



Maturing 2nd Generation Technologies

Membrane Technology and Research Advanced Membrane Process

DOE/FE/NETL has sponsored highly successful second-generation technologies that will dramatically reduce CO₂ capture costs. MTR's Advanced Membrane Process is one of those technologies.

MTR Skid at Babcock & Wilcox's SBS-II Research Facility

BACKGROUND

CHALLENGE:

- CO₂ concentration in post-combustion flue gas was considered too low to provide sufficient driving force for membrane-based separation
- Permeance and selectivity of 1st generation membranes were too low for cost-effective separation of low-CO₂-concentration gases

MTR'S SOLUTION:

- Materials development efforts increased permeance by 3x while maintaining selectivity
- Innovative process design resulted in increased CO₂ concentration in membrane feed gas, enhancing driving force

SIGNIFICANT RESULTS

- ✓ **Establish Viability of Membrane-based Post-Combustion Capture**
Materials and process innovations overcome limitations of low driving force
- ✓ **Nature of Membrane Systems Provides Potential Solutions to Challenging Problems**
Inherently modular, low-cost, high-volume manufacturing; simplifies scale up



Lab/Bench-Scale Development

Initiated 2007

- Development of advanced Polaris membrane with increased permeance 10x that of existing membranes and CO₂/N₂ selectivity > 20
- Novel countercurrent sweep CO₂ recycle process design reduced the need for energy intensive compression
- 10,000 hours of stable testing at 1 tonne/day scale on actual flue gas confirmed improved permeance and selectivity



Small Pilot-Scale Testing

Initiated 2011

- Over 1,000 hours of testing at 1 MWe (20 tonnes/day) scale at the National Carbon Capture Center
- Validated countercurrent sweep process and a low pressure-drop sweep module that reduces parasitic energy losses
- Revealed effective boiler operation in the presence of recycled CO₂ to increase flue gas CO₂ concentration, reducing cost



Large Pilot-Scale Testing

Initiated 2018

- Detailed techno-economic analysis and preliminary plant design with engineering/cost estimates for construction of a 10 MWe pilot facility at the Wyoming Integrated Test Center
- Field-scale testing at Technology Centre Mongstad to demonstrate modular membrane concept for use in commercial-scale systems



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