

Carbon2Chem<sup>®</sup>

Turning emissions into  
valuable resources



thyssenkrupp

# Carbon2Chem<sup>®</sup> – CO<sub>2</sub> as a raw material.

The objective of the Carbon2Chem project is convert steel mill gases into base chemicals – including the CO<sub>2</sub> contained in them. This means that the greenhouse gas is no longer emitted into the atmosphere. And: The energy required for the conversion comes from renewable sources.

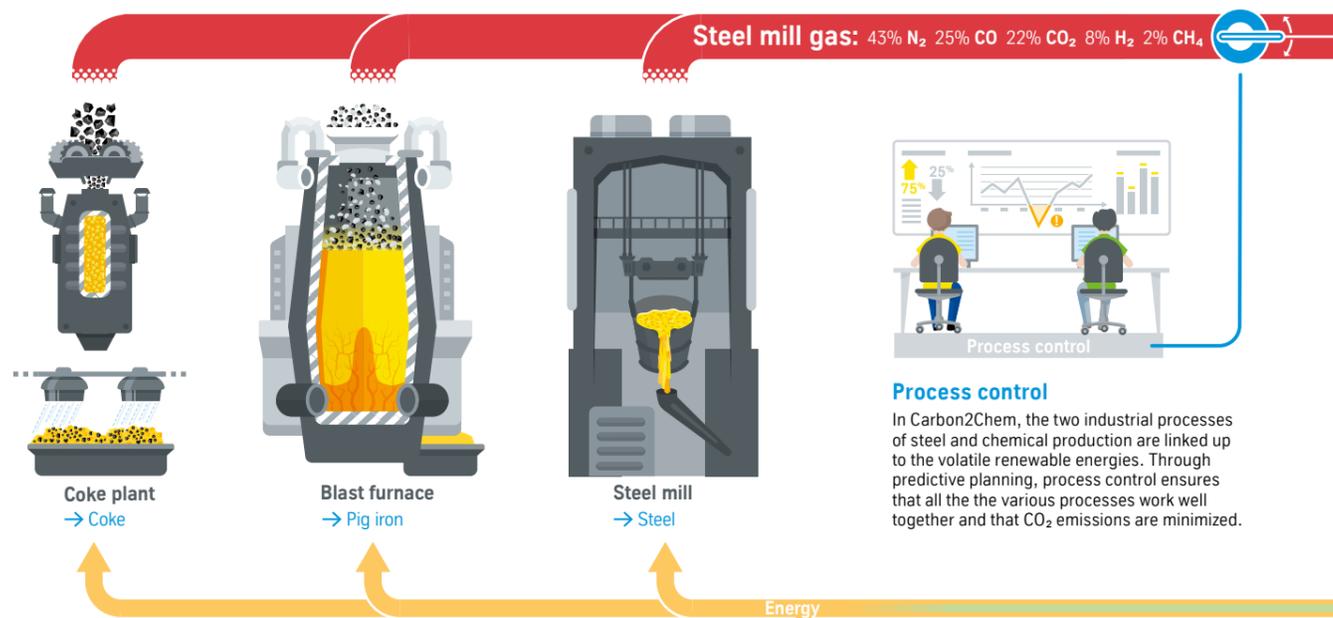
This required a small revolution, but it was a success. We have overcome the boundaries between individual industries. The process gases from a steel mill become raw materials for the chemical industry. The fact that thyssenkrupp is represented by 155,000 employees worldwide in many innovation-rich sectors plays a crucial role in the implementation. It means that we have experts in steel working alongside chemical plant builders. This is where the idea behind Carbon2Chem originated. A further 16 partners from basic and applied research as well as from various sectors of industry are involved in the project. The project is being funded by the Ministry of Education and Research.

Up to now, steel mill gases were combusted in order to produce electricity and heat for the steel making process. Carbon2Chem now places the gases at the start of a chemical production chain. This is possible because steel mill gases contain, among other things, hydrogen, nitrogen and carbon oxides, from which a large number of chemical products can be manufactured.

### We have established a cross-industry network to use CO<sub>2</sub> as raw material.

Hydrogen serves as the energy source, which is partly already present in the steel mill gases. Further hydrogen is to be produced via water electrolysis using renewable energy. The processes in the steel mill will be modified so that a part of the steel mill gases will be diverted for the production of chemicals if cost-effective surplus electricity is available from renewable sources.

### Steel production



With 0.04 percent CO<sub>2</sub> only represents a small fraction of the air, but it plays a decisive role for the climate as a greenhouse gas: It absorbs a portion of the heat released by the earth into space and radiates it back.

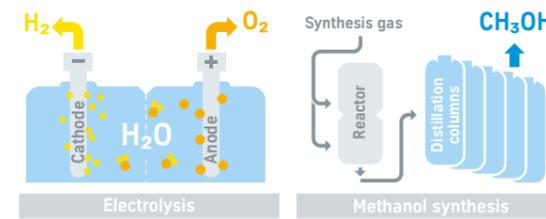
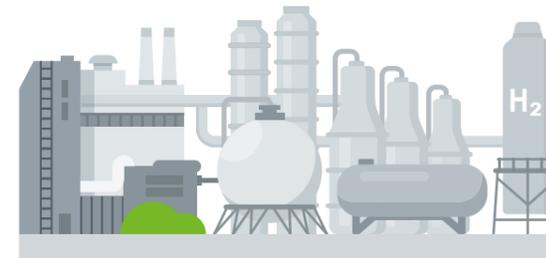


If steel experts and chemical plant builders work together, they can produce something very useful for the environment. Steel mill gases become raw materials for the chemical industry.



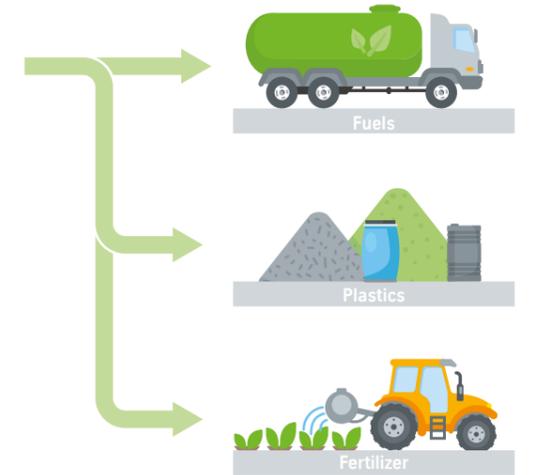
Today, we use steel mill gases to produce electricity and heat for the manufacturing process.

### Chemical plant



### Sustainable chemical products

Ammonia and urea are basic materials for the production of fertilizer; fuel can be manufactured, among other things, from methanol. Today, both are primarily obtained from natural gas – thanks to Carbon2Chem, in the future, chemical plants will be able to use steel mill gases and hydrogen from “green” electricity.



### Renewable energies



It is no wonder that the prospects of success for Carbon2Chem are so good, because the fundamental chemical processes and the necessary technologies are well known. The conversion of process gases into ammonia and urea as precursors for fertilizer is technically, but not yet economically, feasible. This process would use part of the CO<sub>2</sub> contained in the steel mill gases. It would also be possible to generate methanol from steel mill gas, a process in which the CO<sub>2</sub> amounts present could be almost entirely used.

### Power plant



### Renewable sources of energy

Wind and solar power deliver the electricity to produce hydrogen by water electrolysis. Together with the steel mill gases, it forms the synthesis gas for many chemical products. Alternatively, however, the steel mill gases can also be used to generate electricity and heat for the production of steel.

You can read about the background to this good news at: [thyssenkrupp.com/en/carbon2chem](https://thyssenkrupp.com/en/carbon2chem)

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