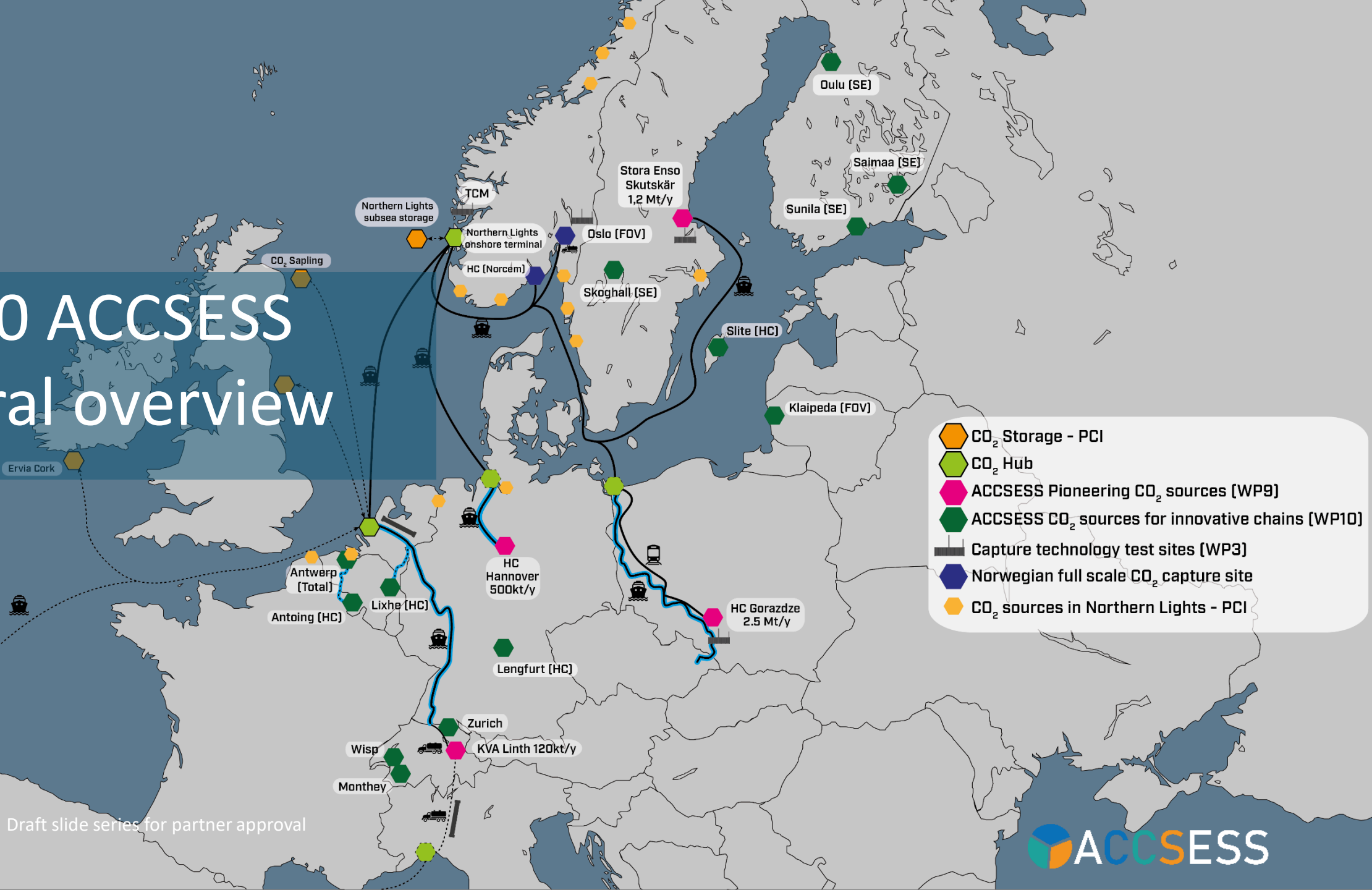


H2020 ACCESS general overview



Draft slide series for partner approval

Read me (and delete before presenting)

- This slide series gives a general overview of ACCSESS. Slides can be used freely, and e.g. be copied and used for internal and public presentations. Additional slides with own work can of course be added. Partners can also add their own logo on slides that present activities they are involved in.
- Note that slide 4 is a summary of slides 5-7, you typically won't need all four of slides 4-7.
- This slide series and other slides that are approved by the consortium and ready to use freely when presenting ACCSESS can be found under *030 Templates, Graphics and Procedures > 045 ACCSESS slides free for consortium to use*
- Graphics you can use can be found under *030 Templates, Graphics and Procedures > 040 Project logo and other graphics*
- If you wish to present slides with Results, be aware of that **dissemination of Results is subject to the conditions set out in clause 8.4.2 of the Consortium Agreement**
- If you have suggestions for additional slides that you think could be useful, please send to access@sintef.no and to Ruben and Kristin. This can e.g. be slides that present more in detail the work your organisation does in ACCSESS, or slides with approved results that could be of interest for several partners to disseminate



ACCESS

Providing access to cost-efficient, replicable, safe, and flexible CCUS

Horizon2020 Innovation Action

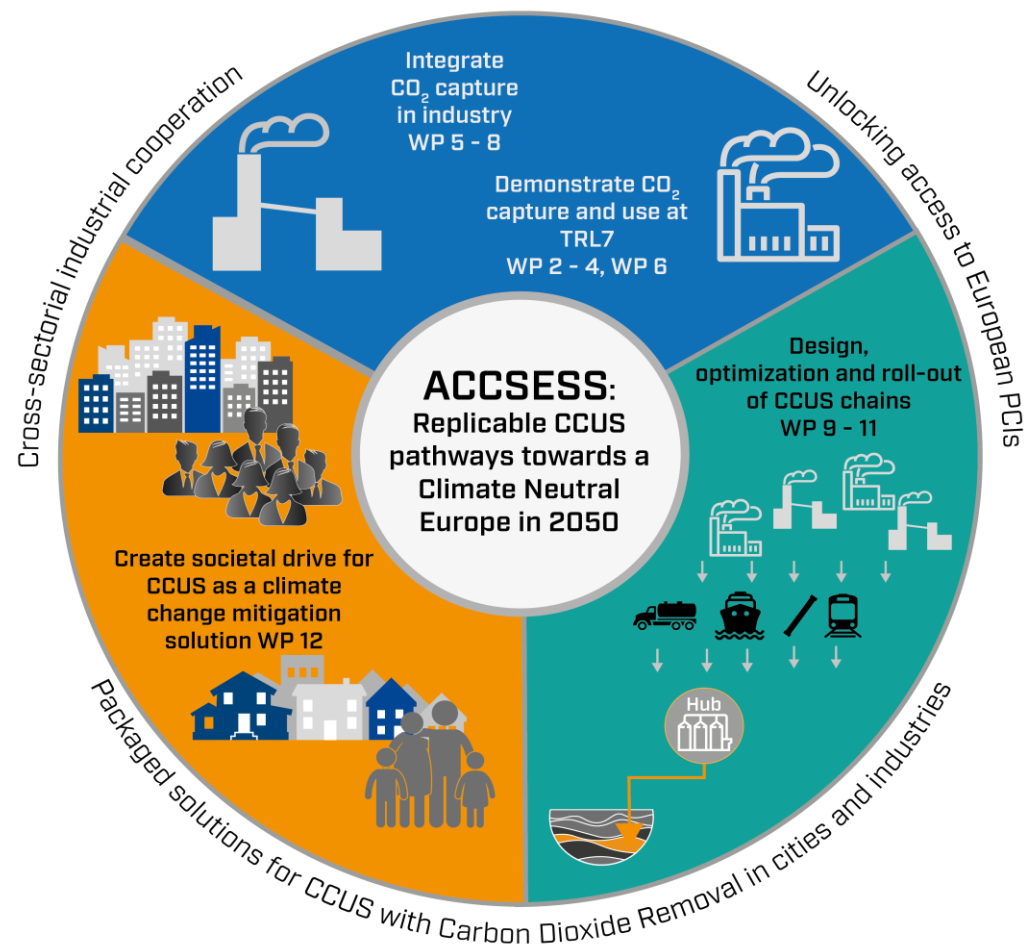
Duration: May 2021- April 2025

Coordinator: SINTEF Energy

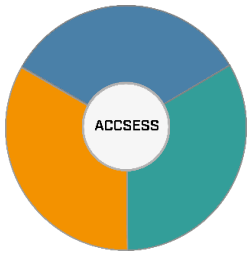
Budget: 18.4 MEUR, EU funding 15.0 MEUR

Main objectives

- **In blue:** Test CO₂ capture and CO₂ use at TRL7 and integrate capture technologies in industrial installations
- **In green:** Develop and improve CCUS chains from continental Europe and the Baltic area to the North Sea
- **In orange:** Engage and inform stakeholders about CCUS and explain its societal benefits at large and for sustainable cities

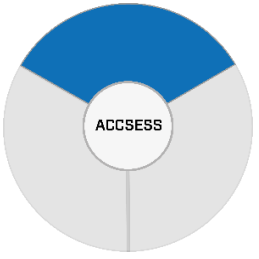


Targeted results



- Demonstrate at TRL7 (~2 tonnes/day) the *CO₂ solutions by Saipem* capture technology combined with a Prospin rotary packed bed absorber at Stora Enso in Sweden and HeidelbergCement in Poland
- Demonstrate at TRL7 (~5 tonnes/day) the Neustark carbonation process for demolition concrete recycling (CCU)
- Integrate CO₂ capture in pulp and paper, cement, waste to energy and biorefineries, aiming at CO₂ avoidance cost cuts of ~20-30%
- Establish a replicable CCUS chain development methodology, using integrated techno-economic and environmental analysis, and deliver a supporting open-source chain development tool
- Identify feasible, safe and cost-efficient tank-based CO₂ transport solutions with potential for 50% cost cuts
- Deliver a Handbook on how CCUS can enable sustainable cities development

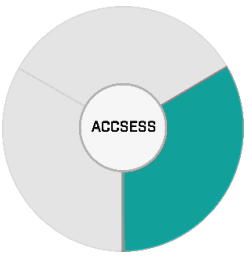




Objectives – capture demonstration and integration, CO₂ use

- Demonstrate at TRL7 on a 2 tonnes/day scale the enzymatic "CO₂ solutions by Saipem" capture technology operating with a Propsin rotary packed bed absorber at the Stora Enso pulp and kraft mill in Skutskär, Sweden and the HeidelbergCement kiln in Gorazdze, Poland
- Design an innovative cement kiln with integration of the cement clinker line and amine scrubbing
- Demonstrate at TRL7 the Neustark continuous two-step mineral carbonation process for demolition concrete recycling
- Perform systematic process integration studies of CO₂ capture for pulp and paper, cement, waste to energy and biorefineries, with the objective to cut CO₂ avoidance costs with 20-30%



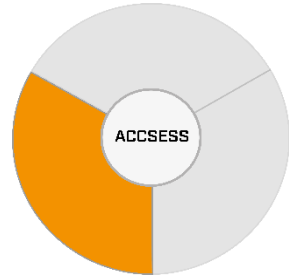


Objectives – CCUS chains and clusters

- Establish a replicable CCUS chain development methodology, using integrated techno-economic and environmental analysis
- Develop designs for minimal cost and minimal environmental impact CCUS chains, serving intersectorial clusters and networks
- Deliver an open-source CCUS chain development tool
- Identify feasible, safe and cost-efficient tank-based CO₂ transport solutions with potential for 50% cost cuts
- Develop safe and time-efficient procedures for CO₂ loading/offloading along the CCUS chain



Objectives – Societal integration of CCUS

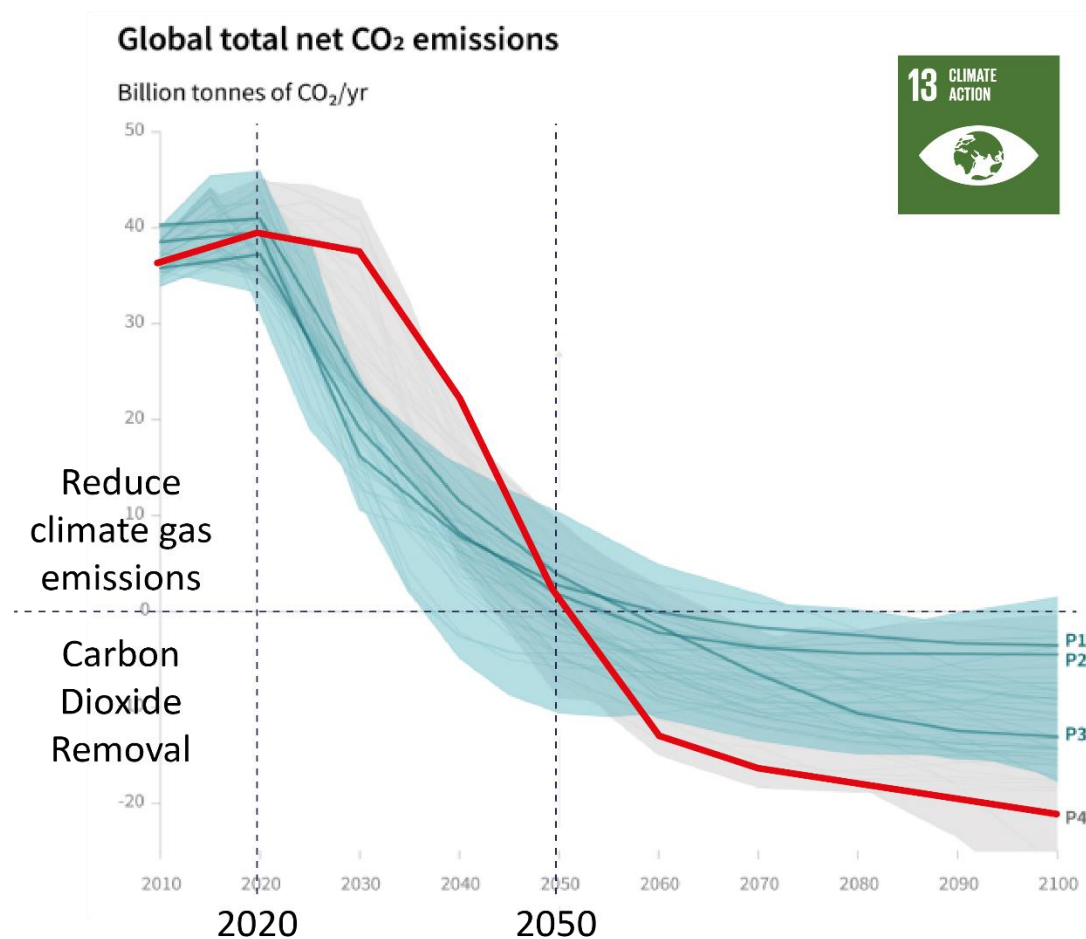


- Demonstrate how CCUS significantly can reduce housing and products' carbon footprint
- Deliver a Handbook on how CCUS can enable sustainable cities development
- Synthesize how cost efficient CO₂ capture can be integrated in industries and connect to CO₂ transport infrastructures
- Train Swedish and German environmental authorities in how to regulate CO₂ capture installations
- Establish an International Liaisons Council to exchange knowledge and foster ideas for driving CCUS implementation globally



The **ACCSESS** Vision is to Develop replicable CCUS pathways towards a Climate Neutral Europe in 2050

- A need for net removal of CO₂ to reach the 1.5°C target
 - *IPCC AR6 WGI: "Anthropogenic CO₂ removal (CDR) leading to global net negative emissions would lower the atmospheric CO₂ concentration and reverse surface ocean acidification."*
- *The industrial sectors in ACCSESS can contribute to CDR*
 - *The extent of the contribution depends on the feedstocks and other characteristics of each sector*

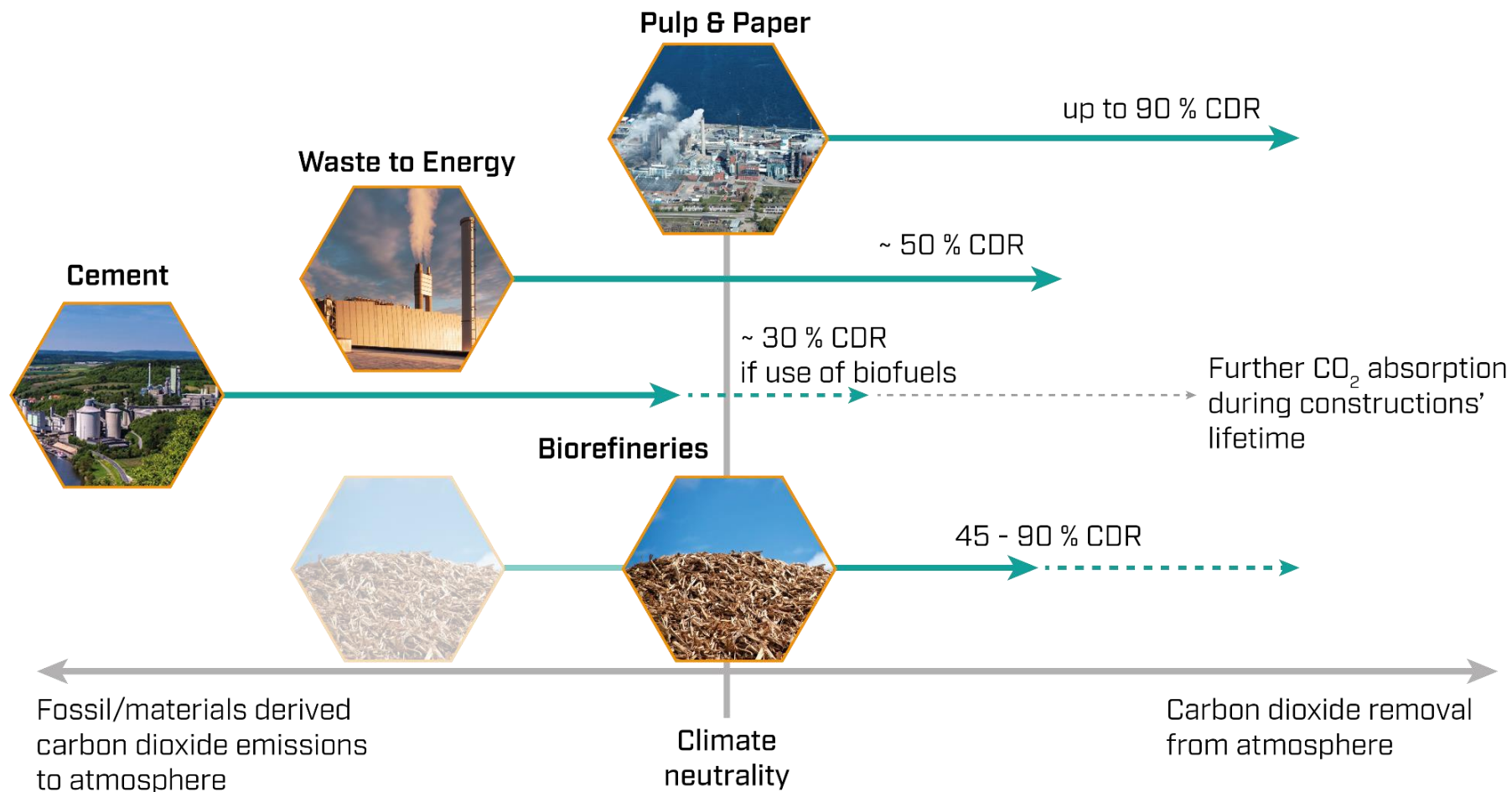


Adapted from [Global Warming of 1.5 °C — \(ipcc.ch\)](https://www.ipcc.ch)

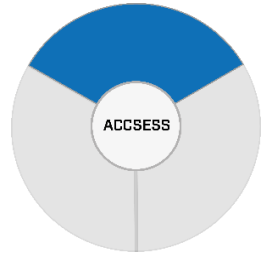
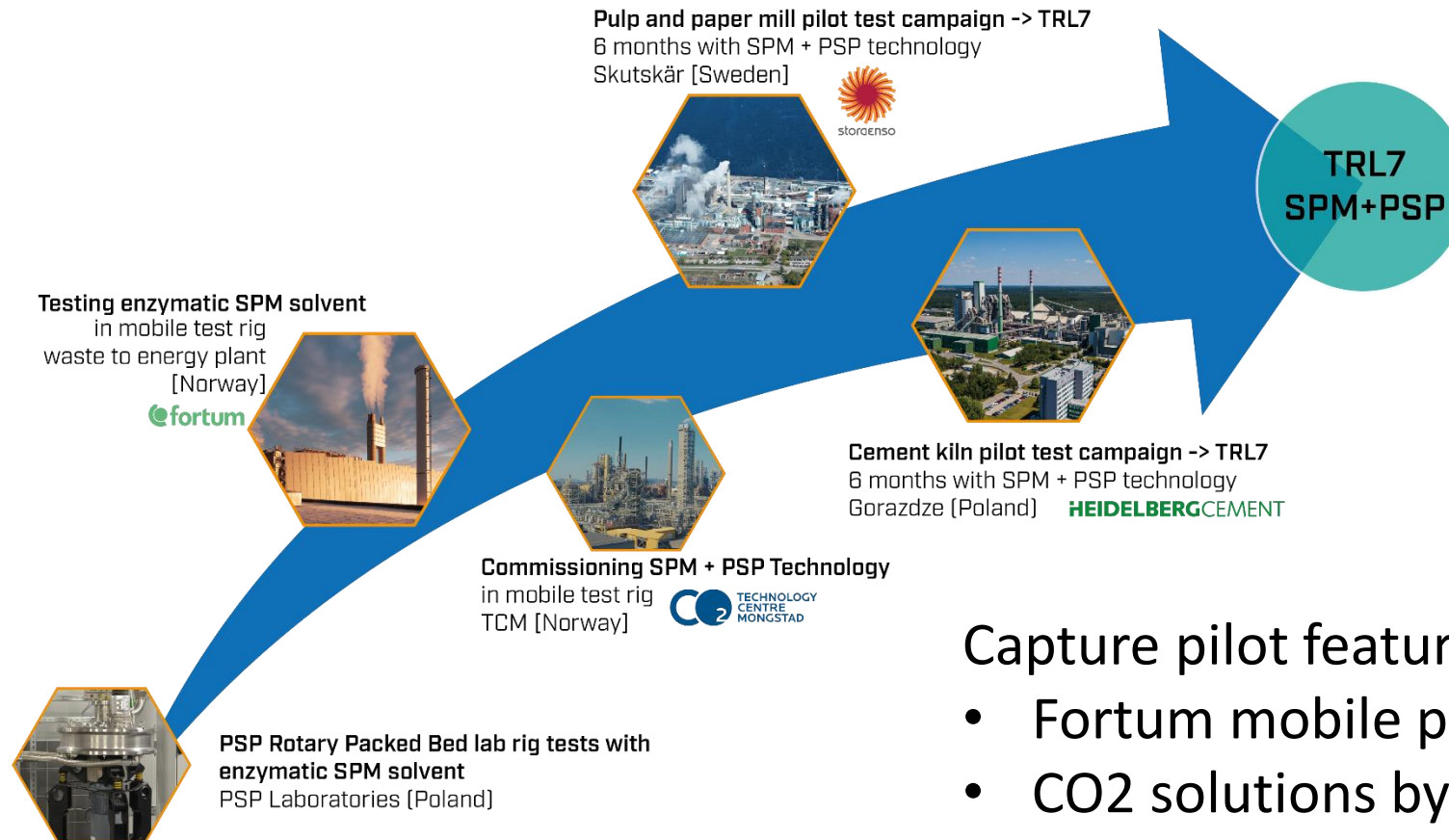


ACCSESS - a climate-positive project

CDR = Carbon
Dioxide Removal



CO₂ capture piloting



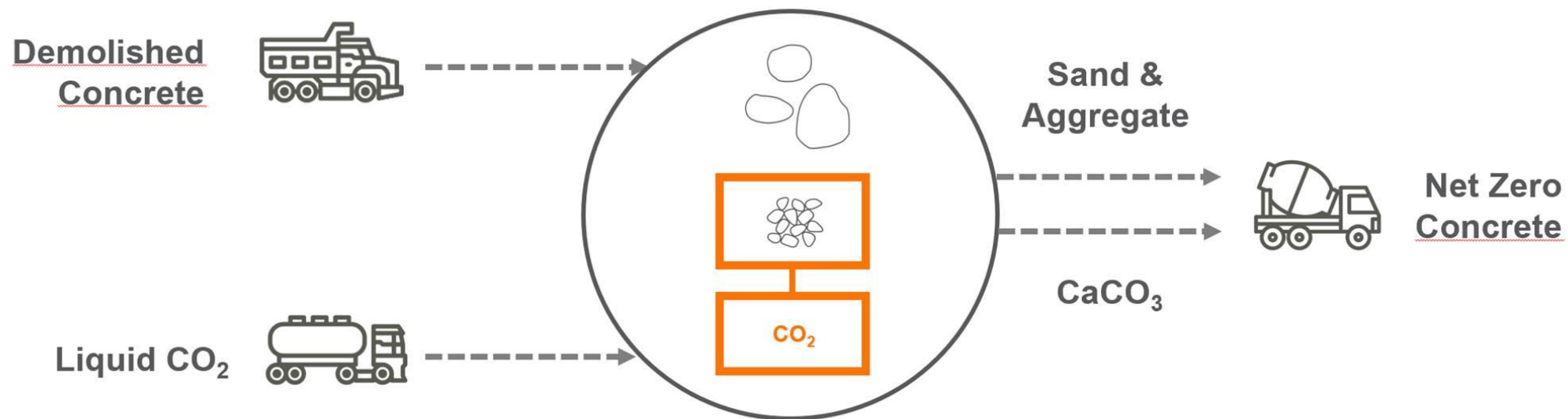
Capture pilot features:

- Fortum mobile pilot plant
- CO₂ solutions by Saipem solvent
- Prospin Rotary Packed Bed absorber

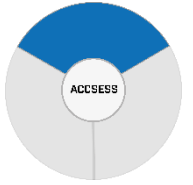
CCU: Concrete recarbonation

Recarbonation of waste materials from demolished concrete – making useful material from the world's largest waste stream

Demonstration at TRL7 of permanent storage of ~5 tonnes/day of CO₂ in CaCO₃



Innovative kiln design for integrated amine capture



- Combined steam generation and kiln heat supply
- Combined structural elements, e.g., for preheating tower and absorption tower
- Operational synergies
- Case study for HeidelbergCement kiln in Hannover with biofuel
- Technology supplier cooperation between KHD and Linde



+

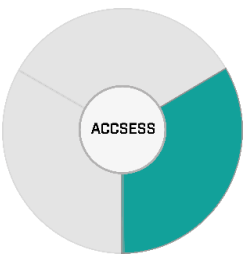


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Innovative PCC
cement kiln design
with targeted 25%
cost cut and CDR





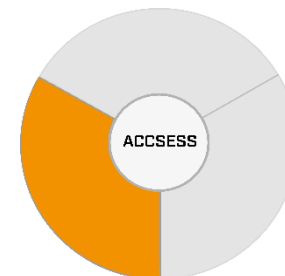
CCUS Chain analysis

"The holistic approach for the development of the CCUS chain network targeted for large scale European CO₂ market is ground-breaking" (from Evaluation Summary Report)

- Technoeconomic analysis
- Regulatory/legal framework
- Environmental aspects/LCA along the chain
- Delivery of an Open-source code for optimizing CCUS networks over time and in space



Sustainable Cities development and CCUS



CCUS end-products cost



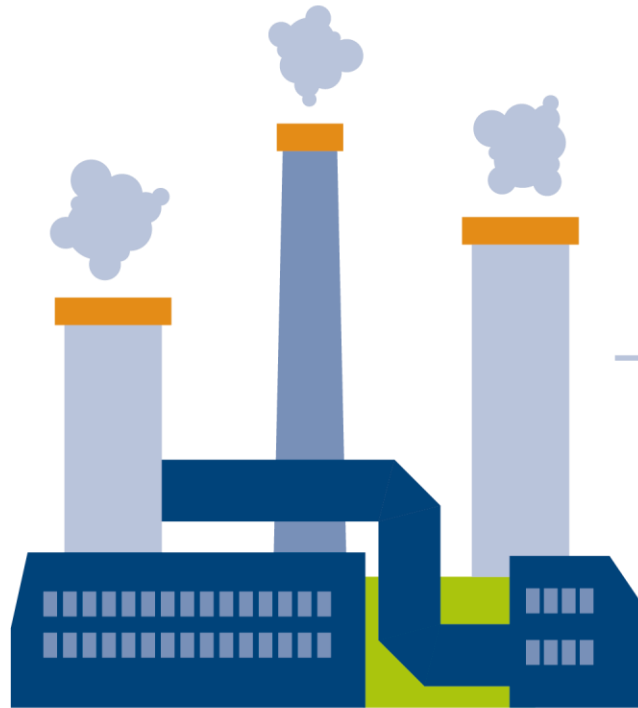
Cement industry

Price increase cement
+ 70 %



Price increase
building
Less than
+ 0.5 %

Rootzén, J. & Johnsson, F.
Energy Policy 98 (2016) 459–469



**CCUS Mitigation Costs at point
emissions ~100€/tonCO₂, while
EU-ETS ~25€/tonCO₂**

Value chain
analysis of
end-products
and services

EU Sustainable cities
Demand for climate neutral or climate
positive end-products and services



"Marginal increase in cost and price of
end-products, while significantly reducing their
carbon footprint, or even providing CDR"

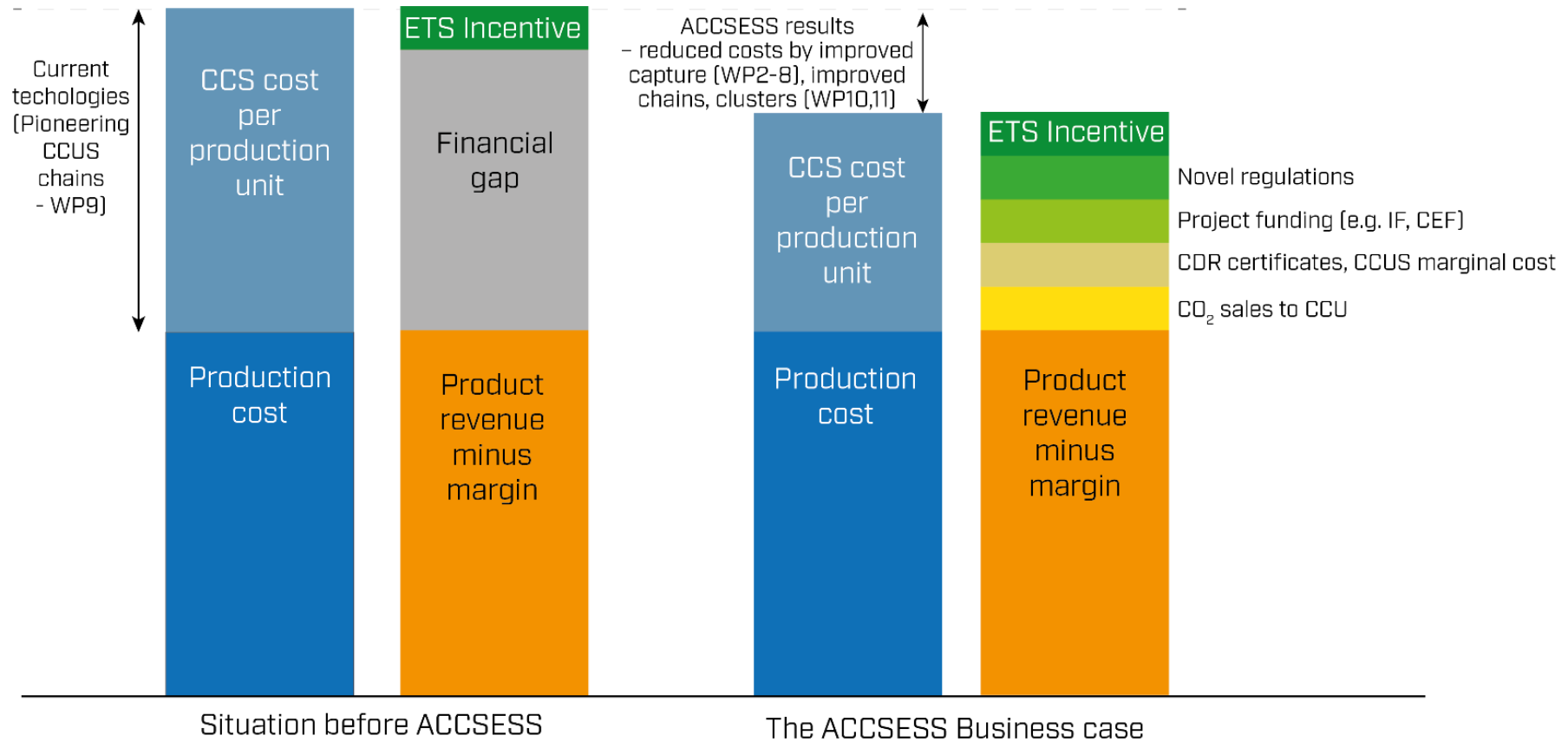


A multi-dimensional approach to innovation and impact

- ACCSESS ties together cities/citizens, industry, research, and public authorities to enhance innovation and maximise impact
- ACCSESS focuses on how business models can be developed by smart interaction between Policy, Academia, Industry and Citizens along the Innovation and Impact dimensions
- Cross-sectorial collaboration aims to progress CCUS, foster and exchange learnings and jointly address most relevant deployment challenges



Building CCUS business cases – cutting costs and increasing income



ACCSESS will...

Demonstrate environmentally benign CO₂ capture in Waste-to-Energy, Pulp and paper and Cement.

Develop a tool for optimal CO₂ capture deployment in industrial clusters

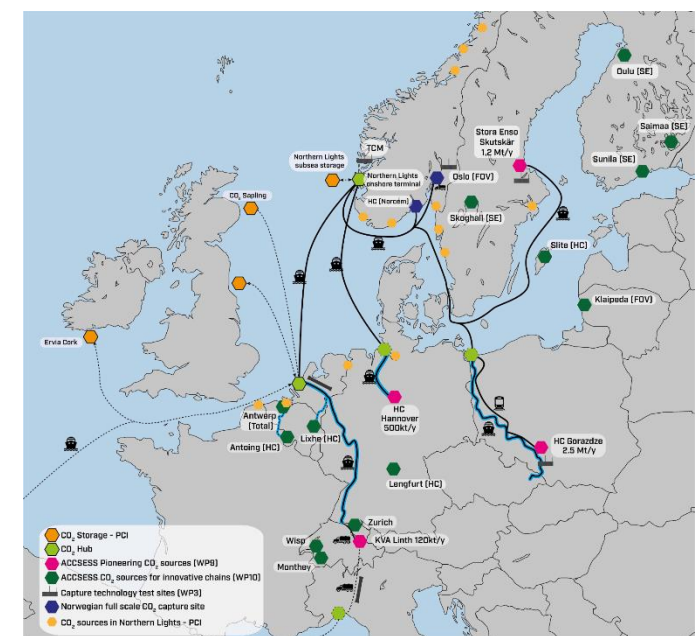
Deliver an Open-source code for optimizing CCUS networks over time and in space

Leverage on the Norwegian full-scale CCS project Longship, in operation from 2024

Connect to and draw on Northern Lights CO₂ transport and storage expertise

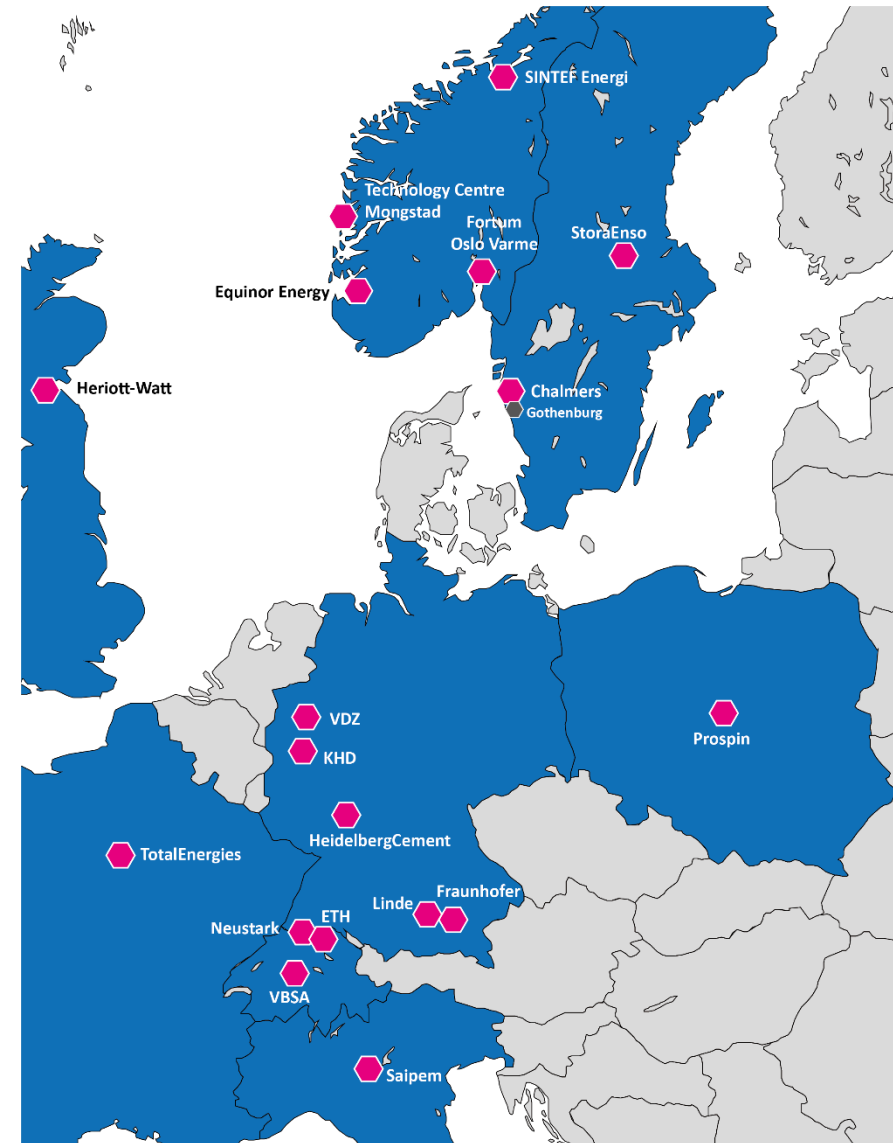
Develop CCUS chains from inland Europe and the Baltics, offering complementarity to the current Northern Lights PCI

Generate replicable methods, tools and plans that will have an impact on CCUS over the medium to long term, and contribute to the deployment of CCUS in hubs and clusters



The ACCSESS consortium

- Covers four energy-intensive sectors: Pulp and Paper, Cement, Waste to Energy and Refining
- Technology and R&I competence along the full CCUS chain as well as complementary expertise



- **SINTEF Energi AS**
Trondheim - NO
- **Stora Enso AB**
Falun - SE
- **HeidelbergCement AG**
Heidelberg - DE
- **Fortum Oslo Varme AS**
Oslo - NO
- **Saipem**
Milano - IT
- **Neustark AG**
Stettlen - CH
- **Linde Aktiengesellschaft**
Munich - DE
- **KHD GmbH**
Cologne - DE
- **Equinor Energy AS**
Stavanger - NO
- **TotalEnergies**
Paris - FR
- **Technology Centre Mongstad**
Mongstad - NO
- **VBSA**
Bern - CH
- **ETH Zürich**
Zurich - CH
- **VDZ Gemeinnützige GmbH**
Dusseldorf - DE
- **Fraunhofer IAO**
Munich - DE
- **Chalmers Tekniska Högskola AB**
Gothenburg - SE
- **Heriot-Watt University**
Edinburgh - UK
- **Prospin**
Lodz - PL



Partners



HEIDELBERGCEMENT



CHALMERS



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