17th International Conference on Greenhouse Gas Control Technologies **GHGT-17**

20th -24th October 2024, Calgary Canada

A framework for regional high-level technical screening of promising CCUS value chains

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Abstract

There is a demand to accelerate the deployment of Carbon Capture, Utilization, and Storage (CCUS) throughout Europe. As part of this, the CCUS ZEN project has connected CCUS actors in Europe, to identify promising value chains and to share knowledge and experience. A high-level screening of promising value chains has been carried out for two selected regions: the Baltic Sea region and the Mediterranean Sea region.

In the regional screening, technical and non-technical mappings were carried out. The technical mapping focused on emission sources, storage sites, transport infrastructure, utilization options and renewables (Figure 1). The non-technical mapping included stakeholders needs, regulations, climate policies and funding opportunities. These aspects should be considered, when CCUS value chain are to be developed further after the initial technical high-level screening.

First, a screening of the emission sources in each geographical sector leads to the identification of promising sites for CO_2 capture. The focus is put on identifying clusters of emitters, where CO_2 could be captured from different industrial sites and gathered at a hub before common transport to storage. Yet, standalone emitters can also be identified as promising for CCUS value chains, depending on their amount of emission, location, type of industry, etc. For each emission source, information about the facility is collected (facility name, company, location, coordinates, and industrial sector), along with information about the facility's emissions (annual amount of CO_2 emitted, emissions trend, share of biomass, and waste-to-energy). The reported CO_2 emissions are in general from 2021, except for some facilities where only older data are available. Clusters are defined, with the total amount of emissions, the number of

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facilities in the cluster, and the share of each industrial sector in the total emissions. Data from CaptureMap provided by Endrava are used for mapping CO_2 emissions sources in the Baltic Sea region (Denmark, Sweden, Finland, Germany, Estonia, Latvia, Lithuania, Poland) and the Mediterranean Sea region (France, Spain, Italy, Greece, Türkiye). The emission data were quality-checked, and amended where necessary, by the CCUS ZEN partners in Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Poland and France. Since Türkiye was not covered in the CaptureMap database, this mapping was carried out in the project by the Türkiye partner.

The screening of potential storage sites in the geographical sectors is carried out and based on public and available data from projects such as GESTCO, GeoCapacity, CO2Stop, NORDICCS, Strategy CCUS, PilotSTRATEGY, and national projects. For each mapped storage site, information is gathered about the type of reservoir (deep saline aquifer or depleted hydrocarbon field), the onshore or offshore location, the capacity of the reservoir (mean value), and the SRL level indicating the maturity of the capacity evaluation based on Akhurst et al. (2019).

For the infrastructure screening, we looked at existing infrastructure relevant for CO_2-transport with emphasis on pipelines, existing natural gas corridors, waterways and ports. If transport using pipelines or waterways are not an option, also railways and road (lorries) are evaluated. For transportation the mapping tool developed in the CO2LOS project was used to identify opportunities in ship transport or barges, while PCI Transparency Platform, combined with OpenStreetMap, was used for pipelines.

Thereafter, one or more chains are suggested, linking one or more emission clusters to one or more storage sites. The total emissions amount of the clusters and the storage capacities are considered. However, it is recognised that numbers should be treated with caution. On the one side, the maturity level of the storage sites is often low, inferring potential smaller capacities when the resource is further assessed. Also, crucial data can be missing or confidential, which makes detailed studies and dynamic reservoir modelling challenging. On the other side, the total amount of the clusters' emission does not exactly represent the amount of captured CO_2, but rather a maximum, as not 100% of the emissions would be eventually captured. Besides, the level of emissions in 2021 does not foresee future emissions of the cluster, as by 2050 other low carbon levers would be set up. The potential for carbon utilisation is also tackled by identifying relevant existing projects and technology providers in the areas of interest while also looking at the renewable energy potential from the EIGL database.

The overall screening workflow was tested in the two geographical regions and led to the definition of at least 15 CCUS value chains, several with different transport solution included, for instance using ships or pipelines or a combination. From the 15 CCUS value chains, we identified the eight most promising to be further evaluated for accelerating CCUS deployment throughout Baltic and Mediterranean regions, see Figure 2.

This study is supported by the CCUS ZEN project which has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101075693.

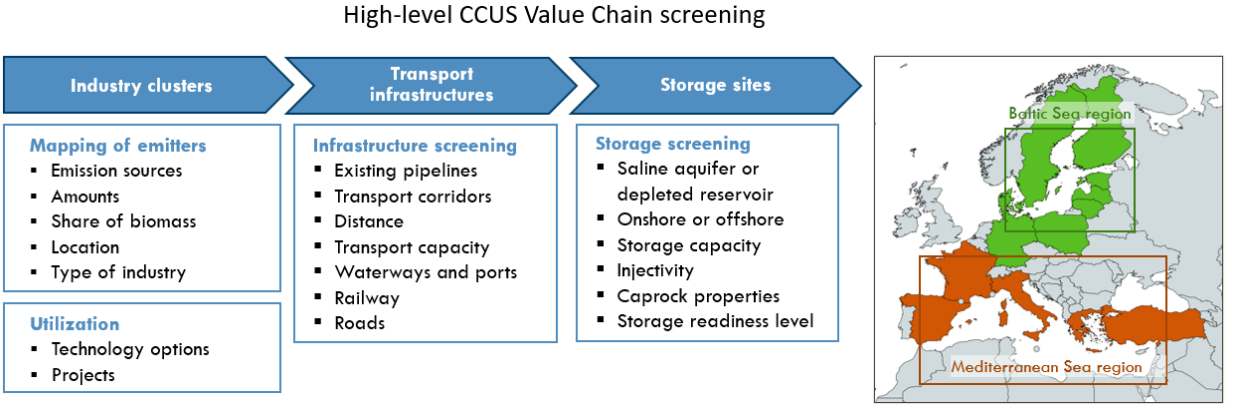

Figure 1 Principal sketch presenting workflow in the high-level CCUS value screening.

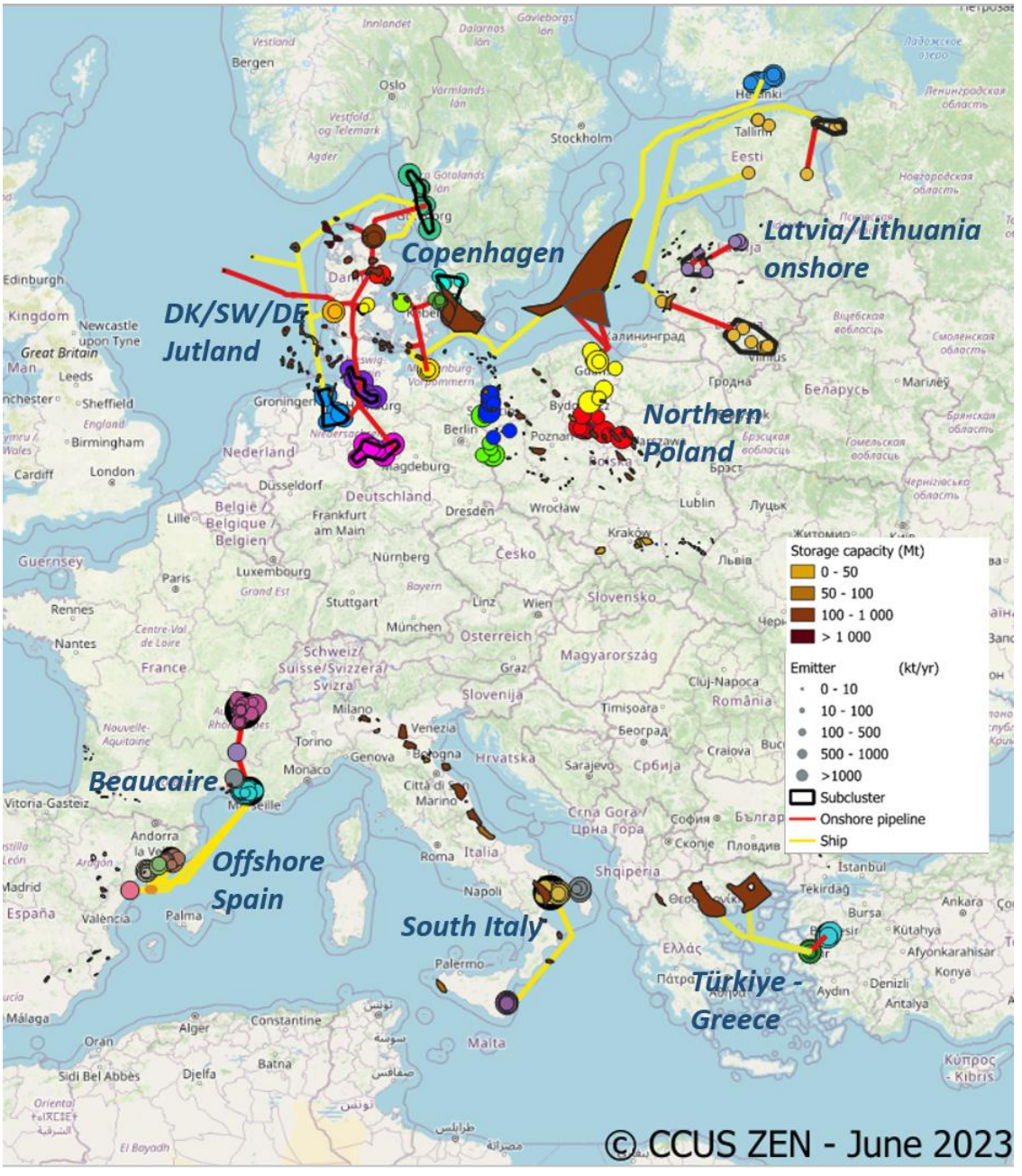

Figure 2: Location of identified CCUS value chains in the CCSU ZEN regions (Baltic sea and Mediterranean sea).

Keywords: capture, transport, storage, mapping, Europe, CCUS