

# National Carbon Capture Center

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U.S. DEPARTMENT OF  
**ENERGY**



NATIONAL  
ENERGY  
TECHNOLOGY  
LABORATORY

The logo of the National Carbon Capture Center, featuring the letters "NCC" in a stylized font with concentric circles around the "C".

**NATIONAL CARBON  
CAPTURE CENTER**

# Nation Carbon Capture Center (NCCC)

Located in Wilsonville, AL at Alabama Power's Plant Gaston Since 2009



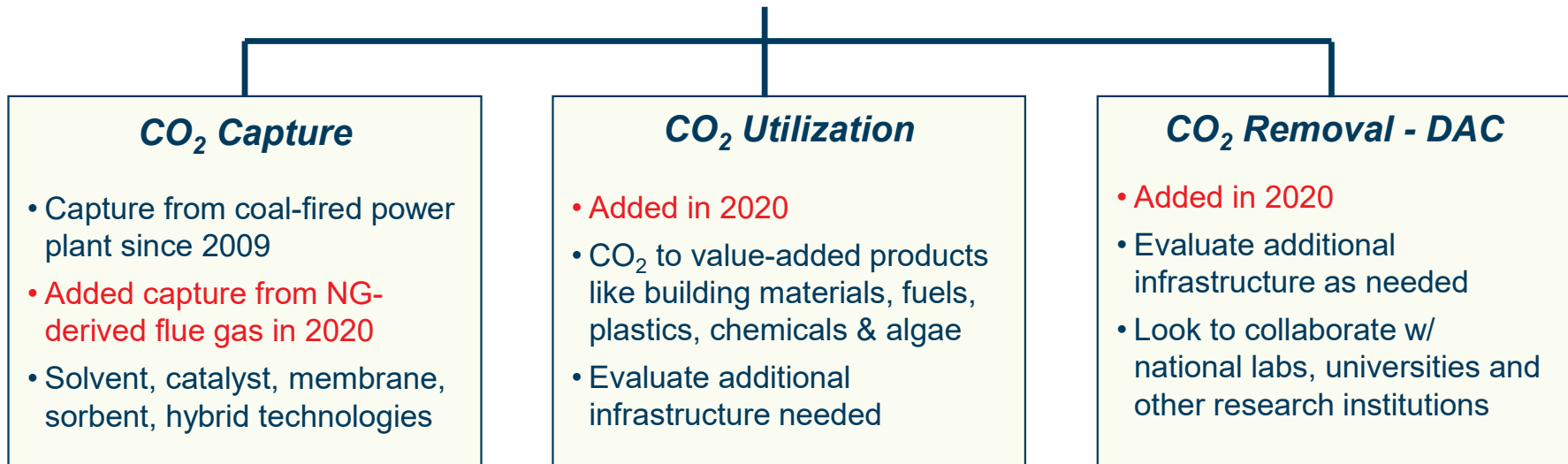
- A **centralized test facility** providing comprehensive support for technology testing and evaluation
  - Process, engineering, operational, analytical, troubleshooting and maintenance
- Goal: **Accelerating** technology development, scale-up, cost reduction and commercialization
  - CO<sub>2</sub> capture, utilization and removal
- Sponsored by **DOE/NETL, research and industrial partners**; managed by Southern Company
  - Coal, utility, research, oil & gas, policy
  - Project period: 2014-2025 (Current BP7)
  - Total \$348MM (DOE \$253.4MM / Non-DOE \$94.6MM)
  - PI: John Northington, Director of NCCC

## Sponsors

- **Sponsors:** U.S. Department of Energy and its National Energy Technology Laboratory
  - DOE's primary carbon capture research facility since 2009
- **Partners:** Electric Power Research Institute, power/energy industry leaders
- **Managed/operated by:** Southern Company
- **Location:** Wilsonville, Alabama
- **Infrastructure:** Real-world power plant operating conditions – coal and natural gas
- **Expertise:** Technical staff for design, installation, testing support and analysis
- **International collaboration:** Co-founder of International Test Center Network



# NCCC – Technical Program



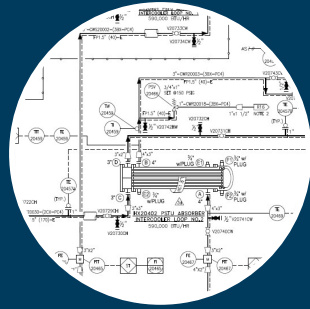
*DAC: Direct Air Capture*

# Project Development and Implementation

Safety  
First

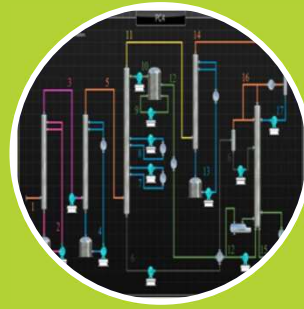
## Contract

- Screening
- NDA/TCA
- Onboarding



## Project Scope

- Process
- Modification
- Integration



## Design

- Mechanical
- Instrument
- Control
- Electrical
- Civil



## Construction

- Foundation
- Flue Gas
- Utilities
- Installation
- Interconnection



## O&M

- Operate
- Test Support
- Analysis
- Troubleshoot
- Repair

# NCCC – Facility Infrastructure

## Plant Gaston: Host Site

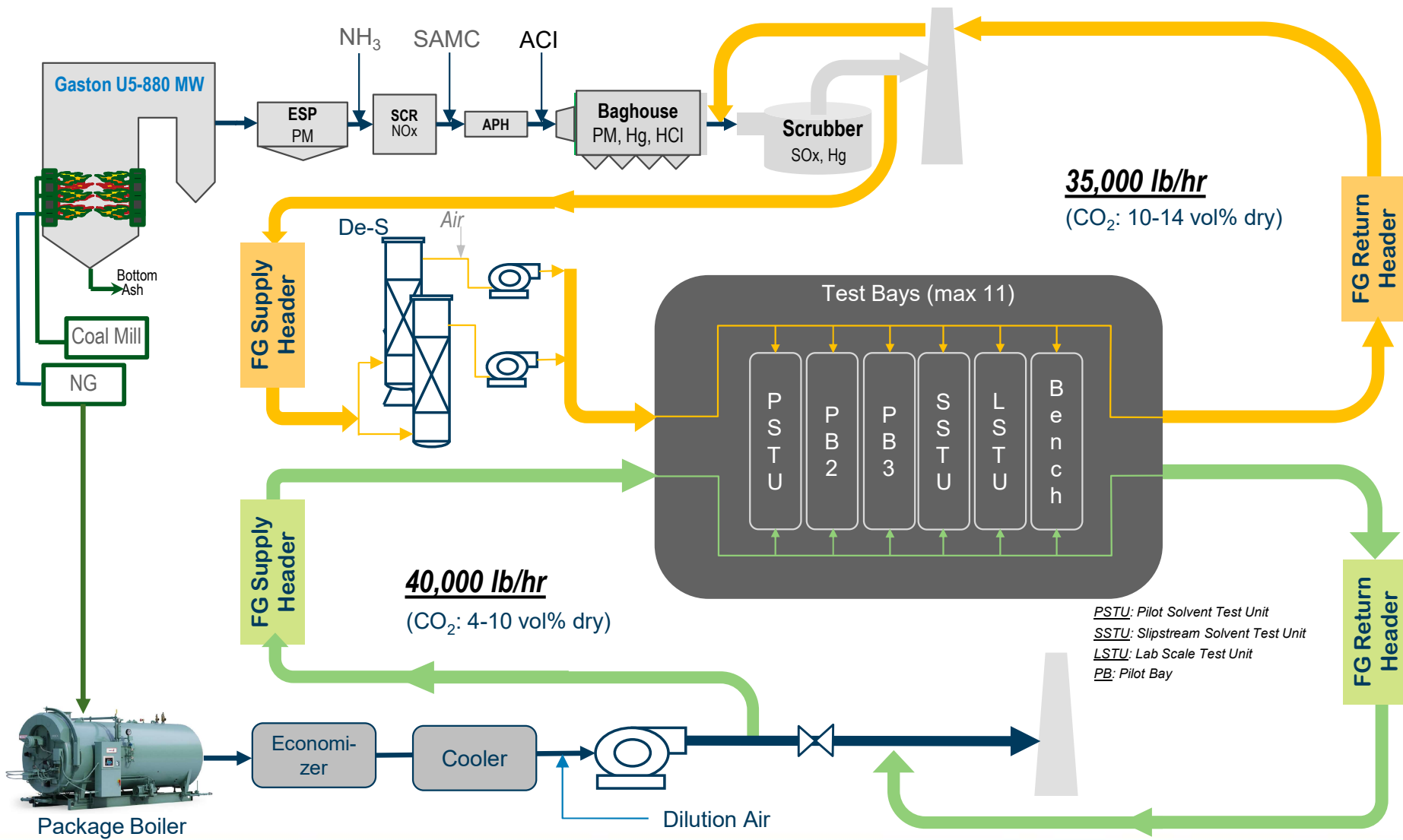
- Unit 5 (U5) -890 MWe supercritical
  - Dual fuel – coal and natural gas
  - 35,000 lb/hr slipstream flue gas (FG) from U5
  - Exhaust gas from NCCC returns to U5 stack
- Low/Medium pressure steam, water (demin, potable, filter-treated), instrument air and power
- Wastewater returns to plant Gaston for treatment and disposal

## NCCC

- NG flue gas from package boiler (new 2021)
  - 40,000 lb/hr flue gas
  - Exhaust stack
- Low pressure steam, nitrogen and cooling water
- Test equipment, test bays and infrastructure



Test Facility for Post-Combustion CO<sub>2</sub> Capture, CO<sub>2</sub> Utilization and DAC Technologies

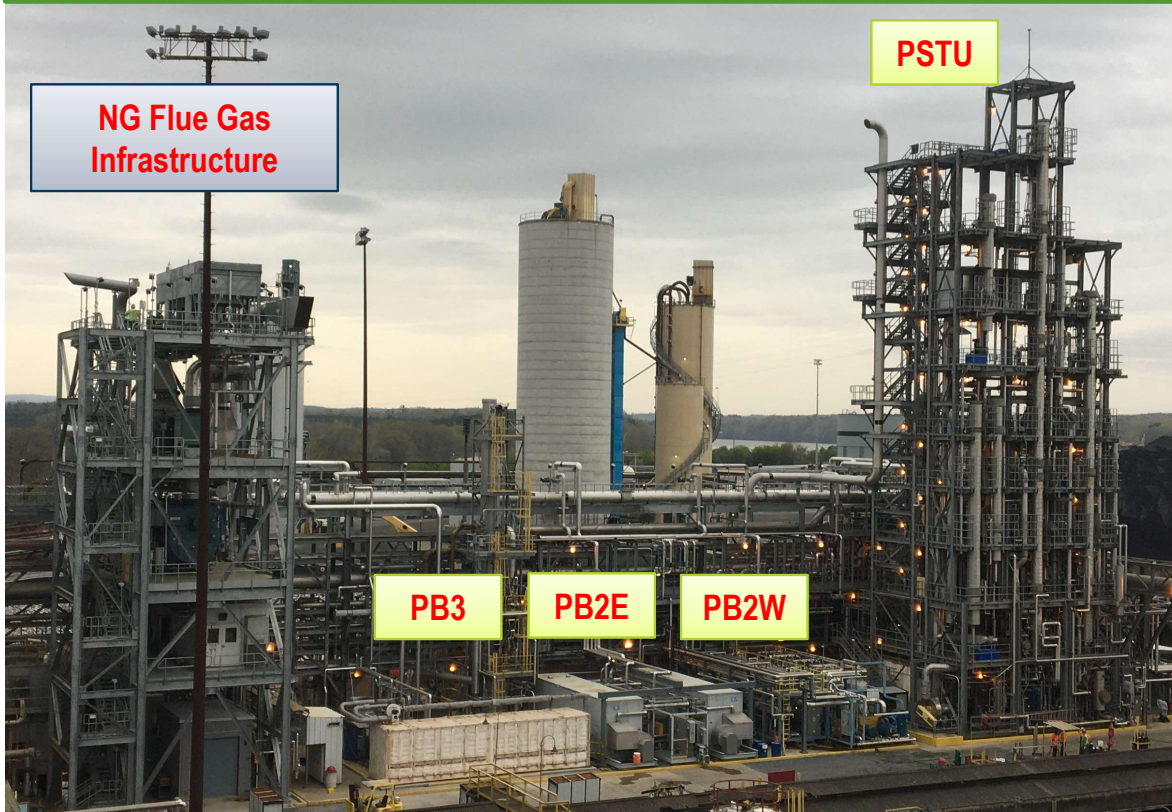


**Coal FG Config**

**NG FG Config**

# Test Bays and Equipment

Pilot Scale



Lab/Bench Scale



Benchscale

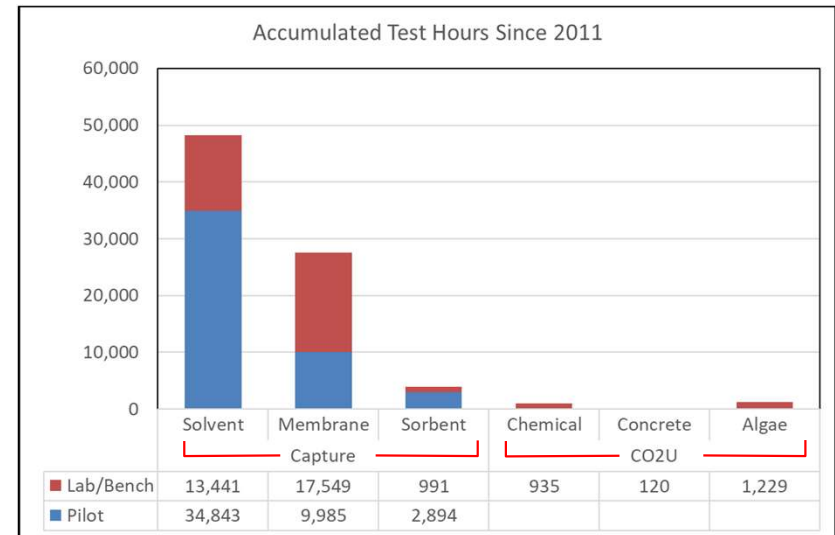




# Technology Portfolio

	2011-2022	
Tech Areas	Pilot	Lab/Bench
Solvent/Contactor	13	5
CO <sub>2</sub> Membrane	3	3
Sorbent	1	3
Cryogenic	1	-
CO <sub>2</sub> Utilization	-	3
<b>Total</b>	<b>18</b>	<b>14</b>

**32 Technologies Tested  
~ 82,000 Hours of Data**



# CO2 Utilization Project: UCLA/CO<sub>2</sub>Concrete

UCLA

CarbonBuilt™

- CO<sub>2</sub> Mineralization for Concrete Production

- Tested at Wyoming Integrated Test Center (WITC)
- One of two NRG COSIA X-PRIZE winners

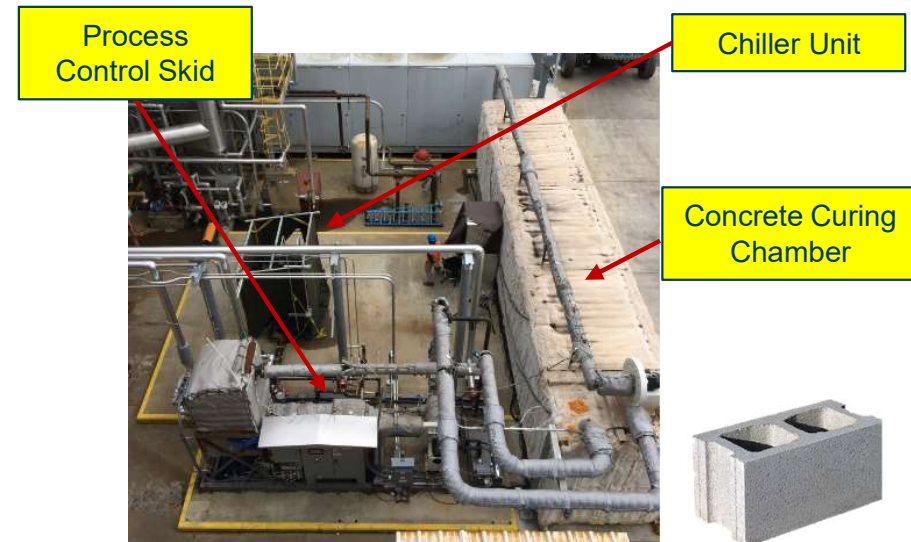


- Objectives (vs WITC test)

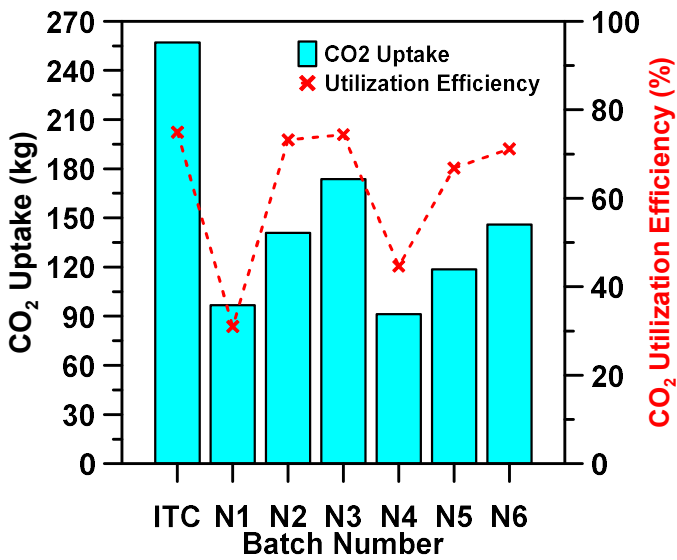
- Different coal flue gas (12% CO<sub>2</sub>)
- Test of NG flue gas (4% CO<sub>2</sub>)
- Improved process
- Outdoor environment (ambient 35 F-83 F)
- Different blocks locally sourced

- Project

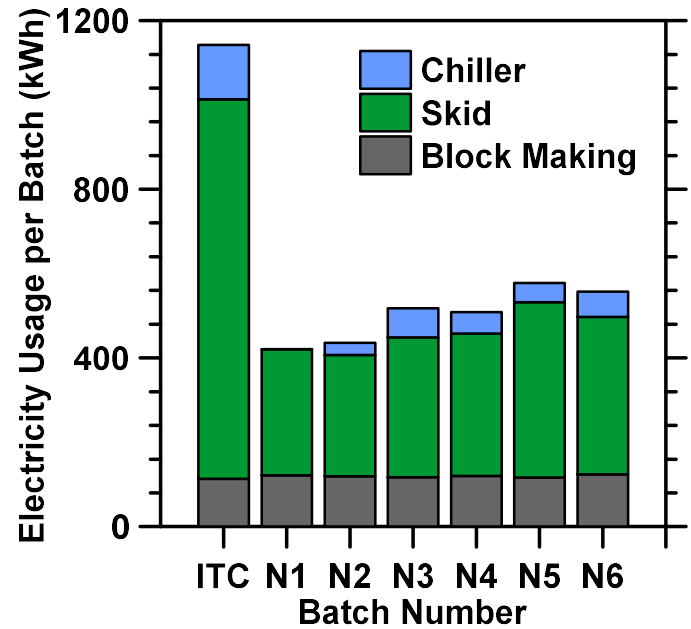
- 9/2020 WITC test completed
- 12/3/2020 Skids delivered to NCCC
- 3/2 – 3/25, 2021 Test campaign
  - ▶ 6 batches; 864 blocks/batch; 4 on coal & 2 on NG FG
  - ▶ Cycle time: 24 hrs/batch (18-hr carbonation)



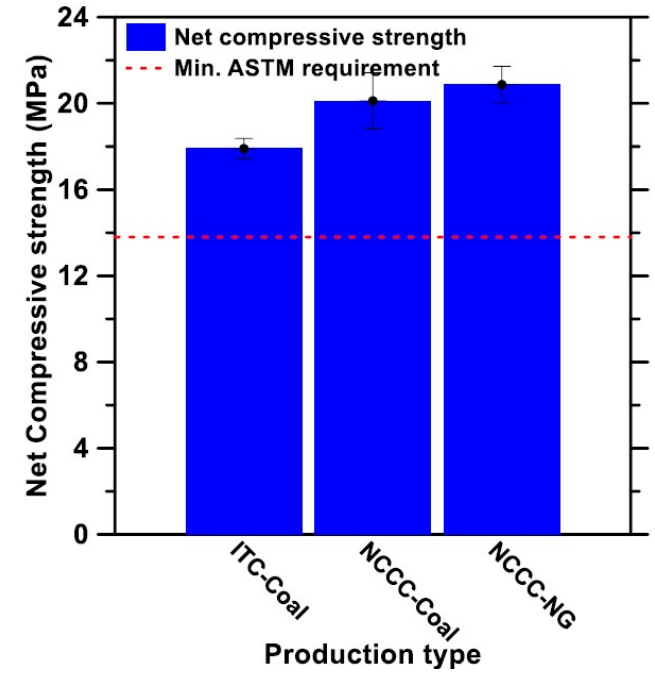
# UCLA/CO<sub>2</sub> Concrete



CO<sub>2</sub> Utilization

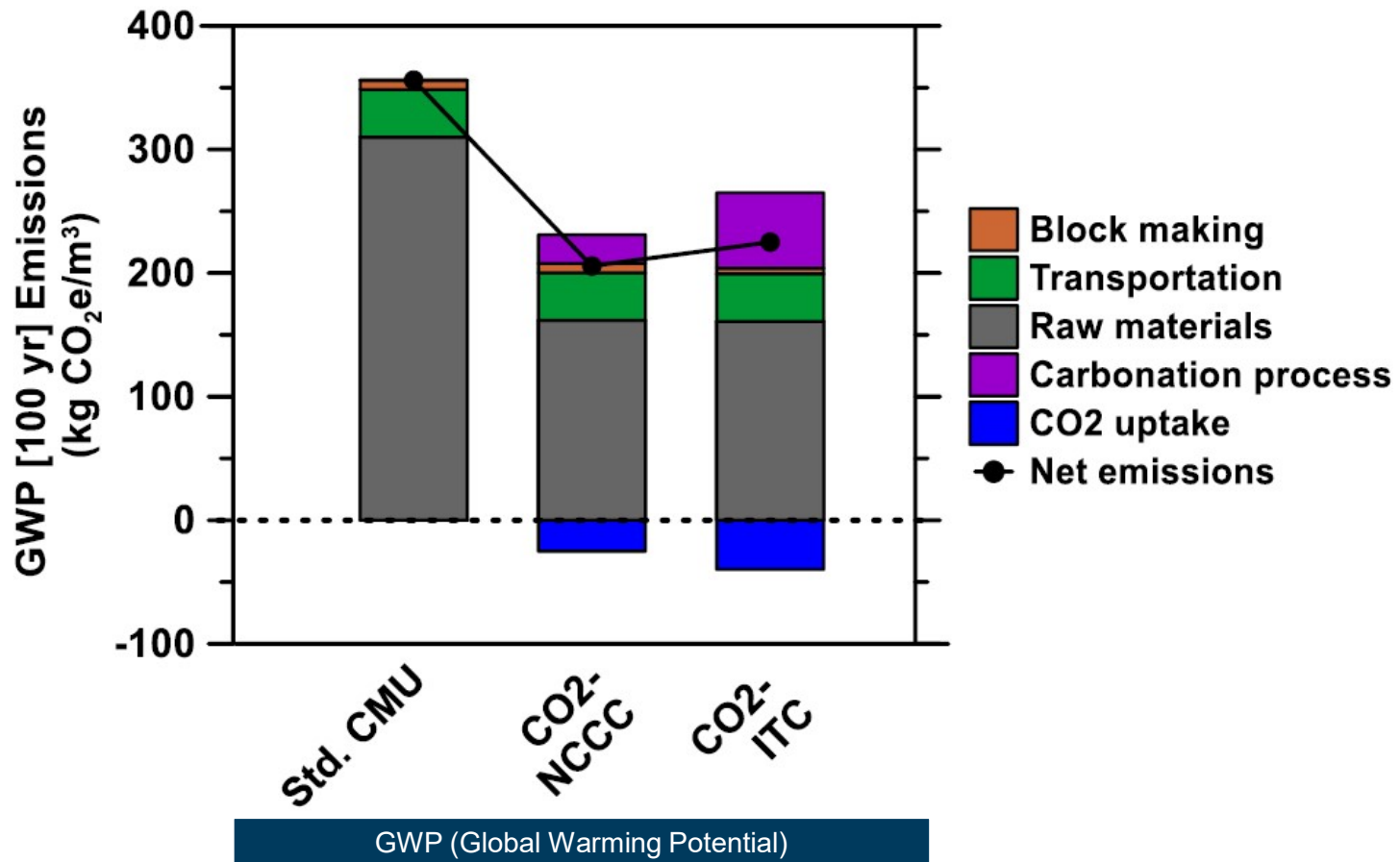


Energy Consumption



Concrete Strength

# UCLA/CO<sub>2</sub>Concrete



Questions?

