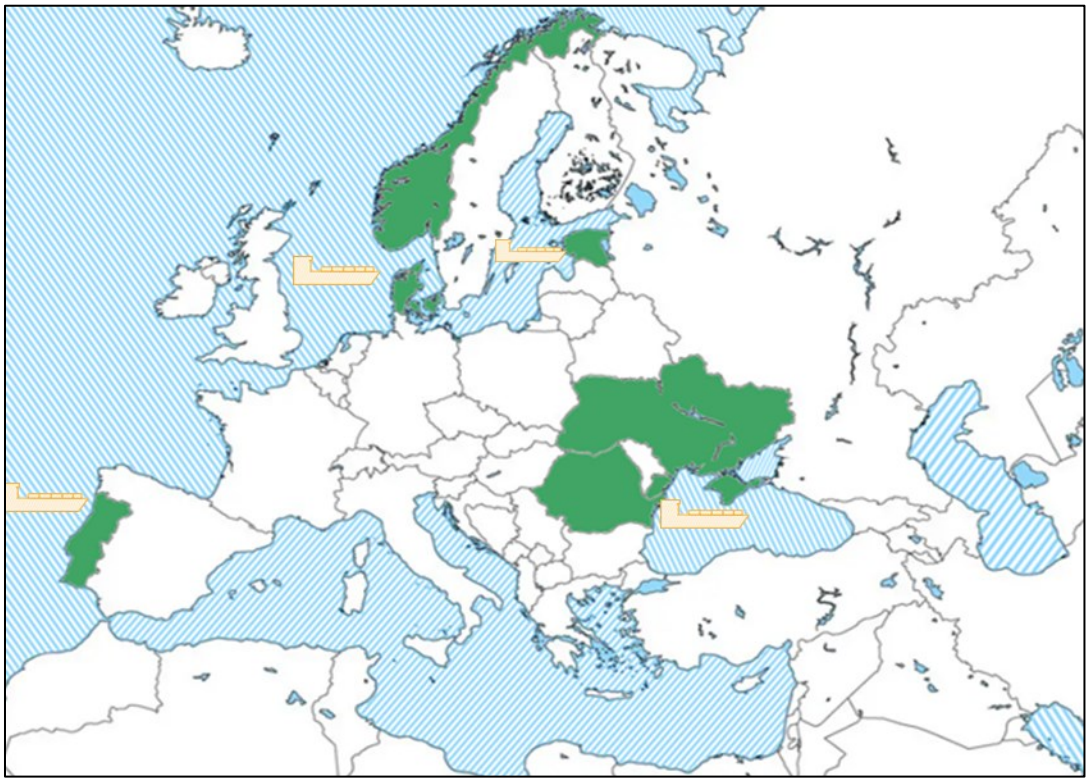
CO_2 Transport and Storage directly from a ship: flexible and cost-effective solutions for European offshore storage

Deliverable 5.1

Stakeholder mapping report - summary



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Executive summary

CTS project main objective is to demonstrate techno-economic feasibility of direct injection from ship to unlock CCS potential for the industry by increasing flexibility and versatility of the CCS value chain as well as to reduce costs.

Stakeholder engagement is achieved through a number of actions in WP5 and is starting with stakeholder mapping (Task 5.1.). For stakeholder mapping, the regional teams have identified the relevant stakeholders for applying the technology based on its own experience (e.g. ongoing and former projects and activities) and own past interactions. For each region, the following categories of stakeholders are listed: emitters, potential storage operators (operators of hydrocarbon fields), harbour operators/authorities, representatives of Competent Authority for CO2 geological storage, NGO's.

The current deliverable is presenting the key, publicly open, results of stakeholder mapping activity performed by the regional teams and also the stakeholder engagement strategy of the project. At regional level, considering the scenarios created, all relevant stakeholders have been identified, emitters, regional and local authorities, transport operators, storage operators, oil and gas operators etc.

Stakeholder mapping for Romania

Romania has an 85% GHG emission reduction target by 2030 compared to the 1990 levels, with sector-specific goals, according to the final updated Integrated National Energy and Climate Plan for 2025-2030 published in October 2024. As regulation, Romania has Directive 2009/31/EC for the geological storage of CO_2, transposed through Law 114/2013, with the competent authority being the National Authority for Regulations in Mining, Petroleum and Carbon Dioxide Storage (ANRMPSG). To this regulation, several amendments have been proposed and approved by the Government in December 2024. Although the regulatory framework is in place, including specific procedures for granting exploration and storage permits, no CCS project is operational in the country.

Apart from ANRMPSG, other relevant national authorities are ACROPO (The Competent Regulatory Authority for Offshore Oil Operations in the Black Sea), ANRE (The National Regulatory Authority in the field of Energy), Galați Lower Danube River Administration and Ministry of Environment, Waters and Forests. Among the regional authorities the important stakeholders are the local administration of Călărași and Constanța counties and for the ports in the Romanian scenario.

The targeted regions in the CTS Romanian scenario are Dobrogea (onshore) and Histria Depression, in the Black Sea, where storage potential has been considered. Considering these regions, several local key players have been identified including emitters, potential transport and storage operators. Apart from these local players, relevant NGO’s have been considered as relevant for CCS implementation according to the CTS scenario.

Emitters involved in the scenario are the cement company ROMCIM S.A., the construction material companies CELCO S.A., Termocentrale Constanța (thermal energy producer), the refinery Rompetrol Rafinare, the energy producer Rompetrol Energy, the glass producer Saint Gobain Glass Călărași and the steel plant Silcotub Călărași. The potential transport operator is Transgaz, the technical operator of the National Transport System for natural gas. Potential storage operators are OMV Petrom and Romgaz, the main oil and gas companies in the country. As relevant NGO’s we have identified the following

organizations: Greenpeace Romania, WWF Romania, Association for Intelligent Energy, Federation of the Association of Energy Utility Companies, COGEN Romania, Romanian Energy Centre, The Romanian Association for Petroleum Exploration and Production, The Oil and Gas Employers' Federation and CIROM, employers' organization for producers of cement and mineral products.

Stakeholder mapping for Norway

Norway has been pioneering implementing climate change concerns into policy developments. Norwegian CO_2 tax was introduced in 1991 to provide stronger incentives for reducing emissions. It is also connected to the EU-ETS trading scheme.

Catching and injecting CO_2 started at the Sleipner gas field. The gas has a high content of CO_2 and needed to be removed prior to exporting to the market. Due to a tax on CO_2 emissions for the offshore industry, it was decided to inject CO_2 into the high porosity Utsira Formation about 1000 meters below the field. The CCS activity has been in operation since 1996 injecting an accumulated volume of over 19 Mtons of CO_2.The Snøhvit gas field has also a high CO_2 content and CCS was developed in connection with the production start-up in 1997.

The Norwegian Offshore Directorate developed a National CO_2 storage atlas estimating several gigatons of storage capacity on the Continental Shelf. Currently 11 storage licences have been granted (one exploitation, the others are exploration licenses) with several more in the pipeline. The Longship project is a pilot project for carbon capture and transport to reduce the national greenhouse gas emissions and to demonstrate the feasibility of a complete CCS chain on a large scale. The Project includes CO_2 captured at a cement factory and later also from a waste facility in Oslo. In addition, CO_2 emitters in Denmark, Sweden and The Netherlands have signed contracts to deliver CO_2 for storage in the Longship storage site. The CO_2 will be transported in specially designed CO_2 carriers at medium pressure regime (15 barges) with a capacity of 7500 liquid tons of CO_2.

In Norway, the Norwegian Ministry of Energy is responsible for awarding CO_2 licenses Norway has a Climate Action Plan 2021-2030 with an emission reduction target of 45%. The policy document "Grønt industriløft 2.0" stated an emission reduction level of 55% in 2030 and other environmentally ambitious goals. Relevant national authorities are the Norwegian Offshore Directorate, the Ministry of Energy, Gassnova SF. Other relevant authorities are the local ones, emitters, transport operators Gassco and Gassled and storage operators. Other relevant organizations are the Bellona Environmental Foundation and IOM Law.

The offshore industry is the largest CO_2 emitter. This industry also pays the highest CO_2 tax and has a high incentive to reduce its emissions. There are plans to reduce emissions by using electric power from shore to process the produced oil and gas. Emissions from Norwegian industry is mainly connected to metal production, fertilizers and cement. Most of the emitters are located close to the sea or a fjord. This project will analyse possibilities to develop CCS solutions for the main industry hubs by use of ship-based transportation and injection.

Key stakeholders are the Norwegian Offshore directorate, The Ministries of Energy and Environment; Gassnova SF; local authorities in Vestfold og Telemark, Agder, Rogaland and Vestland; transport operators such as Gassco and Gassled and Knutsen Group; storage owners of 001 to 011 licenses: Northern Lights

JV, Equinor ASA, Horisont Energi AS and PGNiG Upstream Norway AS, Harbour Energy, Total Energies EP Norge, Aker BP, OMV Norge, Stella Maris CCS, Sval Energi, Storegga Norge, Vår Energi, Equinor Low Carbon Solutions AS, Lime Petroleum AS.

Stakeholder mapping for Baltics

Baltic Scenario includes CO_2 emissions from Estonia, Latvia and Lithuania and storage in E6 structure offshore Latvia. Despite planning to becoming carbon-neutral by 2050, they did not include CO_2 storage in their national energy and climate plans, while only Lithuania included CO_2 capture, transport and utilization in its final national plan (NECP) by 2030.

EU CCS directive was implemented in the Baltic states in 2011, where at the time CO_2 storage was banned in Estonia and Latvia except for research, with transportation permitted in both countries. Lithuania banned underground CO_2 injection in 2019. Latvia is the only country in the region with good geological prospects for CO_2 storage.

Total GHG and CO_2 emissions are the highest in Lithuania but highest per capita in Estonia, especially in the North-East. National and regional key players are in Estonia the Ministry of Climate and the Ministry of Economic Affairs and Communications. In Latvia there is the Ministry of Energy and Climate. In Lithuania there is the Ministry of Energy and the Ministry of Environment, as well as a National Climate Change Committee. Regional authorities are the port administrations of Sillamäe and Muuga in Estonia, Riga port in Latvia and Klapeda port in Lithuania.

As emitters involved in scenarios, in Estonia they are owned by the companies Enefit and VKG, Kiviõli Chemical plant, Horizon paper factory and UTILITAS. Latvia has the biggest emitters owned by Latvenergo (power) and Schwenk (cement). In Lithuania the owners are Fortum, Orlen and Schwenk. Potential transport operators in Estonia are AS Gaasivõrk, in Latvia is “Conexus Baltic Grid” and in Lithuania there is “AB Amber Grid”. As potential storage operators are Minijos Nafta company and Latvian company Conexus. As NGOs the most active are Bellona Europa and BASRECCS.

Stakeholder mapping for Denmark

The Danish government aims at a 70% GHG emission reduction by 2030 and achieving net-zero emissions by 2050. A regulatory framework was agreed by government and a broad political majority so that the Danish state will be a co-owner of CO_2 storage licenses in Denmark, with state ownership assumed by the public fund Nordsøfonden. There is a consolidated Act on pipeline transport of CO_2 and two executive orders to ensure a high level of environmental protection during CCUS project developments.

Two CO_2 storage exploration licensing rounds took place in 2022-2023 and 2023-2024. For the first round, three offshore licences were awarded, the depleted oil and gas fields in the Harald area, a new unexplored area with saline formations east of Harald area and the depleted oil and gas fields in the Siri Canyon area (Greensand project). For the second round, three onshore licences were awarded, Gassum area in Eastern Jutland (Greenstore project), Rødby area on Lolland (Ruby project) and Havnsø area in Western Zealand (CO_2StorageKalundborg project). A new storage licensing round was initiated at the end of September 2024 with deadline in November for exploration and use of the subsoil for geological CO_2 storage at Thorning located south of Viborg in Jutland.

As National authorities, the Danish state is a co-owner of CO_2 exploration and storage licenses through the public fund Nordsøfonden. Other important actor is The Danish Energy Agency responsible for the licensing procedures for the award of licenses for exploration and storage of CO_2 into the Danish subsoil. Other important authorities are the Danish Ministry of Climate, Energy and Utilities and the Ministry of Industry, Business and Financial Affairs, strongly involved in the development of CCS at national level.

The national and regional key players from Denmark, relevant to the CTS scenario, include emitters, mainly from electricity and heat, but also refineries and biogas plants, cluster organizations (Carbon Capture Cluster Copenhagen, Energy Cluster Denmark, Clean and the Green Hub Denmark), companies developing pipeline infrastructure (Evida, Ørsted and Energinet), harbour administrations/authorities upgrading for CO_2 vessels (Fredericia Havn , Copenhagen Malmö Port, Esbjerg Havn, and Hanstholm Havn), storage operators (TotalEnergies EP Denmark A/S, INEOS E&P, Wintershall DEA International, Equinor, CarbonCuts A/S and Nordsøfonden – state partner), knowledge institutions bringing expertise along the CCUS value chain (DTU Offshore – storage, DTU Kemiteknik - Capture, Dansk Gas Teknisk Center - DGC, Teknologisk Institut - DTI, Force Technology, and GEUS - Geological Survey of Denmark and Greenland) and also consultants supporting the development of the CCUS sector (Rambøll, COWI, NIRAS, DNV and Grøn Agenda).

Stakeholder mapping for Ukraine

Ukraine pledged not to exceed 60% of GHG emission levels in 1990 by 2030, which became 65% in the NDC2. The Ministry of Environmental Protection and Natural Resources of Ukraine developed a National Energy and Climate Plan for up to 2030, developed according to EU 2018/1999 Regulation. Another goal is climate neutrality by 2050 for the energy sector and for whole country by 2060. The legal framework for CCS in Ukraine is still under development and currently lacks an effective GHG monitoring system as the basis for the Emissions Trading System (ETS).

The target regions are Odesa and Mykolaiv. The national and regional key players are the Ministry of Environmental Protection and Natural Resources of Ukraine, The Ministry of Energy of Ukraine, the Ukrainian Geological Survey, The State Commission of Ukraine on Mineral Resources and others. Possible CO2 hubs are Pivdennyi Sea Port for Odesa and Mykolaiv Sea Port for Mykolaiv.

Emitters are Odesa Port Plant PJSC, Odesagaz JSC, Yugcement JSC, Mykolaiv Alumina Plant LL, Mykolaivgaz and Chornomarnoftogaz. However, due to the lack of CO2 emissions data for specific industry players and only general emissions available for the region, the CTS scenario is made at regional scale without individual emitters involved. Gas Transmission System Operator of Ukraine LLC (gas pipelines) could be involved in CO2 transportation. Potential ship operators could be Ukrferrgy, Blasko, NIBULON and Ukrtanker for the Black Sea and UKRRICHFLOT and Dnipro Cargo as river operators.

Relevant NGOs involved in reducing carbon emissions include Ukrainian Climate Office, National Ecological Center of Ukraine, Ukrainian Climate Network and other organizations.

Stakeholder mapping for Portugal

The Portuguese National Energy and Climate Plan 2030 aims for 55% reduction in GHG emissions by 2030 compared to 2005 levels, and it now considers CCS within the portfolio of activities that need to be studied for hard-to-abate sectors. Recently a new target for carbon neutrality by 2045 has been set by the Government, a target that cannot realistically be achieved without CCS and, possibly, without negative emissions linked to BECCS.

The regulatory authority for CCS lies with the ministry responsible for mineral resources and geological issues, currently the Ministry for Energy and Environment. The CCS European Directive is incorporated into law through Decree-Law 60/2012, which defines the Directorate-General for Energy and Geology (DGEG) as the licensing body and introduced the requirement for EIA in CCS projects under the regulations of the Environment Protection Agency (APA).

The target region for the CTS project was made to coincide with those of the STRATEGY CCUS project, and extends along the coastal region of the country, where most of the CO2 point sources are located, between the Figueira-da-Foz and Setúbal. Nevertheless, within the scenarios to be developed in CTS, the target region is expected to be expanded geographically to the cities of Porto to the North and Sines to the South, to include relevant industrial areas and sectors that were not included in STRATEGY CCUS. The storage site is located offshore, around 20 km from Figueira-da-Foz, where the ongoing PilotSTRATEGY project identified a geological structure, designated as Q4-TV1, adequate for CO_2 storage. PiltoSTRATEGY built a detailed static and dynamic model for the storage complex and is currently designing the injection facilities.

The national authorities relevant for the project are DGEG, the Directorate-General for Natural Resources, Safety and Maritime Services (DGRM) which oversees the maritime activities, and therefore have an important regulatory role to implement offshore CO2 transport and storage, APA, and the Institute for the Conservation of Nature and Forests (ICNF). The most relevant regional authorities are the Aveiro and Figueira de Foz Port Authority and the Figueira da Foz municipality and the **Center Regional Coordination and Development Commission** (CCDR Centro), a centre for regional governance.

The sector that is the largest emitter of fossil-fuel based CO2 is the cement and lime sector, with Cimpor and Secil several cement factories and LUSICAL / LHOIST lime factory, some of which have been involved with the CCUS studies for many years and actively promote the technology. The pulp and paper sector, namely the companies Navigator and Altri, although not requiring the CCS to achieve carbon neutrality since it can rely heavily on biomass as the energy source, is an important emitter of biogenic CO2 and has the potential to generate negative emissions, contributing to carbon neutrality of the country. The same potential for negative emissions can be identified, at least partially, from the waste incineration plants (LIPOR and VALORSUL). The GALP refinery in Sines is also an important point-source, but no plans so far have been put forward for carbon capture on it.

In what regards CO2 transport, potential pipeline operators are Redes Energéticas Nacionais (REN), that currently manages the existing natural gas pipeline network, and GALP, a Portuguese multinational energy company. No potential ship operators have been identified. Potential storage operators are, again GALP and REPSOL, a Spanish-based oil and gas company. Relevant NGOs are OIKOS, ZERO and QUERCUS, which should be engaged in any stakeholder discussion about CCS in the country.

Stakeholder engagement strategy

Stakeholder engagement strategy includes dedicated workshops associated with project meetings, dedicated consultation meetings and workshops focusing on individual scenarios.

As a part of the stakeholder engagement strategy, the consortium will apply next year a questionnaire in order to check among stakeholders their interest in application of direct ship injection technology and also the level of interest and awareness towards CCS in regions where CCS is not currently implemented.