Introduction:
Carbon sequestration is essential for reducing CO_2 levels and combating climate change. Shipping CO_2 for sequestration offers advantages for both emitters and sequestration sites compared to subsea pipelines, particularly in terms of flexibility and cost-effectiveness. Crondall Energy examines the advantages of using ships for CO_2 transport, comparing them with subsea pipelines and discussing their implications for carbon sequestration projects.

Flexibility:
Shipping CO_2 offers flexibility in both volumes and locations. Pipelines are fixed infrastructures that require substantial investment and planning. Ships, however, can be deployed on demand, transporting varying volumes of CO_2 to multiple locations. This flexibility is particularly advantageous for smaller emitters who may not generate enough CO_2 to justify building a pipeline or are not near sequestration sites. Furthermore, ships can be redeployed and are not at risk of becoming a stranded asset if the economics of the project change.

In addition, from a sequestration site perspective, shipping can provide an opportunity to increase sequestered volumes outside of their immediate region and with reduced infrastructure requirements. Thus, improving project performance.

Cost and Complexity of Subsea Pipelines:
Building subsea pipelines to offshore sequestration sites is expensive and technically challenging. While these are crucial for exporting CO_2 to the sequestration site, maximizing their utilisation helps to dramatically improve the feasibility of CCS projects. Shipping CO_2 provides an opportunity to increase the sequestered volumes while minimizing the additional pipeline transportation network, by providing an offloading terminal.

Supporting Smaller Emitters:
Shipping CO_2 also benefits smaller and stranded emitters, allowing them to participate in carbon sequestration projects. By consolidating CO_2 from various sources, ships can ensure that the required injection volumes are met. This collaborative approach lowers entry barriers for smaller emitters and broadens participation in sequestration efforts.

Storage and Transport Conditions:
CO_2 is transported on ships in liquid form, maintained at temperatures between -55˚C and 15˚C and pressures from 5 to 50 bar. These conditions are safely controlled. The equipment required to maintain these conditions is relatively simple, making CO_2 transport on ships manageable and safe. However, although much can be transferred from other industries, this is still a new industry and there will be a development process.

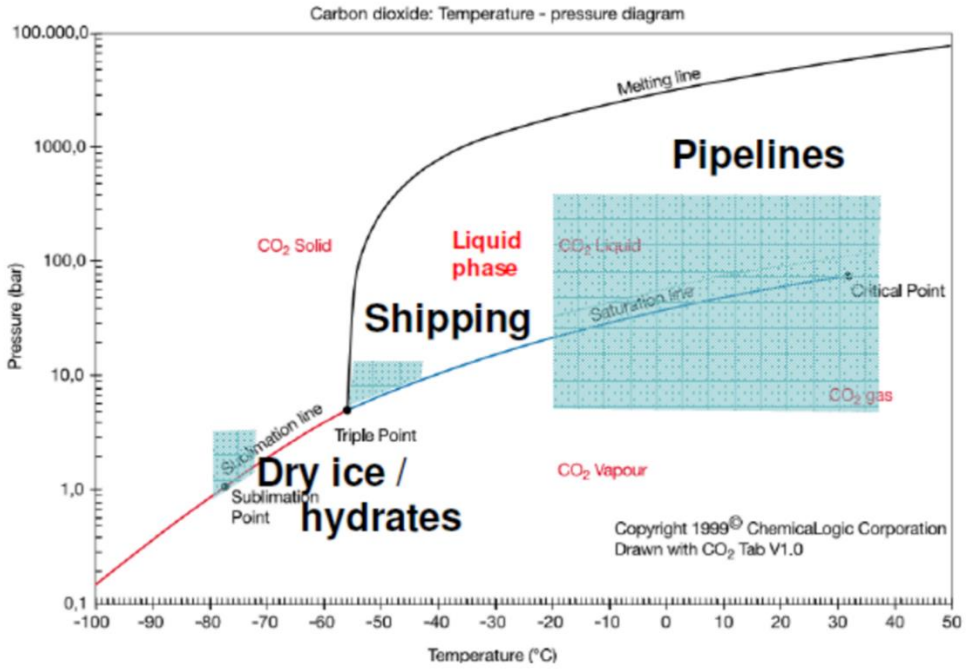

Figure 1 *Carbon dioxide, Temperature – pressure diagram for comparing the requirements of pipelines to shipping for transport* (StellaeEnergy, 2021).

Offloading Systems:

Offloading systems used in the oil and gas industry can be adapted for CO_2 transport. These systems ensure safe and efficient delivery to sequestration sites. Maintaining a steady flow into the sequestration wells is crucial, so more robust and weather-resistant offloading systems may be needed. Although these systems can be expensive, they provide the necessary reliability for successful CO_2 sequestration.

Figure 2 *Example of a loading arm solution.* (CONNEX SVT Inc., 2025)

Conclusion:
This presentation will provide an overview of CCS sequestration, the current challenges around increasing volumes, and the opportunity presented by CO_2 shipping, which offers a viable alternative to solely pipeline transportation, providing flexibility, cost savings, and opportunities for smaller emitters. By using existing maritime infrastructure and adapting oil and gas technologies, shipping CO_2 can play a key role in advancing carbon sequestration efforts. As the need for sequestration grows, ships will become increasingly important in meeting global climate goals.

References

CONNEX SVT Inc. (2025, April 17). *Arctic 2*. Retrieved from CONNEX SVT Inc.: https://www.connexsvt.com/produkte/arctic-2/

StellaeEnergy. (2021, August 26). *Carbon Dioxide Transport*. Retrieved from StellaeEnergy: https://stellaeenergy.com/carbon-dioxide-transport