Sustainability Assessment of Large-Scale Carbon Capture and Sequestration Deployment Outside the System Boundaries - Opportunities and Challenges

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Mohammad Abotalib

BIO

In 2001 Mohammad received a scholarship from the Ministry of Higher Education, Kuwait to pursue his undergraduate studies at Griffith University, Brisbane, Australia. After graduation, he joined Kuwait Oil Company (KOC) as and environmental engineer and there he got exposed to several environmental problems such as air pollution, land contamination and industrial waste management. During his time at KOC, he became keenly aware of the urgency of addressing environmental challenges properly, especially for a country like Kuwait, which is highly dependent on oil.

In 2010 he received a scholarship from Kuwait University to purse his master and Ph.D. in the United Sates. In January, 2011, he started his master degree at the University of Pennsylvania and graduated in December 2012. In January 2013, he joined the Ecological Sciences and Engineering Ph.D. program at Purdue University.

Abstract

Most power generation in the United States is derived from the combustion of fossil fuels, primarily coal. As a result, greenhouse gases (GHGs) are generated, and they act to trap radiant heat from the Earth. Therefore, introducing new technologies, primarily those which deal with CO_2 capture and storage, is seen as a potential option for managing GHGs. For this reason, carbon capture and sequestration (CCS) has become a very attractive approach by several industries, including the coal-fired power industry, to reduce their GHG emissions. However, the implementation of CCS on a broad scale will require an enormous input of resources and energy, which will be used during the CCS production, installation, and operation phases.

To expand the foreseen benefits of CCS and widen it applications, CCS integration with EOR was investigated from an LCA-GIS perspective in which the CO_2 is utilized from ethanol, coal-fired, and natural gas power plants in the lower 48 states of the U.S. the results indicated that that crude oil with lower carbon intensity can be produced from EOR reservoirs that are less efficient in terms of crude recovered per ton of CO_2 injected. However, it should be acknowledged that using less efficient reservoirs would be associated with greater CO_2 supply which has a parasitic energy requirement and would in turn entail a higher cost burden.

Despite the potential that CCS have to reduce the carbon intensity of electric or transportation fuel, the existing carbon policies and the current cost of CCS deployment are not sufficient to motivate power plants to integrate CCS into their operations.