



# 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 CO<sub>2</sub> capture costs. MTR's Advanced Membrane Process is one of those technologies.

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

## BACKGROUND

### CHALLENGE:

- CO<sub>2</sub> 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-CO<sub>2</sub>-concentration gases

### MTR'S SOLUTION:

- Materials development efforts increased permeance by 3x while maintaining selectivity
- Innovative process design resulted in increased CO<sub>2</sub> 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 CO<sub>2</sub>/N<sub>2</sub> selectivity > 20
- Novel countercurrent sweep CO<sub>2</sub> 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 CO<sub>2</sub> to increase flue gas CO<sub>2</sub> 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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