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# German utilities and distributed PV: How to overcome barriers to business model innovation

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ABSTRACT

The transformation of the energy industry towards a more sustainable production of electricity increases the importance of distributed generation from renewable sources such as solar photovoltaic (PV). German utilities have largely failed to benefit from this development and lost 97% of the distributed PV generation market to investors from outside the electric power industry. Recent studies indicate that utilities have to react to prevent revenue erosion and loss of profits. This study identifies threats and opportunities of distributed PV generation for utilities based on a series of interviews with German utility managers. The key finding is that utilities do not perceive distributed PV as a threat to their current business models nor do they see it as a potential market for them. Relating these findings to the existing literature on transformation processes in other industries leads to the conclusion that the solution for utilities lies in changing their perspective on distributed PV. Utilities could greatly benefit if they did not treat PV as just another source of electricity generation in competition with traditional sources (as they do today), but as a strategic gateway into the emerging distributed generation and service market. Distributed PV could function as a basis for further business model innovation in new growth markets such as energy efficiency and distributed storage. Specific recommendations are provided and a modular value proposition is suggested to help utilities to turn distributed PV from a threat into an attractive business opportunity.



## 1. Introduction

Distributed solar photovoltaic (PV) has become a noticeable source of electricity generation in Germany, providing 5.3% of the country's electricity in the first half of 2012 [1]. By the end of 2011, the country had an installed PV capacity of some 25,000 MW, of which more than 80% is installed on buildings [2,3]. In the German state of Bavaria, for example, 200,000 out of 2,300,000 electricity users own and operate a distributed PV system [4]. This means that 8.5% of electricity consumers in that region have become independent power producers. If this trend continues, it may well become a problem for the established utilities.

Utilities are by far the largest group of actors in the German electricity market, controlling about 80% of the country's generation capacity. Recent studies on utilities' business models find that the increasing share of distributed PV is a threat to the utilities' current business models [5–10]. It is argued that increased electricity generation by private individuals leads to a decreasing demand for electricity from the utilities and, consequently, an erosion of their revenues [7,8,11]. There is consensus among authors that utilities need to react and adapt their business models to the current challenges. To date, however, it is far from clear what successful future utility business models for distributed PV could look like [12,13].

It is important to better understand the role of the utilities in the energy transition for various reasons. From the utility perspective, the increasing share of distributed PV may become a strategic challenge that has to be met. From a societal perspective, the behavior of the utilities will be decisive for the success of the energy transition. Research must therefore answer the question of *what barriers to business model innovation do German utilities face in the field of distributed PV generation and how these barriers can be overcome?*

The present study identifies opportunities and threats of distributed PV from the perspective of the utilities. Moreover, it reveals utilities' barriers to business model innovation in the field of distributed PV. The results were derived from a series of interviews with German utility managers. A key finding is that the managers are – on average – not very excited about distributed PV generation: they do not perceive it as a threat to their utilities' current business

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model, nor do they see it as a new business opportunity for their companies. This result contradicts the conclusions of recent studies on utilities' business models. It thus raises the question whether researchers are overestimating the importance of distributed PV or whether the utilities are underestimating the threat to their business model.

The existing literature on disruptive technologies and transition processes in other industries indicates that neglecting emerging technologies such as PV could harm the utilities in the long run [14,15]. The conclusion of this study is that the solution for utilities lies in changing their perspective on distributed PV. Utilities could greatly benefit if they did not treat distributed PV generation as merely another source of electricity generation in competition with traditional sources (as they do today), but as a strategic gateway into the emerging distributed generation and service market. Accordant specific recommendations are provided and a modular value proposition is suggested.

The study is organized as follows. Section 2 provides some background to the topic and reviews the different strands of the published literature, thus laying the ground for the analytical and theoretical framework of this study. Section 3 describes the methodology and the data sources. Section 4 displays the results of the in-depth interviews with German utility managers, and discusses them in Section 5. Section 6, finally, gives a brief summary and points out some directions for future research.

## 2. Background

### 2.1. Distributed PV generation

Distributed electricity generation is gaining increasing interest in current research and practice [3]. The Institute of Electrical and Electronics Engineers (IEEE) defines distributed generation as the generation of electricity in facilities that are sufficiently smaller than central generating plants and thus allow interconnection at nearly any point in the power system [16]. Ackermann et al. [17] define a distributed generation source as an electric power generation source connected directly to the distribution network or to the customer side of the meter. The feature common to all definitions of distributed generation is the generation of power in small-scale generation units close to the point of consumption [18]. The main technology for distributed generation from renewable sources is PV [19]. What is, therefore, understood as distributed generation in this study is electricity generation from PV in residential or small and medium-sized commercial environments.

### 2.2. The business model concept

The increasing challenges posed by the energy transition have started a debate about utilities' business models for renewable energies [6]. A business model can be understood as a structural template that describes a firm's organizational and financial architecture [15]. Teece [20] explains that the essence of a business model lies in defining the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. Osterwalder and Pigneur [[21]: p.14] define a business model as *"the rationale of how an organization creates, delivers, and captures value"*. A review of the literature shows that many authors favor a conceptualization based on four elements [21–23]: the value proposition, the customer interface, the infrastructure, and the revenue model:

- *Value proposition*: refers to the bundle of products and services that creates value for the customer and allows the company to earn revenue;
- *Customer interface*: comprises the overall interaction with the customer. It consists of customer relationship, customer segments, and distribution channels;
- *Infrastructure*: describes the architecture of the company's value creation process. It includes assets, know-how, and partnerships; and
- *Revenue model*: represents the relationship between costs to produce the value proposition and the revenues that are generated by offering the value proposition to customers.

Researchers find the business model concept to be a valuable new tool for analysis and management in research and practice [24]. In terms of analysis, the concept enables the examination and comparison of companies and markets in a structured way [25]. In addition, using the business model as a classifying device to build generic categories helps to understand business phenomena [26]. As a management tool, the business model helps managers to design, implement, operate, change, and control their business [27]. Business models can also function as blueprints suitable to be copied or be used for further improvement through innovation [26].

### 2.3. The German energy market and PV

The German electric power market is currently in a major transition process towards a more sustainable production based on renewable energy technologies (the so called "Energiewende"). In 2010, the German federal government decided to have 80% of the country's electricity produced from renewable sources by 2050 [28]. In addition, last year's decision to phase out nuclear energy in Germany by 2022 increases the need to replace existing electricity generation capacities through renewable energy technologies.

In the first half of 2012, Germany had produced 25% of its electricity from renewable sources. PV accounted for 5.3% of the total electricity supply [1]. Until (very) recently, electricity generation had almost exclusively been the domain of the utilities. This is now dramatically changing with the increasing share of renewable energies. Today, the largest share of the renewable generation capacity installed in Germany is owned and operated by private investors like farmers, project development companies, investment funds, and private individuals, while the utilities own only 13.5% of the overall renewable generation capacity [29]. The lowest involvement of utilities can be observed in the field of PV where utilities own and operate only 3% of the installed capacity [29]. The vast majority of small and medium-sized PV systems (<500 kW) is owned by private individuals (41.8%), farmers (22.5%) and small and medium-sized enterprises (20.3%). To put it in other words: Utilities have already lost 97% of the PV electricity generation market (Fig. 1).

The legal framework regulating tariffs for electricity generation from renewable sources in Germany is the Renewable Energy Sources Act ("Erneuerbare Energien Gesetz"). In recent years this generation was exclusively remunerated using a fixed feed-in tariff per kilowatt hour fed into the grid. Technically speaking, German utilities have not lost revenues from electricity sales due to distributed PV generation in Germany so far. This is because the owners have not used the electricity directly for their own consumption, but fed it into the grid to obtain the feed-in tariff. However, the regulations of the Renewable Energy Sources Act increasingly encourage the direct use of electricity from PV. This means that incentives are provided to use the electricity directly close to where it is produced. Excess electricity can still be fed into the grid, and excess demand that cannot be met by the owners' PV system can be supplied from the grid. The increasing share of direct use reduces the electricity demand from the grid, i.e. from the utilities and consequently leads to lower revenues per customer for the utilities.