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# kleinkraft

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## Energy Efficiency and Renewable Energy

kleinkraft helps transforming companies towards an decarbonized or de-fossilized industry.The engineering office founded in 2015 and help companies to profit from the energy transition.

To reach this goal, kleinkraft offers technical consulting to mainly industrial companies identifying viable energy efficiency and renewable energy measures. As these measures result in significant energy and $CO_2$ emission savings the implementations are supported through public funding's. Therefore, kleinkraft offers this whole process until implementation to its customers ranging from energy audits over photovoltaic plants to industrial heat pumps. Beside these state-of-the-art measures, research projects for more complex topics are initiated. kleinkraft actively promotes scalable innovations for a climate-neutral future.

kleinkraft is developing processes in the area of $CO_2$ conversion to chemicals together with the TU Wien (Vienna University of Technology), the Austrian Institute of Technology, and further industrial companies. Together we are developing **scalable processes for the use of $CO_2$ as a raw material**.

## $CO_2$: from waste to resource

Carbon dioxide ($CO_2$) is mainly responsible for global climate change and its serious consequences. However, the greenhouse gas $CO_2$ does not only have disadvantages. As a carbon supplier, $CO_2$ can be used as **a raw material** for the production of fuels or chemicals. By capturing and using $CO_2$, new markets can be opened up, with domestic raw materials, can promote regional value supply chains.

Although the capture and use of $CO_2$ alone will not be able to prevent climate change, they are essential technologies through which the use of fossil fuels can be avoided.

To reduce $CO_2$ levels in the atmosphere, three possibilities exist [1]:

- Increasing energy efficiency
- Changing to renewable energy carriers
- Capturing CO2 with subsequent storage or reuse

There are many existing and emerging technologies in which $CO_2$ can be utilised. The application possibilities are equally diverse. There is no commercial utilization pathway which is universally applicable. Various factors have to be considered, e.g. location, available $CO_2$ sources, and available technologies.

However, advantages from using $CO_2$ as a resource are very promising. $CO_2$ from regional sources to produce high quality products creates

- independence from fossil fuels,
- local added value,
- is climate friendly and
- is a scalable technology.

## $CO_2$-to-Chemicals

Currently, the entire chemical industry is based on the use of fossil raw materials. Approximately 11% of the world's primary oil and gas demand is consumed by the chemical industry. More than half of this is used directly as raw material for production [2].

Carbon from Carbon Dioxide shall be utilized to produce different hydrocarbon chains, resulting in **net-negative emission production process for chemicals** with various application potentials. The focus of our consortium is on the production of chemicals which are already utilized in the industry or have additional potential future applications which help to foster the ongoing energy transition.

Nevertheless, realizing this basic idea comes with several technical challenges including the thermodynamic stability of $CO_2$, the qualities and quantities of $CO_2$, process conversion efficiency, but also process and reactor design and upscaling challenges. Last but not least, to bring this idea to life, it is necessary to develop a sound business model to guarantee a rapid uptake of the idea from the market.

## Research progress

Currently the above-mentioned research and development partners are successful producing two chemicals in lab-scale and we are therefore currently working on process optimisation and upscaling challenges from a technical as well as from an economical point of view. Thereby also the extension of the partner network with interested industrial companies and multiplicators is ongoing as well as the continuous development within public funded research projects to continue our promising research and development approach.

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