SE-15.4 Role of renewable energies for realizing cross industrial cooperation such as in the project Carbon2Chem

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Over the past years, industry has been investing increasingly in energy-efficient and environmentally sustainable facilities for reducing emissions and energy supply from fossil-sources.
Nowadays, the optimization within the particular system boundaries is reaching its scientific limits. Therefore, only cross-linking along the value-added chain and establishing an integrated production-network with various branches will enable to result in further noticeable potentials for optimization of processes. The Carbon2Chem® project shall create an example for such a cross-industrial cooperation in the field of CCU.

Initial situation
The reduction of CO_2 emissions into the environment presents a huge challenge to the energy-intensive industries. At the same time, many chemical processes can use CO_2 as precursor for producing basic chemicals. Because of that, it is possible to reduce CO_2 emissions by connecting processes. Huge stationary sources of emission like plants for the production of steel or energy are particularly suitable for these types of connections, as they are potentially able to provide a constant flow of educts for chemical processes. Another essential element of such a cross-industrial cooperation is the use of renewable energies to avoid producing additional CO_2 emissions by the extra energy demand of these cooperation systems.

Research and development
One of the goals within the Carbon2Chem® project is to identify the chemical processes that in particular contribute to a reduction in CO_2 emissions and to find out how to interconnect and to adapt them in the steel and energy production. Nevertheless, the task is to analyze how fluctuations of the educts flow or the renewable energies can be balanced by sufficient flexibility in the complete system.
Integrated mills already use their steelworks off-gases among others for providing their own energy and steam supply. This means that, precisely, the material use of gases requires substitution possibilities, which obviously shall not come from fossil energy sources. Additionally, the profitability of the possible networking concepts has to be examined considering the various framework conditions. For this, suitable methods of modeling and simulation are necessary for showing the interaction in such overall system with regard to demand and evaluation.

Challenges
For using the emissions of the steel production, it is also necessary to have suitable methods for gas purification and gas conditioning. The required degree of purity defines significantly the profitability of the specified cross-industrial cooperation.
The supply of synthesis gas for the chemical processes also requires the provision of sufficient hydrogen. However, it is only possible to extract a limited amount of hydrogen from steelwork off-gases.
The educts flows (e.g. steelworks off-gases and renewable energies) are subject to strong fluctuations in terms of quantity and composition, that is why there is a need for an appropriate process design with a corresponding monitoring and control system.

Summary
Chemical technologies play a decisive role when it comes to networking of several branches. This involves the conversion of byproducts from one process into educts for another process as well as the transition from static to flexible chemical processes. Renewable energies are an important part of the solution. Besides, new business models are needed urgently, because the optimization of discrete systems within a cross-industrial cooperation does not lead necessarily to an optimum for the complete system. The crucial flexibility, as well, will only be possible to achieve by means of proper balancing mechanisms.
In reference to that, the essential project objectives of the Carbon2Chem® project like CO_2-reduction and profitability have the same weighing.