A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

THE RISE OF SERVITIZATION IN THE GERMAN B2C SOLAR ENERGY MARKET: INVESTIGATING SOLAR-ENERGY-AS-A-SERVICE BUSINESS MODELS FROM A CUSTOMER PERSPECTIVE

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16/12/2024

Abstract

In the post-feed-in tariff era, business models in the German B2C solar energy market have shifted from relying on governmental subsidies towards achieving profitability by providing customers with effective service solutions and flexible financing options. This work project investigates how Solar-Energy-as-a-Service companies can enhance their value generation, delivery, and capture in current market environment. Through nine semi-structured expert interviews and a review of secondary data, three key recommendations were formulated directed at companies operating with SEaaS business models. These recommendations include the areas of sales and marketing channels, predictive analysis for lead generation, and Energy-as-a-Service expansion through electric vehicles.

The individual part of this work project examines key strategic components for customer-centricity and competitive positioning within the Solar-Energy-as-a-Service Business Model and illustrates the recommendation to expand customer reach, enhance engagement, and drive solar energy adoption in the SEaaS market through strategic partnerships.

Keywords:

Strategic Business Models, Photovoltaic Industry, Solar Energy Systems, Business Model CANVAS, Business Ecosystem, Energy-as-a-Service, Solar-Energy-as-a-Service, SEaaS, Virtual Power Plant, All-In-One Energy Supplier

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

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List of Abbreviations

BM	Business Model
BMC	Business Model Canvas
BMI	Business Model Innovation
BSW	Bundesverband Solarwirtschaft (Solar Industry Association)
BNE	Bundesverband neue Energiewirtschaft (Federal Association of the New Energy Industry)
CAC	Customer Acquisition Cost
CLV	Customer Lifetime Value
CVP	Customer Value Proposition
EaaS	Energy-as-a-Service
EEG	Erneuerbare-Energien-Gesetz (Renewable Energy Act)
EMS	Energy Management System
EV	Electric Vehicle
FiT	Feed-in Tariff
HEMS	Home Energy Management System
IoT	Internet of Things
LCR	Lead Conversion Rate
MCDA	Multi-Criteria Decision Analysis
NGT	Nominal Group Technique
PPA	Power Purchase Agreement
PSS	Product-Service Systems
PV	Photovoltaic
ROI	Return on Investment
SBM	Strategic Business Models
SEaaS	Solar-Energy-as-a-Service
SPV	Special Purpose Vehicles
VC	Venture Capital
VPP	Virtual Power Plant
V2G	Vehicle-to-Grid
WP	Work Project
XaaS	Everything-as-a-Service

1. Introduction

> "*Our industry is well-prepared to step into a bright future where demand for photovoltaics on the one hand and innovative storage and charging infrastructure on the other will bring about rapid growth in the coming years."*
>
> – Carsten Körnig, Director of German Solar Industry Association (BSW-Solar 2024b)

1.1 Industry Background and Context

As Europe's largest residential solar energy market, Germany's solar energy is a key cornerstone to its energy transition (GTAI n.d.). The Federal Government (2020) aims to cover 65 percent of the gross energy consumption with renewable energies by 2050. Recent geopolitical concerns have further underscored the importance of reducing dependency on foreign fossil fuels and advancing energy independence (Federal Government 2023). Specific to photovoltaic (PV), Germany aims to achieve 215 gigawatts of PV capacity by 2030 (BMWK 2023b). However, only 53 percent of this PV target for residential households had been reached by mid-2024, leaving nearly half of the planned capacity yet to be installed (BSW-Solar 2024c).

Despite these ambitious renewable energy objectives, the industry has faced several challenges over the past two decades. In the 2010s, key domestic solar panel producers declared bankruptcy due to reduced subsidies and the production shifted to Asia (Junichi 2022). In response to the ongoing market consolidation with fierce domestic competition, many companies started shifting from hardware-centric business models (BMs) to service-oriented approaches. These BMs integrate PV systems with complementary technologies, including energy storage and electric vehicle (EV) charging, addressing financial barriers while aligning with consumer demand for sustainable and independent energy solutions (Sułek and Borowski 2024).

1.2 Problem Statement

Despite significant progress in securing Germany's energy supply through renewable sources, companies in the solar sector still face the challenge of navigating an uncertain and rapidly changing market environment. Growing consumer demand for integrated energy solutions and flexible financing options requires solar energy companies to balance customer expectations with profitability (McKinsey & Company 2022). To succeed, companies must address these challenges while adapting their BMs to contribute to Germany's broader energy transition.

1.3 Objective of this Work Project

The objective of this WP is to analyze BMs in the German B2C solar energy industry, with a focus on understanding how SEaaS companies can enhance value generation, delivery, and capture through their BM. By examining the SEaaS business model employed by market leader Enpal, this WP aims to make an academic contribution by exploring the critical strengths, vulnerabilities, and opportunities of this emerging BM. Through an analysis of both traditional and innovative BMs, the WP provides practical recommendations to help SEaaS companies adapt their strategies to dynamic market conditions, achieve long-term success, and support their strategic development within the context of Germany's energy transition.

1.4 Significance of this Work Project

This WP seeks to offer insights into how the SEaaS BM employed by the market leader enables success in the dynamic B2C solar energy market. Given the industry's recent challenges, including a wave of bankruptcies and intense competition, understanding the vulnerabilities and strengths of this BM is critical (Wehrmann 2024). By analyzing innovative developments and identifying best practices among industry leaders, this WP aims to provide actionable recommendations for PV installation companies. These recommendations are designed not only strengthen competitiveness but also to accelerate the adoption of PV solutions, supporting Germany's broader objective of achieving its energy transition goals.

1.5 Scope and Limitations

The scope of this WP is limited to the German B2C solar systems market, with an emphasis on PV installation companies. These companies are specialized in installing PV systems for private homeowners and often provide complementary services, such as batteries, energy storage systems, EV chargers, heat pumps and energy management solutions. To be included in this WP, companies must offer PV systems as a core component of their services. The WP excludes PV panel manufacturing and commercial PV projects, as the focus remains on residential installations due to the unique strategic challenges and opportunities. Industry developments are analyzed from the 2000s onward, a period marked by significant advancements in PV technology and key policy changes like the Renewable Energy Sources Act (Fraunhofer ISE 2024a). A detailed analysis of vulnerabilities and strengths is conducted exclusively for the SEaaS BM, while contextualizing these findings within broader industry developments.

1.6 Work Project Structure

The first chapter provides an overview of the literature on Strategic Business Models (SBM) and introduces the analytical framework employed in this WP, followed by a description of the methodology. The second chapter examines the evolution of BMs in the industry, focusing on historical trends and contemporary variations. The third chapter applies the analytical framework to the SEaaS BM, identifying its vulnerabilities and strengths. The final chapters synthesize the findings to present conclusions and offer recommendations for enhancing value generation, delivery, and capture for companies operating with a SEaaS BM.

2. Justification of the Analytical Framework

In order to achieve the WP's objective of understanding how value can be created with different BMs for customers in the German B2C solar industry, academic literature on SBMs has been reviewed in the following section. This review forms the foundation for the analytical framework, which will be utilized for evaluating the effectiveness of SBMs and its elements and is introduced at the end of this chapter.

2.1 Origin and Development of the Term Business Model

A synthesis of BM research revealed an ambiguity of definitions, with various BM definitions coexisting without consensus among scholars (Massa, Tucci and Afuah 2017). Building up on Peter Drucker's key questions on how BMs should be designed, an early definition was formulated by Magretta (2002), who described it as "at heart, they are stories that explain how enterprises work". According to Magretta (2002), successful companies must be able to tell customers a coherent story on Peter Drucker's key questions, being the value created, its delivery, and costs. Other authors follow a different approach and simply define BMs by listing the elements that should be included (Casadesus-Masanell and Ricart 2011). More recently, Osterwalder and Pigneur (2010, 14) published their definition of BMs, described as the "a business model describes the rationale of how an organization creates, delivers, and captures value". For its well-established theory, this WP will use Osterwalder and Pigneur's BM definition.

2.2 Business Model Frameworks in Academic Literature

Several frameworks have been developed to capture the essence of different BMs and apply BM theory in practice. These frameworks provide valuable tools to analyze the different aspects of companies in a structured way by identifying the key components. This section reviews what

BMs are predominant in literature and discusses how these frameworks were adapted in the selected industry of B2C solar energy.

One early well-known BM framework, developed by the Harvard researchers Johnson, Christensen and Kagermann (2008) is the Four-Box BM, which is illustrated in Figure 1. It is developed for understanding and reinventing BMs by breaking them into four core components. The first component, *Customer Value Proposition* (CVP) describes the core of any BM and is solving a critical customer problem or fulfilling a significant need. This value proposition must be compelling enough to encourage customers to switch from an existing alternative. The second box, the *Profit Formula* illustrates how companies create value for themselves while delivering value to customers. This formula includes the revenue model, cost structure, target margins, and resource velocity. The third box, *Key Resources* are the assets necessary to deliver the value proposition. These resources can be tangible and intangible such as people, technology, brands, and capital. Lastly, the fourth box, *Key Processes* refer to the tasks, activities, and workflows that allow the business to deliver the value proposition in a consistent, scalable, and repeatable manner. Together, these four components form an interconnected system that allows businesses to deliver customer value profitably and sustainably. However, the model is not static, requiring continuous adaptation to shifts in competition or customer needs (Johnson, Christensen and Kagermann 2008).

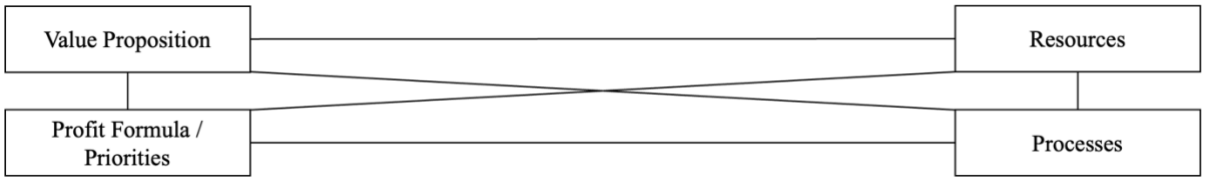

Figure 1: Four-Box Model. (adopted from (Johnson, Christensen and Kagermann 2008).

The Four-Box BM, however, has limitations in certain industries. In the German solar B2C sector, external factors like subsidies and fluctuating energy policies, which will be explored in the industry evolution part, are not fully addressed. Additionally, customer decisions in this

sector often hinge on long-term investments, sustainability goals, and environmental incentives, which go beyond the immediate profit-oriented focus of the model. While the Four-Box BM framework provides a strong foundation for many businesses, it is less effective in industries heavily influenced by external, policy-driven, or long-term factors (Christensen, Bartman and Van Bever 2016).

When reviewing the elements of the Four-Box BM, similarities to the more recent Business Model Canvas (BMC) can be observed, as illustrated in Figure 2. The BMC comprises nine elements, grouped into four categories: “customers,” “offer,” “infrastructure,” and “financial viability” (Osterwalder and Pigneur 2010, 15). By providing a more detailed breakdown, the BMC enables a granular analysis of a business model’s components compared to the Four-Box BM’s broader approach. According to Osterwalder and Pigneur (2010, 50-51), the BMC is a visual framework that helps businesses define, visualize, and adapt their business models holistically. This adaptability makes it particularly valuable for dynamic industries, allowing companies to design or refine business models that align more closely with strategic objectives.

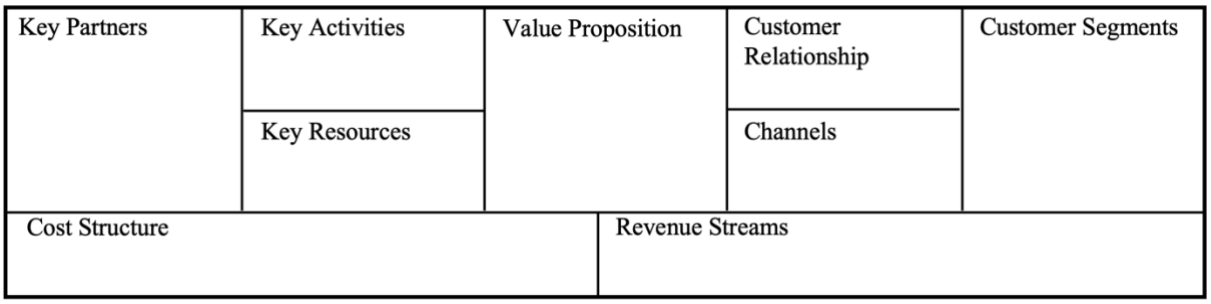

Figure 2: Business Model Canvas. (adopted from Osterwalder and Pigneur 2010, 44).

The first element, *Key Partners*, identifies the essential partnerships a company relies on to operate effectively. These may include suppliers, manufacturers, distributors, and other organizations that provide critical resources or services. The second element, *Key Activities*, highlights the essential tasks a company must perform to deliver its value proposition, such as production, distribution, customer service, or marketing. *Key Resources*, the third element,

refers to the assets and capabilities required to deliver the value proposition. These include physical, intellectual, human, and financial resources. At the core of the BMC, similar to the Four-Box BM, is the *Value Propositions* element, which defines what makes a company's product or service unique and valuable to customers, answering why they should choose it over competitors. The fifth element, *Customer Relationships*, describes how a company interacts with its customers and the types of relationships it fosters, ranging from personal assistance to automated services, *Customer Segments*, the sixth element, categorizes the specific groups of people the business aims to serve, considering their unique needs, behaviors, and preferences. The seventh element, *Channels*, outlines how a company delivers its value proposition to customer segments. These include sales channels, distribution methods, and marketing platforms. *Cost Structure*, the eighth element, details the key costs associated with running the business, including fixed and variable costs tied to activities, resources, and partnerships. Finally, *Revenue Streams* explains how the company generates income from its customer segments, such as through product sales, subscription fees, or leasing models (Osterwalder and Pigneur 2010, 16-42).

Given the B2C solar market's complex nature with many interconnected stakeholders, high competitiveness and extensive need for customer support, a more detailed breakdown of BM components is better suited for this industry compared to the Four-Box BM. he BMC's dedicated sections for customer-related elements allow for a deeper exploration of customer-centric approaches, whereas the Four-Box BM consolidates these into a single section. Additionally, the BMC's detailed focus on cost structure and revenue streams helps companies balance investments and returns, enabling profitability in a competitive market. Finally, the BMC includes a section on partnerships, absent in the Four-Box BM, which facilitates an understanding of stakeholder interconnections and highlights potential collaborations.

2.3 Business Model Frameworks used in the Solar Industry

The BMC has also been adopted in the solar energy industry. Horváth and Szabó (2019) applied the lean canvas model, an adjusted BMC that incorporates risk factors and is better suited for startups, to compare community-shared, host-owned, and third-party owned PV industry BMs. Another Brazilian study used the BMC approach to introduce a competitive BM for local PV installers (Rigo et al. 2022). A third paper applied the BMC to explore differences and similarities between shared PV BMs in India and Brazil, suggesting further research on regulatory differences is needed (Marques et al. 2023).

2.4 Criticism on Business Model Theory

Although the BMC is well-established in academic literature and the solar industry, it is not without limitations. The BMC, along with BM theory, has been criticized for several shortcomings. Specifically, the BMC has been critiqued in three areas: a limited focus on external market developments, a failure to address innovation and disruption, and an overemphasis on the company's economic factors. These points will be elaborated in the following paragraph.

One major criticism of BM theory is its limited focus on external market developments, such as integrating partners, suppliers, or competitors. By focusing only on the firm, synergies with partners, cost improvements, switching costs, or novel business operations may not be sufficiently understood or addressed (Zott and Amit 2010). A second criticism is the lack of focus on innovation and disruption. BMs tend to reflect a single point in time, but this static view fails to capture dynamic market shifts or how well companies can innovate (Massa, Tucci and Afuah 2017). Research indicates that BM theories are often integrated with innovation and competition elements, and the term Business Model Innovation (BMI) has gained significant traction in recent years (Andreini et al. 2022). A third criticism is the economic focus of the BMC, which overlooks social and environmental factors. As a result, the framework has been

expanded into a “Triple Line Framework”, adding two canvases for social and environmental factors alongside economic ones (Alexandre and Paquin 2016).

2.5 Analytical Framework

To address the limitations of the BMC, this WP incorporates an extended framework that integrates a business ecosystem perspective. Business ecosystems emphasize the interconnections between various stakeholders and how their actions influence the entire system (Moore 1996, 18-19). Research in this field identifies three key layers: the core company, its extended network of suppliers and customers, and the broader ecosystem, including policymakers, financial investors, and associations. While the first two layers are already addressed within the BMC, this WP adds the third layer to capture the external dynamics shaping the solar industry. This extension allows for the identification of innovations and disruptions arising from regulatory changes, industry alliances, or shifting consumer demands. The resulting analytical framework combines the detailed internal focus of the BMC with an external market perspective, which is illustrated below in Figure 3.

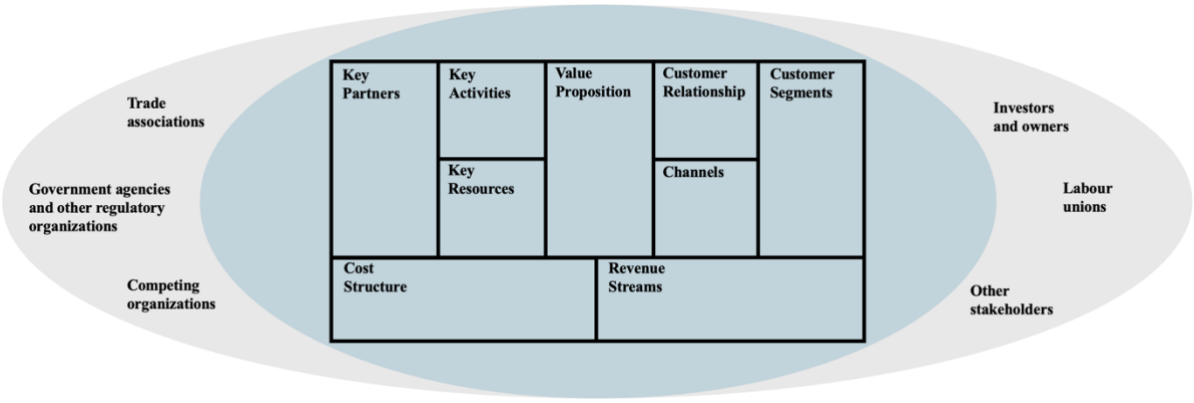

Figure 3: Analytical Framework (adopted from Osterwalder and Pigneur 2010, 15; Moore 1996, 19).

3. Methodology

This chapter outlines the data collection and analysis process conducted for the development of this WP. It begins by presenting selected methodological approach, followed by an introduction of the two data collection methods. Next, a justification on why these data collection methods were selected and how they complement each other is provided. Finally, this chapter concludes with a detailed discussion of the data analysis process.

3.1 Methodological Approach

A qualitative research approach together with a convergent analysis of qualitative and quantitative secondary data has been adopted to support the conclusion of this WP. As most of the academic literature is centered around solar technology, the specific research context of PV installation company's BM remains underexplored (Franco and Groesser 2021). In addition, the rapidly changing market environment has left only a limited amount of recent literature to draw from. Employing a qualitative approach allows the exploration of new insights directly from market experts in the specific context under study (Larsen 2023, 31).

3.2 Data Collection Method

The WP's data collection is designed as a convergent analysis of expert interviews, as well as secondary qualitative and quantitative research data. The insights of both collection methods were combined to provide a solid foundation derived from practical experience and theoretical knowledge for the recommendations part. The experts' insider information captured recent market trends and forward-looking perspectives from diverse solar energy professionals, while secondary research data was used to reflect previous work from established academics to ensure a validated contextual background of the interview findings.

3.2.1 Semi-Structured Expert Interviews

In order to achieve the WP's objective of explaining how a certain BM can generate, capture and deliver value in the current market environment, primary data was collected by conducting interviews with solar energy experts on Microsoft Teams. These interviews have been conducted in a semi-structured format in order to profit from the expert's knowledge and delve into their specific expertise deeply. Semi-structured interviews are defined as "an exploratory interview used most often in the social sciences for qualitative research purposes or to gather clinical data. It generally follows a guide or protocol that is devised prior to the interview and is focused on a core topic to provide a general structure." (Magaldi and Berler 2020). An interview question guide has been prepared as a general structure, which is presented in Appendix A. To improve the quality of the interview, questions were structured along the nine building blocks of the BMC to improve the question's validity.

The interviewee selection process involved multiple steps. As the objective of the interview was to get an in-depth market understanding, interviewees with different perspectives on the market and professional backgrounds were selected. Therefore, interviewee's professional backgrounds include company employees, VC fund investors, journalists, and researchers. All interviewees needed to fulfill a predefined set of criteria in order to qualify as experts for this specific research context. These criteria ensure that the selected interviewees possess the relevant expertise to provide insights into how PV installation company BMs generate, capture, and deliver value. Therefore, interviewees were purposively selected, not following random sampling method, as sufficient knowledge on the discussed matters needed to be ensured. This purposive sampling technique can be described as "[…] population samples used for research that have been deliberately chosen to reflect a specific characteristic such as age, location, or even species." (Bullard 2024). The characteristics which the interviewees had to fulfill in order to be selected as experts are depictured in Table 1.

Table 1: Interviewee Selection Criteria

1. Work Experience	Experts have a minimum of two years of professional work experience in the solar energy sector. Their professional roles are related to strategy, market analysis, policy, or business development. Relevant work experience can be gathered by working within a company, energy consultancy, dedicated public institution, association, or institute as a researcher.
2. German Market Expertise	Experts possess in-depth knowledge of the German market developments, either through their residence in Germany, or focusing on the German market from abroad to qualify as experts.
3. Seniority	Experts hold a senior level position in their organization, indicating a high level of decision-making responsibility and strategic insights to qualify as an expert for this research.
4. B2C Market Knowledge	Experts have extensive knowledge of the B2C solar energy market. Commercial and industrial industry knowledge is not required.

Interviewees were identified through official websites of research institutes, companies, or trade associations and informed about the interview context beforehand. At the start of each interview, participants described their professional background as part of a secondary background check. In addition to purposive sampling, snowball sampling was used to identify additional experts who might otherwise be inaccessible. Before transcription, experts were informed about the interview's purpose and the audio recording process, with the option to remain anonymous, which only one interviewee chose. Detailed information about the interviewees' industry backgrounds is provided in Table 2 and Appendix D.

Table 2: Overview of Interview Participants

Interview	Name	Sector	Company Name	Company Size	Job Title	Years of Experience
1	*Anonymous*	Venture Capital	*Undisclosed*	<100	Senior Vice President	8 years
2	Interviewe e 2 Köpke	Advocacy group	LEE NRW	<20	Press Spokesman	>30 years
3	Jan Wiesenthal	Ecological research	IÖW	>100	Environment al Economist	>5 years
4	Benjamin Merle-Oberheide	Solar installer	Enpal	>3,000	CPO	8 years
5	Oskar Latussek	Solar installer	LumixSolar	<50	CEO	2 years
6	Joel Ploeger	Solar installer	1KOMMA5°	>2,000	Business Development Manager	2 years
7	Florian Scholz	Solar installer	Solaro PV	25	CEO	7 years
8	Tim Siegelkow	Solar installer	1KOMMA5°	>2,000	Product Manager	2.5 years
9	Max Finne	Solar installer	Enpal	>3,000	Director Go-To-Market	4.5 years

3.2.2 Secondary Research Data

While conducting semi-structured, in-depth interviews, secondary research data was also analyzed to contextualize the interview's findings within the existent related research on BMs within the chosen industry (Saunders, Lewis and Thornhill 2019, 181). Secondary data considered for this WP includes academic papers, statistics from official institutions, solar energy company insights directly retrieved from their websites, and well-trusted newspaper information. When searching for literature, reports, and statistics, it was ensured that the sources are up-to-date, reliable, and reflect the newest market developments. This was done by conducting checks on the authors, previous publications and citations. Also, most academic papers which were selected are peer-reviewed.

3.3 Data Analysis

In order to derive recommendations for BM improvements based on the semi-structured interviews, the interviews were coded to uncover patterns and themes within the transcript which are relevant for meeting the WP's objective (Auerbach and Silverstein 2003, 3). For this purpose, a thematic coding approach was applied. This thematic analysis has been selected, as it has also been applied in similar research setting in which BM were explored on the Finnish PV market (Shakeel, Juntunen and Rajala 2024). The researcher follows the coding procedure introduced by Gioia, Corley and Hamilton (2013) to uncover new information from stakeholders within the dynamically evolving PV industry.

Following the thematic analysis as proposed by Gioia, Corley and Hamilton (2013), coding is conducted starting with an open coding step. In this step, the raw data of the transcripts was read and information relevant for the research context was highlighted as first order concepts. These concepts were gathered and formulated close to the terms used by the interviewees. Next, similarities and differences between the different concepts were analyzed to allow themes to emerge. Themes combine multiple concepts into categories on a more abstract level. In the last step, themes were reviewed for similarities and differences again to create more aggregated third-level dimensions from which the recommendations can be derived. This process was conducted in a nonlinear way multiple times (Gioia, Corley and Hamilton 2013). For this WP, themes emerged only if ideas were mentioned repeatedly by multiple interviewees, otherwise the information was disregarded. Interviews were conducted until data saturation was reached. In this WP, data saturation is referred to as "the point in data collection when no additional issues or insights are identified and data begin to repeat so that further data collection is redundant, signifying that an adequate sample size is reached." (Hennink and Kaiser 2022). An overview of the first order concepts, second order themes, and third order dimensions derived from the nine semi-structured expert interviews can be found in Appendix B.

4. Evolution and Variation of Business Models

As businesses seek to deliver value for customers with differentiated value propositions, the adaptability and variation of their BMs have become critical to long-term success (Lüdeke-Freund et al. 2020). This chapter explores the dynamic evolution of BMs, focusing on how companies in the German solar B2C sector have adapted over time. Key drivers of change, such as technological advancements and regulatory shifts, are examined alongside the range of BMs that have emerged in response. By analyzing the differences and innovative aspects within these BM variations, this section provides a comprehensive understanding of companies' strategic adaptations to the competitive environment.

4.1 Evolution of PV Installing Companies' Business Models

Over the last two decades, Germany's solar energy market has experienced substantial fluctuations in installed PV capacity, as illustrated in Figure 4. These shifts, driven primarily by technological innovation and evolving regulatory frameworks, have shaped the evolution of BMs (Quitzow 2015). The following section analyzes how PV companies have adjusted their BMs in response to periods of rapid growth, market stagnation, and changing customer expectations.

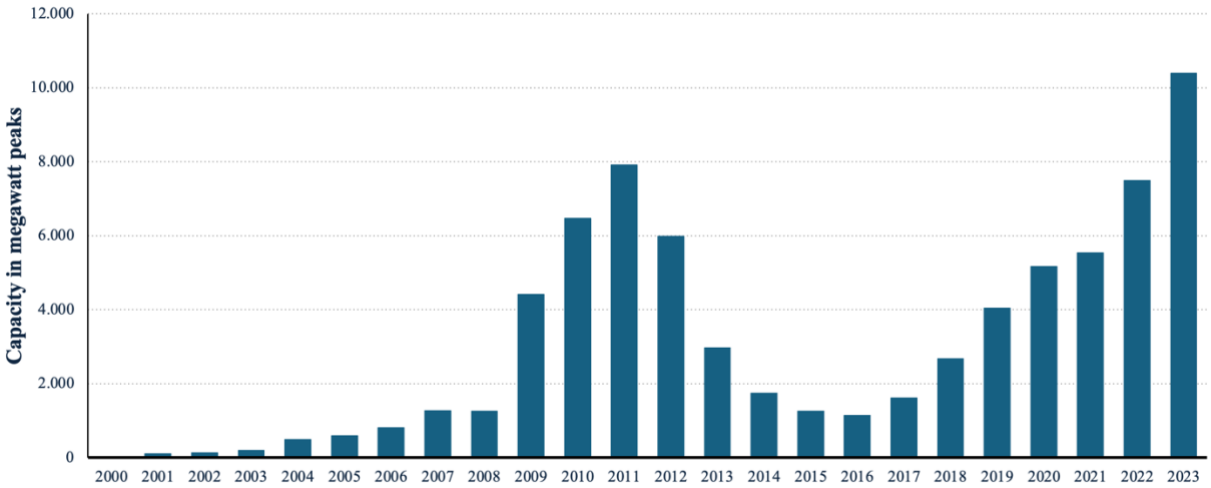

Figure 4: Installed PV Capacity in Germany from 2000 to 2023. (adapted from Statista 2024a).

4.1.1 Phase 1 (2000s- 2010): The Rise of Host-Owned Feed-In Tariff Business Models

From the early 2000s until the 2010s, the predominant BM of solar system firms centered around the "feed-in tariff scheme" provided by the German government (Quitzow 2015). Feed-in tariffs (FiTs) guaranteed homeowners who installed rooftop PV systems a fixed return for each kWh fed into the grid over 20 to 21 years, starting in 2002 (Bundesgesetzblatt 2000).

During this period, the PV market consisted primarily of small, local craftsmen businesses. Highly fragmented and decentralized, around 5,000 firms operated primarily in their local regions until 2013 (BSW-Solar 2014). PV systems were a profitable investment for homeowners, who typically financed the upfront costs themselves. To support this, the German development bank KfW offered low-interest loans, while local banks provided favorable financing conditions, further incentivizing adoption (Quitzow 2015).

As illustrated in Figure 5, FiT-based BMs positioned installers as trusted advisors to homeowners. Locally rooted craft firms often had pre-existing relationships with customers, underlining trust and reducing the need for extensive customer acquisition efforts. Payments flowed directly from homeowners to installers, who sourced PV systems from reliable networks of manufacturers, often with the help of wholesalers (Strupeit and Palm 2016). Large PV technology manufacturers, such as Q-cells and SolarWorld, were based in Germany, and thereby ensured high supply chain stability. This stability proved critical, as it ensured availability and quality of PV systems, which was particularly important in times of increasing demand and reliance on government incentives (Quitzow 2015).

Alongside installation services, firms provided complementary offerings such as insurance packages, warranties, and certified German PV systems, further differentiating their value propositions. These conditions helped installers maintain low customer acquisition costs (CAC) (Strupeit and Palm 2016). However, because this BM relied heavily on policy-driven FiTs, it

was vulnerable to regulatory changes. Any reduction in financial incentives could destabilize the model, as explored in the subsequent chapter.

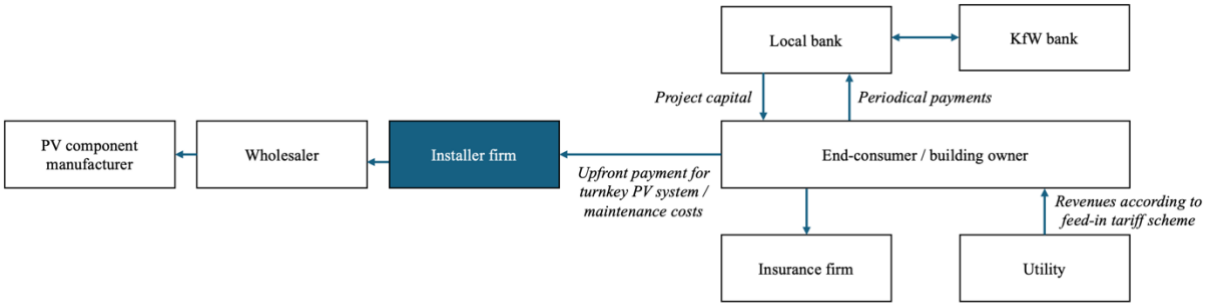

Figure 5: Financial Flows of Host-Owned Feed-In Tariff Business Model. (adapted from Strupeit and Palm 2016).

4.1.2 Phase 2 (2010-2015): The Market Decline resulting in Bankruptcies and BM Adaptions

Between 2010 and 2015, Germany's B2C solar market faced significant challenges due to regulatory changes and global competition (Janzing 2015). After years of high demand fueled by generous FiTs under the 2000 Renewable Energy Sources Act (EEG), cost-control reforms led to tariff cuts of 11 to 16 percent in 2010, with further reductions under the 2014 EEG reforms. By 2015, tariffs for small rooftop systems had dropped to 12.31 cents/kWh, creating uncertainty about the economic viability of PV installations (Bundesnetzagentur n.d.). This decline in government support caused a sharp drop in PV installations, with industry revenues plummeting from €13.2 billion in 2011 to €4.37 billion in 2013 (Statista 2024b).

At the same time, German solar companies faced increasing competition from Chinese manufacturers with significantly lower production costs. Once global leaders in solar technology, German firms struggled with shrinking profit margins and declining domestic demand, leading to several high-profile bankruptcies, including Solon, Germany’s first publicly listed solar company, and Q-Cells, once the world’s largest solar panel manufacturer, which collapsed in 2012 (Klooß 2021; Wehrmann 2019). Reliance on subsidies left these firms vulnerable to shifting market conditions, while increasing imports from China heightened supply chain dependence and exposed the market to global price fluctuations (Quitzow 2015).

In response to these pressures, PV installer companies adapted by transitioning from subsidy-driven BMs to diversified, customer-focused strategies. Many began offering energy storage solutions alongside PV systems, emphasizing long-term energy independence over short-term financial incentives (PV Magazine 2015a). Government subsidies supported this transition, covering up to 30 percent of residential storage system costs (PV Magazine 2015b). By 2014–2015, 85 percent of surveyed companies had integrated or planned to integrate storage solutions, reflecting a shift toward comprehensive energy offerings tailored to consumer demand for self-sufficiency (EuPD Research 2015).

This adaptation marked a broader industry trend toward diversification and the integration of complementary products. Companies adopted value-added service models, such as "solar-plus-storage systems," promoting energy independence and fostering sustained customer engagement (Cucchiella et al. 2018). By expanding their offerings, PV installers positioned themselves as providers of long-term energy solutions, creating opportunities for recurring revenue and enhancing their resilience to market fluctuations (Agrawal, Toktay and Yücel 2019). While these adaptations helped stabilize the industry, the limitations of subsidy reliance and competitive pressures paved the way for more innovative, service-oriented business models.

4.1.3 Phase 3 (2015-2022): The Rise of Service-Oriented Models and Digital Adoption

In response to earlier challenges, the German solar industry between 2015 and 2022 transitioned toward service-oriented business models and the adoption of digital tools to address evolving market demands and enhance operational resilience (McKinsey & Company 2022). During this period, the industry moved away from one-time sales of PV systems toward subscription-based offerings. Companies such as Enpal and Zolar pioneered leasing models, which eliminated high upfront costs and enabled customers to access solar power systems through manageable monthly payments (Zolar 2021). These innovations democratized access to solar energy,

expanded the customer base, and transformed the financial structure of solar firms by introducing predictable, recurring revenue streams (McKinsey & Company 2022).

Product diversification emerged as a central strategy during this phase. Companies expanded their offerings to include complementary solutions such as EV chargers, capitalizing on the increasing demand for sustainable mobility. This strategic shift enabled firms to position themselves as providers of integrated energy solutions, encompassing solar energy production, storage, and EV infrastructure. These developments aligned with growing consumer demand for energy autonomy and reduced dependency on traditional energy grids (Figgener et al. 2023).

The adoption of energy management systems (EMS) further supported the evolution of service-oriented models. EMS platforms, which monitor, control, and optimize energy flows, became instrumental in improving operational efficiency and enhancing customer engagement (Shufian and Fattah 2024). Although these digital solutions were in the early stages of development, they laid the foundation for future data-driven business models (Chasin et al. 2020, 566–568). Companies such as Enpal introduced proprietary apps featuring gamified real-time energy tracking, while external providers like Solar-Log developed third-party monitoring software, fostering greater customer interaction and energy optimization (Solar-Log n.d.). These advancements marked the initial integration of software-driven tools into solar product offerings, setting the stage for more sophisticated customer interaction and energy management capabilities.

Toward the end of this period, global supply chain disruptions, further impacted by the war in Ukraine in 2022, significantly shaped the solar industry. Rising energy prices in Germany made solar energy an increasingly attractive option as a cost-effective and secure alternative. This sudden surge in demand placed additional pressure on supply chains, leading to bottlenecks in the delivery of solar equipment (Tagesschau 2022). Companies with strong supply chain

management gained a competitive advantage by maintaining consistent service delivery and strengthening customer trust (Interviewee 1). These challenges highlighted the importance of operational resilience and adaptability in addressing market fluctuations and sustaining competitiveness.

4.1.4 Phase 4 (2023-2024): Transformation of Financial Models and Digital Integration

Building on the foundation of service-oriented models, the German solar market in 2023–2024 witnessed significant innovation in financial models, complemented by deeper integration of digital tools. An example of this is Enpal's introduction of a loan model, which allowed customers to finance solar installations through loans. This approach offered an alternative to leasing or installment purchase models, enabling customers to eventually own their systems after a defined repayment period while benefiting from low monthly payments (Enpal n.d.a). By bridging the gap between leasing and ownership, this model expanded financing options and attracted a new demographic interested in long-term solar investment (ISA 2024). At the same time, it created a new revenue stream through loan management and service contracts, enabling companies to secure long-term income while lowering financial barriers for customers (Enpal n.d.a).

Building on these financial innovations, the industry simultaneously embraced digital transformation to further enhance value delivery and customer engagement. Gamified digital platforms initiated new ways to engage customers through real-time energy tracking, fostering higher levels of interaction and retention while enabling companies to collect valuable data for service customization (AlSkaif et al. 2018). By 2024, EMS and smart meters had become standard practice, empowering customers to monitor and optimize their energy production and consumption while providing companies with real-time data to enhance operational efficiency (FfE 2023).

These digital tools played a pivotal role in the evolution of Energy-as-a-Service (EaaS) models, shifting solar companies' roles from hardware providers to comprehensive energy service providers (Deloitte 2019a). This transition closely aligns with the Product-Service System (PSS) model, where solar companies offer continuous service packages that include installation, monitoring, maintenance, and optimization, in addition to hardware. The PSS model emphasizes long-term value creation, customer loyalty, and sustainable energy use by embedding services throughout the product lifecycle (Tukker 2004).

By offering end-to-end solutions—from installation and maintenance to energy management—companies like 1KOMMA5° and Enpal could secure recurring income through service agreements, reducing reliance on hardware sales (Cleary and Palmer 2019). By integrating innovative financial models with advanced digital tools, the German solar market in 2023 and 2024 transitioned toward a more consumer-centric approach. This shift not only enhanced accessibility and engagement but also positioned solar firms for leadership in the broader energy transition.

4.1.5 Phase 5 (2024): Rise of Virtual Power Plants and Full-Service Energy Solutions

By 2024, the next major evolution in solar BMs arrived: the implementation of Virtual Power Plants (VPPs). Pioneered by companies like 1KOMMA5° ('Heartbeat AI') and Enpal ('Enpal.One'), this innovation connected households equipped with solar panels and battery storage into decentralized energy networks (1KOMMA5° n.d. ; Enpal n.d.b). This innovation enabled households to transition into prosumers—entities that simultaneously consume and produce energy—allowing them to generate, store, and sell surplus energy to the grid (Xia-Bauer et al. 2022). By leveraging this decentralized model, VPPs offered solar companies' scalable platforms for managing energy flows, while generating additional revenue streams through energy trading facilitated on behalf of their customers (Bannavikarn and Hoonchareon 2021).

For consumers, VPPs offered significant benefits, including enhanced energy autonomy and economic participation. Households could optimize energy production, stabilize consumption during peak demand, and monetize surplus energy through grid sales. These features aligned with the broader trend toward decentralized energy systems, empowering consumers to actively contribute to grid stability and reducing dependency on centralized energy sources (Berntzen et al. 2021). The operational framework of a VPP is illustrated in Figure 6.

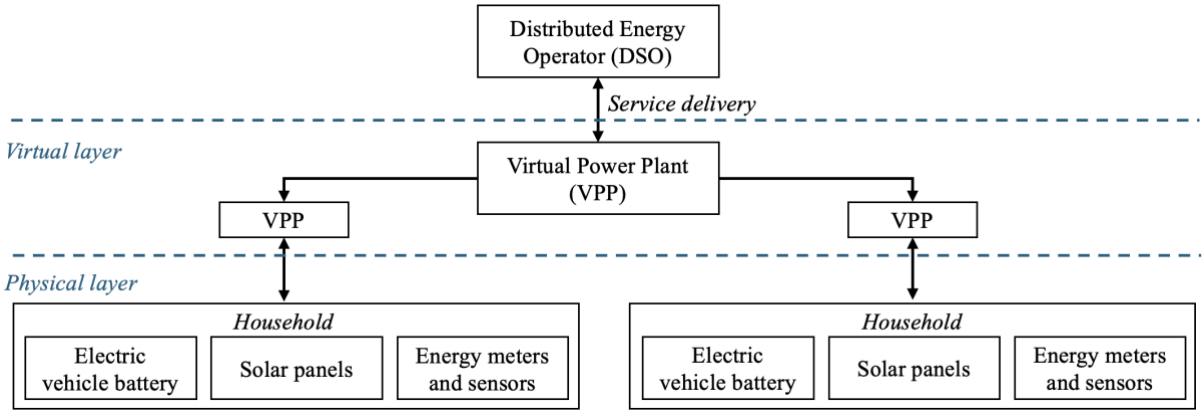

Figure 6: Virtual Power Plant. (adapted from Berntzen et al. 2021).

The rollout of VPPs also underscores the continued importance of digital platforms in the solar industry's evolution. Real-time energy management software enables companies to optimize energy flows within decentralized networks, improving operational efficiency and scalability (Behi et al. 2021). These tools also strengthen customer loyalty by providing personalized, data-driven energy insights that enhance user engagement (Behi et al. 2020).

Aggregators emerged as pivotal players within the VPP ecosystem, particularly for small and medium-sized prosumers. By pooling resources from multiple households, aggregators ensured efficient integration of prosumer-generated energy into broader energy markets. They also facilitated participation in demand-response and energy efficiency programs, offering incentives such as subscription fees or profit-sharing from energy savings (Berntzen et al.2021).

By bridging the gap between individual households and the broader energy market, VPPs represent a shift from hardware-centric sales to service-oriented, software-driven models. This transition positions solar companies to remain competitive in a rapidly changing market, fostering long-term customer relationships and securing stable, recurring revenue streams (Deloitte 2019a).

4.2 Variation of Business Models

As PV companies' BMs have evolved to adapt to changing market conditions and policies, understanding the variations that coexist today is essential for capturing the dynamics of the current market environment. Bankel and Mignon (2022) highlight that inconsistencies exist across studies in classifying solar BM variations. They also note that many companies operate with multiple BMs in parallel to target different customer groups. Solar energy BMs are typically categorized by ownership structures, value chain activities, or application types, as explained in Table 3 (Bankel & Mignon 2022).

Table 3: Classification of Solar Energy Business Model Variations

Classification	Description
Ownership Structures	BMs are differentiated based on who the legal owner of the PV system is and the parties' agreements regarding property ownership, its location, or energy generation and supply. The three main ownership types are host-owned BMs, third party-owned BMs, and community BMs.
Value Chain Activities	BMs are classified by distinguishing between one-shot activities, such as consulting services, and recurring operations, such as maintenance.
Applications	BMs are differentiated by sector, being residential or commercial, system size or PV panel location (Bankel and Mignon 2022).

Given the WP's focus on the B2C sector, the application-based classification between residential and solar is not sufficient for this WP. Similarly, distinctions based on one-time or recurring activities are also not sufficient, as the PV solar system companies within the scope

of this WP all have recurring activities. Therefore, this study will categorize the BMs based on their ownership structure, specifically focusing on host-owned, third party-owned, community-owned and evolving BMs. These four categories with further subcategories for each type are illustrated in Figure 7.

	Host-Owned BM		Third-Party-Owned BM			Community-Owned BM	Emerging BM
	Direct Purchase	Installment Purchase / Loan	Leasing / Rent	Tenant Electricity	Power Purchase Agreement	Solar Crowdfunding	Solar-Energy-as-a-Service
Energiekonzepte Deutschland	✓		✓				
EnBW	✓	✓	✓	✓	✓		
Enpal	✓	✓	✓				✓
e.on	✓	✓	✓	✓		✓	
lumix SOLAR	✓	✓		✓			
SOLARO	✓	✓			✓		
sunvigo	✓	✓	✓				
zolar*	✓	✓	✓				
1KOMMA5°	✓	✓	✓				✓

*not active in B2C anymore

Figure 7: Overview of Business Model Variations of German Solar Companies. (own illustration).

4.2.1 Host-Owned Business Model

Host-owned BMs are defined by the homeowner's direct ownership of the PV system, granting them full control over the installation and electricity it generates. These models typically require the customer to invest upfront or finance the system through a loan. Within this category, there are two key variations, direct purchase and installment purchase BMs. In the following sections, these models will be further examined.

4.2.1.1 Direct Purchase Business Model

Within the direct purchase BM, illustrated in Figure 8, customers acquire solar systems from installer firms as a direct investment, assuming full financial risk. Homeowners can decide to consume the generated electricity or feed it into the electricity grid (Hamwi and Lizarralde 2017). In Germany, low interest loans for such purchase are available and low transaction costs occur due to low legal requirements (KfW 2024). Under this model, the installer's role is limited

to designing and building the system, after which they are paid in full. All responsibilities for operation, maintenance, and repairs fall entirely on the homeowner. While this model provides long-term savings, eligibility for subsidies, and the potential to increase property value, it also involves significant upfront investment and ongoing management responsibilities for the homeowner (Hamwi and Lizarralde 2017).

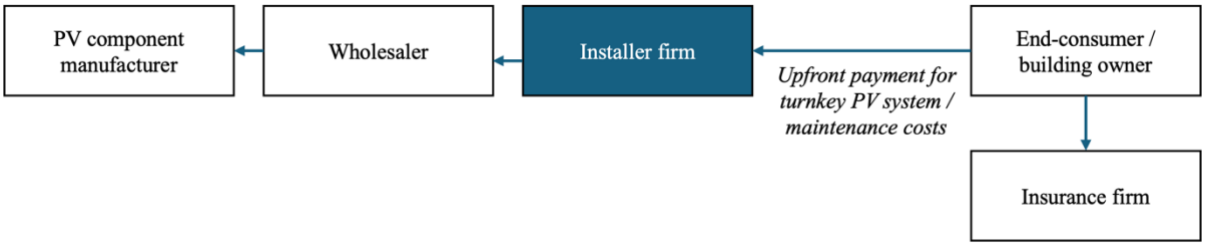

Figure 8: Direct Purchase Business Model. (own illustration).

A practical example of this model's implementation is provided by Vattenfall, a leading energy supplier in Germany. The company offers direct purchase options for homeowners, with costs for solar panels ranging between €11,000 and €17,000. Discounts are available for purchasing multiple products within its modular solar system. Products offered include solar panels, inverters, storage solutions, wall box, and EMS. The company estimates an amortization period of around 10 years, depending on the system's performance and selected options. A key advantage of direct purchase over third-party ownership models is the access to PV subsidy programs. For customers unable to afford the upfront investment, alternative financing options, such as low-interest KfW loans, provide additional support (Vattenfall n.d.).

4.2.1.2 Installment Purchase / Loan Business Model

The second host-owned BM is the loan or installment purchase model, which allows customers to finance solar PV systems over time. First introduced in the United States by companies such as Mosaic and Sunrun, this model has gained popularity in Germany through companies like Enpal, 1KOMMA5°, and Zolar (PV Magazine 2018). It provides an alternative to outright purchase by enabling consumers to spread costs across monthly payments, thus eliminating the

need for substantial upfront capital and making solar ownership more accessible to a broader audience (Finance Forward 2024).

In this model, the installer provides both the installation and financing of the PV system, granting consumers immediate ownership while they pay incrementally over a fixed term. The installment plan typically includes installation, maintenance, and service agreements, ensuring continuous technical support and a simplified ownership experience. At the end of the loan period, the consumer fully owns the system, allowing them to benefit from long-term savings without ongoing monthly payments (PV Magazine 2024b). A visualization of this BM is presented in Figure 9.

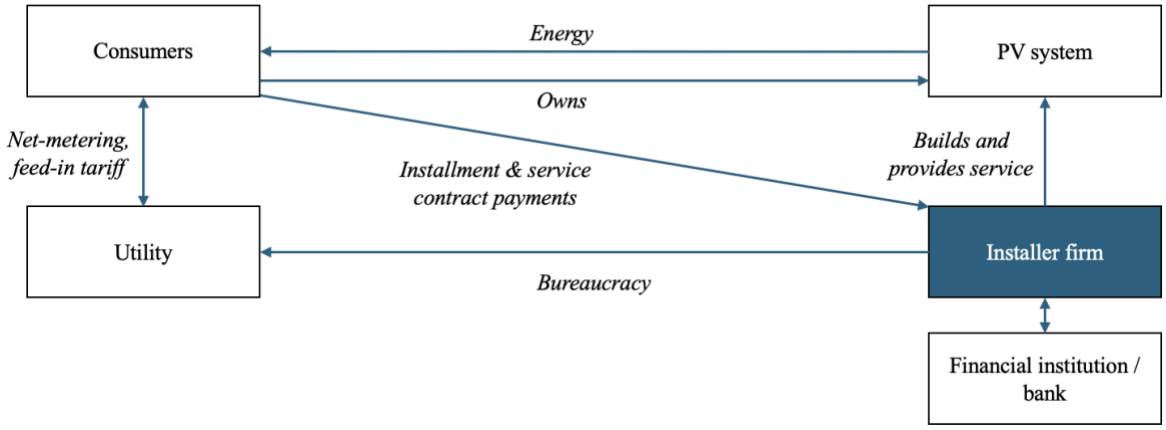

Figure 9: Installment Purchase / Loan Business Model. (own illustration).

This model offers significant advantages in flexibility and affordability. By removing high initial costs, it allows households that might otherwise lack the means to invest in renewable energy to adopt solar power (Enpal 2024b). The financial structure of the installment purchase model is typically supported by partnerships with financial institutions, which provide the necessary capital to offer low-interest loans (PV Magazine 2024a). These partnerships enable companies to maintain a capital-light approach while expanding their customer base. By ensuring monthly payments remain competitive with traditional electricity bills, this BM aligns

with consumer financial expectations and facilitates a smooth transition from grid reliance to renewable energy production (Soly Energy n.d.).

4.2.2 Third-Party Owned Business Model

Third-party owned BMs transfer PV system ownership to external entities, which retain ownership while providing customers access to the systems through various agreements. By reducing upfront investment, third-party owned models enhance the accessibility of PV systems, appealing to a broader audience. Internationally, third-party owned variations include leasing and Power Purchase Agreements (PPAs), while a unique German adaptation is the tenant electricity model (SEIA n.d.a). These variations are analyzed below.

4.2.2.1 Leasing Business Model

The leasing BM for solar PV systems is a key driver of renewable energy adoption in Germany. Firms like Enpal, Zolar, and municipal utilities allow residential consumers to access solar power without significant upfront investment. Instead, consumers enter long-term lease agreements, paying fixed monthly fees to use the system, while the asset owner retains responsibility for installation, maintenance, and operation (Marques et al. 2023). At Enpal, a 10 kWp PV system with storage is available for €243 per month under a 20-year leasing agreement (EFAHRER 2024). As the system is rented, the asset owner covers repairs or replacements, ensuring operational reliability and shielding households from unexpected costs. This model broadens access to solar energy, enabling greater participation in Germany's energy transition (Agrawal, Toktay, and Yücel 2019).

In this model, illustrated in Figure 10, installer firms or utilities act as asset owners, covering the initial capital costs and retaining ownership of the PV systems. Consumers may have the option to purchase the system outright after a specified period, offering flexibility for those seeking long-term ownership (Hong et al. 2018). Some utilities bundle PV leasing with

traditional grid electricity, ensuring a stable energy mix for consumers while managing bureaucratic processes such as net metering and feed-in registration. This integration aligns with regulatory frameworks promoting renewable energy generation and simplifies the adoption process for consumers (Agrawal, Toktay and Yücel 2019; Marques et al. 2023).

Financial sustainability in the leasing model relies on partnerships with external financiers or dedicated funds, which provide the capital to cover installation costs. This structure enables companies to expand their customer base while maintaining a capital-light approach. Recurring lease payments provide a stable revenue stream, supporting further investment in solar infrastructure and contributing to the long-term viability of the model (Marques et al. 2023).

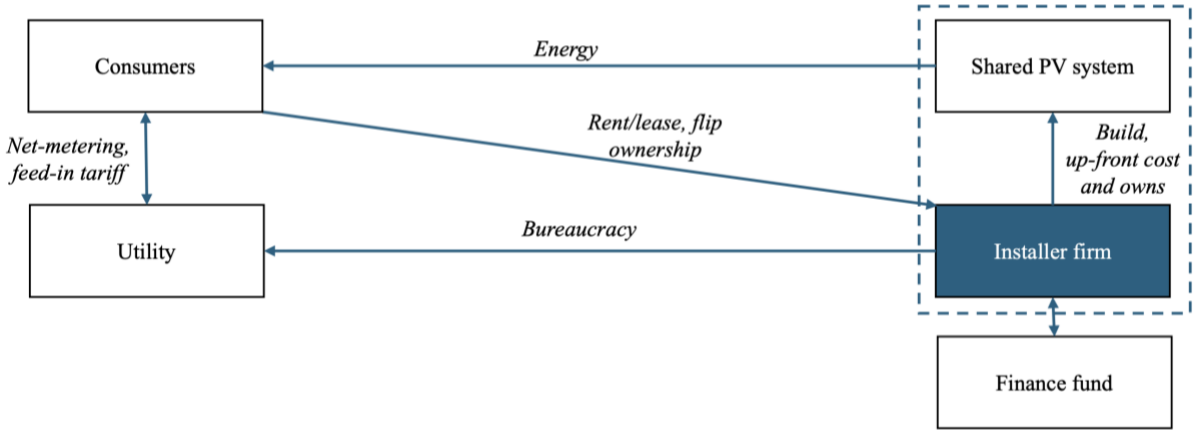

Figure 10: Lease Business Model. (adopted from Marques et al. 2023).

4.2.2.2 Tenant Electricity ("Mieterstrom") Business Model

Unique to Germany, this “Mieterstrom” B2B2C model under the German Tenant Electricity Law allows third parties to install solar systems on apartment buildings or commercial properties. The German government estimates that nearly four million tenant households could benefit from this model, which emerged alongside the decentralization of energy supply (Moser et al. 2021). As illustrated in Figure 11, electricity generated under this model bypasses traditional utilities and is sold directly to tenants at rates lower than grid electricity. Tenants gain access to locally generated renewable energy without requiring individual ownership of

the systems. Despite its growth, “Mieterstrom” remains a niche market due to underdeveloped regulatory frameworks, which complicate coordination among the numerous participants involved. Effective implementation requires careful tracking and billing of electricity consumption, often managed by specialized third-party providers to simplify technical and administrative processes (BSW-Solar 2017).

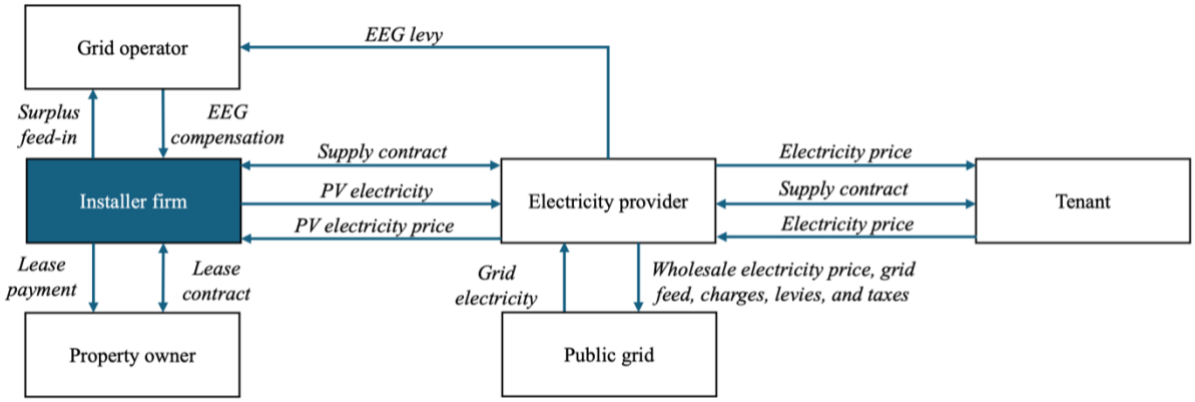

Figure 11: Tenant Electricity Business Model. (adapted from BSW-Solar 2016).

A prominent example is EnBW, a major German energy supply company that offers six “Mieterstrom” concepts. These include: the “direct sales model,” where landlords sell PV power directly to tenants, forfeiting subsidies for additional energy contracts; the “shared supply model,” enabling multi-family residents to share PV power without subsidies, and the “landlord provider model,” where landlords supply all tenant electricity while qualifying for subsidies but taking on greater management responsibilities. Other concepts, such as the “service model,” delegate electricity sales and compliance to third parties, while the “cooperative model” allows owners and tenants to share electricity through cooperatives with tax benefits. Lastly, the “pseudo model” feeds PV electricity into the grid, providing tenants with discounts but no direct supply or subsidies (Rahnfeld 2024).

4.2.2.3 Solar Power Purchase Agreement Business Models

PPAs are contractual arrangements between power producers and purchasers to sell electricity at predetermined prices and volumes over a specified period (Tantau et al. 2024). Solar PPAs, a specific application of this model, are typically structured for long-term durations of 10 to 20 years. Under this arrangement, the installer retains ownership of the solar system installed on the consumer's premises and supplies electricity at a fixed price per kilowatt-hour. These rates, negotiated directly with the provider, offer consumers price stability and cost savings by reducing dependency on public grid electricity (Pena, Rodriguez, and Mayoral 2024; Rövekamp et al. 2021). An illustration of the PPA BM is presented in Figure 12.

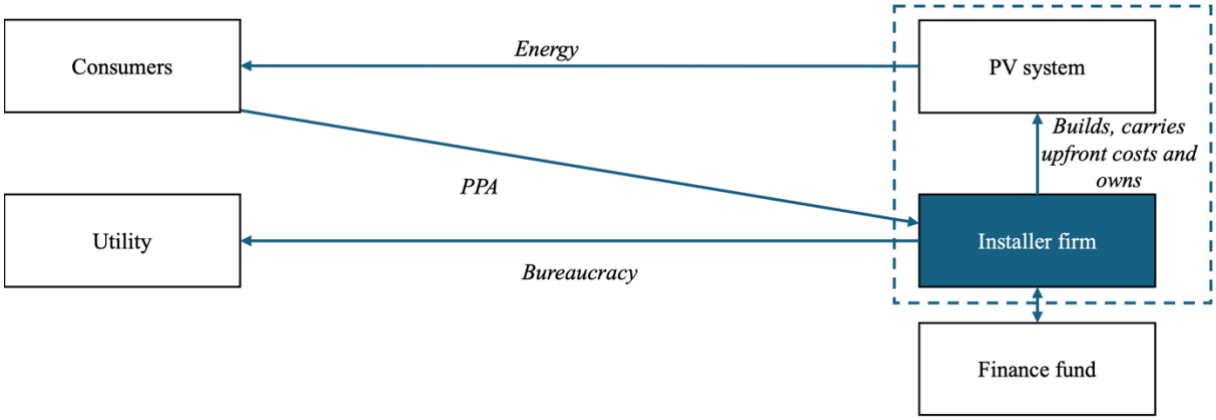

Figure 12: Solar PPA Business Model. (adapted from Marques et al. 2023).

In Germany, Sunvigo is among the few companies leveraging a BM comparable to Solar PPAs. The company's "sunfarming" concept integrates with a virtual power purchase model, allowing customers to become part of a VPP. Through this model, customers achieve independence from the public electricity grid by purchasing electricity generated by the PV system at a fixed rate of 15.95 cents per kilowatt-hour for a twenty-year period. Sunvigo's app enhances customer engagement by enabling real-time monitoring of tariff prices, electricity consumption, and feed-in data, as well as live tracking of additional services like wallbox usage and battery charging (Sunvigo n.d.).

4.2.3 Community-Owned Business Model: Solar Crowdfunding

Community-owned business models in the solar industry represent collaborative frameworks where individuals, businesses, and organizations collectively finance and benefit from shared solar projects. These models align financial returns with ecological and social objectives while promoting local energy independence. In Germany, this approach reflects the cultural and legislative emphasis on energy decentralization and citizen involvement under the framework of the *Energiewende.* Regulatory barriers have limited the adoption of community-owned business models in Germany, with solar crowdfunding being the only significant variation currently in operation (Natilus Solar 2024).

Solar crowdfunding, which is illustrated in Figure 13, enables individuals to finance solar projects by contributing small amounts through online platforms. This model democratizes investment in solar energy, fostering public engagement while raising capital for projects. Online platforms list projects, detailing the investment opportunity and expected returns. Investors can contribute as little as a few euros, making participation accessible, and contributors typically receive financial returns through interest payments or revenue sharing. Solar crowdfunding enables widespread participation, including individuals who lack significant capital. It offers transparency and direct engagement with renewable energy projects while providing an alternative to traditional financing methods, accelerating project deployment (Natilus Solar 2024).

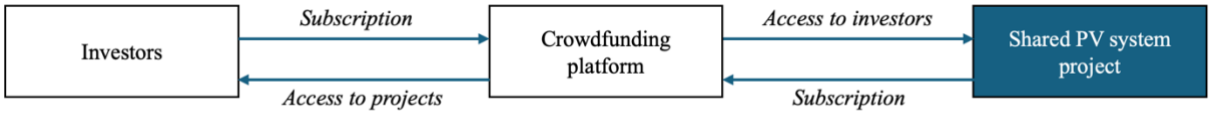

Figure 13: Crowdfunding Business Model. (adopted from Marques et al. 2023).

A notable example of solar crowdfunding in Germany is the energy company E.ON, which facilitates investments in small to mid-sized PV parks or wind farms through its digital

platform. This platform connects municipalities, local banks, and citizens, providing detailed project information to guide investment decisions. In cases where projects fail to attract sufficient local funding, the initiative allows for broader regional participation. By involving residents—both homeowners and renters—E.ON's initiative fosters community ownership, advances renewable energy adoption, and helps municipalities achieve climate goals. This model also addresses financial challenges by streamlining transactions through partnerships with established banks (E.ON n.d.).

4.2.4 Emerging BM: Solar-Energy-as-a-Service Business Model

In recent years, a new BM has emerged, combining elements of previously discussed models. The "Solar-Energy-as-a-Service" BM provides solar electricity as a service rather than selling solar systems as products (Singh et al. 2022). First introduced in the United States in the mid-2000s, this service-based BM was later adopted in other markets (Overholm 2015). SEaaS is part of the broader EaaS framework, that has gained importance within the German market in the last years (Cleary and Palmer 2019). As part of the broader Everything-as-a-Service (XaaS) framework, the EaaS BM integrates digitalization, energy service provision, as well as subscriptions in order to generate recurring revenue streams and strengthening customer loyalty through engagement (Cusumano, Kahl and Suarez 2015). It can be understood as a PSS tailored specifically for the energy sector, offering a comprehensive service package.

This model aligns with the evolution of “Tomorrow’s Power Market”, characterized by decentralized networks of interconnected ecosystem participants, as opposed to the centralized and vertically integrated structure of traditional power markets (Deloitte 2019a). As shown in Figure 14, the SEaaS BM centers on PV installation companies that retain ownership of solar power systems and act as intermediaries between manufacturers and customers (Overholm 2015). Ownership of the PV systems vary depending on the financing arrangement. The installer company manages all key services, including the installation, maintenance,

monitoring, and financing of the PV systems. Additional related home energy management systems (HEMS) offerings can also be provided (Singh et al. 2022). Customers typically pay for these services through leasing agreements or PPAs, with some contracts including provisions for insurance coverage (Overholm 2015).

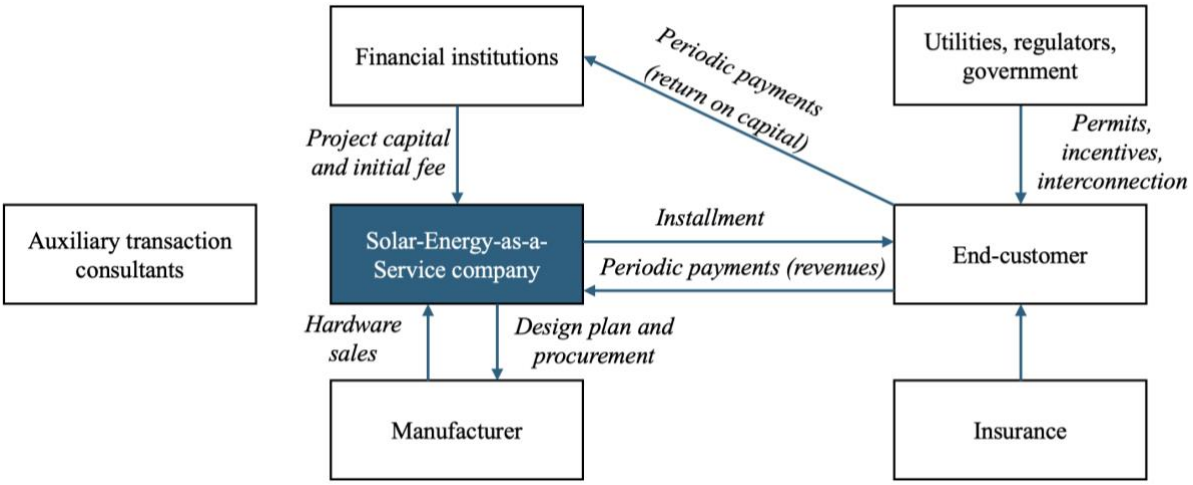

Figure 14: Solar-Energy-as-a-Service Business Model. (adopted from Overholm 2015).

Companies such as Enpal and 1KOMMA5° have expanded the SEaaS model by incorporating VPP capabilities. Platforms such as Enpal's "Enpal.One" and 1KOMMA5°'s "Heartbeat AI" enable consumers to act as prosumers, actively participating in energy production, consumption, and management (1KOMMA5° n.d..; Enpal n.d.b). By combining leasing, digital energy management, and VPP functionality into a unified service offering, SEaaS addresses diverse consumer energy needs while positioning companies as comprehensive energy service providers (Paukstadt and Becker 2021).

5 In-Depth Solar-Energy-as-a-Service Business Model Analysis

This chapter conducts an in-depth investigation of a BM variation, focusing on its strengths and vulnerabilities. To ensure relevance of the BM variation in the current market environment, this WP will examine the BM employed by the market leader further. The identification of the market leader is based on a recent statistic from Statista Q and Enpal (2023), which ranks the top PV rooftop installers in the German B2C market by revenue for the year 2022. As presented in Figure 15, Enpal holds a leading position, generating over €400 million in revenue, and with over €150 million revenue lead over the second-largest competition in this segment. As stated in the interviews with Enpal employees, the company currently is currently adopting a SEaaS BM (Interviewee 9). Following the identification, this chapter will analyze its SEaaS BM in-depth, using the predefined analytical framework.

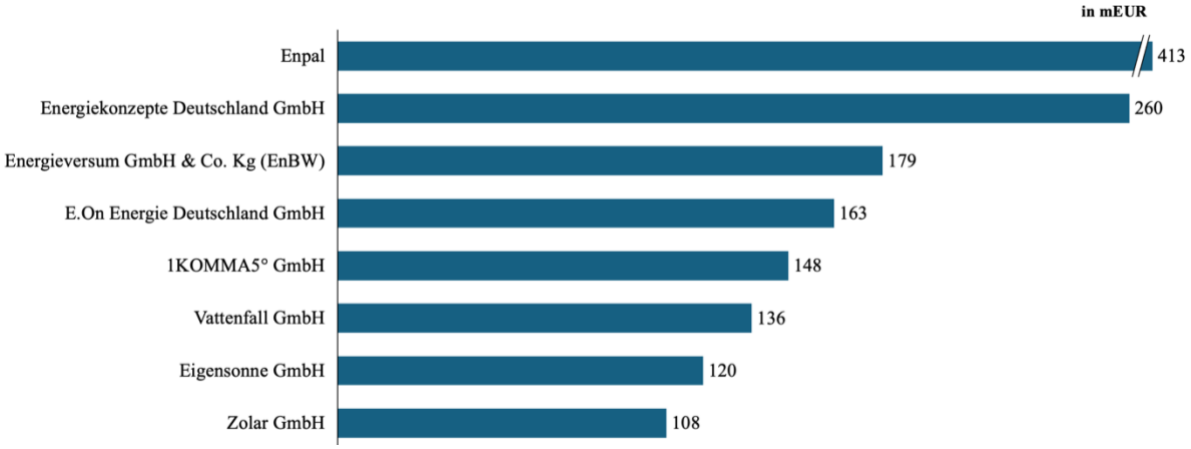

Figure 15: B2C PV Rooftop Revenue Market Ranking 2022. (adapted from Statista Q and Enpal 2023).

5.1 Business Model Canvas Analysis

The application of the BMC for the in-depth analysis of the SEaaS BM is structured along the nine BMC components and extended by the business ecosystem framework in the following chapter. By examining these strengths and vulnerabilities, this analysis provides insights into how companies like Enpal and 1KOMMA5° leverage the SEaaS model to succeed on the German solar market.

5.1.5 Customer Segments

According to Osterwalder and Pigneur (2010, 21), customer segments can be defined as distinct groups of individuals or organizations that share similar needs, behaviors, or characteristics, making it logical and effective for a business to tailor its offerings to these groups. Identifying and understanding these customer segments is critical for effectively designing, delivering, and capturing value. Segmentation can be categorized using various criteria, including demographics, geographic location, and psychographics, with the primary goal of aligning tailored value propositions to meet the distinct needs of prioritized customer groups.

According to expert interviews, the primary customer base for solar energy solutions consists predominantly of homeowners and families, with a significant focus on males aged 50 to 65. However, recent trends indicate a growing participation of women and younger individuals compared to a decade ago, reflecting an evolving demographic landscape (Interviewee 6). Solar panel owners often possess higher-than-average household incomes and reside in wealthier neighborhoods, highlighting the financial considerations that frequently accompany the adoption of solar energy solutions (Reed 2023). This demographic shift broadens the potential market for solar energy, creating opportunities to target a more diverse audience.

Psychographically, the key customer segments can be classified based on the underlying motivations and priorities of customers. One prominent segment consists of value-driven customers who emphasize core value propositions such as cost savings, energy independence, and environmental benefits. Another significant segment includes families or individuals struggling with high energy costs, who are motivated by the prospect of long-term financial relief through reduced utility expenses (Interviewee 5 and 9). The subscription-based or lease-based nature of the EaaS model has further expanded accessibility by enabling customers who cannot afford the upfront cost of purchasing a solar system to benefit from renewable energy

solutions (Shakeel et al. 2023). This has opened the market to a new group of consumers who were previously excluded and not considering PV installations due to financial barriers.

Environmental awareness, bolstered by policies promoting renewable energy adoption in Germany, has led to the rise of a segment of environmentally conscious consumers. These individuals are driven by sustainability considerations and a desire to minimize their ecological footprint. This segment is becoming increasingly influential, as awareness of climate change and its impacts continues to grow. Moreover, emerging energy markets have introduced a demand for tailored solutions and innovative service features, giving rise to a new segment seeking personalization and cutting-edge technology in solar offerings (Fraunhofer ISE 2024b).

One key strength of the SEaaS customer segment is its adaptability to the evolving demographic landscape, particularly the growing participation of women and younger individuals. This shift reflects increased environmental awareness among these groups, driving demand for cost-effective and sustainable energy solutions. By appealing to a more diverse audience, SEaaS broadens its customer base and enhances market inclusivity. However, gaps remain in addressing the needs of renters and urban populations with limited property ownership and decision-making autonomy. SEaaS companies risk missing out on these segments, which could hinder broader market penetration (Fraunhofer ISE 2024b; Singh, Kesselring, and Klobasa 2024).

5.1.6 Customer Relationship

Customer relationships focus on building and maintaining connections with customer segments to enhance satisfaction and loyalty, serving as a strategic BM component to attract, retain, and grow customer bases in line with the company's value proposition (Osterwalder and Pigneur 2010, 28-29). In the SEaaS model, the emphasis is on long-term engagement due to the lasting nature of solar energy solutions and ongoing service needs. Its subscription-based structure

fosters sustained interaction through regular touchpoints such as performance updates, maintenance, and tailored optimization advice, ensuring consistent communication and strong customer connections (Enpal 2024a).

A critical element of SEaaS customer relationship is personalized customer service, providing dedicated support to help customers navigate solar technology, financing plans, and installation. By addressing individual needs, this approach builds trust, enhances satisfaction, and facilitates smoother adoption of solar solutions (Deloitte 2019b). Furthermore, loyalty programs play a pivotal role in strengthening customer relationships. Such programs offer incentives, including discounts for referrals or rewards for long-term commitments, which foster customer retention and encourage organic word-of-mouth promotion. By recognizing and rewarding customer loyalty, such initiatives contribute to a mutually beneficial relationship, ensuring sustained engagement and advocacy within the customer base (Interviewee 5).

PV owners, as prosumers, who both produce and consume energy, strengthen customer relationships through empowerment, ownership, and active participation in the energy ecosystem. By directly experiencing benefits like reduced electricity costs and environmental impact, prosumers build a strong personal connection to the product and company. This transforms the relationship from a one-way transaction into an interactive partnership, where customers feel valued as contributors rather than mere consumers (Kühl 2022).

Another key segment of the customer relationship is the customer journey map. As stated above, the customer journey begins with the awareness phase, where potential customers are introduced to the concept and benefits of leasing PV. For instance, this is achieved through online ads or PR campaigns in newspapers and magazines. Customers may visit the company website, engage with materials, or subscribe to newsletters. In the consideration phase, trust is fostered through case studies, cost calculators, webinars, positive reviews, and accessible

customer support, as customers research options, request consultations, and assess the service. The purchase phase simplifies the process with personalized consultations, clear leasing agreements, and an easy online sign-up system. Customers finalize contracts, set up payments, and prepare for installation. Next, the retention phase focuses on satisfaction and loyalty. Proactive maintenance and performance monitoring keep systems running efficiently, while periodic energy savings reports, and dedicated customer support enhance the experience. Upselling options like battery storage and loyalty rewards strengthen retention. Customers actively use their systems, monitor savings, and renew contracts. Finally, in the advocacy phase, satisfied customers are encouraged to share their experiences through referral programs, reviews, and social media and may join renewable energy communities or participate in events. This journey ensures a seamless, customer-centric experience that builds trust and long-term advocacy (Forbes 2024).

A key strength of this customer relationship is its focus on long-term engagement, enhancing satisfaction by addressing ongoing needs, building trust, and fostering loyalty, particularly among empowered prosumers. However, as the customer base grows, maintaining consistent, high-quality, personalized experiences may strain resources, risking lapses in service quality and reduced customer satisfaction (Jiang 2023).

5.1.7 Channels

According to Osterwalder and Pigneur (2010, 26-27), channels are the various means by which a company delivers its value proposition to its customer segments. Channels encompass all touchpoints that facilitate marketing, sales, and distribution, ensuring that customers can access and experience the value being offered.

As previously stated, customer referrals remain one of the most important marketing channels for attracting new customers. Incentivized word-of-mouth initiatives, offering bonuses or

discounts for successful referrals, have proven to be particularly effective in building trust and expanding the customer base organically. Big players in the industry such as Enpal and 1KOMMA5° rely heavily on this specific strategy since it is cost-effective and reliable (Interviewee 4).

For big industry players such as Enpal, online channels continue to remain the standard channel, with strategies such as performance marketing and video sales playing a central role (Interviewee 4). Social media platforms such as LinkedIn and Instagram and search advertisements are employed to attract eco-conscious and tech-savvy individuals. These channels allow precise targeting, engaging audiences who are most likely to resonate with sustainable energy solutions (Interviewee 5). Beyond digital efforts, broadcast advertising significantly extends market reach, with notable achievements such as companies like 1KOMMA5° airing TV spots before Germany's *Tagesschau* news program. Securing such a high-profile advertising slot underscores the importance of building brand recognition among mass audiences and reinforces the credibility of these energy providers. Podcasts and other audio media further diversify the outreach strategy, connecting with consumers in more personal and conversational ways. Together, these multifaceted approaches ensure a comprehensive and effective customer acquisition strategy in the competitive energy sector (Interviewee 6).

Secondly, sales channels in the energy sector are meticulously designed to balance convenience, personalization, and strategic outreach. Direct sales channels, such as user-friendly websites - widely adopted by major industry players - streamline the customer journey by offering clear information, intuitive navigation, and the ability to compare and purchase solutions seamlessly online. Additionally, installation teams are crucial in the sales process as they ensure smooth system setups, provide hands-on support, and address any final customer concerns, which

builds trust and confidence, enhancing the overall customer experience. The direct channels are completed by various indirect sales channels, which expand market reach and cater to diverse customer preferences. Examples include partnerships with retailers, collaborations with energy consultants, and leveraging third-party marketplaces. Such channels allow energy companies to tap into established networks, gain access to specialized customer bases, and offer tailored solutions through intermediaries. Integrating both sales strategies forms a comprehensive, customer-centric approach to addressing a wide array of needs and preferences (Forbes 2019).

Distribution Channels, as the final type of channels, ensure the efficient delivery of solar solutions. Direct distribution for instance involves company-owned installation teams that oversee the end-to-end setup process, guaranteeing quality and reliability. Leading companies such as Enpal hold partnerships with third-party contractors and local installation businesses, indirectly distributing their solar solutions while ensuring timely service delivery to customers in more remote areas (Enpal 2024b). Additionally, regional warehouses and distribution hubs optimize supply chain efficiency, reducing lead times for equipment delivery and installation. By integrating these distribution strategies, companies ensure that solar solutions are accessible, reliable, and efficiently implemented, enhancing overall customer satisfaction (Sharma 2024).

One key strength of the channels in the SEaaS model is the combination of personalized direct sales and hands-on support from installation teams provides a unique opportunity to build strong customer relationships. A possible vulnerability is the extended use of digital and broadcast advertising to attract customers may risk excluding older or less tech-savvy demographics who may not engage with these platforms, potentially limiting market penetration in certain customer segments that could benefit from solar solutions (Sharma 2024).

5.2.4 Competing Organizations

The German B2C solar market is highly competitive, with companies striving to differentiate their offerings while managing cost pressures, scaling operations, and meeting evolving customer expectations in a rapidly growing industry (Interviewee 4). According to Moore's (1996) third layer of the business ecosystem, competing organizations include all direct competitors and those tied to ecosystem dynamics. This WP identifies the largest players in the German B2C solar market as Enpal, 1KOMMA5°, EKD, E.ON, and Zolar (Solarserver 2023). As increased demand during the energy crisis attracted new entrants, competition intensified, forcing less adaptable firms into insolvency while creating opportunities for survivors to acquire assets and market share (Lontay 2024).

Meanwhile, the B2B solar market is gaining traction as businesses adopt solar to cut costs, meet sustainability goals, and benefit from regulatory incentives and scalable solutions (Interviewee 6). Companies like Zolar are pivoting to capitalize on these opportunities, leveraging industry insolvencies to consolidate assets and target higher-margin commercial projects. This shift reflects the growing appeal of B2B for its stability and long-term growth potential, even as B2C demand remains strong. Firms are balancing organic expansion with faster, riskier inorganic growth through acquisitions to enhance resilience and competitiveness (Interviewee 8; Hajiyev et al. 2024).

Additionally, co-opetition –collaboration among competitors– has become important for reducing costs, sharing innovations, and accessing new markets. Sonnen for instance exemplifies this strategy by partnering with stakeholders, including competitors, to advance renewable energy. Notably, it collaborated with TenneT to integrate decentralized PV home storage systems using blockchain, stabilizing the power grid and enhancing renewable energy integration (Sonnen 2017).

6. Recommendations

This chapter presents three in-depth recommendations to optimize the SEaaS business model by addressing key vulnerabilities and leveraging strategic opportunities. These recommendations were derived through a structured process to ensure alignment present needs of the B2C solar energy market in Germany. By systematically generating, refining, and prioritizing recommendations, this chapter provides three actions for SEaaS companies to enhance and expand their business models.

6.1 Selection Process of Recommendations

Key recommendations were identified by analyzing vulnerabilities and opportunities in the SEaaS BM, derived through thematic coding of expert interviews in Appendix D and cross-referenced with industry reports and market analyses to ensure relevance and comprehensiveness. To ensure that the dimensions captured key strategic and operational challenges, they were cross-referenced with secondary data, including industry reports and market analyses, resulting in a comprehensive and relevant framework for the recommendation development.

6.1.1 Developing a Long List of Recommendations

Building on the identified dimensions, a brainstorming workshop was conducted following the principles of the Nominal Group Technique (NGT), a recognized method for structured idea generation and consensus-building (Delbecq, Van de Ven and Gustafson 1975). Each WP author independently proposed recommendations for each dimension. The ideas were collaboratively refined to consolidate overlaps and focus on actionable suggestions.

This iterative process resulted in nine key recommendations aligned with the dimensions identified in the interviews. To streamline the analysis, one recommendation per dimension was selected, resulting in nine key recommendations addressing critical vulnerabilities and

opportunities. This decision balanced the need for comprehensiveness with the practicality of focusing on high-impact actions.

The relevance and feasibility of these recommendations were validated through consultations with industry experts from Enpal and 1KOMMA5°, ensuring that they were not only theoretically sound but also practically applicable. This validation step integrated real-world perspectives to enhance the credibility and utility of the recommendations.

6.1.2 Prioritization of Key Recommendations

To systematically prioritize the recommendations, this WP employed a Multi-Criteria Decision Analysis (MCDA) supplemented by stakeholder validation. The MCDA approach was partially inspired by Wang et al.'s (2009) review on multi-criteria decision analysis in sustainable energy decision-making, adapting its principles to fit the specific context and requirements of this study. This approach, characterized by structured criteria selection, weighting, and the potential for aggregation, was well-suited to the complex, multi-dimensional context of SEaaS business models. Consequently, the prioritization process offered a transparent and theoretically grounded evaluation, applying three core criteria—addressing current vulnerabilities, enhancing strategic value, and ease of implementation—each carefully weighted to reflect its relative importance.

The first criterion, *Addressing Current Vulnerabilities*, was assigned a weight of 40 percent, was assigned a weight of 40 percent, reflecting its importance and urgency in mitigating operational challenges that could limit SEaaS scalability and long-term viability. This emphasis aligns with the view that proactive risk management underpins dynamic capabilities, enabling firms to adapt, seize opportunities, and maintain competitive advantage (Teece 2010).

The second criterion, *Enhancing Strategic Value*, also received a weight of 40 percent, underscoring its equal importance to addressing vulnerabilities. This criterion evaluates the

potential for long-term growth, differentiation, and competitive advantage, ensuring that the recommendations not only address immediate challenges but also align with broader strategic objectives. Academic perspectives, including those articulated by Porter (1996), as well as by Casadesus-Masanell and Ricart (2010), emphasize that sustained differentiation and value creation are essential to achieving long-term competitiveness, particularly in industries undergoing rapid transformation. The emphasis on strategic value ensures that recommendations are forward-looking, fostering innovation and sustainability.

The third criterion, *Ease of Implementation*, was weighted at 20 percent, acknowledging its practical relevance while maintaining a secondary role to strategic and operational considerations. This criterion assesses the availability of resources and the complexity of integrating recommendations into existing processes. Saaty's (1980, 23-25) *Analytic Hierarchy Process* underscores the importance of systematically balancing strategic priorities with practical feasibility, emphasizing proportional weighting of criteria to align decisions with objectives. In this context, assigning lower weights to ease-related factors reflects a deliberate focus on achieving significant strategic impact. While ease of implementation is critical for operational feasibility, prioritizing transformative elements ensures that the recommendations drive long-term value and address the evolving challenges faced by SEaaS companies.

To validate the prioritization process, two scorings of employees from leading industry players were integrated into the MCDA framework. Following the initial scoring by the WP authors, two employees from SEaaS companies reviewed and ranked the recommendations based on the three core criteria outlined above. Each recommendation was weighted from very low (1) to very high (5). A weighted average of the scores was calculated to finalize the prioritization, with 50 percent of the weighting assigned to the WP authors and 50 percent assigned to industry stakeholders. This weighting was chosen to balance academic insights with practical expertise, ensuring that the final prioritization reflects both the structured analysis by WP authors and the

real-world applicability validated by industry stakeholders. An aggregated score, reflecting the combined evaluations, is presented in Table 4, with a detailed breakdown available in Appendix C. This approach ensured that the final rankings reflect both academic rigor and practical industry insights, reinforcing the credibility, transparency, and relevance of the prioritization.

Table 4: Long-List and Scoring of Recommendations

	Recommendations	Score
1	**Reliance on Partnerships (stated in 9 interviews)** Collaborate with solar installers to implement joint training programs and share labor resources, addressing workforce shortages	**2.92**
2	**Fierce Domestic Competition (stated in 8 interviews)** Engage in M&A activities in Germany to secure market share	**2.40**
3	**Transition Towards a Holistic EaaS Offering (stated in 8 interviews)** Complement PV systems by expanding the product offering with electric vehicles	**4.18**
4	**Importance of Diverse Sales and Marketing Channels (stated in 7 interviews)** Form partnerships with real estate agencies and hardware stores to expand customer reach through trusted intermediaries	**4.00**
5	**Leveraging Customer Referrals for Sustainable Growth (stated in 7 interviews)** Introduce tiered loyalty programs that reward repeat customers with service discounts or exclusive benefit	**2.97**
6	**Customer-Centric Value Creation and Engagement (stated in 6 interviews)** Streamline the customer experience by incorporating feedback loops and proactive engagement touchpoints throughout the service lifecycle	**3.03**
7	**Leveraging Data for Operational Excellence (stated in 6 interviews)** Utilize customer energy consumption data to optimize product offerings and tailor solutions to regional demand patterns	**2.55**
8	**Optimizing Lead Generation and Conversion Strategies (stated in 6 interviews)** Leverage predictive models to identify and prioritize high-quality leads	**3.95**
9	**Regulatory Volatility and Market Stability (stated in 4 interviews)** Develop adaptive pricing models that remain attractive during subsidy fluctuations	**2.63**

6.2 In-Depth Recommendations

The prioritization process concluded that recommendations 3, 4 and 8 scored particularly high according to the MCDA framework. The first two recommendations represent a BM enhancement in the areas of sales and marketing channels, as well as predictive analysis on lead generation, while the third one represents a BMI in the area of EaaS expansion by integrating EVs. The next sections elaborate in-depth on the three recommendations with the highest MCDA score.

6.2.1 Form partnerships with real estate agencies and hardware stores to expand customer reach though trusted intermediaries

As the first recommendation, drawn from the customer segment of the BMC, SEaaS companies should expand sales and marketing channels by establishing strategic partnerships. This aligns with expert interviews highlighting the importance of a multichannel strategy to reach a diverse customer base, using each channel to capture leads and guide them through the buying journey (Interviewee 5 and 7). This strategy also mitigates reliance on traditional methods like word-of-mouth, enabling broader reach and greater customer centricity (Adamson 2022). The recommended partnerships should be established with real estate agencies and hardware stores, which provide trusted networks and relationships, allowing SEaaS companies to tap into new customer segments or expand existing ones while overcoming barriers such as limited awareness or accessibility (Waterworth 2023). This recommendation received a 4.25 (high) for effectively addressing vulnerabilities, such as high CAC, by leveraging the partnerships to tap into established customer bases. It also scored 4.00 (high) for enhancing strategic value through expanded distribution networks and improved visibility. However, its ease of implementation was rated at 3.50 (medium-high), reflecting the significant upfront costs and resource commitment required, which make the partnership relatively expensive to execute despite its benefits. An overall score of 4.00 (high) highlights its potential for scalable growth through targeted collaborations.

6.2.1.1 Partnerships with Real Estate Agencies

The first potential partnership, with real estate agencies such as Engel & Völkers—one of Germany’s biggest real estate agencies—provides direct access to customers exploring property-related solutions. Brokers could advocate for solar solutions by emphasizing their environmental and financial advantages, such as reduced energy costs, which will appeal to sustainability-conscious buyers, particularly younger generations, positioning solar adoption as

a key selling point, as outlined in the previous BMC analysis. Moreover, the added property value should be actively promoted, particularly in the context of potential resale scenarios. For instance, a study by the National Association of Realtors (NAR) found that certain home remodeling projects, such as integrating PV, can yield a return of up to 147 percent of their cost at resale, underscoring the financial viability of PV installations (NAR 2022). Similarly, Zillow (2019) reported that homes with PV systems sell for up to 4.1 percent more than comparable properties.

Real estate agencies would benefit from this partnership through commission-based compensation, while their advocacy and tailored messaging drive customer adoption. To maximize the effectiveness of this strategy, real estate brokers would require specialized training to address customer questions and seamlessly incorporate solar messaging into the property-buying process (Rudy 2022). With Germany's 46.7 percent homeownership rate in 2022 (Statista 2024e) and many buyers relying on real estate agencies (Walborn 2024), this strategy positions PV systems as a compelling investment for homeowners while allowing SEaaS companies to reach a significant segment of potential solar energy costumers.

6.2.1.2 Partnerships with Hardware Stores

Secondly, partnering with hardware stores creates a trusted and direct connection between SEaaS companies and their primary target audience by leveraging the familiar, high-traffic environment of these stores. Middle-aged male homeowners, identified as the primary SEaaS target group (Interviewee 5), frequently visit these stores for home improvement needs, making them ideal touchpoints for showcasing solar solutions (Statista 2024c). To maximize impact, trained representatives of SEaaS companies should strategically position in high-visibility areas, such as energy-efficient home sections, with info stalls offering advice, product demonstrations, and cost calculators. Educational materials like brochures and videos can

further explain benefits, costs, and installation processes, raising awareness and building trust (Röder 2020).

For example, a partnership between Enpal and OBI, one of Germany's largest hardware store chains, could yield significant benefits (Statista 2024c). Under a structured monetary compensation model, OBI would earn commissions for each customer acquired in favor of Enpal, creating mutual incentives to actively promote Enpal's solar solutions. OBI's extensive network of 350 retail locations, attracting 19 million customers annually, provides a vast market reach that SEaaS companies could strategically leverage (Statista 2024e). With a conservative one percent conversion rate—an industry benchmark for targeted in-store promotions (Dopson 2021)—Enpal could acquire approximately 190,000 customers annually across all OBI locations. These figures underscore the significant potential of such a partnership, utilizing OBI's market presence and customer foot traffic to drive solar adoption.

However, these partnerships also involve risks and limitations for SEaaS companies. A key limitation is the financial commitment required to establish partnerships, such as commissions, which can strain budgets even for larger companies. Despite their often significant operational scale, a capital-intensive BM means that managing multiple growth initiatives simultaneously may limit financial flexibility. To mitigate this, SEaaS companies should conduct thorough cost-benefit analyses, determine realistic conversion rates, and establish performance benchmarks to ensure financial viability. Another potential risk is achieving a low ROI. Factors such as low conversion rates, ineffective in-store promotion, or limited customer interest can diminish returns. To address these challenges, SEaaS companies could implement pilot programs to test the effectiveness of collaborations before committing to a full-scale rollout. Additionally, setting clear expectations about conversion rates and responsibilities with partners helps ensure alignment and reduces the risk of unmet goals or miscommunication (RTF 2024).

7. Limitations of Analysis

The findings of this WP are subject to several limitations. One key limitation is the lack of academic research about the emerging SEaaS BM, which remains largely unexplored, particularly in the context of the German B2C solar sector. While general market statistics are available, academic literature that addresses the unique characteristics of SEaaS BMs is scarce. Furthermore, quantitative research methods, such as customer surveys, remain underutilized, leaving a gap in understanding customer perspectives.

Additionally, a lack of publicly accessible financial statements of solar companies further intensifies this limitation. Apart from one annual financial statement by Enpal, SEaaS companies do not publicly disclose detailed financial information or report their solar energy performance in dedicated sections. Consequently, relying on non-academic resources such as company reports and media articles to supplement the analysis, while timesaving, can potentially introduce biased information.

Another limitation arises from the WP's qualitative expert interview approach, which is inherently prone to subjectivity in the form of interviewer and interviewee biases, as well as the interpretative nature of data analysis (Saunders, Lewis and Thornhill, 2019, 639). While steps were taken to mitigate these biases—such as using semi-structured interview guides and a systematic thematic coding procedure—eliminating them completely is impossible.

Lastly, the limited timeframe and scope of 75 pages of this WP restricted both the number of interviews conducted and the depth of secondary analysis. As a result of this time limitation, the analysis may lack comprehensive saturation, potentially due to emerging trends or nuanced interviewee opinions. Moreover, the rapid evolution of the SEaaS models and the German B2C solar industry means that some findings may not fully capture the latest developments, making the recommendations only applicable to the current market environment.

8. Conclusion and Future Research Directions

This WP examined how companies operating with a *SEaaS BM can enhance value generation, delivery, and capture within the German B2C solar systems market*. Through a combination of qualitative expert interviews and secondary data analysis, the WP's findings illustrate that SEaaS models have emerged as a direct response to key market trends. By transitioning from traditional hardware-centric solutions to service-oriented solutions, SEaaS companies address both financial and administrative complexities while enhancing customer value through bundled services offerings.

The German solar energy sector is undergoing a significant transformation towards energy servitization, driven by accelerating innovation cycles within the evolving PV industry. Many of today's dominant BMs have emerged over the last 10 to 15 years, marking a shift from host-owned to third-party-owned approaches. In particular, the SEaaS BM presents a promising pathway for innovation and growth due to its ability to integrate technological advancements and align with evolving consumer expectations through customer-centric solutions. Moreover, SEaaS holds the potential to evolve into a comprehensive EaaS offering. By expanding into adjacent markets such as HEMS, electric vehicle EV charging, energy storage, and VPPs, SEaaS companies can position themselves as all-encompassing energy solution providers. This evolution would not only unlock new revenue streams but also strengthen the role of SEaaS in driving the German energy transition within an interconnected and decentralized energy ecosystem.

However, the WP identifies critical challenges inherent in the SEaaS BM. High CAC due to fierce domestic competition, reliance on external financing providers, and operational vulnerabilities – such as workforce shortages and cybersecurity risks – pose significant

obstacles. Additionally, companies must navigate a volatile regulatory landscape while continuously innovating to maintain differentiation in a highly competitive market.

To address these challenges and leverage the unique strengths, this WP provides three key recommendations. SEaaS companies are advised to explore hardware stores and real estate brokers as sales and marketing channels, leverage predictive lead generation models, and complement existing service offerings with EV solutions. By implementing these strategic recommendations and continuously adapting to market trends, SEaaS can broaden consumer access to solar energy through low entry barriers and position themselves as important contributors to achieving Germany's energy transition objectives.

Future research can extend this WP by incorporating quantitative approaches to complement the qualitative insights presented in this WP. Surveys targeting end-consumers could provide deeper insights into preferences, behaviors, and decision-making processes, while econometric studies could quantify market potential and growth developments.

Cross-market comparisons could also enhance the findings of this WP. For example, analyzing the U.S. market, which pioneered EaaS concepts, could offer valuable lessons on adoption challenges and opportunities. Similarly, a comparative analysis of European solar energy markets could identify best practices for market expansion and inform strategies to accelerate growth across the region. These complementary approaches would not only further underline this study's conclusions but also provide a more nuanced and actionable understanding of the SEaaS BM's role in driving the energy transition.

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Appendices

Appendix A: Interview Question Guide

Market Development and Business Models: In your opinion, what market trends are having a major impact on the solar market right now?

Success Factors: What are the most important factors of the business models that you think determine the success of your company in the B2C solar market?

Questions of the Business Model Canvas (approx. 2-4 questions depending on focus above)

1. Value Proposition: What feature (e.g. financing, offering, etc.) do companies currently use to particularly differentiate their business model?

2. Customer Segments: Which customer groups are currently coming into focus in the B2C market?

3. Customer Relationships: How are customer expectations changing in the solar sector?

4. Channels: Which distribution channels are currently proving most effective for solar companies in the B2C market?

6. Key Partners: What type of partnerships (e.g. with technology providers, installers) play an increasingly important role in the B2C solar market?

5. Revenue Streams: Which new revenue streams are emerging from innovative business models in the B2C solar market and are particularly promising?

7. Cost Structure: Which factors currently have the greatest impact on the cost structure of solar companies in the B2C sector?

Barriers and Challenges: What structural challenges and barriers are hindering the growth of solar companies?

Future Prospects and Trends: In your opinion, what are the key skills companies should possess to adapt and grow in the changing solar market in the future?

Recommendations: What recommendations do you have for companies in the B2C solar market to remain competitive and secure their market position in the long-term?

Appendix B: Thematic Interview Coding

Table 5: Thematic Coding of Semi-Structured Expert Interviews

Concept	Theme	Dimension
Interviewee 1: “These models had a very integrated source of supply and very high volumes.“	Importance of hardware provider network	**Reliance on partnerships for market share gains**
Interviewee 1: “One of the key advantages was that they had exclusive access to high-quality solar modules and batteries, which smaller companies often could not secure during supply chain shortages.“		
Interviewee 1: “Partnerships with local installers play a significant role in expanding their footprint in less saturated markets.“	Close integration of local installer network	
Interviewee 1: “On the one hand, if you look at the market as a whole, I believe that 80+ percent of the total market is still in the hands of smaller installers”		
Interviewee 1: “We have an incredible shortage of skilled workers or installation specialists. Accordingly, I have seen a lot of models lately that try to train skilled workers or even career changers to train them for a home energy installation or to further educate them”		
Interviewee 4: "We are pursuing two concepts with tradespeople: having trade partners who build for us, treated almost like our own employees, and Enpal Pro, a platform where we initially act as a wholesaler but add services like grid connection and financing solutions."		
Interviewee 5: "Partnerships with trusted local businesses, like roofers or electricians, not only improve our fulfillment but also help us build credibility within the community."		
Interviewee 7: "Cooperation with medium-sized partners, like roofers, has been very important. These partnerships work well and are mutually beneficial."		
Interviewee 9: "Partnerships through Enpal Pro can turn local installers into allies rather than		

competitors. This allows them to offer our products, benefiting both parties."		
Interviewee 2: “the bottleneck remains the shortage of skilled workers. There are still too few craft businesses that want to focus specifically on solar energy again now. Many have become rather cautious due to the experiences of ten years ago.”	Shortage of skilled craftsmen	
Interviewee 2: “It will simply depend on training enough skilled workers in the next few years, and that has to happen relatively quickly.”		
Interviewee 2: “For many years, there was a lack of support from the traditional energy industry, which saw solar energy as a competitor to its fossil fuel power plants.”	Growing role of energy suppliers	
Interview 3: “You also have to say that the larger players or the big energy suppliers that now offer such solutions have to reinvent themselves to a certain extent. Their old business model - producing electricity and selling it to customers - will only work partially or not at all if customers suddenly produce their own electricity.”		
Interviewee 5: "For financing, we rely on external partners to provide the flexibility and scale we need for our customer offerings."	Importance of Financial partners	
Interviewee 1: “They are moving towards a holistic energy offering, where it is not just about selling solar systems, but also including battery storage, heat pumps, and e-mobility solutions.“	Large solar system service offerings	**Transition towards a holistic EaaS offering**
Interviewee 1: “I see more and more smaller installers, or medium-sized installers, using their own resources or partnerships to enter this market, offering a complete energy system for the household and not just modules or individual energy installations that only include a PV system.”	Convergence to home energy management systems	
Interviewee 2: “heat pumps will certainly establish themselves as the main heating technology in the private sector”		
Interviewee 2: “heat pumps will certainly establish themselves as the main heating technology in the private sector”		
Interviewee 3:: “Keyword sector coupling: more and more is being electrified, whether it's mobility or heat generation using heat pumps”		

Interviewee 4: “The third theme in this new market phase is the opportunity to develop real technology – especially software technology that intelligently connects these decentralized units."		
Interviewee 5: "The biggest influencing factor at the moment is inhibitor systems, i.e., home energy management systems."		
Interviewee 7: "The problem is not end customers but the grid expansion, which was overslept. We must avoid penalizing customers for these structural issues."		
Interviewee 8: "The new model is intelligent control systems, where components and households are networked with the grid."		
Interviewee 8: "The more renewable energy we generate, the greater the challenges for the grid itself... Static models won’t be sufficient in the future."		
Interviewee 1: “Step 2 would be to perfect the overall system or solution, in other words, to actually become this “one energy supplier” or “one energy provider”	Convergence to “One Energy Supplier”	
Interviewee: 9: “From ‘Solar-Energy-as-a-Service’ to taking care of all the customer’s energy needs.”		
Interviewee 6: "Our partnerships extend to software providers who help us develop integrated energy management systems, enabling our hardware to communicate seamlessly with the electricity market."	Technology as facilitator towards EaaS	
Interviewee 1: “Ultimately, the goal is to connect a decentralized energy system and create a so-called “virtual power plant”	End goal of becoming VPP	
Interviewee 1: “Their business model is incredibly scalable, partly because it digitally maps processes and partly because it integrates a wide range of services.“	Digital scalability	**Leveraging data for operational excellence**
Interviewee 8: "We want to ‘SaaSify’ our system and license it to installation companies worldwide."		
Interviewee 6: “you really need intelligent networking, which in our case is the heartbeat AI and the energy management system, which really allows the systems to communicate with each other via a connection to the electricity market, so that you can really let your consumption follow the market.”		

Interviewee 1: „…their data-driven approach allows them to optimize installations and customer acquisition at scale.“	Data-driven customer acquisition	
Interviewee 3:: “Those who are more likely to do it, driven by an affinity for technology, like: “Ah, I want to try something out here and I think it's funny and I'm a bit of a hobbyist”, they probably already have it or just don't really make the big deal. And then, for the general public, the most important thing is simply whether it's worth it or not, i.e. whether you really gain an advantage or not”	Resistance to technology adoption	
Interviewee 4: “The third theme in this new market phase is the opportunity to develop real technology – especially software technology that intelligently connects these decentralized units."	Intelligent unit connection with technology	
Interviewee 6: "Without intelligent networking, short-term market options are limited."		
Interviewee 1: “Accordingly, we are certainly in a phase in which the mere installation of solar panels has become very price competitive.”	Price competition across supply chain	**Fierce domestic competition**
Interviewee 1: “, I would point out that, as with any technology industry, there are always consolidation tendencies somewhere. This also applies to the solar industry, which is also currently undergoing a consolidation.”	Market consolidation among competitors	
Interviewee 8: "We are gaining market share […] smaller companies are going bankrupt because they can’t manage growth and lose to larger players like us."		
Interviewee 9: “Even Sonnen has completely changed its business model in response to the wave of consolidation.”		
Interviewee 1: “I probably wouldn't bake a fully integrated player a la Enpal and 1KOMMA5° again, because I think the days when you could build that from 0 are rather over.”	High market entry barriers	
Interviewee 9: "Local installers make life difficult by offering low prices and competing on customer acquisition costs."	Competition of local installers	
Interviewee 1: “It is the simplest in terms of billing, it is the simplest in terms of incentives, because if you talk to the homeowner who also lives in it, you have just one party with whom you are dealing.”	Homeowner incentivization	

Interviewee 1: “I would be more inclined to say that the opportunities in the residential sector, i.e. the topic of upselling and assets”	Upselling as economic chance	**Customer-centric value creation and engagement**
Interviewee 1: “I think we are now so integrated that we can say that an interesting target group is also those who already have one asset and perhaps want a second.”		
Interviewee 1: “It is good that the financing to some extent creates a continuous engagement with the customer, because you can logically see an Enpal, 1KOMMA5° or whatever on your monthly bill or bank statement.”	High customer engagement across service	
Interviewee 3:: “Somehow there is a mix, because so those who are in the consumer area who now have time and money to deal with it, they would probably build such a system on the roof themselves, have it built and that would be the most attractive financially for them. But there are also enough people who don't think like it. But they say OK, maybe I have a roof here, I want someone else to do it all and of course that's attractive to them.”	Mix of financing preferences	
Interviewee 4: "We introduced the rental model to cover not only financing issues but also concerns about hardware lifespan and service costs."		
Interviewee 5: "The interest rates for our financing solutions are slightly higher than a bank’s, but customers value the flexibility and simplicity we offer."		
Interviewee 3:: “Somehow there is a mix, because so those who are in the consumer area who now have time and money to deal with it, they would probably build such a system on the roof themselves, have it built and that would be the most attractive financially for them. But there are also enough people who don't think like it. But they say OK, maybe I have a roof here, I want someone else to do it all and of course that's attractive to them.”		
Interviewee 5: "Flexible financing solutions are critical in a competitive market to attract customers who prioritize value and control."		
Interviewee 8: "Dynamic electricity tariffs pay for themselves faster, making higher-quality systems more attractive."	Customer journey	
Interviewee 9: "The customer journey is complex, and it's crucial to explain our product simply without oversimplifying."		

Interviewee 1: “there is a risk – that incentives are set that do not go in the direction that some market participants desire. In many areas, politics, regulation and bureaucracy are more of an obstacle than a supportive factor for the entire home energy system. To be fair, I must say that I would always advocate that as a player you make yourself as independent as possible from regulatory developments.	Obstacles regarding regulation and bureaucracy	**Regulatory volatility and market stability**
Interviewee 1: “One example of how regulations can get in the way of the system is the smart meter rollout. This is something that has not been implemented in Germany with the same efficiency and controllability as in other countries.”		
Interviewee 7: "Subsidies should generally be discontinued. Photovoltaic systems pay for themselves and don’t need subsidies, which often create uncertainty."	Subsidy uncertainty	
Interviewee 8: "We often have customers who say, ‘We’re waiting for better funding.’ There’s still an expectation for large state subsidies."		
Interviewee 2: “the German solar economy, has certainly never had such good framework conditions and such good political support as it does now under the coalition government. Almost all the demands that came from the industry associations, or many or most of them, have been implemented, for example the exemption from VAT.”	Positive governmental outlook achieved through associations	
Interviewee 4: "Our standard channel remains the online channel, i.e., performance marketing and video sales."	Multiple sales channel approach	**Importance of diverse sales channels**
Interviewee 5: "You can't reach your goal with only one sales channel; you have to use all channels depending on your influence area."		
Interviewee 7: "We don’t just do video calls but also on-site appointments. This creates trust with customers, especially for something as personal as opening and working on their roof."		
Interviewee 5: "The most effective sales channel is clearly still the referral business; it’s simply the most valuable."	Customer acquisition	
Interviewee 9: "Customer acquisition remains a major cost driver. The high lead costs and the		

increasing price pressure from comparison portals are making it difficult."		**Leveraging customer referrals for sustainable growth**
Interviewee 9: "Referral marketing is key. Satisfied customers are our best leads."		
Interviewee 3:: “what you can observe is that when a solar system is built somewhere in the neighborhood, it spreads by word of mouth.”	Word-of-mouth	
Interviewee 6: "If you deliver a high-quality product and service, it creates a natural ripple effect where people spread the word for you."		
Interviewee 5: "A strong referral program builds long-term trust and loyalty among customers, which is hard to achieve with paid Inter alone."		
Interviewee 6: "Satisfied customers naturally lead to more referrals, which boosts organic growth without additional costs."		
Interviewee 1: “…acquiring customers, top-of-funnel work, and good sales work has become all the more important.”	Importance of leads marketing	**Optimizing lead generation and conversion strategies**
Interviewee 5: "A combination of strong online presence, including Google Ads and social media campaigns, and offline events … So it's important that you build up a certain brand in your sphere of influence and you have to be able to create a touchpoint everywhere."		
Interviewee 5: "Word-of-mouth referrals and recommendations from satisfied customers continue to bring in organic leads without additional marketing costs."		
Interviewee 6: "Our dynamic energy management system attracts leads interested in innovative and cost-saving solutions, making them high-value prospects."		
Interviewee 6: "Leads from social media campaigns not only bring in traffic but also help us build a long-term relationship with younger, tech-savvy customers."	Importance of leads marketing on social media	
Interviewee 5: "It's also important to generate leads, so we also notice that the majority of our leads come via our partner network, i.e. we have energy consultants, heating engineers and so on and immediately all the people who are basically in contact with our target group.”	Lead acquisition through partners	

Interviewee 7: “Back then, we still had to buy in a lot of leads because the demand was so high and we couldn't rely on recommendations. Another thing that works very well: We don't just do video calls, but also on-site appointments. That creates trust with the customer”	High lead to customer conversion costs	
Interviewee 5: “so you're currently in a time where you can't reach your goal if you only have one sales channel or one lead channel”		
Interviewee 9: “There is just so much communication and budget in the market, and leads have become expensive. The market needs to rethink.”		

Appendix C: Scoring of Recommendations

In Table 6 below, scores were allocated on a scale from 1 (very low), 2 (low), 3 (medium), 4 (high), and 5 (very high). All scores reflect ratings across three categories of *Addressing Current Vulnerabilities, Enhancing Strategic Value, and Ease of Implementation*. The individual rankings provided by the three authors and two employees were combined into an overall score, which served as the basis for key recommendations.

Table 6: MCDA Scores of Recommendations

Recommendation 1: 2.92 overall score Collaborate with solar installers to implement joint training programs and share labor resources, addressing workforce shortages			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	3.00	2.00	4.00
Author 2 Score	2.00	3.00	4.00
Author 3 Score	5.00	3.00	3.00
Average Author Score (50% weight)	3.33	2.67	3.67
Employee 1 Score	2.00	3.00	3.00
Employee 2 Score	3.00	3.00	2.00
Average Employee Score (50% weight)	2.50	3.00	2.50
Overall Score Recommendation 1	**2.92**	**2.83**	**3.08**
Recommendation 2: 2.40 overall score Engage in M&A activities in Germany to secure market share			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	3.00	2.00	1.00
Author 2 Score	2.00	2.00	2.00
Author 3 Score	5.00	3.00	2.00
Average Author Score (50% weight)	2.00	3.00	1.00
Employee 1 Score	2.00	3.00	1.00
Employee 2 Score	2.00	3.00	1.00
Average Employee Score (50% weight)	2.00	3.00	1.00
Overall Score Recommendation 2	**2.67**	**2.67**	**1.33**

Recommendation 3: 4.18 overall score Complement PV systems by expanding the product offering with electric vehicles			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	4.00	5.00	2.00
Author 2 Score	4.00	5.00	3.00
Author 3 Score	4.00	4.00	4.00
Average Author Score (50% weight)	4.00	4.67	3.00
Employee 1 Score	5.00	5.00	2.00
Employee 2 Score	4.00	5.00	3.00
Average Employee Score (50% weight)	4.50	5.00	2.50
Overall Score Recommendation 3	**4.25**	**4.83**	**2.75**

Recommendation 4: 4.00 overall score Form partnerships with real estate agencies and hardware stores to expand customer reach through trusted intermediaries			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	4.00	4.00	4.00
Author 2 Score	4.00	4.00	4.00
Author 3 Score	4.00	4.00	4.00
Average Author Score (50% weight)	4.00	4.00	4.00
Employee 1 Score	5	4.00	3.00
Employee 2 Score	4.00	4.00	3.00
Average Employee Score (50% weight)	4.50	4.00	3.00
Overall Score Recommendation 4	**4.25**	**4.00**	**3.50**

Recommendation 5: 2.97 overall score Introduce tiered loyalty programs that reward repeat customers with service discounts or exclusive benefit			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	2.00	3.00	3.00
Author 2 Score	2.00	4.00	3.00
Author 3 Score	2.00	4.00	4.00
Average Author Score (50% weight)	2.00	3.67	3.33
Employee 1 Score	2.00	4.00	3.00
Employee 2 Score	2.00	4.00	3.00
Average Employee Score (50% weight)	2.00	4.00	3.00
Overall Score Recommendation 5	**2.00**	**3.83**	**3.17**

Recommendation 6: 2.55 overall score Utilize customer energy consumption data to optimize product offerings and tailor solutions to regional demand patterns			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	2.00	3.00	2.00
Author 2 Score	1.00	3.00	3.00
Author 3 Score	3.00	3.00	4.00
Average Author Score (50% weight)	2.00	3.00	3.00
Employee 1 Score	2.00	3.00	3.00
Employee 2 Score	2.00	2.00	4.00
Average Employee Score (50% weight)	2.00	2.50	3.50
Overall Score Recommendation 6	**2.00**	**2.75**	**3.25**

Recommendation 7: 2.55 overall score Utilize customer energy consumption data to optimize product offerings and tailor solutions to regional demand patterns			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	2.00	3.00	2.00
Author 2 Score	1.00	3.00	3.00
Author 3 Score	3.00	3.00	4.00
Average Author Score (50% weight)	2.00	3.00	3.00
Employee 1 Score	2.00	3.00	3.00
Employee 2 Score	2.00	2.00	4.00
Average Employee Score (50% weight)	2.00	2.50	3.00
Overall Score Recommendation 7	**2.00**	**2.75**	**3.00**

Recommendation 8: 3.95 overall score Leverage predictive models to identify and prioritize high-quality leads			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	4.00	3.00	5.00
Author 2 Score	4.00	4.00	4.00
Author 3 Score	4.00	4.00	5.00
Average Author Score (50% weight)	4.00	3.67	4.67
Employee 1 Score	4.00	4.00	3.00
Employee 2 Score	4.00	4.00	4.00
Average Employee Score (50% weight)	4.00	4.00	3.50
Overall Score Recommendation 8	**4.00**	**3.84**	**4.09**

Recommendation 9: 2.63 overall score Develop adaptive pricing models that remain attractive during subsidy fluctuations			
	Addressing Current Vulnerabilities (40% weight)	Enhancing Strategic Value (40% weight)	Ease of Implementation (20% weight)
Author 1 Score	4.00	2.00	2.00
Author 2 Score	4.00	2.00	2.00
Author 3 Score	3.00	4.00	1.00
Average Author Score (50% weight)	3.67	2.67	1.67
Employee 1 Score	2.00	3.00	2.00
Employee 2 Score	2.00	3.00	2.00
Average Employee Score (50% weight)	2.00	3.00	2.00
Overall Score Recommendation 9	**2.00**	**2.84**	**1.84**

Appendix D: Interview Transcripts

Table 7: Interviewee 1: VC Fund Vice President

Interview Settings Interviewee 1

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
1	Venture Capital	<100	Strategy Consulting	Senior Vice President	8 Years	Munich

Date	17th of October 2024
Time	19:00
Location	Microsoft Teams
Duration	29:54 minutes
Interviewer	Hendrik Luessem
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee would like to stay anonymous without direct name or company mentioning.

Hendrik: Exactly, perfect. Then let's start right away. Can you please introduce yourself and tell us why you are an expert in the field of energy and especially solar energy in Germany?

Interviewee 1: Yes, I would be happy to. So I'm an investor in a German VC fund. We have been looking at the entire solar and home energy market through various investment opportunities over the last few years. We are also invested in one or two models and accordingly, we have exposure to this market in Germany and beyond, both from the portfolio and from new investment opportunities.

Hendrik: OK, thank you very much. And how would you describe the development of the last investments and also the last opportunities you have seen, the development and especially here in focus the business models, so how they have behaved, developed.

Interviewee 1: Yes, well, I think if you look at private individuals, let me say, we still have a situation in Germany in which we are probably one of the absolute leading home solar markets internationally. Germany is always cited as an example, and I would say that it is enough that

we are invested in one or more German solar models, that it helps, I would say, that it helps to maintain sufficient liquidity, because Germany is definitely seen as a front-running market when it comes to solar. Nevertheless, I think this market has not always been easy in recent years, especially this year and perhaps last year. There has been a slight change in momentum, both a cooling of the acceleration of the expansion and, in particular, a clear decline in expansion this year. So, depending on which statistics you believe and how you assess the next few remaining months, we will certainly see a 20%-30% decline in overall market demand for new installations this year. And that has of course, you asked, especially after the development of business models or what models we see, that has of course also brought out various models through this cycle, I'll say. The big boom came about the rise in energy prices, certainly final then by the Russian war in Ukraine, the rise in energy prices, that has primarily helped above all I would say, integrated solar installation models or home energy models. I would now like to mention Enpal and 1KOMMA5° as the two top dogs, which have been able to build up a particularly large market share and, above all, a particularly large volume over this period. This was certainly mainly due to the fact that these models had a very integrated source of supply and very high volumes. These were certainly driven primarily by Corona, still times of a rather higher shortage of modules, but also of, let's say, peripheral components. This certainly came from the supply chain crisis post-Corona to a certain extent these models, I would say, almost because of this, these will certainly get a great deal of these market shares in the years 2020 and 2021. What we have seen over the last two years, or are still seeing, is a slight shift and alignment of the various models from different directions and for different reasons. On the one hand, if you look at the market as a whole, I believe that 80+ percent of the total market is still in the hands of smaller installers, often regional installers. Accordingly, there is still an incredible fragmentation in this market. On the other hand, we see, let's say, several models popping up that can enable a small installer, to put it simply, to make an offer, such as Enpal or 1KOMMA5°. I'd like to briefly explain what this might mean in detail. And we see that this competitive advantage in the supply chain has somewhat diminished. Accordingly, we are certainly in a phase in which the mere installation of solar panels has become very price competitive. That means that we have a situation in which, as I said, differentiation is possible to a certain extent via price and a downward price trend is more likely to be seen. What we are seeing, above all, is, let me say, convergence in the direction of more home energy systems. This means, and this is what 1KOMMA5° and Enpal have primarily set out through their offering, which I think is now much more, perhaps even more than a pure offering. This includes a battery, this includes a battery management system in case of doubt, it now requires a smart tenant, in other words, an intelligent power grid system. It could even mean that a heat pump is also installed, etc. This also brings me back to my point about the overall market: I see more and more smaller installers, or medium-sized installers, using their own resources or partnerships to enter this market, offering a complete energy system for the household and not just modules or individual energy installations that only include a PV system. I'll stop here for a moment. Please let me know if you think I should go into more detail.

Hendrik: That's exactly what's been touched on, so if it goes further than “One Energy Provider” as a step. Is that exactly what you would see in the startup's value proposition if you were to

invest in the market now. Would you say that's also the biggest market opportunity or where would your investment case be?

Interviewee 1: Well, I think I'll detach myself from the fact that we've already invested in a player in the market, that it probably wouldn't make much sense to invest in another player for portfolio construction and competitiveness reasons. I think what I find most exciting, especially and I always come from a very early-phase perspective, so I probably wouldn't bake a fully integrated player a la Enpal and 1KOMMA5° again, because I think the days when you could build that from 0 are rather over. What I do find exciting is actually a bit of a derivative of that, so the games or the technology solutions that enable smaller installers in the long and medium term to offer the market a proposition like 1KOMMA5°, whether it's through the home energy management system, whether it's through financing solutions, whether it's through, for example, integrating the various assets into one solution bundled with an energy tariff, whether it's through better marketing of these assets. I think these are the models and variants that I find much more interesting than a fully integrated model. That's a bit of what I currently see as an interesting investment opportunity. Having said that, I think that everything that is a bit related to this is still interesting, because we have an incredible shortage of skilled workers or installation specialists. Accordingly, I have seen a lot of models lately that try to train skilled workers or even career changers to train them for a home energy installation or to further educate them, and I think these are also interesting models that I would still look at today.

Hendrik: What you just mentioned is in the area of key resources, apart from the shortage of skilled workers. What else would you say are other key activities that players in the market need to continue to be successful in difficult market conditions? Apart from investment in skilled workers and solar installers.

Interviewee 1: Yes, so you are now targeting installation companies or what exactly do you mean?

Hendrik: In general, whether it is Enpal or a smaller solar company, what is most important to remain active in the market and survive, especially in this period of consolidation that is prevailing in the market with many bankruptcies or companies like Zolar, which are now withdrawing from the B2C market, which is just as important regardless of the size of the company, from small to large, in his view, the key activities that they should carry out, apart from what you have already mentioned, that is, the specialists.

Interviewee 1: Yes, so I would say, in addition to the specialists, what I believe is simply a necessary building block is definitely the ability to offer a complete system. I believe that the pure solar system is now maximally commoditized. What is interesting is the topic and the overall home energy management system, perhaps even coupled with other main home energy assets. The battery should certainly be mentioned here, but the heat sample should also be mentioned in particular. I recently spoke to a few installers and I might not quote them now, but I will at least quote them this situation. He said, “The fact that we also offer heat pumps saves our bacon,” to put it nicely. So, accordingly, I think this differentiated integrated offering is an absolute key point and I think the second one, that was certainly a market in which a great many of them took off, and solar-powered ones have really popped up left and right like

mushrooms in a kind of, let's say, gold-rush fever. I think that gold-rush fever has largely subsided to a certain extent. That's why acquiring customers, top-of-funnel work, and good sales work has become all the more important. This applies to the very large, but it also applies to the medium-sized and the small, while I see the small ones perhaps even in the situation that, due to local activity, they perhaps don't need this “growth and any price mentality” to continue to grow at a crazy rate. But I think the real issue right now is simply maintaining market share or the installation rate by acquiring new customers, because that has become significantly more difficult. For example, we are seeing rental prices continue to rise, and that is another sticking point, I think, another indicator that the core product of solar in particular has become significantly more competitive.

Hendrik: Following on from that: Which target groups do you personally still see as having strong growth or strong opportunities right now? Which channels do you think are the most important and effective right now to reach customers?

Interviewee 1: I think there are various strands. On the one hand, it is either the retrofitting of further home energy assets or the first fitting of other home energy assets. That said, I think we are now so integrated that we can say that an interesting target group is also those who already have one asset and perhaps want a second. And as I said, this step from PV to heat pumps or from heat pumps to PV could be interesting. Otherwise: when we talk about the home energy or home solar market, we like to talk about single-family homes, the perfect case, because it is of course by far the easiest to model. Why is it by far the easiest to model? It is the simplest in terms of billing, it is the simplest in terms of incentives, because if you talk to the homeowner who also lives in it, you have just one party with whom you are dealing. What I also see increasing is actually the expansion. I'll say now in the commercial and industrial sector, for example, warehouses, logistics halls, operating and manufacturing buildings of manufacturing companies. This can also affect small open-space systems, but I am deliberately staying in this context of trade and industry in self-energy supply via solar, also coupled with an energy management system, and/or a battery, which are definitely cases that I also still. This asset cross-sale in individual buildings is an interesting topic. I still see the expansion of the residential home sector towards multi-family homes as exciting and perhaps not yet as penetrated as the single-family home sector.

Hendrik: Yes, so to speak, industry is currently more interesting than homeowners, or how would you put it now? If you had to rank it now, what do you think are the top 3 target groups in the current market?

Interviewee 1: I think all areas are exciting in their own way. I think you have to be aware that they are very different models, each with their own difficulties and complexities. That said, I think I would be more inclined to say that the opportunities in the residential sector, i.e. the topic of upselling and assets, is certainly an issue, since we still have a great many individual households without solar panels. That said, the main question here is why this is the case. When it comes to single-family homes, you can certainly automate a great deal in the planning stage, from the roof pitch to the type of tiles and the orientation of the house. So at the end of the day, it depends on the business model that we look at and assess what is really the case. I know that

it is not a satisfactory answer and not what you had in mind. But I would find it difficult to say exactly. These are different variants that involve different complexities and thus also different differentiation options.

Hendrik: Thank you very much. Back to Enpal, for example, and the different financing solutions. Initially offered with a lease, now also hire purchase and direct purchase since last year. How important would you say these types of financing are for customers to get them through the market? How important is it for companies from a financial point of view, i.e. from a profitability point of view? What is your assessment?

Interviewee 1: Well, I think that at the beginning of the 1KOMMA5° and Enpal era, the topic of financing or, in particular, the topic of solar leasing was a very attractive one because it made the whole thing a no-brainer product, while the product itself was not yet as present in the market at the time. That said, I think that it was a very strong differentiator, especially at the beginning. My take on it today is that it doesn't hurt. But offering financing, especially for smaller installers, is perhaps even a must in many cases. But it is no longer the only way to finance a solar asset. I think that I can now go to my bank, the Sparkasse, and they would also finance a solar system for me. It is good that the financing to some extent creates a continuous engagement with the customer, because you can logically see an Enpal, 1KOMMA5° or whatever on your monthly bill or bank statement. I think what you have to say, of course, is that this is also one of the building blocks that has made an overall model like Enpal or 1KOMMA5° interesting and financially attractive. That's why, in certain comparisons, these models are not necessarily always the cheapest, because there is a lot of leeway. That means that the step from Enpal and 1KOMMA5° is now also one that takes into account the whole issue of price competition. So I would say it is still an important feature. However, due to the customer's knowledge of financing solutions, it is no longer the major differentiator that it may have been. It is important for companies, but it is not decisive, especially in a world in which, as I said, the topic of the overall energy system/overall solution is becoming increasingly important.

Hendrik: Great, you just mentioned price war again and again. Price war always means looking at costs in the end. What are the most important cost blocks that companies should have under control right now? And, so to speak, where should costs be reduced the most and where are the biggest challenges on the cost side?

Interviewee 1: Yes, I don't think I have any special insights into certain cost blocks of the respective companies. However, I gather from the press that the solar industry, for example, is having a very difficult time. However, I can't judge that from the outside in such depth, in terms of which specific cost blocks that might be due to. Let me go into price power a little more. On the subject of price wars – perhaps that's a strong word – my observation is point one: panel prices are currently trending downward. This means that we currently have more overcapacity, more of a glut, than we did two, three or four years ago. Back then, as you mentioned earlier, we may have had significantly higher demand than supply due to supply chain bottlenecks. So this affects the panel prices and also the peripheral prices. I think another aspect is the increasing competition. This probably plays a significant role here. Maybe there is now a kind of

competitive pressure that has not existed in this form before. On the one hand, I would point out the development of cheaper accessories. I mentioned earlier that competition has become tougher and there may be new approaches to finding cost-effective solutions here. Again, the keyword is the overall system and the topic of upgrades for customers who may already have other energy assets that could now be more interesting for them. I don't want to discuss the topic of overhead in general, but if you compare THL, Enpal, 1KOMMA5° and so on with a traditional standard provider, then of course there is the risk that the overhead costs are far from reflecting the product itself or that a lot of time passes before these costs are amortized. Accordingly, I would point out that, as with any technology industry, there are always consolidation tendencies somewhere. This also applies to the solar industry, which is also currently undergoing a consolidation. One point that remains relevant here is overhead. I think that's one of the aspects to remember most. As I said, in addition to this topic, the pressure in the market should not be underestimated. So you don't necessarily have full control in such a competitive market.

Hendrik: Okay, that's been mentioned a lot now. Let's summarize and work out the most important point. Maybe also from a political point of view – you haven't said much about that so far. If you don't have any expertise in this area, feel free to mention it. What market risks and barriers do you see here? Bureaucratic hurdles are often mentioned, or unclear political decisions in the future, such as funding programs or feed-in tariffs. What do you see as the most important factors now and in the future?

Interviewee 1: Well, I think if we go into the political level completely here, then the discussion will probably be too long and also take us a bit away from the topic. One second please... So, I'm back. Regarding the political component: I think it has been emphasized in many places that solar is no longer the central topic. The focus is currently on the Heating Act and heat pumps. Without wanting to criticise the government completely, I think that opportunities to set the right incentives have been missed. Much of the political discussion, especially in public, has led to massive uncertainty. This has certainly contributed to the fact that we are unlikely to achieve the expansion targets for heat pumps in the way originally intended. This means that the government would be well advised – or, to put it another way, there is a risk – that incentives are set that do not go in the direction that some market participants desire. In many areas, politics, regulation and bureaucracy are more of an obstacle than a supportive factor for the entire home energy system. To be fair, I must say that I would always advocate that as a player you make yourself as independent as possible from regulatory developments. And I would also like to emphasize that I may not understand all the details. One example of how regulations can get in the way of the system is the smart meter rollout. This is something that has not been implemented in Germany with the same efficiency and controllability as in other countries. We have a penetration rate of perhaps 1-2% in this country, while other countries are above 50%, and in some cases even close to 100%. The effect of this is that dynamic pricing models do not achieve the penetration they have in other markets. As far as political control mechanisms in the energy market are concerned, I am personally a big fan of price signals as a control instrument, compared to direct intervention by the state. I think that this is something that would certainly restrict the free market or even a price-controlled consumption market to a certain

extent. In this respect, regulation has not been helpful so far – perhaps even the opposite, it has been actively harmful. It has ensured that the expansion was too expensive and associated with high hurdles, etc. However, the topic is to be addressed again in 2025, with the keyword being "law on the digitization of the energy transition." I think that here, too, we are still not at a level that would make a rollout possible in a way that really covers costs. In my opinion, this will continue to hinder the development of an intelligent energy system. This is a consequence of the energy market regulation, which in my opinion has not been well thought out. However, I would like to note that this is a systemic criticism of mine, which I am thoroughly reflecting on. I am aware that I am probably not the one who has the last word here with a well-founded opinion.

Hendrik: Okay, then finally back to the biggest players. We've already identified the trends quite well. What would you recommend as a VC-backed company, as a supervisory board member or similar to a company like Enpal, 1KOMMA5° or Zolar? What would be the most important steps for them this year – so short term, medium term and long term – based on the position they are already in, so with a multi-product offering and on their way to becoming an all-in-one energy provider? What are currently the most important short-term steps, the medium-term steps and the long-term steps?"

Interviewee 1: Yes, yes, I think that's no secret now and it's probably in the roadmaps, although to be fair I don't know them for all the players. I would say that in the short term, the goal is to "get the house in order." I think we are in a year in which the main thing is to defend our market share, maybe even expand it slightly. So I would say that the short-term priority is to streamline and cut unnecessary ballast – in terms of corporate overhead and cost structure. The aim is to position yourself in such a way that you remain effective in the long term. Step 2 would be to perfect the overall system or solution, in other words, to actually become this "one energy supplier" or "one energy provider". This includes activities such as purchasing from suppliers and possibly a direct marketing strategy. In the long term – and I think this is something that should not be forgotten with these business models – neither Enpal nor 1KOMMA5° are doing this because they absolutely want to sell solar panels and batteries. Ultimately, the goal is to connect a decentralized energy system and create a so-called "virtual power plant". I think that is the ultimate goal for many of these players. When I look at what is currently happening in all markets and which new players are entering the market, I see a development towards a final stage in which the smart home is linked to a virtual power plant solution. This means that the flexibilities in the system can be monetized. This makes it possible to make the end customer an attractive and cost-efficient offer while strengthening the position of the major players. I think that's the long-term priority that I see most here. Further developing this strategy towards new assets is crucial to remaining relevant and competitive in the long term.

Hendrik: OK, then thank you very much for your time. I would stop the recording now. Thank you very much again for your time! As I said, if you have any other insights for us or would like to share certain information, we'd be happy to do so.

Table 8: Interviewee 2: Solar Industry Journalist

Interview Settings Interviewee 2

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
2	Advocacy Group	10-20	Energy Journalist	Press spokesman	>30 Years	Essen

Date	18th of October 2024
Time	14:30
Location	Microsoft Teams
Duration	32:22 minutes
Interviewer	Hendrik Luessem
Original language	German
Audio / video tape	Audio
[a]Face to face / online	Online
Received questions in advance	Yes
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee is agreed to mentioning his name, position, and company.

Hendrik: Can you please introduce yourself and explain why you are an expert in the field of solar energy in Germany?

Interviewee 2: I'm a trained journalist and have been following the development of all renewable energies since the late 1980s. I used to focus more on wind energy, but also solar energy. I have followed the development of solar energy in Germany and Europe since at least the early 1990s. The keyword in this case is the so-called Aachen model, the promotion with a fixed feed-in tariff, which I described again and again in the 1990s and described as a success model and recommended that it be applied at the state and national level, which then happened with the EEG amendment, which the red-green federal government that came into office in 1998, was implemented with the EEG 2000 and then in particular with the EEG amendment from 2004. So solar energy was still more of a niche product in the 1990s. Above all, these two legislative changes helped solar energy to achieve a very impressive upswing in the 2000s. This was particularly evident at the end of the noughties, in the years 2010 to 2012, when the newly installed capacity was between 7000 and 8000 megawatts. At that time, Germany was a leader in the development and expansion of solar energy, and in the noughties, the German solar industry had more or less equipped China with equipment, machines and know-how. So the

development was really very exciting and curious. Germany was the world leader in the expansion of solar energy and also number 1 in the solar industry. However, this changed relatively quickly under the black-yellow federal government that won the 2009 federal election. The new environment minister, Peter Altmaier, who was appointed in 2011 or 2012, drastically reduced the compensation under the Renewable Energy Sources Act, which then led to an abrupt halt in solar development and solar expansion. Not only that: the number of jobs that were created primarily in eastern Germany at the time, the so-called Solar Valley around Bitterfeld, also declined. There were job losses, certainly in the range of 60,000 to 70,000 jobs. These were accepted by politicians more or less without comment. There were also no major protests from the trade unions, which is due to the fact that the number of organized union members in solar companies was relatively low. And so the decline of the German solar industry began in 2012. It has led to the fact that China, above all, has recognized the advantages of the solar industry and, above all, Chinese companies with state support or with the support of the Communist Party have then very quickly turned a small-scale business into a mass-market business and have also contributed to the fact that the prices for solar products, be it cells, modules and everything that goes with them, have fallen significantly, thus making solar energy competitive. So the start of the solar industry worldwide can certainly be found in Germany, and China is responsible for mass production.

Hendrik: You are actually describing the path that triggered the boom at the beginning, until the middle or beginning of the 2010s, and then, due to the severe restrictions of the EEG law, domestic solar energy was no longer financially viable due to the costs. lowered the costs again to such an extent that despite the – let me say it in advance – subsidy-dependent business models due to the high costs of solar panels, the costs were so low again that the companies could operate more independently, although they were still dependent on the feed-in tariff, which became significantly less important, right?

Interviewee 2: Yes, although I have to correct you there: the EEG levy or the EEG remuneration is not a subsidy in the traditional sense, because in the end it was paid by the electricity customers. So you have to be careful when you work with the word subsidy in your work. It was not traditional state support, it was the support of all electricity customers and electricity consumers.

Hendrik: Would you explain for the interview how exactly the EG works?

Interviewee 2: You can say that the EEG is a levy that has been added to the electricity price and that new renewable power plants, whether wind turbines or solar energy plants, are then financed from this income. The principle still exists today, and that is how it was financed. That is the basic principle. And to come back to solar energy, so the German solar industry lost its dominant or leading position and the solar build-up here in Germany fell back to a very modest level and as cynical as it may sound, so only the Ukraine war with the beginning of February 2022 has helped the solar energy use in Germany to an unprecedented boom. In 2023, there was a newly installed capacity of more than 15,000 megawatts. By way of comparison, the highest figure was somewhere between 7500 and 8000 megawatts in 2011 or 2012, I think. The motivation of many consumers and many solar energy users was certainly to become independent or to try to become independent in terms of energy supply and to create a buffer against rising energy costs, especially in the electricity sector. So that led to a rapid boom, which at the company level led to a phenomenon that had never been seen before. You couldn't get any more modules, you couldn't get any more tradesmen, you couldn't get any more appointments at all, and if you were lucky you got both after half a year or three quarters of a

year. So these times in the solar sector led to some companies expanding extremely. New business models were also introduced, such as the companies Enpal or 1KOMMA5°, which you always quote. The solar boom in Germany is continuing, as can be seen from the current figures for this year. By the end of September, 11,400 megawatts of solar power had apparently been newly installed in Germany. That is roughly the same level as last year and is above the figures set out in the 2023 amended Renewable Energy Sources Act. According to the Renewable Energy Sources Act, an increase of 12,500 megawatts is expected this year, and this will certainly be exceeded by the end of the year. Whether it will be 13,000, 14,000 or 15,000 megawatts, I don't want to predict that now. In any case, this is a development that exceeds expectations. Ultimately, however, it is still not enough, since the EEG envisages an annual expansion of 21,000 megawatts for the coming years by the end of this decade. In my view, this means that companies will have to focus not only on the usual roof-mounted systems but also on open-field systems. These are underrepresented in some federal states in terms of installation figures, for example in North Rhine-Westphalia. So-called innovative solar applications such as agri-PV, floating-PV (floating solar parks), parking lot photovoltaics or solar systems in moors would also have to be pushed much harder. The next few years will show whether this is implemented. Another area that has developed by leaps and bounds in the last two years and will influence the further use of solar energy is the so-called balcony power plants, also known as plug-in solar systems. These have experienced a rapid upswing that no one had expected in this form. This movement certainly existed ten years ago. At that time, it was still ridiculed as 'solar guerrilla', but the supporters of these balcony modules have managed to achieve reasonable legal conditions. Keyword: Solar Package 1 of the current federal government. Subsequently, there were further regulations so that solar energy could now be used by everyone, even by people without their own roof.

Hendrik: What is the current situation? It seems that the regulation for plug-in solar systems or balcony power plants has been significantly simplified. What is missing, especially for the classic home roof solar systems? What do you think are the biggest barriers and regulatory hurdles? What is your personal opinion on this? What has gone well in recent years, and what is important from a political and regulatory perspective over the next five years to further promote the market?

Interviewee 2: For many years, there was a lack of support from the traditional energy industry, which saw solar energy as a competitor to its fossil fuel power plants. At the latest with the decision to phase out nuclear energy in 2011 under Angela Merkel, a rethinking slowly began. However, it has been shown that the downturn in the German solar industry has led some skilled workers to migrate to other sectors. These are now needed to accompany and support the current upswing of the last two years. It now seems to be relativizing – currently there are enough modules, inverters and everything that goes with them again. However, in my opinion, the bottleneck remains the shortage of skilled workers. There are still too few craft businesses that want to focus specifically on solar energy again now. Many have become rather cautious due to the experiences of ten years ago. They had specialized in solar energy back then, had to accept setbacks and then decided that they could also make a good living from bathroom renovations or boiler replacements. The market for this is large enough for them to make ends meet without solar energy. This means that there are very few truly classic solar companies that focus exclusively on solar.

Hendrik: And if it is a pure-play solar company, what would you say are the most important success factors – apart from the shortage of skilled workers? If you can answer that, also from your perspective as a lobbyist or political and regulatory expert and journalist. If we look at the

big players like Enpal and 1KOMMA5°, which focus exclusively on solar energy – what do you think is crucial for these companies to remain competitive in a phase of consolidation and in the face of many insolvencies?

Interviewee 2: Oh, that will be an exciting question, whether there is still enough room and space for medium-sized companies alongside these major market players you just mentioned – in other words, whether there is enough market and customers for them. Or whether these companies will more or less be bought up by the big companies and then used as their own installation companies to cope with the customer growth that Enpal and 1KOMMA5° have experienced in recent years. That's how I see it.

Hendrik: Exactly, now in more detail. So there are big players like Enpal, who are already recruiting skilled workers from other European countries, and in some cases also electricians from Colombia. How do you see the development in terms of skilled workers, especially for smaller players? What difficulties are there, and to what extent can politics provide support here? What do you think is needed to make this work?

Interviewee 2: Yes, well, I definitely see opportunities for smaller companies in their regional environment. They live on word of mouth and personal recommendations, i.e. recommendations. However, I don't know how long that will last. It will simply depend on training enough skilled workers in the next few years, and that has to happen relatively quickly. There are a wide range of activities and retraining programs. In Aachen, for example, there is a program in which unemployed people are trained as solar installers. It will certainly be a crucial question – how quickly enough skilled workers will be available to install the systems on the roofs.

Hendrik: OK, that's very interesting. Then maybe also with a view to the future: since we've already addressed the shortage of skilled workers, what other political trends will influence the solar market and the home solar market in particular? What is important for companies in this respect – both from a political perspective and from a company perspective? What should companies watch out for and how should they adapt to regulatory decisions or hurdles? So from both perspectives – from a company perspective and from a political perspective. What is needed here?

Interviewee 2: solar companies or companies that use solar energy?

Hendrik: solar companies, so the installers – be it a small craft business or a big player on the market – how do they have to adapt due to the regulation? And how should politics adapt to support the solar market?

Interviewee 2: Oh. Well, I think the solar industry, the German solar economy, has certainly never had such good framework conditions and such good political support as it does now under the coalition government. Almost all the demands that came from the industry associations, or many or most of them, have been implemented, for example the exemption from VAT. So that was, what's the word, a real boost today, which really did cause system prices and offer prices to plummet. We've never had this situation before and it will certainly motivate more homeowners to install their own solar systems on their roofs, because it's safe to assume that electricity prices are more likely to rise than fall. And at the same time, you also have trends, such as the market for home storage tanks picking up. I don't know the current figure, but at least if you buy a solar system, every second project also includes a storage system. It's almost

standard practice these days to sell both together. The third driver is certainly also electromobility, even though there is currently a dip in new registrations in Germany and a discussion that the combustion engine ban, the so-called combustion engine ban that the European Union plans for 2035, should be relaxed again if the CDU has its way. But does that also mean that e-car owners would certainly be only too happy to charge their cars with their own solar power, or indeed want to do so? And surely that also means that this entire market for wallboxes will certainly pick up again. I can't imagine at the moment that there will be another big boom in classic combustion cars in the next two decades. So these e-cars will catch on, especially since there are also improvements in the infrastructure. Does that mean above all in public charging stations and that won't all come as quickly as environmental and other interest groups imagine, but the issue of climate protection remains on the agenda and every flood disaster will remind politicians that this is an issue they cannot avoid.

Hendrik: Thank you very much. You are now always primarily on the offer, so this all-in-one player from Wallbox, home storage, solar energy system, how important do you think it is for a company like that to also offer a heat pump, and to what extent does the heating law and the political uncertainty, as I call it, now influence the future for solar installers to also offer a heat pump? It is foreseeable, due to the increasing CO2 taxation from 2027, that the prices for fossil energy sources, i.e. for oil and natural gas, will rise. Therefore, there will certainly be an increase in the number of private heat pump installations from this period at the latest. And that is why craft businesses will certainly be well advised to take on this technology.

Interviewee 2: Mhm. There will be some dips again, just like in solar energy in the last decade. At the moment, heat pump sales have fallen again, partly due to all the fuss about the so-called Building Energy Act or Heating Act, which has simply been used by interested parties on the CDU side to badmouth and discredit heat pumps. But ultimately, heat pumps will certainly establish themselves as the main heating technology in the private sector, and when you see that a lot is now happening in municipal heating planning, after politicians have realized that they also have to set up appropriate funding programs, that will certainly create more pressure, so that heating systems such as river heat pumps or larger industrial heat pumps will also gradually become established. Sales figures will simply increase because by the mid-30s at the latest, you will use less and less fossil fuels for heating. That's my prediction. Yes, OK, so that also means that to become essential for survival as a solar provider, it is simply important to only offer heat pumps because it will be the type of heating for the future. Of course, the advantages of having a solar system, due to the self-use, the independence is simply advantageous.

Hendrik: Then back to your actual workplace. Can you perhaps briefly say something about what you do at LEE NRW and then elaborate on how important it is now, especially for solar companies, lobbying in today's world, and how important it is to work with lobbying associations and political actors in the solar market.

Interviewee 2: Yes, well, my employer is the Renewable Energy North Rhine-Westphalia State Association. This is a lobby organization for companies, operators and promoters of renewable energies. The NRW Renewable Energy State Association in NRW is a registered association, so to speak, you can become a member of the association, and the association organizes its work with full-time staff through the membership fees. So that means influencing political decision-making processes, starting with the classic lunch with politicians, that means media work, that means discussions with stakeholders and also issuing all kinds of statements on decrees, ordinances, laws and that's the big picture. My job at LEE NRW is media work. I'm

responsible for classic press work, but also for everything that's covered by the term social media today.

Hendrik: OK, and now to the second question: How important is it for LEE NRW in particular and for companies in general in today's market environment to work with such lobby groups and also in general to influence or work with politics, especially at the federal level, from your perspective? So especially for solar systems and solar.

Interviewee 2: Yes, no, I'll say it, this lobbying work is important because as an individual company you are relatively alone. And the more people there are who take a common line, who make a common demand, the greater the chances of success that you will implement your ideas for the further expansion of solar energy. However, if you then remember Peter Altmaier and his solar policy, or back then the economics minister was also Philipp Rösler from the FDP, so there is no guarantee of success, but ultimately, this lobbying is part of the democratic game and belongs to it. It's always such an up and down. At the moment, from a political point of view, solar energy has the wind at its back. You can't say that, that would be the wrong image, but at the moment the sun is shining for solar energy and the figures, the expansion figures, also prove to the government that they have backed the right horse. Yes, and ultimately it is also a contribution to climate protection and to energy security, energy and supply security. These are also arguments that are repeatedly put forward by lobby organizations, be it the German Solar Industry Association or these state associations.

Hendrik: OK, then thank you very much for your insights and for taking the time. I'll stop recording now.

Table 9: Interviewee 3:: Research Institute Employee

Interview Settings Interviewee 3:

Interview	Sector	Institute Size	Background	Job Title	Years of Experience	Place of Residence
3	Institute for Ecological Economy Research (IÖW)	>100	Research associate	Environ-mental Economist	>5 Years	Berlin

Date	22nd of October 2024
Time	15:00
Location	Microsoft Teams
Duration	23:41 minutes
Interviewer	Pia Lehmberg
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee is agreed to mentioning his name, position, and company.

Pia: Now it worked, great. Good, then we can start by you briefly introducing yourself and telling us what you've done so far and perhaps also your points of contact with the solar market.

Interviewee 3: OK, yes, I'm in this part, I work at the Institute for Ecological Economy Research, I've been a research assistant there for about seven and a half years now. And I deal a lot with the topic of prosumers, i.e. people who generate electricity at home and then consume it, especially in the private sector or in apartment buildings or neighborhoods, so more on a smaller scale and there the prosumer technology par excellence is PV. There is also a little bit of wind power, but the main prosumer has PV systems in single-family homes, very well established, and in apartment buildings this is now becoming more and more common. So that's a bit of a solar starting point, perhaps also my point of contact.

Pia: That suits me so far, it definitely fits in well with our topic. I also read online that you are taking a closer look at the digitalization and financing of these energy systems for consumers. Can you perhaps tell us where you see the decisive market trend in the solar market or the important market trends that are currently playing a major role?

Interviewee 3: Yes, I'm afraid I can't say exactly what the most important thing is at the moment. Well, what I tend to do is look at when or how worthwhile it is for the individual? What kind of self-consumption do they need? And then, in principle, I only access cost data - what do modules cost right now? And I couldn't even say what the current situation is, because it has fluctuated so much over the last few years and since I haven't pulled out any cost data in the last two or three months, I can't say exactly what the trend is right now. So my last update was that prices have plummeted, that Perform modules have come in and last week there was a lot of praise and the PV modules have piled up. Especially now with the Chinese suppliers. But I don't know what the current situation is.

Pia: Exactly, let's take a look at this cost point. So you currently see costs as one of the main drivers as to whether customers decide in favor of a solar system or not. Is that correct?

Interviewee 3: Yes, definitely. So I'm at the crossroads here right now, it's about to get a bit quieter again, sorry if it's too loud right now. So the costs are simply very important. Those who are more likely to do this, driven by an affinity for technology, along the lines of, “I want to try something here, and I think it's funny, and I'm such a small hobbyist”, they probably already have it or just don't really make the big market. For the general public, the most important thing is simply whether it's worth it or not, i.e. whether it saves money. Yes, definitely. So the costs are simply very important. Those who are more likely to do it, driven by an affinity for technology, like: “Ah, I want to try something out here and I think it's funny and I'm a bit of a hobbyist”, they probably already have it or just don't really make the big deal. And then, for the general public, the most important thing is simply whether it's worth it or not, i.e. whether you really gain an advantage or not. And that's why the costs are so crucial. It was also the “Solar Package 1” that made further improvements in terms of revenue, i.e. on the revenue side. The costs are one thing, the other is the revenue side because it didn't really fit together anymore. However, the EEG has always reduced the rate that you get when you feed electricity into the grid. And that was based on how much capacity was already on the market. So it went down and was not based on how costs were developing. Last year, it got to the point where it was no longer worthwhile for many people. The rates were raised again to give it a bit of a boost. In order to ensure that people don't just put as much PV on their roof as they can consume themselves - which was the most profitable option under the old system - there is now also a distinction that allows people to say: “I feed everything into the grid and get more money for it.” Costs are important on the one hand, but the revenue side is just as important. What do you get and how are electricity prices developing? That was the case last year. Perhaps it was more on the “What are the alternative costs?” side that tipped the scales and made people say: “I'm going to get a PV system after all.”

Pia: How would you view Solar Package 1 and the new EEG surcharge? How do you see the future prospects for solar companies? Is it competitive with other renewable energies, or how promising is the whole thing at the moment?

Interviewee 3: Well, solar is currently the cheapest technology we have for generating electricity. So solar is definitely here to stay. In this respect, the solar industry can really compete with all the other technologies that are out there. The question is, when you talk about the solar industry, whether the German solar industry can compete with the Chinese solar industry. That is probably more a question of how well they can compete with each other. But first of all: solar has a very low levelized cost of electricity. And if you look at the expansion targets that the German government has set itself, the solar industry will meet these targets, which is more of a problem with wind. They won't reach the figures they actually want to achieve.

Pia: Well, let's jump ahead. You also have very close customer contact. Can you say what the top sales channels are at the moment? For example, is it word of mouth or is it purely online for this B2C market? What is most effective as a sales channel?

Interviewee 3: Well, what you can observe is that when a solar system is built somewhere in the neighborhood, it spreads by word of mouth. Someone says: "Ah, you did that. How did you do that?" I would say that's the most effective way. But to be honest, I don't have a study or any evidence, it's more of a gut feeling than something I can prove.

Pia: Yes, then I'll jump ahead again. First of all, let's talk about the barriers and challenges - do you have an assessment of what is particularly important at the moment, what is perhaps also hindering the growth of solar companies? There have also been a lot of insolvencies recently. So, do you have an assessment of what the biggest obstacles are at the moment?

Interviewee 3: Yes, so as I see it, it's now... so these bankruptcies are not because there is no demand for solar, but rather because the competition, especially from the Far East, is somehow too strong. So the domestic industry is now suffering as a result. But it's not a problem of demand for the technology. If you look at the insolvencies in Europe or Germany, it's more of a competition problem. So an obstacle... Yes, I don't know if you can call that an obstacle.

Pia: You've already mentioned the political and regulatory side. Do you currently see any challenges or obstacles there?

Interviewee 3: Yes, of course you could push even more, i.e. push solar, even beyond the targets that have been set. Sometimes it's not so easy to implement projects. It starts with something as low-threshold as balcony power plants. To install something like that, which is basically just a plug that you have to plug in, there are still certain hurdles for tenants to actually implement it.

Pia: Are there perhaps currently greater opportunities in the industry than in the B2C market? Or how would you compare that?

Interviewee 3: Yes, I do believe that the fact that solar is simply the cheapest and that it also gives companies a certain degree of price certainty makes it attractive for many to take a closer look at it. So the whole price development that we have seen, especially in the last year or in the last few years, has created greater awareness. I see it as a great opportunity, also for the industry, not to become dependent and to secure oneself in the long term with one's own PV system - if one has the space - or with a Power Purchase Agreement. In addition, the requirements for decarbonization and climate neutrality are a driving force in many areas. Companies are increasingly having to look at how they can at least make their electricity cleaner. This is certainly more attractive for the solar industry than just looking at all the balcony power plants, which are marginal or negligible in comparison. So yes, definitely a greater chance of winning over the industry for this, I can well imagine that.

Pia: Great. Thank you very much. In addition to PPAs, there are also other trends such as solar-as-a-service providers or new leasing models that Enpal or 1KOMMA5°, for example, are implementing. What type of financing do you think has the best chance of success when you look to the future?

Interviewee 3: Yes. Yes, well. Somehow there is a mix, because so those who are in the consumer area who now have time and money to deal with it, they would probably build such a system on the roof themselves, have it built and that would be the most attractive financially for them. But there are also enough people who don't think like it. But they say OK, maybe I have a roof here, I want someone else to do it all and of course that's attractive to them. If

someone then comes and says, in the case and here, I'll build everything for you there and offer. Then offer the slightly cheaper electricity price. Yes, so yes, which one will be the biggest now.

Pia: So also simply that the models can continue to exist in parallel because they appeal to different customer segments.

Interviewee 3: Yes, yes, exactly. So, I don't know which will end up with the largest volume. If I had to guess now, it could be the PPA in the long term. Large ground-mounted systems are being built that sell the electricity directly.

Pia: You can see that in the B2C sector, the product range is being expanded more and more, for example to include wallboxes or other energy solutions. Do you have an opinion on how the market could develop further or whether this trend will continue? Is it currently working? Just your perspective on it.

Interviewee 3: Yes, I do believe that it will continue to develop. Keyword sector coupling: more and more is being electrified, whether it's mobility or heat generation using heat pumps - which perhaps wasn't such an issue in the past. There was just the PV system, and everything else was rather uninteresting. Electric cars didn't play a role, and neither did heat pumps. Back then, it wasn't really worthwhile for companies to invest energy in these areas. But now that it's all becoming more and more relevant, it's definitely interesting. You also have to say that the larger players or the big energy suppliers that now offer such solutions have to reinvent themselves to a certain extent. Their old business model - producing electricity and selling it to customers - will only work partially or not at all if customers suddenly produce their own electricity. It is therefore interesting that these companies, with their market expertise and reach, have to develop new business models. I therefore believe that the trend will increasingly be towards an all-round carefree package. You get everything from one supplier. Does that fit?

Pia: Yes, let me come back to the energy suppliers. How do you see them adapting so far? So have they made this change from OK, now the customers are generating their own energy, have they implemented this well, how, yes, how are they currently doing?

Interviewee 3: Yes, I have the impression that they have recognized this in the meantime, maybe they overslept a bit at the beginning or didn't take it seriously, but now everyone has their own offer. As they somehow try to do customers who then want to have a PV system to be able to offer, but I would say that is the case, there are also access points or channels. So if someone established comes along, I think they can also reach people who might be. Yes, those who think that way. Ah, I've always been with E.ON and I've always gotten electricity there. I'm happy with it and I'm happy when they give me that, so they do believe that they also have ways and they simply have a lot of big customers and can then reach them in a completely different way to reach people.

Pia: Yes, great. I'm just looking at my questionnaire again and I see that we actually already discussed the lower questions at the beginning. So I'd like to round things off at this point and end the interview, unless you have any last words? Otherwise, I'll stop the whole thing here.

Interviewee 3: Let me think for a moment... One topic that we haven't even touched on is energy sharing, for example. There are now new ways of doing this, which are also being promoted by the German government. These should actually have been implemented a long time ago because there are EU regulations that are intended to make the sharing, use and consumption of electricity from renewable energies more attractive - which also affects the solar industry. The EU is putting pressure on this and I believe that new concepts such as these can provide additional impetus for development.

Pia: Yes, but will it continue to exist in parallel with the already established one or replace it completely?

Interviewee 3: I think more in parallel. These are then offers for. People who perhaps previously lived in rented accommodation or still live in rented accommodation, who previously couldn't somehow produce and consume electricity themselves. Produce and consume. And now they have a new perspective. So that will.

Pia: Yes, so do you see the biggest barrier for these metastream models on the regulatory side?

Interviewee 3: Definitely. Yes, quite clearly. A lot still needs to be simplified.

Pia: Great. So from my point of view, I think that's it. Jan, then we got through the questions here really quickly. Thank you very much. Ih Stop the recording here.

Table 10: Interviewee 4: Chief Product Officer Enpal

Interview Settings Interviewee 4

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
4	Solar installer	>3,000	Strategy Consulting	CPO	8 Years	Berlin

Date	25th of October 2024
Time	13:10
Location	Microsoft Teams
Duration	30:09 minutes
Interviewer	Hendrik Luessem
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee is agreed to mentioning his name, position, and company.

Hendrik: I've started the recording now. First of all, thank you for taking the time. Can you please introduce yourself and tell us why you are an expert in the B2C solar market in Germany?

Interviewee 4:Yes, I'd be happy to. My name is Benjamin Merle, I've been on the management board at Enpal for almost five years and have always been responsible for our core product in various roles. Ultimately, our core product is the sum of services that go to the customer. This includes classic hardware topics, software solutions, financing services and insurance products. Officially, I am the Chief Product Officer and therefore responsible for these topics.

Hendrik: Thank you. How would you describe the development of the German B2C solar market, especially over the last five years and the development at Enpal? In particular, how have the business models changed or evolved?

Interviewee 4:I think it makes sense to go back a little further. The B2C solar market in Germany actually came about with the EEG, which was launched in the late 1990s and early 2000s. The EEG is the overarching law for promoting renewable energies in Germany, in which the fixed feed-in tariff was established as a subsidy to bring renewable energies to market. The law was a mixture of environmental and industrial policy approaches, with the aim of establishing solar and wind energy as well as the manufacturing industry in Germany and Europe. In the early phases, from around 2000 to 2005 or 2006, the market was strongly

influenced by the feed-in business case. People, often homeowners, saw it as a good investment case, not so much out of environmental awareness as because of high feed-in tariffs. At that time, most of the electricity was not consumed by the owners themselves, and almost all of them were purchasing customers – wealthy early movers interested in the energy transition. At that time, the modules mostly still came from Germany, without storage, heat pumps or e-cars. However, around 2008 the market collapsed because the feed-in tariff was massively reduced overnight, partly in response to the financial crisis. This caused the market to shrink by about 70-80%, and the manufacturing industry was replaced by Chinese modules. This shows how much this market was initially driven purely by regulation. The second wave then came from around 2012 to 2016/2017. The falling prices for PV modules from China and the rising electricity prices in Germany led to a new business model that focused more on self-consumption. Although the feed-in was still relevant, the high electricity prices and cheaper hardware costs suddenly made self-consumption an attractive proposition. We are now in the third phase of this B2C market, and this phase is bringing a few new developments with it. One is the massive professionalization, particularly in financing, which we at Enpal are strongly promoting. In other markets, such as the automotive market, financing models have helped make products suitable for the mass market. There are many examples, such as VW Bank, which has standardized financing for cars. At Enpal, we have similar models, with rental and financing offers for solar installations, which facilitates access to the mass market. The second big topic is sector coupling. A solar system no longer only serves to feed into the grid or for personal consumption, but can also be used to charge an electric car or operate a heat pump. This makes the entire system more attractive, as different energy sectors in the household are being combined, and government subsidies are becoming increasingly irrelevant. The third theme in this new market phase is the opportunity to develop real technology – especially software technology that intelligently connects these decentralized units, such as customers with charging stations, storage units and heat pumps, to the energy market. In the first market phases, the systems simply fed into the grid blindly, without smart meters or control. This led to grid problems and low electricity prices at certain times. Today, the idea of the "virtual power plant" is emerging, in which these units are connected to a software layer to react to market incentives or regulation. There are price signals, e.g. through wholesale prices or variable grid fees, that can be used. If we really want to install solar panels, storage units, heat pumps and charging stations in every house, then the whole thing has to help the grid and not harm it. This also creates new business models for the end customer, because they not only have a "dumb" solar system, but a smart one that can even generate additional revenue for them. So the three big topics in this market phase are: the professionalization of financing in order to reach the mass market; sector coupling, which creates new synergies; and intelligent networking to create virtual power plants, which is necessary to integrate the energy system of the future and at the same time offers a great opportunity to develop new business models with end customers.

Hendrik: Thank you very much. You have talked a lot about the specifics of Enpal. If you had to briefly summarize how Enpal differs from other competitors in the market, how would you describe it?

Interviewee 4:I would say that Enpal is actually the only real one-stop shop on the market. We offer a complete package for electrification: solar panels, storage, charging stations, heat pumps, and smart meters – all integrated. In addition, we offer financing, service and insurance solutions, as well as an energy management system that is still in its infancy today, but will be increasingly networked with the energy market in the future and can thus generate additional revenue – something that a tradesman around the corner cannot offer. I believe that this makes us currently the only provider that actually acts as a comprehensive one-stop shop. If you look

at the market, you see very different competitors. There are local tradespeople who work as installers. They have efficient cost structures and are dangerous competitors because they are very familiar with the hardware. At the same time, however, they do not do anything in the area of hardware and software development or financing products – the three important areas I mentioned earlier: financing solutions, sector coupling and virtual power plants. These craftsmen are difficult competitors at the moment, but if you look at 2030, I see them more as partners than competitors. The second group are the traditional utilities. You can see that E.ON is trying to do similar things. EWE has also tried, but failed and pulled out. ENBW has taken over two or three companies in this area, but they have not succeeded either and have had to stop their efforts. So there are large corporations with a lot of money that want to enter the market, but they are not very successful. The third group are companies that are also trying to become one-stop shops, such as 1KOMMA5° and solar, one of the largest providers in Germany. Zolar, Otovo and Svea were also in the running, although all three no longer exist or are struggling.

Hendrik: OK, thank you very much. You just mentioned partnerships, especially future partnerships with local companies. What do you currently see as important partnerships, particularly with regard to trade partners and, on the other hand, the hardware side and cooperation with producers? Where would you see the most important partnerships in the market, also with regard to the financing solutions offered by Enpal Financial Services?

Interviewee 4:Exactly, you have addressed various fields. Starting with the tradespeople: In the early years, we focused heavily on building up a lot of tradespeople internally because this was a bottleneck and it was the only way we could keep the quality and the entire customer journey under control. But we are increasingly seeing opportunities to also assign the product to certified tradespeople as our product matures. We are pursuing two concepts here: On the one hand, we have trade partners who simply build for us – we treat them almost like our own employees. On the other hand, we have launched Enpal Pro, a platform business in which we initially act as a wholesaler, i.e. as a hardware supplier for tradespeople. Step by step, we are weaving further services of our product into the platform. For example, Enpal Pro could offer grid connection, meter replacement, energy management systems and even financing solutions in the future, so that in 2030 tradespeople will no longer be competitors, but will install Enpal products and services as fulfillment partners. The second topic is hardware partnerships. Here we have built a strong supply chain in China, with our own local office there for five years. We work closely with module, inverter and battery manufacturers, 80-90% of whom are based in China. To achieve our goal of a virtual power plant and a networked home system, we rely on a few, but deep partnerships rather than on broad cooperation. Apple, for example, takes this to the extreme with Foxconn as its exclusive partner. We don't go to such extremes, but we do focus on two to three partners with whom we can work intensively on software integration. The third topic is financing. We do a lot of this in-house, while debt financing for the rental and financing models comes from large banks and capital providers on the world market.

Hendrik: Perfect. That fits very well, as we have talked about financing solutions and also Enpal Pro. What are the biggest revenue streams? Is it mainly the hardware product “solar including storage and wallbox”? What about the path to the heat pump? What are the main revenue streams and what are the main financing types you use – direct sale, leasing rate, etc.? If you can share that.

Interviewee 4:Well, we started with the rental model – originally, many years earlier, we had the purchase model. But we quickly realized that financing products were necessary because

there was nothing good on the market. In 2018, we introduced the rental model, which was extremely valuable at the time because there was less trust and knowledge around solar products. People were worried about whether the hardware would last a long time or break. With the rental model, we were able to cover not only the issue of financing, but also concerns about hardware lifespan and service costs – it was exactly the right product for the market. About a year and a half ago, we started building a financing product as a new pillar. The advantage of this product is the flexibility for the customer: the customer can choose the term themselves, whether they want to pay off in three years or in 25 years, and they don't have to book the complete service package, as is necessary with a rental. We see that the financing product is extremely well received and is now our dominant product – over half of our customers use the financing product. The share of customers who actually buy is below 20% for us. It's hard to say whether this is representative of the market.

Hendrik: Moving on to the customer group: renting was cheaper and appealed to a specific group. To what extent have the customer groups changed as a result of the financing products? How would you describe the most important customer group in the market?

Interviewee 4:Well, the market has now developed and is no longer a market for “rich dentists” or “green hippies” who want to contribute to the energy transition. The market has become a mass market and is similarly distributed across Germany. Our customers come from all income levels, house sizes and age groups, although the average age tends to be higher due to the single-family home owners, mostly in their 50s to 70s. Our products must therefore be suitable for the mass market. I find the comparison with the Volkswagen Golf interesting – Volkswagen has managed to develop a car that appeals to both wealthy and average earners, with many variations and financing options.

Hendrik: And what are the best channels for reaching these customers? You originally started with video sales.

Interviewee 4:Exactly, our standard channel remains the online channel, i.e. performance marketing and video sales. However, we are increasingly expanding to field sales and offline marketing. Partnerships are also becoming more interesting, as there are already other sales teams for similar products, such as e-cars or heat pumps. Therefore, I see great potential in sales partnerships. Our three main channels are online, field sales and partnerships, with online remaining the most important channel for us.

Hendrik:
OK, thank you very much. You mentioned the key activities at the moment and drew a comparison with the Golf. What is currently the most important activity for the product, and where do you see the greatest potential for investment?

Interviewee 4:I think you can divide it up by time horizon. For the next 6 to 12 months, the two most important topics with a direct business impact are: firstly, the connection with the heat pump, as this market is currently booming. We see a great willingness to buy both PV systems and heat pumps at the same time or in quick succession. Creating a good journey and fulfillment for both products is a high priority – that's the sector coupling we talked about earlier. The topic of e-cars is currently less relevant than it was two years ago, as subsidies have decreased and the boom has lost some of its momentum. For the next 9 to 18 months, the topic “Virtual Power Plant” is the most important. We already have our first version live, but it needs to be further expanded. Currently, we are between “crawling” and “walking”, and it will take until the end

of the year before we can really “run”. VPP is the topic with the greatest potential and the highest investment needs, especially in the areas of smart metering, IoT and our AI-driven marketing and aggregation platform. However, it will take about another 12 months before we see this in the profit and loss statement.

Hendrik: You mentioned costs. What are the biggest cost drivers at the moment and where is there potential for savings? Especially compared to local craft businesses, which have a more efficient cost structure.

Interviewee 4:Savings potential is a sensitive topic, and I don't want to comment on it in too much detail. Our largest cost pools are customer acquisition, hardware, fulfillment, technology investments and general overhead. Competition has driven up customer acquisition costs this year. It is therefore important to strengthen our sales channels, online, field, partners, and our unique selling points in sector coupling and VPP. Hardware and fulfillment costs also need to be further managed down.

Hendrik: The market is currently under a lot of pressure. What do you think are the biggest regulatory, political or technological barriers that are complicating the market environment?

Interviewee 4:In terms of regulation, there are many obstacles to intelligent control and networking in the energy market and in the Virtual Power Plant. The federal system with around 800-900 grid operators makes processes such as registration and balancing extremely difficult. It's a bit like working with 800-900 sleepy offices. Barriers must be removed to make this networking case fly and the solar case more profitable. Technologically, I see hurdles in the standardization around bidirectional charging, where standards between car OEMs, wallboxes, smart meters and grid operators have to be aligned. Progress is being made here, but the market could be much further along – bidirectional charging could be a game changer. On the market side, one must not forget the influence of interest rates. Interest rates were significantly higher last year, which influences the business model, and this needs to be monitored further.

Hendrik: And as a final question: What would you recommend to companies that are currently active in the solar market? What recommendations do you have for their business models?

Interviewee 4:We are currently seeing a consolidation in the market. In my opinion, young companies that now want to build a similar model to 1KOMMA5° or Enpal are coming relatively late and will have a hard time gaining a competitive advantage. Every market player should now check where they stand in the landscape and where their strengths lie – whether they are well positioned locally, have an efficient cost structure or offer technological and product advantages. The most important thing is to emerge from the consolidation phase stronger or at least to survive and not to end up realizing that only a few players and a few local providers are left, while you are caught in the “squeeze the middle” and have to file for bankruptcy. It's an exciting phase, as in many markets.

Hendrik: Thank you very much for your time.

Interviewee 4:My pleasure!

Table 11: Interviewee 5: Founder of LumixSolar

Interview Settings Interviewee 5

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
5	Solar installer	<50	Management Consulting	Founder & CEO	2 Years	Mannheim

Date	28th of October 2024
Time	12:30
Location	Microsoft Teams
Duration	25:31 minutes
Interviewer	Amelie Blucke
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee is agreed to mentioning his name, position, and company.

Amelie: Then let's just get straight into it, to start with, could you briefly introduce yourself and describe why you are an expert in this field?

Interviewee 5:Sure, I'm Oskar, I'm one of the founders of Lumix Solar. We were founded two and a half years ago, here in Mannheim, and we basically do everything to do with photovoltaic solutions, so we started with classic PV systems for private customers, in combination of course with battery storage systems with wallboxes, charging solutions and so on. And now, since this year, we have also been doing large-scale projects, where there is simply more range, more market and we actually offer everything you can imagine. At the moment, we are just under 25 people without craftsmen, they are all external.

Amelie: Great, thank you. Then I'd like to dive straight into the market development and the business models, namely which market trends do you think are having a major impact on the solar market at the moment?

Interviewee 5:The biggest influencing factor at the moment is inhibitor systems, i.e. home energy management systems. They basically ensure that PV systems become smart, if you can put it that way, so up to now it was always the case that you had your modules on the roof, when things were going well you had a storage unit in the basement and then electricity was generated when the sun was shining and when the sun wasn't shining, electricity was drawn from the battery or purchased from the grid. This system was not very intelligent and now there

is a new development, so to speak. There are third-party providers who have control boxes that can be installed, which then analyze various data, which are partly AI-controlled, create consumption profiles of the customers, which are linked to the electricity exchange, then carry out a kind of small-scale trading on the exchange in connection with dynamic electricity tariffs and are a bit like the brain of a PV system, which means that these systems simply pay for themselves much faster. The savings that the customer has or the return is simply much greater than it used to be.

Amelie: And if we look at your company specifically, what do you think are the most important factors of the business models or the business model that determine the success of the company in the B2C solar market?

Interviewee 5:Well, I think what we're doing well is that we've found a niche in which we can position ourselves quite well. In principle, the market is divided up in such a way that on the one hand there are really big players that everyone knows, like 1KOMMA5 or something like that, and then you have lots and lots of small players, such as the electrician around the corner, the roofer around the corner, the heating engineer around the corner. In every village there are 5 to 10 people who also have PV on their cars. Exactly and both have their advantages and disadvantages and what we do is basically to be the link between these two extremes and to combine the best of both worlds. By being regional and personal, but still having the professionalism of a big player and being able to offer the right products and prices.

Amelie: Okay, so we've also looked a lot at financing options as part of the thesis. I don't know if you could perhaps say a bit more about this, i.e. what types of financing do you offer? Or do you have a certain type of financing that perhaps differentiates you a little from other business models or other companies in this field?

Interviewee 5:Yes, we have a completely flexible financing solution, where the customer can choose between, I think 25-year terms. They can say that they want to make a down payment. They can make special repayments free of charge at any time within this financing or even pay off the loan completely, so we offer maximum flexibility. The interest rates for such financing solutions are of course a little higher than if you do it with your bank, that's clear, but you simply have the flexibility, and it works quite well.

Amelie: You just mentioned customers again, is there a particular customer group that is currently coming to the fore in the B2C market?

Interviewee 5:Yes, what you notice is that the majority of people who are hot on the topic of PV now have a PV system. These are the people who did it in 2022/23 when the market was booming. And now? Well, the demand is still there, but the people now are more of these latecomers who are somehow doing it either because their neighbor did it too, because it's more or less part of good manners. If you have a house or because you want to look at the money and of course you notice that in the sales process and you rarely have people sitting opposite you who are really keen on the subject, that has simply changed. Most people want to be really convinced.

Amelie: OK, so maybe that has something to do with peer pressure, because you said that maybe some people only do it because they see it in their neighbor's house and then let themselves be led?

Interviewee 5:Yes, of course. Well, the prototypical German already has an issue with their house and their car, and if their neighbor somehow gets a PV system on their roof, then of course there's a certain amount of pressure, you can tell.

Amelie: OK and can you say something else about whether the expectations of customers in this area have perhaps changed a little?

Interviewee 5:Yes, of course, there's a lot more competition now than there was three years ago and the expectations of customers are very, very high because most of them don't do it for idealistic reasons, but rather for financial reasons, and they're getting higher and higher. In other words, it has to be the perfect project process, the cheapest prices, it needs the best components and it somehow needs the fastest implementation, and the expectations are pretty aggressive and you can tell that people are very unrelaxed when something doesn't work out the way they imagined it would. Not even if it somehow goes wrong, but simply if it deviates from the customer's expectations, then they get pretty uncomfortable pretty quickly and of course that's also because they are confronted with a flood of alternatives when they get an offer from us, without having to do any in-depth research, they can get 10 offers from competitors, and if they end up choosing us, then of course they always have this subconscious expectation of "I've chosen you now, so you have to do it exactly the way I want it, because I still had 10 alternatives".

Amelie: Mhm yes, and a bit more in the sales area, what do you think?

which sales channels are proving to be particularly effective? You were just talking about the neighbors, are there any other more important sales channels? Which ones have proven to be particularly important or effective for you?

Interviewee 5:Well, the most effective sales channel is clearly still the referral business. That is simply the most valuable. But that alone isn't enough for a long time, so you're currently in a time where you can't reach your goal if you only have one sales channel or one lead channel, so in principle, depending on how large your area of influence is, and ours is relatively large because we are regional. In principle, you have to use all channels, so you have to have a strong referral business, you have to have a very, very strong online presence, both Google Ads and Meta Ads, i.e. social media, you also have to have a strong offline presence, so you have to be present at trade fairs, door to door, if it is necessary in any way. So it's important that you build up a certain brand in your sphere of influence and you have to be able to create a touchpoint everywhere.

Amelie: Based on this, which activities or resources should companies prioritize in order to remain successful in the market in the long term?

Interviewee 5:Yes, well, that's a bit difficult to say, because there are a lot of insolvencies at the moment. That's why it's difficult to say what you should do to survive in the long term, because at the moment nobody is really managing that, not even the big companies. Differentiation is important, so you have to somehow manage to make people perceive you differently from the competition. For example, 1KOMMA5° has done this very well, they basically do the same as everyone else, but they always have a special position because they position themselves differently on the marketing side and then also in the sales process. That means differentiation is pretty important, I think, and of course you have to be able to adapt extremely quickly to new market environments.

So, you always have to have the latest product, you always have to have the best modules, you always have to have the latest software. You always have to have the usual prices on the market and so on, you have to have a very good overview of what the competition is doing in order to be able to assess what will go down well with customers.

Amelie: Mhm, OK, thank you very much, then something else on the subject of key partnerships, and in our research we kept coming across the fact that there are more and more

types of partnerships, for example with technology providers or installers. Do you think that this is also playing an increasingly important role in the B2C solar market?

Interviewee 5:Yes, definitely, so you notice that the big players, especially 1KOMMA5° , naturally have a lot of resources in-house that smaller companies like us don't have at all. This means that we can't do certain things ourselves that we can do in-house, such as app development. 1KOMMA5° somehow makes its own app, we can't do that ourselves, which means we have to rely on somehow finding a partner who can provide us with a system where we can label an app, for example, and it's the same with financing, so Enpal has its own financing company, we do it with a partner and it's definitely a key point that we are well networked. On the one hand, in order to be able to create a reasonable offer, which you might not be able to do otherwise. On the other hand, it's also important to generate leads, so we also notice that the majority of our leads come via our partner network, i.e. we have energy consultants, heating engineers and so on and immediately all the people who are basically in contact with our target group but don't offer PV systems themselves, or insurance brokers, for example, and who can then basically place us there with their customers and we can make sales through them. Partnerships are also super important for this.

Amelie: Mhm, and building on that, the cost structure is of course very important, perhaps especially for smaller companies. What factors are currently influencing the cost structure in the B2C sector in particular?

Interviewee 5:Yes, so last week or the week before last a huge player went bankrupt, Megatech, and they had over €5000000 in personnel costs in their balance sheet. So, you can see why they went bankrupt. So that's a huge problem. There have been two approaches in the market so far, so as far as personnel is concerned, there are companies that say we attach importance to doing everything from a single source. We have all the roofers in-house, we have all the electricians in-house, we only have one fire that the customer has contact with. On the one hand, this has a great advantage, but on the other hand it also has the disadvantage that if the market collapses, you still have the fixed costs. The other option is to do it the way we do, by saying that we have external partner companies that we can call on as required, which may be a little more expensive if there is a lot to do, but in principle there are no cost problems. And that's something that has definitely saved us, so the decision to do it this way has definitely saved us, when I think that we would somehow have such high personnel costs or even just €100,000,000 in personnel costs. That just won't work, it's just too much and that's why I think it's really important to have this part under control, because that's the part with the highest fixed costs.

Amelie: Great, thank you very much, just a quick look into the future, what do you think are the decisive factors for growth in the future or what do you think are the challenges that are currently emerging in the industry? Let's take a look into the future.

Interviewee 5:Yes, well, I think one of the biggest challenges is getting through this consolidation phase, which we've been in for quite a long time now, for about a year, and we keep hearing that it will soon be over, it will soon be over, but somehow, it's not over. So it's not getting any better, the prices just aren't rising. Prices are extremely low at the moment and there is a lot of competition. As a result, the barriers to market entry are relatively low and so on. And we have to get out of this situation at some point, but it's somehow taking longer than expected and of course costs an incredible amount of money. That's one part, I think the other part, which will be extremely relevant in the future, is the ability to adapt your sales pitch, that's what we're actually struggling with, especially in the last few months, because we have a sales team here that all more or less come from the industry and have been doing this for a while. And they all have a certain way of selling PV systems and that has always worked, but now we

find ourselves in a situation where it no longer works because the overall range has changed so much that the sales have to change too. So it's no longer about somehow selling the customer that we can now screw the best module onto the roof or that we can deliver particularly quickly, but it's about explaining to the customer in principle that with us he gets a fully integrated system that saves him so and so much money per month and ideally he finances it, which is then cheaper. In terms of current electricity costs, it's a win-win situation for him and you have to have all these issues that play into these savings, i.e. dynamic electricity tariffs, reduced grid charges and so on, on your radar and you have to be able to articulate and present them properly so that customers understand them, because that's the only way you can get financing and then sell systems in the long term or stand out from the competition, if you can't do that, then you won't survive in this market in the long term in my opinion. Because it just doesn't make sense to buy a traditional PV system.

Amelie: Yes, so as you said, it's not just about the solar system on the roof, but also about the whole service around it.

Interviewee 5:Yes, exactly.

Table 12: Interviewee 6: 1KOMMA5°

Interview Settings Interviewee 6

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
6	Solar installer	>2,000	Operations Manager	Business Develop-ment Manager	2 Years	Hamburg

Date	29th of October 2024
Time	10:00
Location	Microsoft Teams
Duration	29:33 minutes
Interviewer	Amelie Blucke
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session. The interviewee is agreed to mentioning his name, position, and company.

Amelie: Could you start by introducing yourself and briefly explaining why you are an expert in this field.

Interviewee 6:I've been at 1KOMMA5° for almost two years now and previously studied in Lisbon, but mainly did my Master's in Denmark, in Aarhus in innovation management and business development, and then slipped into the solar industry and am responsible for our software landscape, which means I'm not an expert in the field of hardware as far as solar is concerned, but I am an expert in the field of our software development, which we also have in-house, but also in the customization and individualization of software for CM systems customization of software for CM systems. Because I am involved in every process step at 1KOMMA5°, which also has software, I have an insight into every area, which means that I am involved in running marketing campaigns, that we have a setup, that we can address customers via our website via e-mails and so on, but then also in the sales area, in the operations area and then also up to invoicing, i.e. also as far as the software for invoicing is concerned, so I am more or less deeply involved everywhere. And that's why I have a good overview of all areas. However, I don't have a special focus on sales or operations, but a certain basic depth.

Amelie: Thank you very much, I would like to start with the market development before we look a little deeper into the business models. What market trends do you think are having a big impact on the solar market right now?

Interviewee 6:Well, what we noticed, of course, was Covid, so that was a huge factor. That means you could sell solar differently in 2022 than you can now. That means, of course, you have significantly greater competition now and simply more players on the market. But you can also see now that there is a shift towards heat, i.e. towards heat pumps. But it's still not at a level where you can say that you've somehow achieved the heat expansion target or the targets or goals that have been set or by the federal government, so it's still a difficult environment. Nevertheless, we are noticing that heat pumps in particular are picking up and solar is becoming increasingly competitive. But we also clearly notice that we, as 1KOMMA5°, were in the right place at the right time and that by creating the 1KOMMA5° brand, we are already gaining market share every day, every month in all areas and are actually bucking the trend a little.

Amelie: You just said that you were in the right place at the right time. Now looking a little more at the business model, what would you say is one factor that has differentiated 1KOMMA5° in particular, for example with special financing or special offers or something like that, can you say something about that?

Interviewee 6:Exactly, so of course we have several factors. On the one hand, it's simply about the hardware, i.e. we are also a manufacturer of solar modules, now also relatively new for inverters or for storage wallboxes. On the one hand, we pay attention to ethically correct production, so to speak, and on the other hand, we were also the first to launch an energy management system on the market in terms of software. This really allows the various hardware components to communicate with each other, not just from our own manufacturers, but from components on the market in general. That we really consume when there is energy in the system, when the solar system is producing and that is linked to the dynamic electricity tariff, where we are again the first to have brought a dynamic electricity tariff to the market and that is a thick plank that we have to drill here, that we can really trade electricity on the stock market, That is, if you combine the right hardware that communicates properly with each other and then get the input for the weather forecast, for example, through the energy management system and then have a dynamic electricity tariff that buys when the electricity price is low. But maybe if you then say you can control your consumption according to that and if you say I don't need electricity right now or I can shift it so that I don't have my own consumption right now but it's somehow 6pm in the evening and everyone else needs electricity, that I can then connect from my system to the grid, and that is ultimately 3 components, so we have the hardware, we have the software and we simply have the application to the electricity market.
Amelie: Perfect, thank you, and then a little more from the customer's perspective; is there a particular customer group that is currently coming to the fore in the B2C market, or has something changed in recent years?

Interviewee 6:That's more based on my perception, relatively subjective, so of course I know that the customer segment is generally between 50 and probably 65 years old, mainly men. The question is whether this is, so to speak, against the shift that you might have anyway, but that of course we probably have more women now and also younger people than 10 years ago.
I can imagine that, but as I said, I don't have any company data to prove that we are now experiencing a demographic shift in terms of customers, but as I said, as a rule they are male 50 to 65, I would say roughly.

Amelie: And would you say that with this increasing competition or the greater number of providers, customers' expectations have also changed a little?

Interviewee 6:Yes, the main positive effect for customers is that they can of course make better comparisons. Customers can now compare prices, but of course they can also compare quality. That means, of course, that we also have companies on the market that have used the Covid period and have now, of course, subsequently built up structures where they can no longer be price-competitive, which means they have to charge prices or then charge prices that ensure that they can no longer actually participate in the market. This means that the customer is in a good position right now, i.e. you have, let's say, low prices, you have better and better quality because the companies are naturally also getting better. The fitters in the entire field of PV, but also heat pumps, are of course getting even better and the locations or the companies are also building up this expertise, so I think the customers, if you think about it, 20 years ago there was no website for solar data. Back then it wasn't an issue at all, you could just ask your electrician to help you when you bought the modules or you had local suppliers, of course, but you didn't really have any comparability. And now, if you can somehow compare 10 people, 10 companies or 10 firms online and look at Trustpilot, for example, and look at the prices and the components, you have a completely different information base.

Amelie: Thank you and then also looking a little bit at the sales area; what do you think are the most important sales channels or do you have any insights into what is most successful for you or has proven to be successful?

Interviewee 6:Yes, exactly, so of course referral business is always the best - you don't pay any fees and in the end these are potential customers who have already been convinced. I think we are very strong in communicating our brand. That means, I would say, that we generate attention through the media via articles about what we do, whether it's something from the Handelsblatt or in other media, podcasts and so on, you can really tell, but of course we also started a few months ago before the Tagesschau, for example, the first 1KOMMA5° commercials were shown and that is of course a big deal, for many Germans you've made it if you've somehow managed to be shown before the Tagesschau. And of course that's also a medium that we keep an eye on, but usually it's really recommendations and simply free publicity, i.e. articles and somehow also showing what we do on social media. We pay for adds, so to speak, and we also sometimes have a presence on comparison portals or similar. But a lot also comes from our own website, so we get customers to the website through what we do.

Amelie: Then we briefly touched on the market trends at the beginning. Now more from a cost perspective; what do you think are the factors that currently influence the cost structure of solar companies the most? Or is there something to watch out for right now?

Interviewee 6:Yes, so hardware is getting cheaper and cheaper, I'd say, which means that the production of modules, PV modules and storage systems, i.e. batteries, is getting cheaper and cheaper. This means that it is of course becoming increasingly difficult to build up capacity in terms of fitters and electrics. And of course we're not the only ones, but in general we have a shortage of skilled workers, and we're no different from other large craft businesses, I'd say, because in the end there are craft businesses scattered all over Germany, and we centralize some things, But if there's a shortage of electricians in Munich, we can't send one down from Hamburg to simply move there, of course, but the region itself is responsible for building up its own workforce, and we, like everyone else, have great difficulties in this area. Of course, the brand that we have also helps here, i.e. the fact that a working student or intern who might not

previously have come to a company already has a different platform. In terms of costs, we naturally have this pressure in the market that we have many competitors and some of them are of course of poorer quality, with poorer hardware and poorer installation quality. It's still the case that people let us work on their roofs, and if you do something wrong, you end up with a leaky roof or water damage or something similar, so it's important that you don't just compare prices, but also make sure that a company is structured or set up in such a way that it can fulfill the guarantee that is given and isn't somehow no longer on the market in two years. That's why we ultimately have a lot of pressure on prices, of course simply because of the competition due to falling prices in the hardware segment, but of course we also have personnel, or rather the biggest block, the personnel costs are simply there. The more participants we have, the more demand we have for leads, so to speak, the more we have to invest.

Amelie: Great, thank you. Now you've almost answered a bit of my next question, which would have been what you think the challenges or barriers will be in the future, i.e. the shortage of skilled workers was definitely a big keyword and, of course, the huge competition and rivalry. Do you have anything else to add, looking into the future?

Interviewee 6:Yes, of course we are always a bit driven by politics, that plays a role of course, so last year, for example, we had a subsidy, which of course sounds quite cool at first, but at the moment after that the market is distorted and then we suddenly have, I don't even remember exactly how much it was at the time, which was then first distributed and then of course everyone on the market sold again. In other words, this helps those who would otherwise no longer be able to cope and not necessarily those who already have a good offer and a good price-performance ratio. In other words, there's always the possibility that something will happen that you can't foresee or that there will be a change of government or simply that energy policy will change or that someone will come around the corner with subsidies in one direction or another, so of course that's always a big unknown. But we're not exclusive in this respect either, we're not exclusive in this respect either, this also applies to many industries, to many sectors, which means that we naturally have the component and of course what is still part of the truth is that hardware mainly comes from China and we naturally also have a geographical bottle-neck, so if there are difficulties in whatever form, whether it's a cargo ship that gets in the way or there are simply geopolitical issues, then of course we are always quickly affected. So the times when you're now building up large stocks and putting a lot of goods on top, that's no longer being done or is also becoming less, because of course there are costs involved and above all, if hardware prices tend to move south, i.e. go down, you naturally want to have 2-year-old module editions now. So of course you always have to consider this China component.

Amelie: Then last question, do you have any specific recommendations or what do you think are the most important factors for companies in the B2C solar market to remain competitive and secure their market position in the long term?

Interviewee 6:So what's really important is that you can no longer go and say I'm going to put a module on the roof here. So we call it a bit of an old and new show, so this I'll do it and maybe you'll get a storage unit, that won't be enough anymore. So you really need intelligent networking, which in our case is the heartbeat AI and the energy management system, which really allows the systems to communicate with each other via a connection to the electricity market, so that you can really let your consumption follow the market. This means that not everyone who comes home at 6 p.m. plugs their electric car into the socket and suddenly everyone needs electricity, but that you say I need my car charged tomorrow morning at 6 a.m. and then it's enough for me if it's 80% charged and then the wind that comes in at night on the

North Sea can ensure that you can charge your car for almost nothing or at negative prices. So it's a bit of a simple story that without such an offer, I don't think you have any options in the short term. Ultimately, the software is getting bigger and bigger and is also becoming more and more relevant for us.

Table 13: Interviewee 7: CEO Solaro PV

Interview Settings Interviewee 7

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
7	Solar installer	25	Engineering	CEO	7 Years	Berlin

Date	1st of November 2024
Time	10:45
Location	Microsoft Teams
Duration	31:46 minutes
Interviewer	Hendrik Luessem
Original language	German
Face to face / online	Online
Received questions in advance	No
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session.

Hendrik: I have now started the camera recording, so could you briefly introduce yourself and tell us why you are an expert in the solar sector in Germany, especially in the B2C market.

Interviewee 7:I'm Florian Scholz, Managing Director of Solaro PV Berlin GmbH, and I've been working in the solar sector since 2017. I originally studied electrical engineering at Siemens and we have been self-employed with Solaro PV for almost two and a half years. We build around 500 to 700 photovoltaic systems a year for single-family homes.

Hendrik: And you've been through quite a lot in that time, especially, let me say, in times of great competitive pressure on the market. How would you describe the development in general and especially in recent years in the solar market? How have the business models developed?

Interviewee 7:Basically, when I started building photovoltaic systems in 2017, very few people were really familiar with them. Back then, you still had to explain to people how it worked, which is no longer necessary today. Today, everyone makes a video appointment, which was much more difficult back then. On the other hand, the technology wasn't that advanced either; we really didn't have the best systems back then. Prices have also fallen dramatically since then, and today we can offer customers a better solution. At the same time, I can see that as a rather small, medium-sized company with just under 25 people, we are of course now feeling the effects of the big players, especially as a result of the Ukraine crisis. Many people already had the idea of building a photovoltaic system, and this “Black Swan Event” has led many to anticipate this decision. That's why there was this extreme hype and many systems were built. At the same time, there was a certain amount of uncertainty, energy prices were extremely high

and many people wanted to produce their own energy. Now interest is flattening out again and we have far fewer inquiries than before the war in Ukraine. There was an extreme high and now an extreme low, and I think that will continue next year. In this hype phase, when there is extreme demand for PV, many companies come out of the ground wanting to be part of the "gold rush". The market is now being sounded out and many are being weeded out again, which is a good thing. We hope that this process will continue in 2025 and that more security and stability will return afterwards. Less of these hype cycles and more consistency, which the market urgently needs.

Hendrik: What you just mentioned regarding the channels. Do you only have video sales or what other customer sources do you have? You also mentioned the lead costs, which have gone up or fewer customers contacting you. How have you dealt with this, or what is working particularly well at the moment?

Interviewee 7:Yes, what works particularly well are the referral chains. We pay a lot of attention to reviews, to our online reviews - you can take a look there. It's important to us that they are all honest opinions and that people rate us after their experience with us. We are a relatively young team, many young people work here, which is quite a change, especially in the trade sector. This works extremely well and has meant that we have to buy in far fewer leads than we did a year and a half ago. Back then, we still had to buy in a lot of leads because the demand was so high and we couldn't rely on recommendations. Another thing that works very well: We don't just do video calls, but also on-site appointments. That creates trust with the customer. We talk to them personally, which I think is a shame with a lot of big companies that don't put much emphasis on that. Most people, like you and me, may just have the opportunity to buy a house and will be working for it for the rest of our lives. People don't just want to be put through a video call funnel with three student workers. They want to know exactly how the roof is opened, how it is closed again, how the cables are laid and what exactly is being done. We explain this to them as well as possible during an on-site appointment.

Hendrik: One more question: do you only work around Berlin and Hamburg, or what is your local presence?

Interviewee 7:Exactly, we are very local and will remain in this area. In terms of location, we serve everything within a radius of about 75 kilometers.

Hendrik: Maybe also in general terms: You are a very local player. What makes you special, apart from the personal contact, the expertise of the employees and the young people? What is your value proposition, your USP?

Interviewee 7:Our USP is that, compared to many others, we have set up the company with a very strong focus on electrical engineering. Me and Tim, who does it in Hamburg, are both master electricians, and that brings a lot of expertise to the company. A typical photovoltaic company often has a roof team and then an electrician who connects the whole thing up. With us, it's the other way around: we have five electrical teams and a roof team. We do the rest with subcontractors. Another big advantage is that we are manufacturer-independent. We don't have to sell anything in particular and can offer truly individual solutions. Many providers only have three predefined packages; with us, on the other hand, there is individual advice and a solution that is really tailored to the customer's needs. This means that we can build fewer systems, but the quality and accuracy of fit are higher.

Hendrik: Do you also offer an energy management system in your product portfolio, apart from the standard products such as battery storage, PV and wallbox?

Interviewee 7:Yes, we actually come from the field of building automation and also offer this. We don't develop everything from scratch, but integrate existing solutions on the market. Inverter manufacturers are also waiting in the wings with their own EMS solutions, and European manufacturers in particular are far ahead. Many functions can already be integrated and will probably be available next year.

Hendrik: And how can customers purchase this from you? Do you only offer direct purchase or are there other financing options? The big players often have more options.

Interviewee 7:Around 95% of customers buy directly from us. For the remaining 5%, we offer financing options, for example via the inverter manufacturers or other partners. We work together with Zolar, who provide financing solutions for small and medium-sized companies like us.

Hendrik: And how important is a partnership with existing major players? Enpal also offers various services, such as Solar and Heartbeat, as you mentioned. Is that becoming increasingly important?

Interviewee 7:Yes, I would say it has been extremely important for us over the past two years. At the moment, however, we are also seeing waves of redundancies at Zolar and Enpal - Zolar has laid off 70% of its staff. I often ask myself whether the product “building PV systems” is as scalable as it is made out to be, or whether it only works with huge venture capital funds. The next five years will show whether it works or not. In comparison, medium-sized companies like us are often the biggest competitors to the big players and often build the better systems. The partnership with companies like Zolar has been extremely helpful for us, and without the orders from Zolar we would not have the number of employees we have today, which is around 25. But we are not 100% behind every product, especially if there is no manufacturer independence. This is a dilemma because it has also helped us to grow. At the moment, however, cooperation with other medium-sized partners is also very important to us, for example with roofers who need electrical engineering help from us and vice versa. Such partnerships are really fun and work well.

Hendrik: As far as scalability is concerned, photovoltaics is something we are also looking into. We are looking at the “Energy as a Service” model, where providers of pure photovoltaic systems become a one-stop store for energy. Customers can choose energy solutions for independence. Are you planning to develop in a similar way, or do you want to stay in the “solar, PV, home solar systems and storage” niche?

Interviewee 7:We don't see ourselves as the next competitor to Enpal or E.ON. We also don't want to develop our own products - we'll leave that to the big players. Instead, we'll stick to what we're good at: implementing complicated photovoltaic systems and AC projects. At the same time, as a medium-sized company we have to remain flexible and also look to the left and right. We live from what we generate today, without large financing rounds, so we have to be flexible in order to offer customers the best solution. For example, we are looking at whether we can integrate dynamic tariffs, but this is often not ideal, as when the electricity price is high, there is often no electricity coming from the PV system and customers tend to have to buy extra. But overall, we want to offer flexible solutions for the future, be it through EMS systems or cloud services, in order to be as prepared as possible. If we then say that dynamic tariffs could make sense for certain customers - for example with an electric car or a controllable heat pump - then we also advise accordingly. We approach the problems flexibly and advise our customers individually. Two years ago, we almost only did building automation and smart homes; now we mainly do photovoltaic systems. We are not ruling out the possibility that in two years' time

we will still only be building photovoltaic systems or offering complete solutions. We are open to the future.

Hendrik: Yes, you mentioned another interesting point. Your customer group is special in a way. The geographical origin and age of the customers are probably similar for many providers, but for you it's mainly about the houses. This means that you mainly build complicated electrical configurations for PV systems, where it is otherwise difficult and where other providers may also have had problems. Is that just your hobbyhorse, or do you theoretically also have an eye on the big picture?

Interviewee 7:Exactly, yes. Of course we have the big picture, but we don't categorically rule out complicated projects for the time being.

Hendrik: Moving on to the costs: many other providers don't build complicated systems because it may not be possible in terms of cost or efficiency. A question about this: Do you charge extra for these systems? Do you have a total price per system size? And the other thing: What are the most important cost blocks for you at the moment, especially with regard to consolidation and difficult market conditions?

Interviewee 7:Yes, with more complicated projects it is of course often the case that you need special substructures, which are then also somewhat more expensive and are reflected accordingly in the price. In general, we make sure to keep the “water head” - as they say - small. Everyone who works here has to earn money, and the money doesn't come from anywhere else. In other words, we manage with what we have and our distances are very short. It works really well because we are all here on site. For example, we have a 4-day week and everyone is here in the office every Friday to exchange ideas. Today, training courses are held to keep employees continuously trained and fit. This works very well for up to around 30 people; it would of course be difficult with 3,000 people. This reduces our costs because there are fewer misunderstandings and working time is used more efficiently. For example, we now have training for a microinverter manufacturer, which means that our people are prepared and fewer queries are necessary when they are confronted with problems. That is part of our philosophy, fewer meetings and more efficiency.

Hendrik: That means you value high efficiency and have a broad product portfolio. Do you source the products directly from the manufacturer or do you use wholesalers?

Interviewee 7:Everything goes through wholesalers, yes.

Hendrik: Good. Let's move on to the political sphere. There is always a lot going on in the solar market and there is often a lack of clarity. In your opinion, what is the biggest regulatory barrier for you as a medium-sized solar company? Or perhaps for the solar market in general, if that's easier for you to answer.

Interviewee 7: Yes, especially in the single-family home sector, I have to say that a lot has improved in terms of regulation in recent years. If I think back to 2017, you can see that many network operators now have online portals that you can use for registration. Sure, everything could run more smoothly, but compared to the past, it's a big step forward. As far as network registrations and the like are concerned, it works pretty well, at least in Berlin, where we operate. We have one of the most advanced network operators here. If you have a certain level of expertise, you can plan a lot of things together, including pilot projects such as tenant electricity. I think that's really positive, especially in view of the bureaucracy, and I have little criticism to make. In general, bureaucracy could of course be reduced further. I see a bigger problem in the funding programs that are constantly available. In my opinion, subsidies should

generally be discontinued. Photovoltaic systems don't need to be subsidized - they pay for themselves. It's not a product that needs subsidies.

Hendrik: Are you referring to the feed-in tariff or rather to the chaos surrounding the KfW subsidy last year?

Interviewee 7: Yes, especially the KfW chaos. On the other hand, I think the feed-in tariff is actually a pretty good form of support because it's reliable. Subsidies are often the problem because they are not reliable. With the feed-in tariff, however, you know exactly how it has developed - it once started at one Deutschmark and is now around 7 to 8 cents per kilowatt hour. I find it difficult that the feed-in tariff may be suspended or even abolished next year. We have built so many PV systems and have hardly expanded the grid, which leads to overcapacity in summer. However, the problem does not lie with the end customers who install PV systems. The grid expansion was simply overslept. End customers must not be penalized, but neither should they be overly enticed by high feed-in tariffs, as this leads to extreme peaks. PV systems are currently worthwhile anyway - they are cheaper than ever before and demand is still low. One subsidy that I still think is good is the IBB Berlin storage subsidy and the metering station conversion subsidy. If there are subsidies, then they should be clearly communicated - either for two years or for one million households, so that it is transparent and foreseeable. The uncertainty created by subsidies that are suddenly introduced and then canceled again is harmful and ultimately creates further uncertainty in the market.

Table 14: Interviewee 8: Product Manager 1KOMMA5°

Interview Settings Interviewee 8

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
8	Solar installer	>2,000	Data Analyst and Consultant	Product Manager	2.5 Years	Berlin

Date	4th of November 2024
Time	16:00
Location	Microsoft Teams
Duration	27:16 minutes
Interviewer	Pia
Original language	German
Face to face / online	Online
Received questions in advance	Yes
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session.

Pia: Can you perhaps start by briefly introducing your career and then also briefly explaining your touchpoints or your expertise in the solar sector?

Interviewee 8: Yes, exactly, I also graduated from Nova in 2022 in the summer and then started directly at 1KOMMA5°, so directly in the solar industry for 2 years at the start, before that I got to know a little bit here and there through my father, who was a PV consultant and then started at 1KOMMA5° when it was still relatively small. I was number 40 in the holding company, now we are somehow 370 in the holding company and just over 3000 in total. Accordingly, I have witnessed a bit of the process of the last 2 years of growth from a small start to now a large scale-up from one market to 7 markets from I think somehow 10 locations to just under 100. And at the same time a bit of this transformation process in the industry from what we now call Old Solar to New Solar.

Pia: Perfect. Let's get right back into it. You say you've already noticed the development a bit, what would you say are the decisive factors for companies in the B2C sector, why some are successful, and others are not?

Interviewee 8: Two in any case. One is the consolidation of the market, where we were one of the biggest drivers in Germany. Since the first solar boom in the early 2010s, you had a lot of regionally dispersed craft businesses that only operated in, I don't know, 4-5 zip code areas at a time. And there are tens of thousands of them in Germany. And if you wanted PV, you might have had to go to another one for the wallbox, and if you wanted a heat pump, you had to go to

another trade business - so you didn't get everything from a single source, and accordingly these smaller businesses often had outdated processes and were a bit sleepy and did their own thing. This eventually led to a situation where there was much more demand in the market than could be met by these craft businesses, which were simply not equipped to cope with such growth. And just like in the industry, which is booming and where there are many smaller players, there is then consolidation, which means that many join forces or are overrun by a big player and other companies are left behind. And that is what has happened in the last two years, we are seeing more and more how we are gaining market share and at the same time many other companies are actually going bankrupt, because they have not managed this growth and are now losing market share to larger players like us, who can of course offer everything from a single source, this one-stop store concept. And who also offer lower prices thanks to economies of scale through centralized purchasing and shared services in the holding company. I think the second is what I just meant about old school or new school. In the past, you just put the system on your roof and, if things went well, you also put a battery in the house. And you produced electricity that way and either had to use it directly or it was fed directly into the grid. That's a bit like the old model, and the new model is: you have an intelligent control system, the components are networked, as a household you are networked with the grid. And on the one hand, you can intelligently control the flow of electricity in your home using software. In the past, there was simply no software in the whole concept, only hardware, but now it's a mixture. On the one hand, you can manage your electricity flows intelligently, i.e. when do you charge your car, when do you use the electricity to charge your storage unit and when do you use it yourself, and at the same time you can also manage the grid intelligently. A player like us, who can bundle many households, can then act directly on the electricity market and buy and sell electricity intelligently for customers. Yes, this is a major trend and I think the question was about success factors in the B2C sector, which is definitely one of them. Because customers are realizing that this is more or less the concept of how the energy industry will work in the future and that they simply understand it.

Pia: So if you had to define one characteristic of the business model right now, where you say the business models differ the most, would it be, as you just said, the intelligent aspect of networking, the financing or what stands out in particular at the moment?

Interviewee 8: What definitely stands out the most is the intelligent networking. That's the unique selling point. I mean, we end up selling the hardware components, someone else can sell them too, my father still does it on the side and somehow sells a system and an electricity storage unit here and there and maybe a wallbox as well. But that's not at all the same as what we offer. With this dynamic electricity tariff on top. That's definitely the unique selling point and why people sometimes spend more on higher-quality hardware components. Because they know, OK, it will pay for itself much, much faster thanks to this intelligent electricity tariff that they get from us.

Pia: Have you also noticed a change in customer expectations over the last two years? For example, what customers expect from a solar provider, or what minimum requirements they have.

Interviewee 8: Yes. I'm not that close to the customers myself, but what I have noticed is that at the beginning we still had to go to great lengths to sell and pitch why it makes sense to buy from us and perhaps somehow spend 10% more on better components, but to have this intelligent networking in return. There was not yet such a broad understanding of it. And now the tide has turned a bit and customers are recommending it to other people. We are now in the media and somehow find out about it and approve of it and ask about it.

Pia: So you're hoping that word of mouth will spread?

Interviewee 8: A little bit, yes. And above all, we had to explain this first and now people understand it and come to us with the knowledge and want exactly that.

Pia: I know you're not close to the customer right now, but maybe you can answer this anyway, do you see a particular customer group that is becoming increasingly important for you as 1KOMMA5°?

Interviewee 8: Yes, so in the B2C sector it's actually... it's actually not. I don't know if it's just B2C here, as you see it. It's actually interesting - it's across all age groups. We are gaining market share and have a broad customer group. So, we don't just have a niche group. Of course, the majority of customers are between, I think, 25 and 50 years old, less so under that age and above because they are mostly homeowners. I don't think we have a very typical target group that we appeal to. But what's interesting is that we have an unexpectedly large number of older customers - senior citizens, pensioners - who do it because they say: “Okay, it might not pay off for me, or I won't get anything out of it for very long, but I'm doing it for the planet because it's the only sensible way to contribute to the energy transition myself.

Pia: Then I would move on to the sources of income. Where do you see the most promising revenue streams? So, is it currently in the B2C area or the B2B area?

Interviewee 8: OK, maybe one more thing. So that's another answer to that, which is also a direct answer to the last question. We have huge growth in the B2B area. I don't know if that's relevant for you, but we definitely see huge growth potential there. These are huge roof areas, it's a more complex installation process, but the larger the roof area, the more energy you generate via the modules and the greater your leverage in this dynamic buying and selling. That's why we're growing super fast, much faster than in the B2C sector. And that's one of the income streams that are currently opening up. Another is recurring revenues. These didn't even exist in this business before. Now we have recurring revenues through our electricity contracts - which are called Dynamic Pulse and Energy Trader - which we already have, to which we report and so on. I'm currently working on that too. So these are recurring revenues from these electricity contracts that no other provider on the market has, because everyone only ever sells a hardware shopping card and it's a one-off purchase. After that, you don't make any more money from the customer. That's exactly why we're developing more and more into a tech company, because we're generating more and more of our revenue through recurring revenue and software revenue.

Pia: Yes, do you also see that as a competitive advantage? When you say that you're pretty much alone at the moment, that you can predict exactly when a new income stream is coming.

Interviewee 8: Yes, I think so. So it's mainly driven by the valuation. The valuation on the capital market is mainly driven by this business with recurring revenues, because basically software companies with recurring revenues get a higher multiple, because you simply have a much higher customer lifetime value. So if the customer only buys from us once, that drives our valuation and is definitely a unique selling point. Yes, there are now other providers who are trying to offer something similar to us, but they can't because they are not so deeply integrated. With the manufacturers of the hardware they use. So it's definitely a unique selling point, yes.

Pia: Great. Thank you, then let's move on to the partnerships. What kind of partnerships, whether with energy providers, installers or technology providers, where do you see an important role in the future or what are you currently looking at more closely?

Interviewee 8: Yes, we have also grown a lot through inorganic growth by acquiring companies. So these are not partnerships directly, but 100% subsidiaries of ours. In the future, however, we want to "SaaSify" the system landscape that we are developing - in other words, virtually everything that digitally maps this customer process, such as a CRM system, an operating system for the entire workforce and a planning tool for quoting, and then the app and so on. I don't know if you can say that in German, i.e. that we are essentially building a SaaS solution from it. We would then enter into partnerships with installation companies worldwide that use this system landscape without us having to buy them up. That would then be a license model, and we would effectively be partners with installation companies in other markets. I believe that these will be key partnerships in order to ultimately achieve the energy transition quickly by growing rapidly in many markets. This is only possible if you have a system landscape like this to work with. As you can see here in Germany: The companies that don't have that are simply not growing fast enough.

Pia: Yes, what is the current target or is it already being planned and implemented? Specifically, how far along is it?

Interviewee 8: Yes, we're just getting it "straight" for all our locations. And then it goes outwards. Another important aspect is partnerships with companies that have to do with electricity supply or electricity exchanges. We trade electricity on electricity exchanges, and that is a new aspect that has never existed in the industry before. So we are effectively a player in the electricity market and trade on the electricity exchange. We also currently have an important key partnership with a company called Griddix. In principle, they provide the IoT hardware via which this software then runs and via which the components in the house are addressed. You also need hardware like this, as long as you haven't developed it yourself, to make this intelligent networking possible in the first place.

Pia: Yes OK, so partnerships don't currently play a major role due to non-organic growth, but they are planned for the future, right?

Interviewee 8: Exactly. Apart from that, we also have a lot of lead partnerships for lead generation, i.e. other companies that place social media advertising or do other things and from which we get leads, so to speak. This allows us to intelligently manage our lead requirements by region, depending on how many sales staff we have, depending on how busy they are, so that our order pipeline is always full and not too full, because otherwise we would have problems at the back of the assembly line. So it's all a flexible construct, which also means that the partnerships with these lead cooperation's are also very important at the back end.

Pia: Good. Let's move on to the barriers and challenges. You are also one of the market leaders, but do you see or do you still see structural challenges from the market side, i.e. whether it's politics or other institutions, which could still hinder the growth of the market?

Interviewee 8: I'll have to think about structural problems for a moment. I don't know much about that. I know that it's a problem that so much is subsidized by the state. The customers, well, we often have customers who say, no, we don't want to electrify our building yet or convert it to sustainable, we're still waiting for better funding or something.

So there must be this expectation that you get the components thrown at you because up until 5 years ago there was somehow a 50% subsidy on storage or something like that. But I don't

know much about that. I can, but I can send you an interview with our CEO afterwards. It was explained quite well there.

Pia: Yes, I'd love to. If you had to name two or three skills that a company in your field could use to be successful in the future, what would they be?

Interviewee 8: A solar company or a company in the energy market? Let me think for a moment. Well, you have to manage to become a one-stop store and not just a solar company. Because at some point, all suitable roofs and all roofs will be occupied by customers who can afford it, and the aggressive market will eventually be closed. So you need the entire product portfolio. For example, we now generate almost as much turnover, or at least incoming orders, with heat pumps as with PV. It is important to be flexible in the product portfolio and, in principle, not just be a solar company, but a company that electrifies buildings. That is also the reason why Enpal is struggling. Enpal is basically just a PV sales machine and not so broadly positioned. The other thing is intelligent networking. The more renewable energy we generate and feed into our grid, the greater the challenges for the grid itself. This is because solar power is produced precisely when the sun is shining, which means a large amount of electricity is fed into the grid at peak times, while little or nothing is fed into the grid at other times. The same applies to wind energy. When it is windy, we get a lot of electricity, otherwise little. This poses a problem for grid stability. That's why we need flexible electricity tariffs, which will only be successful in the future for players who can flexibly control the production and consumption of electricity. A solar system is a producer of electricity, while a heat pump, a battery and a wallbox are consumers. The static model that has worked so far will no longer be sufficient in the future. A provider can only be successful if it can manage this flexibly. The third point that strikes me is the corporate culture. This is a big difference between us and Enpal. We have a few people who have come to us from Enpal, and I also know people who work there. At a store like Enpal, you tend to have the mentality of making a quick buck because the market is growing. But that only works in times when the whole market is growing. When things aren't going so well, a store like that quickly collapses. I get the impression that everyone here is really mission-driven and motivated to fulfill the mission and make a difference. I've been here for two years and it's still the same as it was two years ago. You have people who are really on fire for the mission and not just there to make a quick buck. This creates a value-driven culture that is self-sustaining and can get through difficult times. The atmosphere is zero toxic, it's super supportive and the way it should be. That's a soft factor that I can still think of as a recipe for success for companies in the industry.

Pia: Thank you so much. I actually wanted to ask you about your recommendations for staying in the market as a last question, but you've actually just given me a great answer to that, so that would be the questions from my side. Then we can finish here, if that suits you too. Well, then I'll end the recording.

Table 15: Interviewee 9: Director Go-To-Market Enpal

Interview Settings Interviewee 9

Interview	Sector	Company Size	Background	Job Title	Years of Experience	Place of Residence
9	Solar installer	>3,000	Management Consulting	Director Go-To-Market	4.5 Years	Berlin

Date	20th of November 2024
Time	16:30
Location	Microsoft Teams
Duration	27:07 minutes
Interviewer	Hendrik Luessem
Original language	German
Face to face / online	Online
Received questions in advance	Yes
Information received before the interview	Before the transcription started, the purpose of the interview was clarified, and the interviewee was asked for permission to transcribe the session.

Hendrik: I've started the recording now. First of all, thank you for taking the time. Can you please introduce yourself at the beginning and explain briefly why you are an expert in the solar B2C market in Germany?

Interviewee 9: Yes, my name is Max Finne. I've been with Enpal for over 4 years, and I'm now working here as Director Go to Market and have actually been responsible for our product range since I started here 4 years ago, 4 and a half years ago, together with Benni Merle, our Chief Product Officer. This is mainly about the commercial product we have, but also which hardware components we actually offer. Exactly, I think that until four and a half years ago, the solar market was a bit different than it is today and I think that in the last few years it has simply taken a very, very decisive turn and has taken a great many big steps towards the transformation of the entire energy market that is currently taking place. That's why I think it's a very good time to have been part of this market.

Hendrik: You described it. How would you, or what are the special features, in which direction it has developed? From a business model perspective: What have you observed, especially from your Enpal perspective over the last 4 years? You are also welcome to go back a little further.

Interviewee 9: Yes, maybe from a customer perspective first. So, when I started at Enpal, Enpal actually only offered PV – just PV modules and inverters. Not even storage. It was really only about solar power production. That was historically also the case in Germany with the high feed-in tariff 20 years ago, because the feed-in tariff was so high that it was almost worth

feeding in all the electricity. That has now changed significantly over the past few years with the increasing popularity of storage technologies, which are becoming more and more affordable. So: How do I use as much solar power as possible that I produce myself? And that works, on the one hand, if I have a good storage solution. But it also works, above all, if I add sector coupling, for example, mobility, to further increase consumption. And now, a bit more up to date in Germany, sector coupling for heating as well. That was mainly the development we took. That is from a customer perspective. At the same time, however, we are now entering a world where, with an ever-increasing share of renewable energies in the energy mix, the energy market is changing to the extent that we have a huge number of decentralized producers and consumers. This means that there are more and more opportunities to take advantage of the price fluctuations that arise in the energy market as a result. And that's why we are now actually entering a world where I believe self-consumption is still relevant in itself, but what is now becoming much more relevant above all is that you generate additional income from the price volatilities that we have in the market. It then also comes down to us simply buying electricity from the market, storing it temporarily and selling it again. And I think that's the direction we're heading in now.

Hendrik: Good, that's already the path to: What makes Enpal stand out? How would you describe Enpal's USP or, above all, its value proposition? It's good to start with a brief summary and then, at the end, a brief summary of how you would see it in three sentences.

Interviewee 9: Yes, I think Enpal's value proposition has always been that, in the beginning, you want to make solar as easy as possible. Taking all the work off the customer's hands when it comes to getting the system up and running – which is quite complex in Germany – but also offering financing solutions, etc., to reduce the hurdles and perhaps democratize access to the solar market, to put it that way. That was the first step. I think the second step is to offer more and more as a fully integrated solution. So not just a solar system, but also a heat pump and a wallbox. I think that's a bit of the way: from a simple solar provider or “Solar-Energy-as-a-Service”, as it was perhaps first called, to “Energy-as-a-Service”. We want to take care of all the customer's energy needs and offer a solution for each of them. In addition to the components I just mentioned, this also includes the whole topic of energy management, so that we don't just have a system that produces and consumes, but one that then also participates in the energy market in an optimized way.

Hendrik: That's the point about the Virtual Power Plant that you're talking about. To what extent is Enpal already set up right now, and how would you say the resources are currently being used from an Enpal perspective to drive this product development forward? Is VPP the main focus together with the heat pump, or are there other important aspects?

Interviewee 9: Yes, well, I think Enpal started laying the foundation very early on to bring a clear or leading virtual power plant to the starting line. It started with the fact that we set up development teams ourselves from the very beginning, which helped to shape what is now called Enpal Onebox, so that we had our own firmware, our own software to control the systems and read data, and to develop our own app. Enpal started doing this relatively early on, while many in the market simply fell back on existing providers, for example Fronius or similar. A virtual power plant needs various components: you need to have your own measurement technology, good metering point operation, you need to be able to offer electricity tariffs, and you need to be able to control all these systems – 70,000 or 80,000 systems, which Enpal now has – in a networked way and to trade in an optimized way on the energy market. I think Enpal made it very clear again about a year ago with the Enpal Flex joint venture that we are putting a strong focus on this.

During the energy crisis triggered by the war in Ukraine, we noticed that the market was under enormous pressure. Many people wanted solar installations and there were a lot of new local offers. Then, in the middle of last year, it became clear that the market was in great need of consolidation. We were competing with local suppliers, but we couldn't and wouldn't compete at their price level. It was therefore clear that we had to come up with our product USP. VPP is a crucial point here, because it is something that local installers can only buy to a limited extent – and when they do, it is never as effective or efficient as our solution, which scales over tens of thousands of systems.

Hendrik: That means that for the time being, the plan is not to offer Enpal Onebox as a standalone solution through partnerships with local companies?

Interviewee 9: Yes, it is. Enpal Pro is designed precisely for this purpose: to enable us to partner with local providers instead of competing with them. We enable them through the various services we offer – from solar planning and lead generation to material procurement. This also allows local installers to offer Enpal Onebox. This is advantageous for us because the more systems we have under management, the better our energy management works and the more market potential we can leverage. For local installers, this is also an attractive product extension.

Hendrik: Leads have become very expensive at the moment. What do you think are good ways to generate more cost-effective leads, and which ones work well and which ones don't?

Interviewee 9: I'm not that deeply involved in marketing, but I think that if you ask homeowners in Germany how many of them have never been approached by solar companies, it's not many. There is just so much communication and budget in the market, and leads have become expensive. The market needs to rethink. In the past, the approach was often to simply move on to the next prospect if a customer didn't want to buy. Now we have to be more responsive to how we can help customers who are unsure to get a solar energy system after all.

This can be done, for example, by overcoming hurdles related to the construction process, where we have invested heavily to avoid having to turn away customers. Another approach is to respond more closely to customer needs, for example with flexible pricing. We also focus heavily on referral marketing. With 70,000 to 80,000 customers who have had positive experiences, we have enormous potential. These customers can convince their neighbors and friends. The best lead is a satisfied customer who recommends us. We are also focusing on new sales channels, such as partnerships with insurance agents or door-to-door sales, to reach customers who shy away from online-only or video calls.

Hendrik: That's a good segue into customer groups. It's clear that the main customer group is single-family homes. There's not much data to be found online about this – for example, about age groups or different categories. What would you say, what customer groups are there, and how have they changed over the last few years? Who do you see as the main focus right now, and how do these groups convert?

Interviewee 9: I'm not sure if you can segment it so specifically into customer groups. Basically, all customers must own a house. Most homeowners tend to be between 40 and 60 years old when they have a solar system installed. Beyond this age, there is often the consideration of whether the investment is still worthwhile – also in terms of whether the solar system will outlive you. Otherwise, the target group is very broad. We have high-income customers, but also customers with medium or low incomes. Solar installations are now attractive to many households because they represent a profitable investment. Environmental considerations play a role for some customers, but it is usually secondary. The main task is to make it clear to

customers that solar or energy management solutions are a sensible financial decision for them. Particularly when it comes to issues such as heating systems, which will need to be replaced at some point, customers are often forced to deal with them. Whether it's a high-earning lawyer or a simple homeowner is secondary. They all want a profitable investment. That's why I see less sense in a strong segmentation and more in the task of making the added value of our solutions clear.

Hendrik: Let's move on to the revenue streams. Classic models such as direct purchase, leasing and service contracts are well known. How would you describe Enpal's current focus – especially in terms of the mix of one-time and recurring revenues? And how do you see the long-term profitability of the model?

Interviewee 9: You are often surprised at how much potential the market still has. There are still many houses without solar panels. So the market is not saturated yet. If you look at the current focus, the majority of our revenue is still one-time revenue. This enables the rapid growth we are currently experiencing. But we already have various recurring revenue streams, such as electricity contracts, service contracts, metering operations or service calls. We also generate regular income from special purpose vehicles. This is already a significant part of our business.

What we have only tackled in a rudimentary way so far is the question of how we can further exploit our existing customer group. For example, we now also offer storage tanks or heat pumps to customers who were originally only solar customers. This is one approach to increasing customer lifetime value. But there are many more possibilities. Customers who have a wallbox will eventually buy an electric car. We could offer a car subscription or similar models here. Energy managers such as Enpal One could also be established as a recurring revenue stream in the future, whether for end customers or trade partners. Enpal Financial Services, which offers loans and financing models, is also an important component. The ambition is clear: recurring revenues should account for an ever-larger share.

Hendrik: What major cost drivers do you currently see at Enpal, and where is there still potential for efficiency? What do you think is going well?

Interviewee 9: That depends heavily on the respective business unit – whether it's PV or heat pumps. In the PV sector, we have achieved enormous efficiency gains in fulfillment compared to two years ago. We have implemented many measures to reduce the costs per system. However, customer acquisition remains a major cost driver. The high lead costs and the increasing price pressure from comparison portals are making it difficult.

The situation is somewhat different for heat pumps. There is currently a high level of subsidized demand, but the ramp-up in installation is still inefficient. We had to hire a lot of new people, set up academies and still have some quality loops in our processes. There is certainly still room for optimization. But I am confident that this will even out over time when we no longer grow by double every month, but instead enter a “steady state”.

Hendrik: You just mentioned the customer journey – the entire path that a customer goes through from acquisition to use of the product. Where do you see the biggest focus areas for Enpal? Where do you think it would be important to set priorities?

Interviewee 9: The customer journey is extremely complex. Customers first have to understand the product and the concepts behind it. Many don't even know how solar works or how it can benefit them. At the same time, we have to check all the structural requirements and juggle with various dependencies. I think the most important focus continues to be on explaining our

product as simply as possible to customers during sales – without oversimplifying. It's about customers really understanding what they get out of it in the end.

A good example is the topic of “virtual power plants”. There are certainly customers who are interested in technical details. But if we explain to every customer how our avatar model works on the energy market, many will drop out. What ultimately matters to customers is that they receive a monthly payment or a low-cost electricity rate, for example. That remains the main focus: to present the complex journey for the customer as simply as possible.The second focus remains on fulfillment. It is crucial to offer customers an extremely good experience when it comes to installing and commissioning the systems. Every month, we deal with 2,000 to 3,000 customers who need holes drilled in their homes, cables laid and pipes installed. There will always be issues that don't go perfectly, but we have to increase the number of satisfied customers and find good solutions for the others. That's crucial, but also a big challenge given our scale.

Hendrik: Let's finish by looking at the big trends in the solar market. What do you see as the decisive developments right now, and how do they influence business models? Where does Enpal need to position itself even better for the future?

Interviewee 9: A big trend is definitely the virtual power plant. What exactly is included depends on the provider – for some it is already a dynamic electricity tariff, for others it is trading energy on the intraday market. What is crucial is to have a product that exploits as much potential as possible in these very short-term markets. The number of providers that can really do this is currently very limited. Enpal is certainly the leader, with one or two other companies as competitors. The second major trend is “Energy as a Service”. This involves offering an integrated product that not only consists of PV and storage, but also includes charging stations – ideally bidirectional ones soon – as well as intelligent heat pumps. This networking significantly increases the efficiency of the overall system.

Hendrik: Are there any providers that you consider to be capable competitors at this level?

Interviewee 9: In Germany, that's mainly 1KOMMA5°. Other larger providers like EKD have slowed down a lot and are under pressure. Even Sonnen has completely changed its business model in response to the wave of consolidation. Outside of Germany, there are certainly interesting players like Octopus Energy. In the heat pump sector, there are many startups that have potential, but they are still far from being at the level of Enpal.

Hendrik: So you want to move away from competing with local installers and towards partnerships, so that they sell your products as well and eliminate the competition?

Interviewee 9: Exactly. Either they work with us, or customers realize that they may pay €5,000 less to the local installer, but they also don't get VPP revenues of €8,000 over the next ten years. Customers need to understand that the higher investment is worth it because of the additional benefits. Alternatively, we manage to turn the local providers into partners through Enpal Pro. They benefit from our services and a diverse product range, while we benefit from lower installation costs and a stronger market presence.

Hendrik: Max, thank you very much for your time and the detailed insights! I'll stop the recording now.