IEAGHG Information Paper 2017-IP51; Membrane based technologies - 2017 NETL CO_2 Capture Technologies Review Meeting

In the last years, there has not been an agreement on strong advantages of membranes compared to liquid solvents for CO_2 Capture. However, emerging systems based on new configurations and materials could improve the CO_2 separation and process economy. During the 2017 NETL CO_2 Capture meeting, several presentations have shown funded projects on membrane-based technologies at different scale, lab/bench and pilot plant (see table below).

Membranes at medium TRL seems to be one of the main research areas covered by this funding framework in the past years. Those scaled-up systems could give a more accurate economic approach if those are assessed under homogeneous methodologies. As seen in the projects starting in 2017, the technologies currently prioritized are at earlier development stage.

In addition to new materials to produce advanced membranes, hybrid systems are highlighted. As seen in the table, membranes are combined with other technologies such as solvent absorption, electrochemical conversion, advanced compression or heat integration.

Nonetheless, as recent funded projects, the membrane-based research also includes techno-economic analysis (TEA) and life cycle analysis (LCA). As low-medium TRL technologies, still further tests are needed to ensure that those solutions are cheaper than traditional systems.

For more information, the project websites have been included in the table overleaf.

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Project Title	Duration	Coordinator	Info	Website
Integrated Testing of a Membrane Carbon Dioxide Capture Process with a Coal-Fired Boiler	07/01/2015 – 03/31/2018	Membrane Technology and Research Inc.	This project incorporates Polaris™ membranes and a countercurrent sweep module design, and can capture 20 tons CO_2 per day at a coal-fired power plant, what means 0.6 MWe facility	FE0026414
Pilot Test of Novel Electrochemical Membrane System for Carbon Dioxide Capture and Power Generation	10/01/2015 – 03/31/2019	FuelCell Energy, Inc.	The tests in this project will be carried out in a nominal 3-MWe equivalent pilot plant during at least two months. The consortia is using FCE's patented Combined Electric Power and Carbon Dioxide Separation (CEPACS) system	FE0026580
Zeolite Membrane Reactor for Pre-Combustion Carbon Dioxide Capture	First budget period: 10/1/2015-3/31/2017	Arizona State University	The project will demonstrate a bench-scale zeolite membrane reactor for WGS reaction of coal gasification gas for hydrogen production at 10 kW equivalent- IGCC power plant. The evaluation will be done for a 550 MW coal-burning IGCC plant with CO_2 capture.	DE-FE0026435
Sorption-Enhanced Mixed Matrix Membranes for H_2 Purification and CO_2 Capture	10/1/15 - 9/30/18	University at Buffalo	The project team will develop industrial membranes with higher H_2 permeance and carry out parametric tests with real syngas at NCCC.	DE-FE0026463
Lab-Scale Development of a Hybrid Capture System with Advanced Membrane, Solvent System, and Process Integration	10/01/2015 – 09/30/2018	Liquid Ion Solutions LLC	This project includes one hybrid technology, a two-stage CO_2 capture system, which involves a membrane and an absorption/stripping process. The heat integration is done between the absorption column and stripping column through a heat pump cycle	FE0026464
Energy Efficient GO-PEEK Hybrid Membrane Process for Post-Combustion Carbon Dioxide Capture	10/01/2015 – 09/30/2018	Gas Technology Institute - GTI	This research combines a membrane unit (ultrathin graphene oxide) with a solvent-based capture process. A hollow fiber membrane contactor (polyether ether ketone) unit to is used to capture the CO_2. (This project runs at the same time than FE0012829)	FE0026383
Novel Carbon Dioxide (CO_2)-Selective Membranes for CO_2 Capture from less than 1% CO_2 Sources	03/01/2016 – 02/28/2019	Ohio State University	This project is focused in the production of advanced membranes. The process incorporates nanoporous polymer support and a top layer coating of thin, highly-selective, permeable, amine-containing polymer membrane	FE0026919
Bench Scale Testing of Next Generation Hollow Fiber Membrane Modules	10/01/2015 – 12/31/2018	American Air Liquide Inc.	This project, based on two previous studies, aims to reach commercial scale of their combination of cold membrane operation (<20C) with an integrated CO_2 compression and purification unit	FE0026422
Bench-Scale Development of a Hybrid Membrane-Absorption CO2 Capture Process	10/1/13 - 9/30/17	Membrane Technology and Research Inc.	This projects aims to combine membrane and amine absorption/stripping technology for coal-fired power plants, including simulations and production of membranes	DE-FE0013118
Development of a Precombustion Carbon Dioxide Capture Process Using High Temperature Polybenzimidazole Hollow-Fiber Membrane	10/01/2013 – 12/31/2017	SRI International	The process includes a high-temperature stable polybenzimidazole (PBI) polymer to separate syngas at elevated into a hydrogen (H_2)-rich permeate stream and a retentate stream with high concentration of CO_2	FE0012965