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Inserting the missing T in CCUS:

The critical role of transmission in carbon capture, utilization, and storage

In the fight against climate change, most GCC countries have set ambitious net-zero targets. Within these commitments, carbon capture, utilization, and storage (CCUS) plays a crucial role in decarbonization in hard-to-abate industries-those whose carbon emissions are technically difficult to eradicate with existing technology.

There is just one problem: How do you move carbon through the CCUS network without an actual road? Countries have yet to address how to get CO_2 from point A to point B, let alone tackle the many associated questions, from operating and pricing models to regulatory treatment. We need to put the T-for transmission-into CCUS if we are to make it a reality.

The acronym CCUS reflects the myriad complexities of decarbonization. whether it is best to capture emitted carbon through direct-air capture or point sources; whether the captured carbon could be utilized to create more sustainable transportation e-fuels; and whether to store it in, say, depleted gas reservoirs or deep saline aquifers, or to mineralize it into rocks for the long term. All well and good. Now consider legacy natural gas transmission and distribution: those networks took decades and billions of dollars to build. As with natural gas, there can be no capture, usage, and storage of CO_2 without a way to move it.

CO_2 can be moved efficiently only through a pipeline network. Transmission will most likely become a network business, much like traditional gas transmission. But developing and operating efficient CO_2 transmission is complex in many respects. On the technical level, pipeline material must be able to withstand the corrosive nature of CO_2 and the shockwaves caused by compression (the pipeline must operate at high pressure to achieve single-phase flow). Owing to the inherently hazardous nature of CO2 and the dangers posed by even low releases, pipelines will require special design considerations. CO_2 leaks cannot be addressed in the same (or a similar) way as natural gas leaks. Another significant hazard is that CO_2 tends to collect in low-lying areas close to the pipeline because it is heavier than air.

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Some GCC nations (like the UAE) are making progress by launching CCUS pilots and setting national volume targets, but discussion on the "midstream" issues has been lacking. Given their ambitious net-zero goals, GCC countries need to invest in an independent CO_2 transmission infrastructure. That need is as massive as it is urgent. Connecting key industrial hubs like Jubail, Yanbu (Saudi Arabia), Jebel Ali, Ruwais (UAE), Ras Laffan (Qatar), Al Zour (Kuwait), and Sohar (Oman) to depleted gas reservoirs and saline aquifers in their respective countries would require thousands of kilometers of CO_2 pipeline likely at a cost of billions of dollars.

We envision three possible operating models within which CO_2 transmission network development could be achieved:

The integrated value chain:
One entity would control and manage a single, end-to-end CO_2 value chain. Pilot projects often follow this model. For example, ADNOC's initial CCUS project at Al Reyadah will capture 800,000 tons of CO_2 each year from a steel plant and inject it into the subsurface nearby.

The transmission and storage company (TSCo):
This national champion–based model integrates multiple emitters into a common CO_2 carrier through a hub-and-spoke design. Norway's 1.5 million-tons-per-year Longship CCS project, for example, will create a dedicated TSCo (Northern Light) that operates an open-access, multi-modal CCS value chain that transports the emissions of a variety of manufacturers, including petrochemical and cement companies.

Distributed approaches:
This multiplayer model is being adopted across emission hubs or across the CO_2 capture, transmission, and utilization/storage value chain. With its 2030 goal of 30 million tons per year of CO_2 storage capacity, the U.K. has awarded 21 licenses to 14 different companies for capture and storage at offshore sites.

In the GCC, the TSCo model is likely to become increasingly attractive as countries build the scale of their CO_2 value chains. This model connects multiple emissions hubs to sites for long-term CO_2 sequestration and enables countries to establish a new transparent, regulated asset base that can provide a critical service for hard-to-abate industrial emitters.

With national decarbonization ambitions already well defined, every GCC country now needs to accelerate efforts towards developing what we call a National Carbon Management Regulatory Framework. Sector governance structures and operating and remuneration models of their CO_2 value chains need to be carefully considered. Transmission regulations must also be considered in conjunction with existing oil and gas regulations, including rights-of-way, third-party access rights, pore space rights, and long-term storage liabilities. New partnerships need to be forged to develop technologies for safe and reliable CO_2 transmission. Finally, investment models must be created to attract participation and large-scale capital in this critical and emerging sector.

There is much to consider, but these questions can no longer be postponed. Without transmission there can be no capture and storage. Transmission is a vital prerequisite to reaching net-zero ambitions. It is time to put the T on the table and make CCTUS happen.

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