C2PAT – Carbon To Product Austria

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Motivation

The achievement of the strict national and international climate targets for the years 2030 and 2040 form the motivation for the implementation of the project “Carbon to Product Austria (C2PAT)”. Companies with high carbon dioxide footprints need to avoid their emissions by modifying their current process procedures and adapting their energy sources or reducing them through innovative and new technologies. In the C2PAT project, companies from different industrial sectors, namely Lafarge Zementwerke GmbH, Verbund AG, OMV AG and Borealis AG, are working together to contribute to tackling the climate crisis.

Exhaust gases from cement plants contain high concentration of carbon dioxide. The production of cement relies naturally on an endothermal reaction and requires high-temperature heat of around 1,450°C for clinker formation in the rotary kiln. One third of emitted carbon dioxide stems from the provision of heat from fuels such as pieces of tires or plastic, while the remainder is released during the burning of the cement clinker from the fed limestone mixture.

Project implementation

In the project “C2PAT” these unavoidable, process-related carbon dioxide emissions should be used as feedstock for renewable plastics production. At the Lafarge site in Mannersdorf am Leithagebirge (Lower Austria), CO$_2$ will be captured from the waste gas of the cement plant by an amine scrubbing unit, and further processed in a newly erected power-to-liquid pilot (PtL) plant. Green hydrogen will be produced on site with the help of an electrolyzer, which is powered on the one hand by electricity from a newly constructed PV park near the cement plant and on the other hand will be fed
with renewable power from the grid. Syncrude will be produced in a reverse water gas shift reactor with downstream Fischer Tropsch synthesis. The further treatment of the syncrude into various forms of plastic (polymers) will be done in co-processing at the nearby refinery. In addition to using carbon dioxide as feedstock, this project is also an example for a circular economy approach and sectoral cooperation among companies operating in different industrial sectors. The material flow from fired plastics through a carbon capture plant with synthesis and processing to renewable plastics in existing steam crackers is unique.

The annual capacity of the PtL pilot plant is designed for 10,000 tons CO₂ obtained from the exhaust gas of the cement plant Mannersdorf am Leithagebirge. The pilot plant will be used to further develop critical parts of the value chain as well as process equipment, and prove a stable, long-term operation. The pilot plant is a preliminary project to analyze and support the interconnection between the cement plant and the energy supplier handling green power and the operation of the electrolyzer, as well as the chemical conversion to plastics. Furthermore, the cooperation of a large, cross-sectoral industry consortium is implemented in practice. This project shall provide the basis for the breakthrough to erect a scaled-up, industrial sized plant which captures the entire CO₂ of Mannersdorf’s cement plant of about 700,000 tons annually.

**Cross sectoral value chain to drive climate neutrality**

![Figure 1: Schematic flow sheet of the planned Power-to-liquid plant (source: www.lafarge.com)](image-url)