

Carbon capture utilisation and storage (CCUS), a technology which can stop up to 90% of harmful emissions produced by fossil fuels from entering the atmosphere, could be a boon for oil and gas-reliant GCC economies vulnerable to the impacts of climate change. Saudi Arabia, the UAE and Qatar have taken steps to research and deploy the technology on a limited basis, but large-scale adoption faces many challenges, including high capital costs, low technical readiness and underdeveloped regulatory frameworks

Gulf Monitor | Aisha Al Sarihi | Carbon capture technology

Oil price volatility and global initiatives to cut carbon emissions, especially those sourced from fossil fuel combustion – oil, gas and coal – pose a dual challenge to the countries of the GCC, whose economies are still heavily reliant on oil revenues.

Similar to impact of the oil-price slump post 2014, global initiatives to cut greenhouse gas emissions through policies aimed at reducing fossil fuel consumption could impose direct economic losses on GCC states by reducing demand for oil exports, their main source of income.^[1]

Trade partner	Emissions reduction target (intended nationally determined contribution)
EU	40% below 1990 levels by 2030
Japan	26% by fiscal year 2030 from 2013 levels
India	Reduce carbon intensity by 33-35% by 2030, compared to 2005 levels Increase the contribution of non-fossil-fuel-based power generation capacity to 40% by 2030
China	Reduce carbon intensity by 60-65% by 2030, compared to 2005 levels

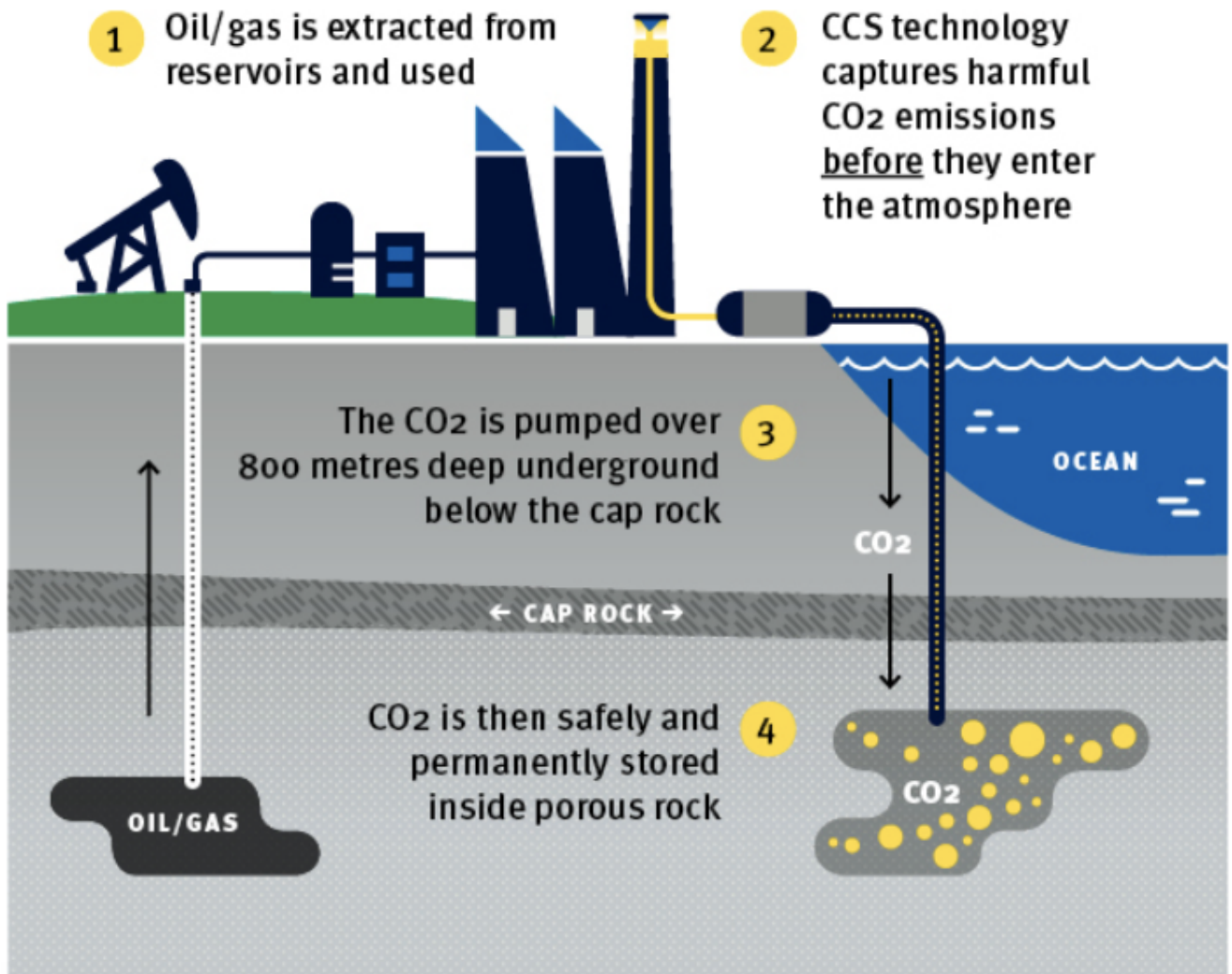
With the aim of limiting their vulnerability to fluctuations in oil prices GCC states have focused on maximising the value of the oil they produce through expanding energy-intensive chemical and

petrochemical downstream industries, as the easiest route to economic diversification. If not managed properly, this process will contribute to the region's rapidly expanding carbon footprint: climate-related greenhouse gas (GHG) emissions have increased by 6% on average each year,^[2] and the GCC is the world's biggest emitter of GHG emissions on a per capita basis, largely as a result of population growth and energy consumption.

How it works: capturing – and utilising – carbon

CCUS technology could allow GCC countries to continue maximising the value of their hydrocarbons assets while cutting carbon emissions responsible for climate change.

CCUS allows access to fossil fuel reserves while preventing at least 85-90% of carbon emissions from entering the atmosphere. The captured carbon can then be stored in geologic reservoirs, such as deep saline formations or depleted natural gas reservoirs, or it can be utilised in depleted oil reservoirs with potential for enhanced oil recovery (EOR).



Source: Imperial College London Sustainable Gas Institute (2016).

In addition to the environmental benefits of taking carbon out of the air, utilising CCUS in EOR is an attractive option for the Gulf Arab states, as it will enable them to produce more oil for export and, at the same time, free up natural gas used to maintain pressure in oil reservoirs for use in meeting domestic energy demands – especially for power generation, water desalination and petrochemical industries.

Captured carbon can also be used to produce other useful products such as methanol, urea (for use as fertiliser) or polymers (for use as durable products in buildings or cars).^[3] The sectors with the

biggest potential for carbon utilisation – industry and power followed by transportation^[4] – are major emitters of carbon in the GCC. Deploying CCUS in these sectors offers an economic opportunity, wherein the sectors are linked along the energy value chain, i.e. from production, to transmission and consumption, in order to enable the circular flow of carbon. This could create new market opportunities for private investors as well as small and medium-sized enterprises.

CCUS pioneers – Saudi, UAE, Qatar

The bulk of research and investment in CCUS has been undertaken by Qatar, Saudi Arabia and the UAE. At present, their interest in the technology has focused on developing research initiatives as well as large-scale commercial projects, mainly for EOR.

Qatar has established a 10-year, \$70m Qatar Carbonate and Carbon Storage Research Centre in collaboration with Imperial College London, which aims to advance research in the feasibility of CCUS for EOR and storage of CO₂ in local geological formations.^[5] The project is funded by Qatar Petroleum, Shell and the Qatar Science and Technology Park, as part of Qatar Foundation. Earlier this year, the country commissioned a CCUS facility at Ras Laffan, which has the capacity to capture and store 2.1m tonnes of CO₂ per year and plans to use some of the captured CO₂ for EOR. ^[6]

Saudi Arabia's interest in CCUS goes back to 2005, when it joined Carbon Sequestration Leadership Forum, which was established to improve the efficiency, and reduce the cost, of the CCUS technology. For the same purpose, Saudi Arabia also joined the Clean Energy Ministerial and Mission Innovation in 2015 and was one of the founders of the Oil and Gas Climate Initiative^[7] – a voluntary group for CEOs, who represent 30% of global oil and gas production and collaborate to find climate solutions for oil producing countries. Currently, there are two CCUS plants in Saudi Arabia: the Uthmaniyah CO₂-EOR Demonstration Project, whose purpose is to aid oil recovery in the Ghawar oilfield, and the Jubail CO₂ to Chemicals plant, developed by Saudi Basic Industries Corporation, which has the capacity to cut 500,000 tonnes of CO₂ per year and use CO₂ to produce methanol and urea. Several institutions in Saudi Arabia are also engaged in CCUS research, including the King Abdulaziz City for Science and Technology, the King Fahd University of Petroleum & Minerals, King Abdullah University of Science and Technology, Saudi Aramco, and King Abdullah Petroleum Studies and Research Centre.^[8]

The UAE's first CCUS plant became operational in 2016, led by [Al Ryadah](#), which is a joint venture between the Abu Dhabi National Oil Company (ADNOC) and Masdar. Located in Musaffah, Abu Dhabi,

the project aims to capture CO₂ emitted from the Emirates Steel factory and transfer it to ADNOC's oil fields in Rumaiitha and Bab for EOR.^[9]

Prospects for CCUS adoption uncertain

CCUS offers potential for oil producing GCC countries to access their fossil fuel resources and maintain economic growth, while minimising the environmental impact. However, deployment of the technology is still slow across the region and faces many challenges.

At present, only the super-rentier states, i.e. Qatar, UAE and Saudi Arabia, have been able to adopt it. Scaling up the use of CCUS is difficult: a study conducted to elicit stakeholder opinions regarding the role of CCUS in Saudi Arabia's energy future showed that high capital costs followed by a lack of technical readiness and carbon pricing, and underdeveloped regulatory frameworks were perceived as the most challenging factors for large-scale CCUS adoption.^[10]

To tackle such financial, technical and regulatory challenges, GCC states could benefit from enhancing regional governance and cooperation, or partner with global CCUS-related coalitions in order to jointly fund CCUS research and development; enable exchange of know-how and capacity building; and promote regional regulatory frameworks such as carbon trading schemes.

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