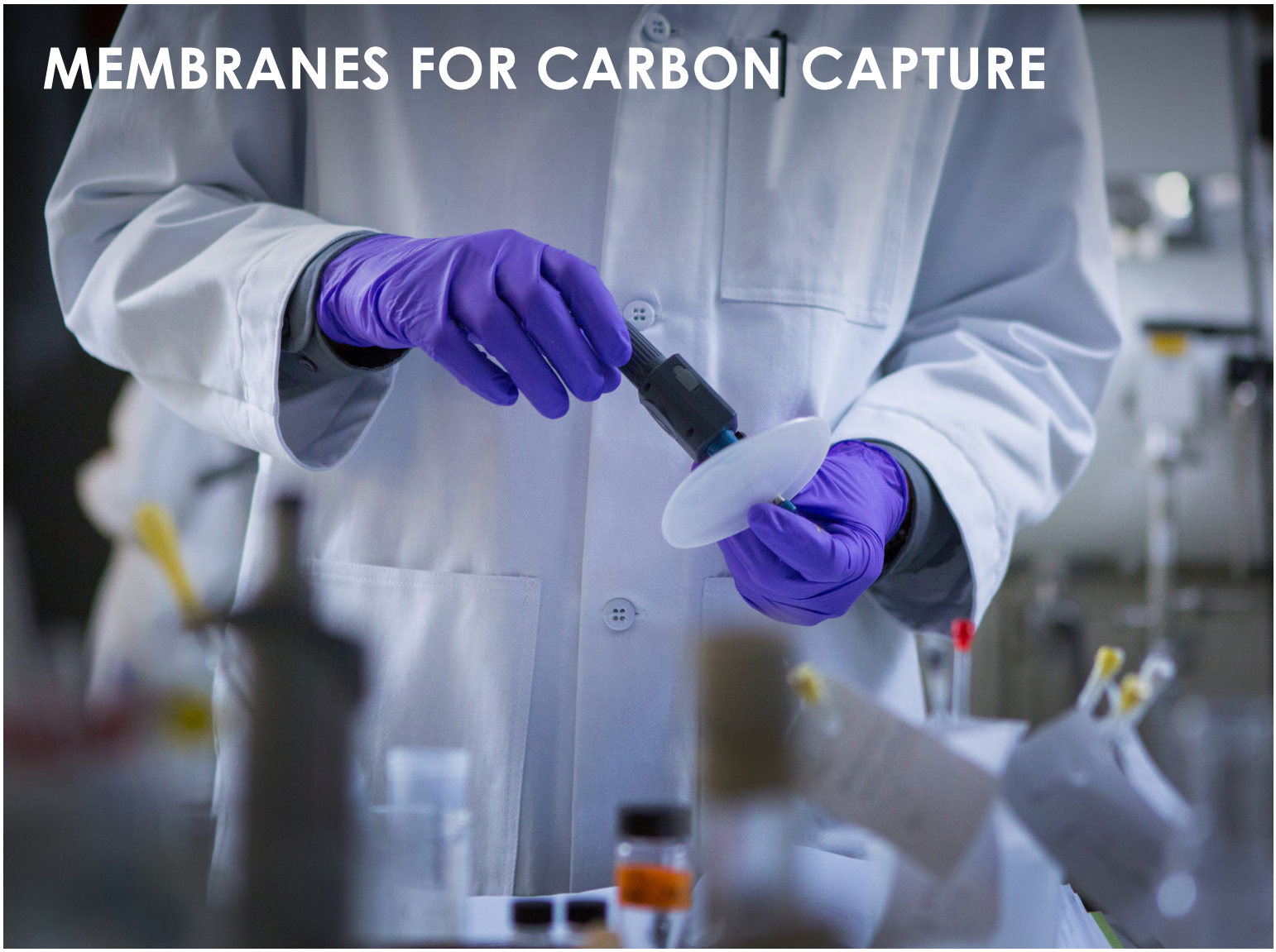
# MEMBRANES FOR CARBON CAPTURE



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

Gas-separation membranes have been studied since the 1850s, but it was not until 1980 that the first commercial polymer-based gas-separation membrane, designed to separate hydrogen from refinery waste gases, was introduced. Gas-separation membranes are an important technology for carbon capture, but current commercial membrane processes are typically limited to smaller-scale natural gas purification. NETL research is underway to develop membranes for $CO_2$ separation that have a long lifetime, high permeance and selectivity, and are composed of low-cost, easily manufactured materials.

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**Membrane-based $CO_2$ capture research within the Carbon Capture Research Portfolio** explores the development of stable transformational membranes with high $CO_2$ selectivity and permeance. Such membranes potentially offer the advantages of reduced area requirements, smaller capital cost and equipment footprint and longer life – ultimately leading to reductions in the cost of $CO_2$ capture. Further, membrane modules offer simple operation with no moving parts, high tolerance to acid gases and excess oxygen, and the ability to incorporate modular unit design, each of which reduce scale-up complications.

Research in this area is combining computational modeling, theory, and simulated and slipstream gas experimentation to predict and characterize $CO_2$ transport properties and performance and assess opportunities for technology advances within, and across, each of the following three primary platforms:

**ADVANCED MEMBRANE MATERIALS —** Research in this area uses multifaceted approaches deploying a full range of computational techniques in combination with extensive chemical and engineering experimental design to develop and synthesize novel membrane materials with superior performance in membrane permeability, selectivity, mechanical stability, and membrane lifetime.

**ADVANCED PROCESS MODELING AND EXPERIMENTATION —** Research in this area analyzes the potential for more efficient membrane modules and process schemes to reduce pressure drop and increase the driving force for $CO_2$ separation in harsh environments, considers the influence of alternative pulverized coal power plant $CO_2$-membrane process configurations and operating conditions, and examines relevant parameters such as membrane area, permeate $CO_2$ purity, and power plant efficiency.

**ENABLING TECHNOLOGY DEVELOPMENT —** Research in this area tests new membrane materials and processes on flue gas at The National Carbon Capture Center (NCCC) in Wilsonville, Alabama. The NCCC is a unique U.S. Department of Energy-sponsored research facility, managed and operated by Southern Company, focused on finding breakthroughs in next-generation carbon capture technologies to reduce greenhouse gas emissions from fossil fuel-based power plants.

The vision for this program is to develop a 21st century America that can take advantage of our nation's abundant, sustainable fossil resources while reducing atmospheric $CO_2$ emissions.

## Contacts


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