Decision Support for Optimal Investments in Building Energy Systems

Completed Research

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Abstract

In 2000, the Renewable Energy Sources Act (EEG) initiated a large dissemination of photovoltaic systems in Germany. The EEG guaranteed a fixed feed-in remuneration for 20 years, which is highly profitable for many private and commercial prosumers. Feed-in tariffs have decreased substantially, resulting in a different economic situation for prosumers. Current prosumers that are about to exit the remuneration in the near future facing the challenge of readjusting their energy infrastructure. Whereas, potential prosumers aiming to establish an efficient building energy system. Both need an artifact that introduces the idea of efficient investments in renewable energy sources technology. Our decision support system (DSS) seeks to provide guidance for private and commercial prosumers by simulating small energy systems, presenting performance indicators and thereby display investments' impact on the building energy system's efficiency. The Green IS based DSS reduces complexity of components and enables prosumers to follow a sustainable transformation path.

Keywords

Decision Support System, Building Energy System, Efficiency, Energy Prosumer, Sustainable Transformation

Introduction

Since the beginning of the 21st century, the concept of energy transition has emerged on a technical and a socio-economical level. This has led to an extensive and drastic change in the global energy system. After the nuclear disasters in Chernobyl in 1986 and in Fukushima in 2011, a political and societal debate regarding nuclear power plants arose in Germany, intensifying the discussion about national energy transition. As the Ethics Commission for a Safe Energy Supply reported, energy transition requires great efforts by all levels of politics, business and society (Töpfer and Kleiner 2011). For instance, in 2000, the Renewable Energy Sources (RES) Act (EEG) initiated a dissemination process of RES technologies, especially photovoltaic systems (PVS). It guaranteed installed PVS before 2000 a feed-in tariff of 50.6 ct per kilowatt hour (kWh) for 20 years up to 5 MWp which is defined as the potential maximum power of PVS (Federal Ministry for Economic Affairs and Energy 2017, Renewable Energy Act 2017). Therefore, investments in PVS were incentivized and became more profitable. In contrast, potential prosumers who installed a PVS up to 40 kWp in February 2019, received a feed-in remuneration of 11.03 ct/kWh (Federal Ministry for Economic Affairs and Energy 2017; Federal Grid Agency 2017).

As the EEG successfully supported the dissemination of RES generation systems, the trend of energy prosumers emerged. According to Parag and Sovacool (2016), energy prosumers are agents who both consume and produce energy. This definition refers to industrial energy suppliers as well as households that use a PVS. Advances in electricity generation and energy storage technologies as well as declining costs have enabled private and commercial prosumers to establish building energy systems (BES) (Parag and Sovacool 2016). Recent studies by the Institute of Environmental Economic Research and the Institute of Future Energy Consumer Needs and Behavior state that several types of prosumers exist regarding technical setups, which indicates that there is no homogenous type of prosumer (Lautermann 2018).