Translation from German original

20 November 2020

STUDY ON THE "EFFICIENCY TERM“

A replica to conceptual points of criticism

On 26 October, Frontier published the study on "The concept of efficiency in the German climate policy debate on road transport". Here, we address some methodological points of criticism to our study.

The methodological criticism

The study has received much public support, but also some critical comments. In some cases, methodological objections against the calculation approach: Frontier Economics would treat kilowatt hours of electricity differently and would mix up electrical energy and capacity. In this context, it is argued that by means of the so-called comprehensive analysis we have invented a method that lacks any physical-technical consistency.[1]

Our replica

We cannot agree with this criticism. In the energy policy debate, the efficiency of technologies is frequently used as the first guideline for decisions on pre-selecting technologies. The aim of our study is therefore to question this assessment method and to extend the efficiency debate, which has so far been too narrow, to a more comprehensive view. In our study, the conventional technical concept of efficiency is therefore deliberately expanded to include, among other things, the term “electricity yield efficiency" of renewable energies.

The technical energy efficiency of e.g. photovoltaic (PV) plants has conventionally been defined as the ratio between solar radiation on the one hand and electricity generation on the other hand (in kWh). However, this conventional approach fails to take into account that the electricity yield of a PV system in Germany differs from many other locations around the world, for example in North Africa, the Middle East or Australia.

It is exactly this location-dependent yield where electricity generation from renewable energies differs decisively from conventional electricity generation, e.g. from natural gas or coal-fired power plants, but also from other conversion stages such as electrolysis or synthesis processes. None of these technologies is as strongly dependent on location.

Against this background, it is essential which usable final energy can be generated from e.g. a wind turbine or a PV system. This also allows us to calculate how many PV systems or wind turbines are required to operate an average car in Germany with a mileage of about 14.000 km per year with renewable electricity: Our analysis shows: If, for example, a vehicle with an internal combustion engine in Germany is

[1] Handelsblatt, 02.11.2020, https://www.handelsblatt.com/politik/deutschland/klimaschutz-im-verkehrssektor-batterie-verhagelt-e-autos-die-co2-bilanz/26575906.html?ticket=ST-4218567-OseeWaSSPnzKZOPbTsSL-ap2

operated with PtL with electricity produced in a PV plant in North Africa, this requires an installed PV capacity of 6 kW. A battery electric vehicle would require 5,7 kW for the same mileage. - with PV modules installed in Germany.[2]

Conventional efficiency analyses neglect the electricity yield of renewable energy plants. They are therefore not suitable as a basis for political decisions on technology choice. The installed capacities of wind and PV systems should ultimately be decisive when it comes to evaluating different drive technologies as they are the main determinants of costs, CO2 emissions (during the manufacture of the plants), acceptance, achievability of climate protection targets, etc.

Beyond the discussion around terms of definition, this view on efficiency analyses seems to be shared by critics, e.g. Felix Matthes (Twitter, 27 October 2020): "*What is ultimately decisive is costs, not energy efficiency. If the answer is not a meaningful economic analysis, but absurd hybrids [...],it is it is scientifically questionable*." On closer inspection, this is in line with section 6 of our study, where we explicitly point out that the technical concept of efficiency is insufficient for political decisions (page 64).

This also means that political conclusions based on simple efficiency analyses, which are based on energy losses of individual conversion stages in kWh, are not appropriate, e.g. the frequently quoted causal chain for PtL: ["conversion of RE electricity to fuel = efficiency loss = only apply PtL in the eventif direct electricity generation is unavailable"].

Conclusion

In summary, this means: With a more comprehensive technical efficiency term regarding renewable energies, the analysis results do not show one single advantageous technology choice. A narrower conventional technical efficiency term fails to consider important aspects relevant to climate policy. Therefore, efficiency considerations alone cannot serve as a basis for drawing any political conclusions.

In the end, technology requires a comprehensive assessment of relevant options, including costs, value for money, available volumes, acceptance, etc. This explicitly includes both the expected massive expansion of battery electric mobility and the use of alternative defossilisation technologies such as green synthetic fuels. Our study provides an important step in this direction and as such it is exactly the opposite of a hasty exclusion of certain technologies based on incomplete analytic chains.

[2] As a result, the differences in installed capacity are relatively small. However, the PV potential, i.e. the availability of land for "harvesting" renewable electricity, is far greater outside Germany than in Germany itself. This advantage of importing PtL fuels is inherently not considered in our quantitative analysis, but it is of immense importance for the strategy to achieve the climate targets.