

The transition to distributed electricity generation: An agent-based model of interdependent household investment decisions

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Abstract An important element of a future low-carbon electricity system is small-scale distributed production of renewable energy. In this paper we explore the transition from traditional centralized electricity distribution systems towards distributed systems of electricity production and consumption. We focus on the self-organization of consumers who become producers (“prosumers”) to provide such a distributed production system under different policy scenarios. Self-organization results from mutually dependent investment decisions of connected actors.

We adopt an agent-based simulation approach to analyze the possible build-up of such a system. Interconnected households as agents decide upon investment into small- and medium renewable energy generation. Investment decisions upon possible investment options are based on individual preferences, social interaction, regulatory constraints and the limits of a power grid. Other relevant actors (energy suppliers, network operators, regulatory authorities, government agencies) are considered as exogenous factors.

The model allows for simulation experiments to explore four policy options, namely feed-in tariffs, public provision of extended grid capacity, investment subsidies and awareness measures contributing to a better understanding of policy effects on the socio-economic feasibility of the transition.

Keywords Energy transition, investment, distributed generation, agent-based modelling, energy policy