

CO₂ Capturing and Sequestration in Lebanon – A Full Cycle Assessment and Optimization towards Minimizing the Country Emissions Footprint

Kassem Ghorayeb and Sabla Alnouri, Department of Chemical & Petroleum Engineering

Houssam El-Rassy, Department of Chemistry

Joanna Doummar, Department of Geology

The Paris Agreement, a fruit of the Paris Climate Conference (2015), included limiting global warming to 2 degrees Celsius above the average global temperature of pre-industrial times, through limiting cumulative CO₂ emissions below 1100 gigatonnes of CO₂ by 2050. Among the countries that ratify this accord is Lebanon. The Government of Lebanon has declared in its Intended Nationally Determined Contribution (INDC) its intention to reduce greenhouse gas emissions by 15% by 2030 as an unconditional target and by 30% as a conditional one.

Without a systematic and detailed mapping of the current and expected future CO₂ emission sources in Lebanon in view of the potential changing energy seen, a plan for reducing emission cannot be realistic. This project aims at building this map and recommending scientifically backed and pragmatically feasible options towards minimizing the CO₂ emission footprints through sequestration or other utilization of CO₂. Below is what our multi-disciplinary research team we propose to do to address this challenge:

- Identifying and estimating current and future sources of CO₂ in Lebanon (time lapse).
- Assessing optimal capturing and gathering technologies with associated costs.
- Assessing and identifying potential structures / sites for sequestration with the associated risks and cost (onshore and offshore).
- Assessing the benefit of using CO₂ in future potential CO₂ based EOR for the upcoming oil and gas business in Lebanon.
- Assessing the applicability of the developed methodologies and workflows in other countries with similar conditions.

This project will be the seed of a bigger externally funded project. We expect that many Agencies will be interested in this project, such as EU, UNFCCC, UNDF, US-AID. Furthermore, given the “sustainability” oriented research, larger funding proposals will be prepared and submitted for research funding agencies as we progress with this project in the upcoming two years (e.g. EU). Given the multidisciplinary nature of the work and the importance of the subject, we expect that this research will lead to several publications in journals related to environment, geology, chemistry, engineering, and business. This study will be also reported to ministries and governmental agencies such as the ministry of energy, ministry of environment, ministry of industry and ministry of health.

The target is for this study to help shaping the national policies and plans with regard to emissions reduction. Furthermore, the results of this study and the methodology that the research team will establish and follow will form a benchmark for similar studies in countries with common or close conditions, such as in Saudi Arabia. The Kingdom of Saudi Arabia (KSA) has also ratified the Paris Agreement and committed, in its INDC, to take measures to reduce emissions by 130 million tons of avoided CO₂ by 2030. Safeguarding natural resources and the environment is a key national milestone in KSA. With an escalating global concern about climate change, the Oil & Gas industry will be challenged to adapt to tighter regulations and to low-emission economies. Sustaining the growth of the energy sector in KSA with low environment footprint is currently an active research area for the KAUST Team. This project will be jointly funded by MI (AUB) and KAUST. While this proposal addresses the CCS potential in Lebanon as briefed earlier, we believe that the anticipated developed methodologies and technology from this collaboration between AUB and KAUST will be applicable to a large extent in KSA. A similar project with focus on KSA will be addressed at a later stage.