DOE/FE/NETL has sponsored highly successful second-generation technologies that will dramatically reduce CO$_2$ capture costs. MTR’s Advanced Membrane Process is one of those technologies.

**BACKGROUND**

**CHALLENGE:**
- CO$_2$ 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$_2$-concentration gases

**MTR’S SOLUTION:**
- Materials development efforts increased permeance by 3x while maintaining selectivity
- Innovative process design resulted in increased CO$_2$ 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$_2$/N$_2$ selectivity > 20
- Novel countercurrent sweep CO$_2$ 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$_2$ to increase flue gas CO$_2$ 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

**CARBON CAPTURE CONTACTS**

- John Litynski
  DOE/FE Program Manager
  202.586.8087
  John.Litynski@hq.doe.gov

- Lynn Brickett
  NETL Technology Manager
  412.386.6574
  Lynn.Brickett@netl.doe.gov

https://www.netl.doe.gov/research/coal/carbon-capture