Municipal Utilities in the Energy Transition: Customer Expectations

Master's Thesis

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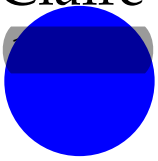

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Abstract

The energy transition is significantly impacting the operations of municipal utilities and with it, the expectations placed on energy supply companies are evolving. Thereby digitalisation becomes increasingly important. Despite the many new technical possibilities available, the perspective and needs of the customer are often not given adequate consideration. This work gives an insight into the customer perspective concerning the expanding municipal utility portfolio by means of two focus group discussions with actual and potential municipal utility customers supplemented by two interviews with municipal utilities. The results show, that customers still primarily see municipal utilities as energy suppliers and operators of the grid infrastructure. Digital products and services offered by municipal utilities are expected to reduce bureaucracy and be easy to use. As part of the municipal utility business, local presence and proximity to customers are essential. Given the trust that customers place in municipal utilities, advice and support are gaining in importance. Transparent communication is important to maintain this trust. The use of digital media can help municipal utilities share their activities with their customers and keep them informed, thereby increasing local presence and thus their competitive advantage.

1. Introduction

1.1. Motivation

In recent years energy supply companies face a number of external as well as internal challenges as a result of the current upheavals in the energy industry (Schepers, Kalny, & Löbbe, 2020). The energy transition is shaped by the goals of politics, which have a massive influence on the field of action of energy suppliers. New legal regulations and, in some cases, changes in direction cause energy suppliers to operate in a volatile environment. A declared goal of German politics is to achieve greenhouse gas neutrality by the year 2045. The interim goal is to reduce greenhouse gas emissions by at least 65% by 2030 measured against the year 1990 (§ 3 para. 2, Climate Protection Act (KSG)). With the circumstances caused by the Russian war of aggression the need for the rapid expansion of renewable energies has become even more pressing to overcome dependence on imported gas (McPhie, Crespo Parrondo, & Bedini, 2022).

The energy transition affects society as well as the energy industry (Doleski, 2020; Grunwald, Renn, & Schippl, 2017; Schmid, Knopf, & Pechan, 2016). High energy prices as a consequence of the Russian war of aggression directly influence customer behaviour and create greater energy awareness (deutschlandfunk, 2022; faz, 2022; tagesschau, 2022; taz, 2022). Increased energy awareness encourages customers to address energy-saving potentials, which can be achieved, among other things, through digital products and services offered by municipal utilities (Paukstadt et al., 2020). Increasingly individualised customer needs and rising customer demand for such new, energy-related services are changing the demands on energy supply companies (Fett & Küller, 2017; Schepers et al., 2020). Due to increasing decentralization and digitization within the energy sector, energy supply companies are compelled to break away from their traditional commodity business models and develop new products and services (Schepers et al., 2020). Nowadays, the modern world is dominated by digital technology - online activities and solutions are taken for granted by many customers (BDEW, 2017). Given the many new technical possibilities, the customer's perspective and needs are often only given secondary consideration (BDEW, 2017). Customer centricity and the provision of complete solutions for end customers become more important. It is the business area with the largest growth market for many municipal utilities (Fidan, Timm, Siebel, & Nording, 2022). In their function as municipal energy suppliers, municipal utilities have a long tradition in Germany (Berlo & Wagner, 2015; Schmid et al., 2016). With the liberalisation in the 1990s, the electricity market was open to other market participants with the aim of increasing competition, which led to the emergence of additional energy suppliers (Canzler et al., 2016). Municipal utilities differentiate from such in that they often perform a variety of other tasks of municipal public services in addition to the local basic supply of citizens with energy and water (Beier et al., 2020; Jenner & Schmitz-Grethlein, 2017). Their decentralized structure increases accessibility and local awareness. And thanks to their local roots, municipal utilities have the unique opportunity to develop customised offers (Jenner & Schmitz-Grethlein, 2017).

A future-oriented approach is required for municipal utilities to help shape the future energy system (Beier et al., 2020). To be successful on the market in the long term, energy supply companies must nonehteless evolve away from the classic energy supplier as a provider of simple products towards modern, customer-centred energy service providers that offer customers individual and customised complete solutions (Schepers et al., 2020). In this evolution digitalization plays a crucial role offering new business models, personalized products and competitive advantages (Schilling, 2019). For example, smart energy products can create new customer value and create new business opportunities (Paukstadt, 2019). The term *'smart energy'* refers to products equipped with Information- and Communication Technology (ICT) such as smart meters and intelligent batteries (Paukstadt, 2019). They become increasingly important as their dissemination is accelerated by legal regulations (BMWK, 2016a, 2023). However, due to their complexity, there is an increasing necessity for collaboration. Municipal utilities can thereby be part of a larger ecosystem of actors, such as in the field of electromobility or smart home. These partnerships allow companies to provide bundles of smart energy products and contribute to different smart product layers (Paukstadt, 2019).

1.2. Aim of this Research

Municipal utilities are acting in a dynamic environment, which requires a further development of the corporate strategies. These new corporate strategies can include the development of new business models and thus also an expansion of the service portfolio (Kowallik, 2022; Nitsche, 2019). The aim of this work is to give an insight into the customer perspective in relation to the expanding municipal utility portfolio. As municipal utilities usually have limited resources, those insights might support municipal utilities to identify customer needs if they have not been able to devote enough resources to this themselves. Identifying customer needs might be a first step towards a customer oriented prioritization process for new business model opportunities. It is necessary to take a closer look at customers and involve them in the transformation of the energy system. Moreover, digital solutions and energy services play a crucial role for clients when choosing their energy provider (Schilling, 2019). By investigation of the customers, this work could serve as a basis for further local analysis of customer needs. To provide the basic understanding, this work will examine the following questions in detail:

1. **What do customers expect from (the digital products and services of) their municipal utility?**
2. **Where do municipal utilities see the potential of digital tools and services for their customers?**
3. **What digital tools are municipal utilities willing to provide to / develop for their customers?**

In order to address these questions, focus group discussions are conducted as part of this work. In the focus groups, the customers' perspective and expectations regarding the digital offer of municipal utilities are examined in more detail. These group discussions

are supplemented by exchanges with municipal utilities in the region providing a deeper insight into the company's perspective.

The thesis is divided into 6 chapters. First, Chapter 2 describes the changes in the German energy system and the resulting business areas for municipal utilities. A special focus is set on digitalisation in the area of private customers. The chapter is supplemented by an insight into the political and legal framework in which municipal utilities and their private customers operate. Chapter 3 describes the methodological approach. The chapter is divided into the method selection, data collection, data analysis and ensuring the quality criteria. Chapter 4 then analyses the results, which are discussed in more detail in the following Chapter 5. Finally, Chapter 6 concludes with a summary of the main results and an outlook on further research.

2. Background & Related Work

The acting environment for municipal utilities is uncertain and volatile as a consequence of being guided by legal and political targets at national as well as international level. This introduces a variety of challenges that municipal utilities have to face as the energy transition process proceeds (Beier et al., 2020; Schepers et al., 2020). In addition to the requirements set by the political framework, municipal utilities must navigate in an increasingly digitalised world while adapting to changing customer needs and decentralisation with suitable solutions (Beier et al., 2020; Schepers et al., 2020). This chapter, therefore, provides a comprehensive overview of the changes in the German energy system. In the following the German municipal utility model, with a special focus on digitalisation and research relevant to this study is presented. To conclude the chapter some of the main aspects of the legal framework conditions are highlighted in section 2.3, which shape the environment municipal utilities operate in and affect their business models as well as their customers.

2.1. Changes in the German Energy System

The German energy system is and has been constantly changing under the influence of politics, economics, society, technology, and the environment. A particularly far-reaching change in the system can be traced back to the large-scale introduction of decentralised, volatile renewable energies. However, social change and the participation of new players in the market also influence the system. (Richter et al., 2019)

The Energy System of the 20th Century

The German energy market structure is fundamentally based on the Law for the Promotion of the Energy Industry - Energiewirtschaftsgesetz (EnWG) of 1935. It aims to allow for a reliable and cheap energy supply. Influencing the economic structure of the energy system, it formed the foundation for the emergence of supply monopolies. Shaped by these monopolies, a centralised fossil energy supply was established. Coal, oil, natural gas, and nuclear power were the primary energy sources of the German energy system at that time. In the middle of the century, the system consisted mainly of central lignite and hard coal-fired power plants owned by large energy supply companies. (Richter et al., 2019)

Thus, at the beginning and in the middle of the 20th century, the political focus was primarily on the nationwide and cost-effective provisioning of electrical energy, which was implemented in a centralised and fossil-based power generation system. According to Richter et al. (2019), greater environmental awareness and the accompanying social pressure in the late 20th century triggered a political and later also technological and economic change, which they describe as the beginning of the energy and system transition. (Richter et al., 2019)

Change through Liberalisation

Due to the liberalization of the energy market in the 1990s and the promotion of renewable energy via the Energy Efficiency and Renewable Energy Act (EEG) in 2000, the conditions have changed in the German energy market (Beier et al., 2020; Richter et al., 2019). Consequently, municipal utilities are in free competition with other companies. With the expansion of energy distribution and other service offerings beyond the boundaries of a municipal utility's own supply or grid area, the potential customer base of municipal utilities expanded as well. As a result, municipal utilities also face the challenge of increased competition within their own area. To succeed in this competition, an orientation towards the customers' needs is necessary. Modern customers are well-informed and eager to switch providers (Schepers et al., 2020). Furthermore, they place high demands on digital solutions, speed, and service quality (Schepers et al., 2020). Due to their regional roots, municipal utilities have the possibility to respond to the diverse needs of their customers, as they can design products adapted to the demands of the local people. Their large task portfolio also offers them the possibility to plan and realise holistic concepts that combine several sectors and emphasise synergies. (Beier et al., 2020)

The Rise of Renewable Energies

As a consequence of the nuclear catastrophe in Fukushima, the political energy transition picked up in 2010 with the German government's plan to increase the share of renewable energies in electricity consumption to 80% by 2050 and the decision in 2011 to phase out nuclear power by 2022 (Joas, Pahle, Flachsland, & Joas, 2016). These decisions mark the basis for the Federal Government's energy policy (BMWK, 2016b). With the reform of the Climate Protection Act by the federal government, the goal of Germany's total climate neutrality was brought forward to 2045 (Bundesregierung, 2021). The draft bill for the EEG 2023 furthermore envisages an expansion of the share of renewable energies to 80% of gross electricity consumption by the year 2030 (BMWK, 2022c).

Since the introduction of the EEG, renewable energies have experienced a noticeable increase (Richter et al., 2019; Umweltbundesamt, n.d.). Renewable energy sources differ from conventional energy sources in terms of performance, volatility, and location (Richter et al., 2019; Stram, 2016). The resulting higher forecast uncertainty and distribution of plants pose particular challenges to grid stability Richter et al. (2019). As a result, the technical structure of the energy system must adapt to meet new challenges (Richter et al., 2019; Stram, 2016). Richter et al. (2019) contrasts the two systems - the *conventional* and the *renewable energy system* - as shown in Table 2.1. According to Richter et al. (2019), the system is currently in a transformation between the two highly contrasting systems. Richter et al. (2019) compare the two energy systems based on four dimensions: environment, technology, economy, and society. The key points of the transformation described - towards a renewable energy system - include, among other things, an increasing decentralisation of the system due to the addition of many small generators, increased flexibility in consumption, and a need for storage. As a consequence, new business models such as virtual power plants, direct marketers, smart home platforms, energy communities,

landlord-to-tenant electricity supply, and prosumerism have emerged (Richter et al., 2019). However, the current development towards renewables that are sufficiently developed and storable will take some time. To ensure the security of supply in the transitional period after the phase-out of nuclear energy on the way to a climate-neutral energy supply, fossil gas is needed. In early 2022, Germany's gas supply depended primarily on gas from Russia. Putin's war of aggression on Ukraine was the trigger to reduce this dependence (BMWK, 2022b), leading to a series of measures to reduce import dependence (BMWK, 2022a). As a result, the market is changing and also citizens need to adapt. The Federal Network Agency (BNetzA) called on citizens to save gas to avoid a national gas shortage in the winter of 2022 (BNetzA, 2022a). Prices have risen significantly and wholesale prices have fluctuated greatly. Consequently, high energy prices directly influence customer behavior. Saving energy is being addressed more and more in the public media and is thus creating greater energy awareness (deutschlandfunk, 2022; faz, 2022; tagesschau, 2022; taz, 2022).

Players in the Renewable Energy System

Along with the increasingly decentralized structure, players in a renewable energy system are becoming more and more diverse (Agora Energiewende, 2017; Richter et al., 2019). In the electricity sector in particular, numerous new players have emerged. Among them are a particularly large number of private individuals, including i.e. farmers, as well as citizen energy communities, which operate plants for renewable energy production (Agora Energiewende, 2017; BNetzA, 2022b). These communities are composed of a number of natural persons living in the plant's vicinity (BNetzA, 2022b).

As the energy transition proceeds, self-supply is becoming increasingly important. This leads to the disappearance of the traditional producer-consumer division (Agora Energiewende, 2017), and a new kind of consumer, the prosumer, emerges. The self-generating consumer (prosumer) is often seen as a strong driver of the transformation - for the expansion of renewable energies as well as for the transformation in society (Agora Energiewende, 2017). The main generation technologies to be considered for self-sufficiency are photovoltaics and combined heat and power (based on natural gas) (Agora Energiewende, 2017). A surplus of energy generated on an individual basis can either be stored - if the system is designed for this - (Agora Energiewende, 2017) or used for reselling: A surplus can be sold by the prosumer directly, without an intermediary through a peer-to-peer network (Rijkers-Defrasne, von Versen, & Malanowski, 2021; Rohbogner, 2020) .

Grid Requirements

So far only the effects on the players have been highlighted. However, the changes also impose new requirements on the power grid infrastructure. Especially, the installation of many small generators is leading to a growing decentralisation of the system. The increase in wind and photovoltaic energy in particular causes an increase in volatility, which in turn leads to greater forecast uncertainty and greater fluctuations in production. Additionally, generation and consumption of electricity produced from renewable sources are often not balanced and/or spatially distant from each other, which causes bidirectional load flows in

the distribution grid. Consequently, an increase in the capacity of the distribution grids is necessary, which in turn requires an increased grid expansion. Used in a targeted manner, decentralised solutions can also counteract further grid expansion, e.g. through storage solutions. Another challenge arises from the localisation of some energy sources. For example, the wind energy output in northern and eastern Germany exceeds the regional demand considerably in some cases. Therefore, an expansion of the transmission grid is necessary to enable energy transport from northern to southern Germany, where energy is in demand. (Agora Energiewende, 2017)

Partly, this need for expansion can be reduced by making use of the increasing digitalisation (Möller, 2022). Smart energy grids could ensure greater grid stability as well as flexibility through digital control (Möller, 2022). Nevertheless, the reduced fraction of electricity generated by controllable power plants complicates achieving a balance between energy supply and demand (Weckmann, Kuhlmann, & Sauer, 2017). Thus, to guarantee a higher level of system stability, energy demand will be more closely matched to supply through demand-side load management (Lösch & Schneider, 2016). One way of encouraging flexible consumption behaviour and thereby reducing the rising network load can be realized, e.g. via dynamic electricity tariffs (Stute & Kühnbach, 2021).

The presented change in the grid usage reveals the need for intelligent grids (Lösch & Schneider, 2016). Smart grids allow the management of electricity generation, storage, users, and the grid itself (Lösch & Schneider, 2016). Along with the smart grid infrastructure, intelligent grid control becomes necessary and requires a change in the tasks of the distribution grid operators (Canzler et al., 2016). To transform the grids into smart grids, competencies in information and communication technologies (ICT) are increasingly necessary (Agora Energiewende, 2017).

Electricity Transition - Heat Transition - Transport Transition

The term energy transition is often only referred to as electricity transition. In fact, in the power sector, the transformation towards renewable generation technology has progressed at a particularly rapid pace, according to Canzler et al. (2016). Nevertheless, the energy transition includes not only a transition in electricity but also a transition in heating and transport (Beier et al., 2020; Canzler et al., 2016). In the conventional system described by Richter et al. (2019), the electricity, heat, and mobility sectors operate largely independently of each other. However, in the renewable system, the sectors are coupled to each other, enabling better optimization of the overall system (Richter et al., 2019). Hence, the overall system becomes more interconnected and complex due to technologies like Power-to-Heat, heat pumps, or electromobility (Richter et al., 2019).

2.2. Understanding the Role and Business Areas of Municipal Utilities

For a better understanding of the special position of municipal utilities, a few terms must first be explained. Section 2.2 delineates the most important terms from each other and

Table 2.1.: Characteristics of Conventional and Renewable Energy Systems Adapted from Richter et al. (2019)

	Conventional energy system	**Renewable energy system**
Environment	Little environmental and climate awareness	Environmental movements, pressure from society
	No internalisation of external effects	Emission reduction through CO_2 pricing
Technology	Central energy supply through fossil fuels and nuclear power	Decentralised energy supply through renewable energy sources
	Feed-in at high voltage levels, unidirectional current flow	Feed-in also at medium and low voltage levels, bidirectional current flow
	Regulated generation follows consumption	Volatile weather-dependent generation
	Consumption approximated via standard load profiles	Flexibility in consumption, storage possibilities
	Sectors (electricity, heat, transport) mostly separated	Sector coupling through electromobility, power-to-X
Economoy	Supply monopolies (regional)	Diversity of players
	Principle "copper plate": loss-free and unlimited transport to ensure competition	Mapping of the physical restrictions of the transport system on the market
	Central European market, market zone Germany, pricing via merit order	New decentralised market approaches (peer-to-peer, virtual power plants)
	Energy-only market	Capacity-related mechanisms
	Rigid levies	Flexibilised levies
Societey	Passive end users	Consumers as active participants in the energy system: DSM, prosumers, citizen energy
	Hardly any opportunities for participation	Participation and acceptance as a condition

gives an overview of the most important business areas of municipal utilities. Finally, a focus is placed on digital offerings in the private customer segment.

Internationally, the German municipal utility model is appreciated as a model of a municipal organization oriented towards the common good (Wagner et al., 2018). Municipal utilities have a long tradition in German history (Lütjen, Tietze, & Nuske, 2014), leading to many different forms and structures. Due to this richness in variations, a general and

precise definition does not exist and different terms such as *"municipal energy supplier"* are mostly used synonymously (Lütjen et al., 2014, p. 7). A possible definition according to EnWG §3, para.18, **energy supply companies** are companies "*that supply energy to others, operate an energy supply grid or have power of disposal over an energy supply grid as the owner; the operation of a customer plant or a customer plant for operational self-supply does not make the operator an energy supply company*". According to EnWG §3, para. 14, **energy** includes "*electricity, gas and hydrogen, insofar as they are used for grid-based energy supply*". The Gabler Business Encyclopaedia (Gabler Wirtschaftslexikon, n.d.) describes municipal utilities as **communal supply companies**. According to this, municipal utilities are *"companies, providing such services as water, electricity, district heating, and gas supply in modern societies, along with the infrastructure for public services. Frequently, health care facilities such as hospitals are also included in utilities. In principle, utilities can be privately or publicly owned. In Germany, the vast majority are publicly owned, mainly by municipalities. [...] The municipal utilities operate as their own business or company. They often form a transverse association with the municipal transport companies and bear the designation "Stadtwerke" (municipal utilities)*". The latter definition clearly shows the wide range of possible forms and the variety of tasks performed by municipal utilities. Besides the basic local supply of energy and water to citizens, municipal utilities thus also perform many other tasks in the field of public services touching various areas of public life (Beier et al., 2020; Fidan et al., 2022; Jenner & Schmitz-Grethlein, 2017). For many municipalities, municipal utilities are the general service provider for the successful implementation of innovative or previously loss-making projects (Fidan et al., 2022; Möller, 2022). This makes them a vital part of the local communities (Fidan et al., 2022). Thus, municipal utilities are expected to increasingly evolve from pure suppliers to central infrastructure service providers for municipalities, according to EY and BDEW (Fidan, Timm, Beermann, & Nording, 2021).

A municipal utility is often active in at least two divisions and performs various activities. These activities include electricity, gas, district heating, water, waste water, waste disposal if necessary and public transport (Beier et al., 2020; Kowallik, 2022). According to Beier et al. (2020) the majority of municipal utilities operate in both the energy and distribution networks simultaneously. In the course of the energy transition, the main business areas of municipal utilities are changing: Potential new business areas involve electromobility, neighborhood supply, broadband expansion and the expansion of energy services, to name just a few of them (Kowallik, 2022; Nitsche, 2019). Through the implementation of the smart meter roll-out mandated by law, more intelligent communication systems are installed, accelerating the pace of digitalisation and again offering new business opportunities for municipal utilities (Fidan et al., 2021). Overall, with the rapid development of digital technology comes the opportunity to take advantage of increasingly personalized products, a better competitiveness, gain in efficiency in existing processes, customer-self-service offers, completely new sales approaches in online marketing, and attractive customer contact points (Schilling, 2019). Summing up, digitization enables municipal utilities for a gradual transition to a more customer-centric, digital world (Schilling, 2019).

Since the liberalization of markets, the customer occupies an increasingly important role for municipal utilities (Fett & Küller, 2017). Fett and Küller (2017) describe the importance of a positive customer experience and how essential customer focus is for the competitiveness of municipal utilities. Services and complementary products related to energy are becoming increasingly important compared to the classic commodity business. They adduce the importance of providing consumers with fully integrated, hybrid solutions that meet all their needs in terms of energy and beyond. There is an increasing demand for services and change among customers. However, a detailed investigation of offers and services desired by the customers is not given. When it comes to customers' perception of already existing touch-points, municipal utilities especially mention meter reading for private customers at the end of the year, setting up grid connections, repairing grid disturbances or the public transport operated by the municipal utility as points of contact (Möller, 2022).

Schepers et al. (2020) emphasize the strategic importance of energy services in order to remain competitive. They examine how the development of energy services can be shaped on a strategic, procedural, organizational, and cultural level. Möller (2022) examined how the energy transition and digitization impact municipal utilities and their business areas. Likewise, she shows the increasing importance of services for municipal utilities. Moreover, she points out the municipal utilities' commitment to actively involve citizens in the transformation of the energy system. However, the question of implementation remains open. Municipal utilities have the advantage of being able to offer their customers local offers that are as tailored as possible (Gumbert & Fuchs, 2016). Gumbert and Fuchs (2016) conducted a survey of customers of Stadtwerke Münster in 2016 regarding their willingness to participate in the context of the energy transition in Germany. Their results show an example of the diversity of the application areas of digital tools - indicating that participation offers are particularly popular in the form of internet portals - far more than forms of physical encounters such as neighborhood meetings, workshops or the like. Innovative digital services represent e.g. one application area for digital solutions opened up by ICT, so called smart services (Paukstadt et al., 2020). These are described among other things in more detail in the following subsection.

Digitalisation for Municipal Utilities in the Private Customer Segment

In this section an overview of digital offers from the municipal utility's point of view will be presented. In the latter course of this work these various application areas will be examined from the customer's perspective. The digitization in the energy sector is one of the top three topics that municipal utilities have focused on in 2021 as it offers new opportunities (Fidan et al., 2021). The advancing digitization is associated with the opportunity for new business models, personalized products and a better competitiveness (Schilling, 2019). In (Schilling, 2019) the author presents the changes in customer expectations. He states that an extensive range of online services is a fundamental criterion for most clients when choosing their energy provider, aside from price and tariff information. Important administrative work, like concluding contracts, changing contracts, information about the contract, online billing or transmission of meter readings should be designed easily, conveniently and accessible all around the clock. But even though digital tools appear to

be fundamental, according to Möller (2022) several experts agree that municipal utilities only receive little feedback on the digital solutions they already offer. This observation emphasises the need for structured examinations of customer insights in order to design appropriate solutions adapted to customer needs.

In (BDEW, 2017) digitalisation from the customer's point of view is investigated. The main focus is on what digital competence customers trust their energy suppliers to have and how they perceive the handling of sensitive data. The results of the study conducted in 2017 show that terms such as *"data exchange"* or *"real time"* generate suspicion. Data sharing is only accepted if there is a comprehensible benefit. The energy transition is perceived as very complex, which is why customers want to delegate the issue to the energy suppliers and the state. However, the more technology- and digital-savvy the respondents are, the greater their willingness to deal with the energy transition and their own opportunities for participation. In addition to the general expectation of digital products and services, an updated study should also focus on the specific selection of digital products and services that are needed or desired by customers.

To investigate how digitalisation shapes municipal utilities and their (future) areas of activity Möller (2022) conducted expert interviews with 15 German municipal utilities. Among the digital products and services that came up for discussion and which are also linked to residential customers, are e.g. the visualisation of the monthly energy consumption, but likewise the visualisation of generation when it comes to prosumers. Additionally, the emerging business area of mobility is a field of growing interest that encompasses electromobility solutions, like applications that manage the charging process for electric cars and display information on charging infrastructures, sharing services for cars and e-scooters and the public transport. The smart home segment meets with varying levels of interest among municipal utilities. In this area, active intelligent load management, PV systems or storage solutions could be integrated, among other things. When it comes to smart meters, the respondents raised that smart meters do not yet offer any added value to customers and even encounter disinterest as customers do not want to worry about their meter readings at all. Other topics that are addressed consider variable power tariffs or applications that map the entire municipal utility portfolio in a single application.

Fidan et al. (2016) demonstrates the use of digital communication technologies for customer communication and support. New customer apps and online discussion platforms initially met with a reserved response from municipal utilities and were mainly implemented by first movers. However, online contract and customer management in particular, but also energy management via a web platform or in mobile form via smartphones or an app have become increasingly popular, even for late followers. Schilling (2019) also emphasises the importance of digital communication channels. According to him, digitalisation increases customer expectations of service quality, usability and the content quality of digitally available information. The channels he highlights in the digital space for municipal utilities include virtual energy consultations, chatbots, websites and social media.

Along with the smart meter roll-out in Europe, smart energy services evolve and disseminate more and more (Paukstadt et al., 2020) bringing new potentials for municipal utilities

and their customers. Smart services are capable of monitoring, controlling, optimizing, and autonomous operation (Paukstadt et al., 2020). Kranz, Kolbe, Koo, and Boudreau (2015, p.8) define smart energy "*as the use of ICTs in energy generation, storage, transmission, and consumption, aiming at increasing efficiency, encouraging eco-friendly behavior, and decreasing the emission of GHG [Greenhouse Gas]*" (p.8). Based on a literature research Paukstadt et al. (2020) grouped the identified smart business models to specific archetypes summarized in Table 2.2.

Table 2.2.: Smart Business Models Adapted from Paukstadt et al. (2020)

Archetype	Description
Energy Efficiency with Smart Home and Smart Meters	Those business models often consist of smart homes and meters, which include energy efficiency and saving services. They aim to reduce energy consumption.
Flexibility	Flexibility services do not intend to reduce consumption, rather they shift the energy load, thus they belong to the category of the demand side management.
Energy Trading	Those business models enable customers to sell energy either through a broker or on their own.
Decentralized Energy Resources	Business models around decentralized energy resources can include different depth, such as installation, predictive maintenance and more. Photovoltaic-systems and battery storages fall into this category, e.g..
Energy Communities	There are many types of energy communities. They are groups of (mostly) prosumers, who share energy resources, like microgeneration units and storage.
EV Storage and Charging	Those business models focus on electromobility including battery stroage and charging infrastrucutre.

2.3. Political and Legal Framework

An essential prerequisite for the implementation of the energy transition is the creation and adaptation of a legal framework (Beier et al., 2020). The following subchapter, therefore, summarizes the most essential laws and regulations that significantly influence the activity of municipal utilities and their customers in the context of the energy transition to allow for a deeper understanding of the services, structures and activities of municipal utilities. As the German energy industry is influenced not only by the German legislation but also by the European legal framework, both legislation levels need to be considered. Figure 2.3 shows an excerpt of the legislative map for the energy supply system. It shows the most important legal guidelines for the scope of this work, which are explained in more detail below.

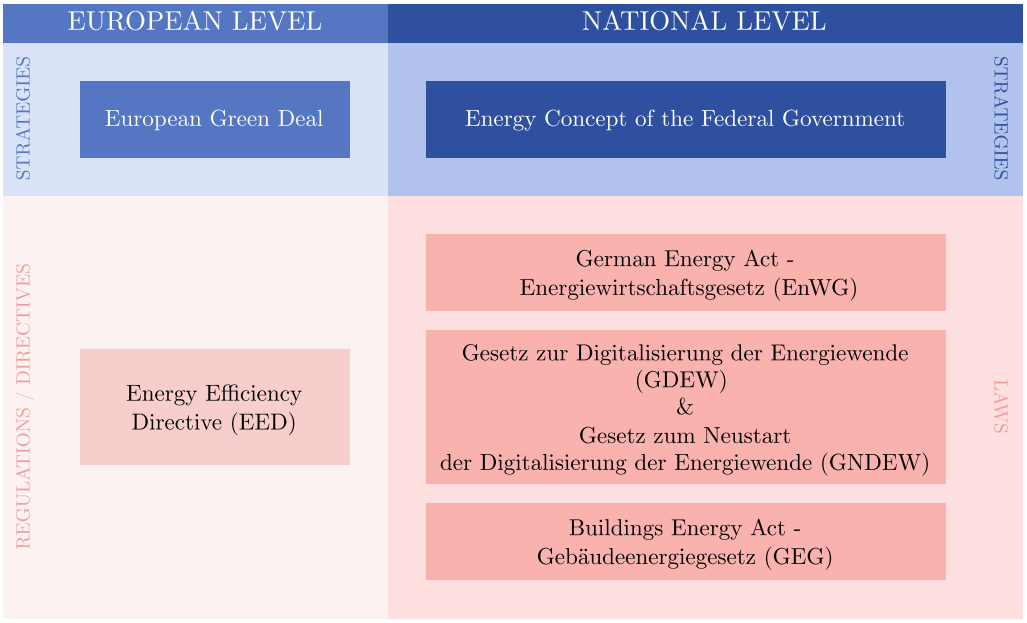


Figure 2.1.: Excerpt of the Legislative Map for the Energy Supply System Adapted from BMWK (2016b)

2.3.1. European Legal Framework

With the European Green Deal, the European Union (EU) is taking an international leadership role and acting as a role model for other states and regions (bpb, n.d.). Presented for the first time in 2019, the deal intends to transform the EU into a *"modern, resource-efficient and competitive economy, ensuring:*

- *no net emissions of greenhouse gases by 2050*
- *economic growth decoupled from resource use*
- *no person and no place left behind"* (European Commission, 2022b).

The European Green Deal affects all EU political fields, such as research, mobility, energy, biodiversity, agricultural, trade and foreign policy (bpb, n.d.). Consequently, it has a significant contribution in shaping the field of activity even for the local municipal utilities. As part of the European Green Deal, the 2030 climate and energy framework includes EU-wide targets and policy objectives for the period from 2021 to 2030 (European Commission, 2014). The Regulation on the Governance of the Energy Union sets common rules for planning, reporting and monitoring to fulfill those targets. Accordingly, integrated national energy and climate plans have been developed within the EU Member States, the following Subchapter 2.3.2 describes the German legal framework in more detail. (European Commission, n.d.)

Energy Efficiency Directive (EED)

With the European Green Deal, the EU is increasing its commitment to climate change. Energy efficiency needs to be prioritised, to meet the 2030 climate target. The therefore revised European Energy Efficiency Directive (EED) sets out cross-sectoral regulations on

energy efficiency that must be implemented in national law (Beier et al., 2020). Additionally, the EED is seeking to increase transparency for consumers. The directive stipulates that if remotely readable devices are installed, consumption and billing information must be provided to the customer or user during the year - at least twice (VKU, 2021). To further increase transparency, additional information must be made available, including information on the fuel mix used, annual greenhouse gas emissions or comparisons with the previous year's consumption (VKU, 2021).

2.3.2. German Legal Framework

The foundation of the German energy policy are the guidelines for an environmentally friendly, reliable and affordable energy supply formulated in the energy concept of 2010 as well as the decision in 2011 to phase out nuclear power by 2022. Those guidelines are accompanied by a number of laws and regulations that shape the German energy market (BMWK, 2016b). Due to the large number of guidelines, only a few particularly relevant regulations will be dealt with in more detail in the following [1].

German Energy Act - Energiewirtschaftsgesetz (EnWG)

The EnWG dates back to 1935, but has been amended several times. Under the act, the basic guidelines for the law governing grid-based energy supply are set out (Vattenfall, n.d.), to ensure the most secure, affordable, consumer-friendly, efficient, environmentally compatible, and greenhouse gas-neutral grid-based supply of electricity, gas, and hydrogen to the general public. This supply aims to be increasingly based on renewable energies, in order to implement EU Law in the field of grid-based energy supply. Fair competition is ensured by the regulation of electricity and gas networks (Section 1, EnWG) (Bundesministerium der Justiz, 2005). Thus, vertically integrated companies are obliged to ensure transparency and non-discriminatory design and operation of the network. In terms of implementation, this implies the independence of distribution system operators from other areas of energy supply activity. This separation is called *unbundling*. However, operators with less than 100,000 customers are excluded from this regulation (de-minimis) (Section 7, EnWG). As many municipal utilities supply fewer than 100,000 customers in terms of electricity supply and gas supply they are subject to this exception (Erdmann & Graebig, 2018).

Furthermore, the EnWG compromises further regulations that impact municipal utilities like meter readings, disclosure obligations or equally tariff design. The latter is especially interesting in the context of this thesis as it impacts end customers as well. An exemplary regulation: If technically feasible, energy suppliers need to offer a tariff, which provides an incentive to save energy or control energy consumption. Such tariffs are, in particular, load-variable or time-of-day-dependent tariffs. Section 41a, EnWG stipulates, that electricity suppliers supplying more than 200,000 end consumers on December 31 of a year are obliged to offer the conclusion of an electricity supply contract with dynamic tariffs for end consumers who have an intelligent metering system in the following year. This regulation

[1] A complete overview of the European and German legal framework is given in BMWK (2016b).

has been enforced by the the passing of the Law on the reorientation of the digitization of the energy transition in January 2023 making the offer of dynamic electricity tariffs mandatory for all electricity suppliers (BMWK, 2023). Municipal utilities in the role of a distribution grid operator additionally have to offer favorable conditions for electricity deliveries if end consumers agree to the network-related control of their electric vehicles or other controllable consumption devices (Section 14a, EnWG).

Gesetz zur Digitalisierung der Energiewende (GDEW) and Gesetz zum Neustart der Digitalisierung der Energiewende (GNDEW)

The Act on the digitalisation of the Energy Transition (Gesetz zur Digitalisierung der Energiewende) was passed in 2016 (BMWK, 2016a) it was followed in 2023 by the Act on the restart of the Digitalisation of the Energy Transition (Gesetz zum Neustart der Digitalisierung der Energiewende - GNDEW) (BMWK, 2023). The core of the GDEW is the Metering Point Operation Act (Messstellenbetriebsgesetz -MsbG). This law regulates how and when the previous analogue electricity meters are to be replaced by smart metering systems or modern metering devices. By means of a gradual installation obligation, it requires all electricity consumers to have a digital electricity meter by 2032. The MsbG differentiates between digital metering systems and intelligent metering systems (smart meter). Smart meters stand out from digital meters due to an additional communication connection via a smart meter gateway (BMWK, 2016a). The roll-out is essential as it implements the digitalisation at the network end points and thereby sets the foundation for intelligent energy networks (smart grids) (SmartGridsBW, n.d.). For end customers, smart meters open up the possibility for new tariff designs, e.g. dynamic tariffs (see 2.3.2). In order to accelerate the slowly progressing smart meter roll-out, the GNDEW was passed at the beginning of 2023. This is intended to bring forward the roll-out deadlines from the year 2032 to the year 2030. Additionally, the offer of dynamic electricity tariffs from 2025 became mandatory for all suppliers (BMWK, 2023).

Buildings Energy Act - Gebäudeenergiegesetz (GEG)

The Gebäudeenergiegesetz came into force on the 1st of November 2020. It combines the former acts Energieeinsparverordnung (EnEV), Erneuerbare-Energien-Wärmegesetz (EEWärmeG) und Energieeinsparungsgesetz (EnEG). The GEG contains requirements affecting end customers concerning the energy quality of buildings, the preparation and use of energy performance certificates and the use of renewable energies in buildings (BMWSB, 2022). Renewable energies can be used by means of photovoltaic and solar installations, combined heat and power plants, as well as the use of district heating. According to Liebscher (2021) at least 15 percent of the heating and cooling demand must be covered by renewable energies. In addition, the GEG stipulates that purchasers of single-family or two-family houses, as well as those undergoing comprehensive renovation, must receive free energy consulting. Here, too, there are links to the fields of activity of municipal utilities. (Liebscher, 2021)

Mandatory Installation of Photovoltaic Systems

A regulation that directly affects the end customer is a decision at the federal state level. The mandatory installation of photovoltaic systems has been decided for new buildings, roof renovations and/or parking areas in seven federal states in Germany, including Baden-Württemberg, North Rhine-Westphalia and Schleswig-Holstein since the beginning of the year 2022. At the time of this thesis, this regulation does not yet apply at the national level. However, the current federal government stated in its coalition agreement: *"All suitable roof surfaces are to be used for solar energy in the future. This is to become mandatory for new commercial buildings, and the norm for new private buildings."* (Wörrle, 2022)

The changes by this regulation create new opportunities for municipal utilities. One possible example is the *swt-Energiedach - Photovoltaik im Pachtmodell* programme in Tübingen. The programme is aimed at building owners, hesitating to commit to the full investment and effort of installing a PV system. Instead, municipal utilities take care of the financing, installation and maintenance of the system, in return of a small system lease. The electricity generated by the system can be used by the owners free of charge, while surplus electricity is fed into the grid and remunerated. (Palacios, Bauknecht, & Ritter, 2020)

3. Methods

In the context of this thesis, a qualitative study was conducted to examine the orientation of municipal utilities in the energy transition. The focus is on the customer perspective and in particular the customer expectations regarding digital products and services. The method and structure of the study consist of a series of focus group discussions with end-users and are supplemented by two interviews with municipal utilities. First, the choice of method and the study procedure are described in detail. Lastly, the evaluation method is presented.

3.1. Method Selection

In research, qualitative and quantitative methods are differentiated (Krueger, 1994). As this thesis aims to explore and extend the understanding of customer expectations, qualitative approaches need to be utilized. According to Mayring (2015), *"the aim of the qualitative approach is not only to be able to analyse objects, contexts and processes, but also to be able to empathise with them"* or *"relive"* them. Thus, these methods primarily allow to understand the facts, rather than give a pure explanation based on a quantitative investigation. A core aspect of qualitative analysis is seeking to understand the entire complexity of its objects (Mayring, 2015). Both individual interviews and focus groups, belong to the qualitative methods. Both are considered for conducting the study as they can be used for similar objects of investigation (Schulz, Mack, & Renn, 2012).

"For the guided interview, a series of questions is prepared which should cover the thematically relevant spectrum of the interview and its subject. For this purpose, a guideline is prepared, which the interviewer follows. (...) The aim is to obtain the interviewee's individual view of the topic, for which purpose a dialogue between interviewer and interviewee is to be initiated with the questions." (Flick, 2009) According to Krueger (1994, p. 6) a focus group *"is a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment. The discussion is comfortable and often enjoyable for participants as they share their ideas and perceptions"*. A significant difference between the two approaches: In focus groups *"group members influence each other by responding to ideas and comments in the discussion."*

According to Morgan (1997), individual interviews do provide a deeper insight into the attitudes and experiences of the interviewees. However, this is mainly attributed to the time factor as individuals have a significantly higher share of speech in individual interviews. In addition, with individual interviews, the researcher has a greater degree of control on the course of the conversation. The data obtained in the process is easier to analyse because the group interaction does not need to be interpreted. Furthermore, the difficult process of group composition can be bypassed (Krueger, 1994).

Nevertheless, for our study focus groups show some essential advantages compared to individual interviews that are decisive for the choice of research method. First of all, as a result of spontaneous expressions in a group, new ideas can be stimulated within groups

that would have passed unnoticed in individual conversations (Krueger, 1994; Schulz et al., 2012). Moreover, participants can draw each other's attention to previously neglected topics and produce more detailed expressions (Lamnek, 2010). This enables a broader overview of the topic compared to individual interviews, individual participants can switch between active and passive participation (Schulz et al., 2012). Compared to the individual interview, interviewer or moderator effects can be minimised due to the group size (Schulz et al., 2012). This aspect is especially relevant for less experienced moderators as the quality of the study depends largely on the skills of the moderator (Schulz et al., 2012). His or her task is to involve all participants equally, to keep troublemakers under control and to encourage reticent people to participate actively (Schulz et al., 2012). Although the moderator already has some experience, she is not a professional, so moderator effects can not completely be ruled out. Furthermore, in front of a group it seems more difficult for individuals to credibly and persistently defend socially desirable opinions they are adapting (Schulz et al., 2012). Lastly, the time aspect should not be neglected, as final theses have limited resources and, in particular, a limited time frame. Summarizing, focus groups produce believable results at a reasonable cost and time (Krueger, 1994) and were thus chosen for this research project.

3.2. Data Collection

The study design applied in this thesis is oriented on the approach presented by Krueger, in his work *Focus Groups - A Practical Guide for Applied Research* (1994).

3.2.1. The Preparation and the Preparatory Interview

For an adequate study design that brings the greatest possible benefit for the municipal utilities, it is essential to enter into an exchange with them as early as possible in the planning process. In this way, the aspects that are important to them can be taken into account directly in the study design. Answering questions such as *"Who is interested in the study results?"* or *"What might those individuals do with the study results?"* should be answered (Krueger, 1994, pp. 46). With this study, we intend to provide added value for the offer and design of digital products and services of municipal utilities. As municipal utilities in contrast to other energy suppliers have the unique opportunity to offer solutions adapted to the local needs, we thereby focus on two municipal utilities in the region. In the following they are referred to as municipal utility A and municipal utility B.

Before conducting the focus groups an interview with the corporate development department of municipal utility A is conducted. From the results, necessary information for the study design and the target group can be drawn. Prior to the interview relevant information about potential digital services and products of municipal utilities that are summarized in section 2.2 is collected and used for the interview. Those are compared to the publicly available information about the digital offer of the municipal utility. Via the interview missing information about the municipal utility's digital offer can be gathered. Moreover, the municipal utility's perception of their customers, their mutual touch-points and their customers' role for the company alignment is investigated. Last, the municipal

utility's key interests of this study are asked for. Potential use cases and target group characteristics of the municipal utility are also discussed. The interview is conducted in German, but an English version of the detailed questionnaire is appended in Annex A. The results were incorporated into the structure and design of the focus groups in order to conduct the study in such a way that the results are most useful for the municipal utility.

3.2.2. Structure of the Focus Groups

Focus groups can be performed either using a topic guide or a detailed questioning route (Krueger, 1994). The topic guide consists of a simple list of topics which are to be addressed in the course of the discussion whereas the questioning route is composed of a sequence of complete pre-formulated sentences (Krueger, 1994). Both approaches have advantages and disadvantages: On the one hand, the topic guide seems more spontaneous and natural to the participants. On the other hand, a detailed questioning route though requires more effort in the preparation process, but is therefore more appropriate for non-professional moderators (Krueger, 1994). As the moderator in this thesis is not a professional, the detailed questioning route is used, as it offers a more rigid structure to follow.

Following Krueger (1994) the questionnaire consists of five parts. The focus group is chaired by the moderator, assisted by an assistant moderator taking minutes. After completing the consent form and a short demographic questionnaire (see Annex D), the focus group starts with some **opening questions** to start the conversation and get the participants to introduce themselves. In this round-robin questions, we asked the participants about their current situation regarding their energy supplier.

The **introductory questions** then start the discussion on the intended topic of the focus group. To do so, they explore the participants' perceptions of the remit of municipal utilities and their own points of contact with municipal utilities. In order to involve the target group of the focus group discussion as much as possible in the development process, both the content and the first draft of the questionnaire were discussed with potential participants before the first focus group. In this preliminary discussion, it could be found, that the broad spectrum of tasks of municipal utilities was not commonly known to all participants - a circumstance that was also confirmed by our first focus group. After a first uninfluenced assessment of the participants, the introductory part is complemented by an overview of potential business areas and potential digital products and services of municipal utilities, to provide a basis for further discussion (see Annex C). The list of digital products and services is based on the results from literature described in Chapter 2.2 and the results of the preparatory interview with the municipal utility.

The introductory questions are followed by a **transitional part** which leads to the core topic. Here, we explore personal experiences and the emotional level in more detail.

The **key questions** deal with the digital products and services a municipal utility should offer and what to consider when designing them. To this end, the list of the most important digital products serves as a basis for discussion. However, the discussion should not be limited to these aspects summarised from the literature. During the interview, the

list is thus compiled and supplemented by additional suggestions from the focus group. Furthermore, in order to take also the results from previous focus group discussions into account, the list is extended in the course of the interviews by the results of the previous focus group interviews.

A summary of the respective results forms the **conclusion** of the discussion round. We first ask the participants themselves to summarise their main takeaways. Afterwards, the assistant moderator summarizes the main results again and gives the participants the opportunity to make additions or changes. Finally, we collect feedback on the implementation and suggestions for improvement for the next run. Again the interviews are conducted in German, but an English version of the questionnaire can be found in Annex B. The focus groups were designed for a two-hour time frame.

3.2.2.1. Sample and Recruitment

In contrast to a quantitative survey, a focus group-based study only requires relatively few different groups and individuals. Focus groups are conducted until **theoretical saturation** is reached (Krueger, 1994). This means further focus group interviews yield only a few new pieces of information. The first two focus groups typically reveal a significant amount of new information, whereas, for the third focus group, a large part of the content has already been addressed. Therefore, Krueger (1994)'s suggested rule of thumb is to reevaluate after three focus groups. Considering the time frame, we therefore initially set a target of 3 focus groups. However, recruitment difficulties forced us to combine two dates.

Referring to the focus group composition Krueger (1994) suggests an ideal size for focus groups between 6 to 9 participants. Regarding the participants of each group, the group should be as homogeneous as possible with the necessary level of variation among participants to create room for discussion. To maintain this level of variation and not to influence the group dynamics through familiarity among the participants, care was taken when selecting the participants to ensure that they were not familiar with each other.

Concerning the composition of the focus groups, the preparatory interview reveals that a special characteristic of the current customer base of the municipal utility was the mature age structure. In addition, the municipal utility is also particularly interested in the younger generation, as *"there is still a bit of work to be done in this direction"* (MUA, para. 145). Based on these findings, we decide on the following breakdown:

- one focus group consisting of a younger group (20-30 years) of current and potential clients and
- two focus groups of an older target group (30-80 years) splitted in
  - a group consisting of existing customers and
  - a group consisting of current and mainly potential clients.

As some universities are located in the catchment area of both municipal utilities and students thus make up a significant proportion of the target group of 20-30-year-olds, students, in particular, are asked to participate. We reach them via the Institute's distribution lists, notices on campus, publications in social media, and mainly word of mouth.

For the older target groups of existing customers, recruitment using an already existing research cooperation with the municipal utility is tried, but we only received little feedback. Despite numerous efforts, no further participants could be recruited in this way.

Incentivisation plays an important role in focus groups, as participation requires both time and effort (Krueger, 1994). Since the budget for the thesis is very limited, we are mainly left with addressing intrinsic motivation. To minimise the participants' travel to the focus group and thus the effort of attending a session, we plan the focus groups at two different locations. However, due to the merging of two focus groups, both groups took place in our institute rooms.

As recruitment proved difficult, our two focus groups ultimately consist of two groups with five and six participants respectively. Details about the group composition can be drawn from Table 3.1. The first group consists entirely of students, all between 25 and 30 years old and living in rented flats and partly in shared flats. The second group is more diverse and includes participants between 25 and 30, as well as those between 30 and 50 or 50 and 80. A total of two participants live in a house, the rest in rented flats.

Table 3.1.: Metadata of the Focus Groups

	Reffered to as	**Age**	**Employment**	**Housing**
Focus Group 1	I1	20-30	Student	Rental flat
	I2	20-30	Student	Rental flat
	I3	20-30	Student	Rental flat
	I4	20-30	Student	Rental flat
	I5	20-30	Student	Rental flat
	I6	20-30	Student	Rental flat
Focus Group 2	I7	20-30	Employed	Rental flat
	I8	50-80	Pensioner	House
	I9	20-30	Student	Rental flat
	I10	20-30	Student	House
	I11	30-50	Employed	Rental flat

At the time of conducting the survey, none of the participants owned a photovoltaic system, an electric car or a wall box. However, one photovoltaic system and one electric car are each planned for the following months. One participant is a customer of municipal utility A. Three of the participants are customers of municipal utility B and one is not sure. Two of the participants are customers of both electricity and gas. In total there were 8 male and 3 female participants. In the following chapters, all participants are addressed with the masculine form of address, regardless of gender, in order to preserve anonymity and emphasize the irrelevance of gender.

3.2.3. The Follow-Up Interview

The second interview, this time with a representative of municipal utility B, takes place after the analysis process. Research questions 2 and 3 deal with the municipal utility perspective. The first results for answering them were already obtained through the preparatory interview (see Chapter 3.2.1). This second interview now serves to complete the municipal utility perspective. The procedure is outlined below.

After a few introductory questions regarding the future vision of the municipal utility and the role of customer expectations, the focus of the interview is on a discourse of the focus group results. On the one hand, the aim is to compare the results with the previous experiences of the municipal utility. On the other hand, the position of the municipal utility vis-à-vis the customers' expectations and their plans regarding the offer of digital products and services are to be examined more closely. For this purpose, a short summary of the central results is first presented to the representative, which is subsequently discussed. An English version of the detailed questionnaire can be found in Annex E.

3.3. Data Analysis

According to Krueger (1994) the data analysis procedure already needs to be considered before conducting the focus group interviews. In general the purpose of the study defines the scientific rigour necessary for the analysis procedure. For this thesis, a transcript-based analysis is chosen as it treats the data most rigorously and is thus the best basis for the subsequent content analysis of scientific works (Krueger, 1994) [1]. The choice of data analysis procedure as well as the focus groups themselves need to be constantly revised after each interview Krueger (1994). In especial, Krueger (1994) advises to revise the wording and sequence of the questions. In this way the first focus group interview also serves as pilot study, also probing the applicability of the developed questionnaire. In the case of this work, the questions were understood by all participants and a sufficient flow of the group discussion could be achieved. Therefore, no major changes to the questionnaire were applied. As only change for the second focus group the task to write down the tasks of municipal utilities on paper was introduced. This task allows the participants to reflect on the statements before starting with the discussion.

According to Krueger (1994) during the analysis several factors need to be considered:

- **Words**: Actual words and their meaning need to be considered. During a focus group a variety of words might be used which refer to similar matters.
- **Context**: Responses need to be seen in their context.
- **Internal Consistency**: Triggered by the interaction with others during the discussion, participants might change their positions.

[1] In less restricted environments, for example in internal surveys of private companies, also less rigorous methods can be applied.

- **Frequency or Extensiveness of Comments**: Frequency - some comments are made more often than others. Extensiveness - some topics are discussed by more participants. However, neither frequency nor extensiveness allow a conclusion about the importance.
- **Intensity of Comments**: Sometimes participants talk with a special depth of feelings. This intensity often cannot be spotted with transcripts alone.
- **Specificity of Responses**: Specific and personal responses based on experiences are more valuable than vague and impersonal responses.
- **Find the Big Ideas**: Big ideas might sometimes be difficult to spot, as they don't emerge from isolated comments but rather an accumulation of evidence.

Due to the complexity of the numerous interactions between the participants of each focus group, data analysis can be involved. Hence different analysis strategies have emerged. In (Lamnek, 2010) different analysis strategies, that can be used for group discussions, are presented. There, *content* and *group dynamic* analyses are distinguished. As group dynamics are not of central importance for the topic of this thesis, a content-based analysis method is chosen to analyse the data in transcript form. In the course of a group discussion, an abundance of data is collected, that needs to be reduced to allow for a detailed interpretation. Therefore, the *"reductive content analysis attempts to reduce the abundance of data material in such a way that information gain results"* (Lamnek, 2010). To achieve the necessary reduction, for this work, a qualitative content analysis following the method of Mayring (2015) is performed.

The underlying approach of qualitative content analysis is to retain the strengths of quantitative content analysis and, on top of this, to develop procedures of systematic qualitatively oriented text analysis (Mayring, 2015). Qualitative content analysis should thus not be regarded as an alternative to quantitative methods. Mayring (2015) describes through eight central aspects how to a qualitative analysis method can still consider the strength of quantitative methods. Those aspects will be described in the following.

1) **Embedding of the material in the communication context**
   The interpretation of the material in the qualitative content analysis must always take into account the context of communication to grasp the entire complexity of the subject to be investigated.

2) **The procedure is systematic and rule-governed**
   Even though the analysis is carried out on the basis of predefined rules, these must nevertheless be adapted to the concrete object of investigation, since content analysis is not a standard instrument.

3) **At the centre of this analysis is the category system**
   It guarantees the comprehensibility and intersubjectivity of the analysis for others.

4) **The focus of qualitative content analysis is on the concrete reference to the object**
   Mayring (2015) distinguishes between the three basic procedures of *summarising*,

explicating and *structuring*. Since the methods of qualitative content analysis can be used in many ways, the choice depends on the subject of the analysis. Mixed forms are also conceivable. In the end, the procedure needs to be modified adapting to the concrete study.

5) **Review of the specific instruments using pilot studies**
The comparability to other studies is controversial due to the lack of fully standardised instruments. The applied methods thus need to be tested in form of a pilot study. In this trial run of the procedure, which serves as a pilot study, the specific category system is to be tested based on the material to be examined.

6) **Theory-based analysis**
The analysis process is characterised by a large number of determinations and decisions that are to be made in a *theory-based* manner. This implies the inclusion of the current state of research in procedural decisions.

7) **Inclusion of quantitative analysis steps**
Qualitative as well as quantitative methods should be applied in an integrated form. Quantitative steps should be integrated, where they are beneficial. For example, the frequency of a category can be an indication of its importance. However, in qualitative research, the quantitative argument must ultimately additionally be qualitatively justified.

8) **Quality criteria**
Finally, Mayring (2015) describes the quality criteria on which the evaluation of the analysis should be based. Since the choice of qualitative content analysis methods depends on the subject matter, the assessment of the results under the criteria of objectivity, reliability, and validity plays a special role.

Mayring (2015) presents tree basic procedures of content analysis: *summary*, *explication* and *structuring*. They are characterised by different objectives. In the context of this thesis, the evaluation is oriented towards the latter subform of the structural analysis, which according to Mayring (2015) is probably the most central content-analytical technique. For this reason, the explanation of the analytical techniques will be limited to this form.

The analysis aims to filter out certain aspects from the material, to lay out a cross-section through the material under previously defined classification criteria, or to assess the material based on certain criteria (Mayring, 2015). The process of structuring content analysis can be described by the process model shown in Figure 3.1 and presented in the following.

In the beginning, it is necessary to determine the units of analysis (1). Following (Mayring, 2015) the following units of analysis are defined for the process:

- The smallest unit is the **coding unit**. It specifies the smallest component of the material that may be analysed. Delimitation of this type includes clearly identifiable semantic elements that represent an unambiguous meaning.

- The **context unit** is its counterpart and specifies the largest textual component which may fall into a category. It is determined by the respective focus group and the corresponding transcript.
- The largest unit is the **evaluation unit**. It includes all text components to be evaluated and determines the order of the texts to be evaluated. This thus includes the entirety of the focus group interviews.

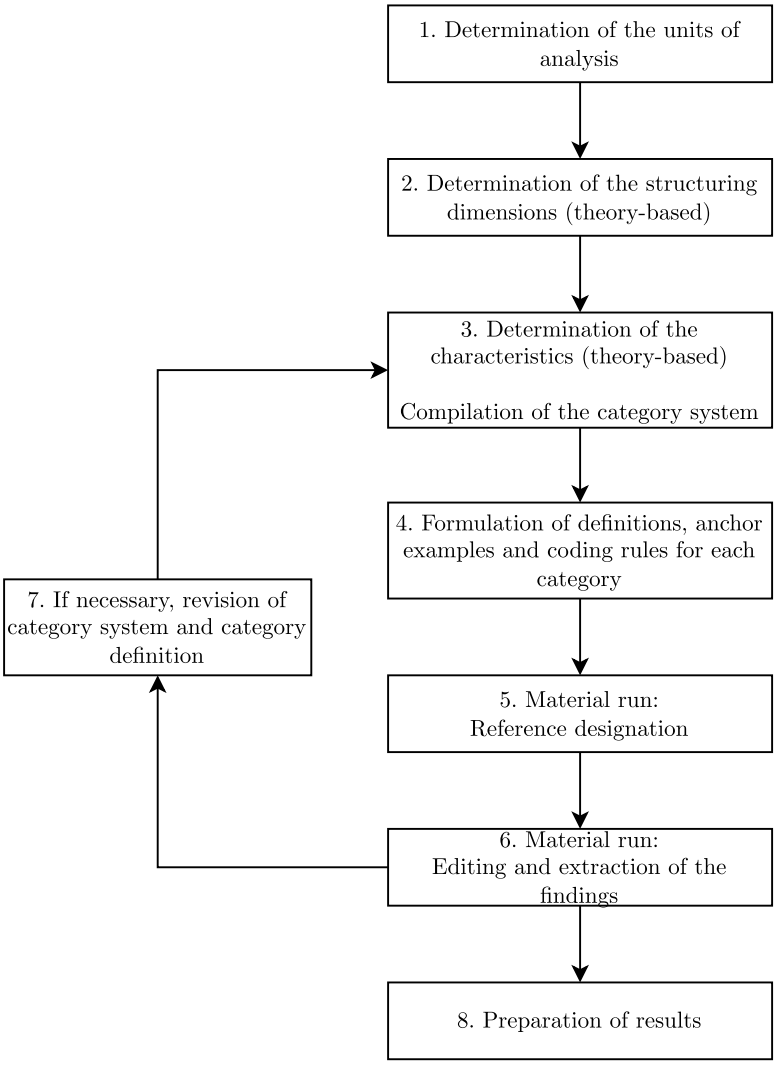


Figure 3.1.: Process Model of Content Structuring Content Analysis Adjusted and Adapted from Mayring (2015, p. 98)

Subsequently, the structuring dimensions must be derived from the research question and theoretically justified (2). Different manifestations of these dimensions should be filtered out and compiled in a category system (3). To be able to clearly assign a text component to a category, precise descriptions of the individual categories are required (4). Therefore, for each individual category its content is defined and summarized in the form of coding rules. These allow an exact demarcation from the contents of other categories. If necessary, they are supplemented by concise anchor examples, which contain concrete text passages that are to be assigned to a category. A first test run (5 - 6), through a section of the material, serves to check and, if necessary, revise (7) the category system. Steps 3 to 6

are to be repeated until all text passages have been processed and the sources have been worked out. The final step is the preparation of the results (8).

3.4. Data Set Preparation and Quality Criteria Confirmation

To ensure internal study quality, all interviews are transcribed verbatim, using automatic transcription software [2]. The resulting transcript is manually revised afterward to check for correctness. Since the group discussions took place in German, the transcription is also done in German. Relevant passages are subsequently translated into English for elaboration.

For the content analysis following the transcription process another computer software, MaxQDA [3] is employed. The content of the transcript is analyzed based on a previously prepared category manual, which contains detailed category definitions. The category manual enables the comprehensibility of the coding process and intersubjectivity. A controversial process in content analysis to ensure transferability is to perform the analysis of each transcript by several scientists and then compare the results afterward. In this way, personal interpretations by every single scientist can be minimized, increasing the intercoder reliability. However, as in the context of this thesis, the whole analysis is required to be performed by the author alone this technique could not be employed anyway.

Qualitative methods, and especially group discussions, cannot usually be measured that easily by the quality criteria of reliability and validity that are commonly used in quantitative research (Lamnek, 2010). Krippendorf, therefore, proposes quality criteria adapted to qualitative research (Lamnek, 2010). Using communicative validation following the analysis, agreement between researchers and interviewees regarding the results of the analysis is ensured. Additionally, the conclusion part of the interview, verified by the participants themselves, forms already an initial basis for the analysis process taking place after the focus groups. Besides communicative validation, expert validity is also a validity criterion used for qualitative research (Lamnek, 2010). The exchange with municipal utility B following the analysis thus not only serves to examine the municipal utility's perspective but also as a further validation step.

[2] https://www.tucan.ai/app
[3] https://www.maxqda.com/de

4. Results

In this chapter, the results of the study are presented descriptively before they are discussed in Chapter 5 with a focus on the research questions. Therefore, the main results presented in this chapter are already attributed to their respective research question. The focus of this thesis is on the first research question, which deals with the customer perspective on digital products and services. The focus group results relevant to this perspective are presented in Section 4.1. The following two research questions deal with the municipal utility perspective. They cover where municipal utilities see the potential of digital products and services for their customers and which products and services they would be willing to offer to them. The results of the two interviews with municipal utilities that are relevant for answering these research questions are presented in Section 4.2. As described in Section 3.3 the group dynamics are of minor importance for this topic. For the sake of completeness, however, it should be mentioned here that opinions rarely changed during the interview. Rather, the joint exchange of ideas led to further discussion, for example on the subject of energy saving or data security. These are therefore not highlighted in the following.

4.1. Customers' Perspective

The customers' expectations of digital products and services were investigated with two focus groups following the procedure in (Krueger, 1994). The analysis was carried out by a qualitative content analysis following Mayring (see Section 3.3). At the centre of this analysis is the category system; Table 4.1 shows a small and simplified excerpt from this system as an example. The full category system can be found in Annex F. In total, the system comprised about 46 individual categories, distributed over up to 4 hierarchical levels. The application of 47 categories to 2 focus group interviews resulted in a total of 448 codings.

4.1.1. General Image of a Municipal Utility

Before going into more detail on the individual products and services of municipal utilities, essential aspects concerning the municipal utilities and in particular the participants' touch-points of the participants with municipal utilities need to be covered at this point.

4.1.1.1. Personal Touch-points

The participants' contact with municipal utilities was largely limited to administrative processes such as concluding and changing contracts, transmitting meter readings, and online invoices. Occasionally, the use of the public charging infrastructure was also included. However, younger participants in particular did not rule out the possibility that other touch-points could be added in the course of their lives.

Table 4.1.: Excerpt from the Category System

Category	Subcategory	Subsubcategory
General Image of a Municipal Utility	Changing Portfolio	
	City and Municipal Utilities	
	Personal Touch-points	
	Local Presence	
Products, Services and Tasks of Municipal Utilities	Core Competences	
	Smart Services	EV Storage and Charging
		Decentralized Energy Ressources
		Energy Efficiency with Smart Home and Smart Meters
	Other Mobility Services	
	Information Provision, Communication and Consulting	Customer Service
	App	
	Web Platform	
	Administrative Processes	
	Synergy Effects and Bundle Products	
	Variable Electricity Tariffs	
Design of Digital Products and Services		

4.1.1.2. Locality of the Municipal Utilities

One topic that only came up in the first focus group was the special position of municipal utilities in comparison with other energy suppliers. Proximity to citizens and customers and regionality was a central factor that distinguished municipal utilities from other energy suppliers. Personal contact was important, e.g. via telephone or a customer centre as a place for face-to-face consulting.

"It would be important to me to have a feeling of being close to the citizens or something. I mean, it's the [...] municipal utility company. And yes, I always think to myself that there aren't that many customers and so on, so it has to be done in such a way that in doubt I call someone or that it's just somehow personal in a way." (I5, para. 236)

Several suggestions have been made to even increase the local presence, such as city advertising, communication via social media channels, or an open day where people can take a look at a transformer station or promote contact and exchange through tangible events. Furthermore, YouTube videos could be used to communicate the company's vision, thus creating transparency, promoting the image of a modern company, and possibly even triggering a kind of pride among the population. Pop-up stands, on the other hand, were not

considered helpful, unless they would be linked to local events.

An important factor for the special level of trust put on municpal utilities was their regionality. In order to maintain this trust, it could be found, that the municipal utility's communication with its customers is essential. As social media has been becoming increasingly important in the provision of information, these channels could be used in a variety of ways from energy saving tips, to providing information about current cooperations, to the aforementioned suggestions for raising local presence.

During the focus group discussion in several occasions the demarcation between city and municipal utilites was confused by some of the participants. Consequently, it was difficult to separate the responsibilities of the city and the municipal utilities. In some cases, the municipal utilities were seen more as an extension of the city. In the first focus group, this discussion only came up towards the end. For the second focus group, the separation was much sharper, as one of the participants pointed out during the discussion: *"It's not the municipal utility. You have to differentiate a bit"* (I11, para. 636). This should be kept in mind when considering the following results.

4.1.2. Products, Services and Tasks of Municipal Utilities

In the following, the expectations of products, services, and tasks of municipal utilities will be described in more detail. The first subsection gives an overview of those services that have been highlighted several times as core tasks of municipal utilities. Further products, services, and tasks of municipal utilities were subdivided based on the categories described in Table 4.1. The subdivision of the smart services is done according to Paukstadt et al. (2020).

4.1.2.1. Core Tasks of Municipal Utilities

Before all products and services are discussed in the following sections, an overview of the tasks that the focus group participants considered to be among the core tasks of municipal utilities is given here. These are summarised in Table 4.2.

Table 4.2.: Core Tasks of Municipal Utilities Identified in the Focus Group Discussions

Core Tasks	Energy supply (electricity and heat)
	Network operations
	Secure and reliable power supply
	Transparent customer commmunication
Increasingly important	Energy production
	New business models such as public charging infrastructure

First of all, it should be noted that the participants primarily regarded energy supply (primarily electricity, but also heat) and network operation as core tasks of municipal utilities. For the participants, it was important to have a secure and reliable power supply and access to information quickly in case of malfunctions. Furthermore, transparency in terms of prices and the electricity mix was highly valued.

Besides the core tasks of municipal utilities, there have been tasks that are becoming increasingly important and increasingly counted among the core tasks. Among those energy production, especially investment in green energy, was increasingly seen as a duty of municipal utilities. Furthermore, new business areas have been also increasingly finding their way into the municipal utility portfolio. Notably, the public charging infrastructure is becoming more and more important. But new business models such as broadband expansion, photovoltaics, and wall boxes were discussed as well. In general, it could be stated, that digital products should above all support security of supply and reduce bureaucracy.

4.1.2.2. Smart Services

Before going into detail about the digital products and services offered by municipal utilities, some general impressions of the participants in relation to the increasing digitalisation should be given.

In general, the slow progress of digitalisation in Germany compared to other countries was mentioned by the participants. I5 describes this by: *"It is little [...] digital exchange, but it works"* (I5, para. 196). The advantages of digitalisation, including reduced manual effort and faster processing, were, however, appreciated. I1 speaks of the *"added value [..] in everyday life"* (I1, para. 62). Nevertheless, the first focus group in particular equally showed scepticism towards digitalisation. A strongly discussed topic was the issue of data security, notably, in relation to the data collection associated with real-time power consumption displays. I2, for example, states: *"And I would have a more fundamental problem with that, that it would mean that I would simply make my entire history of my energy consumption available to the municipal utilities, the data would then be collected by the municipal utilities if I did that via the municipal utility's app"* (I2, para. 72). As a consequence, local technical solutions have been proposed as a solution. While data security was a strongly discussed topic in the first focus group, I11, as part of the second focus group, raises a much more fundamental question: *"How much more digitalisation do you actually need as a customer? I mean, as long as you still have this rigid uniform tariff, it doesn't really matter"* (I11, para. 198). Even if digital offers were not yet used much in the current everyday life of the participants at the time when the focus group discussion took place, there were also digital offers that were nevertheless highly appreciated, as can be seen in the following.

EV Storage and Charging

From the customer's point of view, the area of electromobility has been increasingly anchored in the portfolio of municipal utilities. In particular, the area of public charging infrastructure was more and more seen as a core competence. *"There has to be done more"* (I11, para. 440). Municipal utilities were seen as having a responsibility to promote electromobility, especially if this is not done by private providers in the municipality. In particular, when it comes to developing an overall planning concept that takes into account the effects on the population, municipal utilities were considered responsible. Keywords

that came up in this context are: charging for single-family homes, kerbside charging stations, charging at work, and planning and construction of parking spaces.

The area of private charging infrastructure, on the other hand, was not seen among the main duties of the municipal utilities but was nevertheless welcomed as a beneficial add-on. However, the difficulty of establishing such a new business model was also recognized and discussed. One of the two municipal utilities already offered consulting, purchase, and installation services for wall boxes, which was well received by the focus group participants. Still, there were also participants that categorically ruled out the municipal utilities as soon as it was a matter of personal property, as would be the case with wall boxes or photovoltaic systems, for example.

Participation Offerings

As the generation of renewable energies is an important topic in today's everyday life and politics, participants of both focus groups attributed high priority to this topic. In Chapter 2.2 potentials for involving municipal utility customers via participation offers are presented. These can take the form of energy cooperatives. Concerning these, participant I11 stated:

"I find that quite exciting. I find that very interesting. The municipal utilities could really do more. For example, they could say that they have open space X and [build] solar energy on it. I then participate with shares in the cooperative and get the electricity in return. [...] Or biogas plants, that is a broad field. [...] That's really something you can get involved in. You get something out of it. You are part of the energy transition. [...] I think that's great" (I11, para. 570-574).

Here, municipal utilities were seen as being primarily responsible for initiating the initiative.

Decentralized Energy Resources

Another way to become active in renewable energy generation is based on decentralized energy resources. In this area photovoltaics was the main topic. Similar to the charging infrastructure, photovoltaics has already been anchored partly in the municipal utility portfolio.

In general, photovoltaics and the expansion of this technique was not identified as one of the core tasks of municipal utilities in the focus groups, but could be seen as such in the future. However, as a limiting factor the area of personal property was mentioned once again, which is why the involvement of municipal utilities was viewed critically by some of the participants. Nevertheless, the participants expressed their desire for the municipal utilities to provide advice in the search for technical solutions and assistance, mainly in the form of criteria for the form of the technical solution. In addition, information for self-installations in the form of balcony solar systems should be made available by the municipal utility.

Energy Efficiency with Smart Home and Smart Meters

The last of the smart services to be discussed here are services that increase energy efficiency by using smart homes and smart meters. Along with the introduction of a smart meter, a real-time consumption display was mainly rated as interesting by the participants. However, the interplay between energy management and smart home systems and particularly the role of municipal utilities in this context was discussed controversially. I4 pointed out the following on energy management in the municipal utility portfolio and thus summarised the main points of the discussion:

"Here I see [the] municipal utilities [...] because I would trust them more than a provider where I have no regional connection or something, but of course, there is also the question of whether they have the competence to make it so secure that it works then. That's the field of tension I see there" (I4, para. 197).

Overall, energy management, for example in the form of providing a gateway to the smart home system, was seen as the responsibility of the municipal utilities. The smart home components themselves, however, were seen as outside the competence of municipal utilities due to their complicated structure. Of greatest importance in this context, the participants mentioned the open and manufacturer-independent design of the various interfaces. The overall importance of this topic is stressed by the fact, that these statements were repeated several times with regard to different products.

The role of municipal utilities as providers of advice in energy-related topics was generally agreed on but the degree and complexity of advice were discussed controversially. On the one hand, the wish was expressed that municipal utilities should offer consultation and show the possibilities that exist in the area of energy efficiency with smart homes, independent of manufacturers. On the other hand, another participant argued that due to the complexity, the large number of different systems, and high degree of individuality, this could not be regarded as a duty of the municipal utilities. This is why, especially with regard to energy management and smart home systems, the legislator was attributed a special responsibility to ensure a standardisation to reduce the current complexity.

4.1.3. Energy Saving

In general, the attitude towards energy-saving tips from the municipal utilities was rather mixed. Even though the participants were partly critical of the intervention in their personal homes, they still wished for advice from municipal utilities to save energy. One of the participants suggested interactive tips in the form of challenges or bonus systems. Both of these forms, however, were also seen as problematic, due to data protection reasons. Therefore it was suggested to offer challenges on a voluntary basis and only if the anonymity of each participant could be ensured by large numbers of participants. One idea that met with approval by large parts of both groups was support from the municipal utilities in identifying the top three electricity consumers. However, there was also displeasure, as this would require an invasion of privacy. Thus, data could be analysed on request to identify the top three consumers. A rather controversial attitude towards energy-saving tips was expressed by a participant in the second focus group:

"The question is, at the latest with the Ukraine war, the topic of saving energy is the topic par excellence. [...] Anyone who is not interested in this at the present time -they have to learn through pain. Learning through high electricity prices" (I11, para. 642).

4.1.3.1. Other Mobility Services

As described in Chapter 2, municipal utilities often take care of a variety of tasks of public services, among those mobility services such as public transport. Subsection 4.1.2.2 already summarized the participants' attitudes towards electromobility services. Other mobility services such as public transport or sharing services for cars or e-scooters were seen as tasks for private providers or independent transport companies. In the region under consideration in this study, these services were mostly provided by private providers. In the municipal utility portfolio, they were seen rather as an add-on, but not as a core task. Especially in this context, the confusion about the distinction between city and municipal utilities was apparent.

4.1.3.2. Customer Service

As a mean of personal contact, good customer service and quick assistance were essential for most participants and a fundamental part of the municipal utility. In general, telephone support was chosen as the favoured communication medium for quick and targeted support. As another mean of communication e-mail was identified to be of great importance. However, the response times were claimed to be very long on numerous occasions.

Due to the increasing importance of digitalisation in customer service (Schilling, 2019) also additional digital forms of customer service, like voice or chatbots, were brought up. Yet, among the participants, these forms were not appreciated. Chatbots would often serve more as a navigation tool to better navigate on an existing website, however the independent direct search via the website was often more efficient. The participants agreed that chatbots, especially in their current development stage, often would not contribute to find solutions more efficiently:

"I can only speak for myself, but in the cases where I have a problem, I actually know from the start that I can only hope that someone is sitting there with whom I can talk again, because the problems are usually not solved by such prefabricated [answers]. I don't usually have any points of contact, that is, I have a problem, something doesn't work, something doesn't work as it should, and I start looking for support, for some kind of contact, and then often end up in a chat like this. But generally it doesn't help and you have to be redirected again" (I10, para. 378).

In the future, however, this technology could still show potential:

"Yes, I think it always lives and dies with the quality of the chatbot, and what is currently available, I think, it is simply not at a level where it helps me. But yes, there have been massive improvements, also in recent times, and one can imagine that perhaps in a few years it will also come within the financial reach of the municipal utilities, which is good enough in terms of functionality that it actually brings something and then perhaps. But as it currently looks, I would not want to invest many resources in it" (I2, para. 149).

4.1.3.3. App and Web platform

In general, the participants expressed the wish to be provided with at least an app or web platform by the municipal utility. Especially the web platform was seen as *"of course part of the basic equipment"* (I2, para. 282). In direct comparison, the importance *"that the platform works well"* (I4, para. 68) was rated higher than the existence of an app. Additionally, as part of a good web platform, a transparent structure of the career page was stressed. Both focus groups agreed that the advantages of an app or a web platform depended on the frequency of use. Consequently, a web platform was preferred for infrequent use cases, for example, meter readings, as it would be accessible by a wide spectrum of different devices. An app was regarded to be only useful for a smaller range of functions and frequent use, like retrieving smart meter readings or the power consumption of a wall box. In addition, various functions could be integrated into an app, such as bicycle-sharing services. For infrequent use, however, the mobile version of the website for mobile phones would be a good alternative. Both, a web platform and an app were seen as instruments to digitalise administrative processes.

4.1.3.4. Administrative Processes

Using an app or web platform, there are a number of administrative processes, that could be designed to be digital. Often digital products and services were likely to be expected to reduce bureaucracy. Meter readings were generally felt to be a nuisance and participants looked forward to their elimination through the installation of smart meters. A digital design for the meter reading transmission was important, favoured via a web platform. Invoicing should also be done online. Thereby, it was important to have everything in a single place. For the design, there were both advocates of an app and of transmission by e-mail. Processes such as concluding a contract, changing a contract, or reporting faults should in any case be possible online via a platform. Even though digital products were appreciated to reduce manual effort, the respective focus groups sometimes came to different conclusions regarding the design of such administrative processes. For example, the grid connection process was agreed on to be digitalized by the first focus group. The second focus group, however, did not see a need for this process to be digitalized as it was a one-off process. The last administrative process addressed was the submission of EEG applications. Here, too, both focus groups came to different conclusions. While the first group definitely wanted the possibility to submit applications digitally, the second group saw less of a need for this. Since the process *"needs to be explained"* (I11, para. 220), it required additional advice. Moreover, this task would usually be taken over by the respective installer anyway. An online solution would therefore possibly facilitate the process for the installer.

4.1.3.5. Synergy Effects and Bundle Products

Bundle solutions and a diverse task portfolio were perceived very differently in the individual focus groups. Especially in the first focus group, the advantages of all-in-one solutions were discussed.

For example, referring to photovoltaic solutions, I3 pointed out: *"I find it practical that I might not need another provider. Rather, it could be handled by a single entity. But in itself it is perhaps not the core task. It would be practical if they had it."* (para. 139)

However, the trade-off between the advantage of all-in-one solutions and the limited resources of municipal utilities was also discussed. The municipal utilities were seen to potentially act as portal operators and coordinators between cooperating experts from other fields, that could be involved for tasks outside the field of expertise of the municipal utilities.

The second focus group was much more critical of bundle solutions and a broad range of services.

"I also have to admit that I think it would be crazy if it all came from the same provider. I mean, there are already many topics and somehow it would be nice if everything came from the same provider, then they would have very high rights in the city or in the region, so to speak" (I9, para. 450).

On the one hand, the regional concentration of power had to be taken into account. Additionally, the potential risk of costs being passed on from one sector to another, and in particular to the electricity sector was pointed out. It was for this reason, that city advertising was received poorly. On the other hand, integrated projects were welcomed, if they served multiple objectives at the same time and thus lead to an overall saving of costs, projects that required the demolition of a road where mentioned in this context.

4.1.4. Design of Digital Products and Services

A keyword that appeared several times in connection with the design of digital products and services is the expression *"easy"*, however, referred to several characteristics of digital services. In general, these services were expected to *"make life easier"* (I11, para. 646), for example by reducing bureaucracy and increasing automation. *"Easy"* was not only put in context to the effect of the services; but also in the operation of the digital services. They should be intuitive to use, so that everyone can use them, including laymen, without having to spend much time learning the operation.

There has been a discussion if an application would be necessary, but if so it should integrate as many functions as possible into a single app.

Talking about hard- and software solutions like wall boxes, photovoltaic installations, smart home solutions, energy management, and the like, both groups highlighted the importance of open interfaces for technical solutions.

4.2. Municipal Utility's Perspective

In order to obtain an overall picture, the customer perspective will be supplemented by the company perspective in the following. The results of the two interviews with municipal utilities presented below serve to answer the second and third research questions. First,

impacts of digitalisation from a municipal utility perspective are addressed, including opportunities and risks associated with digitalisation. Then, the role of digitalisation for customer service and new business models will be covered, concluding with the opportunities arising from the smart meter roll-out.

4.2.1. Impacts of Digitalisation

Digitalisation and customer-centricity are becoming increasingly important for municipal utilities. The following paragraphs explain which role they play in the municipal utilities' future vision and where the latter see the opportunities and risks associated with digitalisation.

Future Vision

Looking at the future visions of both municipal utilities, it could be seen that regionality played an important role and that the customer held an essential place in it. Municipal utility A described the role of customers and their influence on their future vision as follows: *"we live from the customers. Therefore, you always have to look at where the customer has a need, what the new topics are, and where the customers also have added value. So I wouldn't digitalise it just to do it but it has to have a certain added value for the customer"* (MUA, para. 12). Municipal utility B set itself the goal *"to be the energy partner of the region. [...] Especially for us in product management, the focus with our vision is [...] that we also want to put the customer needs at the centre of our products. [...] We even want to take this a step further and interpret the whole as a life partner. But what does life partner mean in that sense? I mean, that is a very powerful word. And we also want to support the customer in other ways. Not only in the normal things that are part and parcel of being an energy supplier, but also more in the direction of emotionality with the customer. That means we also have [...] a customer loyalty programme"* (MUB, para. 7 et seqq.).

Opportunities of Digitalisation

Digitalisation is growing increasingly important to provide this support to customers. On the one hand, digitalisation would allow municipal utilities to appeal to increasingly younger customers and also ensure smooth and transparent customer communication. On the other hand, it would also enable increasing standardisation and automation of processes and thus better scaling of products. Further advantages as a consequence of advancing digitalisation would be improved use of resources, addressing problems like increasing staff shortage and eventually even allowing a reduction in process costs. Increasing standardisation and automation would also offer additional advantages for the customer in the form of reduced susceptibility to errors, faster provision of information, higher flexibility, and also better comparability.

Risks of Digitalisation

However, digitalisation would also entail the risk of digitalisation for the sake of digitalisation. Even if aligned with customer needs, there is the risk of *"spending too much money*

or making too many processes digital [...] which are actually not needed" (MUA, para. 21). In both interviews, the high investment costs associated with innovative digital products or services were mentioned, which could not be sustained economically due to the lack of scaling effects resulting from the size of the company. To counteract this problem, both municipal utilities pointed to the potential of cooperation partnerships or the use of white-label solutions. Both municipal utilities also emphasised that digitalisation could not substitute for personal contact, which is so important for regional energy suppliers. One of the municipal utilities described the necessity to offer two *"channels"*, a digital and a personal one. The other municipal utility even described this as two different *"business models"*. Personal contact would be particularly important on a regional level, especially in the municipal utility's role as the basic supplier, as not all customers would be digitally active. Therefore, products had to be offered offline as well. For nationwide sales, on the other hand, digitalisation played a crucial role, as there would not be another way to handle it. In particular municipal utility B reported positive experiences with this.

4.2.2. Customer Contact

The municipal utilities described their customer touch-points predominantly as contract conclusions, meter reading transmission, and billing. According to the municipal utility, there are the *"classic things"* of the core business. Inquiries about price increases additionally lead to increased customer contact or, especially at the time of the interview, a growing need for information associated with the energy crisis. But also the publication of the customer magazine and occasional reports in the newspaper were means to establish contact with the customer. Especially events and trade fairs in the vicinity of the municipal utility would be utilized to exchange information with customers, and furthermore establishing a local presence. Social media was a further medium for customer interaction and information provision, for example, used by municipal utility A to provide energy-saving tips.

Especially concerning the younger generation, there would be still *"a bit of work to be done"* (MUA, para. 145), but so far there was only little insight into their needs, even though digital products were mainly aimed at this target group. As municipal utility A reported the customer nevertheless had an impact on the external orientation of the company, but as new ideas emerged inside the company, the effect arising from the internal staff structure on the external orientation should not be neglected. Furthermore, the representatives of municipal utility A did not exclude that there might be fundamental differences between their perception of the customers' expectations and the expectations of the customers themselves. Consequently, they saw the need to focus more on their customers and deal with them. Internally, the implementation of a customer survey has been discussed several times, but due to missing resources, it so far hasn't been conducted. Some digitalisation steps, such as the digitalisation of the grid connection application, could be *"done already"* because *"the time [for it] has come"*. For other topics, such as the digital chatbot, they did not see the need for customer feedback: *"I don't need direct customer feedback or the company in general. You can see in the figures, how it is also used. It is feedback for us*

and we see that it is being used. That's why it's positive for us. We are glad that they have included it, even without the live function. Even if it's just an intelligent navigator, that's what I call it. But it is helpful. It's helpful for the customer. The paths are shorter and I would say faster" (MUA, para. 84).

4.2.3. New Business Models

As digitalisation offers potential for new business models, smart services such as public charging infrastructure, wall boxes, photovoltaic systems, or smart home solutions are increasingly implemented into the portfolios of municipal utilities. However, especially in such cost-intensive business areas, the aforementioned investment costs and scaling effects are of major concern. Municipal utility B described this as follows: *"It's always a question of make or buy, which in the whole story as a regional municipal utility you can't do everything yourself, but then you are still somewhere, I'll call it an obligation, to also offer the things because it is also expected because you notice it on the market. The customer notices that others do it and that's why it's always a matter of consideration"* (MUB, para. 24).

Especially in the area of public charging infrastructure, municipal utility B found that they also notice among their customers that the local energy supplier is gladly seen as being responsible in this area. Thus, both municipal utilities have already included the public charging infrastructure in their portfolio. For municipal utility B, the focus was on offering customer service (e.g. in the form of a charging card) and thus only the role of the e-mobility provider [1] and does not take the charge point operator's place. It would be in this area that cooperations play an important role for both municipal utilities, as in the area of e-car sharing. The municipal utility would some of the vehicles and the cooperation partner would take care of the rental process.

Municipal utility A also reported offering its private customers an electromobility service in the form of the installation of private wall boxes, as well as an electromobility check or concepts for owner associations. In the latter area, however, consulting was the main business due to the complicated situation. In general, municipal utility A saw the comprehensive consultation of their customers as part of their tasks in the context of these new business opportunities, as well as the offer of modular products. Anyway, the importance of offering these new smart products or services for both municipal utilities became clear through the investment of additional resources, mainly additional personnel specialised in these topics. Municipal utility B saw the problem of high individuality in the offer of such smart solutions and thus a necessary high degree of specialisation. The essential role of photovoltaics, home storage, charging infrastructure, and the like was expressed by the representative as follows: *"That we want to be involved with the customer? I don't think that's really a question that needs to be discussed anymore, because we actually have to*

[1] In Germany, a distinction is made between the charge point operator (CPO) and the e-mobility provider (EMP). The CPO is the charging station operator and in his role is responsible for the maintenance and operation of the charging stations. The EMP, on the other hand, enables its customers to charge their electric vehicles at specific charging stations at contractually agreed rates (Nationale Leitstelle Ladeinfrastruktur, n.d.).

be involved, because ultimately all these products are about saving energy. And what is actually our core business? We actually want to sell energy, which means we want to have a foot in the door and work together with the customer" (MUB, para. 28). Nevertheless, other handicraft enterprises would be better specialised for these models. Municipal utility B, therefore, saw itself more in the role of the portal operator, providing the primary contact and bringing together the different parts. This has not been realized, though.

Digitalisation also offers potential for new developments in the area of energy services; municipal utility B described the interaction between energy services and digitalisation as follows: *"If I just take a look at energy services, the whole thing should actually work for us in the future in such a way that you can look at the whole thing on our homepage, for example, that you can already enter various initial data from the customer there, so that [an] initial need for information can also be satisfied that the customer has and then accordingly also submits an expression of interest to us. And the whole thing should actually be done digitally for the most part and then the feedback or the exchange with the customer should also take place in a digital form."* (para. 55)

4.2.4. App and Web Platform

The provision of information for customers or various administrative processes can be digitally realized by using either an app or web platform as a communication channel. Municipal utility A handled a large number of services via a digital web portal, such as the registration of a grid connection, which is to be supplemented by the EEG application. Fault messages could also be reported using a portal and thus automatically forwarded to the responsible craftsman in order to fix the default as quickly as possible.

An app would only be of interest to municipal utility A as an *"all-round app with all possible functionalities"* (para 88). They considered a stand-alone municipal utility app to be not interesting. The app would have to be made available in cooperation with the city and enable shared functionalities, such as contacting, making appointments, concluding or terminating contracts, moving or notifying meter readings.

4.2.5. Customer Service

The recent energy crisis and its resulting need for communication between customers and municipal utilities are excellent examples given by the municipal utilities for the importance of customer service for their business. But it is not just the service that is important to them, it is also the speed. For this reason, municipal utility A relied on the development of a chat- and voicebot (without live function). As a *"digital navigator"*, it would offer more flexibility, especially beyond office closing hours. *"Yes, we currently use it a bit after hours as a customer service substitute when people want information. They can also submit meter readings, already via this. But the rest, the further processing is all still done manually"* (MUA, para. 6). Also, municipal utility B already utilized a chatbot as a communication tool but still emphasized its limited functionality. The most common communication channels would be telephone and e-mail, although letters or the local customer centre would still be used. However, in order to guarantee the adequate speed of response to

written as well as verbal customer concerns, the support of an external call centre would be relied on. Overall, it can be stated although there are similarities in the methods, the design of customer service differs among individual municipal utilities.

4.2.6. Opportunities by the Smart Meter Roll-out

In the context of the possibilities that arise for customers through the installation of a smart meter, both municipal utilities first highlighted the stagnating smart meter roll-out. A problem accompanying the roll-out would be the swiftly changing legislation. Referring to the opportunities for the customers, municipal utility A stated: *"There could be opportunities, but I don't think the customer really needs it. Yes, really. It's like that -not yet. I think we are too early there"* (MUA, para. 113). Similarly, municipal utility B argued that a smart meter installation would be a substantial advantage for the majority of customers. Rather, it would be a kind of *"gimmick"* to indulge in technically if interested. Both also mentioned the additional cost component accompanying a smart meter for private households. Therefore, care had to be taken to ensure transparent communication, and explain the processes to the customer in a comprehensible way. Possibilities such as a real-time consumption display or the offer of variable electricity tariffs were only discussed within the framework of the legal regulations. At the time of the meeting, no further plans were available by either of the municipal utilities interviewed.

5. Discussion

After having presented the results of the focus groups and the interviews with the municipal utilities, in this chapter, the results are summarized and related to the research questions of this work. The research questions consider both the customer perspective and the municipal utility perspective separately, whereby the focus has been on the first. Subsequently, these two will be brought together. Different aspects of agreement and disagreement will be discussed and related to previous findings in the literature. At the end of the chapter, limitations of this work will be discussed.

1. What do customers expect from (the digital products and services of) their municipal utility?

The first research question deals with customer expectations of municipal utilities. The results of both focus groups presented in Chapter 4.1 can be used to answer this question. From the results and statements in Chapter 4.1 it can be concluded, that the customers primarily identify municipal utilities as energy suppliers (electricity in particular) and operators of the necessary infrastructure.

Aside from this fundamental role, an advancing development towards producers is desired. While the development of renewable energies, in general, is relevant, municipal utilities are also expected to promote opportunities for citizen participation in the form of energy cooperatives.

The digital products provided by municipal utilities should be simple and intuitive, reduce bureaucracy and further assist the reliability of supply. In particular, the functionality of digital products is considered to be one of the most important criteria.

Public charging infrastructure is increasingly seen as a new business model in the municipal utility portfolio. However, other new business models such as PV or wall boxes are argued. Overall, municipal utilities are often seen as obliged to provide products or services not already offered by other private providers. The first focus group sees the advantage of all-in-one solutions for PV, wall boxes, and comparable services, but also the trade-off between the centrality of all-in-one solutions and the resulting potentially excessive workload for the municipal utilities. Hence, interfaces to other experts are considered useful regarding the municipal utilities as portal operators coordinating everything. The second focus group shows a stronger orientation on power and costs. They are concerned about the concentration of power in one provider, offering all services. Possible consequences in the form of passing costs between different market sectors are declared.

Both focus groups agree on the role of municipal utilities in the energy management sector, yet the municipal utilities are not regarded as responsible in the smart home sector due to its high complexity. Considering their expertise, the latter are seen more as being the responsibility of external providers. Especially in the first group, data security and data collection are important topics, particularly concerning the display of real-time data.

For the handling of administrative processes or the provision of information, it is expected that at least an app or web platform would be made available. In principle, a well-functioning web platform is part of the basic equipment, but the benefit of an app or web platform also depends on the frequency of use.

The focus groups show that personal contact and local presence are of particular importance for the regional supplier. Customer service plays an essential role in this context. In summary, it can be said that the telephone is the favoured medium, as it is hoped to provide a quick solution, while chat- or voicebots, on the other hand, are badly welcomed. Transparency in communication was also emphasised several times by the participants, not only with regard to pricing but also with regard to the energy mix or the rapid provision of information in the event of a problem.

2. Where do municipal utilities see the potential of digital tools and services for their customers?

According to the municipal utilities, customers can mostly benefit from digitalisation through the increasing standardisation and automation induced by the digitalisation. These aspects are expected to reduce susceptibility to errors, provide information faster, and improve flexibility as well as comparability. With the development of a chatbot, for example, municipal utility A sees the potential for higher flexibility for its customers as it offers new communication channels and availability beyond closing hours. The highly awaited smart meter, though, would be more of a technical gimmick than a real added value for customers at the time of this study.

3. What digital tools are municipal utilities willing to provide to / develop for their customers?

According to municipal utility B it is imperative to be involved in new business areas like wall boxes, photovoltaic and other emerging markets. Nevertheless, due to their limited size, the missing scaling effects, that come along with a larger sales market, have an essential impact on the business areas municipal utilities can invest in. Following the strategy of involvement, only the question of make or buy decision resides for the municipal utilities. Therefore, white-label solutions and cooperatives play a significant role for municipal utilities in extending contact with their customers. Future visions portray municipal utilities as portal operators at the centre initialising the primary customer contact and coordinating more specialised cooperation partners. This image also applies for energy services. The first contact is to be made via a web portal in which all the necessary information is provided and via which the initial customer data can be entered. This web portal, which can be used to handle other administrative processes, and the additional provision of a chatbot are intended to increase flexibility for the customer (especially outside opening hours). In addition, municipal utilities are often strongly influenced by legal requirements in their offers. For instance, offers such as variable electricity price tariffs or a consumption display during the year are primarily made based on legal requirements.

Comparison of the Different Perspectives

Considering both perspectives, a general impression of customers' expectations of municipal utilities and the municipal utilities' interpretations of their perceptions shall be given in the following. By comparing the perspectives of customers and municipal utilities agreements and discrepancies are identified. In the following, the agreement and disagreement of both perspectives will be discussed in more depth and related to existing literature. Matching statements are to be considered first. Table 5.1 gives an overview of all the statements considered for this evaluation. In each row, a statement is given. In the second to fourth columns, either an agreement (full circle) or a discrepancy (empty circle) for the customers perspective, municipal utility perspective, or literature, respectively is given. In the last column, literature references are given in the case of agreement. For discrepancies with literature, references are omitted, as discrepancy is related to missing supporting statements and not a hard disagreement. The table does not claim to be complete, as due to the research design (the open discourse in the focus groups as well as the timing of the interviews) not all topics were always covered. If no clear statement can be made for a source, this is indicated by an empty circle as well.

In a direct comparison between the focus groups and the municipal utility perspective, some of the statements of both perspectives coincide with each other. Or in the case of the second municipal utility interview, focus group results have been confirmed by municipal utility B. For example, the participants described their contact with municipal utilities mainly via administrative processes such as concluding and changing contracts, transmitting meter readings, and online invoices. Another example is the essential role of personal contact via local customer centers, or local events for regional energy suppliers. On these points, both focus groups and interviews with municipal utilities agreed. Additionally, both parties stated that the regional factor distinguishes municipal utilities from other energy suppliers. As Jenner and Schmitz-Grethlein (2017) and Beier et al. (2020) point out, this also offers the opportunity for customised local offers. According to Beier et al. (2020) and Fidan et al. (2022) municipal utilities benefit in this manner from the increased trust that is placed in them. This conclusion was likewise supported in the focus groups. Thus, I4 stated for example in connection with energy management systems: *"Here I see [the] municipal utilities [...] because I would trust them more than a provider where I have no regional connection"* (I4, para. 197). Similarly, the majority of experts surveyed in (Möller, 2022) perceive personal customer contact as a clear competitive advantage.

Regionality enables customized offers (Jenner & Schmitz-Grethlein, 2017), that are equally relevant in the context of renewable energy generation. The focus groups emphasized several times that the generation of renewable energies should also become increasingly important for municipal utilities. This expectation is in line with the plans that municipal utility representatives described in the expert interviews conducted by Möller (2022). During the interviews with the municipal utilities interviewed for this study, this aspect has not been directly addressed. Hence, no definitive statement can be made from their point of view. To become more active in the energy transition themselves, the desire for participation formats such as energy cooperatives was also raised by the participants of

Table 5.1.: Statements of Agreement Between the Different Perspectives

Statement	Focus Groups	Municipal Utility	Literature	
The participants' contact with municipal utilities was largely limited to administrative processes.	●	●	○	
Personal contact and local presence are essential for the regional energy supplier.	●	●	○	
Regionality distinguishes municipal utilities from other energy suppliers.	●	●	●	(Beier et al., 2020), (Jenner & Schmitz-Grethlein, 2017)
Municipal utilities enjoy a high level of trust locally.	●	○	●	(Beier et al., 2020), (Fidan et al., 2022)
Generation of (renewable) energies is becoming increasingly important for municipal utilities.	●	○	●	(Möller, 2022)
There is potential for expansion in citizen participation formats such as energy cooperatives.	●	○	●	(Gumbert & Fuchs, 2016)
For many local authorities, municipal utilities are the general service provider for many municipalities.	●	●	●	(Fidan et al., 2021)
The lack of economies of scale hinders the profitability of certain potential business areas for municipal utilities.	●	●	●	(Beier et al., 2020), (Möller, 2022)
The high individuality of specific solutions is a challenge for municipal utilities.	●	●	○	
Holistic energy solutions shape customer needs.	●	●	●	(Fidan et al., 2022)
In the complex interplay of innovative products and services, municipal utilities can act as platform operators coordinating specialised cooperation partner.	●	●	●	(Beier et al., 2020)
Municipal utilities increasingly implement white-label solutions.	○	●	●	(Fidan et al., 2022)
Open interfaces and modularity are essential for technical solutions.	●	●	○	
Clients are concerned about data disclosure.	●	○	●	(BDEW, 2017)
Public charging infrastructure is an increasingly relevant topic for municipal utilities.	●	●	●	(Fidan et al., 2022)
Consultancy is an important field in the municipal utility portfolio.	●	●	○	
Municipal utilities are increasingly supporting their customers in new tasks, i.e. in the development to become prosumers.	●	●	●	(Fidan et al., 2022)
The significance of social media is steadily increasing for municipal utilities.	●	●	●	(Schilling, 2019)
Digitalisation enables easier access to information for clients and thus offers greater comparability.	○	●	●	(Schilling, 2019)
In cooperation with the city, an integrated platform as an app is useful.	●	●	○	

● = supports the statement ○ = no ambiguity in statement

the focus groups. Here, the municipal utilitiy's role was particularly seen in the initiation and organisation. Gumbert and Fuchs (2016) emphasises that the participation opportunities offered have so far fallen short of the wishes and expectations of the citizens. For municipal institutions in particular, it is of interest to have a deeper knowledge of citizens' participation attitudes to offer customised local offerings and align the goals of participation formats on a broad basis of legitimacy (Gumbert & Fuchs, 2016). Nevertheless, plans for such a format have not been raised by any of the interviewed municipal utilities. Yet, based on the results of this study, participation offerings are a promising part of taking on the role of the region's energy partner, as they allow the citizen to become active in the energy transition themselves. As Gumbert and Fuchs (2016) show, digitalisation is much appreciated for the realisation of such offers and should therefore also be taken into account for practical implementation.

According to Fidan et al. (2021), municipal utilities often take the role of the general service provider for many municipalities. For example, the focus group participants often saw the municipal utilities as responsible for providing services not provided by any other company, e.g. in the case of public charging infrastructure. Contrarily, municipal utility B noted, that their customers raised the expectation for them to also provide services already provided by other companies reasoning that others would also be able to do this. Even if the two perspectives differ in this aspect, they still lead to the same result: municipal utilities are faced with a broad portfolio of tasks. However, both parties agree that municipal utilities, which are limited by their resources and size, could not fulfill all tasks. Municipal utility B particularly emphasised the lack of scaling effects, which is likewise confirmed by Beier et al. (2020) and Möller (2022) due to high financing obligations and inefficient recruitment of skilled workers. In addition, the high individuality necessary for some products and services was stressed as an additional challenge by both the focus groups and the municipal utilities. However, a study carried out by the BDEW (2017) shows that many customers even have little interest in a product that is tailored specifically for them. Instead, they are more oriented towards offers also chosen by other customers with comparable needs. As a consequence, municipal utilities should not focus on individually tailored products, but rather on a range of different, yet standardised products (BDEW, 2017). Nevertheless, offering holistic all-in-one energy solutions desired by the customers remains a challenge in particular. Both the interviews with the municipal utilities and the literature support this finding of the focus groups. Fidan et al. (2022) highlight that holistic energy solutions consisting of e.g. heat pump, PV system, wall box, storage, an energy management system, and residual electricity supply will shape future customer needs. According to the author, this business segment offers the largest growth market. In order to still meet the expectations of the customers, municipal utilities could increasingly rely on cooperation and rather act as platform operators in the centre. Municipal utility B confirmed this role seeing itself as a portal operator initiating the primary contact. Furthermore, they would coordinate the different parties represented by more specialised craft businesses. Beier et al. (2020) highlights that municipal utilities' regional networking is particularly advantageous to them in that they have many points of contact for cooperation and partnerships. According to Möller (2022), the most important coop-

eration partner of many municipal utilities is the municipality, as many municipal utilities are in municipal ownership. Fidan et al. (2021) also emphasises the importance of cooperation between municipalities and municipal utilities. This relation could be a reason why many participants had difficulties distinguishing between municipal utilities and the city or municipality. Consequently, due to the many different tasks and expectations placed on municipal utilities, they should concentrate on a range of standardised products for different types of customers. Particularly in the increasingly important area of complete solutions, municipal utilities should strive for a role as portal operator in order to be able to participate in this area despite the wide range of tasks. Furthermore, adequate partnerships enable them to offer a high-quality product without the need to establish their own expertise.

Besides cooperations, white-label solutions become increasingly interesting to meet the expectation of further new business areas, according to municipal utility B. Municipal utilities have in recent years progressively questioned their depth of value creation and have therefore intensified the introduction of white-label solutions with the operating models "Software as a Service" (SaaS) or business process outsourcing - mostly in the areas of IT and electromobility, but also frequently in sales (Fidan et al., 2022). Considering the fact, that municipal utilities are expanding their portfolio, participants raised the need for open interfaces and modularity in the design of technical solutions. Thereby some amount of freedom should be preserved and the customer should not be tied to the municipal utility excessively. This wish is in line with the goal expressed by municipal utility A to offer their customers *"comprehensive"* and *"modular"* products.

Another aspect that is becoming progressively more relevant, as it is decisive for the design of digital products, is the issue of data security. In a survey conducted by the BDEW in 2022 (Fidan et al., 2022), the importance of data security was rated higher than ever before. This issue was also discussed excessively in the first focus group. Participants considered the disclosure of data to be difficult and therefore favoured local solutions, especially regarding the real-time display of electricity consumption. These findings are also similar to the findings of BDEW (2017). In particular, terms such as *"data exchange"* or *"real time"* are found to generate suspicion. Consequently, municipal utilities should consider local solutions when offering digital solutions. Nevertheless, the data acquired by this kind of service is of great interest to municipal utilities. In the interview, the representative of municipal utility B described the significance of this data, particularly in the case of large customers. Whether it is a local solution or not, the overall rule should be transparency, at least in communication, in order to strengthen the trust of the customers and relieve them of their worries.

Given the developments in the electromobility sector in recent years, this business area is advancing further into the area of responsibility of municipal utilities. This development was already noted by Fidan et al. (2022), where electromobility was mentioned as one of the most pressing issues that municipal utilities had to address in 2021. Particularly enforced by political pressure, tasks would have been taken in this area (Fidan et al., 2021). This trend was also observed in the studies of this thesis. Both the representatives of the

municipal utilities and the focus groups emphasised the importance of this sector. For the focus groups, however, this was not yet a direct and compulsory task of the municipal utilities, but rather they were open to other providers. The task in this area was mainly attributed to the municipal utilities, *"if no one else is doing it"*. As a result, municipal utilities should monitor the local market and engage in the search for cooperative partners to ensure the advancement of electromobility in their catchment area and demonstrate their engagement as committed regional energy partners.

Aside from the direct supply of energy or (digital) products, municipal utilities can also act as a source of information or supporter for their customers. The counseling services were therefore highlighted as an important business area by municipal utility A as well as in the focus groups. The focus group participants wished for support in numerous areas, such as photovoltaics or heat pumps. Here, the support of the municipal utilities was requested, not necessarily in the installation phase, but above all in the information phase in advance. These results lead to the following conclusion, the advice offered by the municipal utilities becomes particularly important in consideration of the trust placed in them. Municipal utilities could use this trust to act as the primary contact for energy questions of the regional citizens and, if necessary, refer them to specialists, thus taking the previously described role of a portal operator at the centre of its cooperation partners. This development has also been observed by Fidan et al. (2022). In their study, they describe how municipal utilities are expanding their product range to increasingly accompany their customers on their way to becoming prosumers. For its future vision, municipal utility B likewise shows a desired level of enhanced support for its customers. The company plans to be seen as the energy partner of the region, or increasingly even as a life partner that supports the customer not only as an energy supplier but also on an emotional level. Support from the municipal utility side, not only in the core commodity business, is thus becoming increasingly important.

In order to preserve the trust of customers, transparency, and especially transparent customer communication have been identified as fundamental by the focus group participants. Digital channels present a good medium for this purpose. Generally, digitalisation facilitates easy access to information. Among other things, it enables better comparability, becoming increasingly important with increased price sensitivity (Schilling, 2019). This aspect was likewise highlighted in the interviews with municipal utilities. One form of those digital channels are social media channels. According to the focus groups, social media would become an increasingly important communication channel for utilities to inform customers and share successes and plans with them. Schilling (2019) especially raises the importance of social media for marketing purposes, as social media are spots where existing and potential customers spend a long time informing themselves and communicating. Besides social media, two common channels through which information can be provided and interaction with existing customers is possible are an app or web platform. However, both the focus group participants and the municipal utility A emphasised that an app only made sense in an integrated form as a joint offer together with the city. Municipal utilities should though focus on a well structured web page seeking to offer as many functions as

possible in one place. Summarising, digital media enable a simplified provision of information, increasing transparency. As such digital channels should be used to strengthen customer relationships.

Now that the aspects of agreement have been considered, some differences between the different parties are examined in more detail in the following. These are summarised in Table 5.2.

Table 5.2.: Discrepancies Between the Different Perspectives

Topic	Focus Groups	Municipal Utilities	Literature
Digital grid connection process	Different views: • Necessarily digital • No digital implementation necessary due to a one-off process	It is time to digitalise such processes - also to avoid paper	
Customer service	• The favoured communication medium is phone • Chat- or voicebots are not well received	The existing chatbot is well received	• Innovative customer service using chatbots is essential • Chatbots are not yet able to replace humans (Schilling, 2019)
Smart Meter	Awaited with enthusiasm	• Not interesting for the mass • more of a technical gimmick	• The basis for new business models in the medium term (Fidan et al., 2021) • Smart meters do not yet offer any added value to customers (Möller, 2022)
New business models extending the core business	Municipal utilities should have no interest in business fields that intend to save energy	Municipal utilities need to be proactive in order not to lose customers	

Overall, digitalisation is expected by the customers to enable an increasing level of standardisation as well as automation and thus result in a reduction of bureaucracy while increasing flexibility. Nevertheless, Germany is far behind other European countries in terms of digitalisation at the international level (European Commission, 2022a), leading to a degree of scepticism among the participants. The participants' focus regarding digital products has been on functionality. As I5 expressed *"It is little [...] digital exchange, but it works"* (I5, para. 196). Municipal utility A recognised the delay in digitalisation and likewise the need to digitise processes, such as e.g. the grid connection process, and thus saving both effort and paper. While the first focus group also considered the digitalisation of this process to be necessary, the second focus group saw no need for it, especially since it was a one-off process and the associated effort was therefore manageable. This statement is surprising in that it is a process that should be comparatively easy for municipal utilities to digitise due to the well-standardisable processes. Delays in digitalisation and bad experiences could be possible reasons why the participants did not consider the digitalisation of such processes to be necessary. From these results, it can be concluded that municipal utilities have recognised the need for increasing digitalisation in their processes. Even if some of the focus groups did not see a need for it, their statements generally indicate that, even if not expected, they at least accept and partly even welcome a digital implementation of such processes. However, as with all digital products, reliable functionality remains a prerequisite for positive acceptance.

Another field where digital solutions did not find approval was the field of customer service. The favoured medium was still the telephone, as people hoped to find a solution quickly

thanks to personal contact. Chatbots on the other side did not find approval. Here, too, the participants' personal bad experiences and the lack of trust in the performance of chat- and voicebots played a significant role. Schilling (2019) notes that although chatbots are not yet able to completely replace a human employee, they can be used in the right situations to relieve the latter at peak times. For an innovative company, innovative customer service, as made possible by the use of chatbots, is therefore indispensable (Schilling, 2019). The majority of the municipal utilities surveyed in (Möller, 2022) have already implemented a chatbot as a digital communication channel or are planning to do so by 2023. This is also the case for municipal utility A, which uses a chatbot that primarily assists customers as a digital navigator. The company's perception of its acceptance was thereby very positive. This impression was primarily based on the high usage rates. The discrepancy between these two perspectives could result from several factors. Focus groups do not claim representativeness due to the small sample size. Therefore, the recorded attitude towards chat- and voicebots could change by expanding the sample size. Another possibility is the measure of success for the chatbot chosen by municipal utility A. A high rate of use for the chatbot does not necessarily correlate to customer satisfaction with the functionality offered by the bot, depending on the design of the usage procedure. For example, in some cases, the use of a chatbot is obligatory for customers to get in contact with personal support by a municipal utility employee. Other scenarios may include customers who want to use the chatbot but find that the bot cannot provide the support they need and therefore revert to the phone. In this manner, even unsatisfactory support offered by the chatbot is attributed to its acceptance if only the rate of usage is taken into account. This has also been reported by one of the focus group participants. Likewise, Schilling (2019) does not refer to the customer's perspective but emphasises the many advantages from the company's point of view, which should not be underestimated, such as:

- 24/7 accessibility
- Relief for service staff
- Cost savings through automation
- Positioning as an innovative energy supplier
- Presence in all digital channels possible.

Taking these advantages into account, the provision of a chatbot might be useful for a municipal utility. Also considering the expectations of customers, a chatbot can be reasonable. Möller (2022) reports a change in the expectations of customers, who expect a quick response from the municipal utility. Furthermore, the quality of chatbots has improved considerably in recent years and further development steps are conceivable in the future. New developments such as ChatGPT can be used to improve customer service using Artificial Intelligence (AI) (Aljanabi, 2023). By learning about users' language, tone, and style, ChatGPT can provide more personalized and accurate responses. As a result of this increased level of personalization, ChatGPT can be trained to better understand and address the specific needs and preferefromes of each individual and thus improve customer service (Aljanabi, 2023). When using chatbots, however, care should be taken to ensure an

open design not forcing the customers to use the chatbot but rather offering an additional option providing greater flexibility.

Nevertheless, new digital technologies were also met by enthusiastic approval among some of the respondents. The majority of respondents, for example, looked forward to the planned implementation of smart meters. However, the benefits of this technology were assessed very differently by the various parties. While the focus group participants looked forward to the technology with enthusiasm, the municipal utilities saw rather less added value for the customer. On the one hand, it would be *"too early"*, and on the other hand, it would not be an application for the broad masses and rather a *"technical gimmick"*. Even so, the controversial character of this subject is reflected in a review of previously published work. Möller (2022) notes: Regarding the introduction of smart meters, the respondents raised that smart meters do not yet offer any added value to customers and even encounter disinterest as customers do not want to worry about their meter readings at all. Yet, according to Fidan et al. (2021), smart meters would lead to numerous new applications and products in the medium term as a data hub and become the basis for new business models that can also be developed jointly by the energy and municipal industries. Due to the ambiguous stance that has emerged from the literature to date, the clear positioning of focus groups in this thesis initially requires critical consideration. Potentially, the enthusiasm of the focus group participants may have been influenced by the sampling process, as most of the participants had a rather technical background, so enthusiasm for technical *"gimmick"* is likely. A selection bias might explain this constellation and hence as well the outcome of the focus groups regarding the smart meters. Even in the focus groups, one of the participants commented on his favor of the analysis of electricity consumption: *"I don't know if this is a hobby of mine or if the general public is interested"* (I8, para. 333). So far, opinions regarding the benefits of the smart meter differ greatly, as they seem to be very limited, especially in the short term. In the medium term, however, it opens up new possibilities for both parties, so it is important to create an openness toward this benefit. This will allow new services that reveal the benefit to be welcomed and not overshadowed by displeasure over the delay in the German smart meter roll-out. In order to achieve this, transparent communication should be emphasised again at this point.

The last aspect of disagreement between customers' and municipal utilities' perspectives is the offer of new business models for municipal utilities. Both focus groups and interviews with municipal utilities revealed the core business of municipal utilities to be energy supply. On this basis, though, the conclusions of municipal utilities and customers differ significantly. New business models often include products and services that aim to save energy. According to the focus groups, it could not be of interest for municipal utilities in their role as energy suppliers - selling energy - to advance into these business areas - that aim to save energy. In this approach, the focus group participants saw a contradiction in terms. The business perspective, though, took a rather long-term view. Since these energy services could not be pushed out of the market, it would be necessary for municipal utilities to be proactive in order to work with their customers and not lose them to other energy suppliers. Energy services are gaining in importance for municipal utilities to stay

competitive in the long-term (Schepers et al., 2020). Nevertheless, the results of this work suggest that, possibly due to customers' lack of insight into the potential long-term consequences for municipal utilities not involving themselves in new business areas such as energy services, customers do not understand the entrance of municipal utilities into these areas. An uncommented involvement of municipal utilities in these areas could therefore lead to a decrease in trust in municipal utilities due to the lack of understanding of the interests of municipal utilities on the part of customers. Since they see municipal utilities primarily as an energy supplier and seller of energy, they might question its intentions to offer them a truly energy-saving product.

In summary, it can be stated that the two perspectives, the customer perspective and the municipal utility perspective, coincide in numerous points. It is particularly thanks to their personal contact that municipal utilities stand out from other energy suppliers. White-label solutions and cooperations increasingly enable municipal utilities to act as the first point of contact for their customers on energy matters. Nevertheless, Germany's falling behind in digitalisation in international comparison has an impact on national expectations. Especially in customer service, digital solutions were hardly accepted by customers, as they hoped for a faster solution through conventional media such as the telephone. For municipal utilities, on the other hand, chatbots offer diverse potential. The intention of the municipal utilities to invest in new business areas that target energy saving was also questioned by the customers. Transparent communication is therefore indispensable for long-term success, as it increases the trust of customers in their municipal utility and is the basis for long-term customer loyalty. After the research questions have been addressed and the different perspectives have been compared, it remains to examine the limitations of this work. These are discussed in the following.

Limitations

The results of this work offer comprehensive insights into the expectations of (potential) municipal utility customers regarding digital products and services of municipal utilities. These were supplemented by the municipal utility perspective to compare both and identify potential agreements and discrepancies. The particularity of regionality, which plays an important role for municipal utilities (Beier et al., 2020; Jenner & Schmitz-Grethlein, 2017), should be emphasised once again at this point. For this reason translating the results of this study to other regions, not to mention countries, is only possible to a limited extent. Furthermore, the temporal validity of the evaluation is equally limited by several factors. First, the ongoing transition of the energy industry and customer needs during the time of this study can lead to further changes in customer needs and expectations as well as business strategies of energy suppliers. Second, the results were collected during a period that was strongly influenced by the Russian war of aggression. Even though Germany was no active participant in the war, the effects strongly affected the German energy market. Substantial changes in energy prices and hence the energy awareness of the customers were the consequences. Due to those unique circumstances, the results could deviate from past as well as future studies.

As the sample is a limited representation of the demographic landscape of current municipal utility customers at the time, the results should also be considered from this perspective. Overall, the recruitment of the focus group participants was challenging. Providing incentives plays a particularly important role in focus groups (Krueger, 1994), as the participants have to go to a certain predetermined location for a given, rather long period of time. Additionally, the time constraints of the work affected the recruitment phase and data collection, occurring over the New Year holidays due to external circumstances. At this time, the workload of the municipal utilities is particularly high due to the billing at the end of the year. Due to the corresponding increased effort for municipal utilities and additionally higher prioritised internal projects, the support from the municipal utility side was also limited. This directly affected the recruitment process as fewer customers from municipal utilities could be reached. The lack of municipal utility customers willing to take part in the focus groups lead to the necessity of merging two focus groups. Although Krueger (1994) recommends conducting at least 3 focus groups, he also states that most results can be gathered from 2 focus groups. Despite the fact that the focus groups were different in a number of aspects, they also had a number of similarities. A broadening of the insights is therefore expected primarily through better targeting. In the end, there were a disproportionately large number of students with a technical background among the participants, which could also have had an effect on the study results, as can be seen, for example, in the topic of smart meters (see Subsection 3.2.2.1). This particular group constellation could be the result of a selection bias. Furthermore, as a consequence of this constellation and the reduced number of focus groups, the division of the different groups could not be done according to plan, so it is difficult to compare the different focus groups based on demographic backgrounds.

Last but not least due to the restricted sample, focus groups do not allow quantitative conclusions to be drawn. They are often used in the context of multi-methods designs to provide an exploratory basis for quantitative studies (Schulz et al., 2012). Thus, the here presented study results could be used for further quantitative studies.

6. Conclusion

The energy transition is significantly impacting the operations of energy suppliers, including municipal utilities. With the growing individualization of customer requirements and the increasing demand for new energy-related services, the expectations placed on energy supply companies are evolving. Despite the many new technical possibilities available, the perspective and needs of the customer are often not given adequate consideration. To be successful on the market in the long term, energy supply companies must evolve away from the conventional energy supplier as a provider of simple products towards modern, customer-centred energy service providers that offer customers individual and customised complete solutions. In this evolution, digitalization becomes relevant offering new business models, personalized products and competitive advantage. As the energy system transforms, customers must be involved more closely. Given the limited resources available to municipal utilities, the insights of this work might assist municipal utilities in identifying customer needs if they are not able to dedicate adequate resources to this task. Identifying customer needs might be a first step towards a customer oriented prioritization process for new business model opportunities.

By means of two focus group discussions with actual and potential municipal utility customers supplemented by two interviews with municipal utilities, this work gives an insight into the customer perspective concerning the expanding municipal utility portfolio. This was explored through 3 research questions, which were answered in this thesis

The results show, that customers still primarily see municipal utilities as energy suppliers and operators of the necessary infrastructure. Digital products and services offered by municipal utilities are expected to reduce bureaucracy and be simple to use. New business models, however, are particularly seen as necessary in the municipal utilities' portfolio when no other private provider offers a service. Furthermore, the comfort of all-in-one solutions by a single provider has been highlighted. For the offer of such solutions, municipal utilities enjoy an advantage, thanks to the trust placed in them as regional suppliers. This proximity to citizens sets them apart from other energy providers.

The municipal utility perspective supplemented the customer perspective in the context of this work. Municipal utilities see the potential for their customers through the offer of digital products and services primarily in the increased level of standardisation and automation. This is expected to result in improved and timely information delivery, as well as increased flexibility and comparability. Involvement in new business areas such as electromobility or photovoltaics is imperative from their perspective. Municipal utilities increasingly identify themselves as the first contact for their customers with respect to energy-related topics in general. In their future role as portal operators, they will be able to refer their customers to a network of specialised cooperation partners. Modular solutions and open interfaces to the products of other providers enable them to establish themselves in the market.

Analysing the results of the study, it can be summarized that the two perspectives, the

customer perspective and the municipal utility perspective, coincide in numerous points. As part of the municipal utility business, local presence and proximity to customers are essential. Given the trust that customers place in municipal utilities, advice and support are gaining in importance. Customers equally desire support to become active in the energy transition themselves, so participation offers are increasingly rated as interesting by customers. Hereby, municipal utilities are particularly seen as responsible for the organisation. Although the focus of the work was on digital products and services of municipal utilities, both parties repeatedly questioned these. Especially in customer service, digital solutions are hardly accepted by customers, as they hope for a faster solution by conventional media such as the telephone. For municipal utilities, on the other hand, chatbots offer diverse potential. Germany's falling behind in digitalisation in international comparison has an impact on national expectations. It can be stated that functionality is a fundamental prerequisite for digital products to find acceptance. In many cases, the importance of transparent communication is the basis for long-term customer loyalty. The use of digital media can help municipal utilities share their activities with their customers and keep them informed, thereby increasing local presence and thus their competitive advantage.

Focus groups are often used to provide an exploratory basis for quantitative studies in the context of multi-methods designs. Based on the results of the study, thus further quantitative studies could be conducted specifying the expectations of customers towards new business models. Since the engagement in new business areas met with a lack of understanding among a large part of the participants in this study, further studies could focus in particular on customers' attitudes towards municipal utilities in the role of a portal operator coordinating a network of specialised cooperation partners. Additionally, there is also the possibility of addressing the specific needs of different target groups more specifically, to develop more suitable products for the respective target group. Furthermore, the sample could be extended to other regions, examining the similarities and differences between the customer expectations of different regions, and thus identifying potential for joint cooperations with other municipal utilities. Last but not least, representatives of both perspectives, the customers' as well as the municipal utilities' perspective could be brought together in a direct discourse enabling a direct discussion of customer wishes confronted with the limitations of feasibility. A direct discourse could be particularly interesting considering the concrete design of products and services.

7. Declaration

Ich versichere hiermit wahrheitsgemäß, die Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung des Karlsruher Instituts für Technologie (KIT) zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben.

Karlsruhe, den 19. 03. 2023 _____

Marie-Claire Thiery

Appendix

Additional information, such as charts and tables.

A. Interview Guide - First Interview Municipal Utility

I) Introduction (approx. 5 min)

Notes for the interviewer are enclosed in square brackets.

- Greeting
- Organisational matters:
  - Interview duration: approx. 1 hour
  - You can ask questions or make comments at any time during the interview, which we discuss directly.
  - The interview will be recorded (from the second step).
  - We will not publish the name of the public utility company or yours.

If you agree, I would start the recording now.

Introduction to the research project
After our e-mail contact so far, I would like to talk again about the aim of the interview and about our research project. As already mentioned, we are dealing with the future orientation of municipal utilities in the energy transition. Our focus here is on the customer perspective in the context of digitalisation. What expectations do customers have of their municipal utility in the energy transition with regard to their digital products and services? In addition, we would like to take a closer look at what you as a municipal utility see as the potential of digital products and services for your customers and, in retrospect, also look at what products you as a municipal utility would be willing to provide to your customers and develop for them.

II) Questions (approx. 50 min)

1. Introduction
   a) Would you like to introduce yourself briefly? What is your position at the utility?
   b) What are your main areas of responsibility?
2. Implications of the energy transition for municipal utilities:
   a) Has your municipal utility realigned itself digitally as a result of the energy transition?
   b) To what extent do digital products and services play a role in your vision of the future? How does this vision take into account the expectations of your customers?

c) How might your vision of the future differ from your customers' expectations of their municipal utility of the future?

d) Which of the aspects just mentioned are within your scope of action and which are outside?

e) What do you see as the biggest opportunities and risks of digital tools and services for municipal utilities?

f) What are the future challenges for municipal utilities in terms of customer expectations for digital products and services?

g) In your opinion, do the opportunities or risks of digitalisation outweigh the risks for your municipal utility?

h) Due to the current energy crisis, is a new strategic orientation with regard to your digital products and services planned or has it already taken place?

3. Customer-centricity: I would now like to take a look at your customers together with you:

a) Describe the role of the customer perspective for your company?

b) What does your customer base look like? What are typical characteristics? [age, income,...]

c) Do you think that the characteristics of your customer base are rooted in the orientation of your municipal utility? (or rather structural reasons, e.g. general demographic characteristics in the city)

d) Does your customer base differ from other municipal utilities?

e) In which situations are your customers in direct contact with you as a municipal utility? [If necessary:] From whom does this contact originate?

f) Do you want to actively win over departing customers or customers of other energy suppliers? [If yes:] How?

g) I had a look at your website for digital products and services. I found the following:

i. Digital grid connection portal "SWEn" - your chatbot and voicebot in the service area Various online forms on different topics, such as:

A. registration

B. deregistration

C. meter reading transmission

D. budget billing

E. reporting defective street lighting

ii. In the electricity sector

A. tariff calculator

iii. For the Ettlingen swimming pools, there was an app + e-ticket dispatch by e-mail.

h) Why do you provide your customers with these products and services?

i) What other digital products and services do you provide to your customers in addition to the ones mentioned above, or are you already planning to do so?

j) Have you already received feedback from your customers on these products and services?

k) If the following points have not yet been discussed:

i. Do you already use or plan to develop your own app for new services/products or their integration into external apps (City App)? [If yes:] What functionalities does/should the app have? [Real-time data visualisation, contract management, ...]

ii. Do you already operate or plan to operate a digital platform? [For distribution purposes, as a municipal network or for Internet of Things applications, real-time customer service, energy data platform, flexibility platform for surplus electricity, platform as an ecosystem, ...]

iii. Do you want to offer concepts for intelligent load management and/or smart home approaches for private customers?

iv. To what extent do you already promote or plan to promote self-generation among customers? [e.g. by means of infrastructure through RE plants, neighbourhood projects, ...].

v. Do you plan to offer customer-oriented services? [e.g. contracting, energy efficiency advice, especially virtual energy advice, smart home or smart city, LoRa Wan, ...].

vi. What are your plans for the mobility business field?

A. electric mobility

B. sharing services

C. public transport

vii. What opportunities will the smart meter rollout create for you in the household customer sector?

viii. To what extent do you plan to implement the new regulation regarding intra-year consumption information to customers?

ix. Do you also plan to do this for energy generation, if we are talking about prosumers?

x. What are your plans for variable electricity pricing?

l) Do you perceive that customer proximity to your municipal utility is changing due to increasing digitalisation? [If yes:] To what extent?

m) Are your digital products and services aimed at a specific target group?

n) Who is already using your digital products and services and to what extent?

o) To what extent do customer wishes flow into your portfolio of offers?

   i. How do you identify them?

p) How do you respond to customer feedback? [is it incorporated directly, is it difficult,...]

q) Where do you see that your customers are satisfied or dissatisfied?

III) Next steps

In the coming weeks, we will conduct focus group interviews to analyse customer expectations regarding digital products & services of municipal utilities in more detail. The questionnaire is not yet ready, but our discussion will be essential for its development. After the focus group interviews, I would like to discuss the results and their feasibility. We would be happy to include your interests in the preparation. I would also be very pleased if you could take a look at the questionnaire before conducting the focus group interviews and give me your feedback. But in order to address your interests already now, I have a few questions:

- What aspects of the research would be of interest to you?
- What would you want to use the results for?
- Which target group would be of particular interest to you? [current customers, former customers, electricity customers, gas customers, certain age groups...].

IV) Conclusion

Do you have any further questions or suggestions regarding our project in general or the conduct of the group discussion?

Thank you again for your time and support!

B. Questioning Route Focus Groups

[Welcome and introduction].

Opening questions

1. Would you like to introduce yourself briefly. What is your name and how long have you been a customer of the Stadtwerke? [everyone answers the question once in 10-20 seconds] Alternatively, for non-Stadtwerke customers: Which energy supplier are you currently with?

Introductory

1. Generally speaking, what are the tasks of a municipal utility from your point of view? [little introduction that municipal utilities are not only electricity suppliers]
2. Where in particular do you have points of contact with your municipal utility?
3. What do you generally expect from your municipal utility?

Transition

1. How do you feel about the increasingly digital offers of municipal utilities? [Possibly ask more deeply: Do you get along well with the digital offers?]
2. Now more concretely: Which digital products or services of your municipal utility do you use so far?
   a) Think back to when you used it: How did you feel when you used it?
   b) What did you like best about it?

Key

1. With a view to the areas presented: Which digital / online products and services should a municipal utility offer?
2. What are your main expectations of the digital products and services of a municipal utility? [As an interim question, always refer back to the chart: Let's take another look at the chart, what about the other areas?]
3. How should digital products and services be best designed in your view? What do you attach particular importance to?

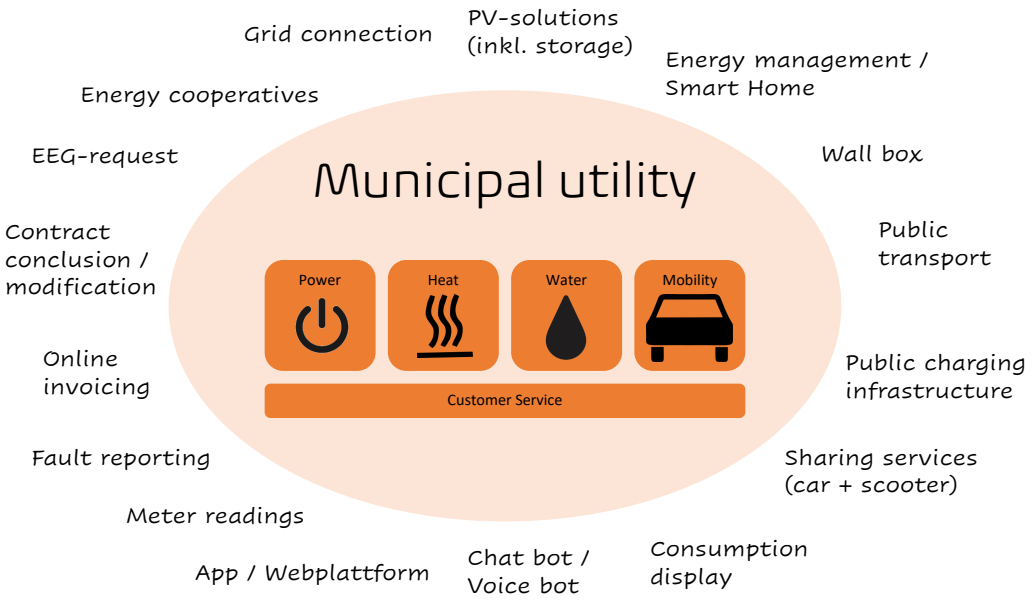
Ending

1. Now, in conclusion, assume you have 1 minute to present your essential personal expectations to the Stadtwerke. What would you say? [all answer the question]
2. Let us summarise the central aspects of our discussion. [2nd moderator summarises the results of the keyquestions in 2 minutes]
3. Is this summary complete? Do you have any changes or additions?
4. Have we forgotten anything?

[Allow 10 minutes for discussion]

[small conclusion]

C. Stimulus Focus Groups



D. Demographic Data

Age	
Gender	
Education, if applicable, course of study / profession if studying	
Housing situation (condominium, rented flat, house...)	
Do you have a PV system?	
Do you have an electric car?	
If you answered ”yes” to the previous question, do you have a wall box?	
Are you currently a customer of the municipal utilities? (If ”yes”, please note the name)	
If you answered ”yes” to the previous question, with which products and services?	
If you answered ”no” to the previous question, which energy supplier are you currently a customer of?	

E. Interview Guide - Second Interview Municipal Utility

I) Introduction

Notes for the interviewer are placed in square brackets.

- Welcome
- Organisational matters:
  - Interview duration: approx. 1 hour.
  - You can ask questions or make comments at any time in the interview, which we discuss directly.
  - The interview is recorded (from the second step).
  - We do not publish the name of the municipal utility, nor your.

If you agree, then I would start the recording now.

Introduction to the research project

After our e-mail contact so far, I would like to go back to the aim of the interview and our research project. As already mentioned, we are dealing with the future orientation of municipal utilities in the energy transition. Our focus here is on the customer perspective in the context of digitalisation. What expectations do customers have of their municipal utility in the energy transition with regard to their digital products and services? In addition, we would like to take a closer look at what you as a municipal utility see as the potential of digital products and services for your customers and also look at what products you as a municipal utility would be willing to provide to your customers and develop for them.

II) Questions

1. Entry: [10-15 min]
   a) Would you like to introduce yourself briefly? What is your position at the municipal utility?
   b) What are your main areas of responsibility?
2. A small question in advance: To what extent do digital products and services play a role in your vision of the future? How does this vision take into account the expectations of your customers?
3. Focus group results [10min]
   I would now like to go into more detail about the results of the focus groups. To do this, I will present a few of the results to you. After that, I would be interested to know: To what extent this corresponds with your previous assessments of customers' expectations and how you face this as a municipal utility. What are your plans? Which of the digital products and services mentioned would you be prepared to make available to your customers / develop for them? Or perhaps you already offer them?

- To sum up in advance: Both focus groups saw municipal utilities first and foremost as an energy supplier, especially an electricity supplier and infrastructure operator.
- Increasingly, development in the direction of generation was also desired:
  - Both in the production of renewable energies and the promotion of energy cooperatives
- Digital products should
  - be simple and intuitive
  - reduce bureaucracy
  - support security of supply
  - the interfaces of technical solutions should be open
  - should work
- Public charging infrastructure was increasingly seen as a new business model in the municipal utility portfolio.
- Or the municipal utilities were often also seen to be responsible if no one else was doing it.
- However, the attitude towards other new business models such as PV or wallboxes offered potential for discussion
- The first FG particularly saw the advantage of one-stop solutions for PV, wallboxes, etc.
- However, one also saw the trade off between centrality, everything from one source, and not being able to load everything onto the municipal utilities.
- Interfaces to other experts would therefore make sense and everything comes together at the municipal utilities as portal operators.
- The second FG was much more power and cost oriented and was more concerned that if everything came from the same supplier, the market power in the region would increase too much and the costs could be passed on to other sectors such as electricity.
- Another field was energy management and smart homes.
  - Here, both FGs saw the municipal utilities in energy management, but not in the smart home due to the high complexity.
  - In other words, the provision of a gateway to the smart home system.
  - Due to the expertise, the latter was seen more with external providers
- This brings us to the next topic, data security and data collection were an important topic in the 1st FG, especially when it comes to the display of real-time data.

- In general, personal contact and local presence is important for customers
- Customer service
  - No interest in chat or voice bots
  - Telephone is the favoured medium as a quick solution is hoped for
- Transparency was also mentioned several times in both focus groups
  - Price
  - Energy mix
  - Rapid provision of information in the event of a problem
- Web platform or app
  - In principle, it was expected that customers would at least be provided with an app or a web platform.
  - Of course, a well-functioning web platform is part of the basic equipment.

4. Focus group discussion

- That was a short summary of the results. I would now be interested in your assessment. To what extent does this correspond with your previous assessments of customer expectations and what is your attitude to this as a municipal utility?
- What are your plans? Which of the digital products and services mentioned would you be willing to provide to your customers / develop for them? Or perhaps you already offer them and why these in particular?
  - If necessary, ask specifically for variable electricity tariffs
    - What are your plans?
    - What do they see as the opportunities that this opens up?
- Customers have described their contact with you as a municipal utility particularly in terms of contract conclusions, meter readings and online bills? Does this match your perception? Do you see other points of contact?
- Have you already received feedback from your customers about your products and services?
- Where do you see that your clients are satisfied or dissatisfied?
- And finally, where do you see the potential of digital products and services for your customers?
- What are the future challenges for municipal utilities in terms of customer expectations for digital products and services?

.... have we forgotten anything?

III) Closing

Do you have any further questions?
Thank you again for your time and support!

F. Codebook

Code	Description	Frequency
Own Energy Supplier	Information and experience about one's own electricity supplier. Anchor example: I7: 00:00:46,140 --> 00:00:48,570 [...] Our electricity provider is YelloStrom, we do that ourselves. Um, but the heat is handled by our landlord, that should be EnBW.	11
Image of a Municipal Utility	Statements about how the participants see municipal utilities. The category includes both the core expectations of public utilities and the participants' points of contact with public utilities.	0
Core Expectations for Municipal Utilities	Collection of general core expectations for municipal utilities. In particular, what differentiates municipal utilities from other energy suppliers? Anchor example: I1: I see energy supply as the main responsibility of the municipal utilities, but also a change in energy supply towards a more sustainable system, especially in the municipal sector. For me, this also includes new technologies. In the future, I will expect my municipal utility to offer a real-time electricity tariff with the corresponding infrastructure of a smart meter and smart offers to implement energy management. And whether that includes PV solutions or a wallbox remains to be seen. But in any case, if I want to have something like that or a heat pump, advice that the municipal utility also has the competence to pass on, at least at some point. #	33
Changing Portfolio for Municipal Utilities	Statements on a changing portfolio of tasks for municipal utilities - initiated in particular by the energy transition. Anchor example: I5: I see it as an opportunity for the municipal utilities. So I don't see why they shouldn't do it and maybe have a new business model? But I can also imagine that they find it difficult to offer products like this if they have only ever done electricity contracts up to now. #	2
City and Municipal Utility	Statements about the relationship between the city and the municipal utility. Anchor example: I8: 00:28:39,910 --> 00:28:47,140 But the question is also whether the city itself can save money, for example by only switching on half of the streetlights after 10 am. I11: 00:28:47,660 --> 00:28:50,230 This is not the public utility. You have to differentiate a bit...	3
Personal Touch-Points	Personal touch-points of the participants to offers of municipal utilities. Anchor example: I9: 00:26:21,500 --> 00:26:45,260 So I only have end customer contact. I actually have a lot of online contact via a web platform, i.e. online invoices, contract conclusions and so on. That's all done online for me now. Even the transmission of meter readings. And apart from that? I don't think that's the case here. Public transport, of course. But of course I also do that online. But that's not here with the public utility company, is it?	11
Local Presence and Personal Contact	Municipal utilities should have a local presence and be close to citizens. Anchor example: I2: I generally believe that there is someone I can talk to. It doesn't matter how I reach them. It's not so important to me whether I have to call or whether I can reach them on some social media channel. The main thing is to find them. #	9
Products, Services and Tasks of Municipal Utilities	Includes discussion aspects about potential digital products, services and other tasks of municipal utilities and their evaluation from the customer's perspective.	0
Core Competences	Includes products identified as core competences of municipal utilities.	0
Customer Contact	Comments about the Customer Contact and Relation. Anchor example: Then take care of the end customers. There is the whole contract management, the contact, the communication...	3

Electricity and Heat Supply	Includes aspects about electricity and heat supply. Anchor example: So for me it is basically clear that municipal utilities are a supplier of infrastructure and electricity, heat, water, mobility, as I said, with electricity, heat and water being the most important.	12
Infrastructure	Includes aspects about the infrastructure operated by municipal utilities. Anchor example: So for me it is basically clear that municipal utilities are a supplier of infrastructure and electricity, heat, water, mobility, as I said, with electricity, heat and water being the most important.	6
Procurement and Generation	This category summarizes comments about the procurement and generation of electricity. Anchor example: This goes in the direction of utility services being expanded to the point where the municipal utility itself expands its utility services or energy production.	8
Security and Reliability	Statements about the security of supply and reliability of public utilities. Anchor example: A reliable energy supply, that is the task of the municipal utilities and not some digital products.	8
Smart Services	Summary of smart services according to Pauckstadt et al. (2020).	0
EV Storage and Charging	Those business models focus on electric mobility including battery stroage and charging infrastrucutre.	0
Wall box	Includes explanations about the design and necessity of wall boxes and services around them in the municipal utility portfolio. Anchor example: If I have a box for my electric vehicle, I have to register it or have it approved from 22 KW. Yes, that's how it is now in the electricity sector.	8
Public Charging Infrastructure	Includes comments on the design and necessity of public charging infrastructure in the municipal utility portfolio. Anchor example: I2: Nevertheless, I see it as the city's responsibility to ensure that there is sufficient charging infrastructure, for example, and I don't really care how the city does it, whether it commissions the public utility company or not. I don't really care, but I wouldn't complain to the municipal utilities if there wasn't enough charging infrastructure, I would complain to the city.	21
Energy Communities and other Forms of Participation	There are many types of energy communities. They are groups of (mostly) prosumers, who share energy resources, like microgeneration units and storage. Among Energy Communities this category summarizes other forms of participation and cooperation. Anchor example: I4: What I think would be even more important would be such citizen energy plants, that you could get the municipal utility company involved, that when you build a wind turbine, that they build up a community where everyone can become a shareholder and own a wind turbine. Because otherwise it is always difficult for people to get together.	6
Decentralized Energy Resources	Business models around decentralized energy resources can include different depth, such as installation, predictive maintenance and more. Photovoltacis-systems and battery storages fall into this category, e.g.. Anchor example: I1: If they also offer PV solutions and storage. Then you have everything from one source. So if that's available, then the rest is too.	27
Energy Trading	Those business models enable customers to sell energy either through a broker or on their own. This category additionally summarizes statements about energy purchases done by	1

	municipal utilities. Anchor example: Or you can even go so far as to say that I want to make zero feed-in based on this data. In other words, I may have a PV system on the roof, but because of the current situation that I hardly receive anything per kilowatt hour that I feed into the grid, I say I don't want to feed it in and then regulate my inverters accordingly so that if I can't use the electricity myself, no one else gets it either. You can do things like that.	
Flexibility	This category summarizes statements about flexibility services.	0
Energy Efficiency with Smart Home and Smart Meters	This category summarizes statements about business models consisting of smart homes and meters, which include energy efficiency and saving services. They aim to reduce energy consumption. Anchor example: The municipal utility should then participate and perhaps hand over such a task, such a programming task, to professionals. But the municipal utility should then participate and perhaps hand over such a task, such a programming task, to the professionals. This may also make sense, as municipal utilities are probably not in the best position due to their personnel. From that point of view.	34
Other Mobility Services	Includes statements about the mobility offerings of municipal utilities with the exception of electromobility offerings.	0
Public Transport	Includes comments on the design and necessity of public transport in the municipal utility portfolio. Anchor example: What about public transport? I11: 00:09:08,680 --> 00:09:14,110 That is the same as sharing services. That is not the issue for us in [this region].	6
Sharing Services	Includes comments on the design and need for sharing services in the municipal utility portfolio. Anchor example: I also think the sharing services, that the all digital for me also the added value for me also in everyday life.	10
Administrative Processes	Includes statements about administrative processes.	1
Grid Connection	Includes comments on the design and necessity of digital or alternative options for grid connection applications. Anchor example: I2: The grid connection is of course clearly municipal utilities.#	4
Meter Reading	Includes explanations on the design and necessity of digital or alternative options for meter reading transmission. Anchor example: 11: 00:57:21,660 --> 00:57:28,050 I mean clearly, then also the meter reading transmission is then obsolete if I get a smart meter.	9
Invoicing	Includes explanations on the design and necessity of digital or alternative ways of invoicing. Anchor example: Whereas for me, an email is also totally important, because it contains my invoices.	6
Conclusion of Contract / Contract Modification	Includes explanations on the design and necessity of digital or alternative ways of concluding or modifying the contract. Anchor example: Good, then, contract conclusions and changes. Of course, they have to be possible in some way. If this can be done elegantly via an online portal. Good.	4
Fault Reports	Includes explanations on the design and necessity of digital or alternative options for fault reporting.	3

EEG Requests	Includes explanations on the design and necessity of digital or alternative ways of submitting EEG requests. Anchor example: [...] EEG requests. I11: 00:46:25,800 --> 00:46:36,940 That's just it. You can do it, but it needs to be explained. That is possible.	3
Broadband Expansion	Information on broadband expansion in the portfolio of municipal utilities. Anchor example: And what I know from Friedrichshafen, where I was before, is that they also promoted the expansion of fibre optics. I don't know how it is here, but I thought it was quite good.	1
Web Platform	Includes explanations about the design and necessity of web platforms. Anchor example: That's nice if they offer it, and something like an e-mail service or a website or something like that is of course part of it.	8
Career Page	Comments about the career page. Anchor example: I6: Then it goes in the other direction. But a transparent career site, where you also apply for jobs, I would say, is also a core competence somewhere.	2
App	Includes explanations about the design and necessity of apps. Anchor example: I don't mean push notifications like when you get a text message. But when you open the app because you want to look up something, you see a little article or sometimes the apps have their own inbox. But I don't actually click on it either.	23
Information Provision and Communication and Consulting	Includes explanations about the design and necessity of information provision, for example through playful approaches or energy-saving tips in the municipal utility portfolio and general external communication. In addition, the category includes explanations about the design and necessity of providing data for customers' own use. Additionally, this category includes comments about consulting tasks of municipal utilities. Anchor example: But in any case consultation, if I want to have something like that or a heat pump, that the public utility company also has the competence to refer me, if nothing else.	66
Customer Service	Statements about the customer service, Chatbots, etc. Anchor example: And I don't expect much from customer service. And there aren't as many customers as Telekom has now or so. So they'll manage that.	22
Displaying Consumption	Includes comments on the design and need for digital or alternative means of displaying consumption. Anchor example: But if I had, let's say, a smart meter and my wallbox and my PV system and I actually wanted to track the consumption, I would do that via an app and not go to some website every time.	19
Variable Electricity Tariffs	Statements about variable electricity tariffs. Anchor example: In the future, I will expect my municipal utility to offer a real-time electricity tariff as a power supply with the corresponding infrastructure of a smart meter and smart offers to implement energy management.	5
Referral to specialised Companies	Statements about the tasks of municipal utilities to refert to other specialised companies, such as installers. Anchor example:	2

	I10: 00:31:13,190 --> 00:31:58,200 It doesn't say that now, but it's also very special and I think that at least EnBW also has that, so that when it comes to any changes to the meter, you can display the specialist companies in the area by postcode.	
Synergy Effects and Bundle Solutions	Statements about simplified or more cost-effective solutions through synergy effects or the convenience of "all from a single source solutions". Anchor example: I3: I find it practical that I might not need another provider. But that it could be handled by a single entity. But in itself it may not be the core task. It would be practical if they had it.	5
Low-cost Energy and Transparency	Statements about the provision of low-cost energy by municipal utilities, prices and tranparency. Anchor example: I wrote about price transparency, because at the end of the day you have to pay for everything and you have to know a little bit where it comes from.	10
Design of Digital Products and Services	Statements on the design of digital products and services. Anchor example: I10: 00:29:33,430 --> 00:29:52,930 Less bureaucracy, in general. So that what can be automated automatically also works. And when I see that the chat or voice bots don't work properly, then we can talk about whether this is necessary at all. But that such transmissions are paperless and transmitted in real time.	10
Data Collection	Comments about data collection by municipal utility applications, DSGVO, data security etc. Anchor example: I5: I don't care if they have my data or not. So they should rather have it and optimise it somehow.	18
Feelings in Connection with the Digital Offer	Feelings and concerns of the participants in connection with the digital and increasingly digital offer of municipal utilities. Anchor example: I11: 0:45:13.7--> 00:45:21.930 It's also a question of how much more digital a customer actually needs. I mean, as long as you still have this rigid uniform tariff, it doesn't really matter.	8

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