Development of Application-Related Emissions in the Course of the German Energy Transition

(1) Energiepolitik – Energiewende in Deutschland
Simon PICHLMAIER[1(1)], Andrej GUMINSKI[(2)], Anika REGETT[(1)]
[(1)]Forschungsstelle für Energiewirtschaft e. V.,
[(2)]Forschungsgesellschaft für Energiewirtschaft mbH

Motivation and key question

„Despite the considerable deployment of human and financial resources, Germany didn't so far achieve the targets for the implementation of the energy turnaround for the majority of cases" [1]. With these harsh words, the Federal Audit Office begins its evaluation of the implementation of the energy turnaround. While in some areas a significant greenhouse gas emission reduction was achieved, others have been stagnating or even increasing. The question that ultimately arises is which areas and applications are responsible for the stagnation of the energy system transformation.

Methodical approach

In this paper emission balances are derived to determine which applications are the root course for the recent stagnation with respect to Germany's greenhouse gas reduction efforts. By identifying areas in which greenhouse emissions reductions are stagnating a first step towards the systematic identification of CO_2 abatement measures is performed. In order to allow the identification of the areas (i.e. applications) which slow emission reduction efforts, indirect emissions from the use of electricity are allocated based on the polluter principle. In a previous paper, the underlying methodology was explained and the application-oriented emissions balance for 2014 drawn up [2]. Thereby the emissions of the energy supply are assigned to the respective energy application. This is done with the use of data from the AG Energiebilanzen [3] and energy data from the Federal Ministry of Economics and Energy (BMWi) [4]. This paper makes use of this methodology and shows the development of emissions from applications over the ten years from 2006 to 2016. This makes it possible to determine which applications are stagnating in their emission development and thus require targeted measures to reduce emissions.

Results and Conclusions

Due to the steadily advancing energy transition in the electricity supply sector, electricity-based applications, such as e. g. process cooling or information and communication technology (ICT), experienced continuous improvement since 2006. Therefore, the development of the energy carrier weighted emission factor is show in Figure 1.
The peak of the emission factor in 2007 can also be seen in the weighted emission factors. Other applications such as process heat, space heating and mechanical energy are largely independent of the emission factor of electricity. The improvement in space heating is caused by the shift from oil-based energy sources to gas and renewable energies. Mechanical energy shows the least enhancement in the weighted emission factor. The graph on the right shows that this can endanger the success of the energy system transformation. With annual CO_2 emissions of more than 300 Mt, the generation of mechanical energy is the largest pollutant. This application, which is mainly used in transport and industry, should be targeted with coordinated CO_2 reduction measures.

[1]Jungautor; Am Blütenanger 71, 80995 München; +49(0)89 15 81 21-41, spichlmaier@ffe.de, www.ffe.de

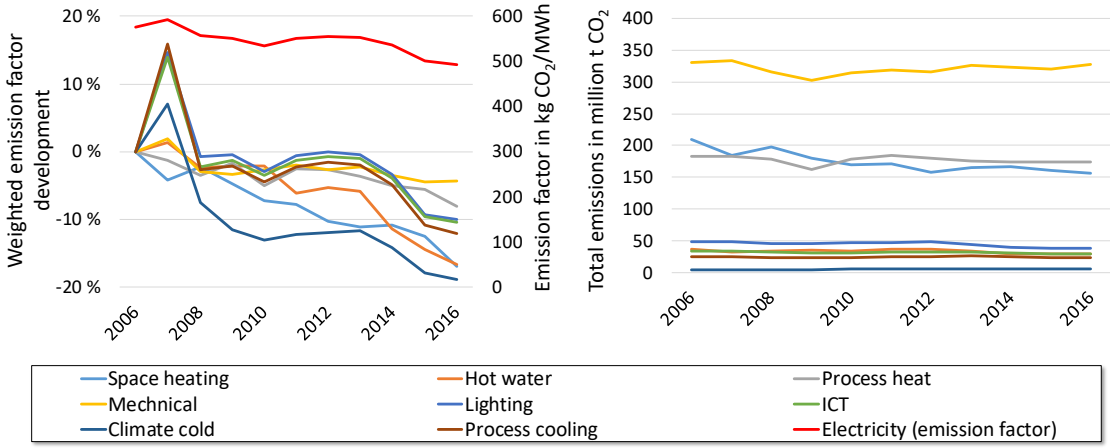

Figure 1: Development of the energy carrier weighted emission factor in comparison to 2006 per application and emission factor of electricity (left); total emissions per application (right)

Literature

[1] Scheller, Kay: Bericht über die Koordination und Steuerung zur Umsetzung der Energiewende durch Bundesministerium für Wirtschaft und Energie. Bonn: Bundesrechnungshof, 2018.

[2] Rasch, M.; Regett, A.; Pichlmaier, S.; Conrad, J.; Greif, S.; Guminski, A.; Rouyrre, E.; Orthofer, C.; Zipperle, T.: Eine anwendungsorientierte Emissionsbilanz - Kosteneffiziente und sektorenübergreifende Dekarbonisierung des Energiesystems in: BWK Ausgabe 03/2017, S. 38-42. Düsseldorf: Verein Deutscher Ingenieure (VDI), 2017

[3] Energiebilanz der Bundesrepublik Deutschland 2006 - 2016. Berlin: Arbeitsgemeinschaft Energiebilanzen e.V. (AGEB), 2018

[4] Energiedaten Gesamtausgabe - Stand: August 2018. Berlin: Bundesministerium für Wirtschaft und Technologie (BMWi), 2018