

This PDF provides a summary of the Life Cycle Assessment (LCA) of greenhouse gas emissions related to the carbon capture and storage (CCS) value chain for Bigadan Kalundborg Bioenergi A/S. The analysis was published on 27 August 2025.

A so-called cradle-to-grave analysis has been carried out to assess the climate impact associated with the construction and operation of the Bigadan Kalundborg Bioenergi CCS value chain. The analysis covers liquefaction, transport, injection, and monitoring of carbon dioxide (CO<sub>2</sub>) for the purpose of permanent storage in offshore geological formations.

## The Six Main Processes

The assessment is based on the functional unit: “liquefaction, transport and storage of 25,000 tonnes of CO<sub>2</sub> per year from 2026 to 2032 in Denmark.” In the analysis, one tonne of stored CO<sub>2</sub> was used as the reference unit. This means that all results are reported per tonne of CO<sub>2</sub> stored. The foreground system was modelled according to the construction, operation, and decommissioning described by Bigadan Kalundborg.

The modelled system consists of six main processes:

1. Liquefaction of CO<sub>2</sub> upgraded at Kalundborg Bioenergi A/S in Denmark.
2. Transport by truck from Kalundborg Bioenergi A/S to a CO<sub>2</sub> storage hub at the Port of Esbjerg, Denmark.
3. Temporary storage in tanks at the Port of Esbjerg.
4. Shipping and injection of CO<sub>2</sub> into the Nini reservoir, located in the Danish sector of the North Sea.
5. Subsurface monitoring.
6. Decommissioning of the constructed facilities across the entire value chain.

# Standard and Method

The LCA modelling follows an attributional approach in accordance with the ISO 14040/44:2008 standard. Quantification and reporting follow the calculation requirements set out in the CRCF methodology.

Primary data for foreground modelling were provided by Bigadan Sourcing & Commodities (formerly Bioman), while background systems are based on secondary, average data from the Ecoinvent 3.9.1 cut-off database.

The selected method for calculating environmental impacts is IPCC 2021 for climate impact using GWP100, with results reported as greenhouse gas (GHG) emissions in tonnes CO<sub>2</sub>-equivalent per year.

Sensitivity analyses were performed for selected parameters based on their expected uncertainty — particularly sensitivity related to the electricity grid's CO<sub>2</sub> intensity for the liquefaction process, which was tested using high-low scenarios based on the Danish Energy Agency's projections for electricity production in Denmark for 2026–2032.

A qualitative assessment of the quality of primary data was conducted using the Ecoinvent Pedigree matrix.

## Conclusions for the Bigadan Kalundborg Bioenergi CCS Project

A total of 1,782 tonnes of CO<sub>2</sub>-equivalent per year is emitted from lifecycle activities and venting, resulting in a net reduction efficiency of 93 percent. The quantified net CO<sub>2</sub> removal benefit (NCRp) corresponds to 23,219 tonnes of CO<sub>2</sub> out of the total 25,000 tonnes of CO<sub>2</sub> eligible for storage per year.

More specifically, operational emissions account for 51 percent of total GHG emissions, while embodied emissions—i.e., from construction and upstream production—account for 32 percent. Vented emissions represent 18 percent of total GHG emissions. No reversal of emissions is expected. The largest share of GHG emissions originates from shipping and injection activities.

If you have additional questions, feel free to reach out to us, and we can provide the full LCA report.



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