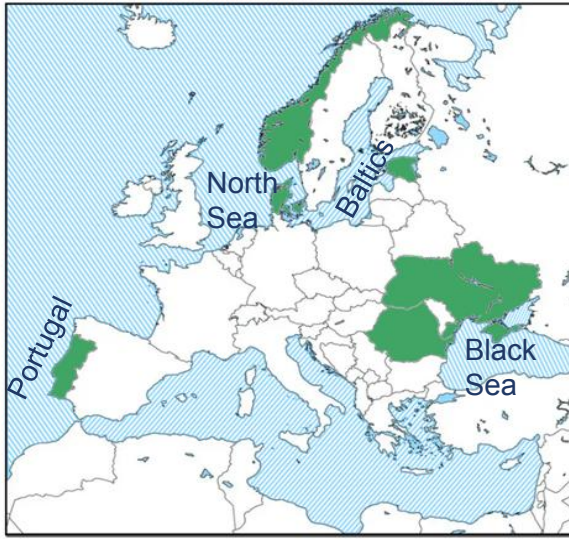
CO_2 Transport and Storage directly from a ship: flexible and cost-effective solution for European offshore storage

By Roman Berenblyum, project coordinator

November 2024

Why?

Large costs and complexity of CCUS value chains hinder its application especially by smaller industries. How ships as transport and injection vessels can unlock CCUS potential and speed up its deployment?

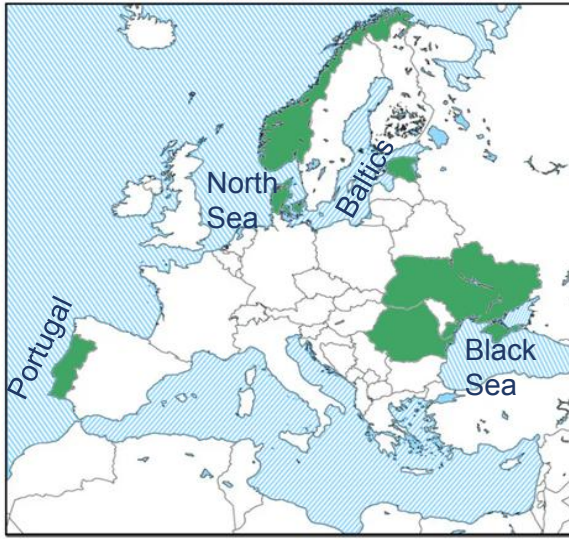


Why?

Large costs and complexity of CCUS value chains hinder its application especially by smaller industries. How ships as transport and injection vessels can unlock CCUS potential and speed up its deployment?

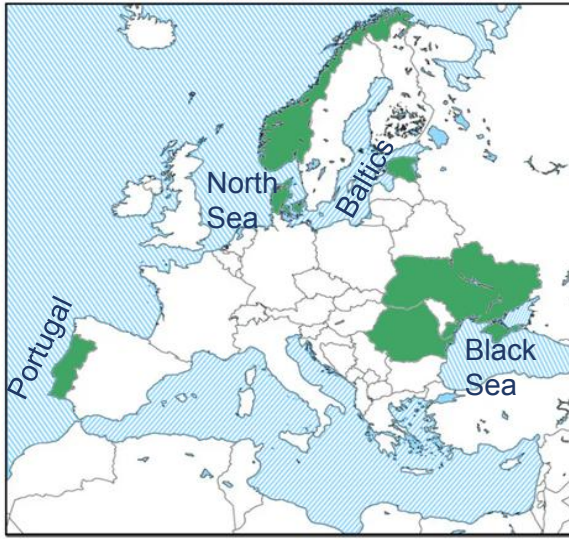
How?

By being decentralized, flexible, faster to deploy the technology can enhance CCUS adoptiation by smaller industries. It will ease creation of on-demand CO_2 storage market



Why?

Large costs and complexity of CCUS value chains hinder its application especially by smaller industries. How ships as transport and injection vessels can unlock CCUS potential and speed up its deployment?



How?

By being decentralized, flexible, faster to deploy the technology can enhance CCUS adoptiation by smaller industries. It will ease creation of on-demand CO_2 storage market

What?

Our end goal is to design and evaluate CCUS value chains in North Sea, Black Sea, Baltic Sea and Atlantic coast of Portugal and to evaluate technology potention agains existing approaches

Consortia

11 partners, 5 countries, 2 years, app. 2M Euro

NORCE

NEMO MARITIME

SHOGENERGY
SYNERGY CONCEPTS

UNIVERSIDADE DE ÉVORA

GeoEcoMar

WellPerform

BREVIK engineering

DTU

НАФТОГАЗ
УКРГАЗВИДОБУВАННЯ

Consortia

11 partners, 5 countries, 2 years, app. 2M Euro

NORCE

NEMO MARITIME

SHOGENERGY
SYNERGY CONCEPTS

UNIVERSIDADE DE ÉVORA

GeoEcoMar

WellPerform

BREVIK engineering

DTU

НАФТОГАЗ
УКРГАЗВИДОБУВАННЯ

+2 independent consultants from 

Project structure

WP 1

Develop the screening criteria and update the scenario analysis tool from H2020 Strategy CCUS project for the direct ship injection

Project structure

WP 1

Develop the screening criteria and update the scenario analysis tool from H2020 Strategy CCUS project for the direct ship injection

Gather the required data on emission points and storage location and build (or update) the scenarios

WP 2

Project structure

WP 1

Develop the screening criteria and update the scenario analysis tool from H2020 Strategy CCUS project for the direct ship injection

Gather the required data on emission points and storage location and build (or update) the scenarios

WP 2

WP 3

Analyse the value chains in different geographical areas. How does the direct injection from ship compare to existing technologies or create new opportunities

Project structure

WP 4

Supporting pilot development plans – looking into conceptual well designs and optimising scenarios in North Sea and Portugal

Project structure

WP 4

Supporting pilot development plans – looking into conceptual well designs and optimising scenarios in North Sea and Portugal

End-user engagement: stakeholder mapping and stakeholder club meetings

WP 5

Project structure

WP 4

Supporting pilot development plans – looking into conceptual well designs and optimising scenarios in North Sea and Portugal

End-user engagement: stakeholder mapping and stakeholder club meetings

WP 5

WP 6

Coordination and dissemination

Join stakeholder club!

Its free, no obligations and we offer quite a lot!

Stakeholders will **be informed** about the progress of the project and about the direct ship injection technology, an alternative to conventional ship transport and offshore injection.

Stakeholders will **consult the team** developing the scenarios to make them more realistic. The scenarios will be then tailored according to their strategy and future approach to decarbonization and CCS.

As a result, **industry gets a techno-economic analysis** for specific industrial clusters considering different options to support the CCS plans at no cost! Traditional transport (pipeline and ship) and direct ship injection will be compared and assessed to provide the most cost-effective and technically feasible solution.

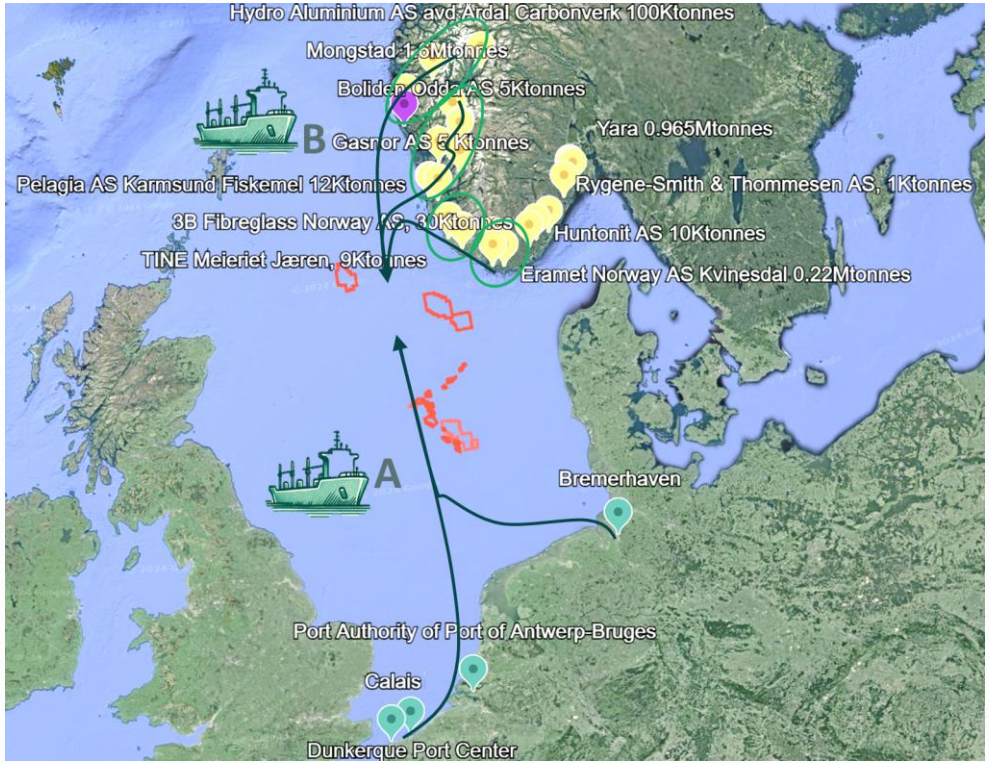
Read more at our website and follow us at LinkedIn.

North Sea

NorthSea scenario looking at both:

Danish and Norwegian storage opportunities

Large ports route (A) and local emission routes (B) (TBD also for Denmark)

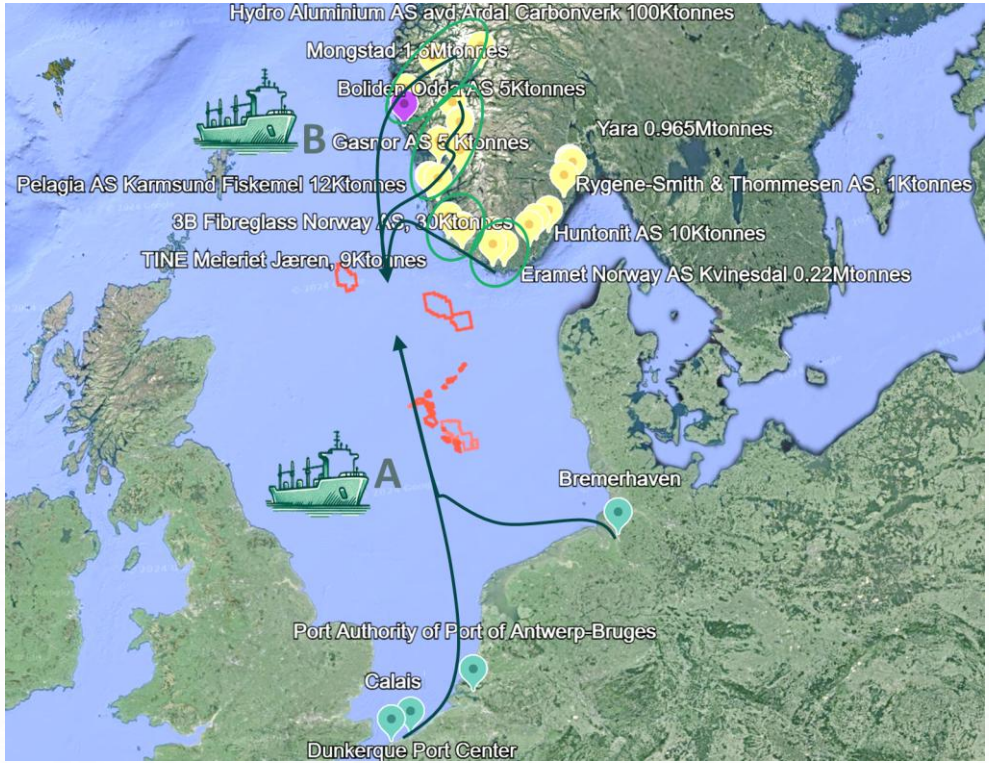


North Sea

NorthSea scenario looking at both:

Danish and Norwegian storage opportunities

Large ports route (A) and local emission routes (B) (TBD also for Denmark)

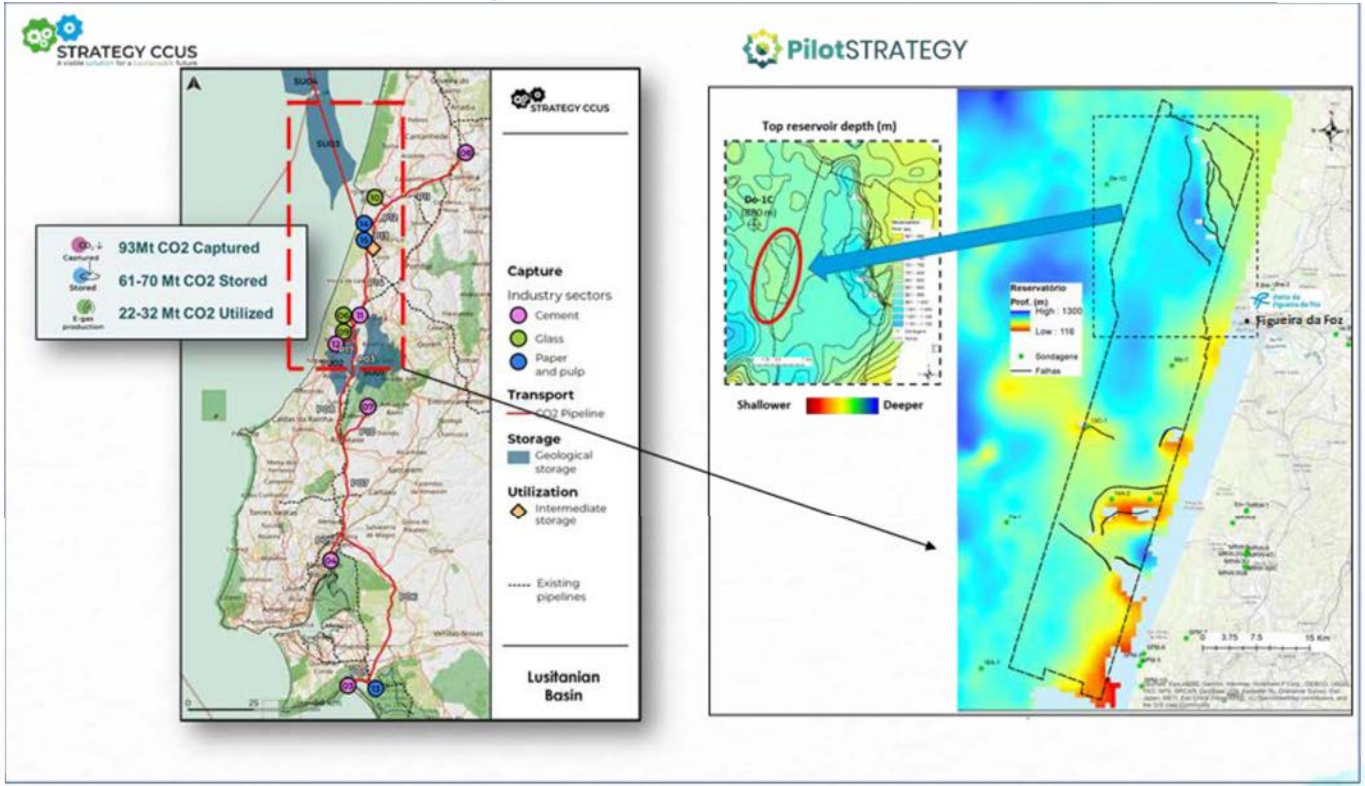


What is TEA / LCA impact of transporting Baltic emissions to North Sea while storage is being developed?

Portugal

CTS project will evaluate replacing shipping routes and storage infrastructure with direct ship injection offshore Portugal.

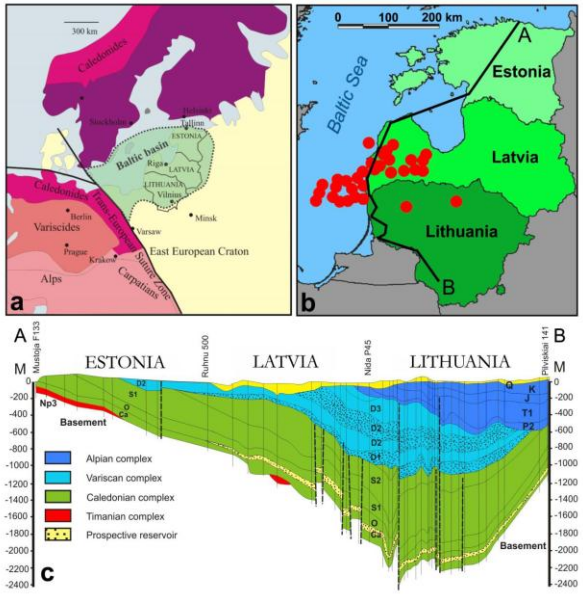
Potential to include shipping routes from southern CO_2 sources will be evaluated.

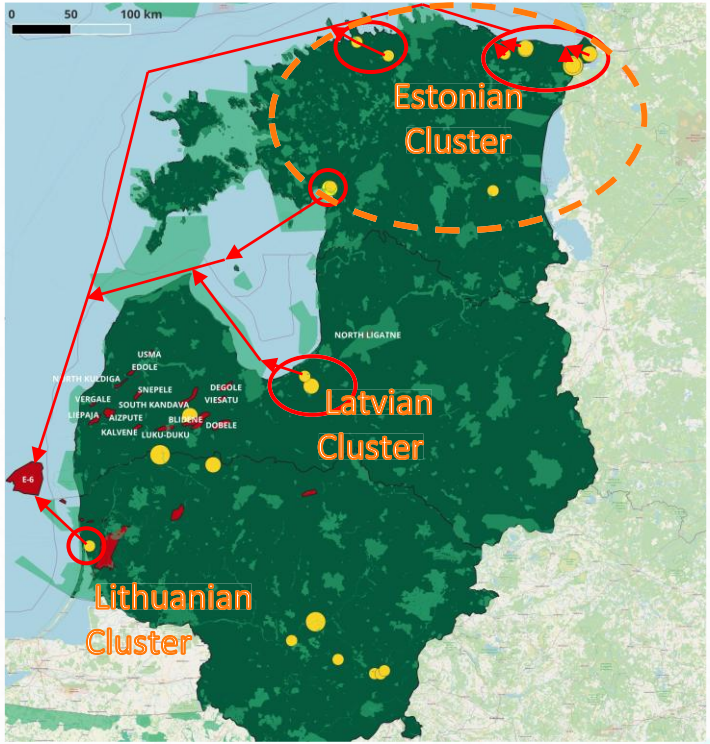


From STRATEGY CCUS scenarios (*left – capture, transport and offshore storage network. Facilities 07 and 08 provided letters of commitment to CTS Industry Club*) to PilotSTRATEGY detailed mapping of suitable storage structures offshore from Figueira da Foz (*right –depth structural map to the top of the reservoir from 3D Seismics. The Figueira da Foz Port Authority has provided a letter of commitment to CTS Industry Club*).

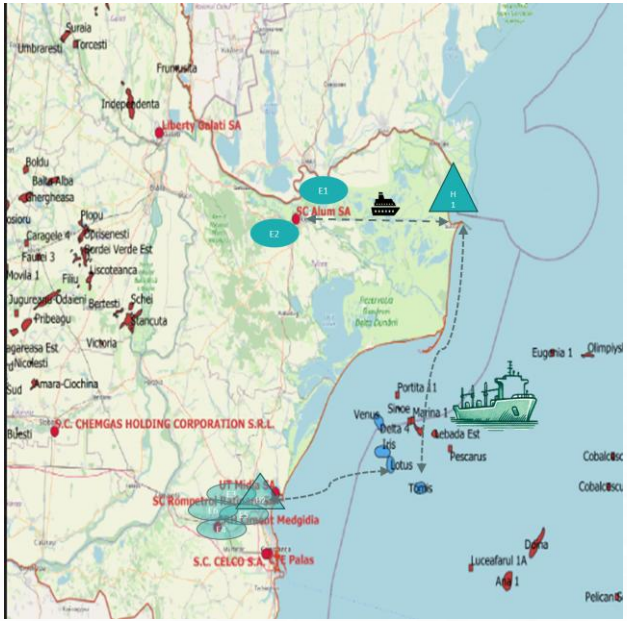
Baltics

Baltic clusters include emissions closest to ports. Shipping routes (servicing Latvian cluster and Southern Estonian sub-cluster) with a single ship and potential of Northern Estonian sub-clusters need to be evaluated





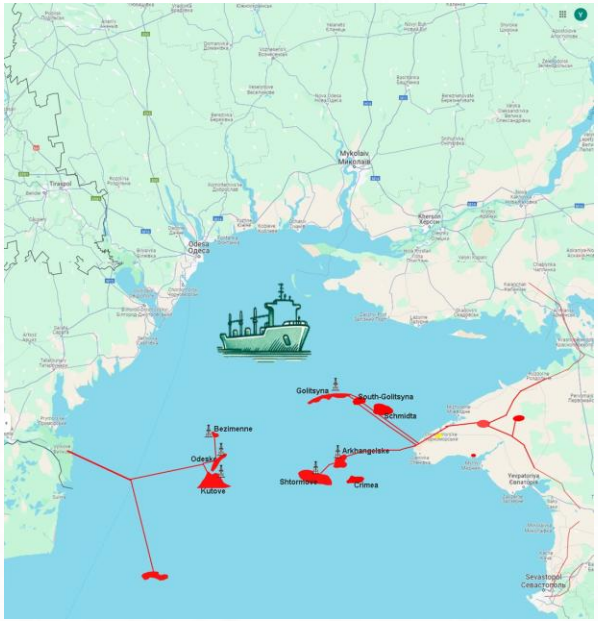
Black Sea



Black Sea case updates Romanian scenario from Strategy CCUS project

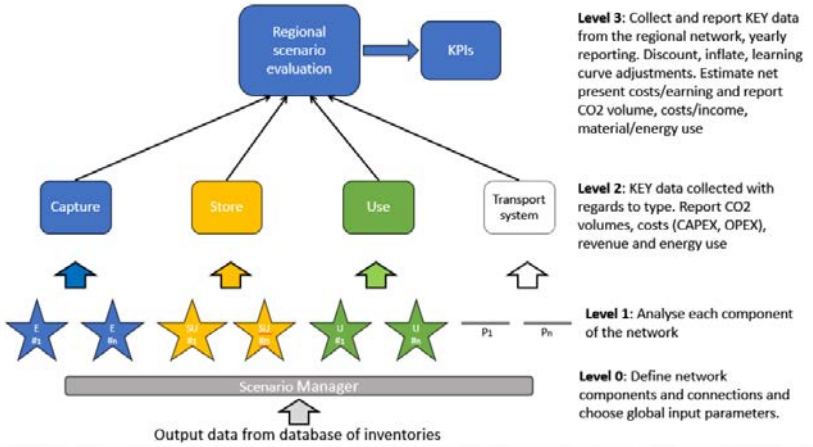
Black Sea

Black Sea case updates Romanian scenario from Strategy CCUS project, includes most promissing sites in Ukraine and investigates interplay in the region



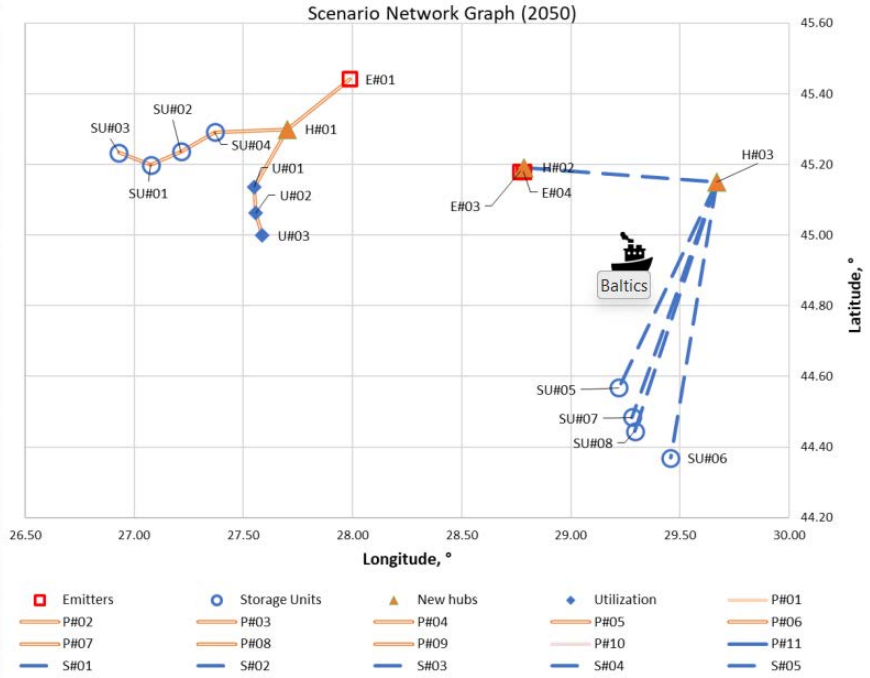
Techno-Economic Analysis Tool

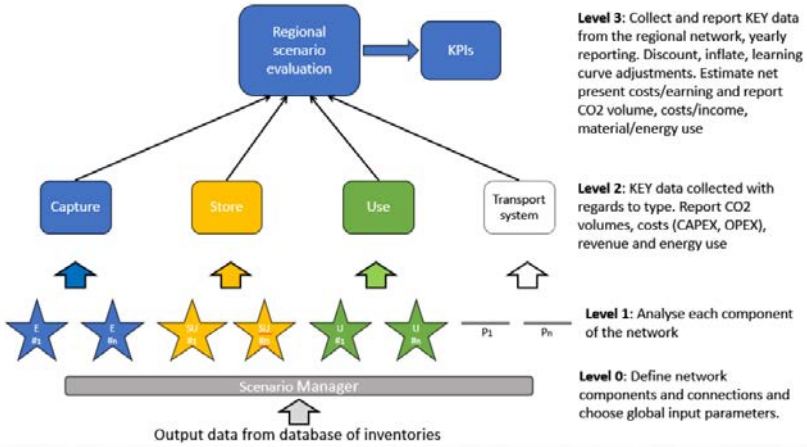
To set up different scenarios a dedicated tool was developed in the STRATEGY CCUS project funded though EU Horizon 2020 program (grant agreement No 837754).



Techno-Economic Analysis Tool

To set up different scenarios a dedicated tool was developed in the STRATEGY CCUS project funded though EU Horizon 2020 program (grant agreement No 837754).





16th International Conference on Greenhouse Gas Control Technologies, GHGT-16

23rd -27th October 2022, Lyon, France

A techno-economic Analysis Tool for Regional CO_2 Capture, Transport, Use and Storage Scenarios

Anders Nermoen[a]*, Roman Berenblyum[a], Paula Coussy[b], Xavier Guichet[b], Paula Canteli[c], Roberto Martínez Orio[c] , Paulo Mesquita[d], Júlio Carneiro[d], Alexey Khrulenko[a], Paulo Rocha[e]

Techno-Economic Analysis Results

Strategy CCUS Region KPIs (Discounted)

Analysis of the CCS system

Total CCS value chain	
CCS value chain (€/tCO2 avoided)	-57
Total CAPEX per block	**-20**
Cost of Capture (€/tonCO2 avoided)	-18
Cost of Transport (€/tonCO2 avoided)	-0,2
Cost of Storage (€/tonCO2 avoided)	-1,4
OPEX per block	**-37**
Cost of Capture (€/tonCO2 avoided)	-30
Cost of Transport (€/tonCO2 avoided)	-1
Cost of Storage (€/tonCO2 avoided)	-7
Transport cost (€/tonCO2 transported)	-0,7
Utilisation (income from CO2 sales) (M€)	6,0
EUA/ETS credit savings in the region (M€)	487,0

Analysis of CO2 volumes (Mt)

Total CO2 Captured	7,5
CO2 utilized	0,1
CO2 for mineralization (perm. avoided)	0,0
Stored	7,4
Total emitted with CCS	41,1
Total avoided emission	7,4
BIO CO2 captured, neg. Emissions	0,0
Total CO2 fed into transport network	**7**
CCUS National Objectives	200
Share in national objectives	3,7 %

STRATEGY CCUS
A viable solution for a sustainable future

Analysis of ETS allowances

EU ETS parameters	
Price of allowances in 2025 (€/tonCO2)	70
Price of allowances in 2045 (€/tonCO2)	212
Whole regional expense without CCUS:	
ETS costs without CCUS (M€)	3 571,7
Whole region expense with CCUS	
ETS costs with CCUS, remaining emissions (M€)	3 084,7
Cost of CCUS (M€)	417,3
TOTAL costs with CCUS (M€)	**3 502,0**
Cost difference, with minus without CCUS (M€)	**-70,0**
Average yearly energy need, TWh/year	**0,24**
Peak energy need, TWh/year	**0,73**
Breakeven CO2 price (€/tonCO2)	52

THANKS

<- For more information follow us on LinkedIN or get in touch:

robe@norceresearch.no

+47 986 21 751

This research was funded by CETPartnership, the Clean Energy Transition Partnership under the 2022 CETPartnership joint call for research proposals, co-funded by the European Commission (GA N°101069750) and with the funding organizations detailed on https://cetpartnership.eu/funding-agencies-and-call-modules."