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NETL DE-FE0032138

Bench Scale Test of a Polyethyleneimine Monolith Carbon Capture Process for NGCC Point Sources

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Overview

- Three years total, in three budget periods.
- Total Federal Share = $2,500,000.
- Cost share ~ 20%.

Objectives

- **Develop and validate** a high performance, lower cost integrated process for NGCC point source CO_2 capture incorporating an **oxide monolith + amine structured contactor** (achieve TRL 6).
- **Refine the process model** with experimental data (for capture performance and accelerated life-cycle tests performed under relevant process conditions) collected during the project to **optimize the process** prior to the bench-scale system test and to support the techno-economic analysis.
- **Refine the process techno-economic analysis**, with multiple stakeholder inputs, to outline the roadmap towards **achieving a 20% cost reduction** with the new integrated process relative to the NETL benchmark carbon capture process.

Project Steps – BP3

BP3 activities (2/1/2024 – 1/31/2025; in Tasks 8 & 9)

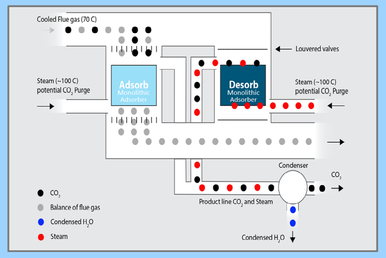
- **Complete the test campaign for the bench-scale IPU at NCCC.**
  - Demonstrate a minimum of one-month continuous, steady state operation achieving >95% carbon capture efficiency and >95% CO_2 purity.
  - Test the impact of dynamic operation on system performance (e.g., trip conditions, and quick start-up and shutdowns).
  - Assess the impact of NOx and SOx on the PEI monolith durability.
- **Complete the TEA, LCA, and Technology EH&S Risk Assessment.**

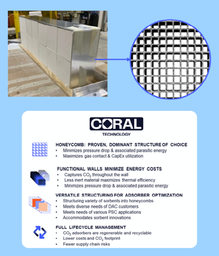
Decision Point	Date	Success Criteria
Project Completion	1/31/2025	❑ >95% carbon capture efficiency and >95% CO_2 purity demonstrated for minimum 1-month continuous operation. ❑ Impact of flue gas contaminants (NOx, SOx) on system performance / durability quantified, to yield <20% adsorber degradation. ❑ The TEA/LCA show advantages of novel PSC system and road map towards 20% reduction in carbon capture cost relative to the NETL standard CANSOLV system. ❑ EH&S risk assessment shows no issues for commercial deployment.

Technology Background

PSC Process Overview

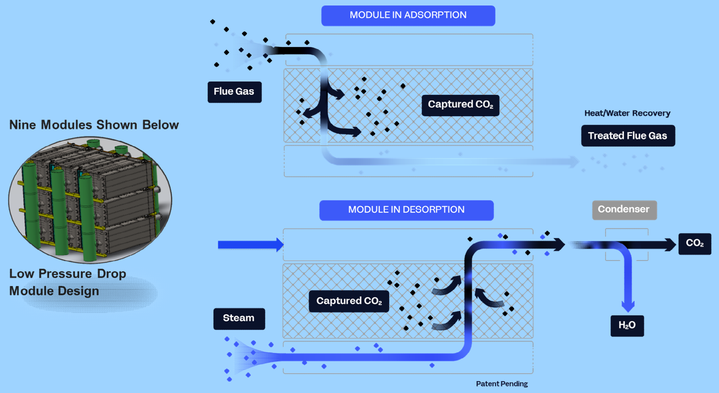
Cyclical, two-step process, centered on the solid monolith adsorber engine:
(1) CO_2 adsorption from flue gas; (2) CO_2 collection by steam-assisted desorption.



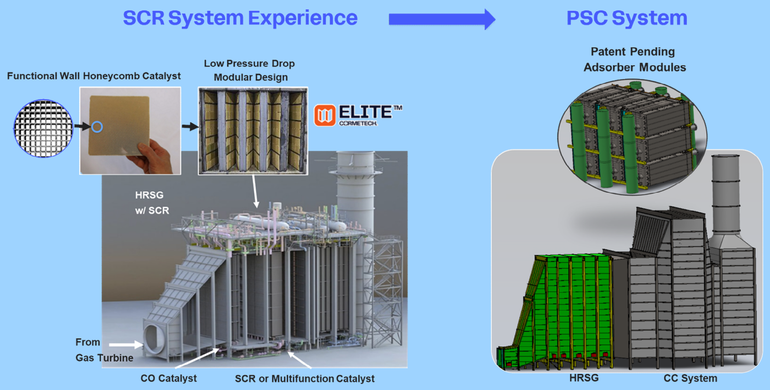


Sorbent Agnostic: Various sorbents and continuous R&D improvements in sorbent and structuring technology can easily be incorporated into this PSC process.

CORMETECH Adsorber Modules



Scale-Up Approach



Loading for transport to NCCC

PATHFINDER™ Point Source Capture (PSC) Integrated Process Demonstration Unit (IPU) at NCCC

Current Status:

- Installed in bench bay at NCCC.
- Utilities and flue gas connections have been completed.

Next steps:

- Handover to CORMETECH.
- Start unit commissioning (August).
- Start test campaign (September).
  - *Runs to 1/31/2025.*

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