MACROECONOMIC EFFECTS OF PROSUMER-HOUSEHOLDS IN GERMANY

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Overview

This paper investigates the macroeconomic effects of the evolution of prosumer-households in the future energy market in Germany. The term „prosumer“ is a mixture of the two words “producer“ and “consumer“ and emphasises the potential new role of private households in the future energy market. In the German policy debate, these households are discussed as potential key actors for the transition of the energy system. On the one hand, prosumer-households produce power from solar PV or Micro Combined Heat and Power (Micro-CHP) systems; on the other hand they (at least partly) consume their own produced power or store the energy on site for use later. Thus, prosumer-households increase the complexity of the energy system, but they also offer opportunities to solve existing problems such as those incurred by the increase of fluctuating power sources such as wind and solar PV.

Methods

The results in this paper are derived from a quantitative and empirical analysis of different scenarios, applied in the macroeconomic top-down model PANTA RHEI. The model links the energy balance to economic sectors and has been extended by a prosumer module, based on work by the project partners Institute for Ecological Economy Research (IÖW), Berlin and the Institute for Future Energy Consumer Needs and Behavior (FCN), RWTH Aachen. The IÖW contributes detailed information for the different types of prosumer-households and their optimal technical equipment, which are the result of a profound household modelling activity. FCN has developed detailed diffusion processes of different types of prosumer technologies using data from a survey with a discrete choice experiment. The main difference between the scenarios in this paper is the total number of prosumer-households. We define a reference case, in which only a few (thousands) prosumer-households step into the market. In two alternative scenarios, the number of prosumer-households increases up to about five million and about eleven million in 2030 respectively. Future cost reductions of battery storage are a key factor for the future development. Inputs from IÖW and FCN are considered in the macroeconomic model framework. Macroeconomic and environmental effects are calculated including direct and different second-round and feedback effects.

Results

The macroeconomic effects of prosumer-households rely on technical and financial conditions of the installed renewable energy-based micro-generation technologies, the government incentive schemes to support their development (feed-in-tariff regulation, privileges such as exemption from the charges for taking power from the grid, other subsidies) and finally the overall number of prosumer-households in the economy. The consumption of self-produced power by the prosumer-households has several implications for the economy. The disposable income of prosumer-households is increased by savings through avoided purchases of power, avoided purchases of fuel for heating and unused excess, which can be sold to the grid; it is (potentially) decreased by the initial investments for the necessary infrastructure and the additional purchases of power to run additional technical equipment of the prosumer-households (e. g. heat pumps). The disposable income is used for consumption purposes and savings. The additional consumption has retroactive effects for the whole economy. Beside the economic effects, the prosumer power generation has also implications for the fossil-fuelled power plants, which may have to be throttled. This throttling has implications for the emission of greenhouse gases and the profitability of some power plants.

The increased solar PV power generation by the prosumer-households causes a reduction in the fossil-fuelled power generation and a reduction in the emission of greenhouse gas. The amount of additional consumption and second-round effects in the economy depends on whether the consumer-households get attached to compensate the savings

or rather the benefits of the prosumer-households or not. Although the number of prosumer-households seems huge, they represent 11 % (in case of five million prosumer-households) or 25 % (in case of eleven million households) of all German households, and their degree of self-supply ranges between 17 % and 58 %. The value of self-produced and self-consumed electricity remains quite small.

Conclusions

In contrast to some literature that expects large impacts of integrating prosumer-households in the economy, effects of a significant increase in prosumer-households in terms of GDP and total private consumption are quite small until 2030. The impacts for a single prosumer-household are more distinct. As the degree of self-supply remains in a range of 17 % to 58 % fears of a large-scale "flight out of the grid" of prosumer-households, which will increase grid costs and electricity prices for all other consumers in a self-reinforcing process, seem unjustified for the coming years. Fast cost reductions of battery storage systems or changes in the support policies for renewables could change results, however. Prosumer-households are a new player in electricity and heat markets. Further research should focus on their behaviour, e. g. concerning their demand for self-produced energy, implications for future market design and support policies, and distributional effects between prosumer and consumer households. Prosuming companies should also be taken into account.

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