Business model challenge: Lessons from a local solar company

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Abstract

Solar photovoltaic systems are considered vital renewable energy sources for mitigating climate change and reducing dependency on fossil fuels. However, in some countries, the diffusion rate of photovoltaic systems is decreasing. A case in point is Germany, the country with the highest installed capacity of photovoltaic systems. Given the new conditions in the German market, the diffusion rate continuously declined in both 2012 and 2013. Whether the diffusion rate will again take off is not known. While the recent literature has pointed out that local solar companies have a vital driving role in diffusion, not many studies have yet discussed the business models and challenges such local companies may have. Through an extensive case study, this paper explores the business model of a local solar company in a town of 43,000 inhabitants in Southern Germany. The case of this company tells about an important business model challenge. Overcoming such challenges may not only let the company survive but also drive the diffusion of solar photovoltaic systems in the region. The results include implications for both industrial actors and policymakers.

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1. Introduction

Germany is a leading producer of solar photovoltaic-power, accounting for one-third of the global photovoltaic (PV) systems’ installed capacity [1]. Although Germany has a relatively limited solar radiation potential, it has outperformed countries that have a larger land area and higher solar radiation, such as France, Spain, Turkey, Brazil and Japan. The mechanisms behind the German story of PV systems’ diffusion have been discussed at length in the literature [e.g., [2–4]]. One of the most important drivers of the diffusion process has been the activities of local solar companies [5]. However, such local solar companies are about to find themselves on the edge of a cliff, given the new conditions in the market: declining feed-in tariff, decreasing turnover per PV system installation and decreasing diffusion rate of PV systems [see, e.g., [6,7], for these new conditions].

The management and economics literature has discussed the diffusion of innovations for decades. Early scholars of this phenomenon studied technological change, explaining how profitability of an innovation and adopters affect the diffusion [8,9]. There has been a general agreement that the diffusion of innovations usually follows a typical s-curve in time dimension [see Refs. [10,11]]. The spatial dimension has also been found to be vital given the local factors which are heterogeneously spread in a geographic region [12,13]. Such local factors have been studied in a variety of studies using various perspectives: local demand [14], peer effects [15], local environmental conditions [16], proximity to early adopters [17] and role of local solar companies [18].

In the realm of the diffusion of environmentally friendly innovations such as PV systems, the literature has often focused on the influence of policy [19,20]. The impact of policy has been engaged by various approaches in the existing literature [see Ref. [21] for a review] such as technological innovations systems [22], lead market model [23], ecological modernization [24] and sustainable transitions [25]. Several studies have also empirically examined the importance of local and regional policies in the rapid diffusion of renewable energy systems [e.g. Refs. [26,27]]. Studying the case of PV systems in Germany, Dewald and Truffer [5] found that the activities and services of local solar companies are vital in stimulating the diffusion process. In the same manner, Fabrizio and Hawn [18] suggested that, in order to achieve rapid diffusion, policy makers should support such local solar companies. However, the existence of such solar companies is bound...
not only to policy interventions but also to the business models that they have.

A business model explains how a company creates economic value [28], describing the factors related to offering, market, strategy, internal capability, competition and investor [29]. Business models may depend on the temporal stages of product life cycle, i.e., introduction, growth, maturity and decline [e.g., 30], which are underpinned by the dynamics of innovation-diffusion patterns. However, business models are hard to be transformed, e.g., during technology shifts [31] or towards sustainable transitions under policy interventions [32]. Empirical studies on energy policy have already discussed the importance of business models in different sectors, for example in heat energy production [33], electrical cars [34] and algae biofuel [35]. Although the business models in the PV sector have also been discussed [e.g. Refs. [32,36,37]], the empirical focus has only been limited to the large-sized electric utilities, solar cell production firms that compete globally and the business models of the adopters. However, less has been said about the business models of local solar companies, especially in times of decline in diffusion.

Responding to this gap, the aim of this paper is to discuss the business model challenge of a local solar company at the decline stage of the product life cycle, i.e., decline in diffusion. This company is located in a small town in southern Germany and specializes in planning and installing PV solutions for local customers in a radius of fifty km. It is not only the pioneer of its kind in the region but also the co-founder of a local solar initiative, a network of several local solar companies in the spatial lead markets of PV systems’ diffusion [4]. By giving a detailed description of the case of this company and the challenge it has faced, this paper seeks to shed some light on the business model challenges of such local solar companies.

Apart from this introduction, this paper consists of four other sections. Section 2 provides a theoretical background used for interpreting the data, while Section 3 explains the methodology of the study. Section 4 presents the results and discussion, explaining the current business model of the company and the challenge it has faced. Finally, Section 5 provides conclusions and policy implications.

2. Literature review and theoretical background

2.1 Diffusion of photovoltaic systems

Diffusion is a process by which an innovation is communicated through a variety of channels over time among the members of a social system [38]. The process is not only affected by the characteristic of the adopters and the innovation itself, but also by the environmental context, which depends on the geographic, social and political settings [39]. The diffusion of environmental innovations such as PV systems is especially bound to political support, pioneer companies and the lead markets [40].

The drivers, barriers and challenges of the diffusion of PV systems in Germany have been extensively discussed in the literature. Early studies focused on the institutional and political challenges behind the diffusion that had occurred before 2004, the year the German National Renewable Energy Act (EEG) was amended. Jacobsson and Johnson [41] developed an analytical framework examining the diffusion of renewable energy technologies, based on illustrative examples from Sweden and Germany. From a technological system perspective, they pointed out the importance of actors, networks and institutions on the successful transition to renewable energy technologies. In a later study, Jacobsson and Bergek [42] also explained the success and failures in such transitions, analyzing the diffusion of renewable energy sources in Netherlands, Sweden and Germany. They identified the three major challenges that policy makers faced: difficulties in foreseeing the outcome of policy intervention; the long time scale of the diffusion process; and the political struggle to overcome the opposition from incumbent actors. Another study, focusing only on the German case [2], described the formation of political support for renewable energies as a “battle over institutions.” In this case, the regulatory frameworks supporting wind energy and PV systems in Germany faced the opposition from both coal and nuclear interests.

Later studies have discussed some new aspects on the PV market in Germany. On the one hand, Frondel et al. [43] criticized the feed-in tariff scheme of the EEG, pointing out the inefficiency of this scheme on greenhouse gas abatement. Rather than supporting the adopters of PV systems with the feed-in tariff, they instead recommended policy makers support the PV panels’ production. On the other hand, Laird and Stefes [44] discussed the German EEG as a role model for the USA. They identified the decades-long substantial political change as a driving factor on diffusion of PV systems, putting much stress on the positive effect of historical contingencies for the German success. In addition, Dewald and Truffer [3] explained the importance of substructures in the market, arguing that the different market segments of PV systems have shown various patterns of diffusion. In addition, Leepa and Unfried [6] studied the effects of feed-in tariff adjustments on diffusion of PV systems in Germany. They had two main contributions. First, they argued that the feed-in tariff in Germany, which declined from 0.39 €/Kwh in 2009 to 0.22 €/Kwh in the early 2012, still supported the diffusion. Second, in order to meet governmental targets in future, the authors recommended alternative ways of adjustments regarding the feed-in tariff.

Moreover, there is a common agreement that local factors have been essential for enabling the diffusion of PV systems in Germany. Dewald and Truffer [5] identified that local solar initiatives have been vital to form the PV market, stimulating rapid diffusion. They argued that the success was not only because of strong policy support or favorable geophysical conditions, but also because of the activities of local solar companies in shaping the PV market formation. In the same manner, Fabrizio and Hawn [18] studied the role of local solar companies in the USA. Conceptualizing the local companies as complementary inputs, they identified these inputs as drivers of the diffusion of PV systems. They recommended that policy makers incentivize local companies in order to achieve successful diffusion.

2.2 Business models

The business model concept has been popularized in the last two decades, particularly in e-business, strategy, innovation and technology management-related fields [45]. Business models are stories that explain how companies work and conduct business [46]. If a business model is successful, it means that the model is able to mediate between the technology and the economic value creation [28]. Based on an extensive literature review, Morris et al. [29] categorized the components of an entrepreneur’s business model as factors related the offering, market factors, internal capability factors, competitive strategy factors, economic factors and personal/investor factors (see Table 1).

The factors related to the offering describe the scope of the product or service offered by the company. This addresses the value proposition and creation. The value can be in different forms, including economic or social [45]. Market factors are related to the scope of the market within which the company competes as well as the nature and geographic dispersion of the customers [29]. The business model of a company focuses on a specified market segment or a group of customers [28]. Internal capability factors are
the source of competence, which can come from various aspects such as production, selling, marketing, supply chain management or creative capability [29]. Competitive strategy factors formulate how the firm gains advantage over rival companies. For example, competitive advantage can be gained by managing environmental innovations [47]. Economic factors provide the logic behind earning profits. The business model estimates the profit potential of the offering, based on a value chain [28]. Personal/investor factors are based on the investment model of the company. Morris et al. [29] give some examples of such models, including the subsistence model, aiming to meet basic standards and to survive; the income model, restricted by a stable income stream; the growth model, targeting re-investment and growth; and the speculative model, with the goal of demonstrating venture potential and selling out.

Just as the business model of a company can evolve over time [29], so too can its revenue. Underpinned by the dynamics of diffusion patterns, the research on product life cycle [see Refs. [48,49]] explains the interrelation between temporal stages on the sales revenues of companies and the change in business strategies. In line with the s-curve of diffusion, the temporal stages of the life-cycle of a product have often been identified as introduction, growth, maturity and decline [e.g., [30]]. At the declining stage, companies face declining revenues, and the functional focus of companies moves from marketing/logistics to finance [50]. However, such decline can sometimes result in re-incline [49]. Both decline and incline often induces companies to revise their business strategies [30]. In this context, a growing body of literature has focused on how to innovate existing business models [e.g. Refs. [51–54]].

It is often a challenge to change the business model [see, e.g., [31,55]]. In particular, the companies in the renewable energy sector, including PV systems, are bound to be influenced by unexpected risks and opportunities, which are often created by policy measures [56]. In this context, there is growing interest in understanding effective business models to accelerate energy transitions, particularly about electric cars [e.g., [57]] and renewable energy sources [e.g., [58]]. The literature on renewable energy sector has paid more attention to the business models of production firms, adopters and electric utilities. For example, Loock [36] studied the business model preferences of 249 investment managers of renewable energy, arguing that service-centered business models are more favorable among investment managers. One conclusion of this study is that policy makers should support service-centered businesses instead of technology or price. Based on the PV sector in Netherlands, Huijben and Verbong [37] categorized the business model of adopters as customer-owned, community shares and third-party business models. The authors conclude that entrepreneurial activities creating new business models for adoption of PV systems have positively influenced the market growth in Netherlands. In addition, Richter [32,59] studied 18 electric utilities in Germany, asserting that business model innovation in electric utilities is vital for managing the transition towards renewable energy sources. However, he also revealed that electric utilities have not been keen on developing adopter-side projects due to smaller profits. Such adopter-side PV projects are, instead, often developed by local solar companies [5].

### 3. Methods

The methodology used is an illustrative case study. In general, the aim of using case study method can vary, including providing description, testing theory or generating theory [60]. The case studies should not only address theory, but also provide real world examples in a new way [61]. We choose to use a case study method in order to provide an in-depth description of a local solar company. This description is framed by the concept of a business model [28] and its components [29]. Following the innovation literature [62–64], we also conceptualize the solar PV system as an innovation for adopters. From the company’s point of view, the PV system is a product, while installing the PV system is a service [see Ref. [18]].

According to Yin [65], a case study approach is appropriate when exploring a contemporary phenomenon and to gain a holistic view of complex instances through observation, and searching for patterns especially when there is a lack of previous research. The stimulus for a case study approach [65,66] is to offer understanding and give insights into reality. In our case, it is about a business model challenge of a local solar company in Germany. We are aware of the limitations regarding the generalization of case studies and recognize that its strength lies in its unique ability to develop “concrete” and “practical” context dependent knowledge that has been empirically collected [66–68]. As Flyvberg [67] suggests, case studies have the ability to provide empirical “real life situations” and “multiple wealth of details” while contributing to the illustrative context-limited knowledge.

#### 3.1. Empirical setting

The focus of our case study is Hartmann Energie technik GmbH (HET) at zip code 72108 in Germany (see Fig. 1). This company has been chosen for two reasons. Firstly, it is located in the spatial lead market of PV systems’ diffusion in Germany [4]. Secondly, it has witnessed the diffusion of PV systems since 1990s as being one of the pioneer local solar companies in Germany [69]. It has been a part of solar initiative movement [70] and featured in several energy magazines [e.g. Refs. [71,72]].

The company offers not only PV systems, but also some other technologies, including solar thermal systems, pellet ovens etc. As shown in Fig. 2, it is located in a rural area, near a village, called Oberndorf in Rottenburg (Am Neckar). It is a local solar company founded in 1995 by a local entrepreneur, Thomas Hartmann, a native of Oberndorf. He is also the co-founder of two solar initiatives: Solar-Partner e.V and Sonnenhaus-Institut e.V. The former is a network of companies, freelance solar consultants and partner companies. The latter is an association of architects, engineers and managers of the solar industry, focusing on solar-heated and solar-electrified buildings. The members of both initiatives are from various locations in zip code areas 7 and 8.

#### 3.2. Data collection and analysis

The major part of the data was collected between December 2012 and March 2013. The data include 18 interviews, approximately 600 h of observation and the internal data of the company.
The interviews were conducted with Thomas Hartmann, the employees in HET, the directors of four other partner local solar companies (Gerold Weber Solartechnik GmbH in Aachen; Solar-Partner Süd GmbH in Kienberg, and two sister companies, System Sonne GmbH in Rottenacker and Frickingen) and the adopters of PV systems. Such diversity in interviewees gave a holistic view to understand the business model of HET. For instance, the interviews from partner companies improved our understanding of HET local network, while the PV adopters helped us to get insights about HET’s customer relations. The durations of interviews varied between 10 min and 1 h. The interviews were designed as semi-structured, including open-end questions. The interviewer had the freedom to add new questions, based on the flow of the discussions during interviews. They were conducted at various locations: the company, the houses of adopters and a regional workshop. Except in one instance, the language of the interviews was German. All interviews were electronically recorded.

The main part of the observations took place in HET for three months by one of the authors. During this period, he also lived at the zip code 72108 in Rottenburg am Neckar. The author was present in HET for an average of 9 h/day on weekdays. He acted as a participant observer [73] at formal meetings and participated in the informal gatherings of the company. He monitored several ongoing PV installations projects and met with the adopters during the installations. He also attended a two-day regional workshop, organized by Solar-Partner e.V. in order to discuss the latest developments in the solar market. The workshop gathered nearly 150 participants from several companies.

The internal data include various documents such as internal agreements, technical and feasibility reports of each PV installation and the documentation of each project, as well as the sales database of HET. For each PV project, the flow of communication and the pictures from installation side are also available. The sales database includes the evolution of offers and confirmation of orders for PV installations. In addition, the data about other technologies that HET offers, such as solar thermal or pellet ovens, have been used as complementary in the study.

Data were analyzed throughout and after the fieldwork. In order to limit subjectivity, data from one source were triangulated with...
multiple sources of evidence, i.e., another interview, observation or internal data of the company [74]. To validate the results, preliminary findings were presented in an internal meeting in HET. In addition, a field-work report was written and sent to HET.

4. Results and discussions

The business model of HET for PV systems is based on developing projects of PV installations. These projects start with the declaration of interest by potential adopters, i.e., the request of quotation. When a potential adopter, e.g., a household, declares interest, a representative of the company visits the place on site where the PV system is planned to be installed. Depending on the characteristics of the place and the preferences of the potential adopter, e.g., the roof space, the sunshine potential and the budget of the potential adopter, HET drafts a project and creates the sales quote (estimate). The sales quote outlines the potential costs for the prospective PV installation. If the potential adopter agrees on the sales quote, he/she confirms this to HET. Based on this confirmation, HET then installs the PV system on the place as planned. The system components needed for the installation are provided by supplier companies, among others, PV module or inverter producers. In the next sub-sections, the business model components are explained, following Morris et al. [29] and the relevant literature.

4.1. How does the company create value from PV systems?

PV system installation is not a simple task. It is bound to both adopters’ preferences and the physical availability of the different types of places, e.g., the rooftop, garage, façade or free-land. This means that each household needs a particular solution for PV system installation. In this context, HET creates value from providing solutions for particular needs through PV installations projects. Fig. 3 presents some examples of PV installations that HET has provided for various needs in the neighborhood. The case of HET is an example of product/service mix offering. In order to let the potential adopter know more about the diverse PV applications, HET then installs the PV system on the place as planned. The system components needed for the installation are provided by supplier companies, among others, PV module or inverter producers. In the next sub-sections, the business model components are explained, following Morris et al. [29] and the relevant literature.

4.2. For whom does the company create value?

The market which HET competes in is a business-to-customer (B2C) type. HET’s primary market segment is the small-scale household PV systems. This market segment is usually composed of decentralized on-grid systems with a capacity up to approximately 10 kWp [3]. Customers, i.e., potential PV adopters, are local, approximately spread to 50 km radius, instead of being national or international [see Ref. [29]]. This local area is a part of Swabia, a major part of zip code area 7. The customers of HET are usually Swabian households, farmers and local small-sized companies, who have a sufficient space on site to install PV system and who are financially stable. These households usually speak a special dialect of German, called Swabian, which is also spoken in HET as an internal company language. This enables HET to better communicate with potential adopters in this local area. Thomas Hartman is personally known by many adopters. When asked “Why have you chosen HET?” one adopter noted,

“Because I work here nearby and I always have had contact with HET” (Mr. R, 29.01.2013).3

4.3. What is the company’s source of competence?

HET’s source of competence is composed of several interrelated factors. The first is the fact that the company is led by a local entrepreneur who knows the local traditions and lifestyle very well. The second is the visibility of the company, which is driven by complementary social activities that potential adopters can have at the company. This includes having the opportunity to dine at the company’s restaurant where the food is cooked by using renewable sources, participating in the monthly 3-h solar-walks (to observe the previous projects of HET), and touring HET on its annual open-door day. The third factor is the high quality of the PV installations, mainly based on German solar modules and inverters. In a nutshell, the competence of HET is what Morris et al. [29] call an intimate-customer type. As an HET engineer noted,

“Probably because we are a local company and we have many good reference systems here in the neighborhood, and yes I

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2 Swabia suffered from the poverty and scarcity in the 19th century, which was followed by the industrial uptake in the 20th century. Nowadays, Swabians are often taken as role models to how to manage the money [91,92].

3 The original text in German: (Warum haben Sie HET ausgewählt?) Weil ich hier in die gegen arbeite und weil ich mit HET wieder immer Kontakt habe.
think we are well known. Plus, the combination of the brand Thomas Hartmann has built (is very important). Solar center and solar walks talk to the feelings; they are not just about purely technical side. This shows off the products. There is a building here. That’s always the most important thing, if one builds a place where people can see. Not every customer care about the purely technical data, but they want to experience” (An Engineer in HET, 31.01.2013).

4.4. How does the company competitively position itself?

“I received two offers; one from Hartmann and one from other guy. I did the comparison but I choose the one which was expensive. It is a local installation company, well-known in the region, there are many references in the area, and he is a very well-known guy. Go for the local!” (PV system adopter, Mr. M, 21.12.2012).

“He [Thomas Hartmann] is trustworthy. I prefer local craftsmen and German PV modules, no imports, and for this I am willing to spend more money” (PV system adopter, Mr. R., 23.01.2013).

HET intends to achieve an advantage over its competitors by providing local products with a good quality service. As HET is a pioneer in the region, the company has many reference projects that instill trust in HET among potential adopters in terms of the quality of the installations. Previous research based in other countries [75,76] also argues that quality of PV systems are vital for potential adopters’ decisions. According to one adopter,

“We had three companies in the race; we asked them all for an offer. We thought we choose the company that is already well-known, which always works for ideological reasons (environmental reasons). Other companies simply appeared on the market in recent years, they want to sell a lot …. All three were regional. We want to buy from our local neighborhood— as much as possible— because you have reliable people here. Many years of experience and highly trained staff were the deciding factors for HET. HET was the most expensive, but not so much” (PV system adopters, Mrs. W. & Mr. H., 29.01.2013).

Most adopters believe that Thomas Hartmann is driven by an ecological idealism and he is a trustworthy entrepreneur. Such trust towards local solar companies is usually associated with the green movement and, in particular, against nuclear power [5]. This seems to be one of the main reasons of why several potential adopters chose HET, instead of its competitors that entered the market several years after HET, when policy makers started to support PV installations through the EEG law throughout the 2000s. If a solar company was established after 2000, potential adopters often perceive it as profit-oriented.

4.5. How does the company make money?

Fig. 4 presents a simplified scheme of the value network of HET. In Germany, policy support is not provided by subsidies but...
through the EEG surcharge [see Ref. [7]]. Anybody who uses electricity has to pay taxes on the EEG surcharge, which funds the feed-in tariff. As a result, through the feed-in tariff, PV adopters are paid for their electricity generation with fixed tariffs for the next 20 years, starting from the time their PV systems are connected to the grid. Such a guarantee enables potential adopters to pay the high installations costs, which are usually passed on to the local solar companies, e.g., HET. This mechanism is similar to the end-user-owned residential type in the PV sector in the USA [see Ref. [77]]. As Dewald and Truffer [3] also argue, such a mechanism relies heavily on the policy support generated by the EEG surcharge.

4.6. What are the company’s time, scope, and size ambitions?

Thomas Hartmann tends to invest until the level that HET is able to generate stable income, known as income-model according to Morris et al. [29]. Moreover, the company is local, targeting a market up to 50 km radius, and aims to stay local. This vision of staying local can be associated with two reasons. The first is the transportation cost of PV systems, as the greater the distance between the adopter and HET, the greater the cost of transportation of the PV system. The second reason concerns the competencies of Thomas Hartmann: a good knowledge about the potential adopters and his reputation in the neighborhood. The further the potential adopters are from HET, the less HET knows about them and the less HET is recognized by them. This partially relates to the literature on local entrepreneurship [78], which indicates that entrepreneurs working in the region where they were born have more chances to exploit the economic opportunities available in their local regions.

4.7. The challenge

The number of yearly PV system installations decreased in 2011, 2012 and 2013 in Germany8. This decrease can be observed in the sales of HET as well. Fig. 5 presents this decline in different observation levels. The decrease in the number of PV installations is usually interpreted as a result of rapid decline in the feed-in tariff from 2010 to 2012 [see, e.g., [79]]. In spite of such interpretations, it is also assumed that the PV systems in Germany reached grid parity by 2012, making the technology advantageous against other conventional sources [80,81]. In any case, the decline in the number of installations resulted in a sharp decrease in HET’s revenues in 2011 and 2012. This was a challenge because the running costs of the company, such as the costs for the human resources needed for engineering and installation, stayed at the same level as before. Fig. 6 shows the evolution of HET’s revenues from 2004 to 2012, revealing the decline in the last two years. In general, such declines sometimes do not last long and may result in re-incline [49]. However, whether the decline stage will continue is not easily predictable.

One additional reason for the sharp decline in the revenue of HET is also decreasing turnover per PV installation (Fig. 7). For example, in 2006, the average price of a PV system that HET installed was around 60 k Euros. This average price decreased to around 30 k Euros in 2012, probably as a result of a learning curve effect [82] on the price of system components such as solar modules [see Ref. [83] for other possible reasons beyond a learning curve].

Fig. 5. The comparison between diffusions of PV systems at different levels and HET’s installations (Sources: The Information Platform of Four German Transmission Network Operators for EEG and KWK-G; and HET).

Fig. 6. Approximate revenue of HET from PV installations and other services and products.9

Fig. 7. The declining average cost of PV installations.10

Business model conceptualization considers the process of doing business and explains the challenges in operationalizing the construct [45]. In this context, we recognize a critical challenge for HET. Similar to the other actors in the renewable energy sector [56], the challenge of HET has been bound to the risks and opportunities

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8 If the capacity of installations is considered, the decrease happens only in 2012 and 2013.
9 The values are approximate.
10 The values are approximate.
created by policy measures. The challenge lies not only on the decreasing revenue, but also on the possible strategies to tackle this decrease. For example, such revenue decreases associated with declining adoption or costs can be tackled by different strategies such as launching incremental or disruptive innovations in the market [e.g., see Ref. [84]] or expansion into national and international markets with existing innovations [see, e.g., [85,86]]. The former strategy is not easy in the case of HET, as the existing adopters are bound to the 20-year lasting EGG support. In addition, these adopters usually do not have extra space left at their houses for new types of installations. The latter strategy can be a possible option, but it contradicts HET’s desire to stay local. HET does not plan to expand its market because its source of competence is highly associated with its local market.

This article not only illustratively describes the business model of local solar companies but also reveals the challenge they have. Both contributions open new avenues for future research. Firstly, given Germany’s ambitious target to double its energy production from renewable energy sources in the next 15 years [87], further research might investigate how policy measures could support local solar companies which are local drivers of diffusion. If the local solar companies fail, so might the diffusion of PV systems. Given the diminishing feed-in tariff, different types of policy measures could be developed in order to support the diffusion of PV systems. Secondly, further research on local solar companies’ business models could shed light on how to respond to the challenges of decline in an effective way. In this context, the literature on business model innovation [e.g., [51,52]], including energy-related empirical cases [e.g., [32,57,59]] and local entrepreneurship [e.g., [78,88]], could be complementary to further understand such a phenomenon.

5. Conclusions

Diffusion studies have examined the factors behind adoption at length [38,39]. The case of PV systems in Germany has gained attention, and the factors behind it have been discussed from several perspectives [see Ref. [2,4]]. The recent literature has emphasized that the local solar companies are important drivers of diffusion [5,18]. Extending this debate from a business model perspective [28,29], this study has presented an illustrative case of a local solar company in Germany, aiming to develop a holistic view of the phenomenon as there is lack of previous research on it.

Our study has illustratively describes the business model of a local solar company and the challenge it faces. The challenge occurs at a time when the diffusion of PV systems is characterized by three facts: diminishing feed-in tariff for PV installations, declining adoption rates and decreasing turnover per PV system installation. As a result, our case company faces a rapid decrease in its revenue. Expanding its market to the national/international level or coming up with incremental/disruptive innovations could be some options to tackle this challenge. However, the company is reluctant to do either of them. This is due to the company’s existing business model, which is based on “being local,” and the fact that existing PV adopters are supposed to keep their PV system for a long time to fully benefit from the feed-in tariff. This challenge exemplifies not only how existing business models can hinder new business models [e.g. [52]] but also how the businesses in energy sector are bound to the policy [56].

Our findings are of crucial importance to the actors in the renewable energy sector, particularly to policy makers. If policy makers seek to support the diffusion of environmentally friendly innovations such as PV systems, they should consider whether the business models of existing local companies will survive. As the policy measures are unlikely to have the expected impact without local solar companies [5,18], the survival of such companies is critical for enhancing the diffusion of PV systems. This means that policy makers might consider new measures to support existing local companies as they are the important drivers of diffusion of PV systems.

Finally, this study is illustrative in nature and has some limitations. For instance, it is based on a single case study. However, as Flyvbjerg [67] suggests, it contributes to the collective process of knowledge accumulation in a particular field that lies among several fields, e.g., energy, economics and management. In addition, the diffusion of PV systems in Germany has been highly influenced by the German feed-in tariff, so the results of this study may not easily transferred to other national markets. However, similar processes might occur in other countries where the diffusion has lately taken off. Nevertheless, as with other energy-related single case studies that focus on particular regions [e.g., [89,90]], we also believe that our study provides empirical insights and a wealth of details, which can be used as a basis for future research.

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References


11 Such a challenge might be also tackled by different strategies, e.g., introducing new products or services in the market. However, we do not aim to give a full picture of all possible options that the company has considered or might consider in the future. Instead, we exemplify only a few most relevant options.


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