



MOL Mitsui O.S.K. Lines

LarvikShipping

CCS FEASIBILITY STUDY

Baltic Carbon Forum 2022

Oct 14, 2022
Kaunas



AB Klaipėdos nafta (KN) - an energy terminal operator company headquartered in Lithuania and has become a player in the global LNG market. KN brings proven developmental and operational know-how as well and bridge energy markets by enabling customers to supply and trade energy resources worldwide.



Mitsui O.S.K. Lines

Mitsui O.S.K. Lines (MOL) – a Japanese multi modal marine transport company, headquartered in Tokyo. It is one of the largest shipping companies in the world, who operates more than 800 ships.



Larvik Shipping AS (LS) – a Norwegian ship management company, one of very few in the world qualified to operate LCO2 vessels. LS has managed dedicated LCO2 tankers trading in Europe for more than 30 years.

VALUE CHAIN OF CO2 TRANSPORTATION FROM EMISSION TO SEQUESTRATION



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Scenarios:

A

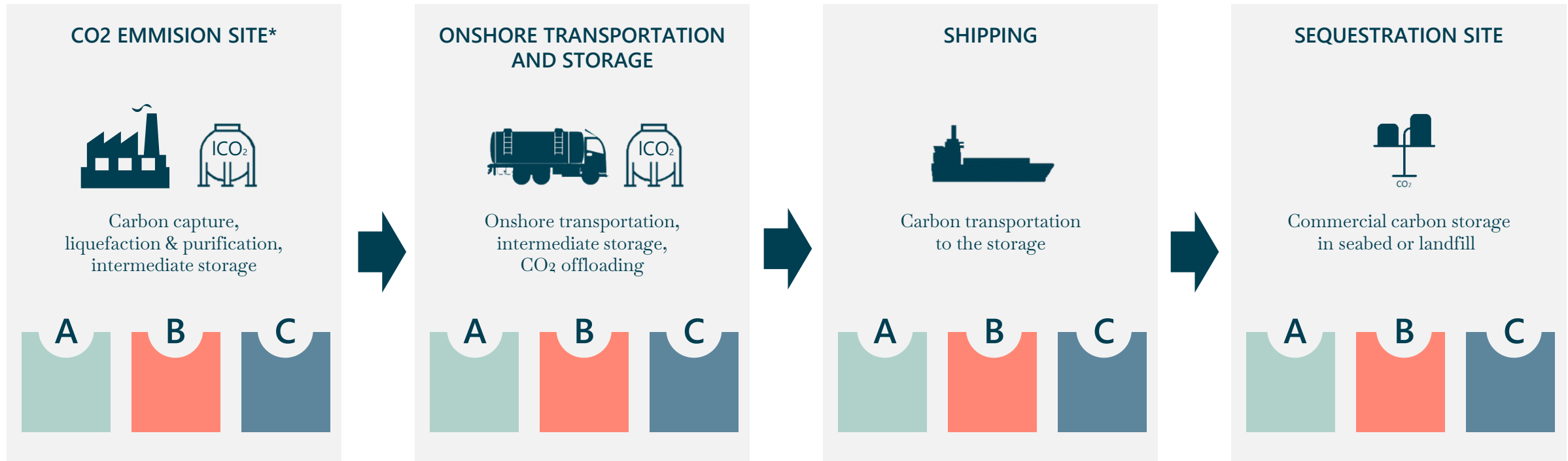
200,000 t

B

800,000 t

C

1,500,000 t



Notes:

1. All estimates are based on CAPEX Class 5, excluding potential project subsidy.
2. * - industry to provide more accurate figures.

STREAM	ACTIONS	RESULTS (UP TO DATE)
Project Scenarios	Analyzed 3 different project scenarios with different throughputs: 200, 800 & 1,500 ktpa	Identified feasible technical solution for entire supply chain Supply chain costs estimated on CAPEX class 5 and preliminary OPEX
Regulatory	Analyzed local and regional legislative framework; London protocol and ETS directive	Necessary changes to the ETS directive identified and potential timeline drafted. Action plan and timeline for adopting London protocol prepared.
Transportation – land based	Estimated semi-trailer and railway as an option for onshore CO ₂ transport	Semi-trailers most feasible for smaller scenario – 200kt, meanwhile railway for 800 and 1,500 ktpa.
Transportation - marine	Estimated multiple cargo size CO ₂ carriers and multiple location for a final destination	The larger the cargo capacity the lower the tariff for shipping. Subject to the final destination.
Storage	Identified and relationship started with several sequestration projects	Multiple projects approached within the North Sea region. With 4 of them in advanced discussion.
Project Funding	Identified and selected most relevant project funding tool on a EU level. Analyzed local funding potentials	Multiple conversations with experienced consultants. Offers for project structurization and assistance during application received.
Market	Identified and approached potential CCS value chain users	At this phase LT and LV region industry have been approached. MoU with Orlen Lietuva and Schwenk Group signed.
Stakeholders	Reached out to the authorities: Ministry of Energy; Ministry of Economics and Innovations.	CCS was included in valuation of submitted proposals for National Climate Change Program.

Total number of projects: **65**, around 60 MtCO₂/yr stored by 2030

AUSTRIA

1. Vienna Green CO₂*

BELGIUM

1. Leilac (pilot capture only)
2. Antwerp@C (Port of Antwerp)*
3. Carbon Connect Delta†
4. Flite*
5. C4U
6. North-CCU-Hub
7. Power-to-Methanol Antwerp BV
8. Kairos@C

CROATIA

1. iCORD*
2. Bio-Refinery Project*

CZECHIA

1. Onshore storage project

DENMARK

1. Greensand*
2. C4: Carbon Capture Cluster Copenhagen
3. Copenhill

FINLAND

1. SHARC

FRANCE

1. DMX Demonstration in Dunkirk*
2. Pycasso*
3. K6 Program

GERMANY

1. H2morrow*
2. Leilac 2
3. Wilhelmshaven

GREECE

1. Energean Carbon Storage

ICELAND

1. Orca
2. Hellisheidi
3. Silverstone

ITALY

1. CCS Ravenna Hub*
2. Cleankerk

THE NETHERLANDS

1. Porthos (Port of Rotterdam)*
2. Aramis (Den Helder)*
3. Magnum (Eemshaven)*
4. H-Vision*
5. Twence
6. AVR-Duiven
7. Project Everest*
8. Vlissingen Cryocap FG

NORWAY

1. **Sleipner CO₂ Storage***
2. Longship (including Northern Lights)*
3. Polaris CCS*
4. Norsk e-fuel
5. Borg CO₂*
6. Fortum Oslo Varne
7. Barents Blue*
8. Norcem Brevik
9. Pilot CCS project

POLAND

1. Poland EU CCS Interconnector

REPUBLIC OF IRELAND

1. ERVIA

ROMANIA

1. Onshore storage project

SPAIN

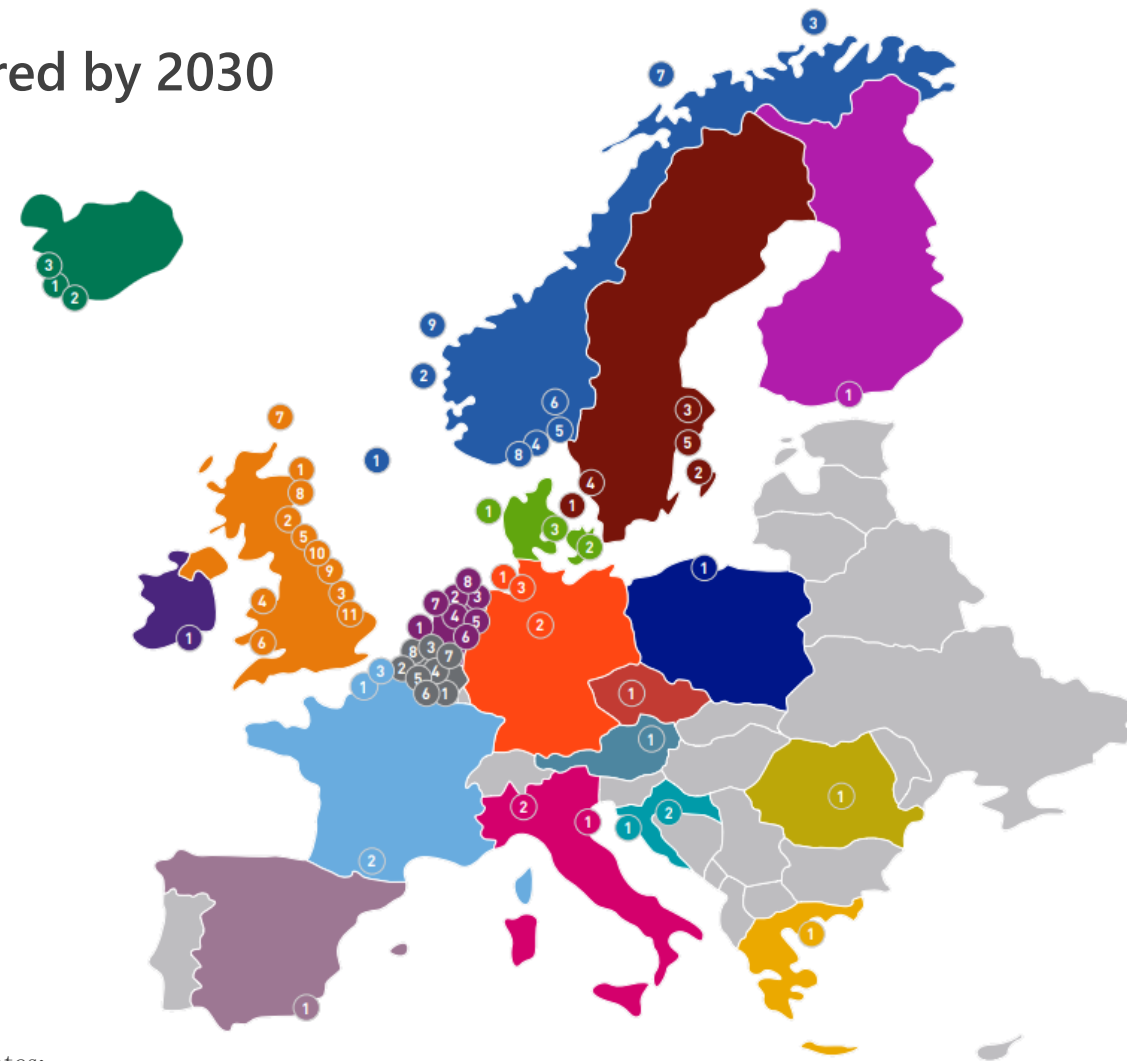
1. CCU Lighthouse Carboneras

SWEDEN

1. Preem CCS*
2. Cementa Slite Plant
3. Vattenfall Uppsala
4. CinfraCap
5. BECCS@STHLM

UK

1. Acorn*
2. Caledonia Clean Energy
3. Zero Carbon Humber*
4. HyNet*
5. Netzero Teesside*
6. South Wales Industrial Cluster
7. STEMM-CCS*
8. CO₂ Sapling Transport Infrastructure Project
9. Northern Endurance Partnership*
10. H2Teesside*
11. H2H Saltend*



Notes:

* Project where IOGP Members are involved

† Project is cross-border with the Netherlands Projects listed in bold are in operation

LOADING PORT	UNLOADING PORT	DISTANCE (1 PASSAGE)	SAILING (1 PASSAGE)	LOADING /TIME(*1)	UNLOADING /TIME(*1)	NO. OF ROUND/Y (PER VESSEL)
Klaipeda	Norway (NLP)	1,000NM	4.2 days	24 hours	24 hours	32 rounds/year
Klaipeda	Peterhead (Acorn)	1,000NM	4.2 days	24 hours	24 hours	32 rounds/year
Klaipeda	Rotterdam	1,100NM	4.6 days	24 hours	24 hours	30 rounds/year
Klaipeda	Carbfix (Iceland)	1,700NM	7.1 days	24 hours	24 hours	21 rounds/year



Notes:

(*1) Cargo Operation Time to be same (2,000 to 73,000m³)

(*2) Utilization of KN Port to be based on calculation of 1 vessel operation. If 2 vessels to be in operation, utilization to be double.

For successful project we need to **achieve:**

Local regulations and legislations in place (LP & ETS)

Support from the Governmental level

Sufficient portion of project subsidy

Attractive CCS value chain cost versus ETS price

CCS value chain emissions should have a low environmental footprint (NET reduction)





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THANK YOU FOR YOUR ATTENTION

