Abstract

Global warming and recent climate change are often attributed to anthropogenic CO2 emissions from burning and consumption of fossil fuels. Fossil fuels supply more than 85% of the current energy consumption worldwide, and contribute in similar proportions to the anthropogenic CO2 emission. In the United States, large stationary sources such as power plants, cement production, iron and steel industries, refineries, petrochemicals, and gas processing plants emit more than 60% of the total emissions. Stationary sources are point sources with large CO2 emissions, and provide a realistic opportunity to reduce CO2 emission.

In this presentation, we will introduce a multi-scale framework for the optimal design of CO2 capture, utilization, and sequestration (CCUS) supply chain network to minimize the cost while reducing stationary CO2 emissions in the United States. The design of CCUS supply chain network requires decision making at material, process and supply chain levels. Depending on the selection of CO2 sources, utilization and/or sequestration sites, CO2 capture technologies, processes and materials used, CCUS costs vary. Key decisions involve the selection of source plants, capture processes, capture materials, CO2 pipelines, locations of utilization and sequestration sites, amounts of CO2 storage, as well as the optimization of each CO2 capture process, and the identification of the best materials. Computational results will be presented that focus on the optimized CCUS supply chain network which can reduce 50% of the total stationary CO2 emission in the U.S. at a cost of $ 35.63 per ton of CO2 captured and managed.