Reference case

Brevik CCS

Key facts:

- End customer: Heidelberg Materials (Norway)
- Scope of delivery: one electrically-driven RG 63-7 compressor train with integrated carbon capture heat recovery (CCHR®) technology
- Task: compress 0.4 Mt CO_2 per year and reduce energy consumption for steam generation by 30 %
- Function: compression of CO_2, liquification of CO_2, heat recovery within the process

Everllence

CCUS put into **practice**

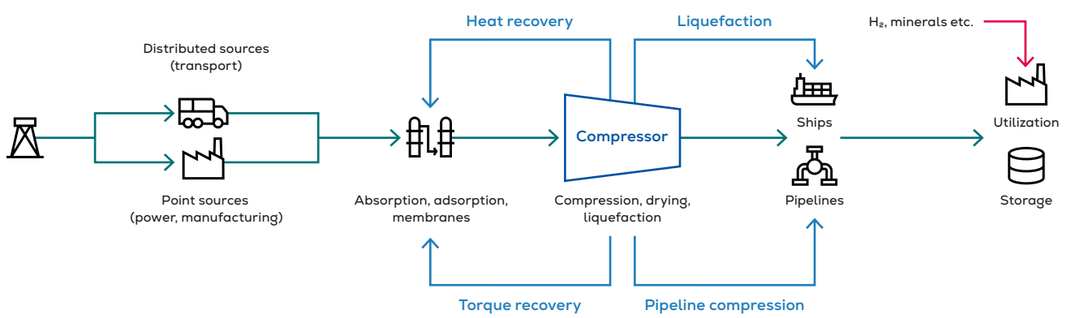
Everllence is supplying the compressor system for the carbon capture and storage (CCS) system at the Norcem Brevik cement plant of Heidelberg Materials in Norway.

Heidelberg Materials will implement the world's first large-scale CO_2 capture plant for cement production. The plant at Brevik CCS will be finalized in 2024, with a capture capacity of 400,000 metric tons of CO_2 per year. This will account for 50 % of the emissions from the cement plant in Brevik. This carbon will be captured using technologies from the cooperation partners Aker Carbon Capture and Everllence, then it will be liquefied and transported by ship to an underground storage site.

First large-scale CO_2 capture plant in the cement industry

Hard-to-abate emissions are a central challenge in the race towards achieving net-zero goals. Industries such as concrete and cement production face significant hurdles in transitioning to more carbon-neutral practices, making the implementation of carbon capture, utilization, and storage (CCUS) an essential option. Given that the cement industry alone accounts for about 8 % of global CO_2 emissions, it plays a crucial role in the pursuit of net-zero targets. Making CCUS an attractive solution for this industry is paramount to achieving rapid and widespread adoption.

Everllence, in collaboration with Aker Carbon Capture, has developed the CCHR® process. This innovative approach aims to reduce the energy requirements of installed CCUS plants, thereby enhancing their efficiency. Additionally, Everllence has devised methods to identify opportunities for reducing cold start times in cement plants through dynamic process simulations. These advancements hold the potential to streamline operations and minimize energy consumption during the whole process.



The carbon capture, utilization, and storage (CCUS) value chain

Reducing the CO_2 footprint using proven technology

Heidelberg Materials recognized the urgent need to minimize its CO_2 emissions and contribute to mitigating climate change. By implementing a CCUS system, they aim to capture and store a significant portion of the CO_2 generated during cement production, effectively reducing their overall carbon footprint. By leveraging this proven technology, Heidelberg Materials can implement an effective solution. This reduces risks associated with untested technologies and ensures the viability and reliability of the system.

Increasing efficiency

Besides the use case shown in this paper, Everllence can utilize the heat from its compression process to enhance the efficiency of customer processes.

Industry leadership

Installing a CCUS system as an extension to a plant which is already in operation allows Heidelberg Materials to leverage existing infrastructure and optimize the integration process. This approach minimizes disruptions to ongoing operations and reduces costs associated with building a new facility from scratch. Heidelberg Materials aims to be a front runner in the cement industry when it comes to adopting sustainable and environmentally friendly practices. By implementing a CCUS system, they demonstrate their commitment to reducing their environmental impact and leading the way in greening the cement sector.

Answers for a unique customer challenge

The quest to combat CO_2 emissions in cement production, presented unique challenges that demanded careful consideration and innovative solutions. Notably, the introduction of a CCUS plant or a chemical plant within an existing cement facility posed significant hurdles. The primary objective was to develop an energy-efficient CO_2 compression and liquefaction system, seamlessly integrated into a state-of-the-art CCUS infrastructure for optimal performance. To overcome these complexities, the project entailed extensive dynamic simulations and comprehensive studies.

The results are truly remarkable, including an impressive 30 % reduction in the energy requirements for steam generation in the absorption process. The project presented another challenge for the team: the CO_2 that is available after the amine wash had such a high water content that no fluid mix properties or sophisticated calculation tools are available.

Intensive in-house research, calculation and programming led the Everllence team to develop the skills to simulate the process and understand the changes in the fluid mix properties throughout the compression of the CO_2. This knowledge was used to determine the process performances and calculate the achievable savings. Moreover, the team demonstrated ingenuity by strategically designing and arranging various components, optimizing space utilization within the site's confined parameters.

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Reference case

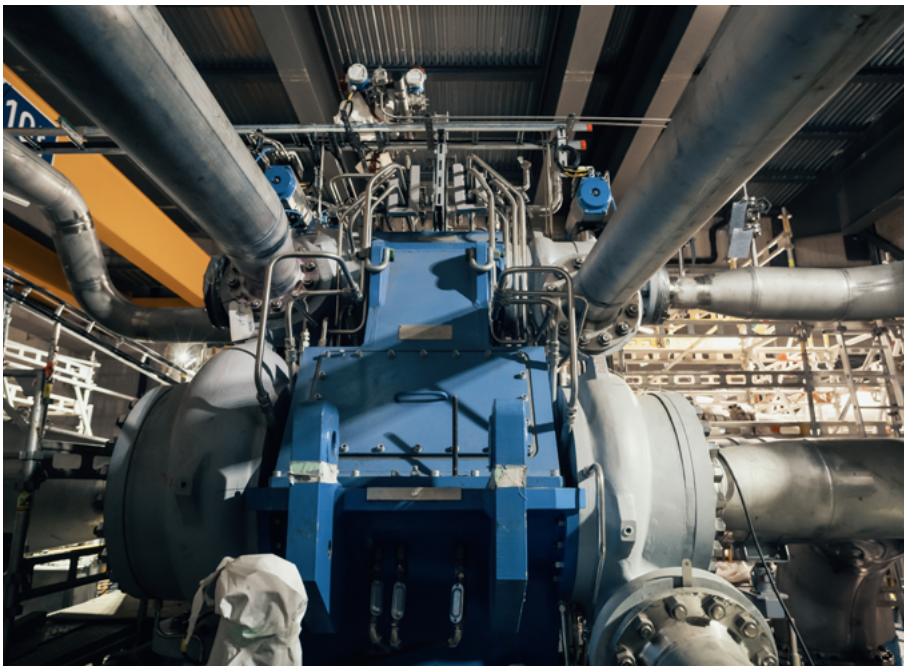
CCUS solution

Everllence is providing an electrically-driven compressor train, specifically the RG 63-7 model, equipped with integrated CCHR®. This innovative technology incorporates steam generators that cool the CO_2 mixture between the compressor stages, effectively harnessing the waste heat and generating steam. This steam is then utilized in the CO_2 capture process.

In the CCUS process, heat generated by the compression of CO_2 is utilized to generate steam. This steam is subsequently introduced to the desorber, effectively reducing the amount of additional steam required in the CO_2 capture process. By utilizing the waste heat from the CO_2 compression process to generate steam, the CCUS system achieves energy efficiency and reduces the demand for external steam generation. This method of steam generation optimizes the utilization of resources and contributes to the overall energy efficiency of the CCUS plant.

The compressed CO_2 is subsequently liquefied using sea water, facilitating its transportation and storage for further utilization. The liquefied CO_2 will be shipped from Brevik to the sequestration site under the North Sea, which is specifically designated for the Northern Lights projects. At the sequestration site, the CO_2 will be permanently stored.

By integrating the RG compressor with the CCHR® technology, Everllence offers an efficient and sustainable solution for CO_2 capture and liquefaction, and so enables subsequent transport to the designated sequestration site. This comprehensive approach contributes to the overall goal of reducing CO_2 emissions and advancing towards carbon neutrality.



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