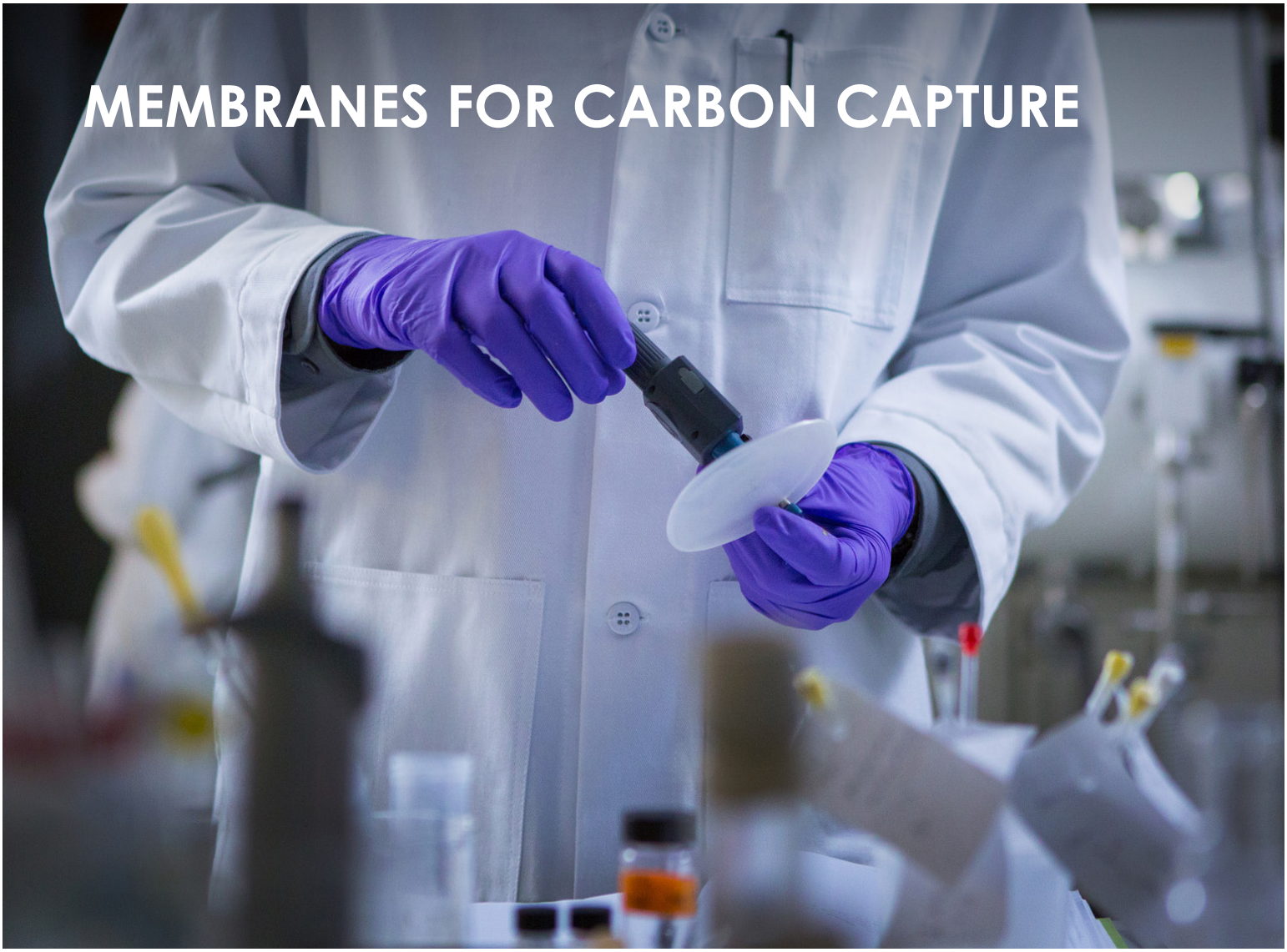
MEMBRANES FOR CARBON CAPTURE



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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.

The vision for this program is to develop a 21st century America that can make responsible use of our nation's abundant, sustainable fossil resources while reducing atmospheric CO_2 emissions as we transition to heavier reliance on renewable and alternative energy resources.

MEMBRANES FOR CARBON CAPTURE

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 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.

NETL is a U.S. Department of Energy national laboratory that drives innovation and delivers technological solutions for an environmentally sustainable and prosperous energy future. Through its world-class scientists, engineers and research facilities, NETL is ensuring affordable, abundant and reliable energy that drives a robust economy and national security, while developing technologies to manage carbon across the full life cycle, enabling environmental sustainability for all Americans, advancing environmental justice and revitalizing the economies of disadvantaged communities.

Leveraging the power of workforce inclusivity and diversity, highly skilled innovators at NETL's research laboratories in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania conduct a broad range of research activities that support DOE's mission to ensure America's security and prosperity by addressing its energy and environmental challenges through transformative science and technology solutions.

NETL lends its expertise toward achieving a carbon-free power sector by 2035 and a net-zero economy by 2050 while catalyzing economic revitalization, creating good-paying jobs and supporting workers in energy communities, especially hard-hit coal, oil and gas, and power plant communities, across the country. One of the most rewarding aspects of NETL's research is that our innovations and our technologies have the potential to improve people's lives in meaningful ways.

Contacts

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