THE IMPACT OF SECTOR COUPLING OPTIONS ON ELECTRICITY SYSTEMS – AN EVALUATION OF DIFFERENT FLEXIBILITY OPTIONS

Mario Kendziorski, Technische Universität Berlin & DIW Berlin, +49 30 314-25048, mak@wip.tu-berlin.de
Wolf-Peter Schill, DIW Berlin, +49 30 89789-675, wschill@diw.de

Overview

The challenge of decarbonizing the energy system involves not only the electricity sector, but also transportation and heating. Yet, there is no clear vision about how these sectors are going to merge into an integrated system with almost zero emissions. Given that the power sector is arguably easier to decarbonize, as well as the versatility of electricity as an energy carrier, a transition towards a fully renewable power sector is mandatory. However, the level of integration of electric vehicles and the additional demand coming from residential heat pumps have an influence on the power demand. On the other hand, the value of flexibility options increases with a high penetration of intermittent renewable energy sources.

Methods

The presented work aims to analyze different power sector scenarios in a highly decarbonized energy system. A focus is set on different configurations for sector coupling and resulting implications on flexibility option. Following variations will be subject to a sensitivity analysis:

(1) The deployment of electric vehicles and their interaction with the power grid, (2) installed heat pumps resulting in different heat demand profiles and potentially additional flexibility for the power system, and (3) demand for hydrogen (e.g. in the chemical industry or the transportation sector). We use the open source electricity system model DIETER to identify determining factors on the generation expansion as well as needed storage capacity.

Results

While additional electricity demand coming from other sectors increase the required installed generation capacity, the needed investments into storage technologies can be reduced. Both, utilized electric vehicles and power-to-gas infrastructure can diminish curtailment of renewables. Investing into Solar PV becomes more valuable with a higher degree of sector coupling and the provided flexibility.