

# SUCCESS STORY: NATIONAL CARBON CAPTURE CENTER (NCCC)



## NCCC ACCOMPLISHMENTS

- Over 91,000 test hours for technology developers from U.S. and six other countries since 2008 founding of NCCC
- More than 20 developer post-combustion projects completed
- More than 21 developer pre-combustion projects completed
- On-site scale-ups and process enhancements for ten technologies
- Scale-ups for testing at larger sites for five solvents
- Scale-up to commercial operation for one solvent
- First coal-derived gas testing of solid oxide fuel cells

# NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

## TECHNOLOGIES TESTED AT THE NCCC INCLUDE:

- Membranes: Hydrogen and CO<sub>2</sub>
- Sorbents: Trace metals, CO<sub>2</sub>, and ammonia
- Sensors for gasification operation
- Biomass gasification: Air- and oxygen-blown
- Novel solvent regeneration methods
- Catalysts: Carbonyl sulfide, water-gas shift
- Enzymatic solvent systems
- Solvents: Ammonium carbonate/bicarbonate, amines, non-aqueous
- Coal-to-liquids
- Advanced emissions monitoring

## SUMMARY OF NCCC SUCCESS HISTORY

The National Carbon Capture Center (NCCC) provides technology developers with a world-class, state-of-the-art, independent test facility and a highly specialized staff to accelerate the commercialization of the most promising advanced carbon capture technologies. Internationally recognized for excellence, the NCCC has established the United States as a global leader for testing of pre- and post-combustion carbon capture technologies as evidenced by the extensive use of the facility by international technology vendors.

The NCCC has been a key component of the Department of Energy's (DOE) success in moving new carbon capture technologies from lab to bench scale and through small pilot testing. The photo below illustrates this progression, which has prepared some technologies for large pilot testing at other locations. This success was facilitated by many factors but a key element was the DOE decision to establish the NCCC.

The advanced technologies developed at the NCCC ultimately will be scaled directly to full-scale and integrated into commercial projects. These technologies will support national efforts to reduce greenhouse gas emissions and enable affordable, reliable, and clean fossil energy power generation for many years to come.

Technologies are tested using actual flue gas from an existing coal-fired unit for post-combustion testing and actual syngas from an existing gasifier for gasification and pre-combustion testing. The NCCC has the flexibility for multiple and simultaneous slipstream testing of bench- and pilot-scale advanced carbon capture and gasification technologies from diverse fuel sources at commercially relevant process conditions. The technology testing at the NCCC enables evaluation of the efficiency, environmental performance, and economic viability of fossil fuel power generation processes with CO<sub>2</sub> capture.

The US power generation industry has faced extremely challenging environmental compliance requirements associated with multiple air emission regulations including Mercury and Air Toxics Standards, the Clean Air Interstate Rule, and 316(b) water regulations. These regulations have required power generators to install a variety of emission controls in existing plants while confronting the need to simultaneously test advanced carbon capture technologies to comply with the Environmental Protection Agency's proposed Clean Power Plan Rule.

The vision of the NCCC took shape in 2007 as a means to provide technology developers with an independent, flexible and cost-efficient carbon capture technology testing facility with real industrial operating conditions as an alternative to on-site testing at power plants. After many months of planning, and in cooperation with Southern Company Services (SCS), DOE's National Energy Technology Laboratory (NETL) established the NCCC in Wilsonville, Alabama in 2008. The NCCC is publicly funded by DOE and privately funded by Southern Company, American Electric Power, Duke Energy, Cloud Peak Energy, Luminant, and EPRI. The NCCC is managed and operated for DOE by SCS.

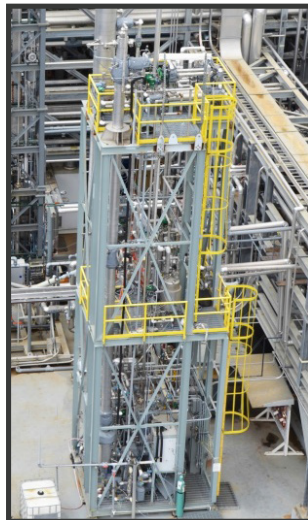
To date, the NCCC collaboration has achieved all expectations with regard to the initial vision of its founders. The DOE carbon capture research program – initiated in 2000 – has succeeded in maturing promising technologies, and the NCCC is the premier host site for testing.

The NCCC is an original member of the International Test Center Network (ITCN), a global consortium of facilities in the United States, Norway, Australia, Canada, Germany, and the United Kingdom that are conducting research and development (R&D) on carbon capture technologies. The global uniqueness of the facility is evidenced by the multiple international vendors that have used the NCCC to test developing technologies including Aker Clean Carbon, BASF/Linde, Cansolv, Carbon Clean Solutions, Chiyoda, Hitachi, MHI, and University of Edinburgh. The unique capabilities of the NCCC were recognized in 2016 when NCCC leadership assumed the chairmanship to guide ITCN activities for two years.

### ← PROGRESSION FROM LAB TO SMALL PILOT →



Lab Scale Unit



Bench Scale Unit



Linde-BASF 1 MWe Pilot Plant at NCCC