Carbon Capture and Storage (CCS) refers to a suite of technologies that capture and store the greenhouse gas carbon dioxide (CO_2), so that it does not reach the atmosphere and contribute to climate change.

CO_2 TRANSPORT

After CO_2 is captured, it can either be injected and stored on site or transported to another location for permanent storage.

Commercial scale transport of CO_2 can be undertaken using pipelines, ships, tanker truck or rail. Before being transported, the captured CO_2 is often compressed into a liquid state, as this occupies much less volume than CO_2 in its gas state.

Pipelines are – and are likely to continue to be – the most common method of transporting the very large quantities of CO_2 involved in CCS.

Ship transportation is an alternative for many regions around the world without close access to storage. Already in use for transporting small amounts of CO_2, larger scale shipments are likely to have much in common with the transportation of liquefied natural gas (LNG), which is a global industry.

TRANSPORT COSTS

In terms of costs, pipelines are generally seen as the cheapest option for transporting large quantities of CO_2. In some instances though, such as for transportation over long distances, ships can be a cheaper option. Transport by rail or tanker truck on the other hand can be around twice as expensive as shipping or pipelines.

Northern Lights onshore pipeline, Norway. Image courtesy Northern Lights JV

COMPARISON OF CO_2 TRANSPORT MODES

CURRENT CAPACITY
MT = MILLION TONNE

PIPELINE
» Most common mode of CO_2 transportation.
» Can move large, commercial-scale quantities over long distances with lower operational cost.

~110 MTCO$_2$
PER YEAR

SHIP
» Offers flexibility in scale and destination.
» Is a good alternative for regions without close access to storage sites.
» In some cases, can be a cheaper option than pipelines for transport over long distances.

>2 MTCO$_2$
PER YEAR

TRUCK
» Best suited for transport of small quantities of CO_2 (2-30 tonnes per batch).

>1 MTCO$_2$
PER YEAR

RAIL
» More advantageous over medium and long distances, using existing rail lines.

>1 MTCO$_2$
PER YEAR

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TRANSPORT CENTRAL TO CCS NETWORK SUCCESS

Networks link CO_2 sources in close proximity to one another with geological storage sites, and rely on ship or pipeline transportation of CO_2.

CCS networks are sometimes referred to as the 'hub and cluster' model, describing the 'clusters' of emission sources and the 'hub' that collects the CO_2 and redistributes it to a storage location.

Networks leverage economies of scale for CO_2 transportation (eg. lower per unit costs for constructing and operating CO_2 pipelines). Networks also lower the barriers of entry for smaller CCS projects.

CCS networks continue to emerge as a preferred method of deployment, with several projects around the world implementing a network strategy.

ALBERTA CARBON TRUNK LINE (ACTL) PROJECT (CANADA)

Currently transports CO_2 from facilities in Canada's Edmonton region and stores it in depleted oil and gas fields 240km away.

LANGSKIP (OR LONGSHIP) PROJECT (NORWAY)

Developed the infrastructure to transport (via ships and pipeline), inject, and store CO_2 from regional emitters across Europe. Began commercial operations in 2024.

HUMBER AND TEESSIDE CLUSTER (OR EAST COAST CLUSTER) (UK)

Plans to capture and store 27 Mtpa by 2030, accounting for nearly half of all UK industrial emissions.

CO_2 TRANSPORT IS STRICTLY CONTROLLED

The transport of CO_2 is regulated and closely managed under national and international laws and standards.

CO_2 is also much safer to transport than many other substances because it does not form flammable or explosive mixtures with air, like oil and gas do.

The safe and reliable transport of CO_2 occurs daily on a commercial scale in many parts of the world.

Northern Lights ship launch, April 2024. Image courtesy Northern Lights JV

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