

Application-side merit-order-curves for synthetic fuels in the german energy system

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Motivation

The analysis of energy and climate policy scenarios shows that a massive use of synthetic fuels is expected by the year 2050 /FFE-38 18/, /DNA-02 18/, /BCG-01 18/, /BMUB-06 15/, /BMWI-01 14/. Besides the GHG-emission reduction, the use of synthetic fuels offers short-term and long-term flexibility in the energy system as well as the use of existing infrastructure and trading networks /AGORA-11 18/, /RUH-02 18/, /IEA-108 17/, /FFE-145 17/, /ENER-02 17/. However, in this context, the use of synfuels risks causing inefficiencies in the energy system as they could be used, although cheaper and more efficient alternative measures to reduce GHG-emissions are available. Since synfuels deployment is often not the most efficient option for defossilizing the energy system, renewable alternative measures must be included in the decision-making process.

Methods

For the analysis of synthetic fuel use, cross-sectoral static merit-order-curves will be compiled in the base year 2020 and with a time horizon to 2050 for the German energy system. Two investigations are carried out: On the one hand, the synthetic fuel input in a merit-order is compared with fossil alternatives (Case 1). On the other hand, if possible, renewable alternatives (mainly electrification) are identified and compared with the synthetic fuel input in a differential-analysis (Case 2). In order to create a cross-sectoral merit-order for synthetic fuel use, the first step is the identification of applications and processes that are suitable for the use of synthetic fuels. In both cases, capital expenditure (CAPEX) and operational expenditure (OPEX) of the respective applications are to be recorded. This data is collected via literature research and validated by expert interviews. In a third step, the amount of energy relevant to synthetic fuel use is quantified. The respective specific costs are allocated to energy.

Results

In each case, a merit-order curve is created according to /FFE-20 17/ for the difference between fossil or alternative renewable technology and synthetic fuel application. If the difference between the most cost-efficient renewable alternative and the synfuels application is presented in a merit-order, under the given assumptions, it can be concluded that all measures below the abscissa can be used for a cost-efficient defossilization.

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