CO_2DataShare Across the CCS Chain: Introducing Fiscal Metering Data

Introduction

CO_2DataShare is a unique open-access portal for sharing CCS datasets, suited for model development, benchmarking, and knowledge sharing. So far, nine datasets have been published, covering topics like rock mechanics, CO_2 storage monitoring, seismic analysis, reservoir modelling, and CCS systems optimization. Most of the datasets are related to CO_2 storage. However, as CCS value chains expand globally, there is a growing need for high-quality, openly available data from all parts of the chain while operational datasets remain scarce. Starting in 2026, the portal has therefore been expanded to cover all stages, also including capture and transport.

This paper presents the evolution of the CO_2DataShare platform (https://co2datashare.org). It also introduces the portal's first openly available dataset on CO_2 transport, a fiscal metering dataset including flow rate, pressure, temperature, density, and associated metadata. By hosting its first transport dataset, CO_2DataShare expands its scope from primarily subsurface data to a broader CCS data infrastructure supporting research, innovation, and transparency across the entire value chain.

CO_2DataShare: A resource for open and reproducible CCS research

Open and reproducible research is increasingly essential in computational and data-driven sciences, yet independent verification is often constrained by limited access to original datasets and code. The CO_2DataShare portal directly addresses this challenge by adhering to the FAIR principles, ensuring that research data are findable, accessible, interoperable, and reusable. By providing streamlined access to reference datasets used in CO_2 storage research, the portal strengthens transparency and supports reproducibility, thereby enhancing the robustness of scientific outcomes.

Since its launch in 2019, CO_2DataShare has become an important resource for the global CCS community. Managed by SINTEF and hosted by Sigma2, the portal offers curated, high-quality datasets derived from real CO_2 storage operations and research activities. It has served users from more than 90 countries and has delivered over 66,000 dataset items to academic, industrial, and governmental organizations worldwide.

A key characteristic of CO_2DataShare is its emphasis on curated, well-structured, and transparently documented datasets. Each dataset is prepared in close collaboration with its owner, including the creation of detailed metadata and assignment of a digital object identifier (DOI) to support proper citation. Dataset landing pages are designed to offer insight into the dataset's context, structure, and contents. Heterogeneous data collections are organized into more homogeneous, individually downloadable items, accompanied by documentation that facilitates correct interpretation and minimizes the need for follow-up clarification. Usage rights are also clearly defined and explained.

For data providers, publication through CO_2DataShare enhances visibility and fosters knowledge exchange. Citations of the dataset are automatically tracked and displayed on the landing page, enabling dataset owners and users to monitor scientific impact. Basic download statistics are shown on the dataset landing page, whereas dataset owners have access to a dedicated, detailed statistics panel further provides download counts and information on user affiliations and geographic distribution. Collectively, these features position CO_2DataShare as a robust, FAIR-aligned infrastructure that supports high-quality and reusable CCS research.

Available datasets at CO2DataShare

The CO_2DataShare portal currently hosts nine datasets spanning a broad range of CCS research domains, including rock mechanics, seismic monitoring and analysis, reservoir modelling, CO_2 transport metering, and systems-level CCS optimization. Each dataset is published on an individual webpage with its own license. To facilitate targeted use and clear documentation, it is structured into one or more components which are coherent units of data such as well logs, geomodels, simulation grids, or monitoring datasets.

The first dataset released on the portal, the Sleipner 2019 Benchmark Model, contains modelling, simulation, and monitoring data from the Sleipner CO_2 storage project. This is the world's longest-running industrial CO_2 storage site. Since publication, its components have been downloaded nearly 15,000 times by an estimated 1,200 industry organizations, hundreds of academic institutions, and numerous governmental agencies. The dataset has also been cited in multiple scientific publications and served as the foundation for a comparative simulation study conducted in 2021 (IEAGHG, 2021).

Subsequent datasets have significantly expanded the portal's coverage. Examples are the Svelvik CO_2 Field Lab Cross-Well Data 2019, offering seismic monitoring data from controlled field experiments (Tangen et al. 2025), and the Illinois Basin – Decatur Project Dataset, which provides a comprehensive, curated collection of georeferenced imagery, seismic surveys, well information, geomodels, and technical reports from the large-scale U.S. CO_2 storage project (Tangen et al. 2022). In 2025, CO_2DataShare expanded its scope by adding the SimCCS dataset. SimCCS is an open-source optimization tool from Los Alamos National Laboratory that designs cost-effective CCUS networks using data on CO_2 sources, storage sites, and transport routes (Chen et al. 2024). The shared dataset provides the essential geospatial and reference data used in SimCCS, enabling researchers to explore and reproduce CCUS planning scenarios.

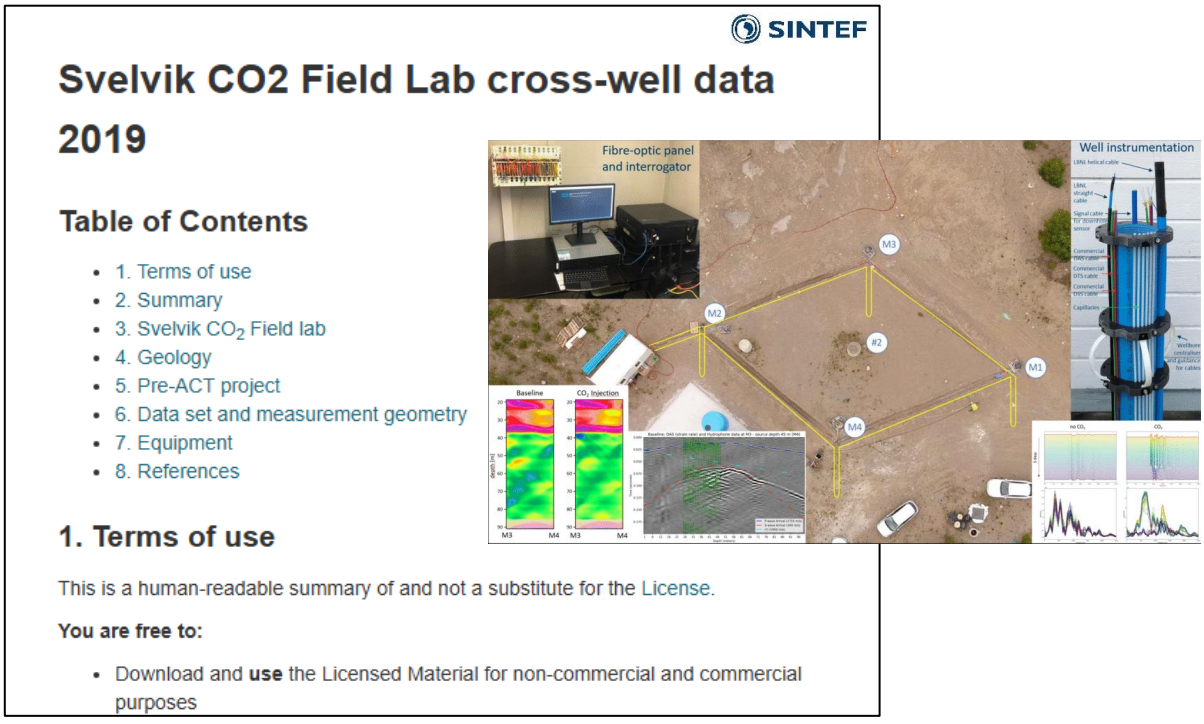

Figure 1: *CO2DataShare is a digital portal for sharing CCS datasets from industry and research. Data from SINTEF's Svelvik CO_2 Field Laboratory was published in 2025.* https://co2datashare.org/

Experimental Liquid CO_2 Density Data Released via CO_2DataShare

A liquid CO_2 density dataset generated within the NCCS Research Centre is now publicly available through the CO_2DataShare portal. By making these measurements accessible, the project aims to support broader research, technology development and industrial deployment within carbon capture and storage (CCS). The dataset provides high-quality, well-documented experimental data that can be used to validate models, benchmark instrumentation, and improve metering practices for CO_2 transport systems.

The NCCS dataset provides quality-assured measurements of liquid CO_2 density collected under controlled laboratory conditions. Accurate density is crucial in CCS operations for process control and for reliable volume-to-mass conversion in fiscal metering. Although density can be calculated using Equations of State, these models do not fully capture the dynamic behaviour of real CO_2 systems, making inline measurements operationally valuable.

The dataset covers two high-TRL density-measurement technologies suitable for industrial deployment. Both instruments meet manufacturer-specified uncertainty requirements and were selected in collaboration with the NCCS Research Centre's industrial partner in Task 8. A full analysis of the measurements is published by Arellano et al. (2025), which assesses meter performance and its implications for flow conversion.

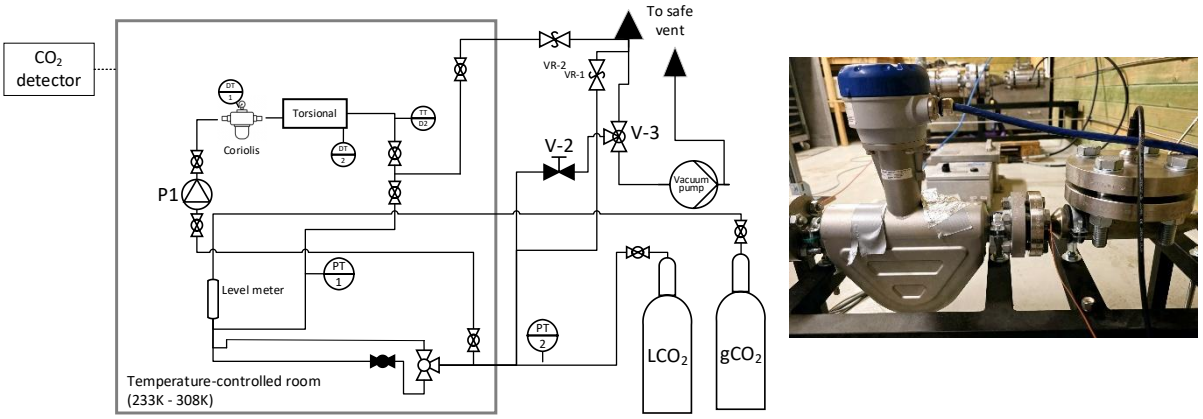

Figure 2: *Schematic of the experimental setup and picture of the experimental setup showing the two density meters (Arellano et al, 2025).*

Experiments were carried out at SINTEF and NTNU's thermal engineering laboratories in Trondheim, using a temperature-controlled setup with stability within ±1 K. Measurements were taken under static conditions and under dynamic recirculation at 0.17 kg/s. The test rig includes a DN10 Coriolis meter and a torsional density meter arranged in series, supported by a recirculation pump for dynamic testing. Temperature was measured using high-accuracy PT100 RTDs, supplemented by additional sensors in the meters and pressure transmitters. Pressure was monitored with two Keller PAA-33x transmitters (10 and 30 MPa ranges), and a level meter ensured the CO_2 remained in the liquid phase.

The dataset includes twelve test conditions, each with separate static and dynamic datasets. Each condition contains four tabs of synchronized measurements: reference pressures, reference temperatures, torsional meter data (density, viscosity, device temperature, oscillation frequency), and Coriolis meter data (density, device temperature, and flow rates and velocities for dynamic tests). Together, these measurements establish a benchmark for assessing inline density-meter performance for CCS applications.

CO2DataShare into the future

Looking ahead, CO_2DataShare continues to evolve through the addition of new datasets and ongoing improvements to portal functionality. Planned developments include tighter integration with the broader open data ecosystem, support for automated downloads, and enhanced feedback mechanisms for dataset owners. Building on a track record since 2019, the portal aims to remain a stable, longterm resource for highquality CCS data across the entire value chain.

CO2DataShare is always on the lookout for quality datasets that is of value for the larger CCS research community. We therefore encourage data owners to contact the authors with suggestions for datasets that may be suitable for sharing.

Acknowledgements

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