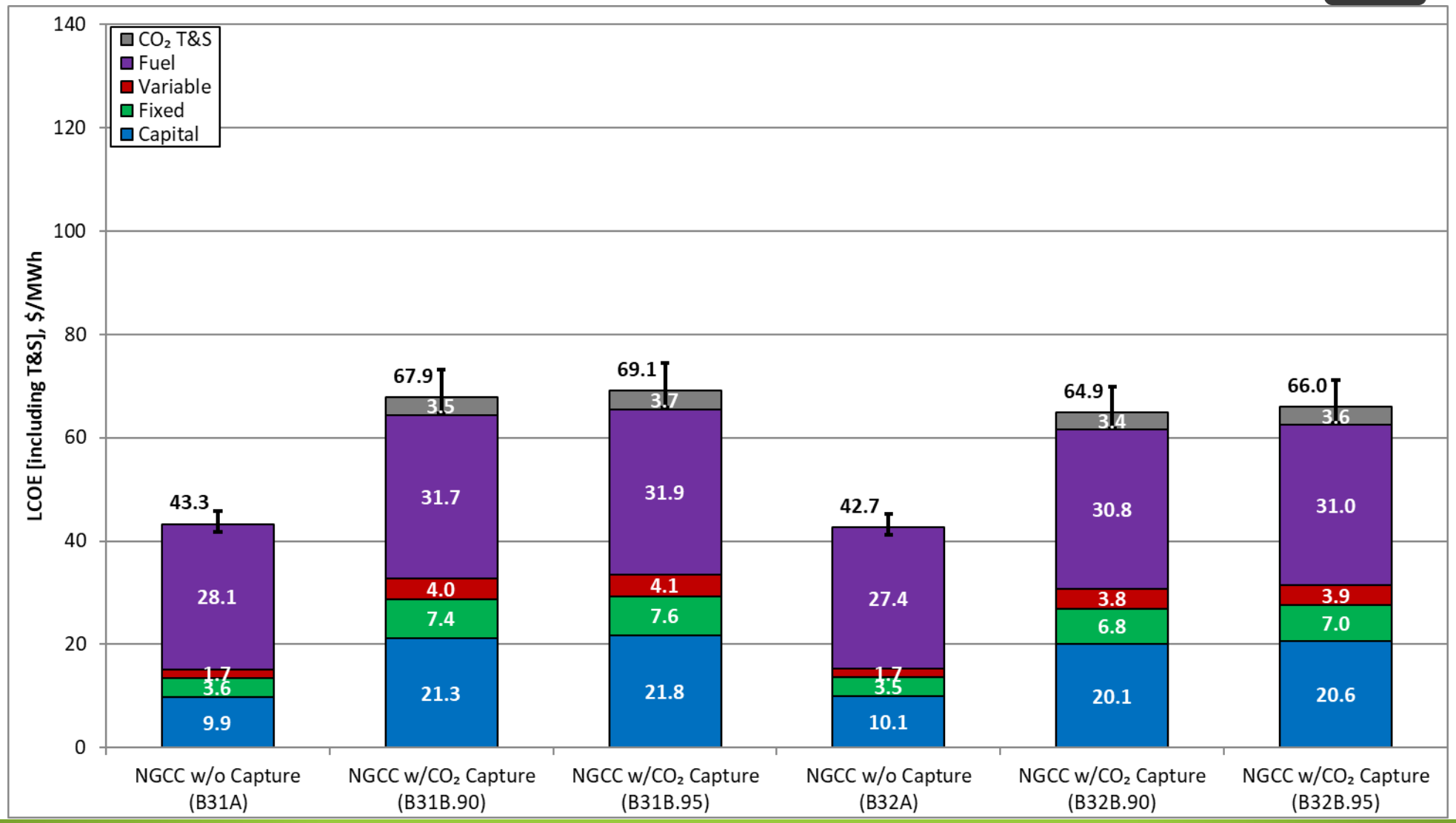


PC LCOE Summary

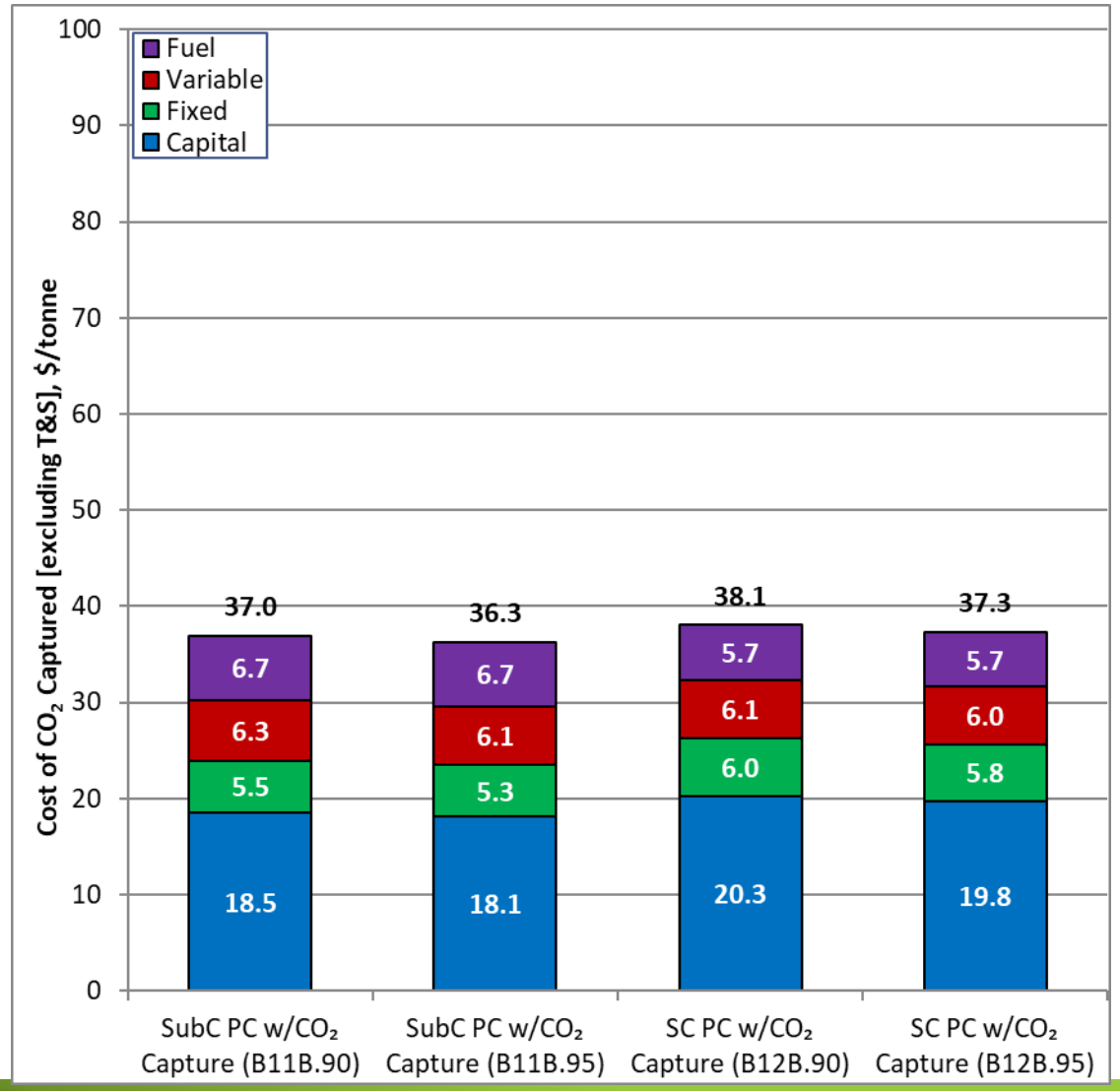


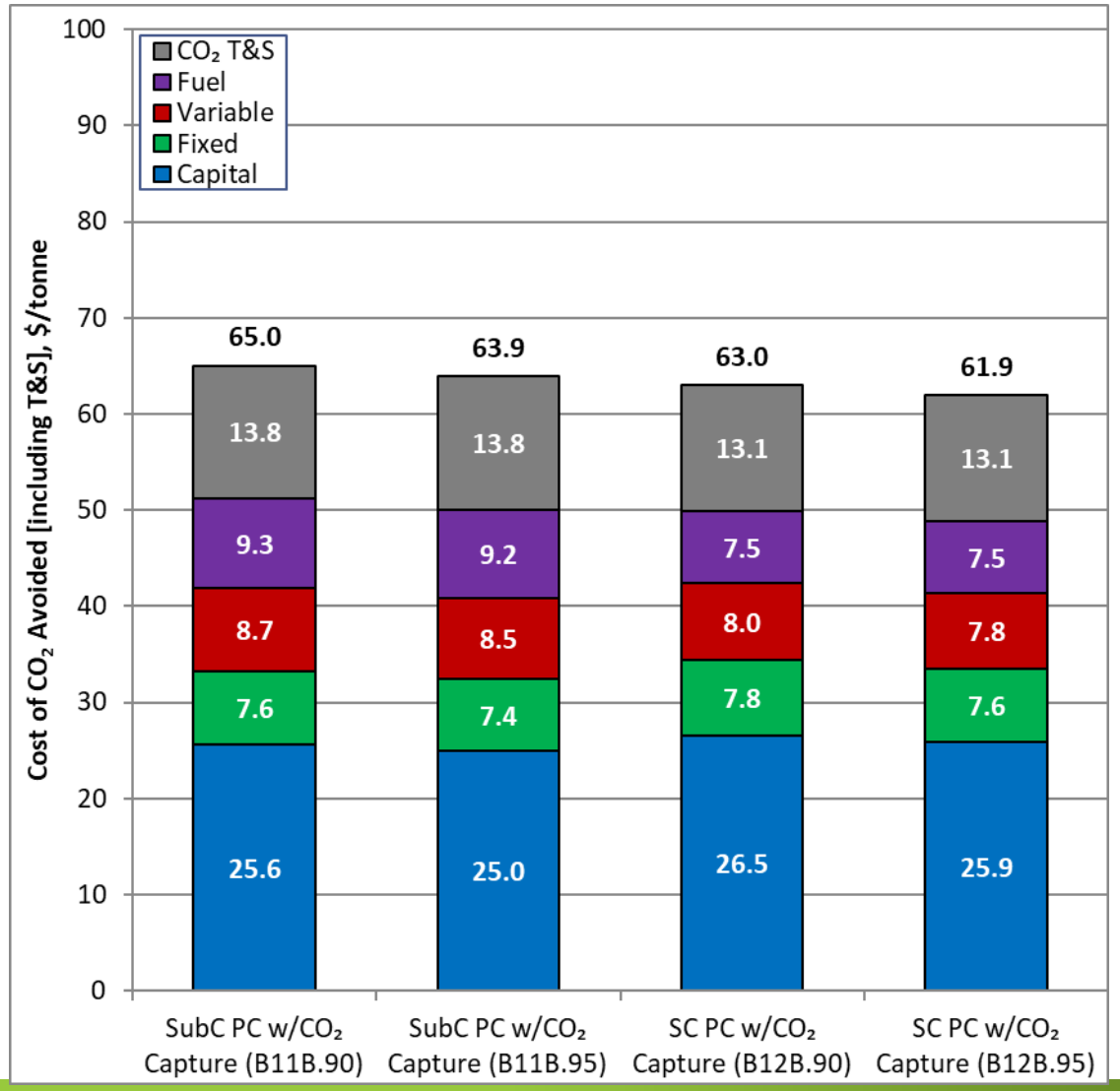
LCOE = levelized cost of electricity

NGCC LCOE Summary

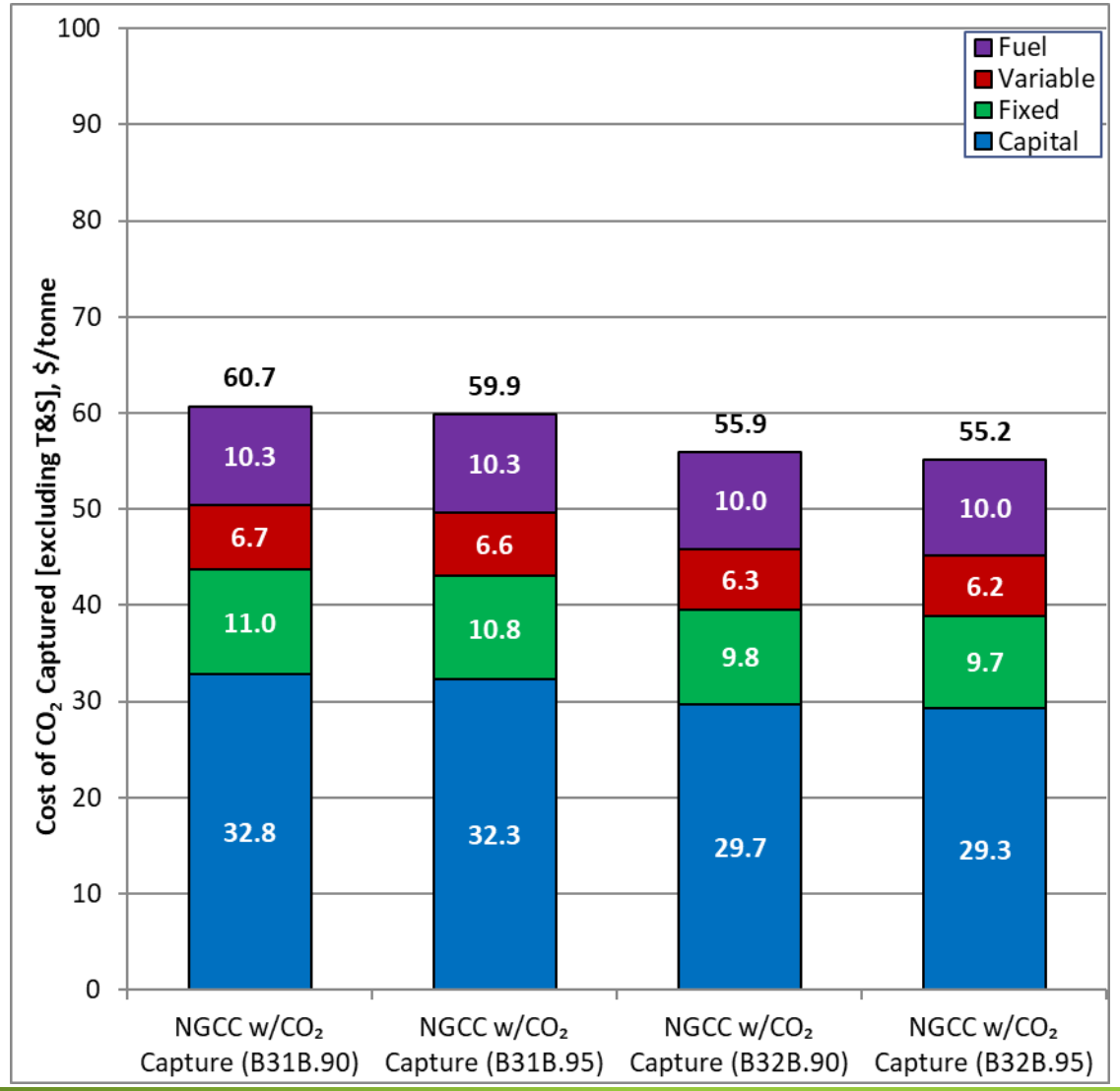


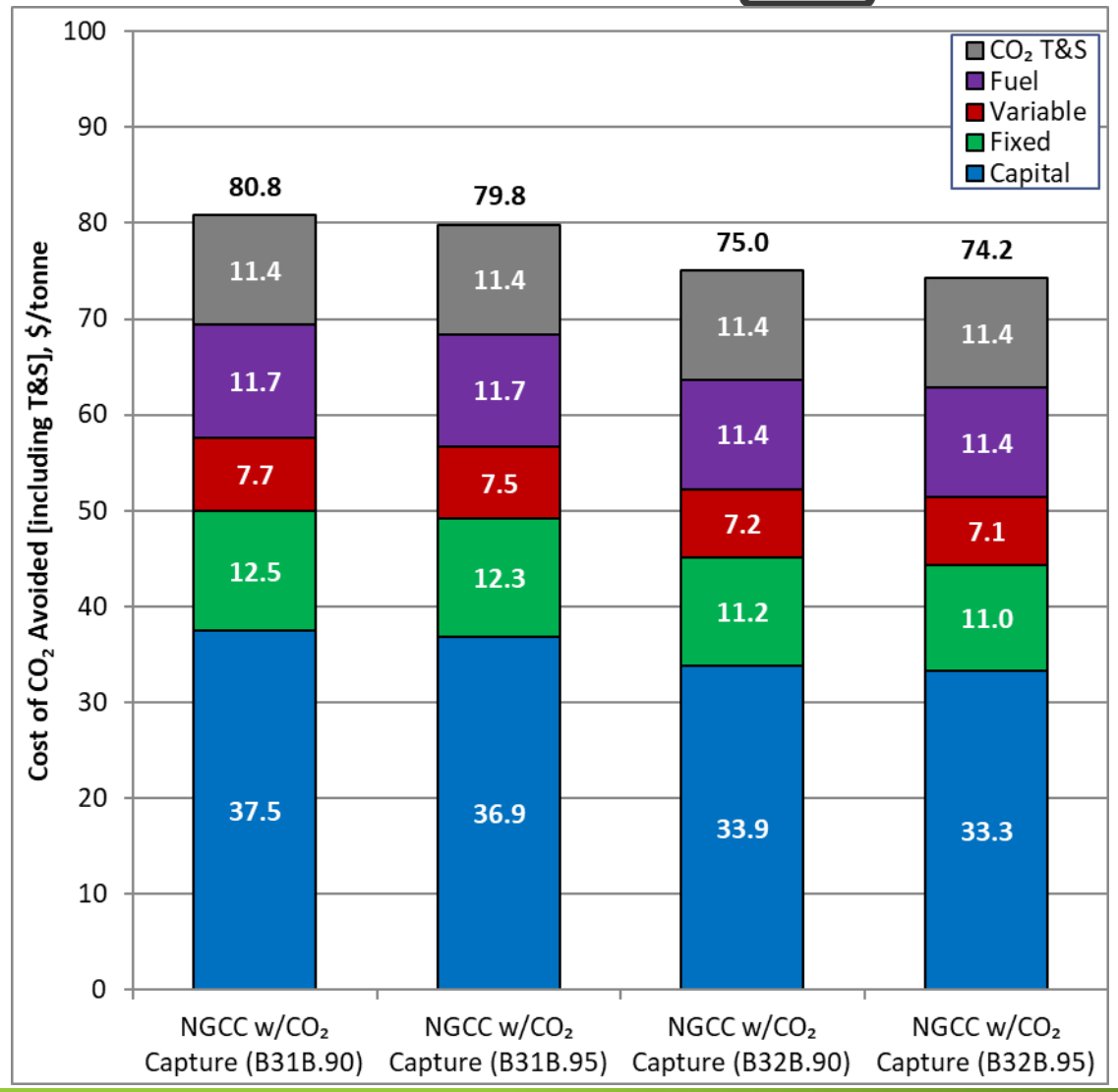
PC Cost of CO_2 Captured and Avoided



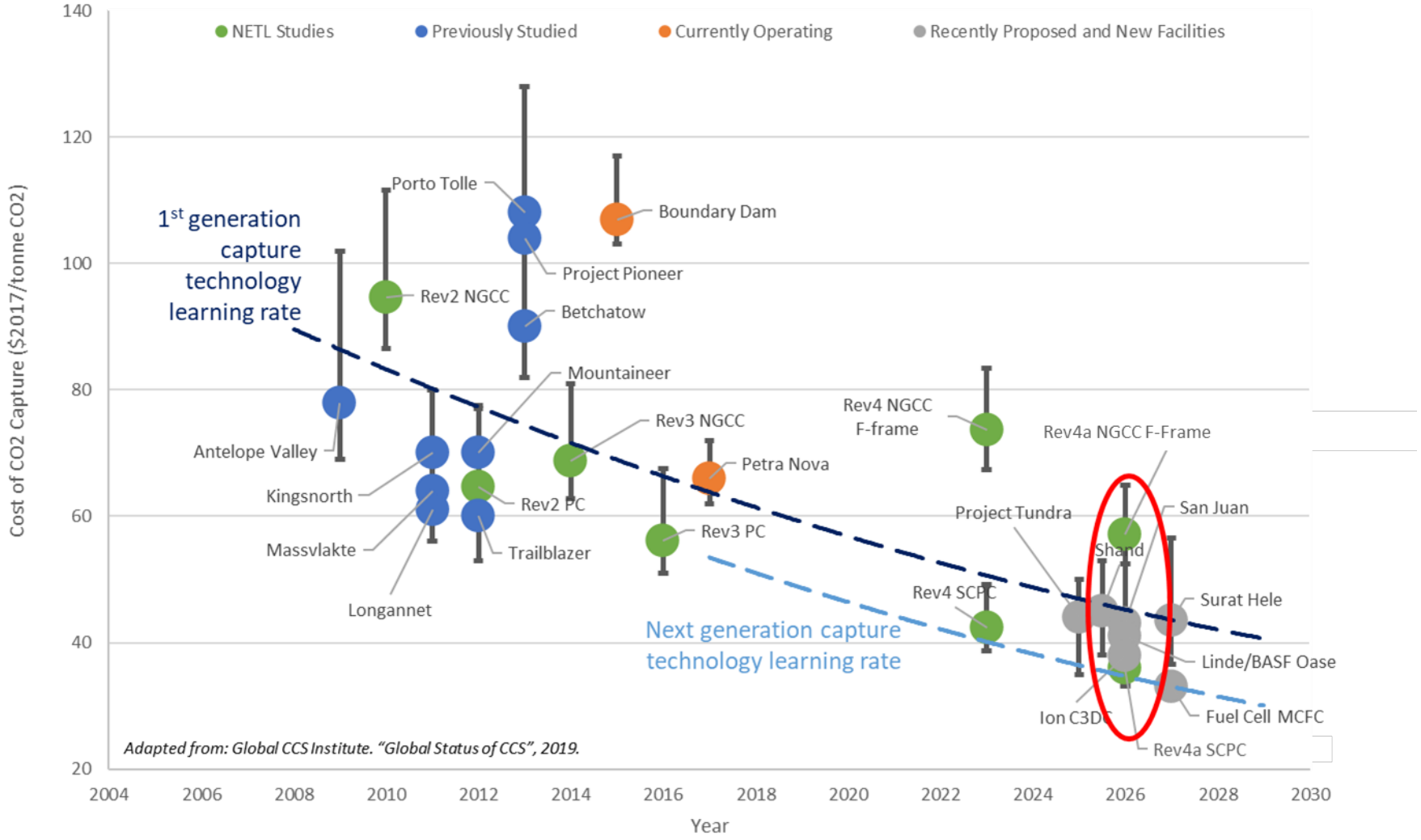


NGCC Cost of CO_2 Captured and Avoided

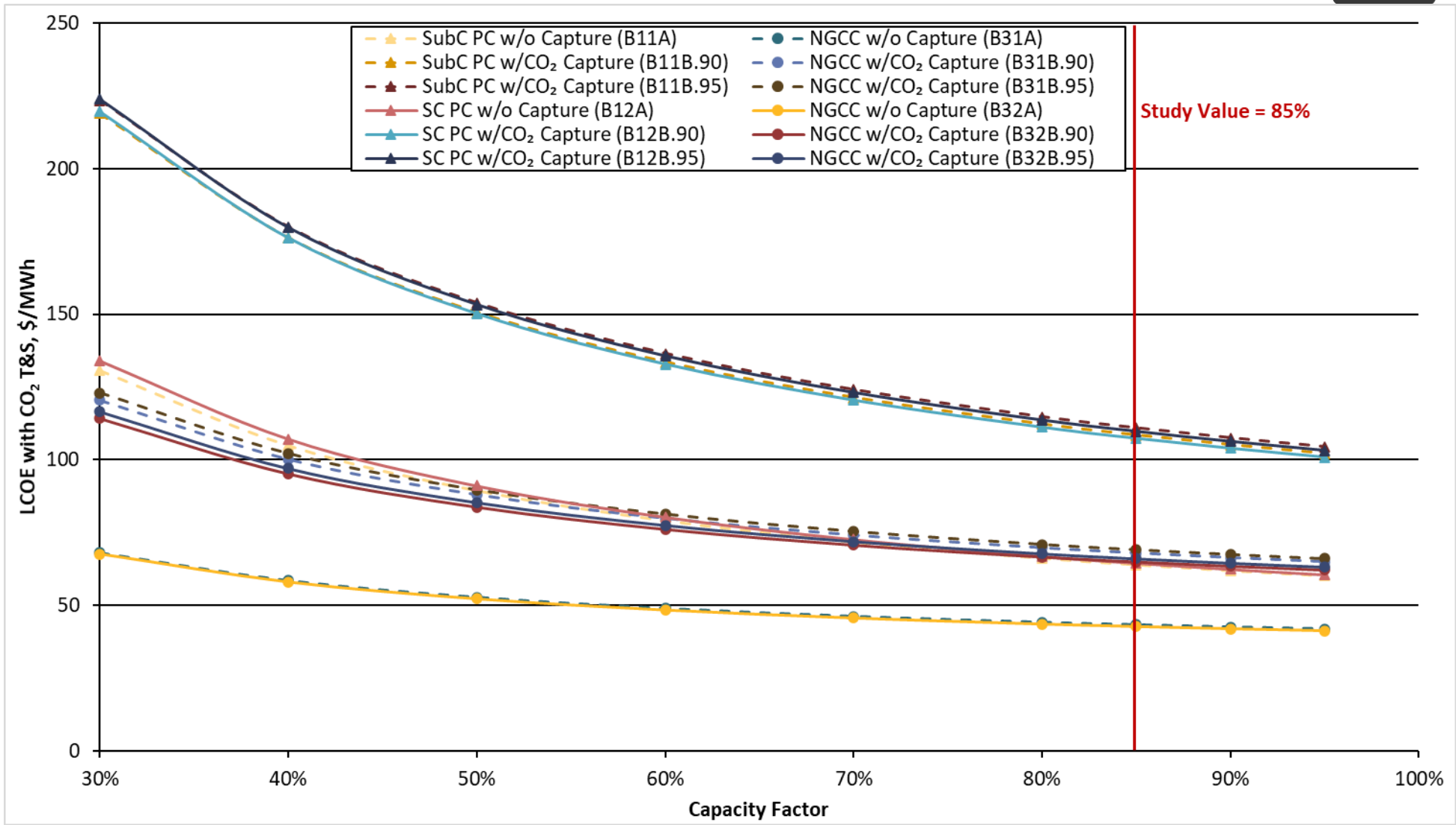




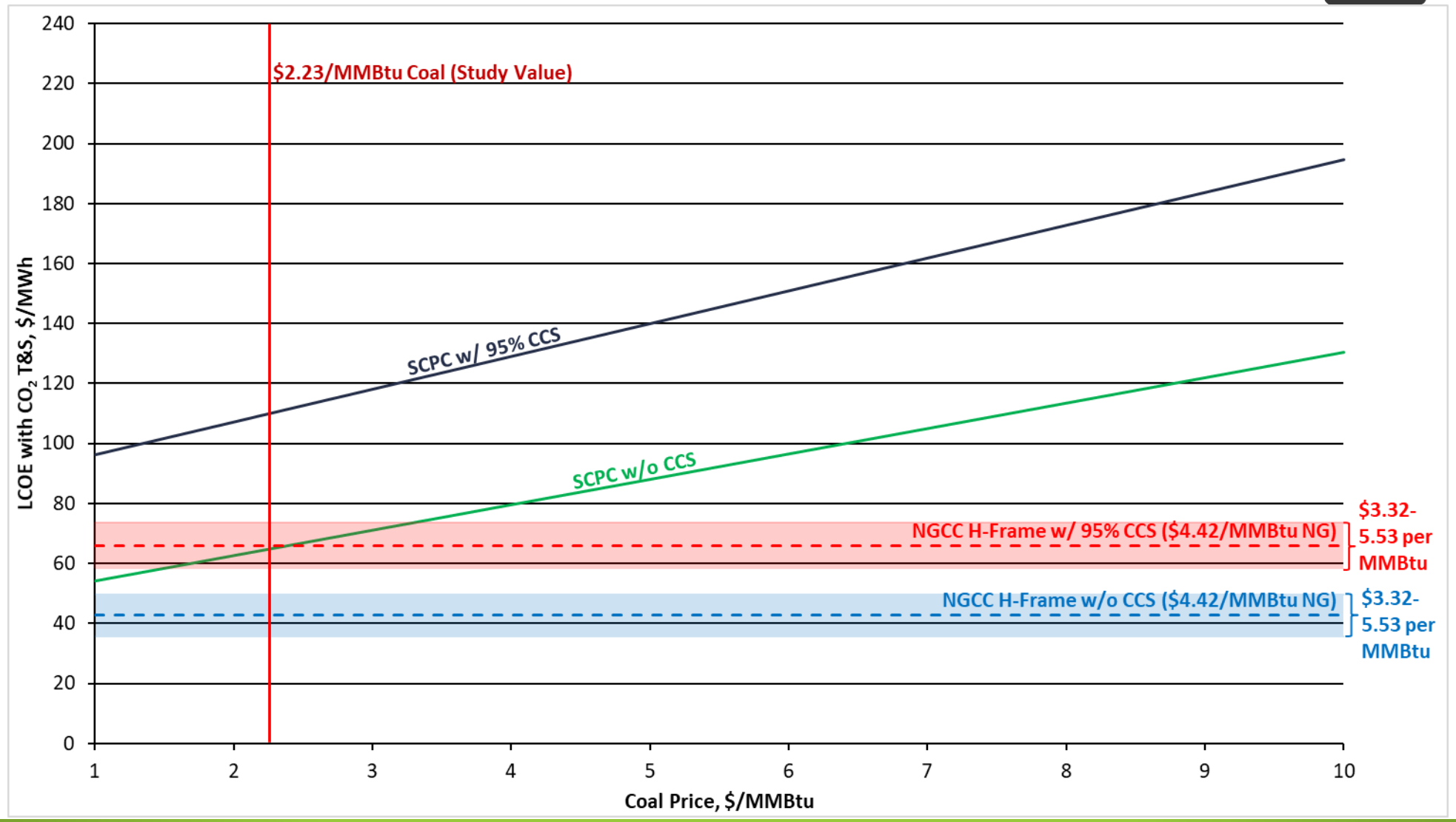
Revision 4a Estimates in Context



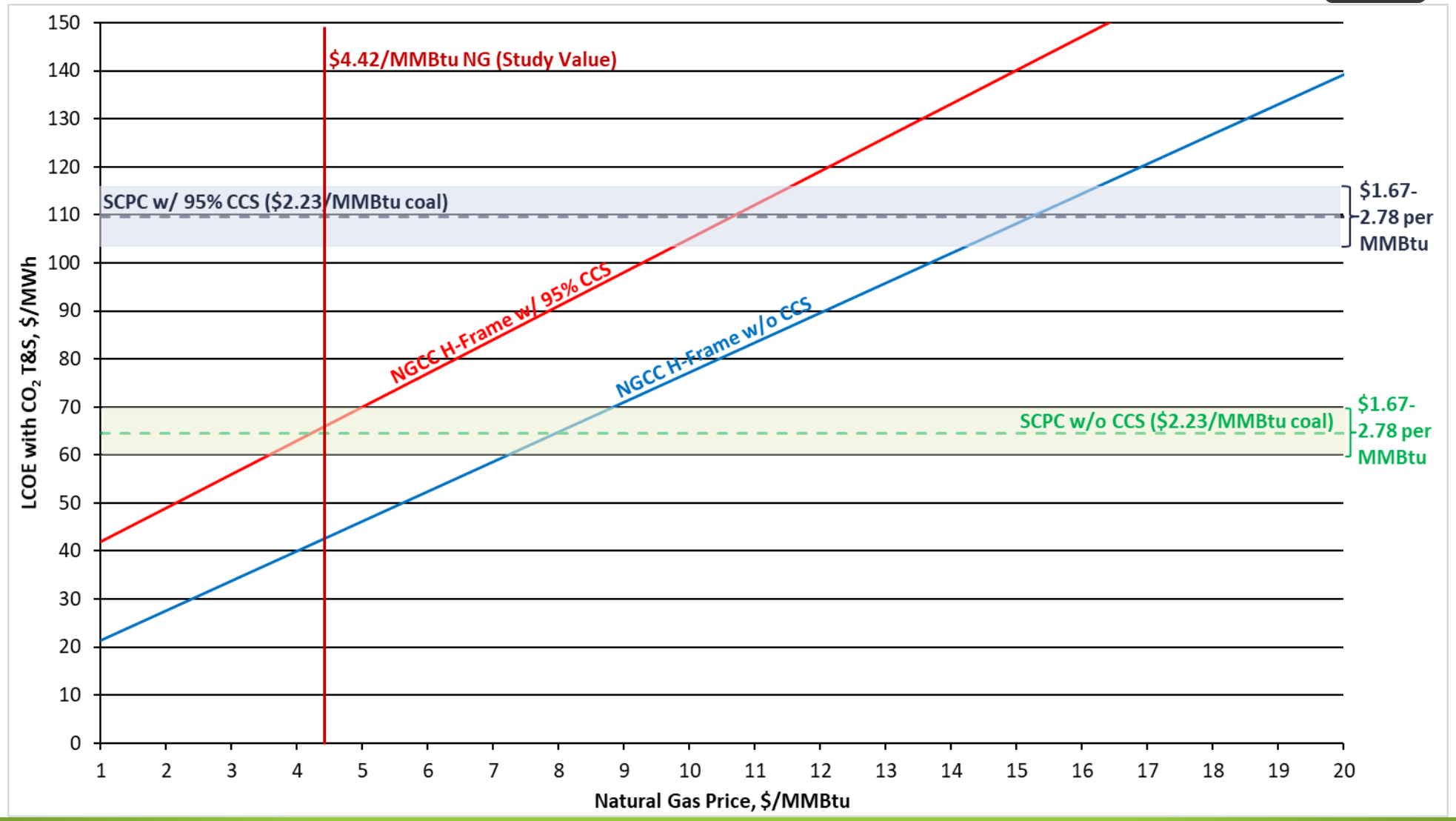
Sensitivity to Capacity Factor



Sensitivity to Coal Price



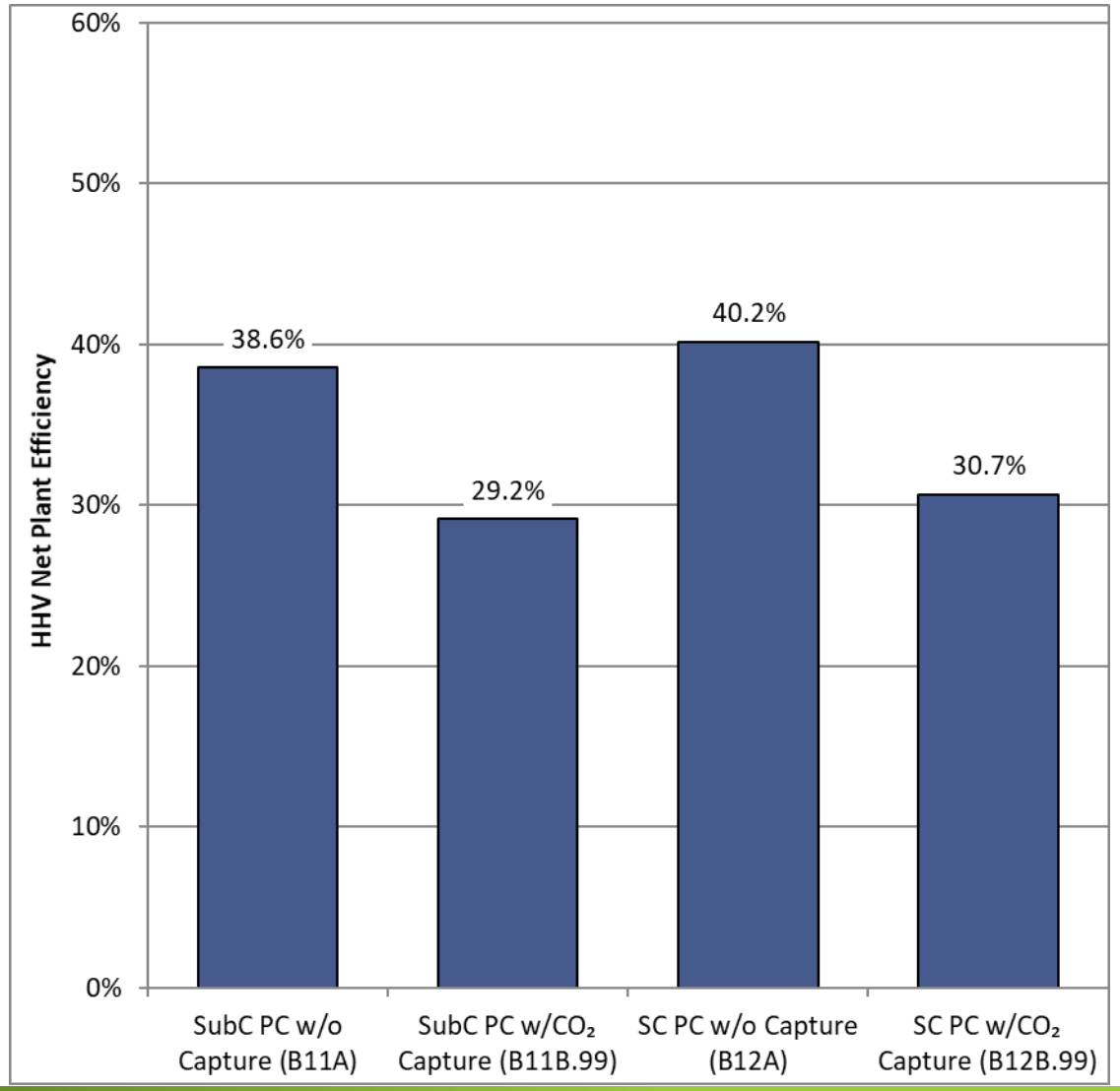
Sensitivity to Natural Gas Price

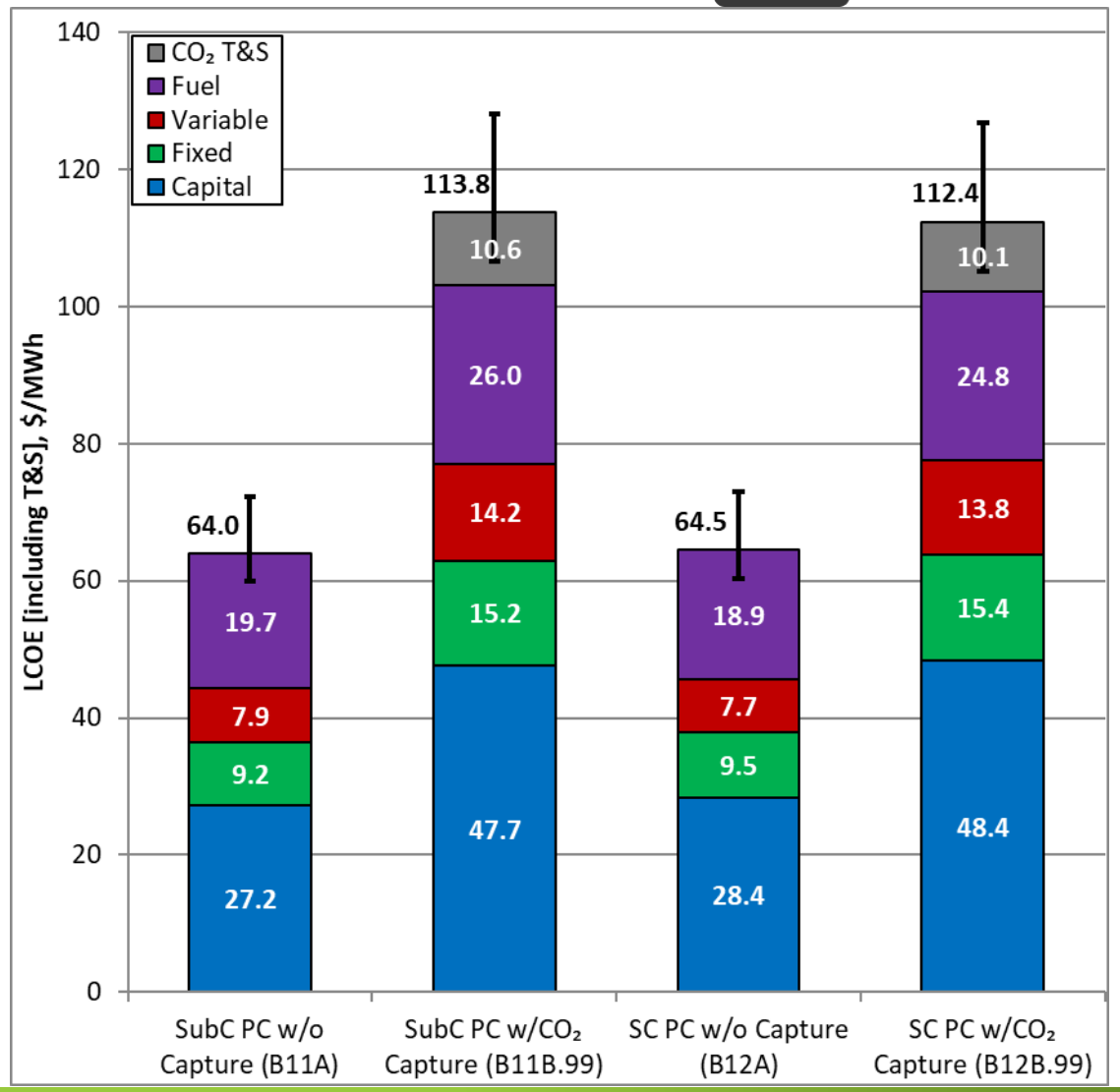


Distinction Between 95% Capture and Higher Rates

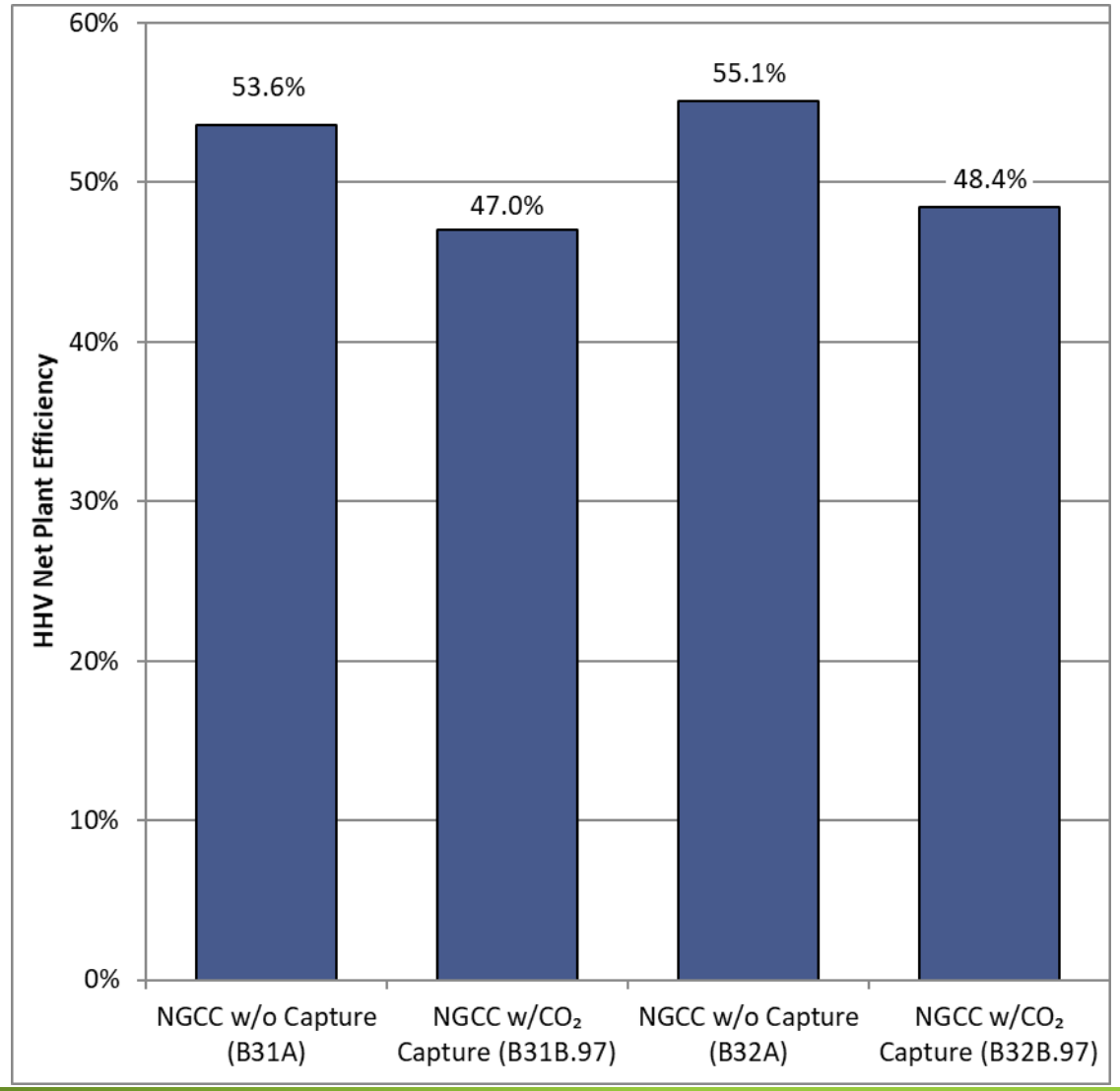
- Commercial-scale demonstration of solvent-based post-combustion CO_2 capture systems at power generation facilities (specifically PC plants) has shown the abilify to capture 90% of the CO_2 in the flue gas stream
- Field-testing of post-combustion CO_2 capture technology, as well as vendor and industry feedback on projects currently in the planning stages, indicates that capture rates as high as 95% are feasible for both coal- and natural gas-fueled electricity generating units
- Technology suppliers and subject matter experts acknowledge and support that solvent-based, post-combustion CO_2 capture technologies can achieve CO_2 removal rates beyond 95% on low-purity streams representative of fossil-fueled combustion
- Although technoeconomic analyses of deep decarbonization (≥ 99%) of combustion flue gas have been published by others, the relatively limited experience with design and operation of capture systems that can routinely, reliably, and economically achieve very high removal rates requires further study
- Technoeconomic analysis of the higher capture rates (97% NGCC and 99% PC) are included in the subject report

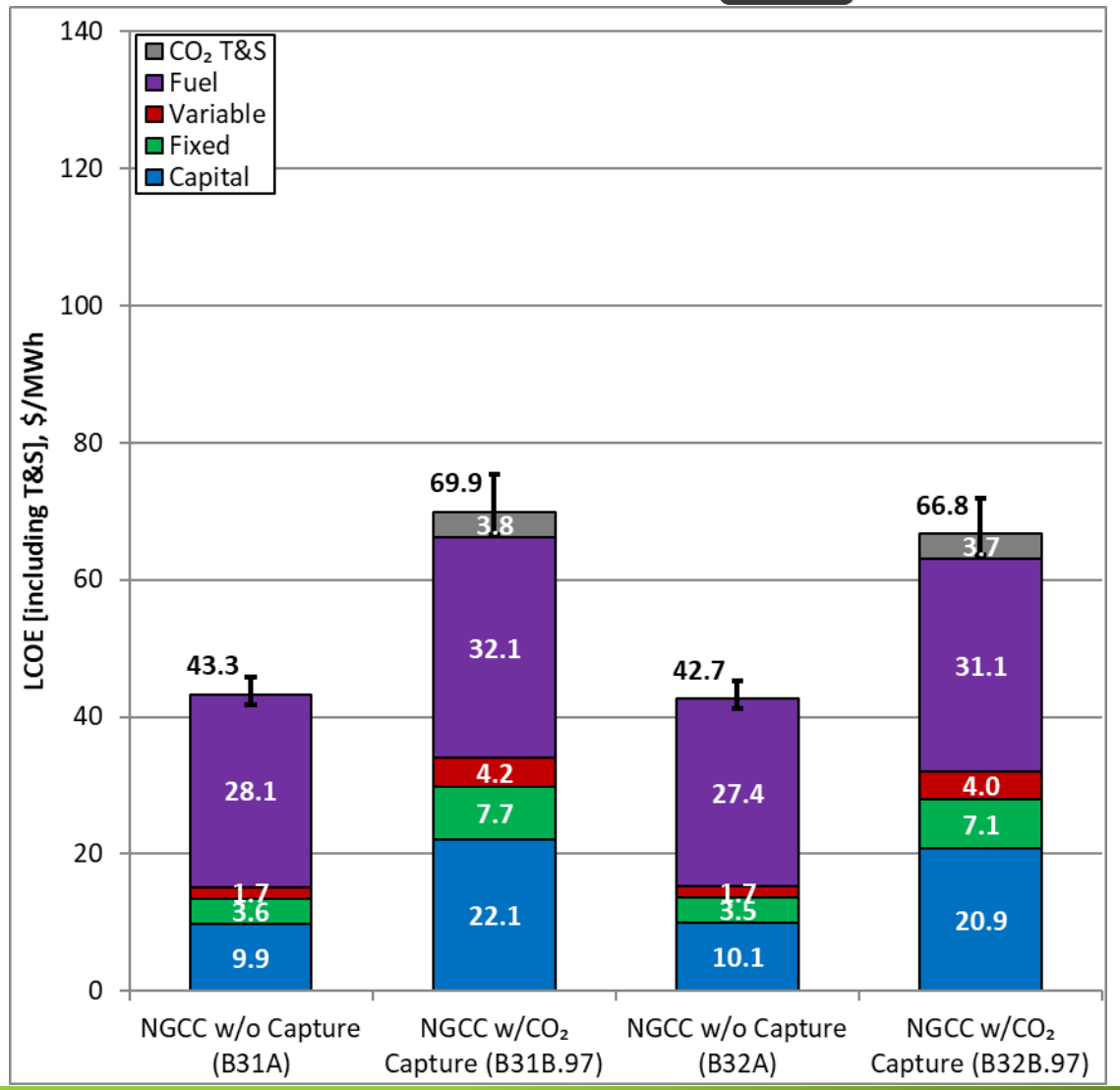
PC with 99% CO_2 Capture vs. No Capture





NGCC with 97% CO_2 Capture vs. No Capture





Completed and Future Work

- Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity – Revision 4A
  - Published October 2022: https://www.osti.gov/biblio/1893822
- Related/derivative studies:
  - Cost of Capturing CO_2 from Industrial Sources - Revision 1 and associated carbon capture retrofit database (CCRD) – September 2022
    - Report available at https://www.osti.gov/biblio/1887586
    - CCRD Model available at https://www.osti.gov/biblio/1887588
    - User Guide available at https://www.osti.gov/biblio/1887587
  - Cost and Performance of Retrofitting NGCC Units for Carbon Capture and associated Carbon Capture Retrofit Database (CCRD) – February 2023
  - Eliminating the Derate of Carbon Capture Retrofits and associated CCRD – 2023
  - Detailed cost sensitivity for NGCC with carbon capture and storage – 2023
  - Technoeconomic and Life Cycle Analysis of Bio-Energy with Carbon Capture and Storage (BECCS) Baseline – 2023

Disclaimer

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Questions?

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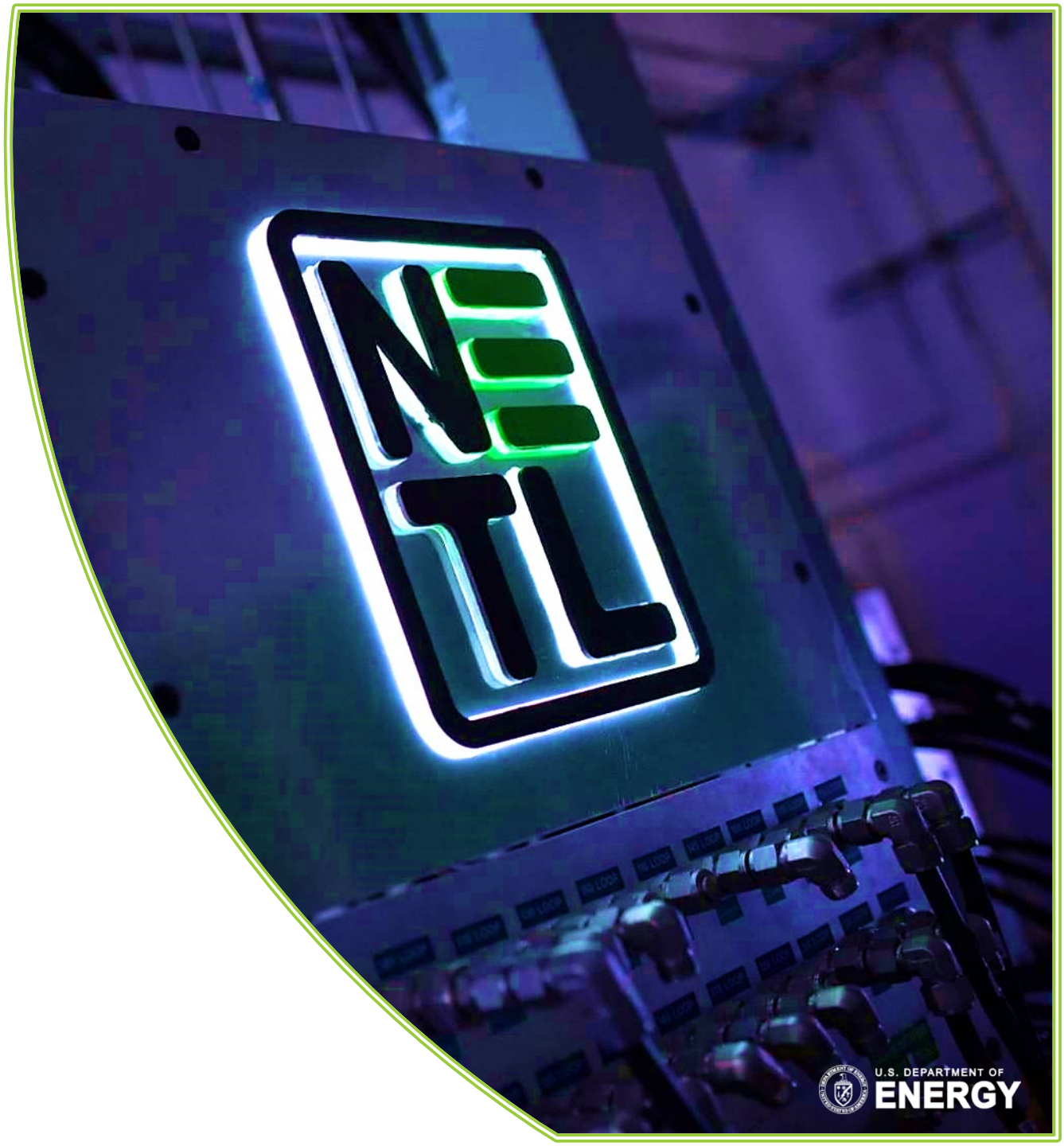

Supplemental Slides

Subcritical PC Plants

Performance Summary	B11A	B11B.90	B11B.95
Total Gross Power, MWe	**688**	**769**	**774**
CO_2 Capture/Removal Auxiliaries, kWe	–	18,800	20,200
CO_2 Compression, kWe	–	48,660	52,170
Balance of Plant, kWe	37,520	50,620	51,470
Total Auxiliaries, MWe	**38**	**118**	**124**
Net Power, MWe	**650**	**650**	**650**
Higher Heating Value (HHV) Net Plant Efficiency, %	38.6	30.2	29.7
HHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	9,336 (8,849)	11,940 (11,317)	12,128 (11,495)
Lower Heating Value (LHV) Net Plant Efficiency, %	40.0	31.3	30.8
LHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	9,005 (8,535)	11,516 (10,915)	11,697 (11,087)
HHV Boiler Efficiency, %	88.0	88.0	88.0
LHV Boiler Efficiency, %	91.3	91.3	91.3
Steam Turbine Cycle Efficiency, %	46.3	55.1	55.8
Steam Turbine Heat Rate, kJ/kWh (Btu/kWh)	7,770 (7,365)	6,532 (6,191)	6,453 (6,116)
Condenser Duty, GJ/hr (MMBtu/hr)	2,793 (2,648)	2,312 (2,191)	2,277 (2,158)
Capture Rate (%)	–	90	95
Acid Gas Removal (AGR) Duty, GJ/hr (MMBtu/hr)	–	2,162 (2,050)	2,288 (2,169)
As-Received Coal Feed, kg/hr (lb/hr)	223,673 (493,115)	286,189 (630,940)	290,670 (640,819)
Limestone Sorbent Feed, kg/hr (lb/hr)	21,637 (47,701)	27,684 (61,033)	28,118 (61,989)
HHV Thermal Input, kWt	1,685,945	2,157,162	2,190,938
LHV Thermal Input, kWt	1,626,114	2,080,609	2,113,187
Raw Water Withdrawal, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.038 (10.0)	0.058 (15.3)	0.059 (15.7)
Raw Water Consumption, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.030 (8.0)	0.043 (11.4)	0.044 (11.7)
Excess Air, %	20.3	20.3	20.3

Power Summary	B11A	B11B.90	B11B.95
Steam Turbine Power, MWe	688	769	774
Total Gross Power, MWe	**688**	**769**	**774**
Auxiliary Load Summary			
Activated Carbon Injection, kWe	30	40	40
Ash Handling, kWe	730	940	950
Baghouse, kWe	100	120	120
Circulating Water Pumps, kWe	5,700	9,670	9,900
CO_2 Capture/Removal Auxiliaries, kWe	–	18,800	20,200
CO_2 Compression, kWe	–	48,660	52,170
Coal Handling and Conveying, kWe	480	540	550
Condensate Pumps, kWe	720	720	720
Cooling Tower Fans, kWe	2,950	5,000	5,120
Dry Sorbent Injection, kWe	60	80	80
Flue Gas Desulfurizer, kWe	3,460	4,420	4,490
Forced Draft Fans, kWe	1,150	1,470	1,490
Ground Water Pumps, kWe	590	900	920
Induced Draft Fans, kWe	10,600	13,570	13,780
Miscellaneous Balance of Plant[A,B], kWe	2,250	2,250	2,250
Primary Air Fans, kWe	1,360	1,740	1,770
Pulverizers, kWe	3,350	4,290	4,360
Selective Catalytic Reduction, kWe	40	50	50
Sorbent Handling & Reagent Preparation, kWe	1,040	1,330	1,350
Spray Dryer Evaporator, kWe	250	320	320
Steam Turbine Auxiliaries, kWe	500	500	500
Transformer Losses, kWe	2,160	2,670	2,710
Total Auxiliaries, MWe	**38**	**118**	**124**
Net Power, MWe	**650**	**650**	**650**

[A] Boiler feed pumps are turbine driven
[B] Includes plant control systems; lighting; heating, ventilation, and combined cycle (HVAC); and miscellaneous low voltage loads

Supercritical PC Plants

Performance Summary	B12A	B12B.90	B12B.95
Total Gross Power, MWe	686	763	768
CO_2 Capture/Removal Auxiliaries, kWe	–	17,900	19,200
CO_2 Compression, kWe	–	46,330	49,640
Balance of Plant, kWe	35,950	48,270	49,030
Total Auxiliaries, MWe	**36**	**113**	**118**
Net Power, MWe	**650**	**650**	**650**
Higher Heating Value (HHV) Net Plant Efficiency, %	40.2	31.7	31.2
HHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	8,957 (8,490)	11,371 (10,778)	11,540 (10,938)
Lower Heating Value (LHV) Net Plant Efficiency, %	41.7	32.8	32.3
LHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	8,639 (8,188)	10,968 (10,396)	11,131 (10,550)
HHV Boiler Efficiency, %	88.0	88.0	88.0
LHV Boiler Efficiency, %	91.3	91.3	91.3
Steam Turbine Cycle Efficiency, %	48.2	57.4	58.2
Steam Turbine Heat Rate, kJ/kWh (Btu/kWh)	7,471 (7,081)	6,267 (5,940)	6,189 (5,866)
Condenser Duty, GJ/hr (MMBtu/hr)	2,592 (2,457)	2,100 (1,990)	2,064 (1,956)
Capture Rate (%)	–	90	95
AGR Duty, GJ/hr (MMBtu/hr)	–	2,059 (1,952)	2,177 (2,064)
As-Received Coal Feed, kg/hr (lb/hr)	214,574 (473,055)	272,519 (600,801)	276,574 (609,741)
Limestone Sorbent Feed, kg/hr (lb/hr)	20,757 (45,761)	26,362 (58,118)	26,754 (58,983)
HHV Thermal Input, kWt	1,617,359	2,054,118	2,084,684
LHV Thermal Input, kWt	1,559,963	1,981,222	2,010,703
Raw Water Withdrawal, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.035 (9.3)	0.054 (14.3)	0.055 (14.6)
Raw Water Consumption, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.028 (7.4)	0.040 (10.6)	0.041 (10.9)
Excess Air, %	20.3	20.3	20.3

Power Summary	B12A	B12B.90	B12B.95
Steam Turbine Power, Mwe	686	763	768
Total Gross Power, Mwe	**686**	**763**	**768**
Auxiliary Load Summary			
Activated Carbon Injection, kWe	30	40	40
Ash Handling, kWe	700	890	910
Baghouse, kWe	90	120	120
Circulating Water Pumps, kWe	5,300	9,020	9,230
CO_2 Capture/Removal Auxiliaries, kWe	–	17,900	19,200
CO_2 Compression, kWe	–	46,330	49,640
Coal Handling and Conveying, kWe	470	530	530
Condensate Pumps, kWe	660	790	800
Cooling Tower Fans, kWe	2,740	4,670	4,770
Dry Sorbent Injection, kWe	60	80	80
Flue Gas Desulfurizer, kWe	3,320	4,210	4,270
Forced Draft Fans, kWe	1,100	1,400	1,420
Ground Water Pumps, kWe	500	840	860
Induced Draft Fans, kWe	10,230	12,920	13,110
Miscellaneous Balance of Plant[A,B], kWe	2,250	2,250	2,250
Primary Air Fans, kWe	1,310	1,660	1,680
Pulverizers, kWe	3,220	4,090	4,150
Selective Catalytic Reduction, kWe	30	50	50
Sorbent Handling & Reagent Preparation, kWe	1,000	1,270	1,290
Spray Dryer Evaporator, kWe	240	300	300
Steam Turbine Auxiliaries, kWe	500	500	500
Transformer Losses, kWe	2,150	2,640	2,670
Total Auxiliaries, MWe	**36**	**113**	**118**
Net Power, MWe	**650**	**650**	**650**

[A] Boiler feed pumps are turbine driven
[B] Includes plant control systems, lighting, HVAC, and miscellaneous low voltage loads

F-Class NGCC Plants

Performance Summary	B31A	B31B.90	B31B.95
Combustion Turbine Power, MWe	477	477	477
Steam Turbine Power, MWe	263	215	212
Total Gross Power, MWe	**740**	**692**	**690**
CO_2 Capture/Removal Auxiliaries, kWe	–	13,600	14,400
CO_2 Compression, kWe	–	17,900	18,900
Balance of Plant, kWe	13,562	15,992	16,042
Total Auxiliaries, MWe	**14**	**47**	**49**
Net Power, MWe	**727**	**645**	**640**
HHV Net Plant Efficiency, %	53.6	47.6	47.3
HHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	6,714 (6,363)	7,563 (7,169)	7,617 (7,220)
HHV Combustion Turbine Efficiency, %	35.2	35.2	35.2
LHV Net Plant Efficiency, %	59.4	52.7	52.4
LHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	6,060 (5,743)	6,827 (6,470)	6,875 (6,516)
LHV Combustion Turbine Efficiency, %	39.0	39.0	39.0
Steam Turbine Cycle Efficiency, %	39.7	46.9	47.5
Steam Turbine Heat Rate, kJ/kWh (Btu/kWh)	9,074 (8,601)	7,678 (7,277)	7,586 (7,190)
CO_2 Capture Rate, %	0	90	95
Condenser Duty, GJ/hr (MMBtu/hr)	1,406 (1,332)	860 (815)	830 (787)
AGR Cooling Duty, GJ/hr (MMBtu/hr)	–	1,194 (1,132)	1,232 (1,167)
Natural Gas Feed Flow, kg/hr (lb/hr)	93,272 (205,630)	93,272 (205,630)	93,272 (205,630)
HHV Thermal Input, kWt	1,354,905	1,354,905	1,354,905
LHV Thermal Input, kWt	1,222,936	1,222,936	1,222,936
Raw Water Withdrawal, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.015 (4.0)	0.026 (6.9)	0.027 (7.0)
Raw Water Consumption, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.012 (3.1)	0.017 (4.6)	0.018 (4.7)

Power Summary	B31A	B31B.90	B31B.95
Combustion Turbine Power, MWe	477	477	477
Steam Turbine Power, MWe	263	215	212
Total Gross Power, MWe	**740**	**692**	**690**
Auxiliary Load Summary			
Circulating Water Pumps, kWe	2,820	4,340	4,360
Combustion Turbine Auxiliaries, kWe	1,020	1,020	1,020
Condensate Pumps, kWe	150	170	170
Cooling Tower Fans, kWe	1,460	2,240	2,260
CO_2 Capture/Removal Auxiliaries, kWe	–	13,600	14,400
CO_2 Compression, kWe	–	17,900	18,900
Feedwater Pumps, kWe	4,830	4,830	4,830
Ground Water Pumps, kWe	260	400	410
Miscellaneous Balance of Plant[A], kWe	570	570	570
SCR, kWe	2	2	2
Steam Turbine Auxiliaries, kWe	200	200	200
Transformer Losses, kWe	2,250	2,220	2,220
Total Auxiliaries, MWe	**14**	**47**	**49**
Net Power, MWe	**727**	**645**	**640**

[A] Includes plant control systems, lighting, HVAC, and miscellaneous low voltage loads

H-Class NGCC Plants

Performance Summary	B32A	B32B.90	B32B.95
Combustion Turbine Power, MWe	686	686	686
Steam Turbine Power, MWe	324	260	256
Total Gross Power, MWe	**1,009**	**945**	**942**
CO_2 Capture/Removal Auxiliaries, kWe	–	18,000	19,200
CO_2 Compression, kWe	–	23,810	25,130
Balance of Plant, kWe	16,923	20,153	20,213
Total Auxiliaries, MWe	**17**	**62**	**65**
Net Power, MWe	**992**	**883**	**877**
HHV Net Plant Efficiency, %	55.1	49.0	48.7
HHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	6,537 (6,196)	7,342 (6,959)	7,393 (7,007)
HHV Combustion Turbine Efficiency, %	38.0	38.0	38.0
LHV Net Plant Efficiency, %	61.0	54.3	54.0
LHV Net Plant Heat Rate, kJ/kWh (Btu/kWh)	5,900 (5,592)	6,627 (6,281)	6,672 (6,324)
LHV Combustion Turbine Efficiency, %	42.2	42.2	42.2
Steam Turbine Cycle Efficiency, %	39.1	46.7	47.3
Steam Turbine Heat Rate, kJ/kWh (Btu/kWh)	9,213 (8,732)	7,713 (7,311)	7,609 (7,212)
CO_2 Capture Rate, %	0	90	95
Condenser Duty, GJ/hr (MMBtu/hr)	1,757 (1,666)	1,031 (978)	992 (940)
AGR Cooling Duty, GJ/hr (MMBtu/hr)	–	1,587 (1,505)	1,638 (1,552)
Natural Gas Feed Flow, kg/hr (lb/hr)	124,025 (273,429)	124,025 (273,429)	124,025 (273,429)
HHV Thermal Input, kWt	1,801,631	1,801,631	1,801,631
LHV Thermal Input, kWt	1,626,150	1,626,150	1,626,150
Raw Water Withdrawal, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.014 (3.6)	0.024 (6.4)	0.025 (6.5)
Raw Water Consumption, $(m^3/min)/MW_{net}$ (gpm/MW_{net})	0.011 (2.8)	0.016 (4.2)	0.016 (4.3)

Power Summary	B32A	B32B.90	B32B.95
Combustion Turbine Power, MWe	686	686	686
Steam Turbine Power, MWe	324	260	256
Total Gross Power, MWe	**1,009**	**945**	**942**
Auxiliary Load Summary			
Circulating Water Pumps, kWe	3,510	5,530	5,570
Combustion Turbine Auxiliaries, kWe	1,320	1,320	1,320
Condensate Pumps, kWe	180	200	200
Cooling Tower Fans, kWe	1,810	2,860	2,880
CO_2 Capture/Removal Auxiliaries, kWe	–	18,000	19,200
CO_2 Compression, kWe	–	23,810	25,130
Feedwater Pumps, kWe	5,760	5,760	5,760
Ground Water Pumps, kWe	330	520	520
Miscellaneous Balance of Plant[A], kWe	710	710	710
SCR, kWe	3	3	3
Steam Turbine Auxiliaries, kWe	230	230	230
Transformer Losses, kWe	3,070	3,020	3,020
Total Auxiliaries, MWe	**17**	**62**	**65**
Net Power, MWe	**992**	**883**	**877**

[A] Includes plant control systems, lighting, HVAC, and miscellaneous low voltage loads