Understanding the challenges for citizens in the municipal heat transition: A Case study of the city of Itzehoe, Germany

Master's Thesis (45 ECTS)

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Summary

In light of the immense challenges of the energy crisis that Germany and many other European countries are currently facing, it becomes evident that a far-reaching energy transition is needed. While a shift away from fossil fuels can be seen in the German electricity sector, the heating sector remains in a fossil lock-in, as only 17.4 % of the domestic and industrial heat used in Germany was produced by using renewable energies (Bundesministerium für Wirtschaft und Klimaschutz, n.d.).

The transformation of the heating sector requires using and intelligently combining locally available energy potentials while considering existing infrastructure. Therefore, municipalities play a central role in the transition process. But most importantly the transition of the heating system includes many measures that take place within people's living spaces, which puts domestic energy users at the core of the transition process, necessitating a shift from passive consumerism to increased involvement.

Therefore, the objective of this research was to understand the challenges for citizens' involvement in the heat transition. To do so a case study was conducted in the city of Itzehoe, Germany based on survey research, interviews with local key actors, and a policy analysis.

The results indicate that the HT in Itzehoe is still at an early stage being a system widely dominated by fossil fuels, but it also suggests that the citizens of Itzehoe are aware of the importance of the energy transition and are motivated to contribute to a more sustainable energy system. However, it also shows that it is important to not overemphasize the responsibility of individuals, as the data suggest that a wide range of structural challenges hamper citizens' involvement.

An overarching and reoccurring theme is the necessity to develop a clear vision for the transition process and the necessity to improve the information flow from the national government, the municipality, the utility provider, and actors from the housing sector to the citizens to make involvement possible. This is especially relevant for the plans for heating networks, as these significantly influence homeowners' decision-making, Further, it can be seen that the current political framework does not take the different financial situations of homeowners into account and fails to protect tenants from increased investment costs.

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1. Introduction

The energy crisis that Germany and many other European countries face in 2022 and that continues in 2023 can be understood as at least a triple crisis. Firstly, the continuous burning of fossil fuels heats up the climate and leads to severe damage all over the planet (e.g., Rockström et al., 2009). Secondly, the crisis is also a social crisis, as the end user costs for natural gas in Germany doubled and for many households even tripled from 2021 to the fourth quarter of 2022 (Bantle, 2023). This leads to financial struggles for many, especially low-income households that often live in poorly insulated houses and spend a larger share of their disposable income on heating (Neuhoff et al., 2022). And thirdly, the energy system is strongly entangled with global politics. This aspect became increasingly clear after the Russian invasion of Ukraine when German politicians warned that the incalculable consequences of an immediate import stop of natural gas from Russia put the energy security of the country at risk, particularly during the heating season in the winter (Fischer et al., 2022). Facing these immense challenges, it becomes evident that a far-reaching energy transition is needed and that the implications and risks of such a transition to the people who bear the brunt need to be examined.

While a shift away from fossil fuels can be seen in the German electricity sector, as 46% of the electricity was produced from renewable sources in 2022 (Bundesministerium für Wirtschaft und Klimaschutz, n.d.), the heating sector remains in a fossil lock-in. In 2022, only 17.4 % of the domestic and industrial heat used in Germany was produced by renewable energies (Bundesministerium für Wirtschaft und Klimaschutz, n.d.). This research focuses on domestic heat, which makes up 67% of the overall heat demand (BDEW, 2022). The current domestic heat system relies mostly on individual heating systems connected to the natural gas grid or running on fossil oil (Fraunhofer IWES/IBP, 2017) thereby contributing to all three aspects of the energy crisis and calling for a fast heat transition.

For the transformation of the heating sector, it is inevitable to reduce the overall heat demand by improving the energy efficiency of houses and by adapting user behavior. Secondly, a strong upscaling of renewable heat production is necessary (Fraunhofer IWES/IBP, 2017). In contrast to electricity, heat cannot be transported over long distances and needs to be generated relatively close to the place of consumption (Riechel & Walter, 2022). This can be realized through the production of heat within buildings (e.g., heat pumps) or by providing it through heat networks (Fraunhofer IWES/IBP, 2017). To achieve this, it is required to use and intelligently combine energy potentials locally available while considering already existing infrastructures. This means that locally adapted, specific solutions must be developed (Riechel & Walter, 2022).

Therefore, municipalities play a central role in the transition process. This is reflected in the uptake of the concept of municipal heat planning, which is already common practice in neighboring countries (i.e., the Netherlands) and is gaining attention in Germany (Riechel & Walter, 2022). Heat planning obliges municipalities to develop a plan that lays out how the heat supply of all buildings in the municipality can be greenhouse gas (GHG)-neutral by 2045. As the instrument of municipal heat planning gets established, an uptake of research focusing on the heat transition (HT) on the local

level is observed (Riechel & Walter, 2022). The literature suggests that the transition requires an effective policy framework and the cooperation of a multitude of actors on the municipal level (e.g. Hertle et al., 2015; Riechel et al., 2016). Next to the municipal governments, state and federal ministries with their funding institutions, local energy providers are identified as key actors in making a socially acceptable heat transition possible (Matußek et al., 2022).

But most importantly it is acknowledged that the transition of the heating system includes many measures that take place within the living spaces of people, as the energetic refurbishment of houses and the installation of renewable heating systems are the central elements of the transition. This puts domestic energy users at the core of the transition process, necessitating a shift from passive consumerism to increased involvement (Baur & Noll, 2015). This transition of the role of citizens is explored in the academic literature on the concept of energy citizenship, which highlights that passive consumerism and fossil energy systems are interconnected and that the energy transition requires new imaginaries about active roles of citizens in the energy system (Devine-Wright, 2007).

Herein, the courses of action differ significantly between tenants and homeowners. The half of the German population that lives in rented living spaces is put into a situation of very little agency, as they rely on the decisions made by the landlord (Matußek et al., 2022). Private homeowners on the other hand are required to take care of the energy efficiency of their homes and are ultimately responsible for the decision to invest in the energy-efficient refurbishment of buildings and/or the expansion of renewable energies (Baur & Noll, 2015; Riechel et al., 2016).

The literature on Energy Citizenship suggests that the decision-making process of citizens regarding energy systems is strongly entangled with the energy system and its corresponding political framework and it is argued that the transition towards a more decentralized renewable energy system requires more active involvement and new roles for citizens (Devine-Wright, 2007). The concept also suggests that overcoming the simplified and negative imaginaries of passive consumers can open up the discussion and allow for investigation of the variety of factors that influence the relationship between citizens and the energy systems (Devine-Wright, 2007).

But while the concept of Energy Citizenship is considered to be useful in conceptualizing the relationship between the energy system and the public it is also criticized because it can turn from an empowering narrative into a disempowering one when the responsibility of individuals is overemphasized and crucial issues regarding unequal agency and access to resources are ignored (Lennon et al., 2020).

It needs to be acknowledged that households are affected very differently by rising energy prices and have different vulnerabilities within the transition process (e.g., Agora Energiewende, 2021; Fjornes & Becker, 2022; Schumacher & Nissen, 2022). To incorporate the criticism on energy citizenship and to further strengthen the emphasis on unequal agency and access to resources for specific groups in society this research is also informed by aspects of energy justice, which puts into focus the distribution of benefits and burdens, the quality of procedural processes and the recognition of vulnerable groups (Sovacool et al., 2016).

As the heat transition (HT) is implemented on the municipal level, the research is designed as a case study looking at the municipality of Itzehoe, located in the state of Schleswig-Holstein in Northern Germany. Itzehoe is chosen as a case study because it represents one of the many small and mid-sized municipalities that face the challenge of realizing the heat transition locally and that need to build up capacities and knowledge for this process. Like many other municipalities in Germany, the municipality of Itzehoe is currently working on a plan for city-wide renewable heating systems that needs to be handed in by the end of 2024 (EWKG, 2021). This research is conducted in cooperation with the local utility provider "Stadtwerke Steinburg", which is an important partner for the municipality for the creation and implementation of the heat planning, as they are responsible for the generation, distribution, and storage of energy. Generally, it is seen that without the engagement of energy providers actions are almost completely limited to individual solutions (Hertle et al., 2015).

1.1 Research objective and research questions

The focus of the municipal heat planning lies mostly with technical considerations, such as the design of district heating networks and the development of energy sources (EWKG, 2021). Therefore, the understanding of the role of citizens in the municipality of Itzehoe is limited. But in order to design efficient policies and to develop future-proof sustainable business models for heat provision, a solid understanding of these roles is indispensable (R. Quurk, personal communication, February 9, 2023).

Therefore, the objective of this research is to understand the challenges for citizens' involvement in the HT. This is done by surveying the citizens of Itzehoe to understand their current situation and to explore how they experience different challenges in the HT, and by analyzing the implications of the policy framework and the structural conditions created by the engagement of local actors.

The research answers the following research questions:

RQ1: How are the citizens of Itzehoe currently involved in the HT and which challenges for involvement in the HT do they experience?

RQ2: How do key local actors influence the challenges experienced by citizens in the HT in Itzehoe?

RQ3: How do relevant policies on the federal and state level shape the challenges experienced by citizens in the HT in Itzehoe?

1.2 Research framework

The research process was constituted of five phases (see Figure 1). First, literature focusing on the technical development pathways for the HT in Germany was reviewed. This was complemented by theory on key stakeholders in the HT, with a special focus on the social implications of the HT for different groups of citizens. Additionally, concepts regarding the role of citizens in the energy transition (e.g., Energy Citizenship and Energy Justice) were reviewed. This shaped the understanding of the problem and together with a preliminary literature review on factors that influence the involvement of citizens in the HT, they were used for the development of the

conceptual framework in the second phase. Thirdly, data was collected by reviewing relevant policies, surveying the citizens of Itzehoe, and interviewing local actors. In the fourth phase, the collected data was analyzed by applying the conceptual framework. This led to an understanding of the challenges for citizens' involvement in the HT in Itzehoe. These results are presented and discussed in phase five. A more elaborated procedure will be explained in the methods section (section 4).

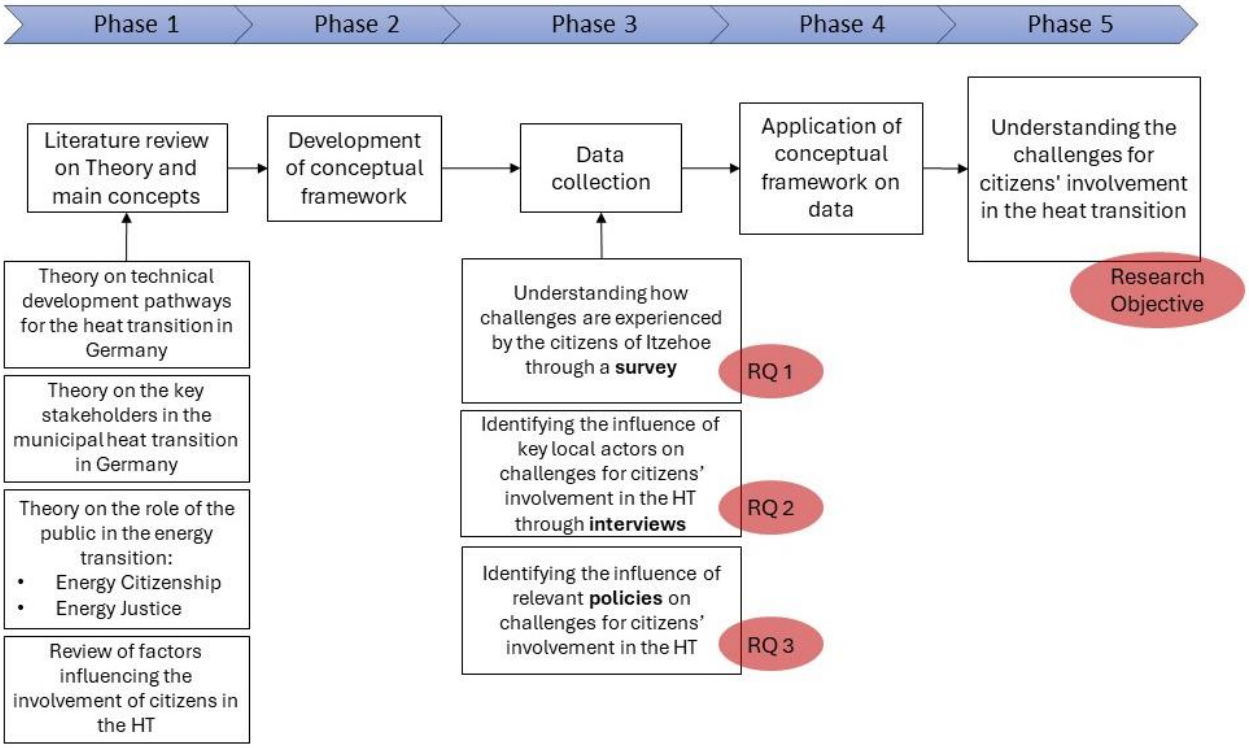

Figure 1:Research framework (own work of author)

1.3 Societal relevance

As stated by Verschuren & Doorewaard (2010), practice-oriented research is meant to provide knowledge and information that can contribute to changing an existing situation through a successful intervention. They point out that at the beginning of an intervention, it is necessary to uncover the problem at hand so that it becomes transparent and can be discussed by all stakeholders. This research contributes to unpacking the complex situation that hinders the HT from unfolding by focusing on the challenges for citizens.

By cooperating with the local utility provider the research aims to contribute to an agenda-setting of the identified problems, which is assumed to benefit the process of successful intervention (Verschuren & Doorewaard, 2010).

Further, the relevance of the research is enhanced, as the generated knowledge can be applied in the design of future strategies by the utility provider. The results of this research could also be used by the municipality to complement the municipal heat planning that is currently being created. As these plans are mostly focused on technical considerations, an understanding of the current situation from a social science perspective is regarded as a valuable addition.

1.4 Scientific relevance

In the literature, it is acknowledged that a sustainable carbon-neutral energy system creates new social roles and responsibilities (Devine-Wright, 2007; Pel et al., 2022; Ryghaug et al., 2018). However, the exact definitions of these remain unclear and the application of energy citizenship in practice is still largely open to interpretation (Lennon et al., 2020; Pel et al., 2022). Therefore, the application of the concept to the case of Itzehoe offers insides into how this theory relates to the practice. Additionally, the combination of the concept of Energy Citizenship with aspects from the concept of Energy Justice offers a new perspective that could contribute to the further development of the concept of Energy Citizenship.

Further, the research adds to the academic discourse about the role of the public in the German HT, which at this point remains limited by focusing on homeowners. Moreover, most of the available research focuses on financial challenges and assesses other factors such as knowledge and the structure of the process only to a limited extent (see e.g., Fjornes & Becker, 2022; Riechel et al., 2016). Additionally, the political decision to accelerate the HT as manifested in the amendment of the GEG is still relatively recent. While it significantly changed the political framework, it is not included in much of the work that takes a closer look at the role of citizens in the HT (see e.g.Achtnicht & Madlener, 2014; Stieß et al., 2009).

2 Theory and main concepts

The following section presents the main theories and concepts from the literature that are used in the research. First, the concept of the HT is explained and the key actors are introduced, with an emphasis on the differences between citizens regarding their access to resources and their different agencies. In the second subsection, the concept of Energy Citizenship is introduced, which is complemented by perspectives from the field of Energy Justice. Based on these theories, as well as the main concepts, and a review of existing research on potential challenges for citizens in the HT, the conceptual framework was developed and is presented at the end of this section.

2.1 Main concepts

2.1.1 The heat transition

From a technical perspective, the HT in the residential sector consists of three main pillars (Fraunhofer IWES/IBP, 2017). Firstly, the improvement of the system's energy efficiency, which leads to a reduction of heat demand, is essential. This can be achieved through different measures, such as the improvement of thermal insulation of houses, changes in consumer behavior, and the use of efficient appliances and heating systems with low energy loss (Hertle et al., 2015). Secondly, fossil-based heat production can be replaced with renewable energy production close to or within houses. This can be achieved by using individual solutions for renewable heat production, such as heat pumps, which make ambient heat usable and are powered by (renewable) electricity, or other solutions for heat provision based on burning biomass or using solar thermal collectors (Fraunhofer IWES/IBP, 2017). Thirdly, another option for renewable heat provision is the distribution through district heating networks. These networks connect several buildings within a neighborhood with a central heat generation unit. This makes it possible to use the efficiency benefits of upscaling. Further, it makes it possible to use heat sources such as geothermal heat or unavoidable waste heat from industries (Riechel & Walter, 2022). The decision whether an area is best supplied with heat by using individual solutions or through a district grid depends on many factors, such as the available space in and around the houses, or the availability of heat sources, such as waste heat from industries. Currently, around 10 % of the heat demand in the building sector in Germany is covered by heating networks. Future development depends on available energy potentials, the ability to integrate such systems into existing infrastructure, and on economic efficiency, which is, among other things, dependent on the heat demand density and the connection rate to the grid (Fraunhofer IWES/IBP, 2017).

To illustrate the interplay of these three parts, a potential scenario for heat provision in Germany developed by Fraunhofer IWES/IBP (2017) is shown in Figure 2. It firstly shows the importance of demand reduction, as the scenario assumes a 40 % reduction for the heating sector (purple). Further, it shows how heat provision can be realized through the combined use of individual heat production in and close to buildings (green) and district heating networks (blue).

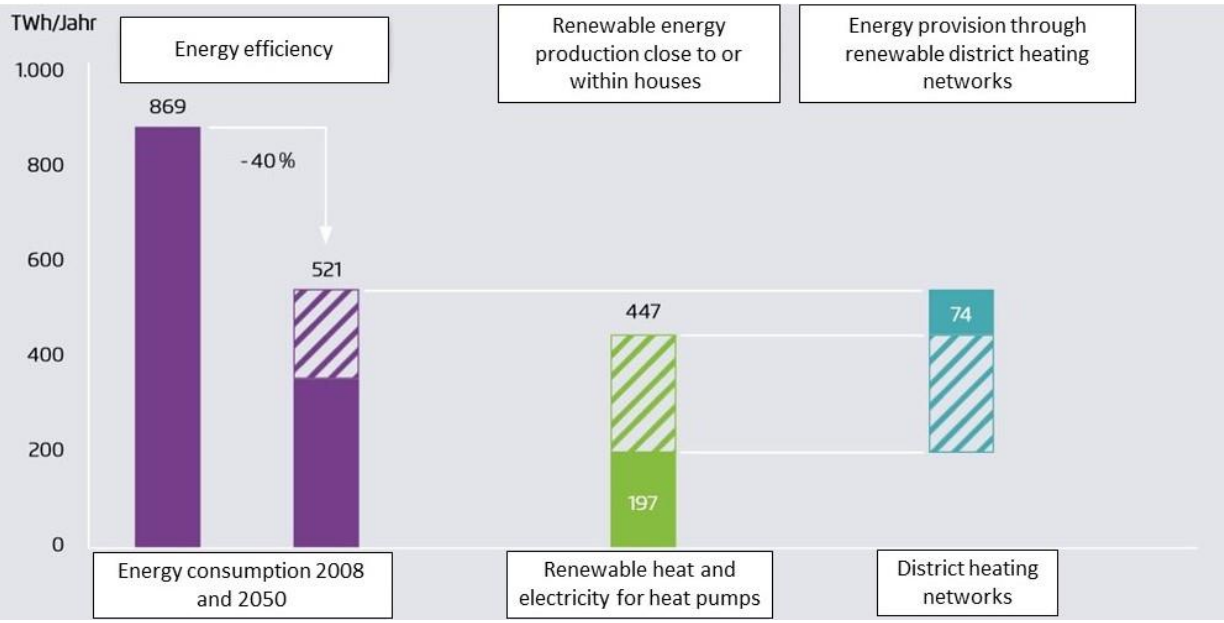

Figure 2: Scenario for heat provision in the residential sector 2008-2050 (adapted from Fraunhofer IWES/IBP (2017).

It can be seen that in this scenario so-called "green gases" do not play a role in individual heat provision. Even though the use of "green gases" in heat provision gained attention in recent political discussions, Rosenow (2022) demonstrated in a structural analysis of 32 independent reports on the use of hydrogen in individual heat provisioning, that not one provided evidence that supports the claim that using hydrogen is an economically or ecologically meaningful alternative to other systems such as, e.g., heat pumps. Therefore "green gases" are also not considered as a viable alternative in this research.

Info box 1: "Green gases"

The term "green gases" was primarily coined by natural gas lobbyists and refers to green, blue, and purple hydrogen, as well as biogas. Hydrogen can be produced in different ways leading to different types of hydrogen which are labeled using different colors. Green hydrogen refers to hydrogen that is produced by using renewable energies, blue hydrogen is based on natural gas when the occurring CO_2 emissions are captured and stored. Purple hydrogen refers to hydrogen produced by using nuclear power (Deckwirth & Katzemich, 2023). It needs to be acknowledged that all three approaches to producing hydrogen are energy-intensive processes, which makes it necessary to carefully consider which end-use applications are useful (Agora Energiewende, Agora Industrie (2022), Breer (2023), Gerhardt et al. (2020) and Klafka et al. (2023)).

2.1.2 Different actors in the heat transition

A distinctive feature of the HT is that many of the required measures to increase energy efficiency and the use of renewable heat take place within people's living spaces. This puts citizens as users and/or owners of residential buildings at the center of the transformation process, as they are

ultimately responsible for the decision to invest in energy-efficient refurbishment, the expansion of renewable energies, and the adaptation of user behavior (Baur & Noll, 2015; Riechel et al., 2016).

However, the HT involves a multitude of different actors on the municipal, state, and federal level that determine the possibilities that citizens have. Matußek et al. (2022) performed an extensive stakeholder analysis for a socially acceptable HT in Germany. They evaluated the interests and the influence of different actors and identified the most important key actors. They identify self-occupying homeowners and small-scale private landlords as important groups, as well as actors from the housing sector, namely housing cooperatives, private housing associations, and municipal and state-owned housing associations. Additionally, they identify state and federal ministries with their funding institutions, private banks, district and municipal governments, and energy providers as key actors. This is also reflected in a study by Riechel et al. (2016) who see the housing sector, the municipality, and the energy provider as key actors.

For this research, the actor group referred to as "citizens", which includes self-occupying homeowners, tenants, and small-scale private landlords, is placed at the center of the analysis. Large-scale landlords are grouped in the category of the housing sector. Additionally, the municipal and district government, the energy provider, and the state and federal ministries with their funding institutes are seen as important actors that are analyzed in more detail. An overview of the relevant actors and the distinction between different groups is shown in Figure 3. It shows that the challenges for citizens are influenced by the structural conditions shaped by the identified key actors. The groups and key actors are described in more detail in the following.

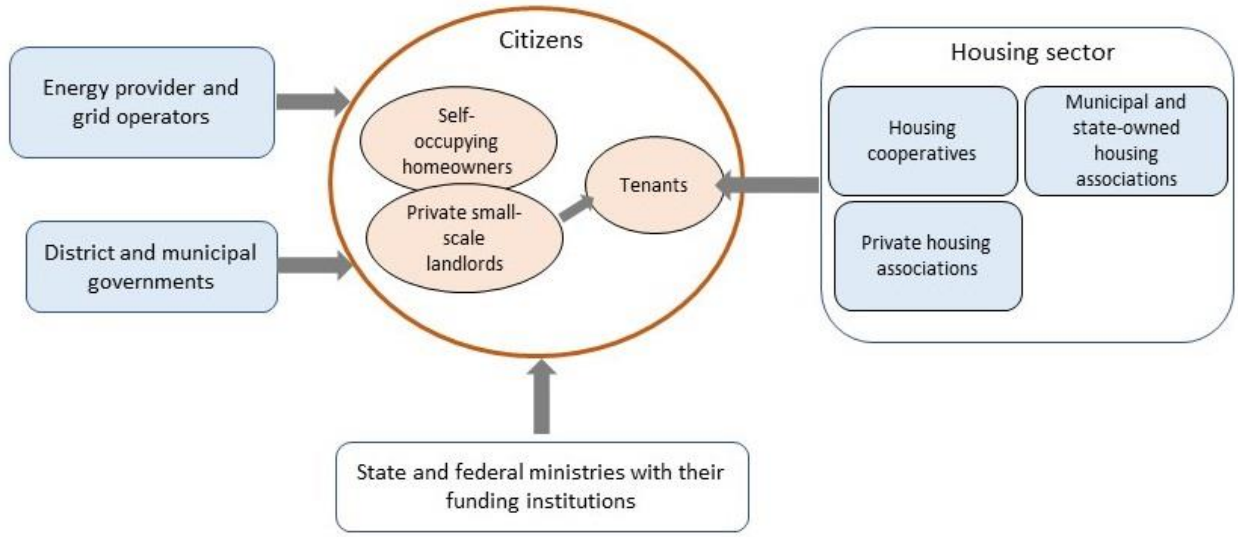

Figure 3: Overview of actors included in the analysis (own work of author based on Matußek et al., 2022; Riechel et al., 2016)

Citizens

Private self-occupying homeowners are the largest group of owners of living spaces, as in 2018, 46.5% of the people in Germany lived in houses they own (Statistisches Bundesamt, 2020a), and

they are responsible for changing their own heating system to a renewable one. It needs to be acknowledged that this group is not homogenous and differs in aspects such as income level, the quality of the building they own, or their age.

The new version of the Energy Building Act (GEG), which will enter into force on January 1, 2024, states that the requirement to use renewable energies when installing new heating systems will likely result in annual compliance expenses of around EUR 9.157 billion for citizens (Bundesregierung, 2023). Without adequate policy measures and an effective framework on the local level, these immense costs can create high burdens for citizens when they have to invest in their own real estate. This would affect low-income households especially.

During the energy crisis in the winter of 2022/2023, high fuel prices already disproportionately affected low-income households, as there is a clear connection between income and the quality of housing. The lower the income of a household the more often the household lives in a building with the lowest energetic standard (Schumacher & Nissen, 2022). The low housing quality leads to increased consumption of fuel without an increase in comfort in comparison to high-standard homes. Concerning disposable income, the burden is therefore significantly higher than for households with higher incomes (Neuhoff et al., 2022). The same applies to the costs associated with the HT. Households that live in low-standard houses are likely to face higher costs for refurbishment while having fewer financial resources available. Therefore, the situation of low-income self-occupying homeowners in the HT needs to be considered when assessing the challenges of citizens in the HT.

Another group that needs to be considered is elderly people. Pensioners make up almost half of all self-occupying homeowners with low incomes. In comparison to the average, they consume more energy and more often live in old houses with low standards (Schumacher & Nissen, 2022). This makes low-income pensioners a specifically vulnerable group. In 2022, the dramatic increase in prices resulted in pensioner households in the lowest income quintile spending 11%, and thus a significant portion of their income, on heating energy (Schumacher & Nissen, 2022). On top of that it is argued that elderly people might have less capacity to familiarize themselves with the available renewable technologies and the corresponding regulations and funding mechanisms (Stieß et al., 2009).

The largest group of landlords are small-scale private landlords who own 31.2 % of the apartments in Germany. For this research, they are grouped with self-occupying homeowners, as they are expected to have similar characteristics and interests.

With more than half of the German population living in rented living spaces, tenants are an important group. In contrast to homeowners, their situation is very different, as they have almost no agency regarding the heating system of the houses they live in and depend on decisions made by their landlord (Matußek et al., 2022).

In this context, the so-called “landlord-tenant-dilemma” is widely discussed in Germany. The German Civil Code (BGB) determines that 8% of the modernization costs can be apportioned to the

tenants per year. While some people argue that the limited possibility of turnover of investments to tenants hinders investments, others argue that passing on investments causes significant financial burdens for tenants (Pallaver, 2019). To justify the turnover of investment costs, proponents argue that the increase in base rent is compensated by savings in energy costs. While this calculation seems to be valid in some cases, it strongly depends on the quality of the house, the quality of the energetic refurbishment, and the user behavior of the tenants (Pallaver, 2019). Calculations by the Scientific Service of the German Parliament show that in the majority of cases, the idea of overall rent neutrality does not hold (Wissenschaftliche Dienste des Deutschen Bundestags, 2018). However, as well-insulated houses and renewable heating systems create resilience against the consequences of high energy prices, Pallaver (2019) argues that energetic refurbishment can be very beneficial for tenants.

In summary, the role of citizens varies strongly depending on their situation. The courses of action are significantly different for homeowners and tenants and the impact is expected to be different for people depending on their income and their age.

The district and municipal governments

The important role of the municipality in the HT is clearly stated in the literature (e.g., Baur & Noll, 2015; Libbe & Riechel, 2017; Riechel et al., 2016) and also reflected in current regulations, such as the state act on climate change for the state of Schleswig-Holstein (EWKG, 2021) and for the state of Baden-Württemberg (Klima G BW, 2023), which make municipal heat planning mandatory for the majority of cities in these states. The municipality acts in different roles. Firstly, it acts as a consumer and role model regarding its own real estate. Secondly, it acts as a planner and regulator by using the different methods it has at hand to promote energy efficiency and renewable energy development in its regional and city planning. Thirdly, the municipality can act as a supplier and provider when it holds shares in local housing cooperatives or the utility provider. Lastly, the role of adviser and promoter is crucial. The municipality can facilitate networking between local stakeholders, provide information, and moderate processes, e.g., by providing competence through district- and climate protection managers (Hertle et al., 2015).

Energy providers and grid operators

Local energy providers are important partners for the municipalities. They are responsible for the generation, distribution, and storage of energy and therefore play an important role in the transition process (Riechel et al., 2016). Oftentimes they own the energy infrastructure and hold a wealth of knowledge about local systems, and many of them are experts in energy efficiency (Hertle et al., 2015). Without the engagement of local energy providers, actions are almost completely limited to individual solutions. When network solutions are aspired to, it is inevitable to work together with the local energy providers. It has proven to be advantageous for cooperation if municipalities work together with a municipality-owned public utility provider that operates their own electricity and gas grids (Riechel et al., 2016). In addition to their traditional business fields, they might also sell energy efficiency products and offer energy services or offer financing models such as contracting. Generally, they are profit-oriented and their main motivation in the HT is long-term customer loyalty and the development of new sustainable business areas (Hertle et al. 2015).

Housing sector

Actors from the housing sector shape the role of tenants in the HT. As the owners of residential buildings, they are in charge of modifications that need to be done within their property (Riechel et al., 2016). The main types of actors from the housing sector are private housing associations, municipal and state-owned housing associations, and cooperatives (Matußek et al., 2022).

Housing cooperatives own a large number of apartments in metropolitan areas and, with a total of 12.4 % of all apartments, they are the second largest group of landlords (Destatis, 2019). Cooperatives are not for profit, building on long-term stability and value preservation and acting in the interests of their members. Generally, they are interested in energetic refurbishment, as they follow socially and economically sustainable principles (Engelmann et al., 2021).

Private housing associations own 8.1 % of all apartments in Germany. They are interested in profit maximization and thereby strongly driven by economic considerations. The social compatibility of redevelopment projects and ecological motives generally play a less important role (Engelmann et al., 2021).

Municipal and state-owned housing associations own about 6 % of the apartment stock (GdW, 2020), especially in densely populated metropolitan areas. They act with the common good in mind and, because of their ties to the municipalities, must always pay attention to the social compatibility of their portfolios. Their main objective is the quantitative and qualitative provision of housing, also for low-income households. This can create a conflict between the objective of providing affordable housing and, on the other hand, making the investments to energetically refurbish the building stock (Matußek et al., 2022).

State and federal ministries with their funding institutions

State and federal ministries create the legal framework for the HT. They define energy efficiency requirements for buildings in Germany, regulate CO_2 pricing, create quotas for renewable energies, and administer funding programs for all aspects of the HT (Hertle et al. 2015). This means that they play a key role by creating incentives to invest in energy efficiency and by setting regulatory standards, thereby strongly influencing the possibilities for actions for actors at the local level (Matußek et al., 2022). Funding schemes are strong instruments in the promotion of technological change. Additionally, each state has specific state-owned investment banks that complement the subsidy scheme from the federal institutions.

2.2 Theory

2.2.1 Energy Citizenship

The basis of the concept of Energy Citizenship is provided by Devine-Wright (2007) who examines how “energy” and “energy users” are socially constructed. The author argues that technological development is embedded within and shaped by the social construction of energy users. The assumptions about what people want, like, and desire and what they tolerate influence the development of different energy pathways.

Devine-Wright (2007) emphasizes that centralized energy systems often consist of fossil power plants located outside of cities in low-populated areas and that the home applications only request minimal engagement from the users. It is argued that in the current fossil system, the public is constructed as consumers who want minimal engagement with the energy system and who have an "out of sight out of mind" mentality toward the centralized energy generation facilities (Pasqualetti, 2000). Devine-Wright (2007) suggests that these beliefs are a "self-fulfilling prophecy" (p. 138). When energy users are characterized by deficits of "interest, knowledge, rationality and environmental and social responsibility" (Devine-Wright, 2007, p. 213) and this deficit view is understood as common sense, it shapes the decisions of planners and policymakers and, in turn, fosters centralized systems designed for low engagement. Figure 4: Visualization of the concept of energy citizenship (own work of author based on Devine-Wright, 2007)

In contrast to the deficit view, energy citizenship offers alternative imaginaries of the public based on very different assumptions about public awareness, motivation, and concern about energy (Devine-Wright, 2007). In Energy Citizenship the public is conceived as active rather than passive stakeholders and their role is framed by "notions of equitable rights and responsibilities across society for dealing with the consequences of energy consumption, notably climate change" (Devine-Wright, 2007, p. 71).

This perspective opens up the possibility that new decentralized technologies can stimulate new ways of thinking about energy and that individuals are not necessarily reluctant to change but can be positive and excited about new technologies. This would lead to citizens being more willing to take an active role in the energy system. The motivation for these actions is at least partly based on a sense of social and environmental responsibility (Devine-Wright, 2007). These reinforcement mechanisms between centralized fossil fuel energy systems and detached consumerism and decentralized renewable energy systems with Energy Citizens are visualized in Figure 4.

Figure 4: Visualization of the concept of energy citizenship (own work of author based on Devine-Wright, 2007)

The concept offers the opportunity to overcome the negative imaginaries of passive consumers, who are reluctant to change, which is persistent in centralized fossil fuel systems, and highlights the co-evolution of the social representation of citizens and the energy system. It establishes the understanding that development in the energy system can open up or close down opportunities for behaviors for citizens. Thereby, the concept opens the discussion to enable a deeper understanding of challenges for citizens in the transition process.

Thus, the concept is considered a valuable perspective to investigate the challenges for citizens in the HT.

However, more recent research on the topic points out that the concept developed by Devine-Wright (2007), which was designed as an emancipatory concept that allows new imaginaries of citizens beyond consumerism, is prone to ideological appropriation and to narrow instrumental interpretation (Pel et al., 2022). While the concept is considered useful for conceptualizing the relationship between the energy system and the public, it is also criticized for being too normative and individualistic. The imaginaries of Energy Citizenship can turn from empowering narratives into disempowering ones when the responsibility of individuals is overemphasized and crucial issues regarding unequal agency and access to resources are ignored (Lennon et al., 2020). When the concept of energy citizenship is understood as allocating responsibilities to people that not everybody is in a position to fulfill, it risks becoming a narrative that shifts attention away from structural conditions. Thereby, it could foster power inequalities and lead to the unfair allocation of burdens and benefits (Lennon et al., 2020).

To incorporate the criticism on energy citizenship and to further strengthen the emphasis on unequal agency and access to resources for specific groups in society, this research is also informed by aspects of Energy Justice.

2.2.2 Energy Justice in low-carbon transitions

Energy Justice is a concept that was expressed by environmental justice activists for several decades and was later defined as a framework in scientific works, becoming one of the leading interdisciplinary energy research topics with the shared goal of a transition towards a more fair, equal, equitable, and inclusive energy system (Heffron, 2021; McCauley et al., 2019). While many injustices are connected to fossil fuel-based energy activities, Sovacool (2021) emphasizes that low-carbon technologies are not inherently more just than their fossil-fueled counterparts and that a critical justice review is indispensable to make use of the great possibilities that the transition process offers in terms of justice and equity.

According to Jenkins et al. (2016), the conceptual approach of Energy Justice encompasses three key dimensions: distributional justice, procedural justice, and recognition justice.

Distributional Justice

Distributional justice in energy refers to the fair allocation of the benefits and burdens associated with energy production, distribution, and consumption. It emphasizes equitable access to clean and affordable energy for all, regardless of socioeconomic status or geographic location (Jenkins et al., 2016). Distributional justice concerns typically arise around the location of energy production plants and question the implications of rising energy prices (Jenkins et al., 2016). Arguably these aspects are not limited to fossil-based energy systems. In contrast, it can be observed that the decarbonization of energy systems tends to show many aspects of distributional injustices, which makes it crucial to investigate these changes in the energy system from this perspective (McCauley et al., 2019). In the context of domestic heat provision, Walker and Day (2012) argue that the main

concern of distributional justice is the access to energy services, i.e., the ability to maintain a comfortable temperature in one's home. This in turn depends on the distribution of income, as this determines whether people can afford a certain energy price. Further, limited financial means can have consequences beyond access to heat, as people who are forced to use a high proportion of their income towards heating energy might be deprived of the ability to purchase other essentials within the household's budget (Hills, 2011). Further, the distribution of the quality of housing and the energy-efficiency of heating technology is crucial as this determines the amount of energy needed to achieve a comfortable temperature in the house (Walker and Day, 2012).

Procedural Justice

Secondly, in addition to distributional justice, which focuses on just outcomes of a process, procedural justice is concerned with the process itself, especially aiming to uncover aspects of the processes that produce or sustain unequal distributional outcomes (Walker and Day, 2012). Jenkins et al. (2016) state that Procedural Justice manifests in procedures that engage all stakeholders in a non-discriminatory way. This perspective enables researchers to explore how decision-makers engage with people and communities. Concerning the HT, a just process is seen to entail ready access to information on energy prices and ways of being more energy efficient (Walker and Day, 2012), as well as a consistent information flow and information sharing about specific plans and infrastructural adjustments, sufficient consultation processes, and local participation in decision-making (Mundaca et al., 2018). Further meaningful representation of peoples' interests in the process is seen as an important aspect of procedural justice, meaning that especially the needs and opinions of people with lower capacities for involvement are recognized in the process (Walker and Day, 2012).

Recognition Justice

Thirdly, recognition justice demands that all individuals are fairly represented. A lack of recognition can be the result of various forms of political and cultural domination, and it also manifests in the non-recognition of different access to resources and different degrees of agencies among people (Jenkins et al., 2016). Therefore, energy justice incorporates a special placeholder for vulnerable groups to counteract the injustice of misrecognition. This means that groups with low capacity, low resilience, and high exposure that are already marginalized in society are not seen to deserve equal treatment but instead, their particular situation needs to be recognized, which then potentially leads to a specific treatment (Sovacool et al., 2016). As recognition justice demands equal respect for everyone's wellbeing, recognition justice manifests in not accepting ongoing material deprivation of any group of people and in the context of heat provision the recognition of differing needs in heating energy due to age or other physiological reasons (Walker and Day, 2012).

Addition: Cosmopolitan Justice

In addition to the three aspects listed by Jenkins et al. (2016), Energy Justice also highlights that the principles of justice are to be understood globally. This can be referred to as a cosmopolitan approach to justice, meaning that "in energy, we are all citizens of the same world" (Heffron, 2021, p.2). This aspect highlights that the cross-border effects of energy activities need to be considered and that the above-mentioned aspects of Energy Justice apply to everyone regardless of the borders

of nation-states (Heffron, 2021). Applying this global perspective also draws attention to the full life cycle of energy technologies. Heffron (2021) summarizes energy justice as the application of human rights across the whole energy life cycle, starting with the extraction of raw materials to production over operation and consumption all the way to waste management. Building upon this notion, energy justice scholars advocate for a whole-system approach in the evaluation of energy systems (Sovacool, 2021).

An analysis of the global implications of the German fossil-based heating system is well beyond the scope of this research, but the global dimension of energy justice is added here to highlight the importance of the HT in general, as the value chain of the current fossil system is related to many injustices on the global level concerning the dimensions of justice introduced above. Looking at the distribution of burdens and benefits globally, research shows that benefits of energy systems are mostly enjoyed in "developed" Global North countries like Germany while many of the burdens are allocated to communities in the Global South (Hickel, 2021). This raises strong concerns regarding fair processes and the recognition of people and communities.

2.3 Conceptual framework

Based on the theory and the main concepts, a conceptual framework was derived to analyze the challenges for citizens in the HT within the local context of Itzehoe. The conceptual framework combines aspects from Energy Citizenship and Energy Justice aiming to incorporate both the more individual perspective of Energy Citizenship and the more systemic perspective provided by Energy Justice. Further, it draws on the main types of challenges identified in a preliminary literature review.

Figure 5 shows a simplified conceptual model of the HT process, summarizing the main assumptions made for this research, and will be explained in the following.

Firstly, the concept of Energy Citizenship is used to conceptualize the relationship between citizens and the energy system highlighting the interconnectedness of both. As introduced in section 2.2.1, citizens in centralized fossil-based energy systems are often represented as detached consumers, while the concept of Energy Citizenship offers a counterpoint to this perspective. It suggests that citizens are not inherently reluctant to change and are open to playing a more active role in the energy transition and that this representation of citizens can reinforce or be reinforced by more decentralized renewable energy structures. As shown in section 2.1.1, the HT relies on decentralized heat provision within or close to people's houses requiring infrastructural adjustments and active involvement of citizens. It is argued here that this makes the concept of Energy Citizenship especially relevant to the HT. The co-evolution of the representation of citizens and the heating systems is visualized in the upper part of Figure 5.

Further, the lower part of Figure 5 represents the influence of the identified key local actors on the citizens in the transition process (see section 2.1.2) and highlights that the structural conditions of the HT are influenced, among others, by the district and municipal governments, energy providers and grid operators and actors from the housing sector, as well as state and federal ministries. To assess the influence on the conditions exerted by these key actors, this research uses the

dimensions of energy justice introduced in section 2.2.2, namely distributional, procedural, and recognitional aspects of energy justice.

The concept of Energy Justice is further deployed to address the limitations of Energy Citizenship, as the limited recognition of different access to resources and different degrees of agencies is a frequent criticism of Energy Citizenship. As introduced in section 2.1.2 citizens in the HT cannot be understood as a homogenous group, as people's situations can vary depending on their age, with elderly people being especially vulnerable, their ownership situation, with tenants being in a situation of low agency, and their financial situation, with a special risk for low-income households. These characteristics can also overlap, potentially causing an even greater risk of vulnerability. Therefore, this research performs distinct analyses for these groups. The characterization is not exhaustive and does not incorporate all factors. But even though it risks overlooking certain patterns, it is assumed to be useful for operationalizing the recognition of different groups and is expected to capture relevant dynamics within the scope of this research.

Notably, the visualization in Figure 5 is a strong simplification of a complex system that comes with several limitations, which are discussed in more detail in section 6.2.

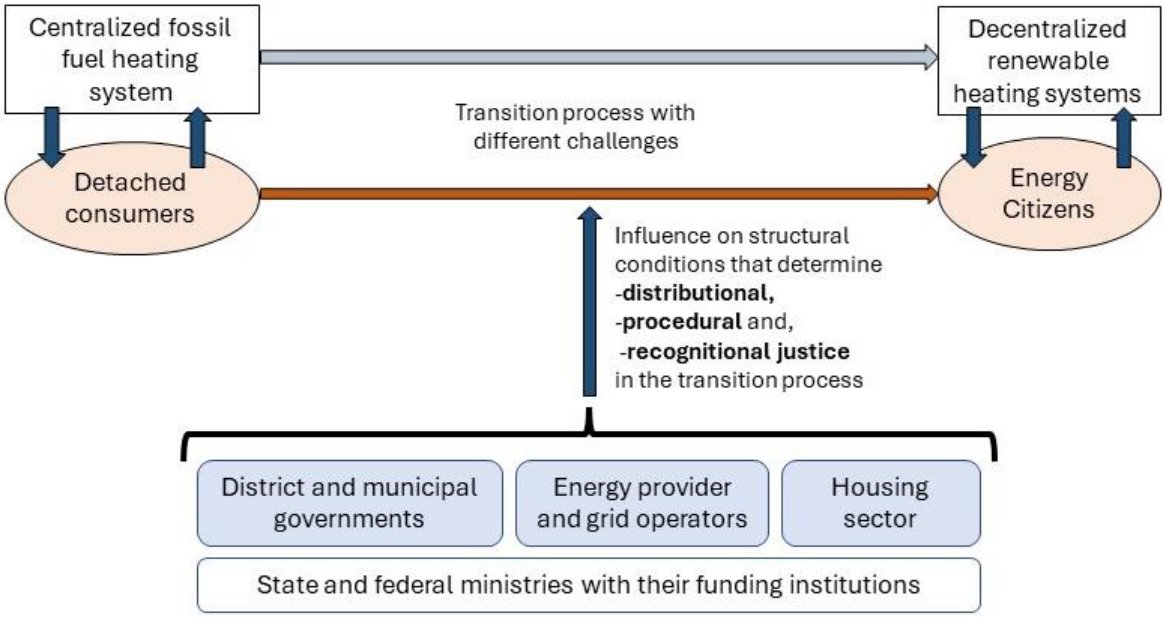

Figure 5: The conceptual model of the transition process used in the research (own work of author)

As the concept of Energy Citizenship leaves open which exact actions are desirable, it is important to be explicit about the normative assumptions and the desired outcomes of the process (Pel et al., 2022). Therefore, it needs to be noted that this research assumes that the increased involvement of citizens is a normative good that supports the implementation of renewable heating systems. Further, the research focuses on the implementation of renewable heating systems and defines an uptake of implementing and using renewable heat as the desired outcome. Within this context, Energy Citizenship is mainly understood as the recognition of responsibility for dealing with the

consequences of heat consumption, which is at least partly motivated by awareness and fosters the motivation of individuals to contribute to cleaner heating provision.

Thus, this approach follows a pragmatic understanding of Energy Citizenship at the expense of a more transformative logic (Pel et al., 2022). This decision does not intend to devaluate the importance of investigating transformative aspects, such as how citizen organizations can question and overcome existing power structures in the energy system, but it was made in order to enhance operationalizability and practical applicability. The resulting limitations of the conceptual framework and further reflections on the use of Energy Citizenship as a concept are provided in section 6.3.

Challenges for citizens' involvement in the HT

To understand the process of the HT from the perspective of citizens, this research takes a closer look at the challenges that hinder the transition of citizens from detached consumers to actively involved Energy Citizens. To facilitate a structured assessment, the literature dealing with the role of citizens in the German HT was reviewed to identify the main areas relevant to citizens' involvement in the HT, resulting in six different categories, namely awareness, motivation, knowledge, practicability, financial aspects, and specific local and personal situations. The main aspects of these categories are described below and summarized in Table 1.

The first category is awareness about the importance of the HT. This is a central element in the concept of Energy Citizenship, as Devine-Wright (2007) assumes that citizens can be strongly motivated to be involved in the energy transition by an awareness of the problems of the fossil energy system and a sense of social and environmental responsibility. This is also reflected by Stieß et al. (2009 as they argue in their study on the motives of private German homeowners for energetically refurbishing their houses that sufficient awareness of the problem and a positive attitude towards the energy transition are important factors that can lead to the decision to refurbish houses.

This is closely related to the second category, motivation, which refers to the motivation of citizens to take action that contributes to a cleaner energy system. This is identified as one of the main factors influencing the role of citizens in the HT by Libbe and Riechel (2017).

The third aspect is knowledge, which is divided into technical and policy knowledge, as also done by Jansma et al. (2020) in their study on the attitudes of tenants and homeowners toward the HT in the Netherlands. In this way, this category distinguished between how familiar citizens are with the technical alternatives to the fossil heating system and their knowledge about current policies, including the funding scheme. Knowledge and the capacity to digest and evaluate information are also understood as important resources needed for the process of energetic refurbishment by Stieß et al., (2009) and Wilson et al. (2015) point out that, the complexity of energetic refurbishment, both technologically but also administratively, can cause a high cognitive burden which is seen to influence the involvement of citizens in the HT.

The fourth factor is the practicability of implementing renewable heating systems, which is identified as a key influencing factor for citizens' involvement in the HT by Libbe and Riechel (2017). This category covers the effort that is required from citizens to pursue a renewable heating project in their

living space, starting with the procurement of information, the administrative procedures, the commissioning of a specialized company, and the implementation of the technology. The difficulty of this process is assumed to be influenced by personal capabilities but also by structural conditions such as the availability of specialized workers, the accessibility of consultancy opportunities, and the administrative effort, which are frequently mentioned in the literature as main barriers to citizensenergetically refurbishing their homes (e.g., Fjornes and Becker, 2022; Stieß et al., 2009; D'Oca et al., 2018; Pallaver, 2019).

The fifth topic, that is frequently mentioned in the literature, is financial aspects. As described above, energetic refurbishment of houses requires high investments, and the expected cost-effectiveness of different measures is found to have a strong influence on decision-making (Baur and Noll, 2015; Fjornes and Becker, 2022; Riechel et al., 2016; Stieß et al., 2009). The financial aspects are divided into access to financial resources to cover the investment costs and perception of the cost-effectiveness of measures. These aspects in turn are highly dependent on the development of prices for renewable energies as well as fossil fuels, services, and the funding scheme offered by the government.

Lastly, it is highlighted in the literature that decisions regarding the heating system are highly dependent on the specific personal and local situation. These aspects can be very diverse, therefore some aspects frequently mentioned in the literature were selected. Firstly, this is the ownership structure of houses, as many buildings are owned by owner communities that need to decide on the refurbishment together. Without efficient communication between stakeholders, this is considered a potential barrier (D'Oca et al., 2018). Secondly, acceptance in the neighborhood is identified as an important aspect by Achtnicht and Madlener (2014). Thirdly, barriers can occur due to the technical setup of buildings (Fjornes and Becker, 2022).

Table 1: Specification of different categories of influencing factors for citizens' involvement in the HT (based on (Achtnicht & Madlener, 2014; Baur & Noll, 2015; Devine-Wright, 2007; D'Oca et al., 2018; Fjornes & Becker, 2022; Jansma et al., 2020; Pallaver, 2019; Riechel et al., 2016; Stieß et al., 2009))

Category of challenges	**Specification in the context of the HT**
Awareness	• Importance given to the energy transition • Sense of environmental and social responsibility • Support of legislation that aims to ensure climate protection
Motivation	• Motivation to contribute to a cleaner energy system • Support of legislation that aims to ensure the change to renewable heat in private households
Knowledge	• Knowledge about available renewable heating technologies • Knowledge about regulations and support mechanisms such as the funding scheme

Practicability of implementing renewable heat	• Required effort in the process of implementing renewable heat for private homeowners → procurement of information, administrative procedures, commissioning of a specialized company, and the implementation of the technology
	• Availability of specialized workers
	• Access to information
	  ○ Reliable consultancy opportunities
	  ○ Communication about relevant policies and regulations

Financial aspects	<u>Homeowners:</u> • Access to sufficient financial resources to invest in renewable heating technologies for homeowners • Support through the funding scheme for homeowners • Perceived cost-effectiveness of measures compared to fossil heating systems for tenants and homeowners <u>Tenants:</u> • Protection from over-proportional allocation of costs through rent increases or high operation costs of the energy system

Specific local and personal context	• Factors that relate to the conditions within one's home or the local surroundings, and personal preferences
	  ○ Structural conditions of the house
	  ○ Acceptance in the neighborhood
	  ○ Expectations about the comfort of renewable heating systems
	  ○ Expectations about the reliability and usability of renewable heating systems
	  ○ Ownership structure of housing

3 Case study description: Itzehoe

This research is designed as a case study looking at the municipality of Itzehoe, located in the state of Schleswig-Holstein in Northern Germany (see Figure 6). Despite its rural character, the city belongs to the metropolitan area of Hamburg. The temperature in Itzehoe can vary from -10 °C in Winter to 28°C in summer making energy use intensive in months of extreme temperatures (Stadt Itzehoe, n.d.).

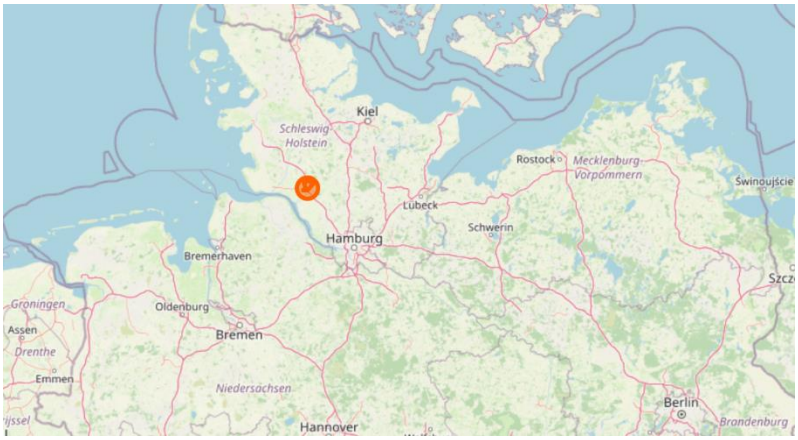

Figure 6: Location of Itzehoe (OpenStreetMap, n.d.)

Itzehoe is a mid-sized town with 31,855 inhabitants with an average age of 45.8 years in 2021, which is one year older than the German average (BIB, 2023; Statistikamt Nord, 2021). There are 8199 residential buildings in Itzehoe. Of these houses, 70 % consist of one flat, 10 % of two flats, and 20 % of three or more flats (Statistikamt Nord, 2021). In 2019, 53.3 % of the citizens in the state of Schleswig Holstein lived in living spaces they own (Statistisches Bundesamt, 2020b).

The municipality of Itzehoe is currently creating the municipal heat planning in cooperation with the local municipality-owned utility provider “Stadtwerke Steinburg GmbH”. The company has been in charge of providing water and natural gas to the citizens of the region since the middle of the 19th century. Today, they provide energy to 79,000 households and own 2,400 km of gas and electricity networks in the area (Stadtwerke Steinburg GmbH, n.d.). A manager, responsible for the municipal heat planning in the company, states that the understanding of the role of the public is limited, especially regarding the activation of people to make energetic adjustments in their own homes and how to avoid social discords due to an inequitable distribution of benefits and burdens (R. Quurk, personal communication, February 9, 2023).

Figure 7 shows the area that belongs to the municipality of Itzehoe and the distribution of head demand densities[1] across the city. There is a high head demand density in the city center (red) and a relatively large area characterized by a low heat demand density (yellow). The low heat demand density and the large share of houses with only one flat point towards a heating system that relies

[1] The head demand density describes the amount of energy used for heating in a given area. The unit used at the present map is MWh / (ha × a).

more on individual heating solutions than on district heating networks. Additionally, the map shows the four district heating networks currently installed in Itzehoe (green dots). All of them are operated by the local utility provider “Stadtwerke Steinburg GmbH”.

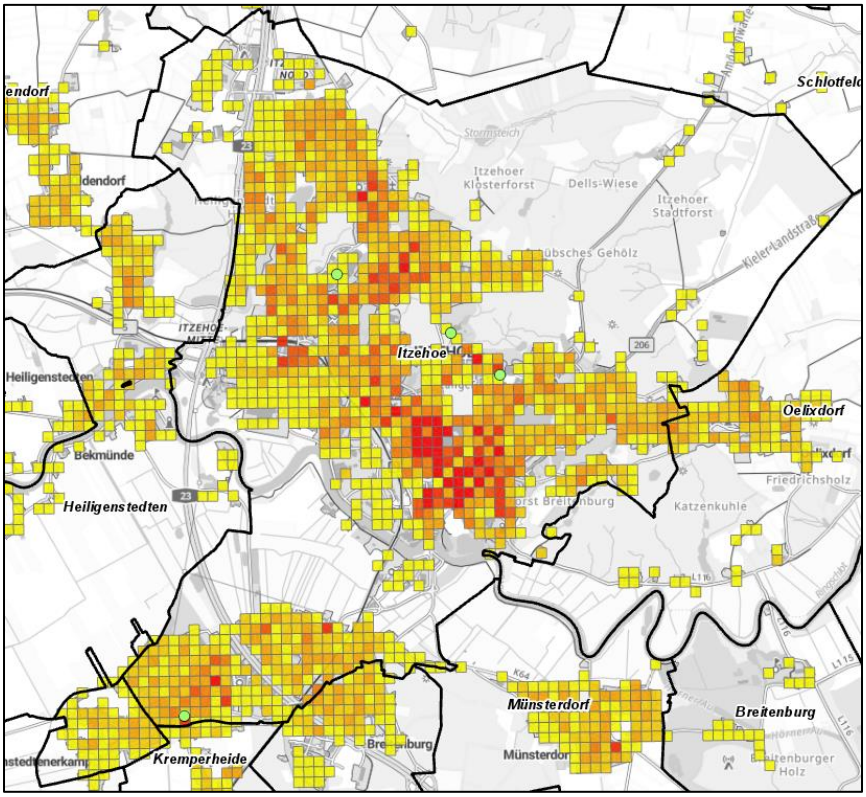

Figure 7: Heat demand density and district heating networks in Itzehoe (Ministerium für Energiewende, Klimaschutz, Umwelt und Natur des Landes Schleswig-Holstein, n.d.)

4 Methodology

This research, aiming to understand the challenges for citizens in the HT, is designed as a case study, in which the main research unit is the experience of the citizens of Itzehoe in the process of the HT. The central element is the collection and analysis of quantitative data through a survey among the citizens of Itzehoe. This is complemented by a qualitative analysis of relevant policy documents to understand how the political framework shapes the situation of citizens in the HT and interviews with local key actors to take the specific local context into account. The detailed processes of data collection and analysis are explained in this chapter.

4.1 Selection of case study

The case study approach was chosen for this research, as it allows an in-depth understanding of a phenomenon at a specific place at a specific time (Verschuren and Doorewaard, 2010). For this research, the community of citizens of Itzehoe was chosen as a case for analysis. This in-depth analysis on the local level is seen as a fitting research strategy to assess the dynamics within the German HT, as the responsibility for the implementation of the HT is given to the municipalities in recent legislations (see Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023; EWKG, 2021). Therefore, many decisions need to be made within the local context of municipalities. This in turn requires a clear understanding of the local situation and its challenges.

Itzehoe is chosen as a case study because it represents one of the many small and mid-sized municipalities that face the challenge of realizing the HT locally and that need to build up capacities and knowledge for this process. Additionally, the city is located in the state of Schleswig-Holstein, which is one of the federal states of Germany that already issued an obligation for municipal heat planning in 2021, which puts the municipalities of Schleswig-Holstein ahead of many other municipalities in the process of the HT. So even as the results of a case study of Itzehoe are not generalizable for other locations (Verschuren and Doorewaard, 2010) it is assumed that many aspects observed in Itzehoe may also be present in other municipalities across the country and could provide interesting insides for other regions.

Another important factor that influenced the selection of Itzehoe for the case study was the personal attachment of the researcher to the place. The researcher grew up close to the city and therefore understands the local culture and specific circumstances of the city. Secondly, the researcher had the opportunity to cooperate with the public utility provider. This was adventurous for the process of data collection, as resources of the company such as social media accounts could be used, and the researcher could profit from the knowledge, experience, and contacts of co-workers. Further, this cooperation connects the research with a local key actor, potentially amplifying the impact of the research project, as the generated knowledge will be presented to decision-makers in the company and the municipality and could be used to inform the development of future strategies.

4.2Data collection and analysis

The three different data collection and analysis methods are explained in the following.

4.2.1 Survey among citizens

The first data collection method was a survey among the citizens of Itzehoe. The analysis of the data enabled answering the first sub-question which is directed toward experiences of the citizens of Itzehoe in the HT. The survey investigated the situation of private self-occupying homeowners, small-scale private landlords, and tenants concerning their current involvement and potential challenges.

The research followed a cross-sectional approach, which means that material was gathered at a certain moment in time from a single group (Verschuren and Doorewaard, 2010). The group that was surveyed was defined as the people who live in Itzehoe or own housing property in Itzehoe and questions were directed to the current experiences regarding the HT. The survey was conducted between June 5, 2023, and July 2, 2023.

The following section gives an overview of the survey design, the distribution, and the analysis of the collected data.

Survey Design

The survey questions were designed based on the preliminary research that led to the analytical framework. It aimed to identify to what extent the citizens of Itzehoe experience the different types of challenges developed in the analytical framework (see Table 1). The survey was created with the help of the software Qualtrics[2]. The license is provided by Utrecht University. It is a tool that allows online surveys that can be accessed via a link and a QR code. The survey was designed to take maximally 10 minutes, as this was assumed to increase the willingness of people to participate as opposed to longer surveys. An overview of all survey questions is presented in Appendix B.

The survey started with a qualifying question. The participants were asked whether they own, rent, or rent out living space in Itzehoe and were informed that people who do not do any of these cannot participate in the survey. Thereby it was ensured that only people who live or own housing property in Itzehoe participated in the survey.

Secondly, demographic data was collected. Participants were asked for their age, gender, and the location and type of their living space. This information was used to assess the representativeness of the sample.

In the main body of the survey questions were designed as closed questions that could be answered by indications on a scale inspired by the Likert scale, which usually gives the options of strongly agree, agree, undecided, disagree, and strongly disagree (Bryman, 2016). Depending on the type of question the wording of the Likert scale was customized to match the specific context. After that, statements that reflect factors that are frequently mentioned in the literature about the HT were displayed and respondents were asked to indicate their agreement on a Likert scale. Depending on

[2] https://www.qualtrics.com/

the indicated ownership situation (e.g., homeowner, tenant, private landlord) different questions and statements were displayed.

Firstly, the survey aimed to collect data that facilitate an understanding of the current state of the HT. Therefore, homeowners and private landlords (hereafter referred to as owners) were asked about the type and age of their current heating system. To understand the current general attitude towards renewable heating systems and energy efficiency measures, they were asked to indicate which renewable technologies and energy efficiency measures they already have or to which extent they could imagine installing them in the future.

Tenants were asked if their landlord currently plans to change to a renewable heating system or energetically refurbish the house and if the participant is in favor of these measures in their home.

Secondly, the survey aimed to provide data that serve as potential explanatory factors for the current state and attitude towards renewable heating systems. These factors relate to the different categories of challenges defined in the analytical framework (Table 1). To assess the awareness and motivation of participants, they were asked how important the implementation of the energy transition in Germany is for them and how important it is for them to contribute to climate protection measures. Further, it was asked for the agreement with two laws. These were the climate protection targets defined in the energy transition and climate protection law (EWKG) and the proposed amendment of the proposal GEG from May 2023[3], specifically the rule that demands a minimum of 65% of renewable energy use in newly installed heating systems after January 1, 2024. Additionally, participants were asked to indicate their agreement with statements regarding the impact of renewable heat on living comfort.

In the next step, participants were asked to self-evaluate their technical knowledge and owners were also asked to self-evaluate their policy knowledge. It was decided to only ask people who own living spaces about the policy knowledge, as the policies in question (e.g., requirements for buildings and energy systems) are more relevant to owners of buildings than to tenants due to their limited agency regarding the building's technological setup.

The next section addressed the financial aspects. For owners, these were the attractivity of the subsidy scheme, the access to financial resources, and whether people think that they could save costs in the long run through investments in renewable options. It was decided to not directly ask for the income of respondents because this was assumed to reduce the willingness of people to respond to the survey as this information could be regarded as too sensitive. Therefore, the question was formulated as a self-evaluation of the financial situation in relation to the expected costs.

Further, tenants were asked whether they are worried that their rent would increase due to a switch to renewable energies and if they think that they could save costs in the long run.

[3] The proposed amendment of the Building Energy Act (GEG) referred to in the question was rejected and replaced by an adjusted version by the federal government after the publication of the survey.

Then owners were asked about the process of switching to renewable energies. They were asked to evaluate the required effort that is needed to get informed and to execute the change of the heating system, as well as the accessibility of consultancy regarding new heating systems and energetic refurbishment and the availability of skilled workers for the process.

Further, respondents were asked whether they live in a Condominium owners' association (*Wohnungseigentümer*innengemeinschaft*) and how they perceive the decision-making process about the heating system. Owners were also asked to indicate their agreement to statements referring to the acceptance of renewable energy projects in their neighborhood, the impact of the structural condition of their houses, and the impact of missing information on the availability of district heating networks in Itzehoe. These questions were designed to capture as many specific circumstances as possible that might influence the role of people in the HT and to assess to which extent these factors occur.

Additionally, the respondents got the opportunity to openly express which challenges or motivational factors they would add or consider particularly important.

Survey distribution

The survey was online and open for respondents from June 5, 2023, until July 2, 2023. The link to the survey was published in the internal communication system of the public utility provider (Stadtwerke Steinburg) on June 5, 2023, reaching the employees of the company. On June 7, it was sent to all employees of the municipality administration (Stadtverwaltung) by the climate protection manager of the city and put on the homepage of the city administration (Stadt Itzehoe, 2023).

The link was additionally distributed via the social media account of the utility provider on the 14th of June (Stadtwerke Itzehoe GmbH, 2023b, 2023a). The Instagram account had 316 followers and the Facebook account had 1176 followers at that time (see Figure 8).

On June 8, a total of 130 flyers were distributed in the morning at the local grocery market (see Figure 8) and in the afternoon in the city center of Itzehoe. People were directly approached, and the aim of the research project was explained briefly. When the person indicated interest in filling in the survey, they received a flyer. In the context of this survey, it was regarded as especially relevant to reach elderly people, as they are identified as a potentially vulnerable group. This was accounted for by approaching people on the market, as it was assumed that the market is frequented by many pensioners. Further, it was expected that some elderly people may not feel comfortable using a phone or computer to fill out the survey, therefore it was possible to fill out the survey in a printed version. The assumption that a significant share of people would prefer a manual survey was strengthened by an observation of the climate protection manager as around 30 % of the funding applications for digital thermostats reached her office by post despite the availability of an online portal (J. Möller, personal communication, April 26, 2023). But in the end, this option was not chosen by anyone, as people who indicated that they do not have access to the internet were not willing to fill out the survey on the spot.

Figure 8: Front and back of flyers that were distributed and the posts on social media

Additionally, in the e-mails that were distributed people were invited to forward the message and to share the link with their networks. This resulted among others in the link being shared in the e-mail distribution list of the church administration office reaching 55 people and the church communities of Sankt Jakobi, Dietrich-Bonhoeffer, and the inner city (M. Kruse, personal conversation, June 19, 2023). Further, the link was shared by people from the network of the researcher via short messengers.

On June 16, 2023, the QR code and a short version of the link to the survey along with a short article about the HT were published in the monthly city newspaper. The newspaper is published by the city administration presenting news from the city and its surroundings, as well as updates on current political developments. The newspaper has a circulation of 20,000 copies (J.Möller, personal communication June 14, 2023). The article can be found in Appendix C. Additionally, the local newspaper Norddeutsche Rundschau took up the topic and published an article that referred to the survey on the homepage of the city administration on June 27 (Ehrich, 2023).

Figure 9: Flyer distribution on the weekly grocery market in Itzehoe

Data collected

In total 581 survey responses were collected. All responses with less than 90 % of the questions edited by the respondent were deleted resulting in a total number of 417 responses for analysis, which is 1.3 % of the population of Itzehoe. The characteristics of the respondents are shown in Table 2.

Table 2: Overview of respondents' characteristics

Characteristics of respondents	Value	Percentage
Total number of respondents	417	
Male	247	59.4 %
female	165	39.7 %
Diverse/non-binary	4	1 %
Homeowners	333	80 %
Tenants	70	16.8 %
Private Landlords	14	3.4 %

The average age of respondents was 54 years which is higher than the average of 45.8 years in Itzehoe (see section 3) pointing toward an overrepresentation of older age groups in this study. 59 % of respondents identified as male, 40 % as female, and 1% as diverse, which means that men are overrepresented in the study. 80 % of the respondents stated that they own the living space they live in, 17 % are renting their living space and 3 % stated that they rent out living space in Itzehoe showing a strong overrepresentation of homeowners, as 53.3 % of the people in Schleswig-Holstein live in spaces they own. The overrepresentation of older groups and homeowners is assumed to correlate, as the purchase of a home is usually not possible at younger ages due to the financial means necessary.

The higher response rate for homeowners might be explained by the different roles of owners and tenants. As owners have a higher agency regarding their heating system, they also have a higher responsibility in the transformation. Even though tenants are affected, as they use the heating technology, need to pay the operation costs, and might be affected by rent increases due to energetic refurbishments, the debate that was going on during the time of the survey focused strongly on homeowners and created a sense of urgency and pressure that is assumed to have increased the perceived importance of the topic for homeowners resulting in a high response rate in that group. The distribution of responses over the different parts of the city is shown in Figure 10: Number of respondents and their ownership situation by district. It can be seen that the survey reached people from all parts of the city. As the districts vary in size and no data could be found on the population distribution between the parts it cannot be evaluated if the distribution of responses correlates with the actual distribution of people.

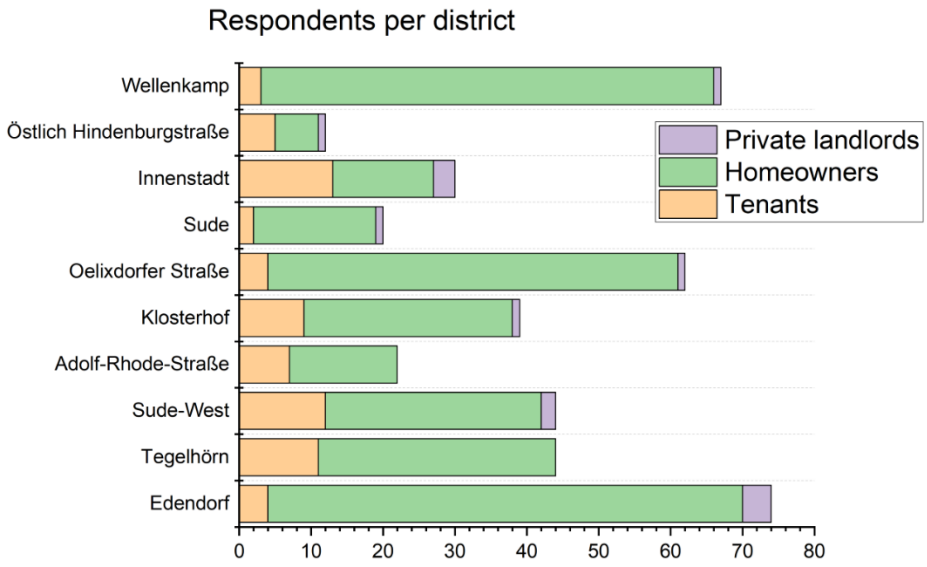

Figure 10: Number of respondents and their ownership situation by district

Data analysis

After the collection, the data was analyzed quantitatively using different tools from the area of descriptive statistics. Thereby it was identified which challenges apply to how many people and to what extent to which groups of people.

Firstly, a frequency analysis was performed showing how often a certain answer was present in the dataset. This was presented as a percentage of all responses and visualized in a pie or bar chart.

Secondly, numeric values were allocated to the answers given in text form. For the questions following the structure of a 4-item Likert scale, the most negative answer was evaluated as 1 and the most positive one as 4. As a central measure of tendency, the mean was used showing the average value of all given answers. This value shows the general tendency within the data set and facilitates comparison between different groups. As a measure of dispersion, the standard deviation was used

giving the average deviation of answers from the mean and thereby measuring the spread of variables within the data set (Bryman, 2016).

These analyses were performed for all responses and depending on the context differentiated for different respondents' characteristics, namely ownership situation and age. There was no differentiation made for the living location of people as the sample size for several districts of Itzehoe became small, which limited the meaningfulness of such an analysis. The financial situation was not used as a variable to distinguish different groups, as the researcher decided to not ask for the financial situation in the survey, as this information was regarded as too sensitive.

4.2.2 Interviews with local actors

The third research question addresses the role of local actors concerning the challenges for citizens in the HT. To answer the question qualitative data was collected through semi-structured interviews with representatives of key actors, who are at the same time experts in the field of heat provision in Itzehoe. These are the manager of the local utility provider, the climate protection officer of the city of Itzehoe, and the manager of Wankendorfer eG a housing cooperative that owns and manages a large stock of buildings in the city of Itzehoe.

The data collection was done through purposive sampling which means that the researcher selected interview partners for their distinctive characteristics (Verschuren and Doorewaard, 2010). For this study, these interview partners were selected, as they each represent an actor group that was identified as key for the implementation of the HT on the municipal level (see section 2.1.2) and were expected to have extensive knowledge on the HT within the context of Itzehoe. Therefore the interviews had a twofold purpose. Firstly, the interviewees were understood as representatives of key actors in the process and thereby could give valuable information about their organization's strategies which are argued to have a strong influence on the local transition process. And secondly, they were understood as experts in the field of heat provision in Itzehoe due to their long-standing experience. Therefore, their assessment of the main challenges for citizens in the HT and the policy framework was used to complement the data from the survey and the policy analysis. The inherent limitations that come with such an approach are discussed in section 4.3.

Data collection

The interviews were conducted in a semi-structured way. The interviewer used interview guides, which were developed separately for each interviewee (see Appendix A) as a guideline but also reacted to the development of the conversation and provided space for the interviewee to express aspects that were important to them. The interviews took between 30 and 60 minutes and were audiotaped and transcribed.

In the interviews, the interviewees were invited to briefly introduce themselves and their role in the organization, as well as the position of the organization in the heating provision in Itzehoe. Further, they were asked to describe how they perceive the challenges for citizens in the HT and what their organization does to contribute to a local system that enables people to be involved in the transition. Additionally, the interviewees were asked to describe how they imagine the climate-neutral heating

system of 2045, how their organization will work to achieve this in the next 10 years, and what they expect from the federal and state governments to support this process.

Table 3: Overview of Interview Partners

Type of organization	Organization in Itzehoe	Person within the organization
Energy provider and grid operator	Stadtwerke Itzehoe	Manager of the company
The municipal government	Municipality of Itzehoe	Climate protection manager of the city administration
Actor from the housing sector: housing cooperative	Wankendorfer Baugenossen-schaft für Schleswig-Holstein eG	Manager of the housing cooperative

Data analysis

For the analysis of the interviews, a content analysis of the transcripts was performed with the help of manual coding. This was done by identifying which statements relate to the different influencing factors defined in the conceptual framework (Table 1). This data was then used to analyze how the engagement of the different key actors relates to the challenges of citizens in the HT. Following the analytical framework, this analysis was done while taking into account potentially different effects for different groups in society.

4.2.3 Policy analysis

The second research question was answered by performing a content analysis of the political framework at the federal and state level that shapes the HT in residential buildings. On the federal level this is the Buildings Energy Act (*Gebäudeenergiegesetz (GEG)*) and on the state level the State Act on Climate Change (*Energiewende und Klimaschutzgesetz Schleswig-Holstein (EWKG)*).

A special focus was put on the obligations to use renewable energies and the subsidy scheme. This analysis enabled an understanding of how the current political framework influences the role of citizens in the HT.

Data collection

The GEG entered into force in 2020 and summarizes several previous laws addressing different aspects of the HT in the building sector (GEG, 2020) becoming the main federal policy shaping the HT in residential buildings. The law specifies the legal requirements for energetic standards of buildings and heating technologies as well as the funding scheme.

The law that is currently in force reflects the changes in the first amendment and entered into force on January 1, 2023. During the period of this research, a second amendment was planned to be developed and to enter into force on January 1, 2024. The amendment of the GEG was discussed intensively and due to several delays in the process, the law could not be adopted in July 2023 as it was planned.

For that reason, this analysis is based on the latest version of the amendment proposal available by the end of July 2023. This is the final decision recommendation paper that was published by the Federal Committee for Climate Protection and Energy on July 5, 2023 (see Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023) that includes all agreements made by the governing parties and two rounds of expert hearings (see Bundesregierung, 2023). More information on the debate surrounding the amendment of the GEG going on during the research period is available in info box 2.

Info box 2: The public discourse surrounding the amendment of the Energy Building Act (GEG)

This goal to decarbonize the heating system and to require at least 65 % renewable energies for new heating systems was already agreed on in the Coalition agreement between the three governing parties SPD, BÜNDNIS 90/DIE GRÜNEN, and the FDP. In light of the energy crisis, the parties agreed to change the entry into force from the start of 2025 to January 2024.

The public discussion started when an internal draft version of the proposal reached the newspaper BILD and the minister for the economy and climate action accused members of the government of leaking the document to the newspaper to undermine the trust in the government (Redaktions Netzwerk Deutschland, 2023). This was followed by intensive discussions between the three government coalition parties (SPD, The Greens, and FDP) and the opposition accompanied by intensive media coverage.

In May 2023 the Federal Ministry of Economic Affairs and Climate Action and the Federal Ministry of Housing, Urban Development and Construction published a first proposal for the new version of the law (see Bundesregierung, 2023). The FDP first agreed to this proposal and then withdrew their agreement shortly before the bill was supposed to be handed to the parliament. After continued debate, the coalition partners agreed on a guideline paper (*Leitplankenpapier*) (see Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023). Based on this agreement a decision recommendation (*Beschlussempfehlung*) was created by the Committee for Climate Protection and Energy. This was supposed to pass the parliament before the parliamentary summer break but was ultimately stopped by the Supreme Court, as it ruled that the limited time available for parliamentary procedure threatens the rights of participation (Schlandt, 2023). Therefore, the law was not adopted during the research period of this thesis (until July 2023).

The main change from the currently enforced GEG to the newest version is the regulation that all newly installed heating systems need to be powered by at least 65 % renewable energies (§71). The technical possibilities that comply with this regulation and further specifications are provided in the newly added paragraphs §§71a to §71h, thereby establishing the regulations for heating systems in residential buildings and creating a vision of the decarbonization of the heating system until 2045. The analysis will focus on these paragraphs, as these regulations are considered as strongly influencing the process of the HT in the next years and thereby also have a strong influence on the role of citizens.

In addition to the requirements for heating systems, the corresponding funding scheme is seen as important regarding the challenges for citizens.

The general rules for the funding scheme are laid out in section 6 of the GEG. The specific funding system is published in a separate administrative regulation determining the actions of the implementing institutions. The current funding scheme Bundesförderung Energieeffiziente Gebäude ("*Federal funding for energy-efficient buildings"*) is implemented by the federal financing institutes that provide financial support and financing options for energetic refurbishment of homes and investments in renewable energy projects. These are the Federal Office for Economic Affairs and Export Control (*Bundesamt für Wirtschaft und Ausfuhrkontrolle)* (BAFA) und the Kreditinstitut für Wiederaufbau (*"Credit Institute for Reconstruction")* (KfW). For the amendment that will enter into force on January 1, 2024, this document defining the subsidy scheme is not available yet. Therefore, the analysis was based on the funding scheme that resulted from the GEG 2023.

On the state level, the State Act on Climate Change (Energiewende und Klimaschutzgesetz Schleswig-Holstein (EWKG)) is the most important policy, as it specifies the climate targets for the building sector and introduces the obligation for the municipal heat planning (§7 and §9) (EWKG, 2021). Therefore, this law was also examined to identify how it influences the challenges for citizens in Itzehoe. Table 4 summarizes the examined documents.

Table 4: Policies included in the content analysis

Original title (German)	English title + used abbreviation	Type of Document	Date	Policy Level
Beschlussempfehlung und Bericht zu dem Gesetzesentwurf der Bundesregierung - Entwurf eines Gesetzes zur Änderung des Gebäudeenergiegesetzes Drucksache 20/7619[4]	Decision recommendation for the Amendment of the Energy Building Act **(GEG)**	Issued by the federal Committee for Climate Protection and Energy entailing agreements of the governing parties, handed to the parliament for approval in September 2023	05.06.2023	Federal
Richtlinie für die Bundesförderung für effiziente Gebäude – Wohngebäude	Guideline for the federal subsidy for efficient buildings - Residential Buildings **(BEG-WG)**	Guideline that specifies the funding scheme defined in the GEG 2023	09.12.2022	Federal
Gesetz zur Energiewende und zum Klimaschutz in Schleswig-Holstein	State Act on the Energy transition and climate protection **(EWKG)**	Policy that defines climate protection targets and actions	Last update 02.12.2021	State Level

[4] To compare the proposed GEG 2024 with previous laws the researcher refers to the currently enforced version of the Energy Building Act (GEG 2023) and to the first version of the proposal of the GEG 2024 published in May 2023 (Proposal GEG 2024).

Data analysis

The content of the policies was analyzed through qualitative content analysis, with the help of manual coding.

Firstly, the aspects of the laws that are directly relevant to the transition of the heating provision in private households in the existing building stock were identified. Based on that data, these aspects of the policies were analyzed to understand how they influence the different factors that determine the ability of people to be involved in the HT previously defined in the conceptual framework (Table 1). Following the analytical framework, this analysis was done while taking into account potentially different effects for different groups in society.

4.3 Reliability and validity

In this section, the reliability and validity of the research methods employed in this study are discussed.

Survey

A survey-based approach, as pointed out by Verschuren and Doorewaard (2010), offers breadth at the expense of depth. While this approach allows for a wide-reaching examination of the subject matter, it necessitates careful consideration of data collection techniques to ensure reliability and validity. As survey research aims for the collection of a large number of data, the data collection needs to be conducted in a well-structured manner. This methodological decision aligns with a reductionist approach, wherein the complex reality is distilled into research units and subsequently into variables (Verschuren and Doorewaard, 2010). In this study, this reductionist perspective was manifested in the use of categories derived from preliminary research (see aspects in Table 1). These were then translated into variables that were used in closed-ended questions in the survey. The use of predefined variables carries the risk of influencing responses, potentially missing out on relevant aspects that were not identified in the preliminary research. To mitigate this concern, open-ended questions were placed at the end of the survey, allowing participants to express their viewpoints without constraint.

Another facet that needs to be considered is the non-randomized distribution of the survey. Despite the efforts to reach a varied audience, it is reasonable to anticipate bias in respondents. To counteract this risk the researcher aimed to employ distribution strategies that reach different target groups, e.g. the e-mail distribution lists of employees of the city administration and the utility provider reached people of working age whereas the flyer distribution at the grocery market was expected to reach mostly elderly people and other people that do not work during the morning.

Further, individuals who hold a pre-existing interest in the topic might be more inclined to participate, potentially influencing the survey outcomes. This was aimed to be mitigated by addressing random people on the market and in the inner city. But even though the researcher tried to follow a random selection of people, a selection was made favoring respondents engaging positively with the researcher.

This is expected to have introduced some degree of bias, but the mixed distribution methods ensured a relatively high response rate and a diverse sample and it is argued that these advantages outweigh the disadvantages of the approach.

Furthermore, the timing of the survey in relation to the ongoing discourse on the GEG introduces an element of uncertainty. Due to the ongoing debate about the amendment respondents might have been influenced by the information in the media that mostly referred to the planned policy, influencing the questions that addressed currently applied policies, the subsidy scheme, for instance. So the assessment of the situation of citizens at a specific moment in time within the dynamic process happening at the same time posed some difficulties and must be acknowledged as a potential limitation of the method. By taking the potential impact of the ongoing discussions on respondents' interpretations into account this study seeks to enhance the credibility of its findings.

Interview

The use of interviews offers a valuable avenue for capturing nuanced insights of key actors that might otherwise remain inaccessible. But for this research, it needs to be acknowledged that the interviewees are not only experts in their field but also active actors with particular interests within the system. This calls for a critical assessment of the data that acknowledges that actors are not neutral to the system. Further, it needs to be taken into account that the interviewees represent their organizations to varying and limited extents and that their perspective does not necessarily align with the organization's engagement. The representativeness of the actor from the housing sector is further limited, as only the views of one type of actor from the housing sector, i.e. a housing cooperative is included in the study, despite the multitude of different actors laid out in section 2.1.2.

Additionally, the personal connections between the interviewer and interviewees have the potential to influence responses. Respondents might feel inclined to align their answers with the interviewer's perspective or expectations, affecting the reliability of the gathered data. Moreover, the researcher did not have prior experience with conducting interviews which might have influenced the quality of how they were conducted. This became especially noticeable when there was a need to react quickly to what was said, e.g. by asking clarifying questions.

In conclusion, it has to be acknowledged that the interviews do not aim to be representative. Instead, the collected data offers a valuable addition to the other data sources and provides a first step in understanding the local dynamics of the HT in Itzehoe.

Policy analysis

The policy landscape is characterized by a multitude of intersecting policies, each contributing to the overarching framework. Resource limitations necessitated a focused approach, wherein two key policies were selected for analysis. For one of the chosen policy documents, namely the final decision recommendation paper published by the Committee for Climate Protection and Energy on the 5th of July 2023 (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023) it needs to be acknowledged that this document has yet to pass through the legislative process and is subject to potential modifications before being enacted as law.

The scope of analysis remains bounded due to the inherent complexities of policy interplay. For this research, this is especially prevalent as the situation of citizens in the HT is influenced by a multitude of interplaying policies from areas such as building laws or regulations concerning the energy markets. Therefore, it needs to be acknowledged that analysis of the complex network of interplaying policies was not possible in the scope of this research but nevertheless, it is argued that assessing the GEG and the EWKG as the main policies for the HT on the federal and state level provides valuable insights and enabled an understanding of the policy framework within the limited scope of this study.

General approach

The general approach of this research consists of a threefold approach to data collection and analysis. It is argued that the quantitative data collected through the survey provides valuable insights into which of the predefined factors are prevalent in Itzehoe and to what extent. The interviews offered the opportunity to validate these findings by comparing the results with the perspectives of experts in the field. The analysis of the policy text enabled the researcher to compare assumptions and statements made by interviewees and survey respondents and distinguish between the actual content of the policy and the perception of people. All in all, in can be seen that approaching the challenges of citizens in the HT from these three angles enhanced reliability and reduced bias of the results.

Byrman (2016) points out that the generalisability of case studies is generally limited. But Yin (2009) argues that generalizability can be enhanced when the case is considered as exemplifying a broader category of which it is a member. For the case of Itzehoe it is argued that it is an exemplifying case to some extent, as the HT needs to be implemented in all municipalities in Germany. Itzehoe can be considered as representing one of the many small and mid-sized municipalities that need to build up capacities and knowledge for this process.

All in all, the methodical approach is despite the various limitations, considered reliable and valid results are expected. Further limitations concerning the conceptual framework and the broader context of the research are discussed in sections 6.2. and 6.3.

4.4 Ethics

To make sure that this research is conducted in an ethically responsible way it was ensured that all participants of the survey and the interview were informed that all participation is voluntary and that they could withdraw at any time without the necessity to give a reason. Further, they were informed about the aim of the research and how their data would be processed following EU privacy standards. To convey this information the consent form provided by Utrecht University was used. It was translated to German and the interviewees were also informed about the content verbally. To make sure that participants were aware of their rights and the content of the consent form they were asked to sign it, or for the case of the survey to tick a box indicating that they were aware of the content of the consent form and want to participate in the survey. In the case of interviewees, they were asked how they would like to be cited in the report. All of them agreed to be cited with their full name and position. For the survey, anonymity was guaranteed as no personally identifying

information was collected. In the rare cases when the survey was filled out in the presence of the researcher or assistance was requested, the researcher treated all information from the conversation confidentially. In some cases, the research relies on information gathered in personal conversations with co-workers in the utility provider. These co-workers were asked for their consent to be mentioned in the report.

The researcher followed the agreements made with survey participants, interviewees, and co-workers strictly.

4.5 Positionality statement

To understand the researcher's worldview on the research topic and to be conscious of biases introduced by the researcher's background, identity, values, and experiences it is important to be reflexive on the positionality of the researcher, which is laid out in the following paragraphs.

Firstly, I think it is relevant for this research that I grew up close to the city where the case study was conducted. While a good understanding of local circumstances was beneficial, this closeness also introduced biases through, partly unconscious, assumptions about the city and its inhabitants.

I am personally leaning toward a worldview that sees radical transformative change as necessary not only in the way we use and provide our energy but also in the wider societal context. This stands in contrast to the image of Itzehoe that built up throughout my youth, as I experienced my personal environment in Itzehoe as dominated by conservative worldviews that contradict many of the changes that I consider necessary. This experience in my own personal environment influences my perception of the citizens of Itzehoe introducing a bias to the research. I aimed to strictly follow the research procedure described in the Methods to counteract the influence of my personal experiences and emotions and constantly reflect on them. But this was additionally aggravated by my strong emotional attachment to the topic of the energy transition. It is my personal belief that this transition is imperative to ensure a future of prosperity for a large share of humanity, including me and my loved ones. Seeing this at risk creates anxieties that risk overshadowing the analytical mind from time to time.

Additionally, I come from a household which never faced financial hardship and in my position as a student I never experienced the burden of having to provide financially for other people. This situation potentially influences my perspective on financial aspects, risking underestimating its significance for decision-making in the context of climate protection. This was counteracted by continuous reflection and questioning of assumptions on the topic.

Finally, I hold a bachelor's degree in Energy- and Environmental Technologies and worked in the area of renewable heat provision which provided a specific set of knowledge and relationship with renewable energy technologies. Therefore, I aimed to be reflexive about my own position and continuously question assumptions about other people's knowledge.

5 Results

In this section, the results are presented. In the first part, background information on the current state of the HT in Itzehoe is provided. The results indicate that the vast majority of heating systems in Itzehoe still rely on fossil fuels. Secondly, the current roles of key local actors are summarized, showing visions for change are present but that they are still embedded in the fossil system. Further, the current changes in the policy framework are outlined, showing that the Building Energy Act (GEG) is expected to shape the transition process by defining regulations for heating systems in private households but also arguing that the policy text only provides a clear vision for the future of heat provision in Germany to a limited extent.

The second part provides the results of the data analysis structured along the predefined categories of challenges for citizens' involvement in the HT, which were introduced in the conceptual framework (Table 1), namely awareness and motivation, knowledge, practicability of implementing renewable heat, financial aspects, and the specific local and personal situation of individuals. This analysis could show that citizens are aware of the importance of the HT and are motivated to contribute to a cleaner energy system but could also identify a range of challenges that impede citizens' involvement in the HT.

5.1 The current state of the head transition and the role of key actors in Itzehoe

This section presents an overview of the current state of the HT in Itzehoe by showing the heating systems currently used by survey respondents and their current attitude toward renewable alternatives. Further, it provides a summary of how the interviewees described their organization's role in the HT and a brief overview of the policy framework, thereby presenting all actors shown in the concept visualized in Figure 5 in section 2.3, which highlights the roles of key local actors and the policy framework while putting citizens at the center of analysis.

5.1.1 Citizens

First, the current technical setup in respondents' households is presented. Figure 11 shows the percentages of different heating technologies used in the houses of survey respondents. One can see that, in total, 71.5% of the heating systems are based on natural gas or oil. When electric boilers, geothermal and air heat pumps, solar thermal systems, and district heating systems are considered renewable[5], their percentage of all heating systems is 12.6 %. Fireplaces are excluded from this calculation, as they are usually only used to complement a primary heating system, and the district heating networks in Itzehoe are included as renewable even though they are powered by fossil fuels (IB.SH Energieagentur, 2017) because the responsibility of decarbonizing them lies with the grid operator and not with the individual person.

[5] Using electricity for heat provision (e.g., electric boilers and heat pumps) is not fully renewable yet, but as it is assumed that the electricity provision will be renewable in the future, these technologies are widely understood as 'renewable' alternatives to fossil heat provision.

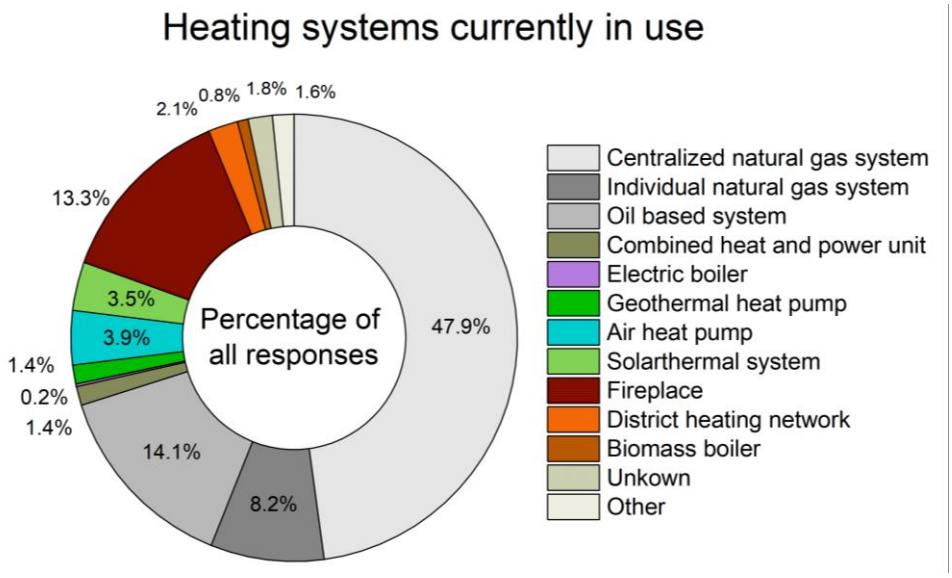

Figure 11: Heating systems currently in use at the homes of survey respondents (survey results question 6)

The manager of the utility provider "Stadtwerke Steinburg" pointed out in the interview that the company operates four district heating networks that have about 260 connection points, which means that they are only reaching a small fraction of households in the city, which matches the relatively low share of respondents indicating that they are connected to such a network.

When this data is looked at differentiated by ownership situation, it can be observed that the share of renewable heating systems for tenants is 7.5 % and for homeowners 14 %. Differentiated by age, one can see that people in the age group of 40-60 have the highest renewable energy quota (14.8%) and people over 80 have the lowest (9.1 %). Overall, the data indicates that the share of renewable heating systems in Itzehoe is low and points to low involvement of tenants and elderly people in the transition process. This data shows that the transition process from a centralized fossil fuel heating system toward a decentralized renewable system in private households is still in its early stages.

Starting from the current situation of a low share of renewable heating systems, the current attitude of citizens towards renewable heat was assessed. This was done separately for homeowners and tenants, as their roles and responsibilities are different (as discussed in section 2.1.2).

Homeowners

Firstly, the attitude of homeowners is shown. As described in section 2.1.1 the HT does not only consist of changing the heating system but oftentimes also requires increased energy efficiency of the buildings, which can be achieved by energetic refurbishment. Therefore, homeowners' attitude toward a change in the heating system and towards energetic refurbishment was assessed.

Survey respondents were asked to indicate their attitude towards different renewable energy technologies (i.e. district heating networks, heat pumps, solar thermal systems, solar panels). They could indicate whether the technology is "in place", or "already being planned" or if they "would consider" or "not consider" implementing the technology in their house. As described in the

methodology (section 4), numeric values were assigned to the answers to calculate the mean value to compare the answers.

Figure 12 shows that solar panels are, overall, the most popular renewable technology, scoring an average of 2.29 followed by solar thermal systems (1.96), heat district networks (1.92), and heat pumps (1.72). It should be noted here that solar panels are not a heat generation unit and that they can only contribute to decarbonizing the heating system in combination with an electric heating system such as a heat pump. Solar thermal systems are usually not used to cover the heat demand all year round and are mostly combined with another heat provisioning unit (as also suggested in the GEG §71 sentence 7).

Notably, 71% of respondents would consider a connection to a district heating network. It can also be seen that no one is currently planning to connect to such a network. This is in line with the limited offers currently available in Itzehoe, which are discussed below. Another prominent value is the high number of people who would not consider a heat pump (45 %), which shows that many people have reservations about it.

All in all, it can be seen that the majority of homeowners are positive about renewable energy technologies, as 66 % of all responses were positive (In place, In the planning, or I would consider that option) while 28 % of the answers were negative ("I would not consider that option"), and that respondents hold reservations about heat pumps and, overall, prefer heating networks.

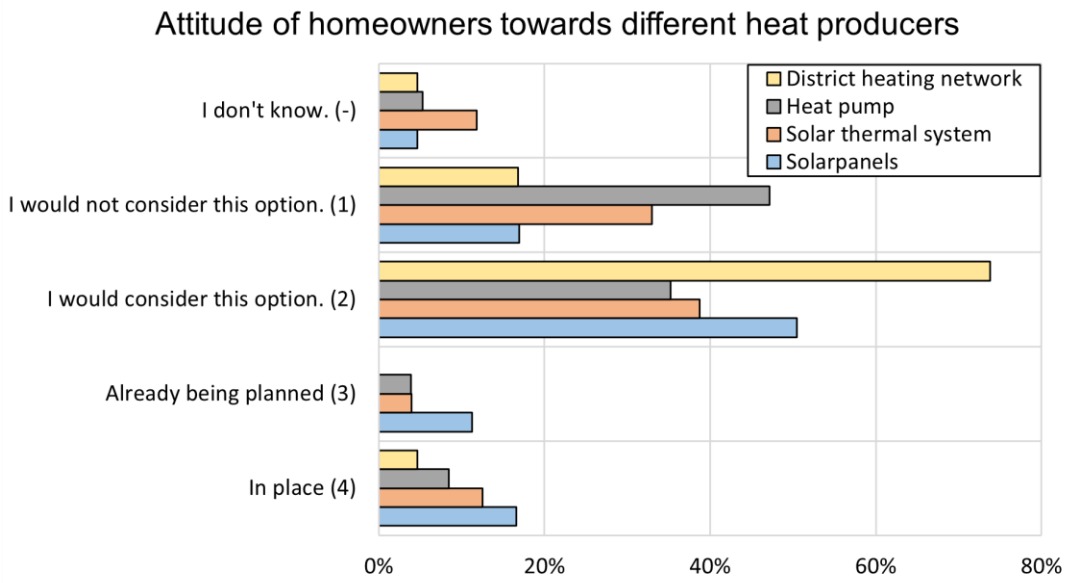

Figure 12: Attitude towards different heat produces (survey results question 7)

Figure 13 shows the popularity of energy efficiency measures. Survey respondents were asked to indicate their attitude towards energy-efficient radiators, energy-efficient windows, insulated walls, and insulated roofs. It can be seen that the majority of homeowners indicated that these measures are already in place in their houses. Especially insulated roofs and efficient windows are in place or

planned by 88% and 89 % of the people respectively. One can also see that respondents would consider efficient radiators. The measure that is considered least is the insulation of walls, as 22 % of the respondents stated that they would not consider this option.

Generally, the data shows that homeowners evaluate the energy efficiency of their houses as high. This is surprising, as this stands in contrast to national data on the energy efficiency of the German building stock, which shows that the implementation of energy efficiency measures still needs to be increased drastically to make greenhouse gas neutrality possible (Umweltbundesamt, 2017). It remains unclear whether the sample population in this survey represents homeowners that have implemented higher energy standards than the overall population or if the results are caused by people overestimating the energy efficiency of their houses or differing interpretations of what exactly energy efficient means in the context of the measures.

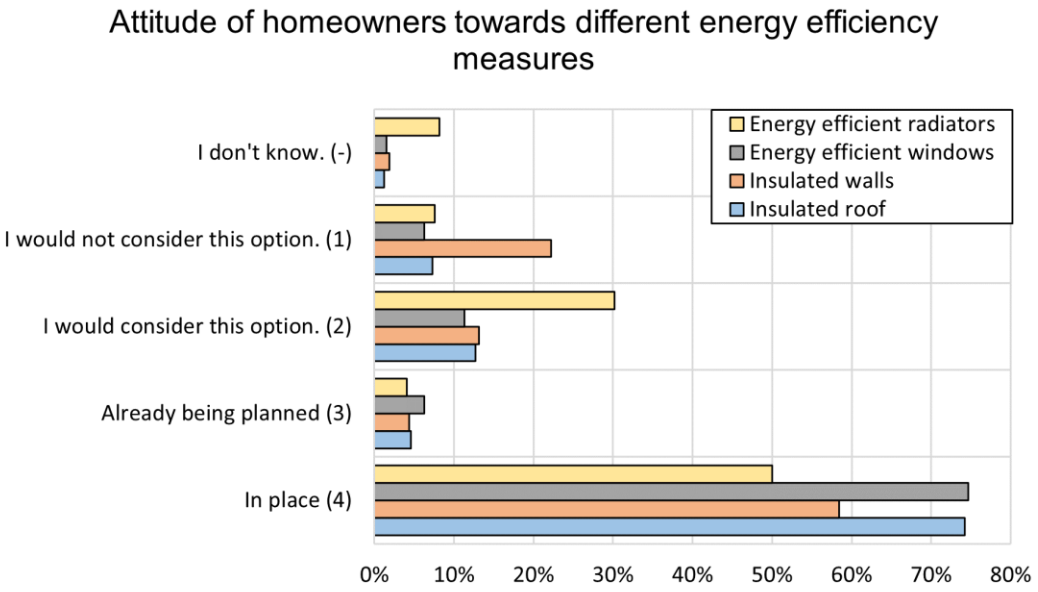

Figure 13: Attitude toward different energy efficiency measures (survey results 8)

In the following the attitude of tenants toward renewable heat is shown.

Tenants

The attitude of tenants toward changing to renewable heating systems was assessed by asking whether they would support switching to renewable heating systems in their houses. Additionally, they were asked if their landlord is planning to switch to renewable heat. The results are shown in Figure 14 and Figure 15 respectively. Figure 14 shows that 64.7 % of the tenants who responded to the survey would support a change to renewable heating systems and 72 % support the energetic refurbishment of their homes. As shown in Figure 15 the majority of tenants do not know whether their landlord is planning to switch to a renewable heating system, which underpins the low agency of tenants regarding the heating system discussed in section 2.1.2.

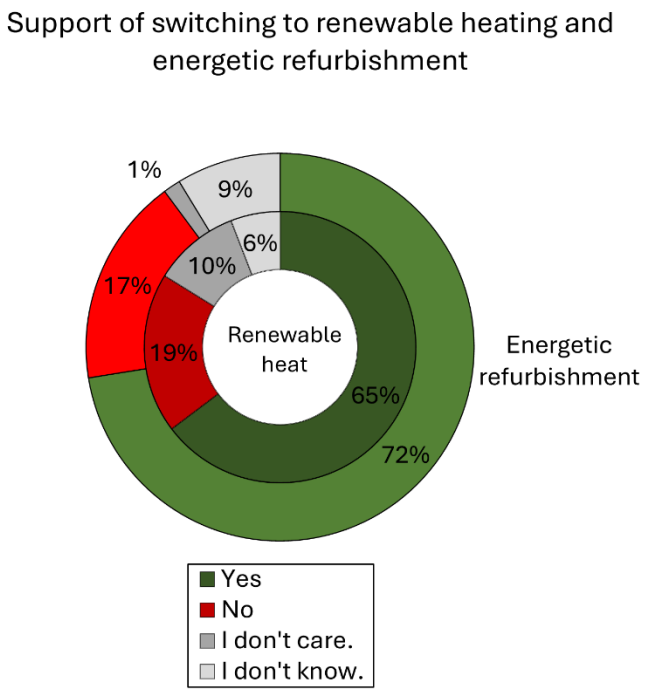

Figure 14: Support of switching to renewable heat and energetic refurbishment of tenants (survey results question 9 and 10)

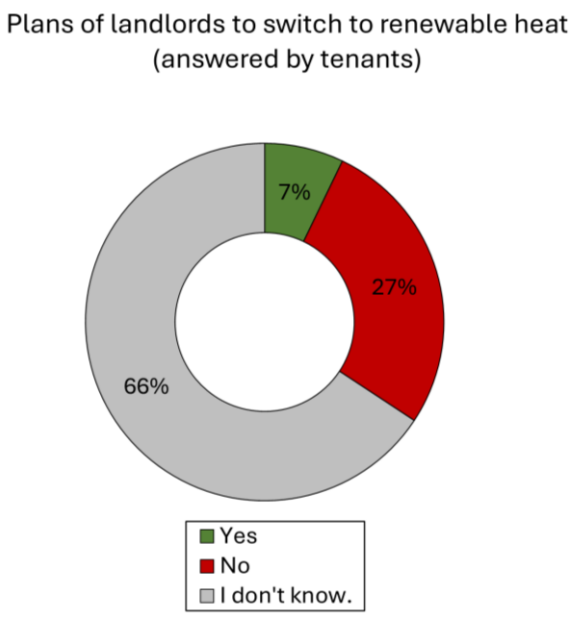

Figure 15: Plans of landlords to switch to renewable heat (survey results question 11)

To sum up, the data in Figure 11 shows that the heating system of Itzehoe can still be understood as a centralized and fossil system, which is only at the beginning of transitioning toward a decentralized renewable system. This manifests in the low share of renewable heating systems currently in use, showing that only a small fraction of citizens is currently involved in the HT by using renewable heat. However, the data indicates that the attitude of the majority of citizens toward renewable heating technologies and energetic refurbishment is positive, despite some reservations. It is argued that the positive attitude towards renewable technologies can be understood as a characteristic of Energy Citizenship, as a positive attitude towards new technologies is mentioned as a core aspect (Devine-Wright, 2007). The data opposes the notion that strong reservations against renewable heating systems by citizens are a main challenge in the HT.

5.1.2 Local key actors

As described in section 2.3 local key actors play an important role in shaping the conditions for citizens' involvement in the HT. Therefore, understanding their engagement is an important part of understanding the challenges in the HT, which was obtained by interviewing representatives of these key actors (e.g. the municipality, the local utility provider, and the largest housing cooperative in Itzehoe.

According to Josefine Möller, the climate protection manager of the municipality of Itzehoe, the municipality has two main functions. Firstly, the municipality acts as a role model, as it owns 30 communal properties that can be used to demonstrate renewable heating systems. Secondly, she sees the main role of the municipality in developing a clear vision of the heating system of the future by pooling the various stakeholders and expertise through municipal heat planning. This is done by

developing the municipal heat planning following §7 EWKG. The regulatory framework concerning municipal heat planning in Schleswig-Holstein is laid out below in section 5.1.3.

The utility provider "Stadtwerke Itzehoe" is fully municipality-owned and as Erik Dittrich, the manager of the utility provider, lays out in the interview, the majority of sales in the heating sector are in the domain of oil and gas. However, Mr. Dittrich highlights the importance of district heating networks for the company and defines the goal of expanding the network structures, which is substantiated by the 2.5 million euros of yearly investments that have already been planned. Mr. Dittrich states that a new district heating network is currently being planned that will provide heat for 260 newly constructed flats. The specific importance of these projects for the company is also rooted in the need to replace the expected declining revenues generated from selling natural gas. While making it clear that the utility provider will not engage in the market of individual heat provision (e.g., selling or installing heat pumps), the manager of the utility provider points out that the company is planning to play an important role in heat provisioning through district heating networks but that they are facing challenges, as these require extensive infrastructural investments that exceed the limited financial resources available. He identifies commercial homeowners as important cooperation partners, as they often own the apartment buildings in the city center, which seem suitable for centralized heat provision due to the limited space available and the high heat demand density (see also Figure 7).

As a representative from the housing sector, Ulrik Schlenz, the manager of the housing cooperative "Wankendorfer Baugenossenschaft für Schleswig Holstein", stated that he sees it as especially important to find a balance between, on the one hand, investments that could help climate protection and lower the operation costs and, on the other hand, ensuring affordable rental prices and sustainable use of the cooperatives' financial capital. He lays out that most of the heat for their building stock in Itzehoe is provided by natural gas followed by oil. He stated that the cooperative is generally interested in access to heating networks, but gives into consideration that to his knowledge it is still unclear where and when these will be in place and he also points out that the energy providers are responsible for decarbonizing their networks for them to be a solution. He explains that his company is acting following a climate roadmap that was developed internally in 2019. He states that in newly constructed buildings or all-encompassing refurbishments, they would use heat pumps or, if available, district heating networks for the heat provision. In contrast, he argues that the oil-based systems that are used in some of the houses that have medium energy efficiency standards should be replaced with natural gas systems. In his view, this is still a useful technology, as he argues that the investment costs in comparison with CO_2 avoidance are relatively low.

Overall, it can be seen that the local actors expressed visions for change for the future but it is apparent that most of the visions are not yet put into practice. This can be observed in the current role of the municipality. Although Mrs. Möller acknowledges the municipality's potential role as a role model (as discussed in Hertle et al., 2015), there was no mention of specific projects in the interview that would substantiate this role. Regarding the utility provider, it becomes evident that they are currently not offering any option for renewable heating to their clients and that the

development of sustainable business ideas, which is identified as an important task of utility providers in the HT (Hertle et al. 2015), is not yet put into practice. A similar scenario unfolds in the housing sector. Dr. Schlenz recognizes the responsibility of large-scale homeowners in decarbonizing their building stock, as outlined by Riechel et al. (2016), and emphasizes the importance of environmental sustainability. However, it is currently apparent that they primarily rely on fossil fuels for heating their building stock and are considering investing in fossil systems in the future. This indicates that the key local actors remain entrenched within a fossil-based system. The implications of this situation for citizen involvement in the HT are further examined in detail in section 5.2.

5.1.3 Policy framework

As laid out in the Methodology (section 4.2.3), the policies that are mainly shaping the heat provision in residential buildings in Itzehoe are the Building Energy Act 2023 (GEG) and the State Act on Climate Action Schleswig-Holstein (EWKG).

Building Energy Act 2023 (GEG)

The amendment of the GEG aims to ensure that whenever a new heating system is installed, it is fueled by at least 65 % renewable energies (Bundesregierung, 2023). In the first proposal, it was planned that this regulation would enter into force on January 1, 2024 (Bundesregierung, 2023), but in the latest version, the starting point was made dependent on the deadline for the municipal heat planning of the municipalities. This will be June 30, 2026, for municipalities with more than 100,000 inhabitants, and June 30, 2028, for municipalities with fewer than 100,000 inhabitants (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023a). Itzehoe has fewer than 100,000 inhabitants, so 2028 is expected.

§§ 71b to §71h define which technologies can be used to reach the target of 65% renewable energies and lay out the specific regulations and transition periods for each technology.

§71b states that the obligation of 65 % renewable heat can be met by the connection to a heating network. Notably, the responsibility of supplying renewable heat and creating a transformation pathway for current fossil-based networks lies with the network operator. §71c states that the installation of a heat pump complies with the regulation. Direct electrical heating, on the other hand, is only allowed if the building is demonstrably energy efficient (§71d). Solar thermal systems are also an option to produce heat in a renewable way that is compliant with the regulation (§71e), as well as solid biomass (§71g). According to §71h, it is also possible to use a heat pump or solar thermal hybrid system consisting of a heat pump or a solar thermal system and a peak load boiler that is powered at least 60 % by hydrogen or biomass. §71f deals with the requirements regarding the use of biomass and hydrogen for individual heat provision and lays out that these two options can be used to comply with the regulation under certain conditions.

By defining the requirements for heating systems in private households, the GEG is expected to have a strong influence on how the HT will unfold in private households in Itzehoe. By defining the technologies that are allowed, the law creates a vision for the technical setup of heat provision of

the future. However, it is argued that the creation of a clear vision is limited. The first aspect that became evident was uncertainty among citizens caused by the public discussion surrounding the GEG going on during the research period. Additionally, including "hydrogen-ready" natural gas boilers among the feasible solutions, despite the many scientific works disagreeing with this vision, is argued to decrease the potential of the GEG to demonstrate a clear vision for the heating provision of the future. Firstly, the inclusion of hydrogen-based individual heating systems jeopardizes the development of a clear vision of the transition process, as this opposes the assessments made by many scholars in the field (see Rosenow, 2022). As discussed in section 2.1.1, using hydrogen as a fuel for individual heat provision is not considered an economically or ecologically meaningful alternative to other systems by many scholars. It is argued here that including this option despite the scientific evidence opposing its use, undermines the trust in the policy and counteracts the development of a clear technical vision based on the agreement of as many stakeholders as possible.

Secondly, while it is acknowledged that policy texts need to be very specific to cover all relevant aspects and specific situations, it is argued that the multitude of regulations and exemptions can make it difficult to identify a clear vision.

Thirdly, next to the defined technological regulations, the subsidy mechanisms are important for the vision of the HT. Due to the prolonged process of discussing the amendment of the GEG, the subsidy scheme has not been published before September 2023. This left people in a situation, in which they are confronted with new requirements that include large investments, while at the same time not knowing the corresponding support mechanisms. This is regarded as detrimental to public acceptance of the policy.

In summary, it can be seen that the GEG influences the role of citizens in the HT by providing direction for the decarbonization of the heating system. But at the same time, it can be observed that the vision of the HT created through the policy is not as clear as it could be, an issue that was exacerbated by the controversial debate surrounding the development process. As the policy framework influences many different aspects of citizens' involvement in the HT, the effects of the policy are discussed in more detail and in connection with the other challenges experienced by citizens in section 5.2.

State Act on Climate Action Schleswig-Holstein (EWKG)

In addition to the federal legislation, the state legislation of Schleswig-Holstein also influences the HT in Itzehoe.

The EWKG adds a state-level target for the heating sector, defining the goal of at least 22 % renewable energy use in the heating sector by 2025 (Sentence 6 §3), to the federal climate protection targets. §7 sentence 2 formulates the obligation for municipalities of a certain size to create municipal heating plans, that provide a spatial concept that shows how the municipality plans to create an emission-free heating system by 2045 substantiated by concrete suggested measures. Depending on the size of the municipality, these plans need to be finished by the end of 2024 or the end of 2027. For Itzehoe, it is the end of 2024, meaning that the process of creating this plan is already ongoing. This provides an opportunity for Itzehoe to address the issue of heat provisioning in

a structured city-wide manner. It also creates an advantageous position in comparison to places in other states that will only be required to start with municipal heat planning by the forthcoming federal Heat Planning Act (*Wärmeplanungsgesetz (WPG)*) (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023a).

5.2 Challenges for citizens' involvement in the heat transition

This section examines the involvement of citizens in more detail, considering the predefined areas in which challenges are expected to arise introduced in section 2.3. To do so, the survey results are presented and discussed in relation to the policy framework and the role of local key actors, as well as the conceptual framework.

5.2.1 Awareness

This section presents the results of the analysis regarding citizens' awareness of the importance of the energy transition.

Figure 16: Importance of implementing the energy transition in Germany shows the results when respondents were asked to indicate the general importance of the implementation of the energy transition in Germany differentiated by ownership situation (i.e., tenants, homeowners, and private landlords). The scale of answers ranges from 0 (not important at all) to 10 (very important). One can see that the majority of people think that the energy transition is important (58 % voted for 8, 9, or 10 points with an average of 7.32 points given). However, it can also be seen that 5 % of the respondents see the implementation of the energy transition as "not important at all".

Looking at different age groups, the group of respondents aged 60-80 indicated the highest importance (mean of 7.85), while the group of 40-60-year-olds showed the lowest average value for the importance of the energy transition (mean of 7.19). Differentiated by ownership situation, it can be seen that the average amount of points is the highest for private landlords (mean of 7.92) and slightly higher for homeowners (mean of 7.31) than for tenants (mean of 7.22).

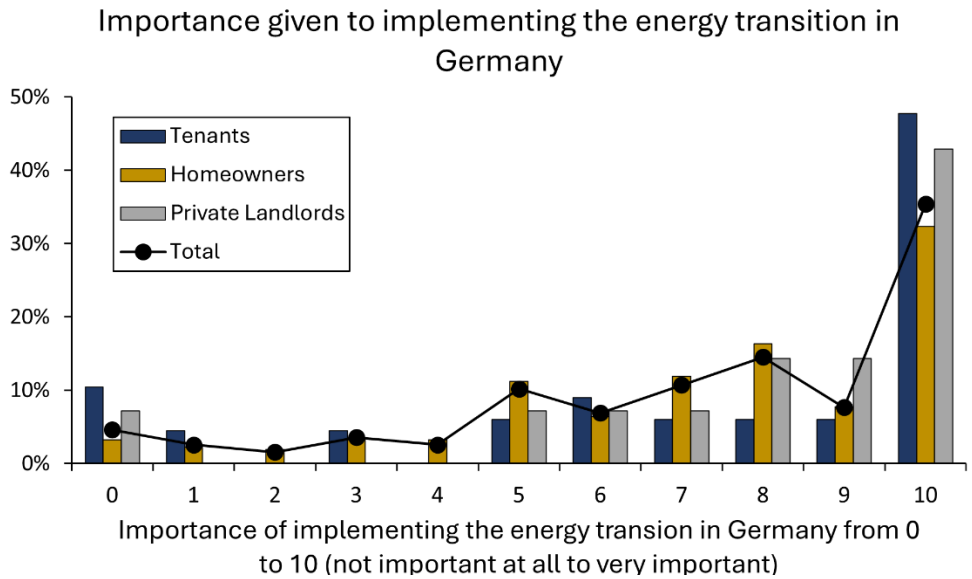

Figure 16: Importance of implementing the energy transition in Germany (survey results question 12)

Figure 17 shows the opinion of respondents on the overall target of climate neutrality in 2045 for the state of Schleswig-Holstein specified in the EWKG. The results show that a large majority of people support the target, as the average points given were 3.43.

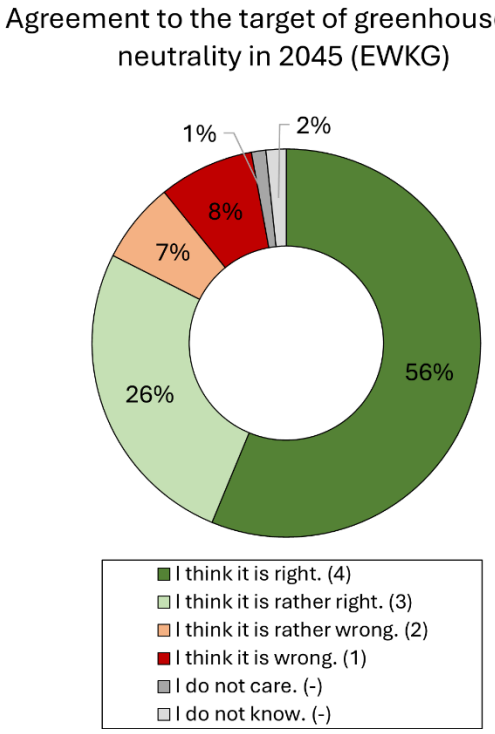

Figure 17: Agreement to the target of greenhouse gas neutrality in 2045 (EWKG) (survey results question 13)

The results of the survey are supported by the statements made by the climate protection manager of Itzehoe who stated in the interview that she generally thinks that people are aware of the impact of fossil heating systems on the climate. She also suggests that citizens might be aware of issues other than the climate, e.g., the import dependency for natural gas that is seen to support autocratic states that supply these fuels. To illustrate this aspect, she cited a saying that goes:

"We prefer to heat with electricity from the dike than with oil from the sheik."

This underpins the awareness of problems related to the fossil system among the people of Itzehoe.

The comments made in response to the open-ended questions also reflect awareness about the importance of the energy transition, as climate protection and responsibility toward younger generations were frequently given as the main motivation for involvement in the HT.

However as shown in Figure 16 and Figure 17, there is also a minority of people who do not see any importance in the energy transition and do not support the target of greenhouse gas neutrality. When looking at the answers of this group given to the open-ended questions, the main narratives that could be identified were a disregard for climate change or its impacts and references to other countries that are allegedly more responsible for climate change, making the German contribution meaningless from their perspective.

Overall, the results show that the participants have a positive attitude towards the energy transition and agree with the general target of greenhouse gas neutrality. These findings align with the assumptions made by Devine-Wright (2007) in the concept of Energy Citizenship and reflect that respondents are aware of the importance of the energy transition.

5.2.2 Motivation

Figure 18 shows how important respondents find it to contribute to climate protection themselves differentiated by ownership situation (i.e., tenants, homeowners, and private landlords). The scale of answers ranges from 0 (not important at all) to 10 (very important). Figure 18 shows the same trend for the importance of one's own contribution as for awareness about the importance of the energy transition, with 63 % of respondents voting for 8, 9, or 10 and an average of 7.53 points. It can also be seen that 5 % see their own contribution as "not important at all".

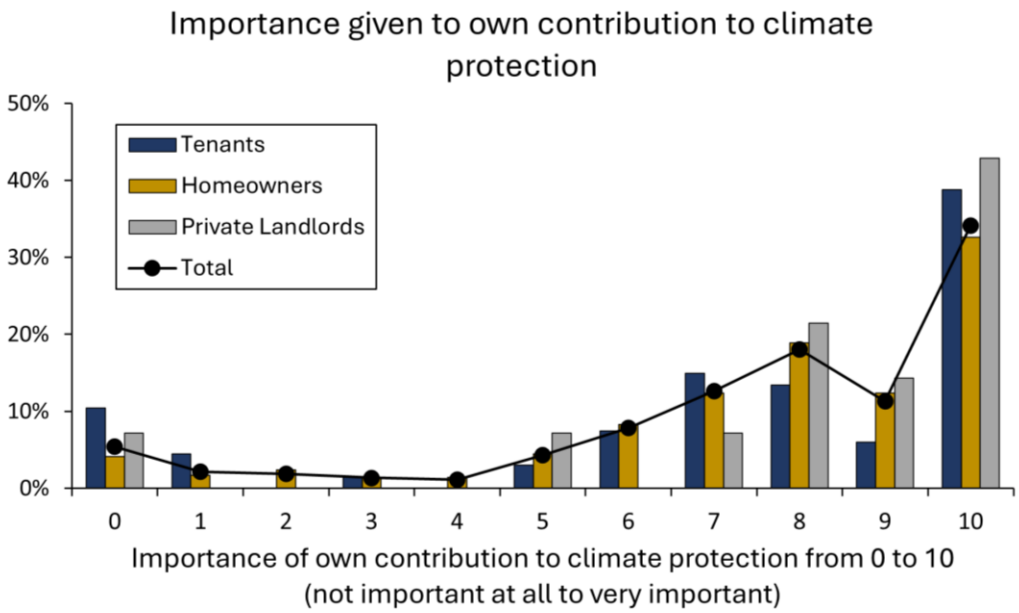

Figure 18: Importance of own contribution to climate protection (survey results question 14)

Looking at different age groups, the group of respondents aged between 60 and 80 puts the most importance on their own contribution (mean of 7.88), while the group between 20 and 40 indicates the lowest average motivation to contribute to climate mitigation (mean of 7.16). Differentiated by ownership situation, one can see the same distribution as for awareness about the energy transition, as the average points given by private landlords were the highest (mean of 8.15), followed by homeowners (mean of 7.64) and tenants (7.22).

Figure 19 shows agreement to the proposal for the Federal Energy Building Act (GEG) (as of May 2023), which made the use of at least 65 % renewable energy mandatory for all newly installed heating systems after January 1, 2024. One can see that 41 % of respondents do not support this policy proposal. The reasons for that can be manyfold, but it is assumed here that the disagreement might be connected to the intense debate about the GEG going on while the survey was conducted and because many citizens expect and experience practical challenges when changing their heating system.

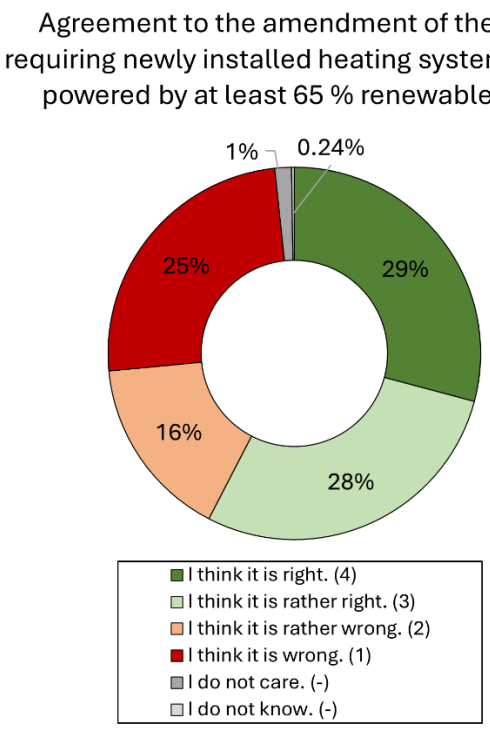

Figure 19: Agreement to the amendment of the GEG requiring newly installed heating systems to be powered by at least 65 % renewable heat (survey results question 15)

Overall, the survey responses show that the participants are motivated to contribute to climate protection, even though they agree less with the concrete target specified in the GEG. These findings support the assumptions made in the concept of Energy Citizenship, as motivation for active involvement in the energy systems is seen as an important element of Energy Citizenship (Devine-Wright, 2007).

As opposed to the assumptions made in the concept of Energy Citizenship that the motivation for involvement in the energy transition is at least partly motivated by environmental concern, the manager of the energy provider "Stadtwerke Steinburg" suggests that citizens' main motivation could be compliance with laws and the minimization of heat provisioning costs. He argues that heat and water supply are services that have been available to citizens for a long time and that they have gotten used to. He argues that heat provision is a "classical non-interest topic" and that people are mostly interested in a reliable supply. This understanding of citizens' motivation is more connected to the imaginaries of detached consumers than to Energy Citizenship and underpins the different ways of understanding the relationship between citizens and the energy system.

Dr. Schlenz, the manager of the Wankendorfer housing cooperative, also identifies a passive role of citizens. He mentions that the members of the cooperative are very interested in maintaining an environmentally sustainable building stock and contributing to greenhouse gas neutrality. But at the same time, he sees that people are unaware of their own energy use and that they need support to find ways to engage with the energy system. As an example, he mentioned a pilot where houses were

equipped with smart meters connected to an app showing detailed information about energy use in appealing visualizations. He argues that this resulted in increased awareness, which ultimately resulted in a measurable demand reduction. He highlighted the importance of concrete courses of action that include fun and education that enable people to engage with the energy system and strongly contribute to people's motivation. Thus, he agrees with the idea that most people are generally motivated to contribute but points out that structural support and knowledge that make active involvement possible are important.

In summary, the data indicate that citizens are motivated to contribute to a cleaner energy system exhibiting characteristics akin to Energy Citizenship, despite the support of the GEG being not as robust. The data from the interview provides a mixed picture of the representation of citizens, as the statements of the manager of the utility provider relate more with a representation as detached consumers, as he sees citizens only interested in the reliable provision of heat, which he frames as a commodity that people want to purchase at the lowest possible price. The climate protection manager's perspective appears to be more closely tied to Energy Citizenship, as she highlighted citizens' concern with energy beyond the understanding as a commodity through the recognition of the ecological and social consequences of its use (Devine-Wright, 2007).

5.2.3 Knowledge

In this section, the results connected to the category of knowledge are presented.

Figure 20 and Figure 21 show the self-evaluation of technical and policy knowledge respectively. The evaluation of technical knowledge refers to the technological alternatives to fossil heating systems and applies to all respondents. The self-evaluation of the policy knowledge refers to current regulations and the funding scheme and was only answered by homeowners and private landlords.

One can see that the majority (62 %) of people evaluate their technical knowledge as "high" (20 %) or "rather high" (42 %) while 33 % evaluate it as "low" and 5 % as "rather low", resulting in an average of 2.76 points.

For policy knowledge, the majority of people (60 %) evaluate their policy knowledge as "rather low" (49 %) or "low" (11 %), resulting in an average of 2.36 points.

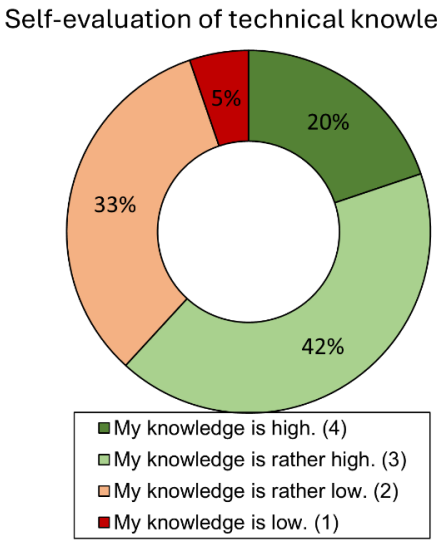

Figure 20: Self-evaluation of technical knowledge of all survey respondents (survey results question 16)

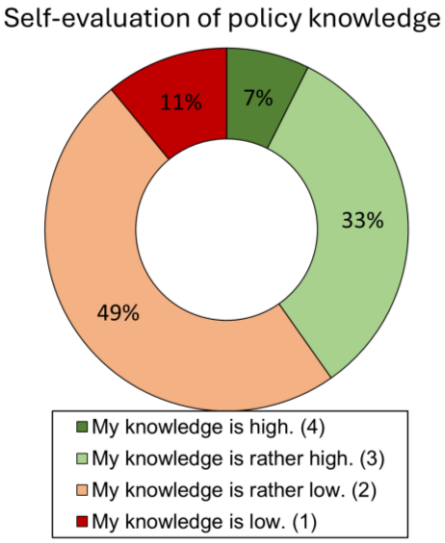

Figure 21: Self-evaluation of policy knowledge for homeowners and private landlords (survey results question 17)

When looking at the different age groups, one can see that the youngest group (20-40 years) evaluates their technical knowledge the best (mean 2.78), and the age group between 60 and 80 the lowest (mean 2.67). Generally, the difference between the age groups is relatively low. For policy knowledge, the oldest age group scores the highest (mean 2.6) and the youngest group the lowest (2.32). This stands in contrast to the assumptions made about elderly people in section 2.1.2, as it was assumed that they might have less capacity to get familiar with available technologies and corresponding regulations and funding schemes.

The importance of knowledge is highlighted by the climate protection manager as she suggests a direct relationship with the motivation to participate in the transition. She states:

> *"I think it's very important that people have an idea of how it can work, and then can weigh up the options. You are simply more satisfied or more willing to get involved in something if you know how it works."*

In line with the low self-evaluation of the policy knowledge, the manager of the energy provider observes a high degree of uncertainty in the population. He states:

> *"I think the political discussions about the Building Energy Act, which have basically been going on for months now, have created a very high level of uncertainty among citizens."*

The climate protection manager also highlights the importance of a clear vision for the HT and demands that the federal government provide clear regulations to the municipalities as well as for the citizens. She argues that this would enhance people's ability to understand the policy framework, and clear communication about technologies could also improve technological knowledge.

An option that could counteract the limited knowledge is the availability of consultancy opportunities. This is addressed in the GEG by integrating mandatory consultancy moments for homeowners. Most of the subsidies can only be requested when people make use of the consultancy services of a state-approved energy consultant (BAFA, 2023). In the new proposal of the GEG, this is also required for people who want to install a heating system powered by any solid, liquid, or gaseous fuel (§71 sentence 11).

Figure 22 shows that 54 % of respondents evaluate the availability of consultancy opportunities in Itzehoe as "insufficient" or "rather insufficient", resulting in a mean value of 1.98. But it also stands out that 33 % indicate that they do not know if the consultancy opportunities are sufficient or not.

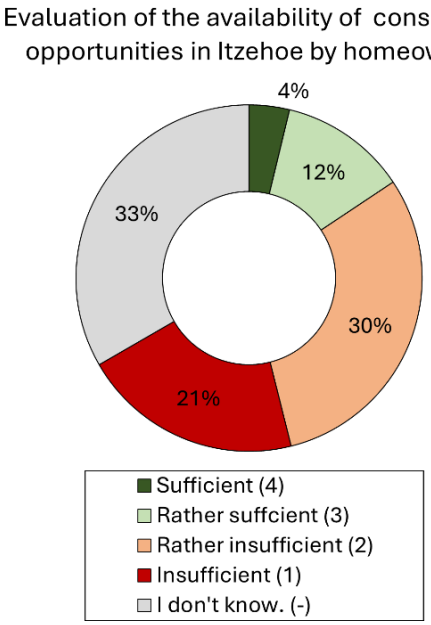

Figure 22: Evaluation of the availability of consulting opportunities in Itzehoe (survey results question 18)

All in all, the data shows that limited political knowledge and insufficient availability of consultancy opportunities seem to be prevalent challenges in Itzehoe. The limited knowledge is arguably counteracting the active involvement of citizens as it might hinder informed decision-making. The negative evaluation of the consultation opportunities and the uncertainty, exacerbated by the discussion surrounding the GEG, show a limited flow of information and information sharing, which are integral parts of procedural justice (Mundaca et al., 2018). The limited availability of knowledge risks excluding people from participating in the transition which counteracts the desired engagement of all citizens in a non-discriminatory way (Jenkins et al., 2016). The results highlight, that limited knowledge cannot be understood as an individual phenomenon but that a closer investigation of the structural conditions and the quality of the process is important. As one's knowledge is closely connected to the experienced practicability of implementing renewable heat, the topic will be further discussed in the following section.

5.2.4 Practicability of implementing renewable heating systems

This section presents the results connected to the practicability of implementing renewable heating systems. This includes an assessment of how much effort is required from homeowners to implement renewable heating systems in their houses and how and to what extent citizens are supported in this process. The process is understood as firstly obtaining the necessary information about technologies and regulations, the administrative effort, and the actual technical implementation of a new heating system. This aspect only applies to homeowners, as they are the ones responsible for managing the process of implementing renewable heat in their homes as opposed to tenants, who are mostly dependent on the actions of their landlords.

Figure 23 shows the evaluation of the required effort needed for renewable heating projects in Itzehoe. It shows that 69 % of the respondents evaluate the effort as “Rather too high” or “Too high” with an average of 2.09 points.

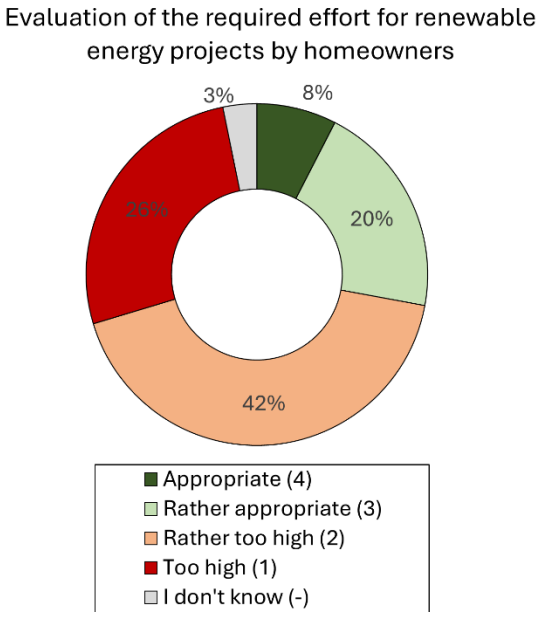

Figure 23: Evaluation of required effort for renewable heating projects (survey results question 19)

When looking at the evaluation of the required effort distinguished by age groups it can be seen that there are no significant differences between younger and older people, as the lowest mean value is 2.0 for 20-40-year-olds and 2.17 for 60-80-year-olds.

A factor that was mentioned frequently in the literature as influencing the effort of such projects negatively is the low availability of skilled workers who can install renewable heating technologies. This seems to be the case for Itzehoe as well, as 68 % of the respondents evaluated the availability as “insufficient” or “rather insufficient” with an average of 1.72 points (Question 20), which indicates that this low availability is a challenge for many citizens and that searching and waiting for specialized workers increases the effort needed.

The climate protection manager of Itzehoe also recognizes a high effort for private households and indicates that the municipal administration plans to react to this situation. In the interview, she states:

> *"Not everyone has the desire and the physical knowledge to choose the best technology from the Internet and there we would like to relieve people also in terms of research and facilitate the decision-making process because, in the heat planning, many people from different professional expertise have hopefully already thought about the solutions intensively."*

She proposes that the municipality could develop sample renovation concepts that present a range of options and lay out the advantages and disadvantages of different types of houses to facilitate easier decision-making for citizens. Individual consultancy on the other hand does not belong to the activities that are planned by the municipal administration, as the focus lies on the development of a common vision on a higher abstraction level. The importance of municipal heat planning is also underpinned by the fact that 57 % of homeowners who responded to the survey agreed with the following statement:

> *"For me, it is difficult to decide which heating technology is suitable for me at the moment because I don't know if and when there would be a district heating network in my neighborhood."* (Question/Statement 21)

This aspect strongly relates to the limited policy knowledge identified in section 5.2.3 and highlights that the limited knowledge is connected to the limited availability of information.

The importance of the municipal heat planning and people's desire to know where district heating networks are planned was also underpinned by the answers given to the open-ended questions, as 22 answers directly referred to heating networks. This is exemplified in the following statement given by a survey respondent:

> *" I would like to know promptly when and whether we will be connected to a heating network or whether we will have to resort to heat pumps. I would prefer a heat network because then we don't have to do everything alone."*

The identification of potential locations for heat networks is part of the municipal heat planning stipulated in the EWKG, and Itzehoe will finish with the planning earlier than other municipalities in other states. This head start can be considered an opportunity for the citizens despite the many challenges.

The climate protection manager of Itzehoe frequently highlighted the importance of the development of a clear vision for the HT in the interview, which she defined as the main task of the municipality but also demands from the national government.

As established in section 5.1.3, it could be argued that the GEG provides this clear vision only in a limited way. This is enhanced by an extensive element of uncertainty, as many regulations (e.g., §§

71j and §71k) are dependent on the development of the municipal heat planning and the still-to-be-built infrastructure for heating networks and hydrogen grids. §71k specifies the associated transition periods for so-called “hydrogen-ready” natural gas heating systems. The user is excluded from the 65 % rule and can use natural gas in case the gas grid operator provides a binding transition pathway by June 30, 2028, which shows how the hydrogen supply will be ramped up until the end of 2044. If the network cannot be built, the homeowner has to comply with the regulations in another way and has a right to reimbursement of additional costs by the network operator. It is argued here that it is very difficult for homeowners to anticipate whether a hydrogen grid will be available to them or not. And as argued by many (Breer, 2023; Klafka et al., 2023) this hydrogen vision can cause a delay in the HT, as homeowners might invest in a so-called “hydrogen-ready” heating system that, without the availability of a hydrogen supply, will be operated with natural gas until at least 2028.

A similar uncertainty can be observed regarding the development of heating networks, with the difference that heating networks are considered an integral component of the HT by experts (e.g., (Fraunhofer IWES/IBP, 2017). §71j provides that when a connection to a heating network is planned by the grid operator, a heating system that does not comply with the 65 % rule can be installed by homeowners in that region and can be used until the construction of the heating network is completed. If the grid operator fails to deliver 65 % renewable heat after the expiration of the deadline, the person needs to comply with the regulations in another way and has a right to reimbursement of additional costs by the network operator.

As it is currently unclear where these networks will be located, many private homeowners could be in a situation where they do not know whether they need to take care of implementing renewable heating systems themselves or can rely on networks. This also applies to large-scale homeowners, as the manager of the Wankendorfer housing cooperative points out that the heat planning in Itzehoe comes too late given that they follow long-term renovation concepts that need to be adapted considering the availability of heating networks. As the information about the heating network is not available yet, this adds a strong element of uncertainty to the planning process.

Nevertheless, the importance of this planning is acknowledged by the municipality, and the planning in Itzehoe is ongoing, and the results of the first analysis identifying energy potentials and possible locations for heat networks will be available by the end of 2024. In comparison with other municipalities in Germany that will finish their heat planning as late as the end of 2028 (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023a), Itzehoe’s head start, initiated by the EWKG, can be considered as an opportunity for the citizens of Itzehoe, despite the prevalent challenges.

Overall, it is argued that the practicability of implementing renewable heat in Itzehoe is a significant challenge for citizens’ involvement, as a range of structural conditions makes the implementation of renewable heating systems difficult. This is demonstrated by the majority of respondents evaluating the effort of the process as (rather) too high. The data suggest that this is due to the limited availability of consultancy opportunities and specialized workers and the lack of information available about the overall city-wide vision of the HT for Itzehoe. This becomes particularly evident

by the lack of information concerning the location of heating networks, which creates a large element of uncertainty and is identified as a significant challenge. This situation hinders people from making informed decisions and highlights that involvement in the HT is not only a matter of personal attitudes but is strongly influenced by the structural conditions created by policies and the engagement of local key actors. The current situation characterized by many uncertainties requires extensive research from citizens to find the best renewable heating option for them. This favors people with pre-existing knowledge and high financial and mental capacities, which is in line with the observations of Wilson et al. (2015) pointing out that, the complexity of energetic refurbishment, both technologically but also administratively can cause a high cognitive burden which can cause resistance and exclusion for people without experience in the field.

5.2.5 Financial aspects

This section covers the financial aspects related to the involvement of citizens in the HT. As their situation is very different regarding financial aspects, the results are presented separately for homeowners and tenants.

Homeowners

Figure 24 shows the results of a self-evaluation regarding access to sufficient financial resources to be involved in the HT for homeowners differentiated by age groups.

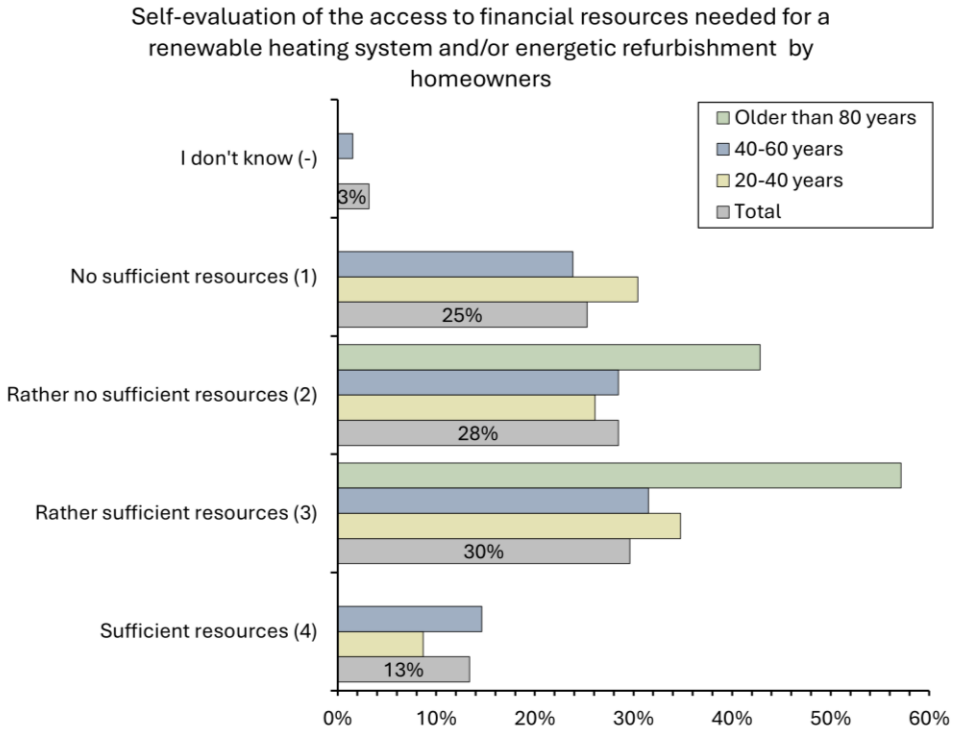

Figure 24: Self-evaluation of the access to financial resources needed for involvement in the heat transition by homeowners (survey results question 22)

The average points given by respondents are 2.32 pointing towards a negative tendency in answers, which can also be seen as the majority of people (53 %) evaluate their access to financial resources

as “not sufficient” or “rather not sufficient”. The standard deviation of 1.0 is relatively high and indicates a high distribution of answers, which can also be seen in Figure X. The group of people older than 80 gave the highest average value of 2.63. The groups in the age range between 40 and 60 and 60 and 80 both have an average of 2.4, while the youngest group evaluates their access to financial resources as the lowest (2.2). These results are surprising, as it was assumed that elderly homeowners would indicate difficulties with accessing sufficient financial resources (Schumacher and Nissen, 2022). However, as the number of respondents in that group older than 80 was low (n=7), it needs to be acknowledged that the data cannot be considered representative.

Furthermore, Figure 25 shows how homeowners evaluate the possibility of saving costs by energetically refurbishing their homes and/or changing to renewable heat. One can see that 48 % of respondents do not think that they could save costs in the long term through investments in renewable heat. 36.3 % think that they would save costs in the long run and 15.6 % of the homeowners stated that they do not know whether they could save costs or not.

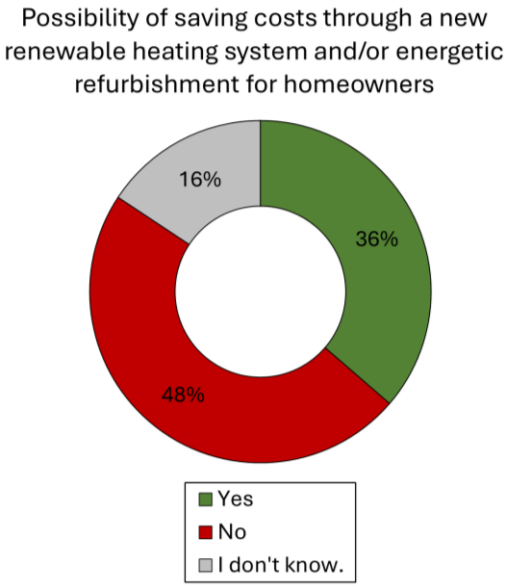

Figure 25: Possibility of saving costs through a new renewable heating system and/or energetic refurbishment for homeowners (survey results question 23)

When looking at the data differentiated by age groups, it can be seen that younger people are more positive about the possibility of saving costs than people in older age groups (see Table 5). This seems plausible, as the investments pay off over a relatively long time period, as, e.g., the life span of a heat pump is estimated as 20 years (energie-experten, 2023). Therefore, it can be argued that the investment is more attractive when people assume that they will stay in their houses for at least the life span of the technology, as also indicated by Achtnicht and Madlener (2014).

Table 5: Possibility of saving costs through a new renewable heating system and/or energetic refurbishment for homeowners by age group (survey results)

Age group	Answers		
	Yes	No	I don't know
20-40	51 %	42 %	7 %
40-60	30 %	52 %	18 %
60-80	38 %	42 %	21 %
Older than 80	29 %	71 %	-

It becomes evident that many homeowners think that they do not have access to sufficient financial resources to be involved in the HT and that many people think that investments in renewable heat are economically inefficient. These findings are in line with research that finds that many homeowners consider the high refurbishment costs and the too long payback time of investments as a main challenge for involvement in the HT (Fjornes and Becker, 2022).

The importance of the financial aspects of the HT is also highlighted by the climate protection manager of Itzehoe, who suggests that investment costs are the main challenge for homeowners. This perspective is shared by the manager of the utility provider. He points out that his company aims to provide energy at affordable prices. However, he explains that it is difficult to offer renewable heat for a price comparable to the prices for fossil energies that people have gotten used to, as the financial resources for the infrastructural changes within his company are not sufficient.

A mechanism that could potentially counteract this challenge is the funding scheme. There are two federal funding schemes currently in place designed to support the HT in residential buildings. Firstly, the federal funding for energy-efficient buildings – single measures (BEG-EM), which provides financial subsidies for several single measures. Secondly, the Federal funding for energy-efficient buildings- residential buildings (BEG-WG), which is designed as a repayment subsidy for a loan, th at can be acquired when the whole building is retrofitted so that it reaches a higher energy-efficiency class than before.

Figure 26 shows to what extent homeowners see the current subsidy scheme as an incentive for investments. As briefly mentioned in section 5.1.3 the new funding scheme that corresponds to the new regulations of the GEG was not published during the time of the survey, so respondents had to base their answers on the subsidy scheme enforced at that time. One can see that more than half of the homeowners (51.7 %) indicated that they do not see the current subsidy scheme as an incentive to invest in energetic refurbishment or a renewable heating system. 23.7 % think it is an incentive and 24.6 % state that they do not know. This data shows that homeowners in Itzehoe think that the funding scheme does not sufficiently counteract the challenges concerning the investment cost for renewable heat.

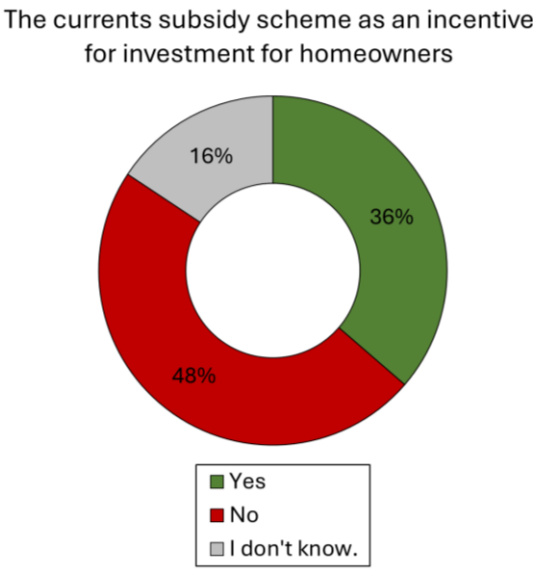

Figure 26: The current subsidy scheme as an incentive for investment for homeowners (survey results question 24)

When looking at the structure of the subsidy scheme BEG-EM, it could be observed that the amount of subsidy solely depends on the technology and does not take other factors such as the income level of people into account. The only aspect that could be considered as taking different groups in society into account is the extra funding for so-called worst-performing buildings, as these are arguably often inhabited by people with low incomes (Bundesministerium für Wirtschaft und Klimaschutz, 2022). Additionally, the subsidies under the BEG-WG are designed as repayment subsidies for loans from private banks. Therefore, they can only be used by people who are considered eligible for a loan by a private bank (Bardt et al., 2008). In addition to the federal structure, the state government of Schleswig Holstein issued a scheme that provides additional support at the state level (IB.SH, 2023). Like the federal structure, it provides subsidies dependent on the type of technology, not taking any other characteristics or people's circumstances into account.

It is argued that this structure creates difficulties for elderly people and low-income households (see also Achtnicht and Madlener (2014)) and thereby creates concerns in terms of distributional, procedural, and recognitional justice. As established in section 2.2.2, the distributional justice of access to clean heat strongly depends on the distribution of the income level and the distribution of the actual fuel demand which is often higher for elderly people and for people who live in old poorly insulated homes (Walker and Day, 2012). This becomes even more evident for the cost-intensive switch to renewable heating systems, as low-income households live more often in buildings with the lowest energetic standards, which require higher investments (Schumacher and Nissen, 2022). Overall, this leads to strong inequalities concerning the distribution of burdens, as low-income households are forced to pay a significantly larger share of their disposable income on heat or are excluded from the process if the investment costs are not affordable to them. By not taking the different access to resources into account, the policy framework contributes to sustaining distributional injustices in the heat provision. Additionally, the structure of the funding scheme as a loan from a private bank which con only be used by people that are considered eledgible for a loan

by the bank creates additional challenges for low-income households and elderly people and risks excluding them from the transition process. This counteracts the non-disciminatory engagement of all stakeholders, considered as an integral part of just processes (Jenkins et al., 2016).

However, the differences in access to resources seem to be recognized by the federal government at least to some extent, as it was announced that the new funding scheme will be attentive to people's different financial situations (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023b). But as mentioned before, the funding scheme that will apply after January 1, 2024, was not published within the period of this research (until mid-September 2023).

In summary, the data indicates that the availability of financial resources and the expected financial efficiency of measures play an important role for homeowners in the HT creating challenges for many compromising their ability to become active energy citizens. One can see that the access to financial resources differs strongly within the group of survey respondents and that the subsidy scheme does not take these differences into account and thereby sustains existing injustices.

Tenants

Tenants find themselves in a very different situation than homeowners, as they are mostly dependent on the decisions made by their landlords. As laid out in section 2.1.2 landlords are responsible for investments in energetic refurbishment and renewable heating systems, while tenants need to pay the operation costs and a potential turnover of investment costs (Pallaver, 2019).

As shown in Figure 27, in contrast to homeowners the majority of tenants are convinced that they could save costs by changing to renewable heat.

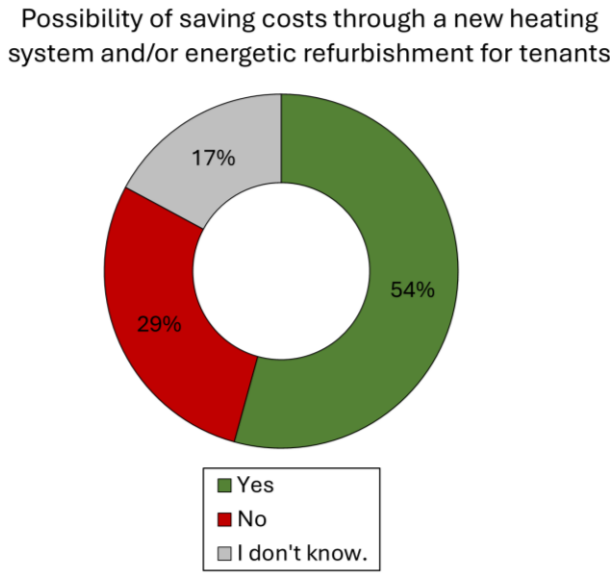

Figure 27: Possibility of saving costs through a new heating system and/or energetic refurbishment for tenants (survey results)

But at the same time, it can also be seen that tenants are worried about the potential turnover of investment costs, as 45 % of the respondents agreed with the statement

"I am worried that my rent will get too high due to energetic refurbishment." (Question/Statement 25)

Additionally, 23 % rather agree, 20 % rather not agree, and 11 % not agree with that statement. This skeptical perspective of tenants underpins the problems related to the so-called "landlord-tenant dilemma" introduced in section 2.1.2, which refers to the situation that landlords are responsible for investments in renewable heat while tenants usually pay the operation costs of the heating system. As discussed before, perspectives on the topic differ but Pallaver (2019) concludes that energetic refurbishment and the use of renewable energy is seen as advantageous for tenants, as it creates resilience toward price fluctuations of fossil fuel prices. The results shown in Figure 27, show that the majority of tenants agree with that conclusion, as they expect to save costs. However, the worries about rent increase show that tenants are worried that the savings in energy costs might be diminished by higher rental costs due to turn turnover of investment costs, which aligns with observations by the Academic Service of the Bundestag *(Wissenschaftliche Dienste des Deutschen Bundestag*s) (2018) laid out in section 2.1.2.

The operation costs that need to be paid by the tenants strongly depend on the investment decisions taken by landlords. When looking at the amendment process of the GEG, it could be observed that the first proposal contained a paragraph that was intended to protect tenants from over-proportionally high operating costs. This paragraph (§71o) determined that tenants only have to pay the operation costs that would occur by unit of heat when using a heat pump and that any costs above that have to be covered by the landlord. This paragraph would have protected tenants from over-proportionally high operation costs caused by the decisions of their landlord. But this paragraph was removed during the process and the final document available for this research does not include it anymore, which means that the risk of high operation costs lies with the tenants. This means that the current policy framework gives room to the allocation of financial costs to tenants.

Thus, the data shows that tenants' possibility to act like actively involved energy citizens in the HT is strongly limited by their situation in which they are dependent on decisions by their landlords. The limited say of tenants in decision-making further compromises procedural justice, which increases the risk of producing and sustaining unjust distributional outcomes of the decision-making process (Walker and Day, 2012). Distributional justice concerns further manifest, as tenants are prone to the over-proportional allocation of burdens through turnover of investment costs or high operation costs caused by the investment decisions of landlords. The assessment of the GEG shows that the law does not include measures to counteract these dynamics.

5.2.6 Specific local and personal situation

This section presents the results connected to the broad category of the specific local and personal situation. As described in section 2.3, these factors can be very diverse, and the analysis focuses on specific aspects that were frequently mentioned in the literature.

To test whether these aspects apply to the citizens of Itzehoe, the degree of agreement to a variety of statements (see Table 6) that represent these was queried. The results are summarized in

One can see that a majority of people think that the structural conditions of their houses make it difficult to energetically refurbish their house and/or change the heating system (statement 1). It can also be seen that a slight majority of people have no or rather no concerns about the acceptance of renewable projects in their neighborhood (statement 2). Most people do not think that their living comfort would be increased by a new heating system or energetic refurbishment (statement 3). It can also be seen that worrying about the operation of the heating systems plays a minor role, with most people disagreeing with the statement (statement 4). The same can be seen for concerns about reliability, as the majority of the respondents disagree with the statement that they believe that their home will not be sufficiently and reliability heated with renewable energies (statement 5).

Another aspect that was mentioned in the literature was that houses are often owned by owner communities that require joint decision-making of all owning parties. In the survey, 32 respondents stated that they live in an owner community and the majority of them evaluated the decision-making process regarding the heating system and energetic refurbishment as “rather difficult” (41 %) and “difficult” (13 %) while 19 % see it as “rather constructive” and 28 % as “constructive”. This indicates that communication within owner communities can be a challenge. As Jaroszek et al. (2015) show energetic refurbishment activities in owner communities in Germany lie below the average. The reasons for that are not that much researched yet but reasons could lie, among others, in the specific requirements of the decision-making process (Jaroszek et al. 2015). This observation suggests that the structures within owner communities need to adapt to the new challenges that arise with the implementation of renewable heat.

The results highlight that the changes required for the HT are highly context-specific, as they have to be implemented within the living spaces of people. Even though not all aspects identified in the literature seem to be highly prevalent in Itzehoe, local structures such as owner communities or acceptance in the neighborhood play a role and need to be taken into account.

Table 6: Agreement to different statements (survey results)

	Statements	Answers				Mean
		I do not agree. (1)	I rather not agree. (2)	I rather agree. (3)	I agree. (4)	
1	"The structural conditions of my house make it difficult to renovate my house energetically and to change the heating."	18%	20%	31 %	32%	**2.76**
2	"I am concerned that there is low acceptance of renewable energy projects in my neighborhood."	15%	44%	33%	9%	**2.47**
3	"I expect a higher living comfort through a new heating system and energetic refurbishment."	30%	29%	26%	15%	**2.25**
4	"I am worried that I won't like the operation of the new heating system."	59%	22%	10%	9%	**1.69**
5	"I believe that my home will not be sufficiently and reliability heated with renewable energies."	41%	17%	23%	19%	**2.2**

5.3 Summary of results

The results of this research indicate that the citizens of Itzehoe generally have a positive attitude toward renewable heating systems and are motivated to contribute to a cleaner energy system. This supports the assumptions made by Devine-Wright (2007) in the concept of energy citizenship and indicates that a lack of awareness and motivation cannot be considered a main challenge for citizens' involvement in the HT in Itzehoe. However, challenges could be shown regarding citizens' knowledge, the practicability of implementing renewable heat, financial aspects, and specific local and personal situations. The results concerning these aspects are summarized in Table 7.

Table 7: Summary of results

Type of challenge	Summary of results
Knowledge	• Insufficient availability of consultancy opportunities • Uncertainty created by the prolonged amendment process of the GEG and the public discussion surrounding it • Information about funding scheme not available • Limited knowledge is counteracting informed decision-making and risks excluding citizens with lower capacity to perform extensive research
Practicability of implementing renewable heat	• Limited availability of specialized workers and consultation opportunities • Lack of information about the city-wide vision for the HT → especially the location of district heating networks • required effort for implementing renewable heat is too high • Practicability is a significant challenge • Problems are not individual but strongly connected to lack of support mechanisms and coherent information flow at the local level
Financial aspects	<u>Homeowners:</u> • Investment costs and expectations about cost efficiency of measures significant challenges • Strong differences in access to financial resources • Non-recognition of different financial situations in funding scheme <u>Tenants:</u> • Positive about economic efficiency of renewable heat • Position of low agency that compromises ability to contribute to cleaner energy system • Vulnerability toward the over-proportional allocation of costs • No sufficient protection against allocation of costs in the GEG
Specific local and personal situation	• Measures are embedded in local and personal context • Structural conditions of houses seem to be a challenge for many • Other aspects (acceptance in the neighborhood, living comfort, usability, and reliability of heating systems) play a role, but less prevalent • Decision-making in owner communities identified as a challenge

6 Discussion

This section discusses the main findings of the research, its limitations, and the resulting suggestions for further research, as well as the theoretical and practical implications.

6.1 Discussion of main findings

The summary of the results (Table 7) shows some prominent reoccurring issues that influence different aspects of citizens' involvement. These are, firstly, the limited flow of information at the municipal level, secondly, the expected low financial efficiency of measures, thirdly, the non-recognition of different access to financial resources, fourthly, the low agency and high vulnerability of tenants regarding the heating system, and lastly, the uncertainty created through the lack of a clear political vision in the GEG and the surrounding public discussion. These aspects and their relation to the theoretical framework are discussed in the following.

The limited flow of information at the municipality level identified in this research shows the underdevelopment of local support and communication mechanisms. This underpins that these structures remain in a setup related to centralized fossil energy systems, where energy consultancy and information on city-wide strategies are less needed, as these systems are managed by a few experts, and citizens are seen as passive consumers (Devine-Wright,2007). This indicates the importance of the system co-evolving in the direction of Energy Citizenship and highlights the responsibility of key local actors and the policy framework to create conditions that enable citizens to become involved in the HT in a way that matches their abilities. Further, the risk of excluding people with fewer capacities to perform extensive research to acquire necessary knowledge counteracts the non-discriminatory inclusion of all stakeholders (Jenkins et al., 2016). Nevertheless, it is seen as advantageous for Itzehoe that, in contrast to other places in Germany, the municipal heat planning is already ongoing. This structured approach can help to overcome the information deficit that is currently prevalent.

Secondly, the result that the majority of citizens of Itzehoe view their involvement in the HT as restricted by their limited access to financial resources (Figure 24) shows that the engagement of citizens in the HT is not solely dependent on personal attitudes and the willingness to take on responsibilities but is highly dependent on citizens' abilities. This aspect highlights the importance of not understanding Energy Citizenship as allocating responsibilities to people, while they are not in the position to fulfill them, as this risks shifting attention away from structural issues (Lennon et al., 2020).

The finding that involvement in the HT and access to clean and affordable energy depends on the income level is also shown by Walker and Day (2012), who stress that it is necessary to counteract these persistent inequalities in income in the funding scheme to ensure equitable access to clean energy and to engage all stakeholders in the transition. However, the results show that the current technology-specific structure of the funding scheme does not recognize differences in access to financial resources, which potentially creates difficulties for elderly people and low-income households, forcing them to pay a significantly larger share of their disposable income on heat (see

also Achtnicht and Madlener, 2014) and thereby compromises distributional and recognitional justice. Additionally, the structure of the funding scheme as a loan from a private bank, which can only be used by people who are considered eligible for a loan by the bank, creates additional challenges for low-income households and elderly people and risks excluding them from the transition process. This counteracts the non-discriminatory engagement of all stakeholders, considered as an integral part of just processes (Jenkins et al., 2016). Therefore, the current subsidy scheme contributes to sustaining distributional injustices in heat provision. However, the differences in access to resources seem to be recognized by the federal government at least to some extent, as it was announced that the new funding scheme will be attentive to people's different financial situations (Ausschuss für Klimaschutz und Energie Deutscher Bundestag, 2023b). But as mentioned before, the funding scheme that will apply after January 1, 2024, was not published within the period of this research (until mid-September 2023).

Another aspect that became increasingly apparent in this study is the low agency and high vulnerability of tenants in the HT. It is argued that their low degree of agency makes them prone to over-proportional allocation of costs compromising distributional justice. This risk is strengthened by the analysis of the GEG, as the law does not protect tenants from over-proportionally high operation costs, thereby leaving space for the allocation of financial burdens to tenants. Further, the dependence on decisions by the landlord strongly restricts the ability of tenants to take on responsibilities and contribute to a cleaner heating system. Therefore, highlighting the responsibility of tenants as Energy Citizens, while their courses of action are strongly restricted, appears contradictory (Lennon et al., 2020), underpinning the limited applicability of energy citizenship on tenants in the HT. Therefore, it becomes clear that within the current structures, in which tenants are widely excluded from decision-making regarding heating systems, policies need to address landlords to ensure that they become engaged in the HT while ensuring that the interests of tenants are fairly represented in decisions.

Lastly, a reoccurring topic in this research was the uncertainty created by the lack of a clear vision of the HT presented in the GEG, an issue exacerbated by the intense public debate surrounding the policies' amendment process. It is argued that the inclusion of hydrogen-based systems a technical solution in the GEG, opposing the assessments by many scholars in the field (see Rosenow, 2022) jeopardizes the provision of reliable information to citizens and adds to existing uncertainties about technologies. Additionally, the public debate that unfolded during the research process had a significant impact on the perceptions of citizens, undermining trust in politics. This research only provides a very limited analysis of the public debate, as it was unfolding in parallel to the data collection process. However, it is assumed that the large amount of misinformation and scandalization influenced citizens' opinions and perceptions, which presumably undermined citizens' motivation to be involved in the HT and jeopardized efforts to create a steady and reliable information flow that provides citizens with the knowledge needed for involvement.

6.2 Limitations & further research

In addition to the methodological limitations outlined in section 4.3, several other constraints impacted the scope, depth, and neutrality of the findings. These limitations are discussed in this chapter and must be considered when interpreting the results and recommendations presented in this study.

An important limitation to acknowledge is that this research primarily investigates the challenges within the existing structural setup of the energy system in Itzehoe. This approach refrains from directly challenging the prevailing structure and power dynamics within the energy system and does not delve deeply into the wider political economy surrounding the HT, even though understanding the larger systemic forces at play is crucial for a comprehensive analysis. This limitation can be seen in the model shown in Figure 5, as it presents the system in a strongly simplified manner focusing on a limited selection of actors and dynamics and thereby not taking the influence of the wider political economy into account. However, the relevance of these dynamics becomes evident in several aspects presented in section 6.1.

Firstly, it is argued that the economic efficiency of renewable heat, which is found to be a very important factor for citizens' involvement, depends on a multitude of dynamics in the global energy market determining the price for fossil fuels and renewable energy technologies. An in-depth analysis of these dynamics exceeds the scope of this research. Nevertheless, the impact of the complex interplay of global energy markets and energy policies becomes evident, as many citizens evaluate the expected cost-effectiveness of renewable measures in comparison to fossil systems negatively (section 5.2.5). To understand these results, it needs to be taken into account that the multitude of influencing factors is difficult to oversee for private homeowners. This is also underpinned by Yannick Schimmel, an employee of the utility provider responsible for natural gas trading, who pointed out that even for professionals in the field it is very difficult to oversee the complexity and estimate the price development of natural gas and electricity for the next years, let alone the next decade (personal communication Yannick Schimmel, September 4, 2023). Therefore, the answers to the survey questions need to be understood as showing a general impression of homeowners rather than a clear evaluation of economic efficiency. It is argued that this large uncertainty about price development is a challenge for many citizens, as it makes it difficult to predict the economic outcome of investment. Arguably, the risks associated with this uncertainty have a particularly strong impact on households with limited financial resources, which have lower resilience to unexpected costs than households with more capacities.

Secondly, it becomes evident, that existing inequalities in German society could be reinforced by the HT, as equal access to clean and affordable heat depends on access to financial resources and necessary investments risk adding to the financial struggle of low-income households (Walker and Day, 2012). Even though the findings show that the subsidy scheme could be improved by incorporating people's different financial situations into the scheme, it is acknowledged that the root causes of existing inequalities in income and assets are to be found far beyond the impact of the HT

and climate policies. The same applies to tenants, as their situation is embedded in the wider dynamics of the housing market. Arguably, their situation is aggravated by the shortage of affordable housing on the rental market, which gives tenants fewer choices and can create fear of displacement, especially in metropolitan areas (Pallaver, 2019). This might force tenants to settle for houses with low energy-efficiency standards (Engelmann et al., 2021). It is argued that these persistent social problems and inequalities are likely to be reinforced by policies concerning the HT. But while inequalities need to be taken into account in policymaking, these issues cannot be solely compensated by energy policies but need to be addressed by a broad policy intervention that ensures social responsibility in a wider sense (Schumacher and Noka, 2021), e.g. by ensuring fair payment for wage labor, a more just tax system, and structural changes in the housing sector that gives more influence on decision-making to tenants.

Last but not least, the significant influence of actors that were not represented in this study becomes apparent through the public debate surrounding the amendment of the GEG, as the NGO Lobby Control claims that the debate was ignited by lobby associations and first and foremost the newspaper BILD[6] (Deckwirth, 2023). Lobby Control describes the role of the newspaper BILD as follows:

> *"The wave of agitation and misinformation on a climate policy project was unprecedented and significantly shaped the political and public debate."* (Deckwirth, 2023)

In their report for Lobby Control, Deckwirth and Katzemich (2023) revealed a strong entanglement between actors from the government and business and lobbying associations from the natural gas sector, underpinned by many examples that show the ability of these actors to exert political influence. Likewise, Breer (2023) and Rosenow (2022) indicate that the consideration of hydrogen as a solution for individual heating is a result of lobbying activities of natural gas-related companies.

Following these observations, the role of lobbying organizations in the negotiation process and the public debate is seen as a relevant mechanism influencing the HT in Germany, but an analysis exceeds the scope of this research. Therefore, it is highly recommended for future research to perform a full analysis of the discourse, unpacking the techniques of misinformation used and considering the influence of powerful entities in shaping public opinion and policy decisions.

These examples show that the challenges in the HT are multidimensional problems entangled in many aspects of society and the economic system. The decision to not include an analysis of the wider economic forces at play is not intended to devalue the significance of such aspects but was made to narrow down the research to a manageable scope and to provide practically relevant knowledge that uncovers potential points of intervention for local actors.

[6] https://www.bild.de/

6.3 Theoretical & practical implications

This subsection discusses the theoretical implications of this research, critically reflecting on the use of energy citizenship and energy justice as concepts to investigate citizens' involvement in the HT. Secondly, it lays out the practical implications focusing on potential intervention points for the local utility provider and the municipality.

The concept of Energy Citizenship has proven to be a useful tool in conceptualizing the complex phenomenon of citizens in the HT. It serves as a bridge between the often-overemphasized technological aspects of the transition and the crucial human dimension. However, it is worth noting that the process of narrowing down the Energy Citizenship framework posed its own set of challenges. Finding a balance between operationalizability and comprehensiveness turned out to be difficult, and in the course of this research, it became evident that the application of the Energy Citizenship concept posed the risk of oversimplifying the framework, thereby potentially repeating aspects that were criticized before in the theory section (2.2.1). The risk of oversimplification manifests in the narrow way in which the concept was employed within this study. While Energy Citizenship, in its broader sense, encompasses both individual and collective aspects of energy engagement (Pel et al., 2022), this study predominantly focused on individual citizens. This decision was not meant to devalue collective approaches but was driven by the constraints of available resources, which made it necessary to select and investigate only certain aspects within a complex sustainability problem like the HT. Further, the researcher encountered several difficulties in operationalizing the framework, as no application of the concept to the field of heat provision could be identified. This limitation is also identified by Pel et al. (2022), as they identified the challenges concerning the operationalization of the concept as a key element for further research. This observation is also shared by Silvast and Valkenburg (2023), as they point out that the academic literature on the topic remains scant and that most scholars, like this research, take the concept directly from Devine-Wright (2007), which points toward limited development of the framework within the last years.

Additionally, as discussed in section 2.2.1, the concept is frequently criticized for not sufficiently taking structural conditions and different degrees of agencies among people into account (Lennon et al., 2020). The neoliberal emphasis is also criticized by Silvast and Valkenburg (2023), but they also argue that this is not an inherent feature of the concept but a consequence of uncritical application and an under-specification of the concept in the academic literature. Nevertheless, Energy Citizenship is seen as a valuable tool for comprehending the dynamics of the HT as individual decisions and involvement of individuals are key for its implementation. Therefore, the concept was applied and the identified limitations were counteracted by combining the concept with aspects of Energy Justice. This combination of two frameworks aimed to increase the comprehensiveness of the research and to encompass both the more individual dimensions addressed by energy citizenship and the more structural focus of energy justice. The aspects of energy justice included in the research are seen as very valuable, as their application helped to uncover structural conditions

and first and foremost the different impacts of certain issues on different groups in society, which in the case of an analysis only based on energy citizenship might have remained hidden.

However, a critical reflection on the research suggests that the development of a framework out of these two perspectives in combination with extensive data collection and analysis created a high workload that was difficult to manage within the time frame of this project. Therefore this research joins the demand by Silvast and Valkenburg (2023) and Pel et al. (2022) for more research in the development of a more specified energy citizenship framework, as this would facilitate the application of this very relevant concept in future research.

Despite the limitations discussed above, this research adds valuable insights to the literature on the role of citizens in the HT in Germany. As stated in section 1.4, most of the available literature focuses on financial considerations of homeowners (see e.g., Fjornes and Becker, 2022; Riechel et al., 2016). Therefore, the broader approach of this study, which also encompasses aspects such as knowledge, the practicability of implementing renewable heat, and structural support mechanisms, is seen as a valuable addition. Further, the relevance of this research is enhanced by the very dynamic and recent changes in heat provisioning, as most of the studies in this field were conducted before the price shocks connected to the Russian invasion of Ukraine that accelerated the political process of the HT and, e.g., led to an earlier amendment of the GEG.

On the local level, the investigation of the HT in Itzehoe from a social science perspective provides knowledge that complements the technical assessment of municipal heat planning. Thereby it offers some points of intervention for the relevant actors. Firstly, as the limited information flow at the municipal level is a prominent result, it is recommended that the utility provider and the municipality increase their engagement in developing city-wide plans for heat provision. It is important to underpin the forthcoming municipal heat planning with concrete measures and clear communication with the citizens of Itzehoe. It is strongly recommended to develop a comprehensive communication strategy, including information on available heating technologies and their investment and operation costs, as well as details on the planning of district heating networks. As the concrete plans for the heating networks will be developed over time, it needs to be ensured that citizens are informed about the process and included in the decision-making in their neighborhood. Transparent information on expected costs and location of networks needs to be available to citizens as early as possible, as this information is needed for informed decision-making on whether citizens want to be connected to a heating network or use individual heating. Moreover, the municipality of Itzehoe is the sole shareholder of the utility provider and owns a building stock managed by Wankendorfer Housing Cooperative. As shown by Hertle et al. (2015), this is a very favorable condition for cooperation between these actors. Therefore, it is recommended that the municipality increasingly uses its influence and position as a moderator of the process (Hertle et al., 2015) to strengthen cooperation and engagement of key actors.

Further, it is recommended that the utility provider considers engagement in areas outside of their traditional business area. An example could be offering contracting solutions for heat pumps as is

done by other utility providers (e.g., in Hannover (enercity, n.d.). This option mitigates the impact of high investment costs for citizens. As investment costs are a significant challenge for many citizens, this research shows the demand for such a product. Thus, it seems to be a business opportunity to consider.

7 Conclusion

This research aimed to understand the challenges for citizens' involvement in the HT. To do so the research first established an understanding of how the citizens of Itzehoe are currently involved in the HT and which challenges for involvement in the HT they experience (RQ 1). Further, it was investigated how important local actors (RQ2), and relevant policies (RQ 3) influence the challenges experienced by citizens. This was done by surveying the citizens of Itzehoe, and by analyzing the implications of the policy framework and the engagement of local actors. To conceptualize the relationship between people and the energy system, the research drew on the concept of Energy Citizenship, which suggests overcoming the simplified and negative imaginaries of passive consumers and opening up to investigating the variety of factors that influence the relationship between citizens and the energy systems (Devine-Wright, 2007). To incorporate the criticism on Energy Citizenship and to strengthen the emphasis on structural conditions, and the unequal agency and access to resources for specific groups in society, this research was also informed by aspects of Energy Justice, which puts into focus that challenges play out differently for citizens depending on their access to resources and different degrees of agencies (Sovacool et al., 2016).

Overall, the research shows that the current involvement of citizens in the HT is limited and that citizens experience a range of different challenges. It could be shown that these challenges are not connected to a lack of motivation or awareness but are connected to systemic issues that compromise peoples' ability to become involved energy citizens and pose justice concerns.

The identified limited flow of information on the municipal level shows that the municipality and the utility provider do not react sufficiently to the challenges faced by citizens in the HT and that a stronger engagement, especially addressing information concerning the planned locations of heating networks and consultancy, is needed.

Further, the non-recognition of different financial situations in the funding scheme, the missing protection of tenants from over-proportional allocation of costs, and the uncertainty created by the prolonged discussion surrounding the GEG, show that the current political framework intensifies challenges for citizens and reinforces existing inequalities. Nevertheless, the decision to make municipal heat planning mandatory in Schleswig-Holstein earlier than on the federal level defined in the EWKG, holds the potential to improve the flow of information, thereby addressing a main challenge for citizens' involvement in the HT in Itzehoe.

Finally, challenges for citizens in the HT are influenced by the dynamics of the wider economy and are embedded in a society with prevalent social inequalities. Even though these issues lie outside of the influence of local actors, it is recommended to always take the difference in access to resources and agency into account in communication and strategy development to prevent the disempowering effects of allocating responsibilities to people while they are not in a position to fulfill them. Additionally, not addressing these issues sufficiently might support attempts by opponents of the HT to instrumentalize social injustices to advocate against climate protection. In contrast, this research underpins that social justice and climate protection need to go hand in hand and are not opposing each other.

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Appendix

Appendix A- Interview guides

Interview guide 1: Climate protection manager of the city administration

1. Do you agree that this conversation will be recorded and transcribed and that the information will be used in my master's thesis?
2. Would you like to be quoted with your name or would you like to be anonymous?
3. Please briefly introduce yourself and your role in the city administration.
4. What role does the city (administration) play in the heat transition for private households? What are your main activities at the moment?
5. From your point of view, what are currently the greatest challenges for private individuals in the heat transition in Itzehoe?
6. How is the city (administration) currently contributing to enabling the residents of Itzehoe to heat with renewable heat and save energy?
7. How does the city of Itzehoe plan to contribute over the next 10 years to enabling the residents of Itzehoe to heat with renewable heat?
8. How do you envisage heat supply in 2045? What role does the city play at this point in time?
9. How do you envisage cooperation with other key players in the heat transition in Itzehoe (public utilities, housing companies) over the next 10 years and up to 2045? What would be particularly important to you?
10. What would you like from the federal or state government in the next 10 years and up to 2045?
11. Are there other topics that you find particularly important for the heat transition in Itzehoe?

Interview guide 2: Management of the municipal utility provider

1. Do you consent to this conversation being recorded and transcribed and to the information being used in my master's thesis?

2. Would you like to be quoted with your name or would you like to be anonymous?

3. Please briefly introduce yourself, Stadtwerke Itzehoe/Steinburg and your role in the company.

4. How would you describe the current position of your company in the heat supply in Itzehoe? What are your main activities? What is special about your company?

5. From your point of view, what are the greatest challenges for private individuals in the heat transition in Itzehoe?

6. How are Stadtwerke currently helping the residents of Itzehoe to heat with renewable heat and save energy?

7. How do you plan to contribute over the next 10 years to enabling the residents of Itzehoe to heat with renewable heat and save energy?

8. How do you imagine the heat supply in 2045? What role does the municipal utility play at this point in time?

9. How do you envisage cooperation with other key players in the heat transition in Itzehoe (city, housing companies) over the next 10 years and up to 2045? What would be particularly important to you?

10. What would you like from the federal or state government in the next 10 years and until 2045?

11. Are there other topics that you find particularly important for the heat transition in Itzehoe?

Interview guide 3: Actor from the housing sector: Wankendorfer eG

1. Do you consent to this conversation being recorded and transcribed and to the information being used in my master's thesis?

2. Would you like to be quoted with your name or would you like to be anonymous?

3. Please briefly introduce yourself, the Wankendorfer Baugenossenschaft für Schleswig-Holstein eG and your role in the company.

4. How would you describe the current position of your company in the heat supply in Itzehoe? What are your main activities? What is special about your company?

5. From your point of view, what are the greatest challenges for your tenants in the heat transition in Itzehoe?

6. How is Wankendorfer eG currently contributing to enabling your tenants in Itzehoe to heat with renewable heat and save energy?

7. How do you plan to enable your tenants to heat with renewable heat and save energy in the next 10 years?

8. How do you imagine the heat supply in 2045? What role does your company play at this point in time?

9. How do you envisage cooperation with other key players in the heat transition in Itzehoe (city, municipal utilities) over the next 10 years and up to 2045? What would be particularly important to you?

10. What would you like from the federal or state government in the next 10 years and until 2045?

11. Are there other topics that you find particularly important for the heat transition in Itzehoe?

Appendix B: Survey questions

	Questions/Statements	Scale	Self-occupying homeowners	Small scale landlords	Tenants
Demographic Data					
1	Are you owning residential property in Itzehoe?	• Yes, I own the house or apartment I live in. • Yes, I own living space that I rent out. • No, I rent living space in Itzehoe. • No, I don't live in Itzehoe and I don't own any living space in Itzehoe either. (then you can unfortunately not participate in this survey)	x	x	x
2	How old are you?	Free input	x	x	x
3	How do you define your gender?	• female • male • divers	x	x	x
4	In which district of Itzehoe is your house or apartment located?	List of districts	x	x	x
5	What kind of landlord do you have?	• Private person • housing cooperative • Municipal housing company • Private housing company • Another type • I do not know			x
Background information on the state of the HT					
6	What kind of heating system are you currently using?	List of different heating systems	x	x	x

7	Which of these renewable options do you already have, or can you envision in the next 5 years?	List of renewable technologies and choices: • In place (4) • in the planning (3) • I would consider (2) • I would not consider(1) • I do not know (-)	x	x	
8	Which of the following energy efficiency measures did you already implement, or can you envision implementing in the next 5 years?	List of energy efficiency measures and choices: • In place (4) • in the planning (3) • I would consider (2) • I would not consider(1) • I do not know (-)	x	x	
9	Do you support switching to renewable heat in your house?	• Yes • No • I do not know, • I do not care			x
10	Do you support energetic refurbishment in your house?	• Yes • No • I do not know, • I do not care			x
11	Does your landlord plan to switch to renewable heat?	• Yes • No • I do not know			x
Awareness					
12	How important do you find the fast implementation of the energy transition in Germany?	1-10 (Not important - very important)	x	x	x
13	The state of Schleswig Holstein plans to make its heating supply climate-neutral by 2045 (Energy Transition and Climate Protection Law (EWKG)). What do you think about this goal?	• I think it is right. (4) • I think it is rather right. (3) • I think it is rather wrong. (2) • I think it is wrong. (1) • I do not care. (-) • I do not know. (-)	x	x	x
Motivation					
14	How important is it for you to contribute to climate protection through your actions?	1-10 (Not important-very important)	x	x	x

15	A legislative proposal for the amendment of the Building Energy Act (GEG) stipulates that from 01.01.2024, only new heating systems powered by min. 65% renewable energy may be installed. What do you think of this proposal?	• I think it is right. (4) • I think it is rather right. (3) • I think it is rather wrong. (2) • I think it is wrong. (1) • I do not care. (-) I do not know. (-)	x	x	x
Knowledge					
16	How do you rate your technical knowledge?	• My knowledge is high. (4) • My knowledge is rather high. (3) • My knowledge is rather low. (2) • My knowledge is low. (1)	x	x	x
17	How do you rate your policy knowledge?	• My knowledge is high. (4) • My knowledge is rather high. (3) • My knowledge is rather low. (2) • My knowledge is low. (1)	x	x	
18	How do you rate the availability of consulting services on renewable heat and energy-efficient refurbishment in Itzehoe?	• Sufficient (4) • Rather sufficient (3) • Rather insufficient (2) • Insufficient (1) • I don't know. (-)	x	x	
Structure of the Process					
19	How would you rate the effort required to find out about and perform a heating system replacement or energetic refurbishment?	• Appropriate (4) • Rather appropriate (3) • Rather too high (2) • Too high (1) • I don't know (-)	x	x	
20	How do you evaluate the availability of specialized workers for the implementation of renewable heat projects in Itzehoe?	• Appropriate (4) • Rather appropriate (3) • Rather too high (2) • Too high (1) • I don't know (-)	x	x	
21	*It is difficult for me to decide on a heating technology because it is not clear to me if and when there will be a district heating offer in my area*.	1-4 (agree-don’t agree + I don’t know)	x	x	

Financial aspects					
22	Do you have access to sufficient financial resources to invest in renewable heat and/or an energy retrofit for your home?	• Sufficient resources (4) • Rather sufficient resources (3) • Rather no sufficient resources (2) • No sufficient resources (1) • I don't know (-)	x	x	
23	Do you think you can save money in the long term through an investment in renewable heat and energetic refurbishment?	• Yes • No • I do not know	x	x	x
24	Are the current subsidies an incentive for you to invest in renewable heat and/or energy renovation?	• Yes • No • I do not know	x	x	
25	*I am worried that my rent will be increased to much due to refurbishment*.	1-4 (agree-don't agree + I don't know)			x
Specific local and personal situation					
26	*The structural conditions of my house make it difficult to renovate my house energetically and to change the heating*.	1-4 (agree-don't agree + I don't know)	x	x	
27	*I am concerned that there is a low acceptance of renewable energy projects in my neighborhood*.	1-4 (agree-don't agree + I don't know)	x	x	
28	*I expect a higher living comfort through a new heating system and energetic refurbishment*.	1-4 (agree-don't agree + I don't know)			
29	*I am worried that I won't like the operation of the new heating system*.	1-4 (agree-don't agree + I don't know)			
30	*I believe that my home will not be sufficiently and reliability heated with renewable energies*.	1-4 (agree-don't agree + I don't know)	x	x	x
31	Is your living space part of a condominium owners' association (WEG) and if so, how is joint decision-making organized?	• I do not live in a WEG • Constructive • Rather constructive • Rather difficult	x	x	
Open-ended questions					
32	Are there other aspects that speak in favor of the replacement of the heating	Free input	x	x	x

	system and energetic refurbishment for you?				
33	Are there other aspects that speak against the replacement of the heating system and energetic refurbishment for you?	Free input	x	x	x
34	Is there anything else you want to let me know?	Free input	x	x	x

Appendix C: Newspaper article

Umfrage zur Wärmewende in Itzehoe

Was motiviert Menschen dazu in den kommenden Jahren auf erneuerbare Heizquellen umzustellen? Oder was hält sie davon ab? Antworten darauf soll jetzt eine Umfrage geben.

Das Energiewende- und Klimaschutzgesetz des Landes Schleswig-Holstein sieht vor, bis 2045 Klimaneutralität in unserem Bundesland zu erreichen. Der Weg dorthin ist weit. Neben Strom und Verkehr spielt die Heizwärme eine besondere Rolle. Laut Umweltbundesamt stammte im Jahr 2022 nur 17 % der Heizenergie (Wohngebäude und Industrie) aus erneuerbaren Quellen.

Um die CO2-Ziele zu erreichen, ist eine Wärmewende nötig. Damit sie vor Ort vorankommt, erstellt die Stadt Itzehoe, wie viele andere Kommunen in Schleswig-Holstein, eine kommunale Wärmeplanung. Die Planung will aufzeigen, wie genau die klimaneutrale Wärmeversorgung aussehen soll und welche Energiequellen erschlossen werden können. Doch neben den technischen Überlegungen ist die Einstellung der Menschen in unserer Stadt bei diesem Thema zentral. Die Frage lautet: Was motiviert Menschen dazu in den kommenden Jahren auf erneuerbare Heizquellen umzustellen oder ihr Haus zu sanieren? Oder was hält sie davon ab?

Spätestens seit dem Ukrainekrieg steht das Thema Heizen ganz oben auf der Agenda. Die Energiepreise sind in die Höhe geschnellt. Die Debatte um eine verlässliche und nachhaltige Energieversorgung gewinnt an Schärfe. Der Klimawandel schreitet voran. Gesetzesvorhaben sorgen für heftige Diskussionen – wie etwa das neue Gebäudeenergiegesetz (GEG), da es für neue Heizungen bereits ab Januar 2024 einen 65-prozentigen Anteil an Erneuerbaren festlegen könnte.

Wissenschaftlich begleitete Umfrage startet

Um herauszufinden was und wie Itzehoerinnen und Itzehoer über dieses Thema denken, hat Jana Rehder im Rahmen ihrer Masterarbeit an der Universität Utrecht und im Rahmen eines Praktikums bei den Stadtwerken Itzehoe eine Wärmewende-Umfrage entwickelt. Josefine Möller, die Klimaschutzmanagerin der Stadt Itzehoe hat sie dabei unterstützt.

Unsere Leserinnen und Leser sind gefragt!

Sie können mithelfen, Antworten auf die Fragen der Wärmewende zu finden. Nehmen Sie an der Umfrage teil. Ihre Antworten sind praktisch das fehlende Teil im Puzzle. Es ist dabei egal, ob Sie Wohneigentum besitzen oder mieten.

Jana Rehder hat im Rahmen eines Praktikums bei den Stadtwerken Itzehoe die Wärmewende-Umfrage entwickelt.

So geht's

Die Umfrage ist bis zum 2. Juli online. Sie dauert nur etwa 10 Minuten. Teilnehmen können Sie unter folgenden Web-Adresse:

https://t1p.de/Itzehoe-Umfrage

Oder Sie nutzen den abgebildeten QR-Code mit Ihrem Handy.

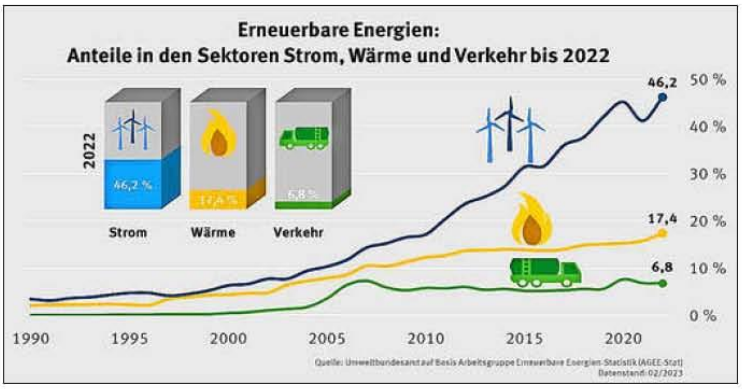

Abbildung: Umweltbundesamt

Bleiben Sie auf dem Laufenden

Bei Fragen und Anregungen zur kommunalen Wärmeplanung wenden Sie sich bitte per E-Mail an Josefine Möller unter josefine.moeller@itzehoe.de.

Für Informationen zur Umfrage schreiben Sie eine E-Mail an Jana Rehder j.c.rehder@students.uu.nl. Wenn Sie möchten, schickt sie Ihnen die Ergebnisse der Umfrage nach Auswertung gern zu.