

Strategic Investment in CCS and CCUS:

Enhancing Sustainability and Competitiveness of Gulf Oil and Gas Producers in a Transitioning Global Market



Lenora Dsouza and Riwa Hassan



منتدى الخليج
Gulf International Forum

Copyright © 2026 Gulf International Forum

All rights reserved. No part of this publication may be reproduced, copied or distributed in any form or by any means, or stored in any database or retrieval system, without the express prior written permission of Gulf International Forum. No part of this publication shall be reproduced, modified, transmitted, distributed, disseminated, sold, published, sub-licensed, or have derivative work created or based upon it, without the express prior written permission of Gulf International Forum. If you wish to reproduce any part of this publication, please contact Gulf International Forum, at the address below, providing full details.

GULF INTERNATIONAL FORUM

gulfif.org

info@gulfif.org

Gulf International Forum does not take institutional positions on public policy issues; the views represented herein are the authors' own and do not necessarily reflect the views of GIF, its staff, or board members. All materials found in this publication have been prepared for informational purposes only. The information herein is provided without any representations or warranties, express or implied, regarding the completeness, accuracy, reliability, suitability or availability with respect to the publication or the information, products, services, or related graphics contained in the publication for any purpose. In no event will GIF be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this publication.

The Gulf Studies Symposium (GSS) stands as an annual gathering committed to advancing the depth of knowledge about the Gulf region. Our overarching mission revolves around the promotion of high-caliber scholarship and the facilitation of insightful analysis. We achieve this by meticulously orchestrating a series of workshops, with the ultimate aim of bringing forth publications that contribute to the academic discourse on the Gulf.

Our approach to achieving comprehensive discourse is characterized by a deliberate pursuit of diversity among our participants. We actively seek the engagement of a broad spectrum of experts, meticulously curating a blend of both emerging talents and esteemed, established scholars. This intentional balance in our selection process ensures a rich and multifaceted exploration of the Gulf region, fostering a dynamic exchange of ideas and perspectives.

Table of Contents

1	About the Authors	1
2	Executive Summary	2
3	Introduction	5
4	Current and Upcoming CCS Initiatives in the Gulf	7
	Saudi Arabia	7
	United Arab Emirates	7
	Qatar	8
5	Policy Road Map for CCS/CCUS in the Gulf	11
	Road Map for CCS/CCUS	11
	Short-Term (2030-2035)	11
	Medium-Term (2035-2045)	13
	Long-Term (2045 and Beyond)	14
6	Regulation for Policy Success	17
7	Conclusion	21
8	Bibliography	23

About the Authors



Riwa Hassan

Riwa Hassan is a graduate researcher at the Sciences Po Paris School of International Affairs and Columbia University's School of International and Public Affairs, focusing on international energy policy and international economics and finance, with a specialization in data analytics. She also serves as Chief of Staff to the RAISE Summit, a leading global AI event. She has experience working with multilateral institutions and industry stakeholders on energy, artificial intelligence, and sustainability issues, and is particularly passionate about bridging energy policy with technological and investment-driven innovation. Her research connects strategic analysis with applied policy and financing frameworks for innovation in resource-rich economies.



Lenora Dsouza

Lenora Dsouza is a Master's student at Sciences Po Paris, where she studies Economic Law. Her research interests focus on energy policy and regulation, and she aims to build a career at the intersection of law and energy.

Executive Summary

In recent years, Gulf governments have taken significant steps to address the urgent challenges of climate change while attempting to sustain the economic benefits of their hydrocarbon industries. Among the tools available to balance reduced emissions with continued energy production, carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS) have emerged as key pillars in national decarbonization strategies. This report offers a Gulf-centric perspective on the deployment of CCS/CCUS technologies across the Gulf Cooperation Council (GCC), with a focus on the policy enablers needed to transition from pilot projects to large-scale implementation.

The Gulf Cooperation Council is uniquely positioned to lead in CCS development, given its:

- High CO₂ emissions from low-cost capture industries such as natural gas processing, petrochemicals, and fertilizers
- High-purity CO₂ sources and substantial storage capacity in depleted reservoirs and saline aquifers
- Competitive cost advantage in CCS and CCUS implementation, with decreasing costs and a lower cost base compared to other regions

Coupled with the rise of “blue hydrogen” (hydrogen produced from natural gas and therefore not “green”), CCS/CCUS offer significant economic opportunities for the Gulf, including the creation of thousands of jobs, the protection of existing positions, and the decarbonization of its industrial sector. These technologies help maximize future oil and gas production, while also repurposing existing uses of oil and gas for export. By leveraging these advantages, Gulf countries have the potential to emerge as global leaders in the production and export of low-carbon hydrogen and commodities. They also hold promise for deploying carbon removal technologies like Direct Air Carbon Capture and Sequestration (DACCS) in the long term, reinforcing their environmental commitments.

Nevertheless, the large-scale deployment of CCS/CCUS in the Gulf faces significant hurdles—particularly regulatory uncertainty and the absence of strong domestic drivers such as robust business models and effective incentive schemes. For CCS/CCUS to succeed, governments must provide subsidies and decouple risks through separate models for capture, transport, storage, and utilization. An established carbon pricing mechanism and a system of incentives and penalties—carbon credits, for instance—are also essential to drive adoption and ensure economic feasibility. Otherwise, the gap between national pledges and operational capacity will continue to widen.

This report focuses on strategies to optimize CCS/CCUS facilities and investments to reduce greenhouse gas emissions, enhance efficiency, and maintain the competitiveness of Gulf oil and gas producers. Tailored approaches that reflect the unique economic and energy contexts of Gulf countries are critical for managing the transition from heavy reliance on oil and gas to a more diversified energy landscape.

Strategic developments are, nonetheless, underway. Saudi Arabia's planned CCS hub at Jubail, the UAE's Al Reyadah and Habshan projects, Qatar's integration of CCS into its LNG expansion, and Oman's innovation in mineralization through startup 44.01 highlight the region's ambition to incorporate CCS/CCUS initiatives into its national plans. However, without comprehensive policy frameworks, clear incentives, and robust investment pipelines, CCS/CCUS will remain a peripheral solution rather than a transformative force in the energy transition.

This report draws on expert analysis, data, and international best practices to offer a series of targeted policy recommendations. It calls for regulatory harmonization across the Gulf, expanded public-private partnerships, cross-border infrastructure planning, and greater alignment with global carbon markets. A roadmap for short-, medium-, and long-term CCS/CCUS development is also provided, detailing how the GCC can leverage existing capacities to secure climate resilience, industrial competitiveness, and economic diversification.

The successful deployment of CCS/CCUS in the Gulf is not merely a technological imperative but a strategic opportunity. If scaled effectively, these technologies can reinforce the Gulf's position as a global leader in low-carbon energy and carbon management solutions.

Policy Recommendations

Short-Term Priorities (2030–2035): Foundation and Activation

- Execute and develop the announced CCS/CCUS projects to confirm their alignment with national goals.
- Enable monetization of CO₂ use, especially for enhanced oil recovery (EOR) and industrial uses, to establish commercial feasibility.
- Invest in digital CO₂ monitoring and data infrastructure, promoting traceability, compliance, and public trust.
- Develop innovation ecosystems, such as R&D grants, accelerators, and public-private consortia to create Gulf-based CCS/CCUS technologies.
- Scale up certification mechanisms through regional platforms such as the Global Carbon Council to bring in international investors through voluntary carbon markets.

Medium-Term Priorities (2035–2045): Integration and Expansion

- Develop a GCC-wide integrated CO₂ transport and storage network underpinned by GIS mapping, AI-powered monitoring, and cross-border planning.
- Establish a Gulf CCUS Investment Fund to fund startups and scale-ups, developing a local CCS/CCUS industry.
- Connect CCUS with blue hydrogen value chains, making the Gulf a major exporter of low-carbon fuels in the global energy transition.
- Establish a GCC carbon credit marketplace, in harmony with international standards, to increase liquidity and draw in private capital.

Long-Term Objectives (2045 and Beyond): Global Leadership and Trade Expansion

- Scale up net-negative technologies like Direct Air Capture and Storage (DACCS) and CO₂ mineralization (e.g. Oman's 44.01 model).
- Position the Gulf as a global CCS/CCUS service provider, providing capture, storage, and monitoring services to other nations.
- Develop regional CO₂ transmission infrastructure and harmonized regulations for cross-border CO₂ transport, including third-party access.
- Export Gulf CCS/CCUS technology to emerging markets.
- Enhance integration with international carbon markets, bringing stability and credibility to global emissions trading regimes.

Introduction

The Gulf region stands at a critical inflection point. Prior to the 2008–2009 financial crisis, the GCC states experienced unprecedented prosperity, buoyed by the soar of oil prices to nearly \$200 per barrel in mid-2008.^[1] Optimistic assumptions about sustained growth shaped government and business strategies—only for this sense of optimism to abruptly dissipate as oil prices plummeted to less than \$50 per barrel by 2014.^[2]

This decline was driven by global developments such as the rise of U.S. shale oil and OPEC's decision to maintain high production levels. The COVID-19 pandemic in 2020, and later Russia's invasion of Ukraine in 2022, further exacerbated this volatility, exposing the fragility of oil-dependent economies and emphasizing the urgent need for diversification and resilience.

The need for a low-carbon future is increasingly underscored by international agreements and initiatives aimed at addressing climate change and reducing greenhouse gas emissions. According to the Paris Agreement, to limit global warming to no more than 1.5°C by 2100, emissions must be reduced by 45 percent by 2030 and reach net zero by 2050.^[3] While the Gulf states have established and funded megaprojects to work in this direction, it seems that their commitments will be challenging to uphold. According to the United Nations, if countries merely uphold their current carbon-cutting commitments rather than

enacting more ambitious ones, global temperatures will increase by 2.6°C to 2.8°C by 2100—well beyond the 1.5°C threshold envisaged by the UN to prevent a major environmental catastrophe.^[4] Conversely, a milder future—1.9°C—is possible if these countries proceed to follow through on their existing net-zero pledges as per the Emissions Gap Report.^[5]

International gatherings such as the annual Conference of Parties (COP) climate summit have amplified the global urgency for energy transitions. With these events, major economies have pledged to eliminate fossil fuel subsidies, accelerate renewable energy adoption, and expand carbon capture, utilization, and storage (CCS and CCUS) technologies. At COP27, a particular emphasis was placed on the climate-related vulnerabilities of oil-dependent economies, and the need for these countries to align their national policies with global decarbonization goals.^[6] One year later, COP28 marked the first time "low-carbon" solutions were widely addressed, signaling a shift from an exclusive focus on "green" fuels to the inclusion of "low-carbon" fuels and derivatives as key elements of the energy transition.^[7]

Today, with increasing climate-related challenges and a shift in global energy markets toward cleaner sources, Gulf countries stand at a pivotal juncture. Despite some progress, heavy reliance on hydroc-

arbons continues to leave these economies vulnerable to external shocks. Addressing these challenges demands investing in a transformative approach. In this context, Carbon Capture and Storage (CCS) and Carbon Capture, Utilization, and Storage (CCUS) technologies emerge as essential tools for reducing emissions without compromising energy security or revenue generation.

The Gulf region is particularly well-suited for CCS deployment due to its high concentration of CO₂ emissions from natural gas processing, petrochemicals, and fertilizers—sectors where CCS and CCUS can be implemented at relatively low cost. Additionally, the region benefits from abundant geological storage capacity in depleted reservoirs and saline aquifers, making CCS potential significantly cheaper than in other regions such as Europe—though it remains costly on a global scale. By integrating CCS and CCUS into their industrial strategies, Gulf countries can decarbonize key sectors, retain jobs, and repurpose existing hydrocarbon infrastructure to support low-carbon energy exports.

While the Gulf holds real potential to become a leader in the CCS field, large-scale CCS adoption faces significant obstacles—primarily due to the lack of strong domestic incentives, clear business models, and supportive regulatory frameworks. To achieve their National Climate Action plans in the coming years, governments must introduce innovative and effective roadmaps to en-

sure a smooth transition towards incorporating CCS and CCUS strategies. More importantly, government initiatives alone are insufficient to drive large-scale adoption; private sector participation and partnerships are vital for success. Without these measures, the full potential of CCS and CCUS technology will remain underutilized.

This report explores how Gulf countries can strategically deploy CCS and CCUS to enhance sustainability, maintain global competitiveness, and shape a pragmatic pathway to net-zero carbon emissions. It draws on regional case studies, maps emerging investments, and offers policy recommendations to enable scalable deployment. While the region's renewable energy goals are crucial, CCS and CCUS offer an immediate and feasible route to industrial decarbonization, blue hydrogen production, and circular carbon economy development.

Current and Upcoming CCS Initiatives in the Gulf

There are currently three CCS facilities in the Gulf, which have a collective carbon capture capacity of 3.7 MtCO₂/yr.^[8] Hosted in Saudi Arabia, the United Arab Emirates, and Qatar, these facilities are re-integrated into natural gas processing and steel industries, using the carbon largely for enhanced oil recovery (EOR) and, increasingly, for blue ammonia and blue hydrogen production. Collectively, the three facilities account for roughly 8 to 10 percent of known global CCS/CCUS capacity.

Saudi Arabia

By 2035, Saudi Arabia plans to achieve a carbon capture capacity of 44 MtCO₂/yr. To achieve this goal, Riyadh adopted the Circular Carbon Economy (CCE) model, which provides a specific national framework that integrates CCS/CCUS into a broader emissions management strategy. The CCE approach emphasizes four pillars: Reduce (via greater energy efficiency), Reuse (using CO₂ in EOR or products), Recycle (converting CO₂ into fuels and chemicals), and Remove (geological storage via CCS or afforestation). Under this plan, CCS/CCUS plays a vital role in both the "Remove" and "Reuse" pillars.^[9]

Uthmaniyah CO₂ in Saudi Arabia is an EOR facility with an annual carbon capture capacity of 0.8Mt-

CO₂/yr. Since 2015, CO₂ has been processed and dehydrated from the Aramco's Hawiyah natural gas liquids (NGL) plant and subsequently transported via an 85km pipeline for injection into the giant Ghawar oil field. The Kingdom has launched numerous initiatives under the CCE framework, including major CCS/CCUS projects like the Jubail Industrial City CCUS Hub, which is expected to become one of the largest CCS/CCUS hubs worldwide. Led by Saudi Aramco in partnership with Linde and SLB, the first phase includes capturing CO₂ from Jubail clusters and transporting it via a new >200km pipeline network for permanent storage in an onshore saline aquifer. Similarly, SABIC's facility in Jubail captures 500,000 MtCO₂/yr from a petrochemical plant, which is then converted into industrial chemicals, including methanol and urea. This hub is a cornerstone of Saudi Arabia's 2035 national CCS target and is directly linked to plans for blue hydrogen production.^[10]

United Arab Emirates

In the UAE, ADNOC aims to expand its CCS capacity to 10 MtCO₂/yr by 2030. The long-term strategy envisions CCS providing 32 percent of industrial decarbonization by 2050 (43.5 MtCO₂/yr). The UAE's main CCUS project, Al Reyadah, was launched in 2016; it captures 0.8

MtCO₂/yr from the Emirates Steel industrial facility in Abu Dhabi, representing the world's first commercial-scale CCS project capturing CO₂ from the iron and steel industry. The CO₂ is then transported by pipeline for EOR injection in ADNOC's onshore oil fields.^[11]

The Habshan CCUS Project, which received a Final Investment Decision (FID) in October 2023, is expected to triple the UAE's current carbon capture capacity to 1.5 MtCO₂/yr. Based at the Habshan gas processing complex, the project will utilize Shell's Cansolv post-combustion capture technology to accomplish this goal.^[12] The captured CO₂ will then be transported via pipeline for permanent geological storage. Other planned initiatives include Hail and Ghasha Gas Development, an off-shore sour gas project with CCS incorporated as an integral part of its design, and the TA'ZIZ Blue Ammonia Project, a world-scale blue ammonia facility in Ruwais with an estimated CCS capacity of 0.8 MtCO₂/yr. The UAE is also exploring partnerships with Santos to develop a joint global carbon management platform^[13] and with Occidental Petroleum (Oxy) to evaluate investment opportunities in DAC projects in the UAE and the United States.^[14]

Qatar

Qatar's Ras Laffan CCS Facility, which has been operational since 2019, is integrated with the Liquefied Natural Gas (LNG) production complex in Ras Laffan Industrial City and captures between 2.1 and 2.2

MtCO₂/yr from the natural gas feed stream prior to liquefaction.^[15] The captured CO₂ is compressed and injected into saline aquifers instead of being used for EOR. Qatar's national objective is to achieve 11 MtCO₂/yr storage by 2035. This target will be made possible through QatarEnergy's integration of CCS in its multiphase expansion of the North Field, the largest gas field in the world. This positions Qatar's CCS project as one of the largest global CCS initiatives within the LNG industry. QatarEnergy's new LNG trains will have 25 percent less greenhouse gas (GHG) emissions intensity when compared to similar facilities without CCS.

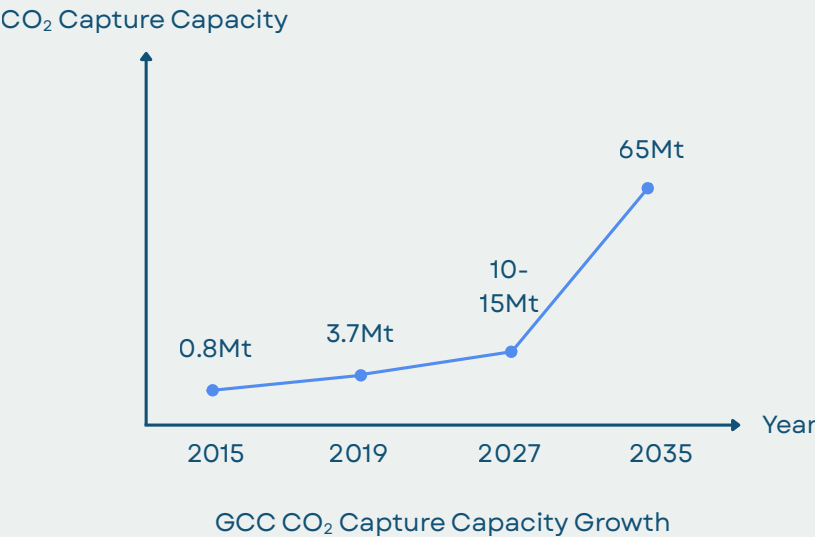
The strategic decision by major Gulf producers like Saudi Arabia, the UAE, and Qatar to pursue large-scale CCS/CCUS hubs reflects a calculated approach to deployment. By concentrating infrastructure—pipelines, compression facilities, injection wells, and monitoring systems—in the areas where CCS is most needed, these hubs aim to capture economies of scale. Additionally, their phased strategies allow National Oil Companies to manage risk effectively and limit financial uncertainties during early implementation stages. Correspondingly, initial phases serve as large-scale demonstration and de-risking exercises, providing invaluable operational experience and validating geological models before committing further capital.

Despite these promising developments, current capture capacities

remain significantly below national and regional targets (as shown in graph two) highlighting the considerable gap that still needs to be addressed to meet long-term climate and decarbonization goals in the region.

While the Gulf states’ national ambi-

tions are bold, their actual capture capacity falls well short of their stated targets. Bridging this gap requires stronger policy coordination, cross-border infrastructure, and carbon market incentives—especially if these hubs are to drive regional decarbonization rather than merely deliver narrow domestic gains.



Graph 1 (Source: Goldman Sachs)

According to the Global CCS Institute’s database, CCS projects in the GCC are as follows:

Name	Facility Category	Facility Status	Location	Operational (or Projected Operational)	Industry
ADNOC DAC	Commercial CCS Facility	Early Development	United Arab Emirates	Under Evaluation	–
ADNOC Natural gas processing plant	Commercial CCS Facility	Cancelled	United Arab Emirates	2025	Natural Gas / LNG

ADNOC Rabdan Blue Ammonia	Commercial CCS Facility	Advanced Development	United Arab Emirates	Under Evaluation	Hydrogen / Ammonia / Fertilizer
Gulf Cryo MEG Plant	Utilization Facilities	Operational	Saudi Arabia	2023	Chemical
Jubail United CCU	Utilization Facilities	Operational	Saudi Arabia	2015	Chemical
Fertil Fertiglobe	Pilot and Demonstration CCS Facility	Operational	United Arab Emirates	2024	Hydrogen / Ammonia / Fertilizer
ADNOC Al- Reyadah	Commercial CCS Facility	Operational	United Arab Emirates	2016	Iron and Steel
ADNOC Ghasha Concession Fields	Commercial CCS Facility	Under Construction	United Arab Emirates	2028	Natural Gas / LNG
ADNOC Habshan	Commercial CCS Facility	Under Construction	United Arab Emirates	2026	Natural Gas / LNG
Alba Aluminium Bahrain	Commercial CCS Facility	Advanced Development	Bahrain	Under Evaluation	Aluminum

Saudi Aramco Jubail Hub	Commercial CCS Facility	Advanced Development	Saudi Arabia	2027	Natural Gas / LNG
SNOC Sharjah	Commercial CCS Facility	Early Development	United Arab Emirates	Under Evaluation	CO ₂ Transport / Storage
Saudi Aramco Uthmaniyah	Commercial CCS Facility	Operational	Saudi Arabia	2015	Natural Gas / LNG

Table 1

Policy Roadmap for CCS/CCUS in the Gulf

A phased CCS/CCUS roadmap provides an effective strategy to achieve national emissions goals, diversify energy exports, and position the region as a global leader in climate technologies. Below is a three-phase policy roadmap aligned with strategic action areas and institutional readiness.

Road Map for CCS/CCUS

To advance CCS/CCUS, the GCC must focus on two pillars:

- Policies and Regulations
- Investments and Incentives

Short-Term (2030-2035).

- Scale announced projects and finalize CCS business models.
- Introduce carbon contracts for difference (CCfDs).

- Create digital CO₂ monitoring systems.
- Launch regional CCS/CCUS data platform.

In the short term (within 5 to 10 years) the GCC should implement and announce more projects to achieve the carbon targets that are yet to be claimed. As this paper has outlined, Saudi Arabia, the UAE, and Qatar have set ambitious targets for CCS/CCUS, which current and planned projects alone will not be sufficient to reach. With increased CCS/CCUS deployment, many jobs can be safeguarded while also freeing up more resources for exports, including blue hydrogen and other low-carbon products like petrochemicals and steel.

The three deployed projects, along

with upcoming facilities, should continue to increase captured CO₂ in EOR, increasing the monetization of CO₂ utilization and extending the productive life of the oil fields. This could be achieved through joint ventures in which CCS and CCUS are integrated into upstream oil and gas production. However, given that CO₂ would eventually be emitted again, this brings up another debate on whether such a process could truly be considered “decarbonization” under international standards.

The Gulf currently lacks the extensive direct financial support mechanisms or high carbon prices that significantly de-risk CCS investments elsewhere. Governments within the GCC need to recognize that outside of EOR or specific low-cost applications, CCS often requires financial support to be commercially viable. Gulf governments should evaluate and implement targeted incentives appropriate for the regional context. Moreover, they should leverage climate finance from the private sector and international funds through green bonds, concessional loans, interest subsidies, and international CCS/CCUS funds. Such financial instruments would incentivize foreign direct investment (FDI) in CCS/CCUS from international energy companies and tech firms. Environment, social, and governance (ESG) criteria are increasingly shaping financial markets by prioritizing capital allocation to companies with high-level sustainability and decarbonization strategies. For instance, the EU’s Sustainable Finance Disclosure

Regulation (SFDR)^[16] and the American Securities and Exchange Commission’s (SEC) Climate Risk Disclosure^[17] rules require vigorous climate-risk and carbon footprint reporting, pressuring investors towards low-carbon capital. Further integrating CCS/CCUS within domestic companies in the region would increase their credit ratings and decrease borrowing costs from international financial institutions and asset managers. GCC countries should also contribute to funds like the World Bank Multi-Donor Carbon Capture and Storage Capacity Building Trust Fund^[18] to position themselves as leaders within the sector.

On the other hand, the Global Carbon Council—the first international carbon credit and sustainable development program based in the Global South that^[19] operates under a voluntary carbon market model—should also produce CCS and CCUS certifications. These certifications would serve as a central tool to attract investors, monetizing carbon capture and utilization in the region.

Domestically and globally, the GCC should not only increase investments in projects but also in research and development, with the intention of reducing the costs of efficient CCS/CCUS hubs and advancing related technologies and facilities. The region must scale up its CCS/CCUS projects to include the hard-to-abate industrial sector—particularly in cement manufacturing and steel and aluminum production—building on the UAE’s AI

Reyadah model. This paper demonstrates the huge potential that CCS/CCUS has within those sectors. To ensure effectiveness, carbon capture should be integrated within the value chain, either through retrofitting or as a requirement for new projects. CO₂ captured from ammonia, methanol, and olefin production can be stored or converted into low-carbon products such as carbon-neutral fuels and CO₂-based polymers, which in turn could be exported to increase revenues. To incentivize these projects, GCC countries should encourage industry-driven consortia to share resources, while also giving these companies access to state-owned transportation, storage, and utilization infrastructure.

Lastly, offshore carbon sequestration projects have great potential, especially in areas close to Qatar's LNG hubs and Abu Dhabi's oil fields. Norway's Northern Lights initiative—the world's first cross-border CO₂ transport and storage facility—serves as a model, storing 1.5 million tonnes of CO₂ per year in offshore reservoirs as of 2024.^[20]

Medium-Term (2035–2045)

- Build GCC-wide CO₂ pipeline and storage network.
- Establish Gulf CCUS Investment Fund.
- Integrate CCS into hydrogen export value chains.
- Support CCS-enabled exports (steel and chemicals) via carbon-adjusted trade.

In the medium term (within 10 to 20 years) the GCC must establish a clear, accessible database and a digital monitoring instrument outlining and mapping all transport facilities and potential sites across the member states. The database must also include clear indications of required investments and return on investment (ROI) to understand bankable capacity, as well as information on industrial clusters of CO₂ emissions, including their volumes and purity values. This could be done through GIS-based mapping and spatial analysis. Artificial Intelligence and machine learning could further enhance this process by optimizing CO₂ injection and storage, predicting maintenance schedules of CCS/CCUS infrastructure, and identifying investment trends.

In addition to increasing data collection, the GCC should introduce a GCC-wide fund for carbon capture. This fund would aid startups in the private sector to specialize in CCUS capabilities, opening up opportunities for young talents to prove their capacity in the field and fostering a CCS/CCUS innovation ecosystem through incubators and accelerators. With the right educational and innovative campaigns, these companies could further attract international funding. Encouraged advancements within early and mature ventures would also help build technological CCS/CCUS hubs, reducing dependency on foreign technology and opening a market for GCC-produced CCS/CCUS technology to the globe.

Given their geological potential, several GCC countries should also pursue carbon capture as a service that could be sold to neighbouring countries, helping them on their decarbonization journeys. OGCI and AFRY estimate new market opportunities in hydrogen export and CO₂ storage services to contribute \$15.5 to \$22 billion in gross added value to the GCC by 2050, supporting between 87,300 and 245,000 jobs. At the global level, CCS/CCUS deployment is essential for the GCC, as it can help reduce the risk of declining global oil and gas demand while supporting international climate targets. If the GCC earnestly pursues CCS/CCUS innovation, it could become the global leader in the industry—driving greater innovation, increasing its capacity to export technological advancements worldwide, and generating significant financial benefits. However, to achieve this goal, carbon credits will be a vital incentive for investment in carbon capture projects.

It is also essential to strengthen the integration of CCS/CCUS in the production of blue hydrogen for export. As climate goals approach their deadlines, the global demand for hydrogen as an alternative fuel will increase, consequently increasing its price.

Blue hydrogen allows GCC countries to leverage their vast, low-cost natural gas reserves and developing CCS capabilities to produce a low-carbon energy carrier suitable for domestic decarbonization and, crucially, for export to meet anticipated

global demand. It offers a pathway to diversify energy exports beyond traditional oil and gas, while also utilizing existing resource endowments.

GCC countries have already positioned hydrogen production at the heart of their decarbonization agendas. Therefore, increasing CCS and CCUS capabilities are essential to achieving these targets and ramping up hydrogen exports. While the Gulf likely holds a cost advantage in blue hydrogen production globally due to its cheap gas, the competitive landscape is dynamic, with the costs of renewable energy and electrolyzers falling rapidly worldwide—developments that directly affect the cost of green hydrogen. To capitalize on a limited window of opportunity, regional producers need to move fast to develop large-scale, integrated blue hydrogen and CCS projects, secure long-term offtake agreements with international buyers, and aggressively pursue cost optimization across the value chain—from gas production and reforming to CCS, hydrogen transport, and conversion.^[21]

Long-Term (2045 and Beyond)

- Expand DACCS and mineralization capacity.
- Create GCC-branded CCS technology export hub.
- Offer CCS-as-a-service to neighboring states.
- Contribute to international CCS carbon markets.

In the long term, the GCC should invest in Direct Air Capture and Car-

bon Storage (DACCS) to extract CO₂ directly from the air through chemical processes, storing the captured carbon or using it for industrial applications such as synthetic fuel. DACCS could be powered by renewable energy, especially solar in the GCC. This technology is one of the few net-negative emissions tools, and positions the GCC to become a pioneer in its deployment. However, early full-scale DACCS plants—expected online by 2030—are projected to cost \$400–\$1,000 per ton of CO₂ removed. For context, capturing 1 MtCO₂/yr at \$500 per ton costs \$500 million annually, while Saudi Arabia’s entire Jubail hub—Aramco’s CCS hub with a capacity of 9 MtCO₂/yr—is projected to cost \$5 billion in total by 2027.^[22]

In line with investment in R&D and new technologies, supporting and financing startups, particularly in new innovative technologies, could present new techniques for carbon sequestration. The new Omani startup 44.01^[23] has developed innovative methods to mineralize carbon, which aims to eliminate carbon emissions and help the Gulf reach its net-zero targets. Following successful pilot and demonstration projects, 44.01 plans to commercialize its technology in Oman and the UAE. Initial trials indicate that the technology can currently sequester 50 to 60 tons of CO₂ per day, with ambitions to scale up to 100 tons per day per injection borehole once fully commercialized, representing a major advancement in carbon sequestration efforts. Other initiatives incl-

ude Saudi Aramco’s work on advanced capture materials and blue hydrogen at its Hawiyah NGL project; ADNOC’s Direct Air Capture (DAC) pilot in Fujairah and CO₂ mineralization trials; QatarEnergy’s integration of CCS with blue ammonia production at Ras Laffan; Oman’s DAC pilot in Khazaen; KAU-ST’s CO₂-to-chemicals research; and Kuwait’s CO₂ utilization studies.

While these projects demonstrate the GCC’s commitment to investing in CCS and CCUS initiatives, the Gulf must prioritize the development of regional transmission and storage networks to ensure the safe and efficient transport of captured CO₂, as well as the long-term viability of CCS/CCUS across the region.^[24] This requires aligning transmission regulations with existing oil and gas frameworks, while addressing key issues such as rights-of-way, third-party access, pore space rights, and long-term storage liabilities. Establishing clear regulatory guidelines will be essential for enabling cross-border cooperation and ensuring a seamless carbon management infrastructure.

Additionally, new partnerships must be forged between governments, energy companies, and research institutions to advance CO₂ transmission technologies and enhance safety and reliability. Investment models must also be developed to attract private sector participation and large-scale capital, ensuring the long-term financial viability of CCS and CCUS projects.

Short Term: 5–10 years (2030–2035)	Medium Term: 10–20 years (2035–2045)	Long Term: 20+ years (2045+)
Actionable initiatives to claim projects that have been announced	Scale up initiatives and ensure a smooth progression	Carbon removal
Increase monetization of CO ₂ utilization	Develop tech database	Mineralization of CO ₂
Leverage global climate finance mechanisms, such as “green bonds,” sustainability-linked loans, and international CCUS funds	Integrate CCUS with hydrogen for export	Regional transmission
Engage with international climate finance institutions (e.g., World Bank, AIIB) to support CCUS in Gulf industries	GCC-wide investment fund	Outsource expertise and eventually transmission
	Develop digital monitoring tools to track CO ₂ transport and storage	Introduce carbon contracts for difference (CCfD)
Investment and R&D to create a GULF CCUS HUB. public and private sec. Increase joint investment opportunities. Invest in capabilities within the value chain of the industrial sector. Encourage industry-driven CCUS consortia		

	Align with international frameworks. Encourage investments in carbon-to-value (C2V) solutions. Develop a CCS and CCUS-linked carbon credit market that integrates with global carbon trading platforms. Reduce dependence on foreign technology by building local CCS and CCUS technology hubs
Foster a CCUS innovation ecosystem through incubators and accelerators	
DEVELOP ROBUST REGULATORY FRAMEWORKS	

Table 2

Regulation for Policy Success

Across all timeframes, one policy lever is constant: regulation. From permitting and storage access to cross-border transport and carbon accounting, a unified regulatory framework across the Gulf will be critical for determining whether CCS/CCUS will succeed or stall in the region. By acting early, investing in innovation, and working within international frameworks such as the GCC, the Gulf states can become not only a regional climate leader but a global export hub for carbon solutions. Below is a table outlining the stages each GCC country is in with regard to regulatory frameworks, their climate mitigation, and their consistency with international laws (see page 19).

Regulatory frameworks are a crucial determinant in the successful deployment of CCS/CCUS across the Gulf region. Clear and well-defined laws, liability provisions, and incentive structures are necessary to ensure

the scalability, safety, and economic feasibility of CCS/CCUS projects. However, GCC countries face significant regulatory gaps that must be addressed to attract investment, ensure compliance with international standards, and integrate CCS/CCUS into broader climate mitigation strategies.

The UAE's Federal Decree-Law No. (11) of 2024, "On the Reduction of Climate Change Effects"—commonly referred to as the climate law^[25]—entered into force in May 2025, providing a direct legal mechanism to support the country's Net Zero 2050 strategy. Similarly, Oman has progressed in developing key frameworks. In November 2023, the MEM signed a Terms of Reference with Petroleum Development Oman (PDO), Sohar Development Organization (SDO), OQ Gas Networks (OQGN), and Occidental Oman^[26] to establish the CCUS and Blue Hydrogen Framework. Under this ag-

reement, PDO is partnering with the Global CCS Institute to develop a legal and regulatory framework for CCS and support its implementation in Oman. Qatar, while not developing any regulatory framework, established a basic GHG regulatory framework through Law 30 of 2002 on Environmental Protection,^[27] which governs efforts to mitigate greenhouse gas emissions, including CCS, by addressing pollution from industrial, agricultural, and economic activities. The other GCC members have not yet established clear regulatory frameworks.

Across the Gulf, the lack of comprehensive CCS/CCUS regulations poses a major barrier to private investment, technology deployment, and cross-border collaboration. Each country must develop clear legal frameworks that define storage liability, CO₂ transport rules, and fin-

ancial incentives to enable large-scale adoption and work supportively with the scale up period. Additionally, a regional regulatory approach, coordinated through the GCC, could help harmonize standards, risk management policies, and transboundary CO₂ movement regulations.

By addressing these regulatory gaps, however, Gulf nations can position themselves as global CCS/CCUS leaders, ensuring the long-term competitiveness of their energy sectors while advancing their carbon-cutting commitments. Without enabling legal frameworks, CCS/CCUS in the Gulf will remain confined to pilot projects. Clear national laws, coordinated by a regional regulatory approach, can unlock the full economic and environmental potential of carbon capture across the region.

Country	Framework		
	Key Regulatory Frameworks	Integration of CCS in Climate Mitigation Strategy	Ensuring Consistency with International Law*
United Arab Emirates	Issued the Federal Decree-Law No. (11) of 2024 ‘On the Reduction of Climate Change Effects’ [“climate law”] Released a national hydrogen strategy	Environment Agency-Abu Dhabi has invited proposals for implementing a MRV system for GHG emissions, paving the way for a cap-and-trade system Has plans for carbon contracts for difference long-term 2050 net-zero strategy Inclusion of CCS on NDC Long term net zero strategy to UNFCCC	

Saudi Arabia	Lacks specific regulations	Greenhouse Gas Crediting and Offsetting Mechanism, launched in 2023 Inclusion of CCS on NDC Circular Carbon Economy Strategy	Ratified London Protocol Following through with many international collaborative efforts to push for low carbon future like Middle East Green Initiative
Qatar	Implemented basic frameworks and approval processes through Law 30 of 2002: Environmental Protection Developing a roadmap to support hydrogen utilization	Inclusion of CCS on NDC, falls under Law 30	
Bahrain	Lacks specific regulations	Inclusion of CCS on NDC 2021 NDC supported CCU and DAC under the Technology Innovation and Deployment sections	
Kuwait	Lacks specific regulations	Inclusion of CCS on NDC 2021 NDC includes a number of pillars for a circular carbon economy, and a net-zero target by 2060 (gas sector by 2050) CCS is included under the carbon re-use pillar	
Oman	Petroleum Development Oman (PDO) working closely with Global CSS institute The Ministry of Energy and Minerals (MEM) has signed a memorandum of cooperation with key industry players, including PDO, Oman Shell, and OQGN, to establish an expertise body	Inclusion of CCS on NDC	Draft of a general policy framework for carbon markets in the region Party to London Convention

	Creating a low-carbon hydrogen legal and regulatory framework		
Middle East Region in General	No explicit law or regulation on CCUS, with some general laws loosely applicable to CCUS No formal permitting or authorization process for CCUS projects Under-developed technical standards and environmental management criteria No clear provisions on liability, transfer of liability, liability from site closure and monitoring, and liability for contingency	Varying degrees of commitments to CCUS Early stage of CCUS development No immediate plan to enforce policy instruments to reduce emissions Incremental and pragmatic CCUS projects Concentration of CCUS for EOR due to economic incentives	Focus on onshore CCUS with limited interaction with international law Future offshore CCUS shall observe regulations in international law on ocean dumping Significance of transboundary movement of CO₂ after sequestration Most GCC member states have not ratified the London Protocol Lack of common regulatory grounds

** All are contracting parties to both London Convention and London Protocol*

Table 3
(Sources: Al Tamimi & Co, ADNOC, MASDAR, CMS, Global CCS Institute)

Conclusion

Most energy expert groups agree that without CCS/CCUS, achieving the climate goals specified by the UN and the IPCC is virtually impossible.^[28] However, the industry continues to face various challenges before CCS/CCUS becomes economically viable for widespread adoption. While the GCC has a great responsibility to ensure the vast development of CCS/CCUS as per their NDC's, and to further diversify their developed economies, CCS/CCUS success requires clear policies and investment from all regions, particularly the United States, Europe, and China.

Momentum must be matched by realism. While enthusiasm for CCS/CCUS has surged in recent years, relatively few projects have reached FID. Many early ventures stalled due to underdeveloped business models, unclear regulatory environments, or insufficient infrastructure. Looking forward, success must be measured not by announced capacity, but by tangible progress across the entire CCS/CCUS value chain: capture systems, transport pipelines, and long-term storage.

For the Gulf region, unlocking the full potential of CCS/CCUS depends on several key conditions:

- Establishing robust, transparent regulatory frameworks that attract private investment and guarantee environmental safety.
- Developing risk-sharing mechanisms, such as carbon contracts for difference (CCfDs), tax incentives, and concessional finance, to de-risk early-stage investments.
- Preventing market monopolization^[29] and ensuring equitable access to CO₂ transport and storage infrastructure.
- Building technical and institutional capacity across sectors and states, supported by regional cooperation.

If these conditions are met, the GCC can position itself not merely as a regional actor but as a global CCS/CCUS hub—offering technology, storage capacity, and leadership worldwide.

The decade ahead will be decisive. By addressing current gaps in finance, policy, and coordination, the Gulf can align CCS/CCUS strategies with both climate goals and national development agendas. In doing so, it will not only meet its Nationally Determined Contributions (NDCs) but help shape the architecture of the next global energy economy.

Bibliography

- [1] Story, L. (2008, May 21). An Oracle of Oil Predicts \$200-a-Barrel Crude—The New York Times. <https://www.nytimes.com/2008/05/21/business/21oil.html>
- [2] Brent crude oil price dips below \$50 a barrel. (2015, January 7). BBC News. <https://www.bbc.com/news/business-30707638>
- [3] United Nations Climate Action
- [4] Is the UN warning of 3.1C global warming a surprise? (2024, October 24). <https://www.bbc.com/news/articles/cn0d24w28qno>
- [5] Environment, U. N. (2024, October 17). Emissions gap report 2024 | unep—Un environment programme. <https://www.unep.org/resources/emissions-gap-report-2024>
- [6] Pandit, P. (2022, November 9). COP27 Key issues and challenges. Vision of Humanity. <https://www.visionofhumanity.org/cop-27-key-issues-and-challenges/>
- [7] COP28 Agreement Signals “Beginning of the End” of the Fossil Fuel Era | UNFCCC. (2023, December 13). <https://unfccc.int/news/cop28-agreement-signals-beginning-of-the-end-of-the-fossil-fuel-era>
- [8] Kourkejian, V., Frans, D., Petrov, C., & Garcia Oliver, C. (11.23). Carbon Capture, Utilisation and Storage in the GCC(p.1– 8).
- [9] Decarbonization of Oil and Gas in the Gulf Cooperation Council: The Way Forward <https://resourcegovernnce.org/publications/decarbonization-oil-and-gas-gulf-cooperation-council-way-forward>
- [10] Meth-Cohn, D. (2022, December 7). Aramco Jubail - The CCUS hub. CCUS Hub - Carbon Capture, Use and Storage. https://ccushub.ogci.com/focus_hubs/aramco-jubail-ccs-hub/
- [11] Gulf Geology Ideal for Carbon Capture, say experts. (2023, August 10). KAPSARC. <https://www.kapsarc.org/news/gulf-geology-ideal-for-carbon-capture-say-experts/>
- [12] ADNOC proceeds with Shell’s Cansolv technology in the recently announced FID for large scale carbon capture in Habshan. (n.d.). Shell Global. <https://www.shell.com/business-customers/catalysts-technologies/resources-library/adnoc-shell-cansolv-technology-large-scale-carbon-capture.html>
- [13] ADNOC and Santos to pursue global CCS platform to accelerate net zero goals. (n.d.). ADNOC. <https://www.adnoc.ae/en/news-and-media/press-releases/2023/adnoc-and-santos-to-pursue-global-ccs-platform-to-accelerate-net-zero-goals>
- [14] Decarbonizing our operations. (n.d.). ADNOC. <https://www.adnoc.ae/en/towards-net-zero/decarbonizing-our-operations>

^[15] QatarEnergy North Field East (NFE) – Technip Energies <https://www.ten.com/en/case-studies/qatarenergy-north-field-east-nfe>

^[16] Sustainability-related disclosure in the financial services sector. (n.d.). https://finance.ec/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector_en

^[17] SEC.gov. (n.d.). SEC Adopts Rules to Enhance and Standardize Climate-Related Disclosures for Investors. <https://www.sec.gov/newsroom/press-releases/2024-31>

^[18] The World Bank carbon capture and storage capacity building trust fund – policies. (n.d.). IEA. <https://www.iea.org/policies/11690-the-world-bank-carbon-capture-and-storage-capacity-building-trust-fund>

^[19] Home—Global carbon council (GCC). (n.d.). Retrieved 30 January 2025, from <https://www.globalcarboncouncil.com/>

^[20] Northern Lights: The first major carbon capture and storage project in Norway. (n.d.). TotalEnergies.Com. <https://totalenergies.com/company/projects/carbon-capture-and-storage/northern-lights-first-major-carbon-capture-and-storage>

^[21] Hydrogen costs in 2024: what you need to know | Wood Mackenzie, <https://www.woodmac.com/news/opinion/hydrogen-costs-in-2024-what-you-need-to-know/>

^[22] Prospects for direct air carbon capture and storage: Costs, scale, and funding. (n.d.). The Belfer Center for Science and International Affairs. <https://www.belfercenter.org/publication/prospects-direct-air-carbon-capture-and-storage-costs-scale-and-funding#in-this-section-nav-3>

^[23] This Oman-based startup turns carbon into solid rock—And does it super fast. (n.d.). Fast Company Middle East | The Future of Tech, Business and Innovation. <https://fastcompanyme.com/impact/this-oman-based-startup-turns-carbon-into-solid-rock-and-does-it-super-fast/>

^[24] PricewaterhouseCoopers. (2023, November 14). Inserting the missing ‘T’ in CCUS. PwC. <https://www.strategyand.pwc.com/m1/en/strategic-foresight/sector-strategies/sustainability-and-environment/ccus-and-the-missing-t.html>

^[25] UAE’s New Climate Law focuses on R&D, Innovation & Sustainability. (n.d.). Al Tamimi & Company. <https://www.tamimi.com/news/uaes-new-climate-law-focuses-on-rd-innovation-sustainability/>

^[26] Oxy Oman and OQ Gas Networks sign MOU for carbon management | Carbon Capture Magazine. (n.d.). <https://carboncapturemagazine.com//articles/oxy-oman-and-oq-gas-networks-sign-mou-for-carbon-management>

^[27] Law No. 30 of 2002 – Environmental Protection Law – Policies. (n.d.). IEA. <https://www.iea.org/policies/12010-law-no-30-of-2002-environmental-protection-law>

^[28] Global CCS Institute. (2021). 2021 global status of CCS report. Global CCS Institute. https://www.globalccsinstitute.com/wp-content/uploads/2021/10/2021-Global-Status-of-CCS-Report_Global_CCS_Institute.pdf

^[29] Zhang, G. H., Coco. (n.d.). Carbon Capture and Storage: Gaining ground, despite challenges. ING Think. <https://thinking.com/articles/carbon-capture-storage-outlook-2025-gaining-ground-despite-challenges/>



منتدى الخليج الدولي
Gulf International Forum



1331 Pennsylvania Ave NW
Suite 515 N
Washington, DC 20004



<https://gulfif.org>