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Abstract

This paper investigates potential drivers of technology and financial investments in energy transition technologies (ETT). The empirical findings rely on three online surveys, one conducted in March and the other two in May 2024 in Germany. The paper presents the descriptive results of the surveys. Respondents reveal a significant engagement in energy-efficient appliances and building measures, followed by roof-mounted PV systems and heat pumps. Notably, financial investments in renewable energy projects remain low. The general approval for the energy transition is high but declines when associated with burdens. Co-ownership of local energy suppliers or municipalities in energy projects enhance investment willingness of citizens, emphasizing the importance of trust in local policymakers. Key non-monetary factors influencing investment decisions include non-monetary costs such as stress and physical efforts, as well as non-monetary benefits such as ease of use, energy independence, or environmental benefits. The paper highlights that while monetary costs are crucial, non-monetary aspects, such as efforts, individual benefits, followed by social benefits, significantly motivate investments in ETT, underscoring the complexity of factors influencing financial participation in energy transition.

Keywords: financial participation, energy transition, preferences, design elements, non-monetary effects

Contents

1 Introduction

Striving for a carbon-neutral economy in 2050 to combat climate change is the overarching objective of the European Union (EU). At the same time the EU also aims at ensuring an affordable, secure, efficient and competitive energy supply within the EU (European Commission 2015, 2018). The Treaty of Lisbon of the European Union (2007) lays out the goals of the EU, which encompass economic, social and environmental aspects. These include "promote peace, its values and the well-being of its citizens, achieve sustainable development based on balanced economic growth and price stability and a highly competitive market economy with full employment and social progress, promote social justice and protection, combat social exclusion and discrimination". Regulatory, behavioral and technological measures are key to further drive the energy transition (European Commission 2022a).

The European Commission has commissioned several impact assessment studies that focus on the economic and climate impacts of the energy transition such as investments into the energy system, future energy prices, impacts on employment and gross domestic product as well as on CO2 emissions (European Commission 2020, 2022b). In contrast, socio-economic impacts, for instance, distributive effects on income and wealth, ownership of assets and returns, ex- or inclusion of citizens as well as impacts on well-being of energy consumer were not, holistically considered in the impact assessments (European Commission 2020). To the authors' knowledge, the evaluation of investments in low-carbon technologies for the energy system, including energy efficient and energy transition technologies (thereafter abbreviated as ETT), has not included a comprehensive set of socio-economic aspects.

Therefore, the project “Socioeconomic indicators of technology assessment” (SOITec), funded by the German Federal Ministry for Economic Affairs and Climate, focuses on indicators that account for macro-, micro-, and socio-economic impacts in technology assessments. The focus of this paper is on socio-micro-economic aspects in the context of investments in ETT. These effects comprise required costs and impacts on well-being of citizens and economic efficiency that arise from investing in or using ETT. Furthermore, we include distributional and social fairness aspects to account for social justice and inclusion when using ETT. The term well-being is defined as the state of feeling healthy and happy by Cambridge Dictionary (2023). It includes non-monetary aspects as well. Since monetary impacts have already been intensively addressed in literature, we focus on non-monetary effects from using ETT. Further, we include the potential of ETT investments for making citizens to participate and being included in the energy transition.

Subsequently, this working paper investigates what kind of non-monetary effects (NME) are perceived and how important are they. Generally, this includes non-monetary costs and benefits of ETT, but a focus is set on non-monetary costs, i. e. efforts citizens have to make. Second, it looks at the characteristics of technologies and investments that drive citizens to adopt or invest in them, and thus to financially participate in the energy transition (ET). Therefore, we aim at identifying preferred design elements of potential financial participation options.

The goal of our paper is to focus on micro-socio-economic aspects to understand which factors and design elements potentially affect investments in or use of ETT by citizens. Specifically, we seek to identify which NME are more or less perceived by citizens when investing in and utilizing ETT, and how significant these effects are. Additionally, we explore the preferred design elements of investment schemes for ETT investments that may act as potential drivers or barriers for financial participation, and factors affecting inclusion of citizens or social groups. We also investigate whether attitudes and acceptance of the ETT influence investments in ETT. Methodologically, we perform a literature review on NME of investing in and utilizing ETT, as well as on design elements

of these investments. The review findings are discussed within the context of a stakeholder workshop and are used to develop a survey targeting German households regarding these effects and preferences.

The purpose of this paper is to outline the survey structure, setting and results. It includes descriptive results of the surveys and derives some conclusions on NME and design elements of financial participation options and outlines further research questions. We explain the frameworks of our research in section 2, and the methodological approach in section 3. The survey's settings and results are detailed in section 4 and 5, respectively. The paper ends with a discussion and conclusion (section 6).

2 Frameworks used in the study

We briefly explain two frameworks that we use for our analysis, i.e., the typology of financial participation (cf. section 2.1), and the delineation of attitudes and acceptance of the ETT (cf. section 2.2).

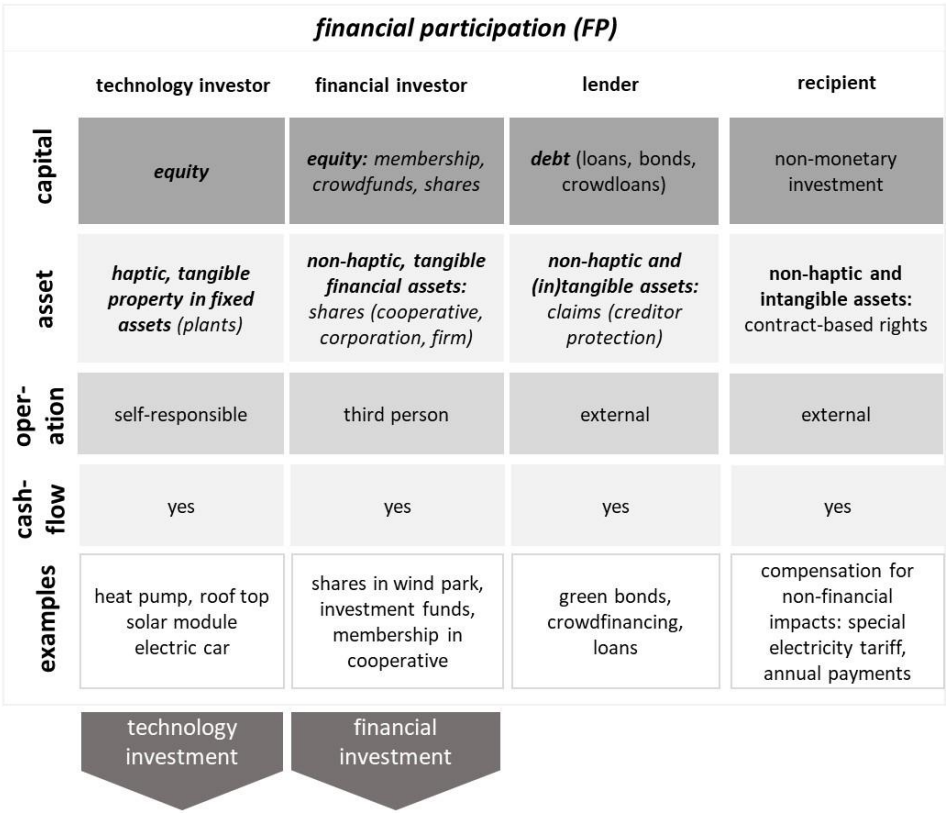
2.1 Financial participation

The term financial participation (FP) is widely used in the context of material financial participation and distributive justice (Langer et al. 2017), as well as in the context of acceptance of local wind projects (Knauf and Le Maitre 2023). Using the definition of Breitschopf et al. (2024b) for FP in the ET, we adapt the dimensions: i) type of capital; ii) ownership of assets; iii) responsibility of operation; iv) existence of a cash-flow. The latter includes for instance tax-based profit sharing or compensation payments. Given the specific characteristics of these dimensions, we identify four types of FP:

1) Technology investments: owners or investors acquire technologies as asset (haptic) and are responsible for operation of the technology. There is a cash-flow encompassing investments and operating capital. Examples are personal electric car, rooftop PV system, or heat pump in their own dwelling. Investments into energy efficiency, even though they are small, are considered as investments in a technology as well.
2) Financial investors: they are shareholders of companies or members of communities, and they invest their equity in projects, corporations, or cooperatives. They purchase shares without being responsible for the operation of the asset, corporation or cooperative. The cash-flow is limited to investments and operational returns.
3) Lenders: they invest in debts, i.e., they hold debt investments and have a right of repayment, but they have no ownership in the asset, nor are they responsible for its operation (e.g., corporate or government bonds or loans). The cash-flow encompasses the investment, interest, and loan repayment.
4) Recipients: they "provide" non-financial input in terms of "tolerating negative impacts" and receive a compensation for their endurance, for instance special electricity tariffs, tax-based profit sharing or annual fixed payments for tolerating noise emissions from a nearby wind park. They only fulfil the criteria of having a cash-flow (revenues).

For the survey, we focus on technology and financial investors that conduct either technology investments or financial investments, respectively. Figure 1 shows the various forms of financial participation.

Figure 1: Typology of financial participation



Source: adjusted illustration based on (Breitschopf et al. 2024b)

2.2 Attitudes and acceptance

Further aspects of our research were attitudes and acceptance of the ETT since they might have an impact on FP. Acceptance could be understood as the combination of an attitude and the respective intention to act accordingly, i.e., the expression for the intention to invest in a certain technology or to adopt a certain behavior (Arndt 2011). The term acceptance is rather abstract, and several approaches exist to better define this term. For example the differentiation into passive and active acceptance behavior combined with positive and negative valuation of the energy transition (Schweizer-Ries 2008), the distinction into socio-political, local and market acceptance (Wüstenhagen et al. 2007), a differentiation in different actor groups and levels (Upham et al. 2015) or differentiation into acceptance object, subject and context (Schäfer and Keppler 2013). The acceptance model by EnArgus encompasses three dimensions to explain acceptance, the attitude, action and normative dimension (EnArgus Wiki 2024). For the purposes of our analysis, we combine the action and attitude dimensions and use the framework of Breitschopf et al. (2024b) which relies on the dimensions action and impactedness, the latter reflecting an attitude towards the impacts resulting from actions.

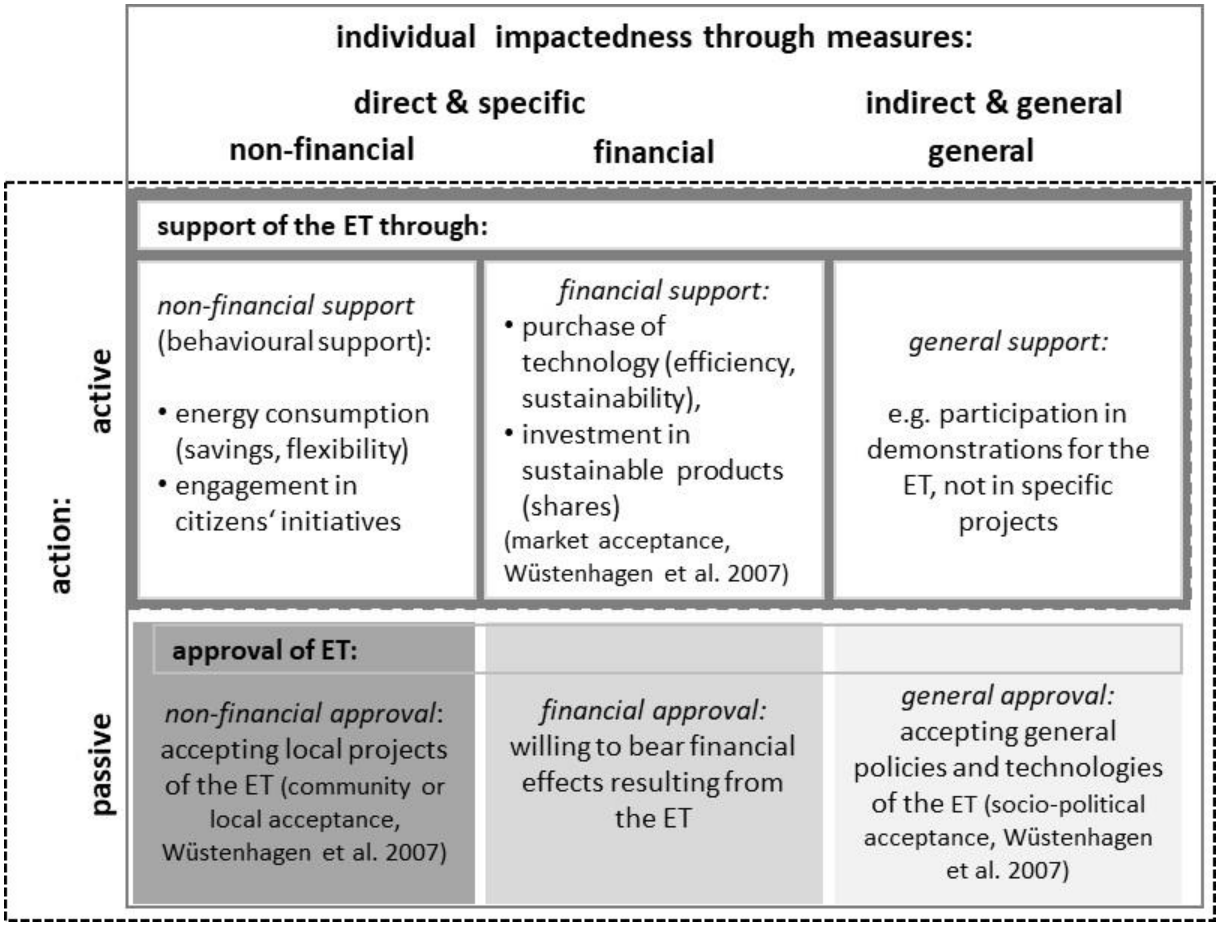
Action involves an activity and could be understood as the active (non-)acceptance of the ETT through actions e.g. purchasing a technology and thus accepting the market (Wüstenhagen et al. 2007), while a passivity, i.e. non-action is characterized by a passive behavior with others or third persons being active. Thus, the impacted person passively (not) accepts resulting impacts of the energy transition (Schweizer-Ries 2008). Within this framework, we call a passive acceptance approval and an active acceptance support of the ET.

Impactedness refers to the type of impacts that are accepted or not accepted. The general, societal or socio-political acceptance (coined by Wüstenhagen et al. (2007)) entails not immediate direct

impacts of ET measures such as target setting, while direct actions or measures imply immediate impacts of financial and non-financial nature. The acceptance of non-financial impacts is often termed community or local acceptance (Wüstenhagen et al. 2007) in the context of actions conducted by third persons. Financial impacts could result from active decisions to spent for or acquire ETT or from measures taken by third persons but entailing financial impacts on others.

The concept is illustrated in Figure 2.

Figure 2: Forms of acceptance of the energy transition



Source: adjusted illustration based on Breitschopf et al. (2024b). Note: Financial approval as well as non-financial approval and support are also inquired within the online survey of this study. General approval and non-financial approval correspond to socio-political acceptance and community acceptance, respectively, coined by Wüstenhagen et al. (2007). ET = energy transition.

3 Methodological approach

Methodologically, we combine a literature review (cf. section 3.1) and stakeholder workshops (cf. section 3.2) to derive the resulting theoretical concept (cf. section 3.3), which is then implemented in the surveys (cf. section 3.4).

3.1 Literature review

A review of the literature on socio-economic indicators in technology assessments from a micro perspective, i.e., on indicators that mirror the potential of a technology to enable financial participation of and facilitate technology adoption through citizens yielded no results. Consequently, we focused on identifying NME of technology investments or adoptions, as well as the design elements of financial investments in ETT.

Non-monetary effects

The energy transition affects individual well-being in various ways. Techno-economic assessment studies such as the integrated impact assessments of the European Commission climate ambitions (European Commission 2020) consider NME at the macro level, i.e. the overall economy and society, in terms of health effects and CO_2 emissions. These are internalized and monetarized through their impact on GDP. At the energy level, the share of renewable energy, the flexibility through sector coupling as well as the exposure to energy poverty could be considered non-monetary effects. The impacts from a micro-perspective have not yet been covered in these studies. In the following the results of a literature review on NME is presented. It forms the basis of the methodological approach.

To capture negative impacts of the energy transition on the well-being of citizens, Buchmayr et al. (2022) combined different social impact assessment methods. They differentiated the impacts into impacts on human health, human rights, working conditions and local job situation, quality of residential life and landscape. A literature review in Breitschopf et al. (2023) shows that barriers to using or adopting ETT are costs in form of efforts at the side of individuals. Examples of these non-monetary costs are **physical efforts** or strains for (re)constructions (Breitschopf and Billerbeck 2023), discomfort through noise, emissions and additional efforts from using new heating technology requiring re-arrangements of the physical environment (van Rijnsoever and Farla 2014), Stieß et al. (2010)) no construction site-in house (VZ RLP 2022). In addition, changes in practices or routines (Sovacool et al. 2019) and incorporation in daily life/routines, e.g., outlined in Gordon et al. (2022)'s overview are **behavioral efforts**. Moreover, planning of project, searching and coordinating installers or craftsmen (VZ RLP 2022; Stieß et al. 2010), installing, operating and becoming familiar with a new technology (Breitschopf and Burghard 2023), understanding complex procedures (Ebrahimigharehbaghi 2022; VZ RLP 2022) and technologies, is time consuming and mentally exhausting (VZ RLP 2022). In addition, uncertainty due to changing market, regulatory or policy conditions (Ebrahimigharehbaghi 2022; Knoefel et al. 2018) represents a mental burden as well. We call these **mental efforts** or **psychological** stress. Changes in heating system or building envelope also entail **cognitive efforts** since technical, organizational, institutional learning is required. In the long-term, this learning contribute to cost reductions (Sagar and van der Zwaan 2006), but in the short-term these are efforts often forced by a third party in order to use ETT. Overall, all these aspects require "mental or cognitive work" and thus, represent to some degree non-monetary costs in the short term.

Furthermore, dependency on a supplier is a non-monetary cost (Breitschopf et al. 2023) while the opposite, **self-determination** and self-organization (van Zyl-Bulitta et al. 2019) or self-realization

(Brummer 2018) stand for non-monetary benefits. Similar to this are the desire of being autonomous or self-supplying with respect to energy (Breitschopf and Burghard 2023). This aligns with the well-being approach, which is understood as humans can take their own decisions, i.e., have the freedom to choose and realize their goals as outlined in the paper of Künneke et al. (2015). Overall, the use of new ETT gives a **value proposition** (Schwidtal et al. 2023). This value proposition could be of financial nature, for instance, reduction in energy costs, increase in real estate values, or environmental nature, e.g. the contribution to the energy and climate goals through climate-friendly renewable electricity and heat (VZ RLP 2022). Further value propositions arise through flexibility potentials of new technologies, low-carbon mobility, energy efficiency, security, autonomy and comfort (VZ RLP 2022).

The **decentralization** of the energy systems means decentralized assets and software (Diaz Valdivia 2023) with physical and organizational proximity of generators to consumers (Hvelplund and Djørup 2019), enabling **coordination of collective** actions (or cooperations (Yildiz et al. 2015)) via market places at low costs (Diaz Valdivia 2023). However, this market change potential entails shifts in market structures, organization and ownerships (Jolink and Niesten; Iskandarova et al. 2021) leading to **organizational learning** and, hence, to higher transaction costs (Hvelplund and Djørup 2019) for all actors at least in the short-term. Similar, unbundling as vertical de-conglomeration of responsibilities requires more coordination and transactions but also entails more responsibilities and self-organization (van Zyl-Bulitta et al. 2019). This self-organization and cooperation among citizens in the energy sector involves **sharing** of responsibilities in decisions, pooling of resources and competencies (Yildiz et al. 2015) that reduces liabilities and risks and increases economic efficiency. This could also be considered as a benefit, especially if inclusion of (energy) poor or social disadvantaged households increases.

Our primary focus is the perspective of citizens that face individually perceived costs and benefits of the energy transition. Based on the findings from literature, we have identified several types of efforts (physical, organizational, cognitive, behavioral and mental or psychological) associated with learning how to install and operate and handle ETT and dependency. At the same time, the use of ETT offers a value proposition that comprises sustainability aspects, social needs, societal aspects, financial and economic issues. Expanding the scope from installation over markets to the broader environment of ETT, NME arise from contributions to sustainable development goals (SDGs). However, the perceived efforts and utility, contributions and value propositions of using ETT are determined by an individual set of values and contextual factors (Steg et al. 2015). The values comprise biospheric and altruistic values aimed at helping others, and hedonic and egoistic values aimed at helping oneself (Sovacool et al. 2020; van der Werff and Steg 2016; Steg et al. 2015). The individual weighting of these values makes it difficult to derive generally valid indicators for ETT assessments. A further challenge is that some of these value propositions or efforts are driven by factors that are dominated by contextual factors such as policies, regulations, peers' behavior (Steg et al. 2015) that are not intrinsic to technology.

Design elements of financial participation

For the purpose of identifying features or design elements of different forms of financial participation, we take a look into current discussions in literature on motivations and reasons for investments in the energy transition. Pons-Seres de Brauwer and Cohen, Jed, J. (2022) and Guetlein and Schleich (2023) investigated citizens' interest and participation in energy communities. They found preferences for a high rate of return, low minimum investment share, participation of municipalities, profit sharing for environmental support, and a rejection of risks of losing the investment. Yildiz et al. (2015) attributed risk sharing through the involvement of multiple parties also a feature of energy communities. Moreover, Brummer (2018) described energy communities

by their benefits such as economic benefits, financial and procedural participation, community building and self-realization. Following further the discussion on energy communities, the value proposition of energy communities such as energy generation, self-consumption, grid reliability, energy savings and costs are seen as the driving force behind energy communities (Kubli and Puranik 2023). These value propositions are linked to value capture such as revenues from energy services , energy cost savings and key functions that energy communities fulfil such as facilitating trading of peers, aggregating flexibility, managing storage, energy delivery (Rossetto et al. 2022; Kubli and Puranik 2023). In addition, Vernay and Sebi (2020) stress the significance of energy communities in getting access to resources that are otherwise not available for citizens, such as shared knowledge and experiences, or access to electricity from solar power. Further aspects of energy communities such as financial volume, cooperation partners, public/private investor or co-owner, ownership structure and decision rights are outlined in Lowitzsch et al. (2023).

Motivational aspects for investments in ETT might be further features of ETT and forms of financial participation. According to Grill and Perczynski (2015), investors can have various objectives when making investments. The most prevalent motivations include investment objectives, asset-related goals, speculative motives, participation, and control intentions. With respect to energy supply, prosumption (Iskandarova et al. 2021), security aspects of supply and independence aspirations (Breitschopf and Burghard 2023) may also come into play in addition to financial aspects, further pushing financial participation. When accounting for social fairness, climate and environmental protection, which seem to be further important drivers of applying or adopting ETT (Breitschopf and Büttner 2023), social and environmental sustainability of the technology or investment is a required feature. In contrast, participation schemes requiring a lot of capabilities, i.e., what a person needs to be able to do to use the technology (Künneke et al. 2015) limits its diffusion and participation. In addition, memberships in social networks as a non-economic driver of becoming involved in an energy community and invest in ETT (Bauwens 2019) represents another motivation. Finally, Fanghella et al. (2023) have identified the transferability of loans as an important property.

3.2 Stakeholder workshops

We conducted several stakeholder workshops with up to ten representatives from industry, society, politics and science to collect feedback on our identified areas of research, approach and selected characteristics or criteria.

Regarding the socio-economic factors, the workshop confirmed to include monetary and non-monetary effects, and not to focus on costs only, but to include benefits as well since they could trade-off some non-monetary or even monetary costs (Steg et al. 2015). Regarding a fair and inclusive energy transition, financial engagement, spending, or participation are of interest to the stakeholders. Examples include investments in individual heat pumps and rooftop photovoltaic (PV) installations for decentralized electricity generation. In line with our definition of financial participation, which includes three key criteria — ownership, investment, and responsibility for operation and management (O&M) — the workshop participants confirmed this definition. However, they suggested adding time spent as a form of non-financial investment and financial compensations for negative non-monetary impacts. Consequently, we also include lenders making debt investments and recipients of financial compensations in our definition, but we limit our analysis to investors and shareholders. The participants identified several relevant attributes of financial participation, including risks, regulatory uncertainty, return, liability, familiarity with technology, and contribution to environmental and climate protection. The technological criteria for these attributes encompass scalability, life cycle, visibility of technology, technology maturity, and repair intensity. Combining the results from the literature review (cf. section 2.1) and the inputs from the stakeholder workshop, we obtain an extensive list of design elements presented in Table

1. Regarding NME, stakeholders supported a classification into efforts, value propositions and financial aspects. Efforts comprise physical, cognitive, mental/psychological, behavioral, and organizational (time) efforts or stress, value propositions individual, social, societal benefits, and financial aspects include non-monetary and monetary factors affecting the return of an investment.

Table 1: Design elements from literature review and stakeholder workshop

Design elements of financial participation
***Financial aspects**:*
ruling out of risks (Guetlein and Schleich 2023)
high returns (Bauwens 2019; Guetlein and Schleich 2023), financial return (cost savings, profit) (Bauwens 2019; Pons-Seres de Brauwer 2022)
duration, payback, holding period (Bauwens 2019)
transaction costs through regulatory complexity (Dioba et al. 2024)
low complexity, minimum of administrative procedures (Künneke et al. 2015)
low threshold of investment (minimum investment) (Guetlein and Schleich 2023)
transferability of financial assets (Fanghella et al. 2023)
***Benefit- related**:*
decision rights (Lowitzsch et al. 2023)
outsourcing of operation (as value capture) (Kubli and Puranik 2023)
high number of different actors (Yildiz et al. 2015), involvement of municipality (Guetlein and Schleich 2023)
high autonomy, security of supply (Iskandarova et al. 2021; Breitschopf and Burghard 2023)
inclusion in social network, social status, community building (Bauwens 2019; Brummer 2018)
use of profits from renewable projects (Guetlein and Schleich 2023)
legal forms and involvement of private or public actors (Lowitzsch et al. 2023) implying impacts on liability and risks, municipal co-ownership (Guetlein and Schleich 2023)
self-realization (Brummer 2018),
self-contribution (from stakeholder WS)
contribution to climate, environment (Rahmani et al. 2023; Scheller et al. 2024)

Source: own composition based on literature review and workshop

3.3 Non-monetary effects (NME)

As a result of the literature review and stakeholder workshop, we classify NME into three categories:

1) Non-monetary costs: efforts when investing or installing ETT in terms of physical labor, cognitive performance, behavioral changes, mental or psychological stress, organizational issues and time spent.
2) Value propositions: comprise non-monetary benefits of ETT, i.e., individual benefits such as secure energy supply, self-determination, social recognition, as well as social and climate benefits such as activities of community, support of social disadvantaged groups, less impacts on environment and climate.

3) Financial aspects: translate in or affect the financial outcome of an investment. They could exist in non-monetary terms such the transfer of acquisitions of assets (transferability), required minimum investment volumes, responsibilities and liabilities, risks, and returns, while investment, operation and maintenance costs are in monetary terms. The latter could be used as benchmarks.

In addition, NME are classified as self-centered serving hedonic and egoistic needs, or altruistic and biospheric when focused on society and environment (Sovacool et al. 2020; Steg et al. 2015). This classification is used to derive and display the value orientation of citizens.

3.4 Survey among households in Germany

Online-surveys were conducted in March 2024 and May 2024 in Germany. The advantage of conducting the survey in two rounds is that it keeps the survey short, revisits specific questions and focuses on identified key points. A panelist offering contact data of German households has been contracted for all surveys. The sample is a quota-based random sample of citizens. The survey in March (sample I) is representative for Germany with respect to gender, age and education or income. The surveys in May (sample II) are split in two surveys with a specific focus and are representative for gender, age and education.

In March 2024, over 2,100 private persons have been approached and were asked to answer questions on their socio-economic situation, perceived effects (efforts or value propositions) when using or investing in an ETT (onshore wind, photovoltaic solar park, heat pump, electric car, district heating connection, shares in energy cooperative or district heating networks). Further, their preferences regarding ETT investment designs as well as their general investment preferences and attitudes were investigated.

In May 2024, a total of over 3,000 persons have been approached. About half of them answered questions on design features of PV and electric car investments (called investment or survey IIa), the other half on heating preferences (called heating or survey IIb).

The first survey included eight control questions and four in the second survey round. Answering one of the control questions incorrectly resulted in an exclusion of the participant from the survey. Furthermore, we excluded the fastest 5% of participants (shortest response time), in addition to those who answered the control question falsely.

The online surveys focus on how selected characteristics of technologies or technology systems are perceived, which design elements of different financial participation models are important and potentially affect investments, which non-monetary and monetary effects mainly restrict financial participation, and whether attitudes towards and acceptance of the energy transition and other preferences play a role for financial participation. The online surveys are conducted in German and are available in Annex A.1. The variables, their codes, scale, and range are listed in Annex 0.

4 Questionnaire and data

4.1 Survey I in March 2024

Following the outcomes of the workshops and literature review on design elements, we requested participants to prioritize selected attributes of financial participations in a survey. So, preferences of respondents for design elements are then identified through the selection and ranking of characteristics of financial participation (Annex A.1.1 question 7):

- investments risks, return on investment, investment volume, transferability
- municipal participation
- uncertainty of revenue, benefits, or costs
- environmental and climate protection
- contractual works, responsibility for O&M, ease of installation and usage
- social interactions and energy sharing
- non-monetary investment contributions
- autonomy and influence over decisions

Similarly to design elements, we link the respondents' perception and rating of NME to different technology and financial investments. The literature review provided the basis for the identification and selection of the effects. These effects are recorded using appropriate questions which are listed in Annex A.1.1 (question 4 for technology investments, and question 7 for financial investments). They include the following aspects:

- Non-monetary costs: self-centered efforts such as on construction works (physical stress), familiarity with the technology (mental stress), technical knowledge (cognitive efforts), behavioral adaptations, organizational efforts, information needs
- Value propositions: individual benefits such as acceptance by peers, good feeling, and social benefits such as beneficial for community or socially disadvantaged groups, contributions to climate and environment, high potential of interaction and participation
- Financial aspects: mainly non-monetary aspects such as autonomy, transfer of ownership, long life cycle, risks and return, minimum required investment threshold, and as monetary aspect and benchmark investment and operation costs of ETT.

General approval (attitude) of the ET is captured by two questions: a) RE deployment is needed for ET, and b) ET entails positive effects for society (Annex A.1.1 question 1a and b). Financial approval is captured through "high willingness to pay higher prices for ET" (see Annex A.1.1 question 1c), non-financial approval through asking the degree of agreement with the statement "I tolerate a distance of 1 km to onshore wind to support the ET" (Annex A.1.1 question 1d). The intended support of the ET is captured through questions addressing behavioral actions or financial investments of the participants (Annex A.1.1 question 1e) and f) and g)). The questions addressing support and approval of the ET have been applied in Breitschopf et al. (2024b), Schumacher et al. (2019) or Sonnberger and Ruddat (2017).

The actual engagement and support of ET in form of investments in technologies or financial assets, or behavioral changes is directly addressed in question such as "Do you have …? (Annex A.1.1 question 2).

Preference for technology or financial investment are asked in question 3, Annex A.1.1. We have found a few papers (e.g. Guetlein and Schleich (2024)) addressing preferences between commercial and municipal co-ownership. Therefore, the survey asked respondents to indicate which options they prefer: commercial projects versus municipal projects, or wind projects versus energy

community projects (Annex A.1.1 question 5). The value orientation, i.e., dominance of more altruistic or self-centered values is tackled with an explicit question (Annex A.1.1 question 8). There are a few papers that link questions or statements to self-centered or altruistic value orientation, for example Sovacool et al. (2020) or Breitschopf et al. (2024a), but none of them explicitly discussed the approach of how to identify value orientation in detail.

4.2 Surveys II in May 2024

The surveys IIa and IIb in May 2024 consist of two parts. Part A includes personal socio-demographic questions and the actual support of the ET through behavioral changes or financial participation (see Annex A.1.2 Part A) as outlined for example in Lienhoop (2018), Langer et al. (2017), Breitschopf et al. (2024b).

Part B has a specific focus:

a) The survey on investments (survey IIa) included questions addressing the relevance of selected characteristics of cars to complement the findings from the first survey by more "car specific" characteristics, as well as specific preferences of citizens for location, type of investors and operators of a solar power park. Furthermore, it explores the potential investment volume or willingness to invest in dependence of different types of operators. Moreover, it asks for individual ratings of common investment options in PV, wind power and infrastructure (see Annex A.1.2).
b) The survey on heating (survey IIb) focuses on the rating and preferences for selected heating systems, required features that a new heating system should fulfil, and the trade-off between costs and technological, financial, efficiency and sustainability aspects. Further, the respondents are asked to indicate which of the selected characteristics of design elements of heating systems is more or less important for them when deciding on a system. Finally, trust in institutions and attitudes towards technology and environment are included as potential explaining variables for decisions and preferences of citizens (see Annex A.1.3).

5 Results

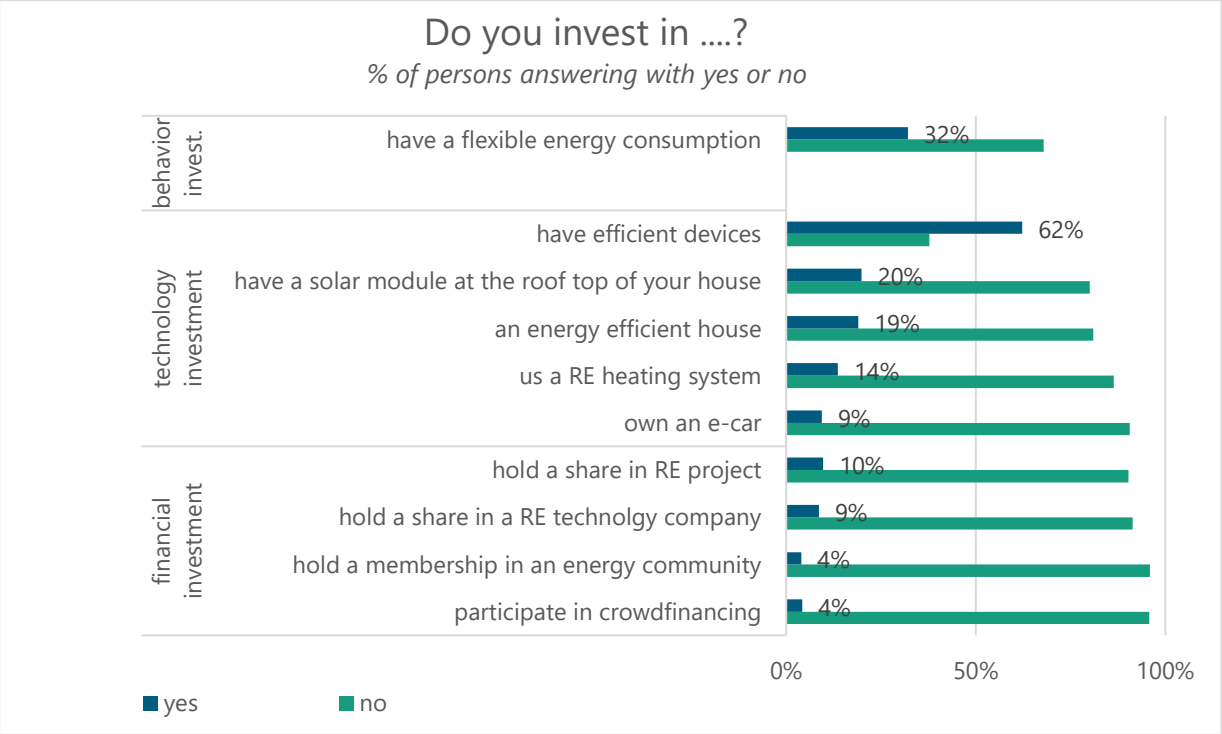
5.1 Results of the survey I in March 2024

The final dataset of survey I included **895 respondents** who answered all questions correctly and completely. Despite reducing the initial sample size by about 60%, the final sample remains representative of Germany in terms of age, sex, income, and federal state (see Annex A.2). However, there is a skew in education levels; respondents without any training are underrepresented, while those with a master's or bachelor's degree are overrepresented. Regarding housing, 56% of the respondents live in rented apartments, 4% in rented houses, 30% own a house, and 8% own an apartment. A significant portion of the participants (56%) reside in cities with more than 100,000 inhabitants, and 30% live in towns with fewer than 5,000 inhabitants.

Actual support of the energy transition

Regarding actual investments in ET and related activities by the respondents (Figure 3), about 20% have installed a solar module on their house, 14% use a renewable source for heating, and 9% own an electric car. In terms of behavior, 62% state to have purchased energy-efficient devices, 32% claim to practice flexible energy consumption, and 19% declare that measures have been taken to improve the energy efficiency of their homes. The share of financial investments, e.g. holding a share in a renewable energy (RE) project, is comparatively low as shown in Figure 3.

Figure 3: Actual participation in the energy transition

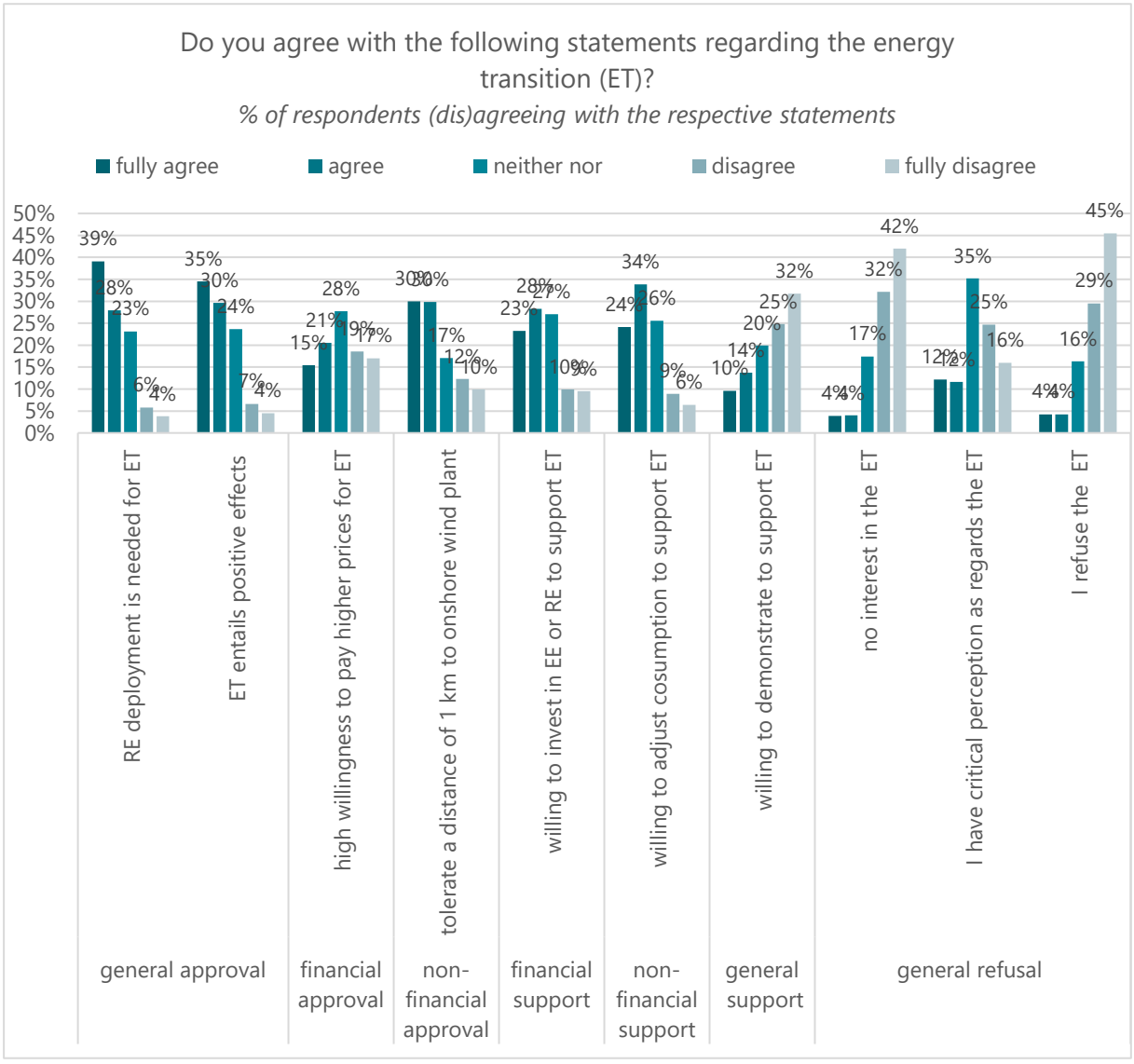


Source: own depiction based on survey data, RE = renewable energy, e-car = electric car.

Acceptance and attitudes towards the ET

The attitudes of the respondents are measured by asking them to agree or disagree with certain statements. These statements encompassed overall positive statements towards the energy transition and support in specific area of actions (Figure 4).

Figure 4: Attitudes towards the energy transition



Source: own depiction based on survey data, RE = renewable energy, ET = energy transition.

Summing up full agreement and agreement to the statements, we obtain the approval or intended support for the ET. The results show a high general approval of RE deployment and a belief in the positive societal impacts of ET, while general support, i.e., an active engagement for the ET in general is low. Regarding the financial aspect, there is a low willingness to pay higher prices for energy or mobility (financial approval), while willingness to financially engage and support the ET through investments in ETT is comparatively high (financial support). In terms of non-financial support, we find strong support for more flexible energy consumption (58% of fully agreement or agreement), and a high approval of a wind park installations within one kilometer (60%) (Table 2).

Table 2: Degree of support and approval

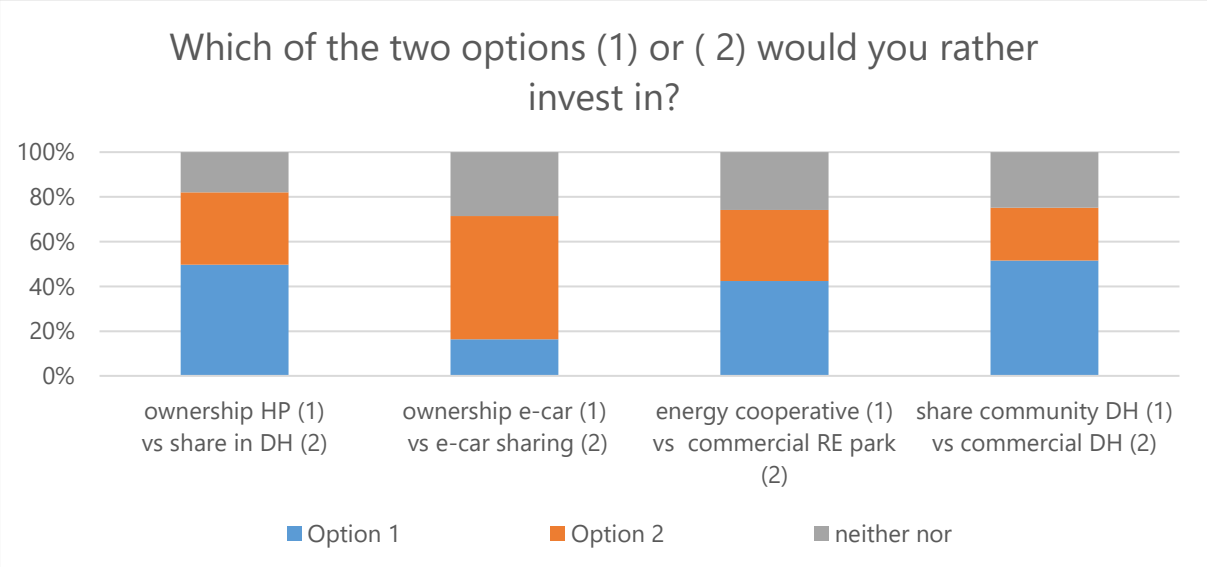
Acceptance of the ET*	non-financial	impactedness financial	general
support of the ET (active)	58%	51%	24%
approval of the ET (passive)	60%	36%	67%**

Source: own depiction based on survey data. Note: * acceptance is assessed as the sum of "fully agree" and "agree" of the respective categories in Figure 4. ** average of both questions under "general approval" in Figure 4. **

Preferences

As for citizens' preferences regarding investments and adoption of technologies, we find support for electric cars is generally low: less than 20% prefer the ownership of an electric car versus the option of car sharing (Figure 5). Albeit a high share of respondents is indifferent between the listed options, we find a stronger support for heat pumps than for district heating. Furthermore, support is stronger for municipally co-owned district heating versus private ownership of district heating. Finally, a slight majority votes for investments in an energy cooperative than in a commercial renewable energy project.

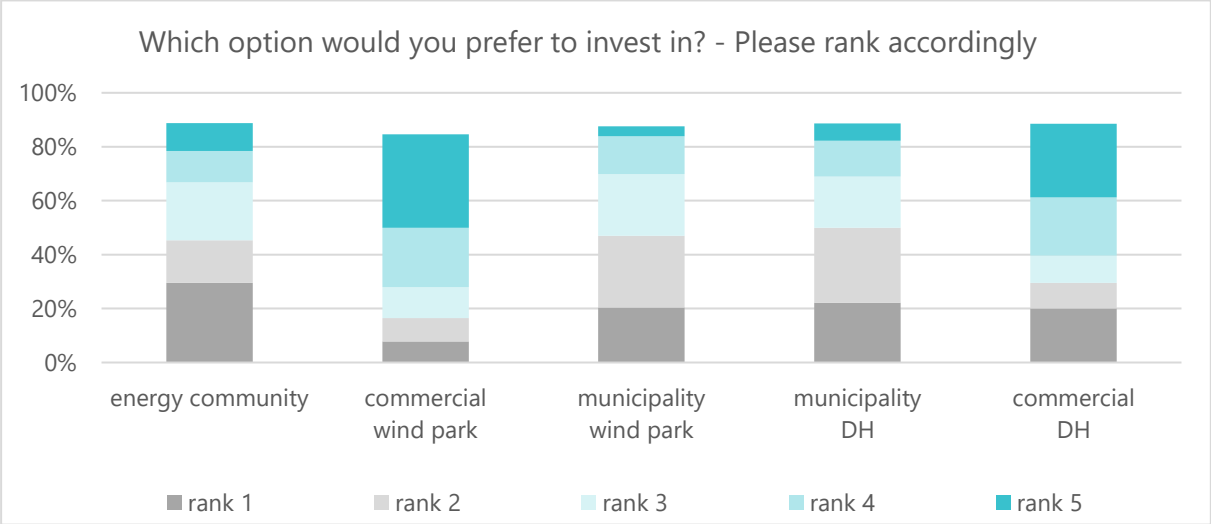
Figure 5: Preferences for investments



Source: own depiction based on survey data Note: DH = district heating; RE = renewable energy, HP = heat pump; vs = versus.

To further elaborate the preferences regarding commercial vs private projects, we find a general strong support for municipal co-ownership, especially for district heating, but also for wind power (Figure 6). Further energy community is equally preferred while a commercially operated and owned wind park is the least preferred option.

Figure 6: Preferred options

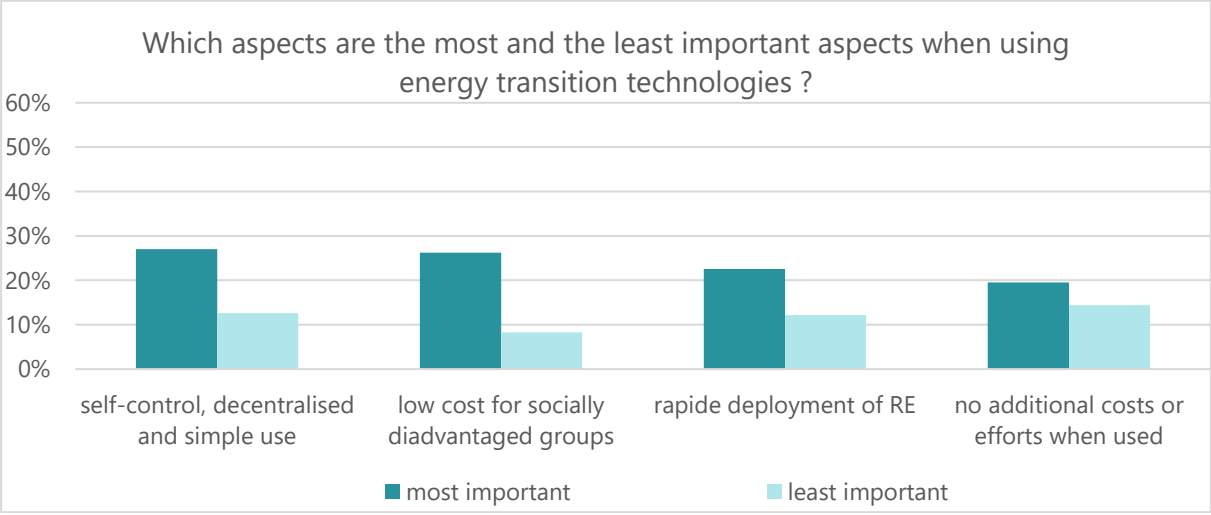


Source: own depiction based on survey data. Note: DH = district heating.

Value orientation

Furthermore, to understand the value orientation we asked to indicate the most and the least important aspects when using an energy transition technology. Our survey results display a rather equally distributed importance of social and self-centered value propositions (Figure 7).

Figure 7: Most important aspects for adoption

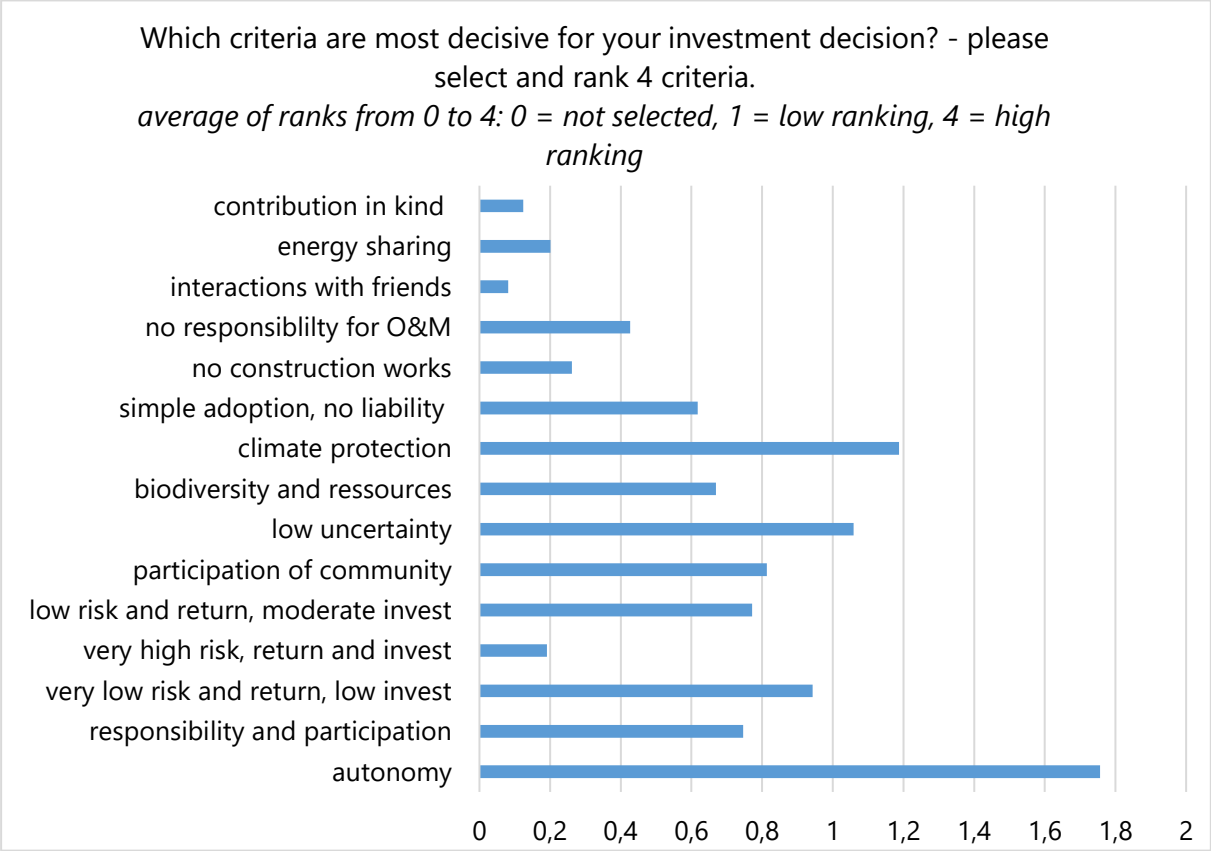


Source: own depiction based on survey data. Note: RE = renewable energy.

Preferences for design elements of financial participation

The results of the survey reveal that the key attribute autonomy is of very high importance. The contribution to climate protection is in second place, closely followed by a low level of uncertainty with respect to revenues and costs and the use of the investment, a low investment volume with a very low risk and low return (Figure 8). A potential community participation, individual participation and responsibility as well as a moderate investment volume with low risk and return are also important. The least important design elements include potential interactions with friends, contributions of in-kind investment, energy sharing, and a design that involves a combination of very high risk, return, and investment volume.

Figure 8: Preferences - ranking of design elements of financial participation



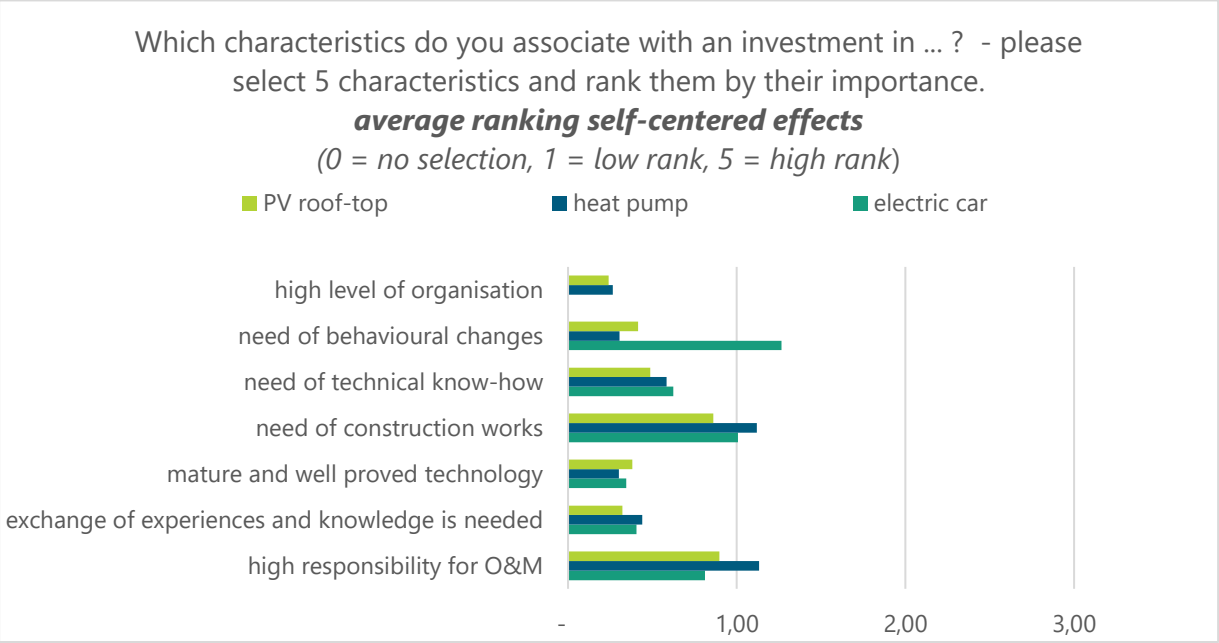
Source: own depiction based on survey data. Note: O&M = operation and maintenance.

Perceived non-monetary effects

As for non-monetary effects, we differentiate into self-centered effects, social effects financial effects. Social effects encompass hedonic (peers, good feeling) and societal (benefit for municipality, social groups) and environmental (environment and climate) value propositions, while financial effects include value propositions that directly or indirectly impact monetary evaluation, and therefore individual, financial analysis.

One question focuses on the perceived non-monetary efforts of adopting an ETT or investing in a sustainable financial product. Regarding adoption of technologies, we find a low importance for non-monetary effects, much lower than for financial products (Figure 9). Second, construction works seem to be a very important issue with a high potential of stress. Similarly, having the responsibility for O&M is also indicated as an important issue entailing mental stress, which is expected to be in particular higher for heat pumps. Third, owning an electric car is perceived with behavioral changes.

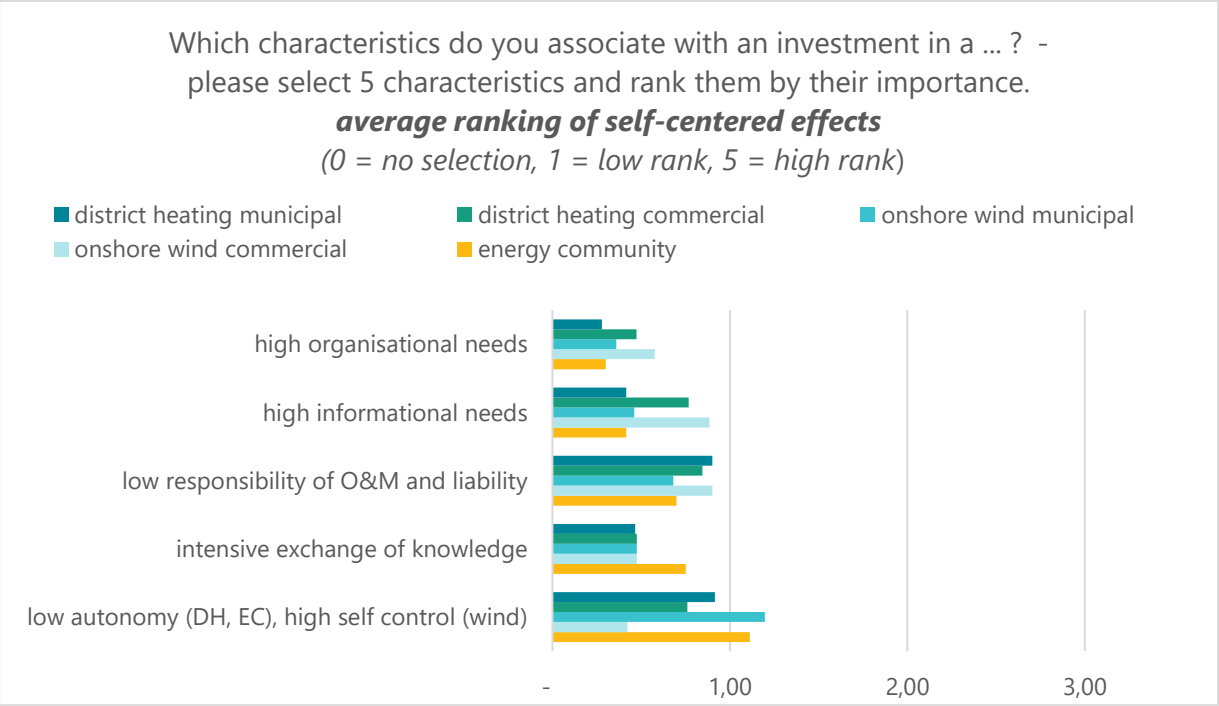
Figure 9: Technology investment and non-monetary costs



Source: own depiction based on survey data. Note: O&M = operation and maintenance.

Similar to technology investment, efforts seem to have a comparably low relevance. However, we find differences between commercial and municipally co-owned financial investments. Firstly, investments with municipal co-ownership or energy communities in general are more strongly linked to autonomy and self-control (Figure 10). Secondly, organizational and information needs are perceived as less relevant. Regarding exchange of knowledge, energy communities are ranked before the other four options.

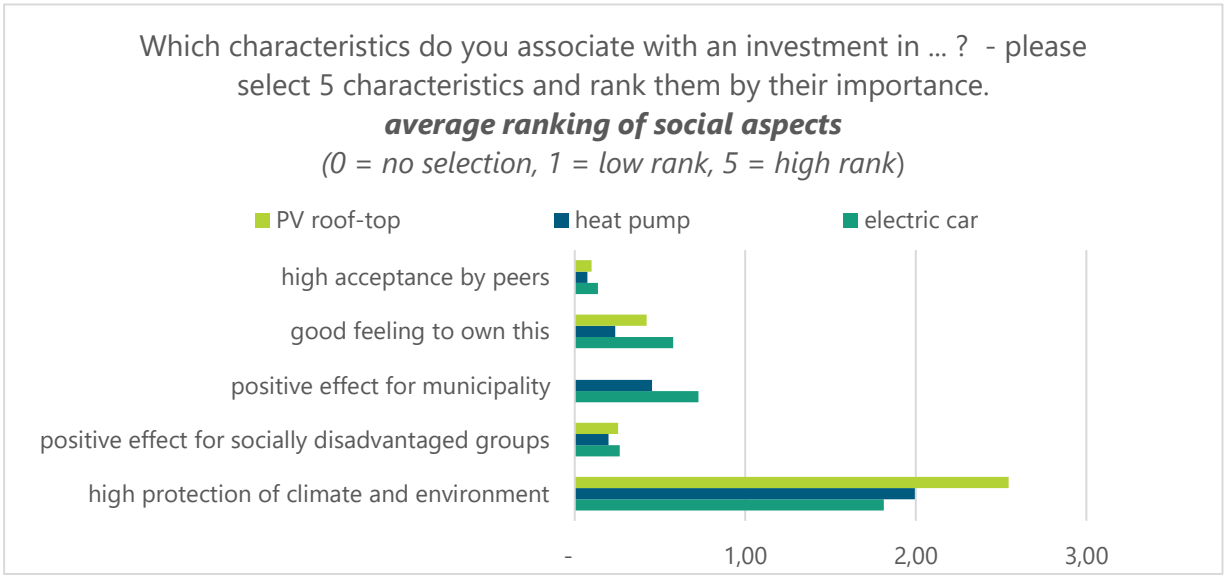
Figure 10: Financial investments and non-monetary costs



Source: own depiction based on survey data.

With respect to social value propositions, respondents expressed a strong importance of climate and environment protection, especially for roof-top solar plants (Figure 11). Its importance is similar to that of financial effects. Albeit at a significantly lower level, the acquisition of an electric car is primarily associated with a good feeling and positive effects for municipalities.

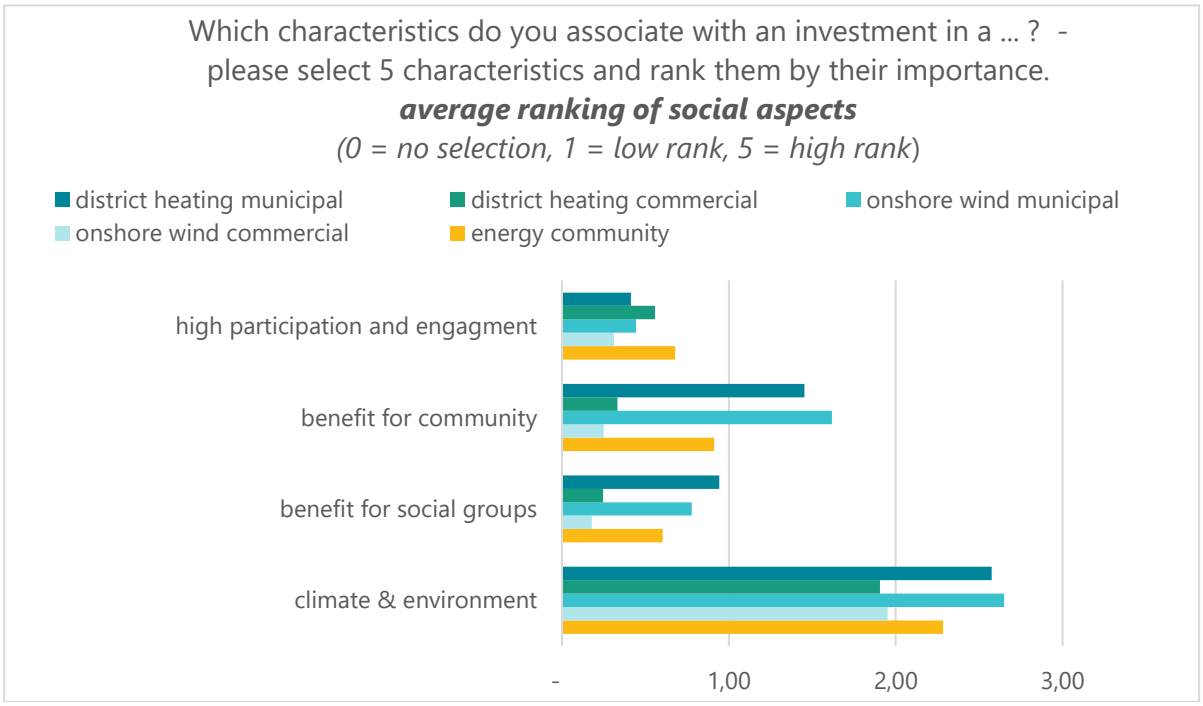
Figure 11: Technology investment and social value proposition



Source: own depiction based on survey data.

When it comes to financial investments, respondents consider positive effects for the community, socially disadvantaged groups, the environment and the climate to be more relevant in municipally co-owned investments and energy communities than in privately owned investments (Figure 12). However, the energy communities are perceived as the most important for climate and environmental issues.

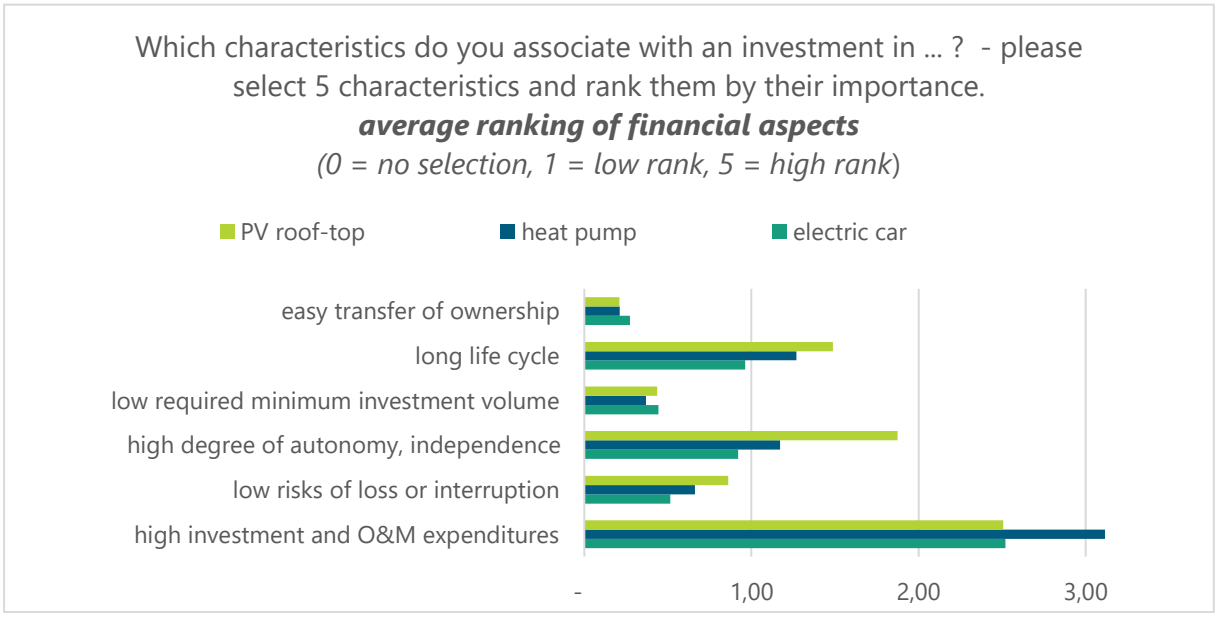
Figure 12: Financial investment and social value proposition



Source: own depiction based on survey data.

Looking at attributes that are related to financial aspects of an investment, the participants assign costs the highest relevance when investing or adopting a technology, especially for heat pumps (cf. Figure 13). Furthermore, autonomy and a long-life cycle are especially important for rooftop PV, while the minimum required investment volume, and ease of transferring ownership is perceived as less important for technology adoption.

Figure 13: Relevance of financial aspects technology investment

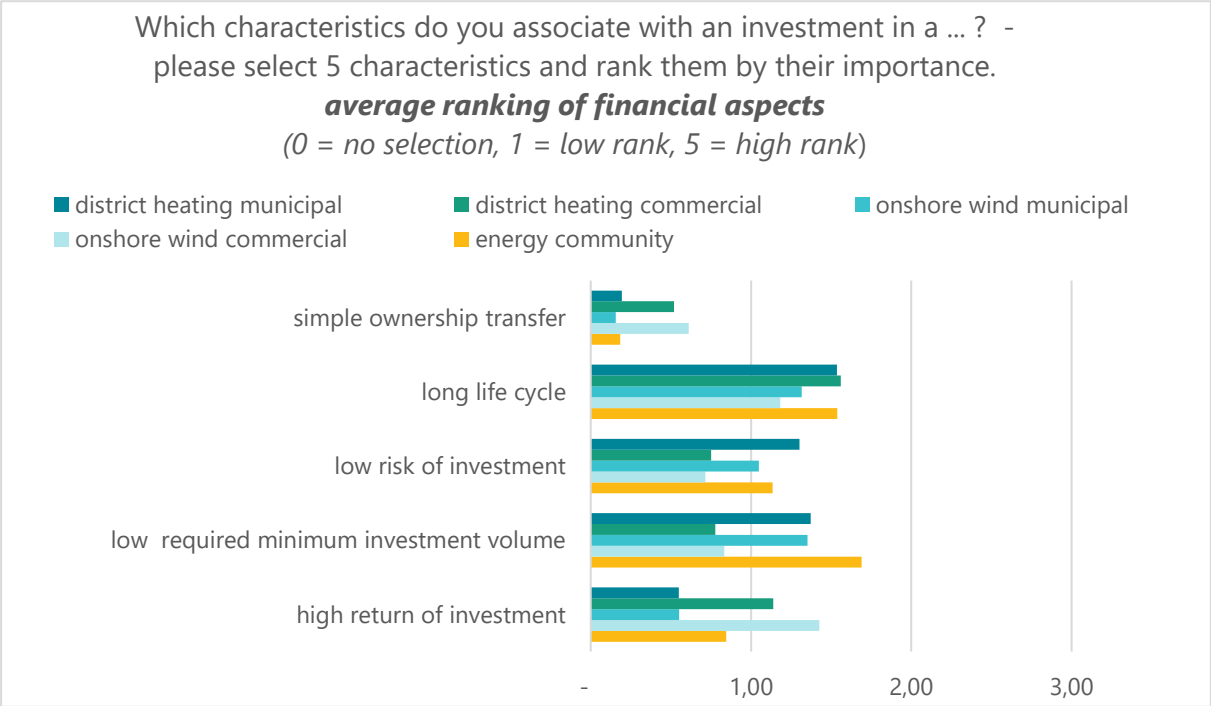


Source: own depiction based on survey data.

In contrast, respondents strongly link a low required investment volume with energy cooperatives and municipal co-ownership and assign this aspect a relatively high importance (cf. Figure 14).

Similarly, the life cycle and low risk of the investment are considered. A high return, especially on privately owned projects and an easy transfer of ownership are perceived as more relevant than for municipally co-owned projects but are generally hardly linked to financial engagement.

Figure 14: Relevance of financial aspects for financial investments



Source: own depiction based on survey data.

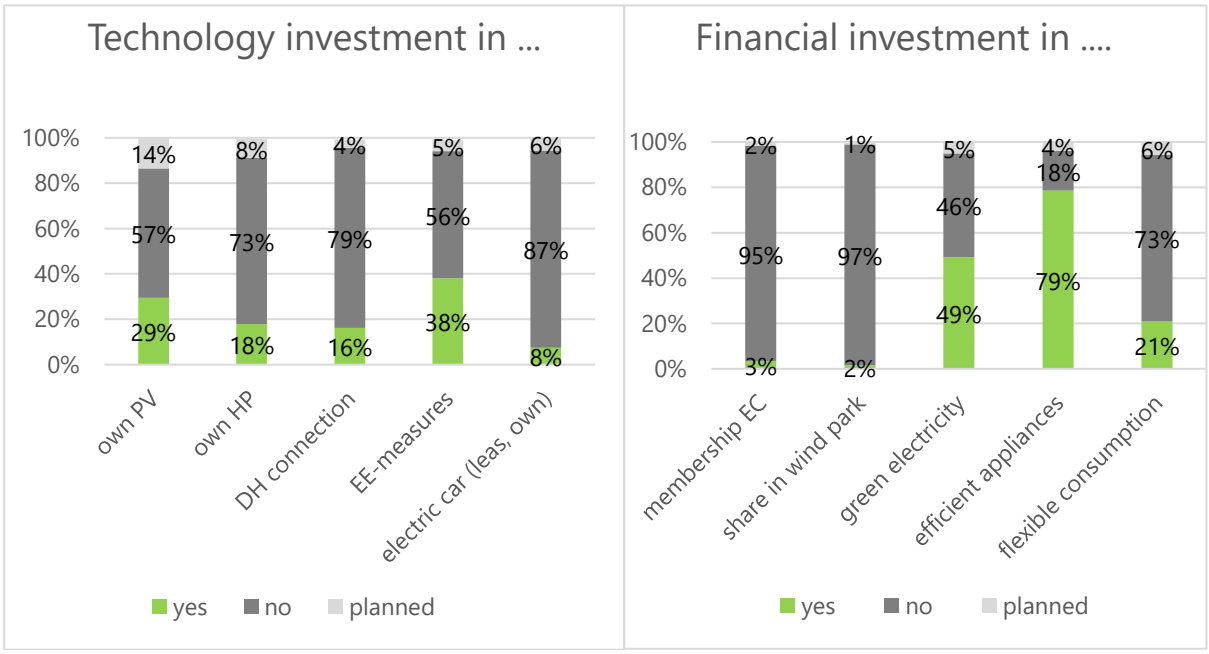
5.2 Results of surveys II in May 2024

Overall, 1,628 (survey IIa: investment) and 1,423 (survey IIb: heating) individuals participated, and 931 (investment) and 928 (heating) replies are included in the final analysis (after sample adjustment), respectively.

5.2.1 Results of survey IIa: investments

In the survey on investment preferences, we have a high share of participants who report using energy efficient appliances, investing in energy efficiency measures at their dwelling, having a green electricity supply contract, owning a small PV roof top plant and having a flexible consumption based on generation (cf. Figure 15). A comparatively high share of respondents also have an individual heat pump or are connected to a district heating network while few own or lease an electric car. Even fewer hold shares in a wind power project or are members of an energy cooperative (EC).

Figure 15: Technology and financial investments of survey IIa

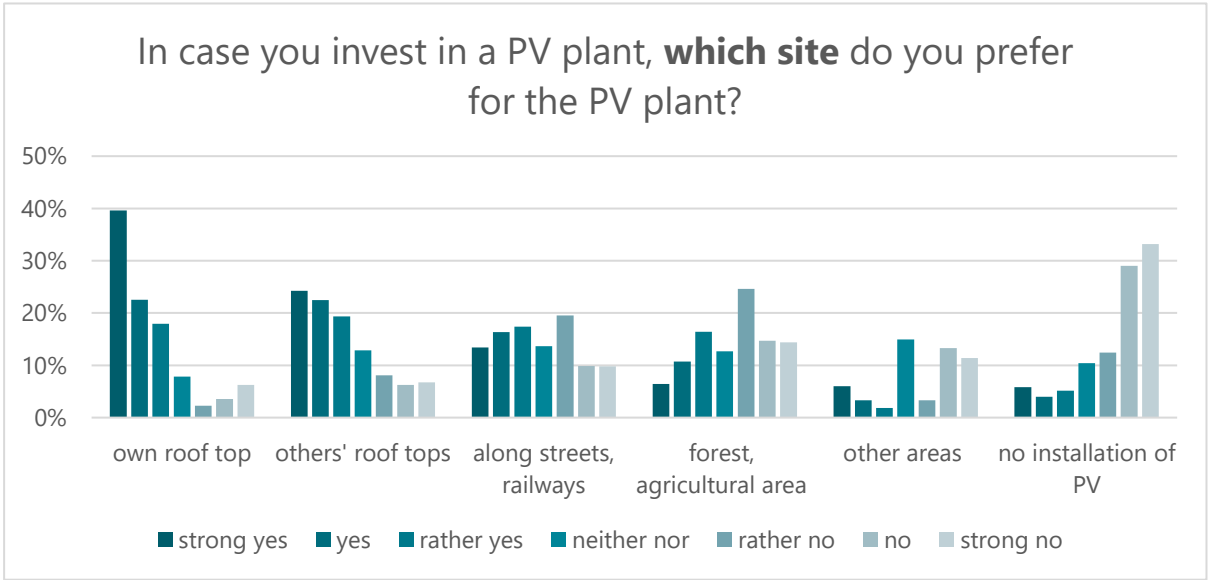


Source: own depiction based on survey data, Note: EC = energy cooperative DH = district heating, EE = energy efficiency.

5.2.1.1 Preferences regarding investments in PV and wind onshore

There is a strong agreement and support of installations on (own) rooftop PVs while in forests or on agricultural land PV installations are rather disliked (cf. Figure 16). Preferences for installations along roads and railroads are mixed.

Figure 16: Preferences for sites of a PV plant

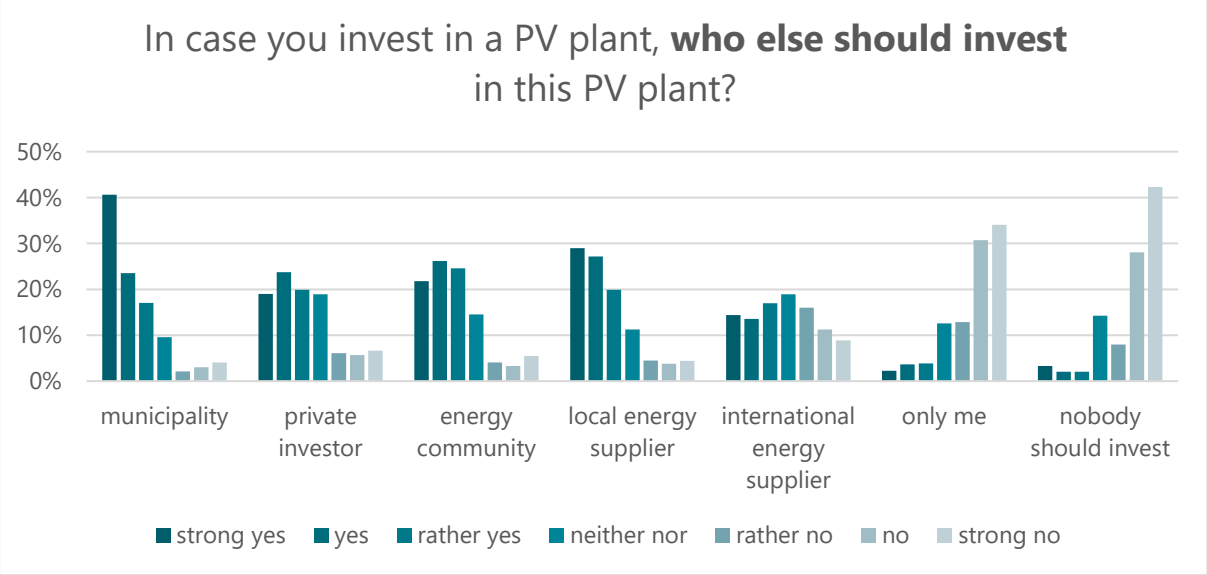


Source: own depiction based on survey data.

There is a strong preference for projects owned and/or operated by municipalities and regional energy supplier, and a weaker preference for energy communities as investors and operators. Private individuals are considered preferred co-investors, but not as operators of the project (cf. Figure 17). By contrast, there is no clear preference for or against international energy suppliers as

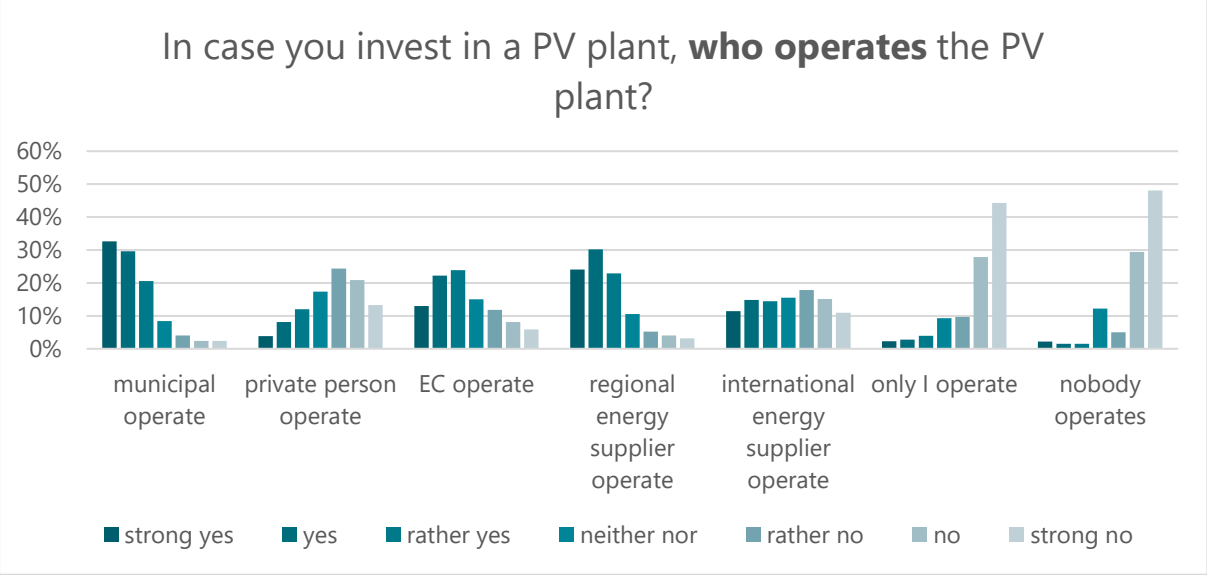
investors or operators while personal responsibility as owner and operator of a plant is not preferred at all (cf. Figure 18).

Figure 17: Preferences for investors in a PV plant



Source: own depiction based on survey data.

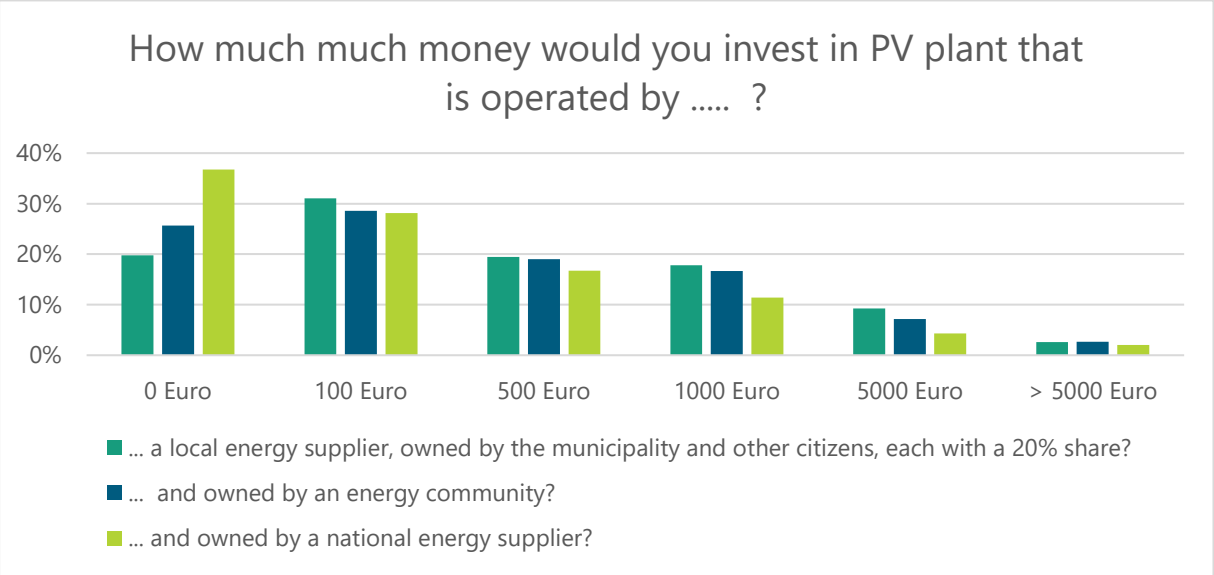
Figure 18: Preferences for operators of a PV plant



Source: own depiction based on survey data.

The readiness to invest is higher for projects operated by local energy suppliers and communities, and lowest for projects operated by national energy suppliers (cf. Figure 19). Overall, few respondents state to invest a large amount of over 5,000 euros. Nevertheless, almost 10% would invest up to 5,000 euros in projects operated by a local energy supplier while less than 5% would invest that sum in projects operated by a national energy supplier.

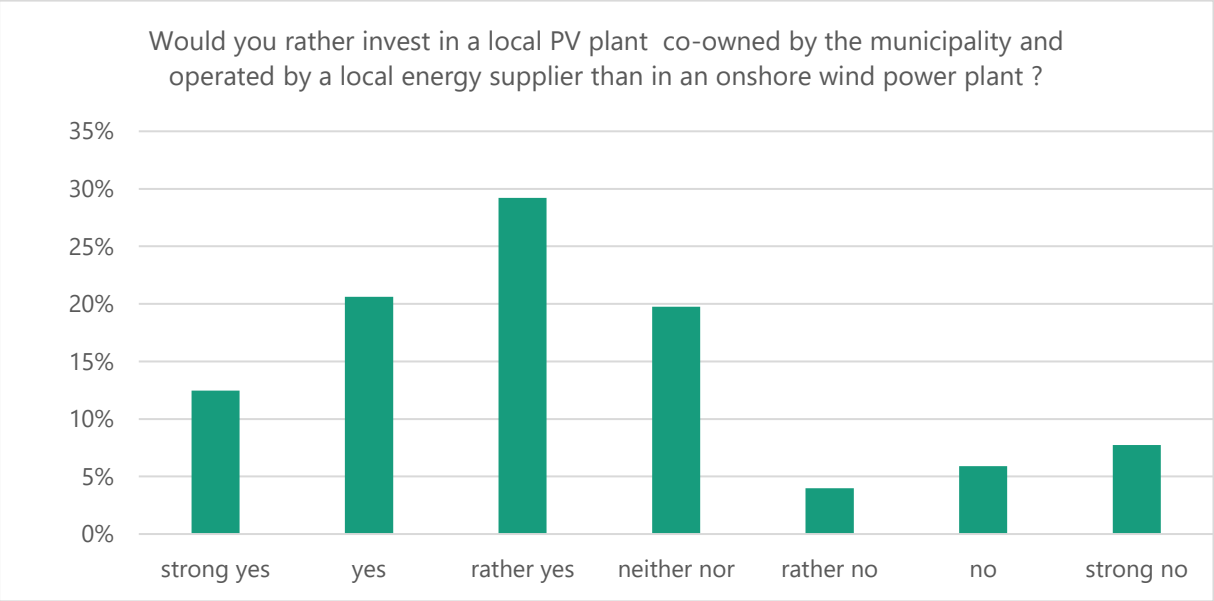
Figure 19: Preferred investment volumes in a PV plant by type of ownership



Source: own depiction based on survey data.

Preferences seem to be stronger for investments in PV than in wind power (cf. Figure 20).

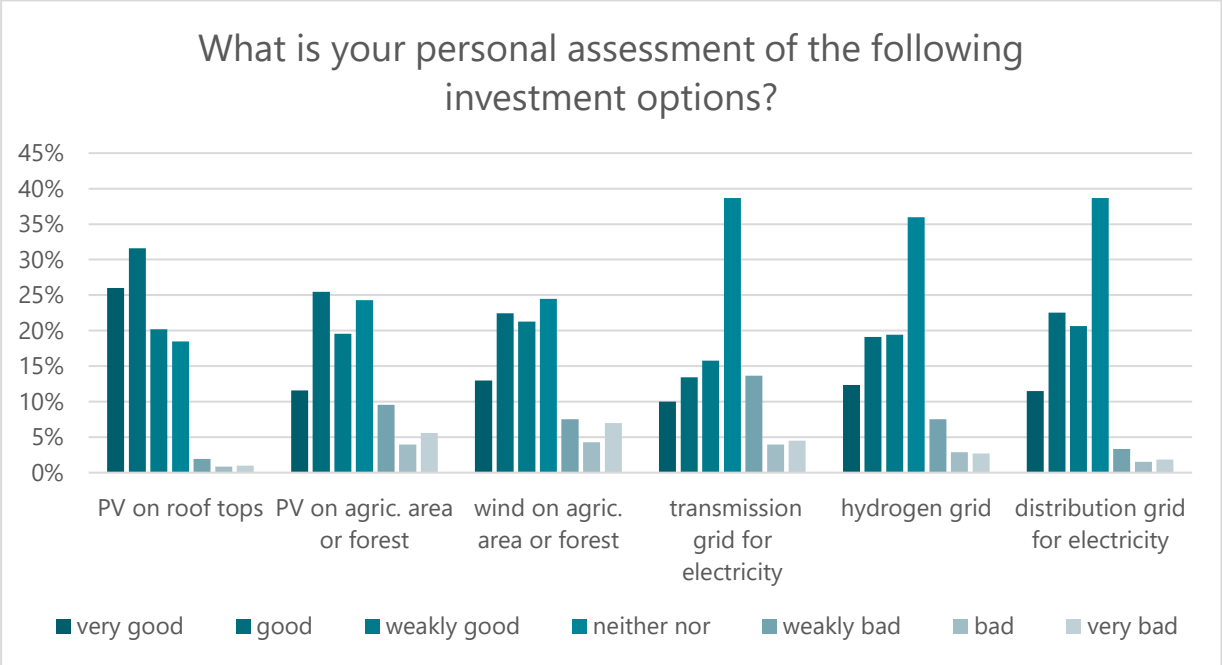
Figure 20: Investments in PV versus wind onshore



Source: own depiction based on survey data.

The most preferred investment option are rooftop PV installations. Differences between PV and wind power plants on agricultural land or in forests display a similar preference pattern. Regarding investment in grid infrastructure, the majority is indifferent (cf. Figure 21).

Figure 21: Assessment of different investment options

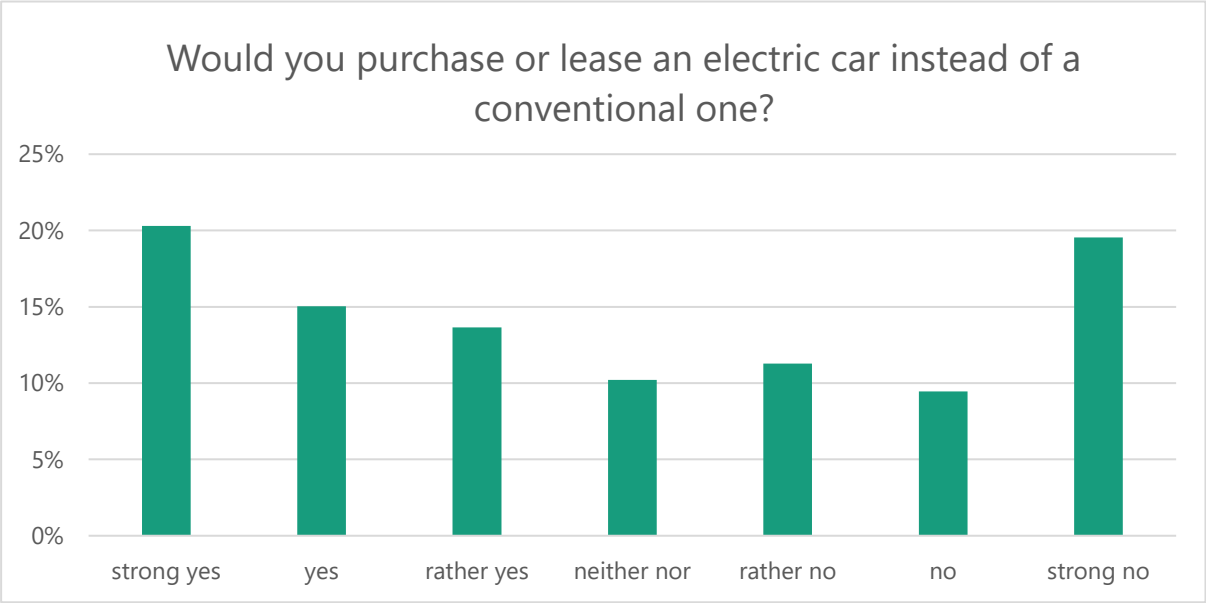


Source: own depiction based on survey data.

5.2.1.2 Investment in passenger car

A high share of respondents strongly rejects investing in an electric car, while a higher share of respondents display (weak) support than (weak) rejection of acquiring an electric car (cf. Figure 22). The most important features of a car (electric or conventional) are of a financial nature: investment expenditures, repairs, operational costs, and non-monetary aspects such as driving long distances and high safety (cf. Figure 23). The least important features are the production in Germany, noise emission, simple equipment, environmental protection and good acceleration. This is a mix of aspects that include hedonic preferences, environmental and social impacts.

Figure 22: Electric car versus conventional car



Source: own depiction based on survey data.

Figure 23: Preferences for design elements of a passenger car

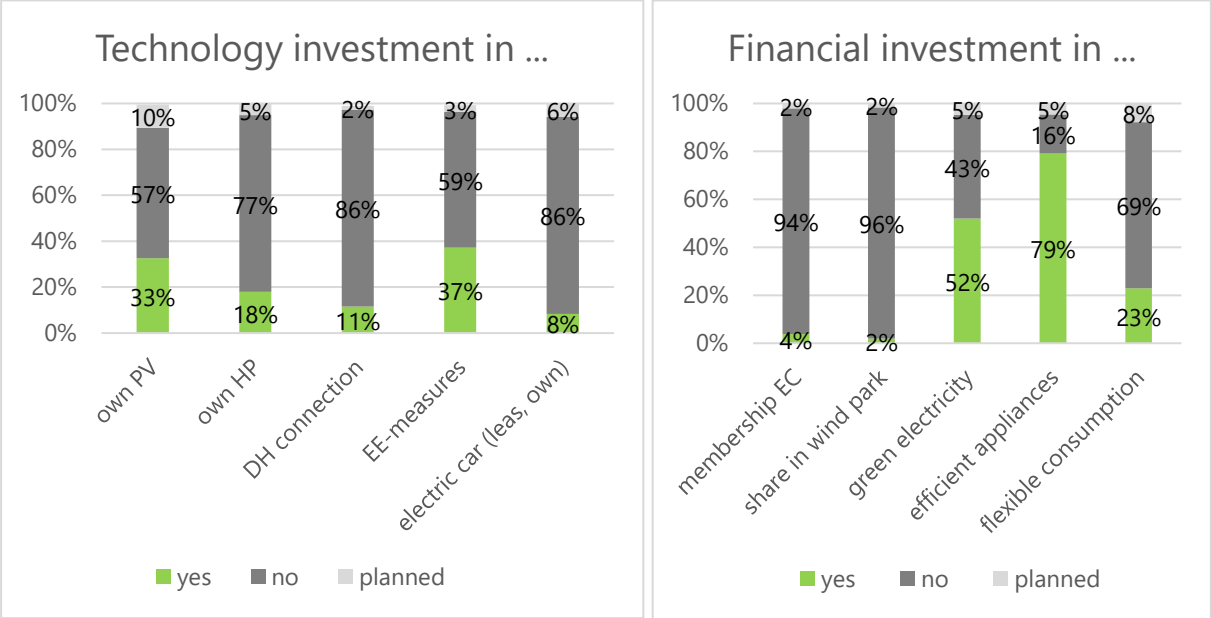
Source: own depiction based on survey data.

5.2.2 Results of survey IIb: heating

5.2.2.1 Respondents' trust and personal characteristics

Similar to survey IIa, a relatively high share of respondents indicates to have purchased energy efficient appliances, use green electricity, have implemented energy efficiency measures in their dwelling, own a small roof top PV plant and are flexible when consuming energy (cf. Figure 24). Also, the share of having a heat pump or a connection to a district heating network is relatively high, while being a member of an energy community or holding a share in a wind park are very low.

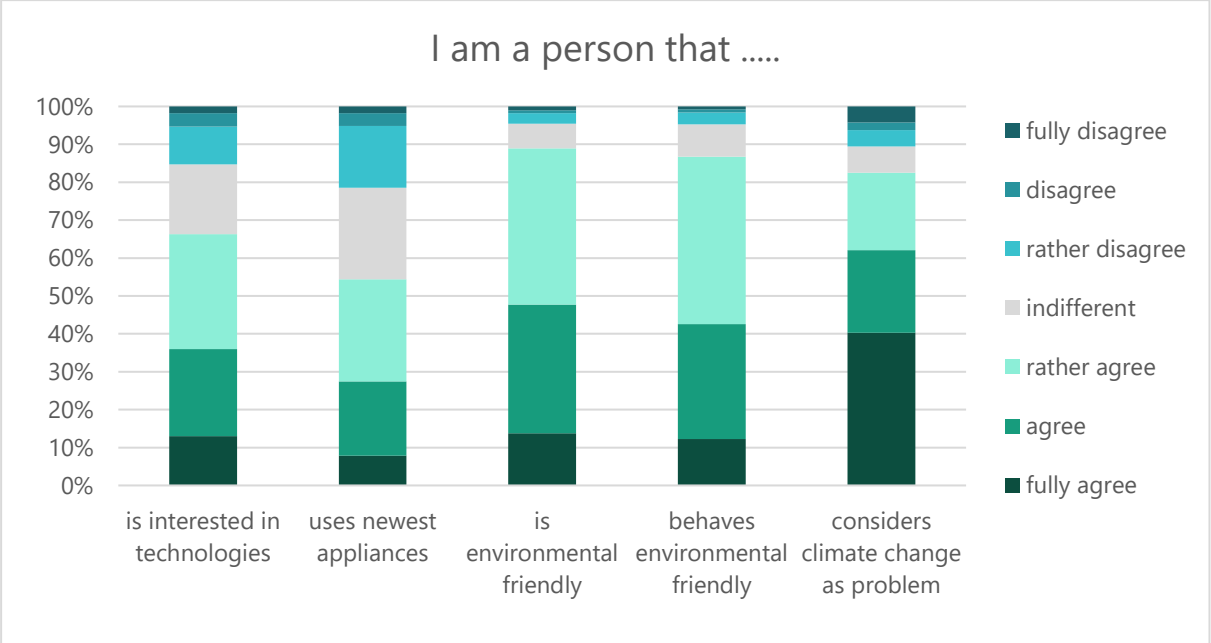
Figure 24: Technology and financial investments of survey IIb



Source: own depiction based on survey data.

Most respondents consider themselves as being environmentally friendly, acknowledge climate change as a real problem and are majorly open to and interested in new technologies (cf. Figure 25).

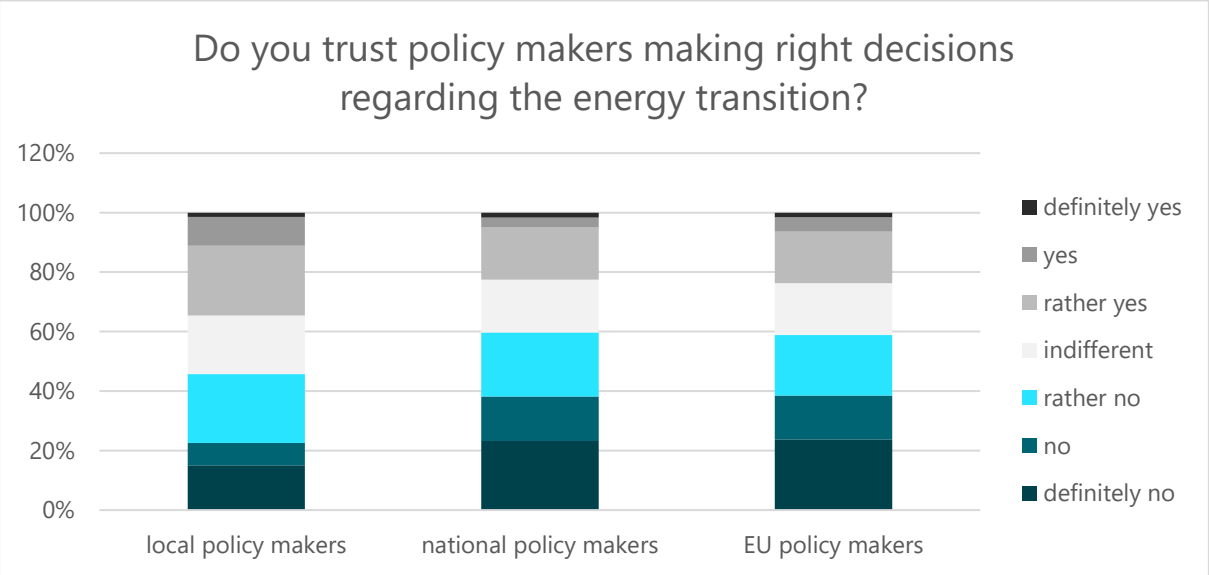
Figure 25: Personal characteristics



Source: own depiction based on survey data.

Respondents' trust in local politicians are the most important, while trust in national policy makers is the least important. Reference of trust is linked to making appropriate decisions regarding the energy transition from a societal perspective (cf. Figure 26).

Figure 26: Trust in policy makers

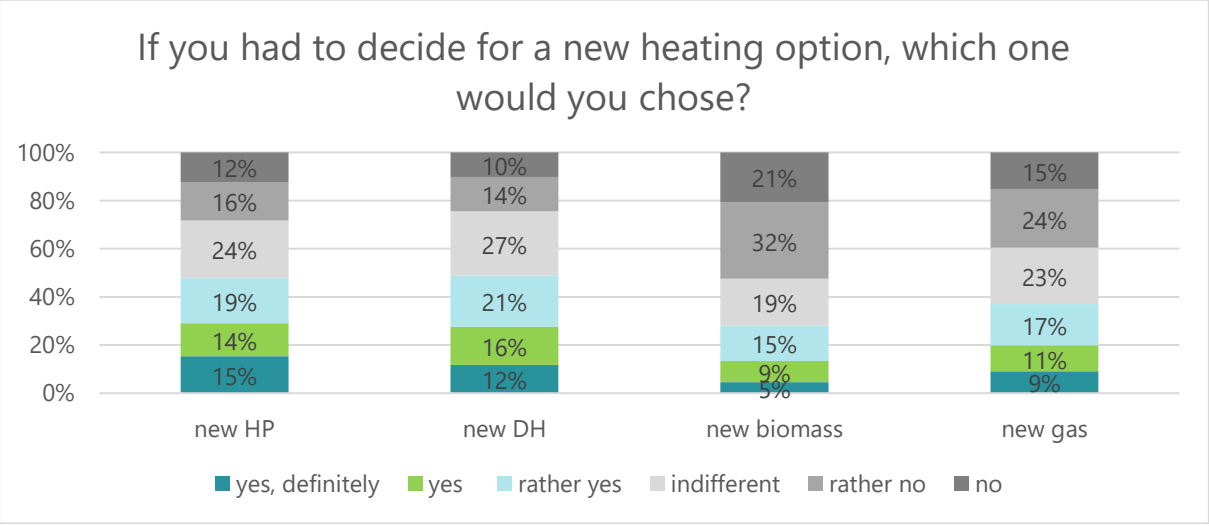


Source: own depiction based on survey data.

5.2.2.2 Preferences regarding heating options

When asked which heating option they would choose if the current heating system broke down, about half would decide for heat pumps (HP) or district heating (DH), while only a small share would be likely to invest in biomass heating (cf. Figure 27). Regarding natural gas or hydrogen, about 37% are likely to invest in this option.

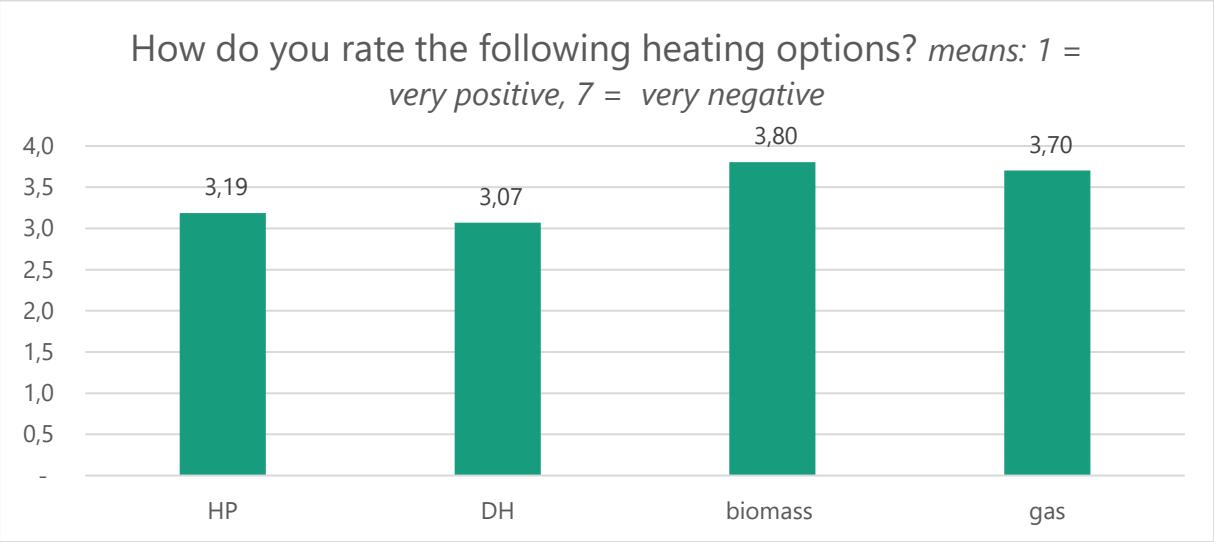
Figure 27: Preferred heating options



Source: own depiction based on survey data.

When asked how they rate the following heating options they consider DH the best option followed by HP and gas (natural and hydrogen) (cf. Figure 28).

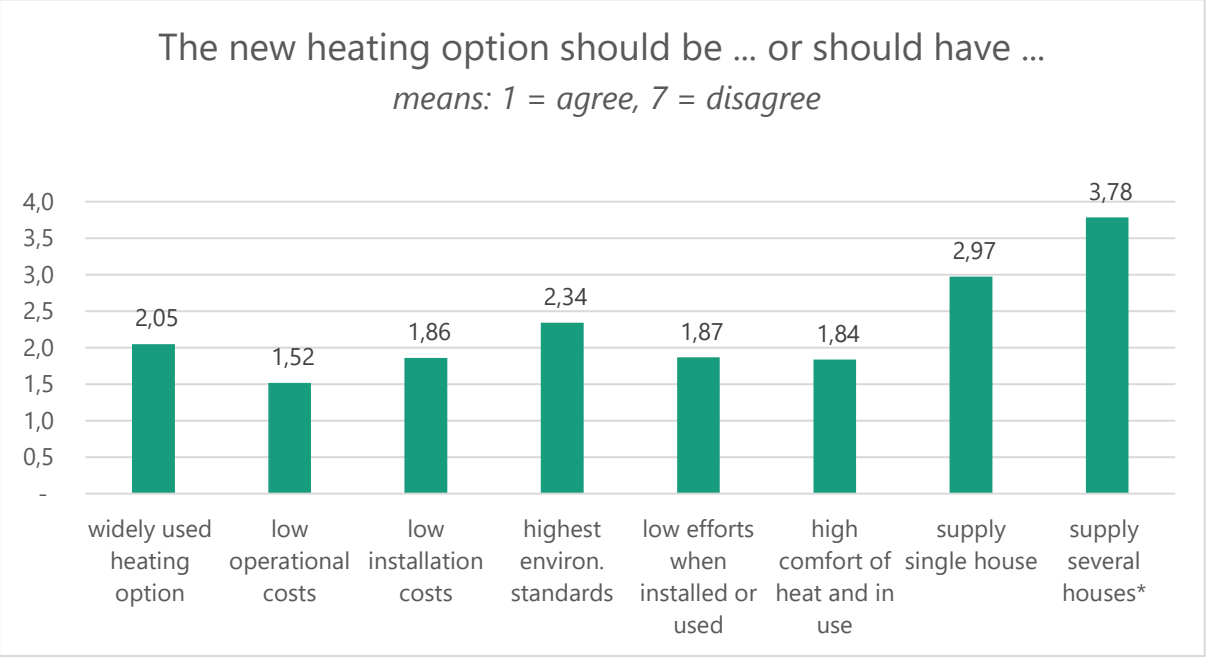
Figure 28: Rating of heating options



Source: own depiction based on survey data.

As for the properties of the new heating system, low operational costs are preferred above all, followed by comfort, installation costs and little effort in installing or using the heating (cf. Figure 29). The least important features are central or decentralized systems supplying several or detached houses. Also, high environmental standards are less important than costs, efforts and comfort.

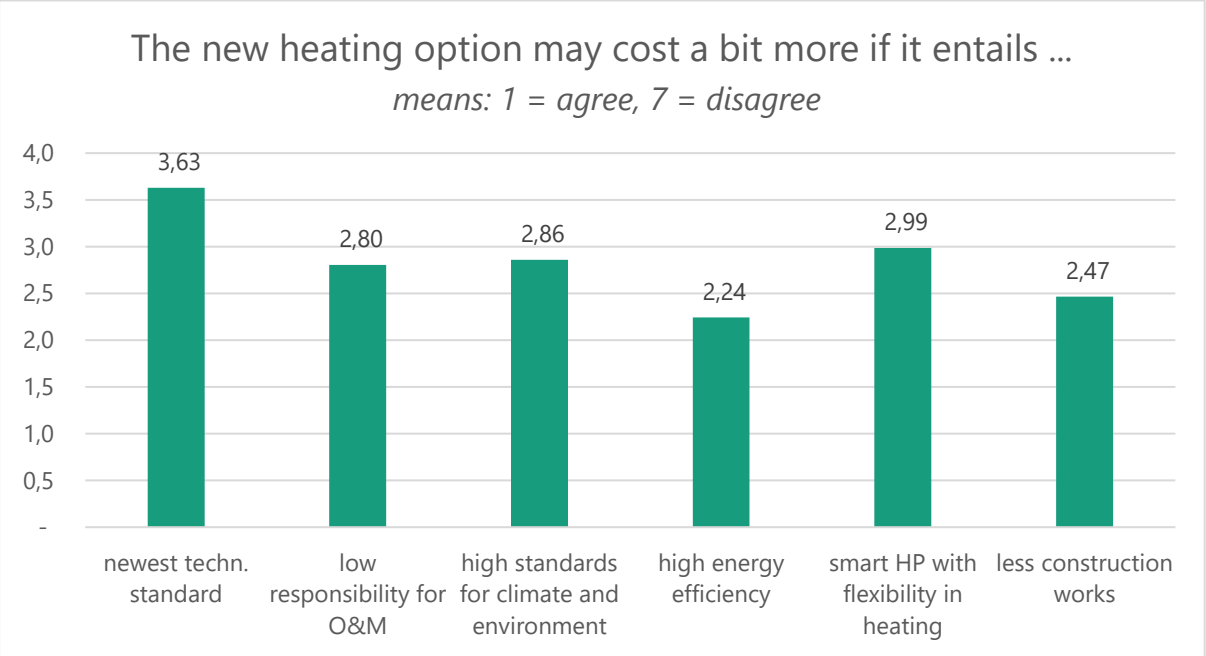
Figure 29: Preferred characteristics of heating options



Source: own depiction based on survey data. Note: 1 = strong agreement to statements, 7 = strong disagreement
Note: high investment but low operational costs if several houses are supplied.

The costs for a new heating systems could be compensated by financial and individual benefits such as energy savings through high energy efficiency, low efforts for construction work and responsibility for O&M (cf. Figure 30) Respondents also agreed, on average, to pay more for reduced impacts on climate and environment, as well as for flexible and smart heating while they consider a system compliant with new technological standards to be the least important.

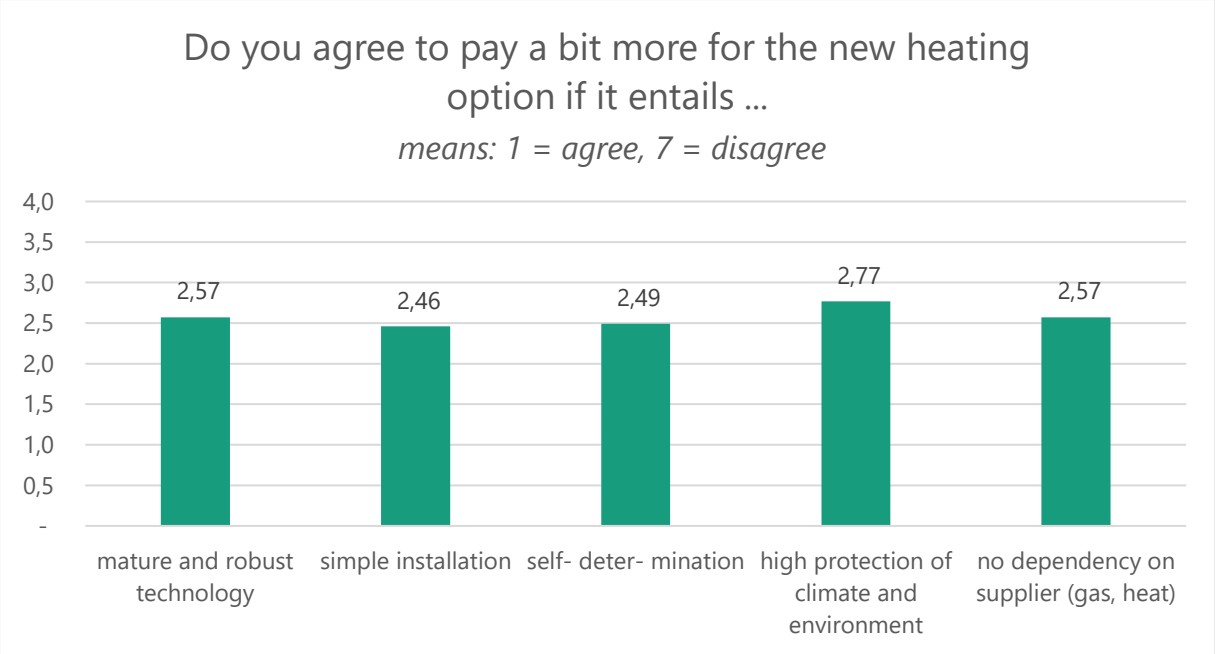
Figure 30: Trade-off between costs, individual and social benefits



Source: own depiction based on survey data.

In line with the previous results, respondents are willing to trade off higher costs with lower efforts, self-determination in heating, low dependency on others and low stress with maintenance or repairs (cf. Figure 31).

Figure 31: Comparison between individual benefits or efforts to climate protection

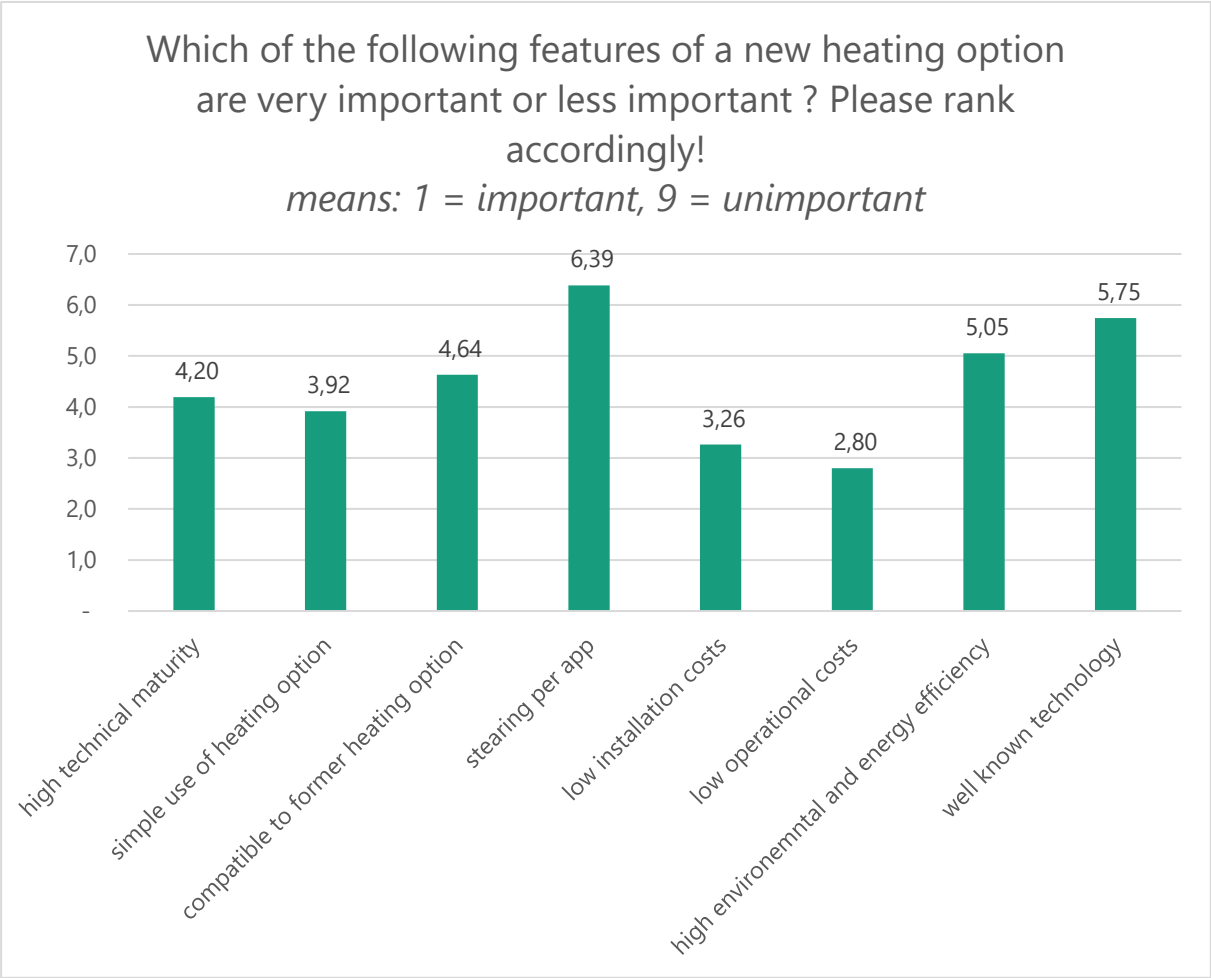


Source: own depiction based on survey data.

A ranking of selected features of heating options emphasizes the previous findings: low operation and installation costs are most important, followed by simple use of the heating system, high technology maturity with a high comparability to the former heating system to avoid additional efforts through construction work or new operation systems (cf. Figure 32). Steering the heating

per an application, a well-known and proved technology as well as environmental impacts are the least important.

Figure 32: Preferences for design features of heating



Source: own depiction based on survey data.

6 Discussion and conclusion

A high share of respondents state they have acquired energy transition technologies (ETT), i.e., made **technology investments**. The majority indicates to have invested in energy efficient appliances (survey I: 62%, survey II: 79%), and a high share indicates to have invested in energy efficiency measures of buildings (survey I: 38%, survey II: 37-38%). Almost one third of the respondents say they have invested in rooftop PV systems (20% in survey I and 29-33% in survey II). Moreover, 18% own a heat pump (survey II), 11-16% are connected to a district heating network (survey II), 14% use a RE heating system (survey I), while about 8-9% are owning or leasing an electric car (survey I and II). Overall, technology investments are relatively high, especially according to the survey in May 2024. Given the limited quota on age and gender for the survey II, there might be a slight participation bias by those that have invested in ETT due to the topic of the survey – participation in the energy transition –, while the higher quota requirements of survey I might have kept the participation bias low. Further, there is a high degree of freedom in answering the question on energy efficiency, since a clear definition of the energy efficiency measures or appliances was not given in the surveys.

In contrast, **financial investments** such as in shares of RE projects or energy communities are low to medium (4-10% in survey I and 2-3% in survey II). Behavioral investments, i.e. flexible consumption behavior is indicated by 32% (survey I) and 21-23% (survey II).

Regarding **attitudes** toward the energy transition (survey I), we find a high level of general approval, while the approval declines with increasing burden, both non-financial and financial. Support, in the sense of intended support, is high for non-financial and financial support when associated with benefits and little effort, and low for general support which entails individual efforts but no immediate benefits.

A strong **driver of financial participation** is *co-ownership* of ETT or any kind of control of the investment or operation of the project by the municipality or local operator (survey I and II). Involvement of local energy suppliers in investment or operation of energy generation project is equally well rated (survey II). Similarly, co-investments of or operation of a project by energy communities is on average preferred to international energy suppliers. Not only the rating, but also the willingness to invest is higher if a local energy supplier and municipality, or energy community is involved (survey II). This is also in line with the trust in policy makers, which is the highest for local policy makers and lowest for national policy makers (survey II).

The *investment volume* is another critical aspect. Respondents would mainly invest a small amount (100 EUR). However, the volume depends on the partners involved. If a municipality and local energy supplier, or an energy community are involved, the level of investment is higher than with the involvement of a national energy supplier (survey II).

Furthermore, some *technologies* are preferred to others. For instance, PV is preferred to wind, and heat pump or district heating are better rated than biomass or natural gas or hydrogen (survey II). Overall, investments in generation *assets* are better rated and potentially more attractive than investment in grid infrastructure (survey II).

A less investigated factor is the *sector* – heating, power and mobility. The results show that for mobility, the protection of the climate and environment as well as noise emissions are of low relevance (survey II). The rating of heating options obtains similar results (survey II), while PV installations are strongly linked with climate and environment protection (survey I).

Although costs (investment, operation and maintenance) are key criteria for investments, the readiness to spend more money in a heating option depends also on its *features*: a high energy

efficiency of the new heating system, as well as a simple installation or low level of construction works entail the highest readiness to pay a bit more for the system. However, self-determination in using the system as well as a proved technology and low dependency on an energy supplier are also important drivers for spending money (survey II).

Important features are **non-monetary effects (NME)**. The survey I gives empirical evidence:

- For **technology investments**, simple use, simple installation or low level of construction works when installing a new heating system are *non-monetary costs*, that are second important features for heating after monetary costs (investment, operation and maintenance). This also applies for PV installations and investment in an electric car (cf. Figure 9).
- Furthermore, low **dependency** on energy supplier, high **security** in supply and use, high self-determination and autonomy, high **comfort** of heat and use, good feeling when using the technology are *individual non-monetary benefits* (value propositions) and drivers of financial participation in heating, as well as in PV and electric car that (cf. Figure 11).
- However, respondents also value *social non-monetary benefits* such as **climate and environmentally friendly** technologies, as well as efficient use of resources (long life cycle) and positive effects for communities, especially for PV. For heating the responses depend on the construction of the question (cf. Figure 30, Figure 31). It is less important when considered as a trade-off to costs and other features. Positive aspects for the national economy are addressed for the case of the electric car, but the scores are low (cf. Figure 23), i.e., signaling low importance of macro-economic aspects.
- Regarding **financial investments**, the positive effect on climate and environment are important regardless of the type and co-owners of investment. However, they are perceived and rated as more important for investments in projects, in which the municipality is engaged (cf. Figure 12). In contrast, returns are important for investments in commercial projects (cf. Figure 14).
- Among financial aspects, the required minimum investment, risks or uncertainties in combination with the return play an important role (cf. Figure 8).

Overall, factors such as technology, sector (mobility, power, heating), investment volume, co-investors or operators, and design features significantly influence the willingness to financially participate in the energy transition. Non-monetary costs are notable design elements that, while secondary to monetary costs, play an essential role in driving investments. Additionally, in certain contexts, climate and environmental considerations, alongside community benefits, can be equally motivating for investing in ETT. This study underscores the complexity of factors influencing financial participation in energy transition.

7 List of figures

8 List of tables

Abbreviations

DH	district heating
EC	energy community
EE	energy efficiency
ETT	clean energy, energy efficient and energy transition technologies
ET	energy transition
FP	financial participation
HP	heat pump
RE	renewable energy
NME	non-monetary effects
vs	versus

Annex

A.1 Questionnaire

All surveys are conducted in German. To avoid potential misunderstandings, we provide the questions in their original language.

A.1.1 Survey I: March 2023 in Germany

Zunächst stellen wir einige Fragen zu Ihrer sozio-ökonomisch-demographischen Situation, um sicherzustellen, dass wir mit diesen Faktoren einen Großteil der Bevölkerung abdecken

- v 149 Bitte geben Sie Ihr Geschlecht an: männlich – weiblich - divers
- v 150 Wie alt sind Sie:
- v 152 Welches Nettoeinkommen steht ihrem Haushalt im Monat zur Verfügung?
    - unter 1000 Euro im Monat
    - 1000-2000
    - 2001-3000
    - 3001-4000
    - 4001-5000
    - 5001-6000
    - 6001-7000
    - über 7001 Euro im Monat
- v 699 In meinem Haushalt leben ... Personen insgesamt.
- v 839 Davon sind ... Kinder
- v 155 Welches ist ihre höchste berufliche Qualifikation?
    - Abgeschlossene 2–4-jährige Lehre oder Ausbildung
    - Meister, Techniker, Fachschulabschluss (z.B. PDA, MDA, Erzieherin, ...)
    - (Fach)Hochschulabschluss (Diplom, Master, Bachelor)
    - Akademischer Grad (Doktorat, Professur)
    - v 156 Sonstiges:
- v 157 Ich bin ...?
    - berufstätig
    - in Rente
    - arbeitslos
    - v 158 sonstiges
- v 159 Wie ist Ihre aktuelle Wohnsituation?
    - Eigenes Haus(hälfte),
    - Eigentumswohnung,
    - Gemietetes Haus(hälfte),
    - Mietwohnung,
    - v 160 Sonstiges
- v 161 Wohnlage: Wie groß ist Ihre Gemeinde/Stadt, in der Sie leben?
    - Landgemeinde bis 5.000
    - Kleinstadt bis zu ca. 5-20.000,
    - Mittlere Stadt bis zu 20- 100.000
    - Größere Stadt (> 100. 000)
    - v 162 Sonstiges
    - v 163 In welchem Bundesland leben Sie?

Nachfolgend stellen wir Ihnen Fragen zu Ihrer Einschätzung der Energiewende, der Möglichkeit sich finanziell zu beteiligen oder direkt zur Energiewende beizutragen.

Wir haben auch ein paar Kontrollfragen eingebaut, um automatisches Antworten zu identifizieren.

Frage 1:

Stimmen Sie folgenden Aussagen zu? (Stimme voll zu (1) - Stimme gar nicht zu (5) - **Skala von 1 bis 5)**

- v 522 wir brauchen einen konsequenten Umstieg auf erneuerbare Energien, auch wenn es viele Investitionen erfordert.
- v 523 insgesamt sehe ich die Energiewende als positiv für die Gesellschaft
- v 524 für das Erreichen der Energiewende, das heißt für klimafreundlichen, grünen Strom, Wärme und/oder Mobilität, bin ich bereit auch etwas höhere Energiepreise zu zahlen
- v 525 für das Erreichen der Energiewende dulde ich auch Windräder privater Investoren im Abstand von 1 Kilometer zu meiner Wohnung
- v 526 für das Erreichen der Energiewende bin ich generell bereit selbst in Energieeffizienz (Wärmedämmung) oder erneuerbare Energien (Photovoltaikanlage) zu investieren
- v 527 für das Erreichen der Energiewende passe ich meinen Energieverbrauch zeitlich an die Verfügbarkeit von grünem Strom oder Wärme an, bzw. bin bereit dazu diesen anzupassen.
- v 528 ich wäre gegebenenfalls sogar bereit für die Umsetzung der Energiewende auf die Straße zu gehen und zu demonstrieren
- v 529 mich interessiert die Energiewende nicht
- v 530 die Energiewende und die damit verbundenen Maßnahmen sehe ich sehr kritisch
- v 531 ich lehne die Energiewende aus verschiedenen Gründen ab

Frage 2:

Nutzen oder investieren Sie oder Ihr Haushalt in eines oder mehrere der folgenden Dinge? (ja/nein)

- v 173 Haben Sie eine Photovoltaik- und/oder Solarthermie- Anlage auf dem Balkon oder Hausdach, in dem Sie wohnen?
- v 174 Haben Sie Geld investiert, z.B. in einen Windpark, oder eine große Photovoltaik-Freiflächenanlage, in einen ökologischen Investment- oder Umweltfond?
- v 175 Sind Sie Mitglied bei einer Energie-Genossenschaft, oder bei einem Bürger-Solar-Park oder Bürger-Windpark?
- v 176 Haben Sie ein eigenes Elektroauto im Haushalt?
- v 177 Nutzen Sie eine Wärmepumpe oder Holz-Pellet-Heizkessel, oder Biogaskessel im Gebäude, in dem Sie wohnen?
- v 178 Haben Sie an einem Crowdfinancing[1] zur Nutzung erneuerbarer Energien oder Energieeffizienz teilgenommen?
- v 532 Versuchen Sie dann Strom zu verbrauchen, wenn gerade viel Strom aus Sonne oder Wind erzeugt wird (sofern Sie das einschätzen können)?
- v 533 Haben Sie in den letzten 2 Jahren in Wärmedämmung investiert (z.B. neue Fenster, Dämmung von Wänden, Dach, Boden etc.)

[1] Crowdfinancing wird auch Gruppenfinanzierung genannt und ist eine Finanzierung durch viele (auch kleinere) Geldgeber. Dadurch kann für Projekte Geld beschafft werden, das nicht von Banken kommt.

- v 534 Haben Sie sich in den letzten 2 Jahren bewusst für energieeffiziente Geräte entschieden, auch wenn diese teurer waren?
- v 535 Haben Sie in Aktien von Solarmodulherstellern oder Windturbinenherstellern investiert?

Frage 3: Angenommen Sie haben ausreichend Geldmittel und Eigentum, und auch sonst keine Einschränkungen um eine Investition zu tätigen: In welche der jeweils aufgeführten Optionen 1 und 2 würden Sie dann eher investieren (und zwar unabhängig davon, ob Sie dies bereits getan haben).[2]

Bitte angeben:

- 1 für Option1,
- 2 für Option2,
- 3 in keine der beiden Optionen (falls Sie weder in die eine noch in die andere Option investieren wollen)

v_	Option 1	.. oder ..	Option 2
		Ihre Auswahl:	
559	Erwerb einer Wärmepumpe für die eigene Wärmeversorgung		Erwerb eines Anteils am lokalen Wärmenetz(betreiber) und Anschluss an das Wärmenetz
560	Mitgliedschaft oder Anteil an einem Car-Sharing Unternehmen für E-Mobilität		Erwerb eines eigenen E-Autos
561	Mitgliedschaft in einer Energiegenossenschaft, die Strom aus Windkraft oder Sonne erzeugt		Erwerb eines Anteils an einem großen Photovoltaik-Solar-, oder Windpark

2

1. Option 1: Kauf und Installation einer Wärmepumpe für die Wärmeversorgung im Wohngebäude bzw. in der Wohnung (Kosten ca. 15.000 Euro);
   Option 2: Beteiligung in Form eines Geschäftsanteils am Wärmenetz vor Ort in Höhe von mindestens 1.000 Euro und Anschluss an das Wärmenetz (ohne Anschlusskosten). Das Wärmenetz wird von einem kommunalen oder privaten Unternehmen betrieben.
2. Option 1: Mitgliedschaft oder Anteil an einem Car-Sharing Unternehmen in Höhe von mindestens 1.000 Euro, das E-Autos zur gemeinsamen Nutzung gegen ein Entgelt für die Anteilseigner bereithält;
   Option 2: Leasing oder Kauf eines eigenen E-Autos (Kosten ca. 25.000 Euro)
3. Option 1: Mitgliedschaft in Höhe von 500 Euro in einer Energiegenossenschaft oder Energiegemeinschaft, in der sich Menschen zusammengeschlossen haben, um dezentral und unabhängig von großen Unternehmen mit Photovoltaik oder Windenergie Strom zu erzeugen, oder ein Wärmenetz zu betreiben und Wärme zu liefern;
   Option 2: Erwerb eines (Aktien-)Anteils in Höhe von mindestens 500 Euro an einem Wind- oder Solarpark, der in Deutschland steht und von einem Unternehmen oder einer Kommune betrieben wird.
4. Option 1: Beteiligung in Form eines Geschäftsanteils am Wärmenetz vor Ort in Höhe von mindestens 1.000 Euro. Das Wärmenetz liegt mehrheitlich in der Hand der Kommune. Beispiele für kommunale Wärmenetzbetreiber sind Kommunen oder kommunale Unternehmen (z. B. Stadtwerke), die mehrheitlich der Kommune (Stadt, Ortsgemeinde) gehören;
   Option 2: Beteiligung in Form eines Geschäftsanteils am Wärmenetz vor Ort in Höhe von mindestens 1.000 Euro. Das Wärmenetz gehört einem privaten Akteur z. B. einem großen kommerziellen Energieversorger (regionale, nationale oder internationale Energieversorgungsunternehmen), an dem die Kommune nicht beteiligt ist.

v_	Option 1	.. oder ..	Option 2
564	Erwerb eines Anteils am **kommunalen** Wärmenetz und Anschluss ans Wärmenetz		Erwerb eines Anteils **am privaten** Wärmenetz und Anschluss ans Wärmenetz

Frage 4:

Frage 4a): Bitte wählen Sie die 5 Eigenschaften aus, die Sie besonders stark mit der Investition in ein **eigenes elektrisches Auto (E-Auto)** verbinden und geben Sie die Rangfolge (1 bis 5) an.

Frage 4b): Bitte wählen Sie die 5 Eigenschaften aus, die Sie besonders stark mit der Investition in eine Photovoltaik (PV) Anlage auf dem Dach verbinden und geben Sie die Rangfolge (1 bis 5) an.

Frage 4c): Bitte wählen Sie die 5 Eigenschaften aus, die Sie besonders stark mit der Investition in eine Wärmepumpe zur Wärmeversorgung im eigenen Gebäude verbinden und geben Sie deren Rangfolge (1 bis 5) an.

1= ganz besonders wichtige Eigenschaft; 2, 3, 4, und 5 = wichtig, aber weniger als die zuvor genannten Eigenschaften.

v_ e-Auto	v_ PV	v_ WP	Eigenschaften
729	752	775	Hohe Investitions- und/oder Betriebsausgaben
730	753	776	Geringes Verlustrisiko oder geringer Ausfall
731	754	777	Hoher Beitrag zum Klima- oder Umweltschutz
732	755	778	Hohe Unabhängigkeit, Autonomie, Selbstbestimmung bei der Nutzung
733	756	779	Keine Eigenschaft, daher hier nichts angeben
734	757	780	Geringe Mindestinvestitionssumme
735	758	781	Hohe eigene Verantwortung für Betrieb und Wartung und ggf. Haftung
736	759	782	Lange Nutzungsdauer der getätigten Investition
737	760	783	Intensiver Erfahrungs- und Wissensaustausch mit anderen ist erforderlich
738	761	784	Positive Wirkung für sozial schwächere Gruppen bei Nutzung
739		785	Positive Wirkung für Kommune (Dorf, Stadt) vor Ort bei Nutzung
740	762	786	Gute Übertragbarkeit bzw. Weiterverkauf der Investition an andere
741	763	787	Hohe Sicherheit bei Nutzung, da damit schon viel Erfahrungen und/oder Vertrautheit im Umgang damit vorliegen
742	764	788	Erfordert Umbaumaßnahmen und/oder Aufräumarbeiten für die Nutzung
743	765	789	Erfordert technisches Verständnis bei der Nutzung

v_ e-Auto	v_ PV	v_ WP	Eigenschaften
744	766	790	Erfordert Veränderungen im Verbrauchsverhalten bei Nutzung
	767	791	Erfordert hohen organisatorischen Aufwand
745	768	792	Es ist ein tolles Gefühl so etwas zu nutzen
746	769	793	Es ist einfach cool so etwas zu haben, und meine Bekannten finden das auch cool

Frage 5

In welche der aufgeführten Optionen würden Sie bevorzugt, in welche weniger gerne investieren?

- v 661 Energiegenossenschaft oder Energiegemeinschaft (EG)[3]
- v 662 Windpark eines Privatinvestors[4]
- v 663 Windpark mit Beteiligung der Gemeinde[5]
- v 664 Kommunale Wärmeversorgung[6]
- v 665 Private Wärmeversorgung[7]

Frage 6:

Frage 6 a): Bitte wählen Sie die 5 Eigenschaften aus, die Sie besonders stark mit der finanziellen Beteiligung an einer Energiegemeinschaft / Energiegenossenschaft (EG) verbinden, und geben Sie deren Rangfolge

Frage 6 b): Bitte wählen Sie nachfolgend die 5 Eigenschaften aus, die Sie besonders stark mit einer Beteiligung am jeweiligen Windpark verbinden, und geben Sie deren Rangfolge

Frage 6 c): Bitte wählen Sie je 5 Eigenschaften, die Sie besonders stark mit dieser Form der finanziellen Beteiligung (an einem Wärmenetz) verbinden.

[3] Energiegenossenschaft oder Energiegemeinschaft (EG): Mitgliedschaft in Höhe von 500 Euro in einer Energiegenossenschaft oder Energiegemeinschaft, in der sich Menschen zusammengeschlossen haben, um dezentral und unabhängig von großen Unternehmen mit Photovoltaik oder Windenergie Strom zu erzeugen, oder ein Wärmenetz zu betreiben und Wärme zu liefern.

[4] Windpark eines Privatinvestors: Beteiligung in Form von Fonds oder Aktienanteilen in Höhe von mindestens 1.000 Euro an einem großen Windparkprojekt in der Nähe Ihres Wohnorts, das von einem Projektentwickler gemanagt wird und ohne Beteiligung der Kommune ist.

[5] Windpark der Gemeinde: Beteiligung in Form eines Geschäftsanteils von mindestens 1.000 Euro an einem Windpark in der Nähe Ihres Wohnorts, an dem die örtliche Kommune auch mit einem signifikanten Anteil von bis zu 49 % beteiligt ist, aber von einem Projektentwickler gemanagt wird.

[6] kommunale Wärmeversorgung: Beteiligung in Form eines Geschäftsanteils am Wärmenetz vor Ort in Höhe von mindestens 1.000 Euro. Das Wärmenetz liegt mehrheitlich in der Hand der Kommune. Beispiele für kommunale Wärmenetzbetreiber sind Eigenbetriebe der Kommunen oder Unternehmen (z. B. Stadtwerke), die mehrheitlich der Kommune (Stadt, Ortsgemeinde) gehören.

[7] private Wärmeversorgung: Beteiligung in Form eines Geschäftsanteils am Wärmenetz vor Ort in Höhe von mindestens 1.000 Euro. Das Wärmenetz gehört privaten Akteuren und ist z. B. ein großer kommerzieller Energieversorger (regionale, nationale oder internationale Energieversorgungsunternehmen), an dem die Kommune nicht beteiligt ist.

Frage 6 a-c):

v_ EG		**v_ WP p**	**v_ WP k**	**v_ WN k**	**v_ WN p**
	Je **5 Eigenschaften, die Sie besonders stark mit dieser Form der finanziellen Beteiligung verbinden:**				
799	Hoher Beitrag zum Klima- oder Umweltschutz	253	275	351	352
800	Geringe Selbstbestimmung bei Nutzung (EG + WN) / hohe Selbstbestimmung und Sicherung der Energieversorgung vor Ort (WP).	259	276	353	354
801	Hohe Rendite, schnelle Rückzahlung der Investition	260	277	355	356
802	Keine Eigenschaft, daher hier nichts angeben	261	278	357	358
803	Beitrag mit geringer Investitionssumme möglich, z.B. 100 Euro	262	279	359	360
804	Geringes Ausfallrisiko der Investition	263	280	361	362
805	Lange Nutzungs-/Anlagedauer der getätigten Investition	264	281	363	364
806	Intensiver Erfahrungs- und Wissensaustausch mit anderen	265	282	365	366
807	Nutzung der Gewinne für sozial schwächere Gruppen (soziale Gerechtigkeit)	266	283	367	368
808	Nutzung der Gewinne für Kommune und Bürger vor Ort (Unterstützung des Gemeinwohls)	267	284	369	370
809	Hohe Einbindung und Beteiligung an Entscheidungen	268	285	371	372
810	Geringe Verantwortung für Betrieb, geringe Haftung	269	286	373	374
811	Gute Übertragbarkeit bzw. Weiterverkauf der Investitionsanteile an andere	270	287	375	376
812	Hoher Informationsaufwand für Investition / bevor Investition getätigt wird / für Investition	271	288	377	378
813	Hoher zeitlicher und organisatorischer Aufwand bei Beteiligung / bevor Investition getätigt wird / bei Beteiligung	272	289	379	380
814	Es ist ein tolles Gefühl bei so etwas dabei zu sein /- / -	-	-		
816	Es ist einfach cool dabei zu sein, und meine Bekannte finden das auch cool / - / -	-	-		

Frage 7:

Wenn Sie die Möglichkeit haben in die Energiewende zu investieren z. B. Investition in PV-Anlage, Wärmepumpe, Beteiligung an Windpark, Mitgliedschaft in einer Genossenschaft, etc.**, welche 4 Kriterien müsste diese Investition erfüllen, damit Sie auch tatsächlich investieren**?

*Bitte wählen Sie **die 4 wichtigsten Eigenschaften** aus und bewerten diese nach ihrer Bedeutung für Sie in der Spalte "Ranking": 1 = am bedeutendsten; 2 = am zweit-bedeutendsten; 3 = am dritt-bedeutendsten; 4 = am viert-bedeutendsten.*

Eigenschaften der Investition	**v_**	**Ranking**
eigene Energieerzeugung und Versorgung (Strom oder Wärme)	822	
Mitverantwortung und Mitsprache bei Investitionsentscheidungen und Betrieb	823	
Große Fahrzeuge und breite Straßen	824	
Sehr geringes Investitionsrisiko, sehr gering Rendite (1- 2%), kleiner Investitionsbetrag (100-1.000 Euro)	825	
Sehr hohes Investitionsrisiko, sehr hohe Rendite (10-20%), sehr hoher Investitionsbetrag (> 10.000 Euro)	826	
Geringes Investitionsrisiko, geringe Rendite (2-4%), mittlerer Investitionsbetrag (1.000-10.000 Euro)	827	
Beteiligung der Gemeinde oder Stadtwerke an der Investition	828	
Keine Unsicherheiten bzgl. Ertrag, Kosten und Nutzung der Investition	829	
Ressourcen- und Artenschutz	830	
Klimaschutz	831	
Einfacher Erwerb ohne viel Zeitaufwand und Organisation, sowie keine Verantwortung und Haftung für Betrieb bzw. Nutzung	832	
Keine größeren baulichen Veränderungen und Mehrarbeit durch Aufräumen und Säubern	833	
Keine Verantwortung für Betrieb und Wartung	834	
Interaktionen mit Bekannten, Freunden, der Kommune, ...	835	
Energie mit anderen teilen gegen geringes Entgelt (energy sharing)	836	
Beitrag zur Investition sollte in Form von Eigenleistung (baulich, handwerklich) möglich sein	837	

Frage 8:

Was ist Ihnen hinsichtlich der Nutzung von Technologien für die Energiewende am wichtigsten und was am unwichtigsten? Bitte geben Sie je Spalte nur eine Antwort (je Spalte nur ein Eintrag).

Das ist mir am ...	v_	...wichtigsten	...unwichtigsten
Keine zusätzlichen Kosten, kein baulicher oder organisatorischer Aufwand bei Nutzung erneuerbaren Stroms oder Wärme oder e-Mobilität	410		
Eine eigenständige, dezentrale und einfache Steuerung der Wärme- Mobilitäts- und Stromversorgung für mich	411		
Eine günstige Energieversorgung (bzgl. Strom, Wärme und Mobilität) für sozial schwache Gruppen	412		
Gutes Essen und Trinken ohne große Auflagen und Kosten	413		
möglichst schneller Ausbau mit erneuerbaren Energien im Strom-, Wärme- und Mobilitätsbereich, um Klima und Umwelt zu schützen	414		

Frage 9: Über weitere Gedanken, Vorschläge oder Anmerkungen zum Thema Beteiligung und Energiewende würde wir uns freuen: v 723

A.1.2 Survey IIa: May 2024 in Germany with focus on investment

<u>Teil A</u>: Zunächst stellen wir einige Fragen zu Ihrer aktuellen Lebenssituation:

1.1 Bitte geben Sie Ihr Geschlecht an: männlich – weiblich - divers

1.2 Ihr Alter ist: ____

1.3 Welches ist Ihre höchste schulische Qualifikation?

- keinen Schulabschluss
- Haupt- oder Realschulabschluss, Handelsschulabschluss
- (Fach)Abitur
- Sonstiges

1.4 Welches ist Ihre höchste berufliche Qualifikation?

- keine Ausbildung, Lehre oder Studium
- noch in Ausbildung/im Studium
- abgeschlossene 2–3-jährige Ausbildung
- Meister, Techniker, Fachschulabschluss (z.B. PDA, MDA, Erzieherin, ...)
- Bachelor, Master, Diplom, Staatsexamen, Magister
- akademischer Grad (Professur, Doktorat)
- Sonstiges:

1.5 Wie groß ist Ihre Gemeinde oder Stadt, in der Sie leben?

- Landgemeinde bis 5.000 Einwohner: innen
- Kleinstadt bis zu ca. 5.000-20.000 Einwohner: innen,
- Mittlere Stadt bis zu 20.000- 100.000 Einwohner: innen
- Größere Stadt (100. 000 -500.000 Einwohner: innen)
- Großstadt (> 500.000 Einwohner: innen)
- das weiß ich nicht

1.6. Wie ist Ihre aktuelle Wohnsituation?

a. Eigenes Haus(hälfte), Reihenhaus,
b. Eigentumswohnung,
c. Gemietetes Haus(hälfte), Reihenhaus
d. Mietwohnung,
e. Sonstiges

Haben Sie .....

.... (Ja/nein/geplant)

- in eine eigene PV-Anlage auf dem eigenen Dach investiert?
- eine Wärmepumpe gekauft und installiert?
- sich an ein Wärmenetz (Fern- oder Nahwärmenetz) angeschlossen?
- in den letzten 5 Jahren Ihr Haus besser gedämmt (Fenster, Wand, Boden oder Decke)?

Haben Sie ….

-> …. (Ja/nein/geplant)

- sich an einer Energiegemeinschaft oder Energiegenossenschaft beteiligt?
- sich an einem Windpark beteiligt?
- ein E-Auto gekauft oder geleast?
- einen Stromliefervertrag mit grünem, nachhaltigem oder erneuerbarem Strom abgeschlossen?
- stromsparende Geräte wie Kühl- oder Gefrierschrank, Wasch- oder Spülmaschine, Herd, Ofen (Energieeffizienz A oder besser) in Ihrem Haushalt?
- die Reise auf den Mond ist hier keine Option, daher hier bitte unbeantwortet lassen
- Ihren Stromverbrauch an die Verfügbarkeit von erneuerbarem Strom gepasst, z.B. oft die Waschmaschine dann angeschaltet, wenn genügend erneuerbarer Strom verfügbar war?

Teil B

Stellen Sie sich vor: Sie stehen vor der Entscheidung ein neues Auto kaufen zu müssen, da ihr altes Auto nicht mehr fahrtüchtig ist.

Könnten Sie sich grundsätzlich vorstellen, ein E-Auto zu kaufen oder zu leasen, statt ein Auto mit Verbrennungsmotor, wenn ansonsten die technischen Ausstattungen und der Kaufpreis ähnlich sind?
(1 = ja, auf alle Fälle, 2 = ja, .3 = eher ja, 4 = unentschieden, 5 eher nein, .6 = nein, 7 = nein, völlig ausgeschlossen)

Was ist Ihnen grundsätzlich beim Erwerb eines neuen Autos (egal ob E-Auto, Benzin- oder Dieselauto) wichtig? Ordnen Sie bitte nach Wichtigkeit:
(1 = am wichtigsten, 2= am zweitwichtigsten, … 12 bzw. 13 = am unwichtigsten)

- geringes Fahrgeräusch und wenig Belästigung der Anwohner
- Ausstattung so wie bisher auch
- einfache Ausstattung ohne viel Schnickschnack
- hoher Komfort
- gute Beschleunigung
- geringer Reparaturanfälligkeit
- hohe Fahrsicherheit (Materialien/Bauweise, Softwareunterstützung beim Fahren)
- ein in Deutschland hergestelltes Auto
- große Reichweite des Autos bis zum nächsten Tanken/Laden
- laufende Betriebskosten pro Monat
- Anschaffungskosten
- Umwelt- und Klimaschutz
- diese Option bitte als letztes anklicken und ins andere Feld ziehen

Stellen Sie sich vor, Sie hätten die Möglichkeit in eine Photovoltaikanlage (Sonnenenergie/-strom) zu investieren., und zwar unabhängig davon, ob Sie selbst einen Acker, eine Wiese oder Dach oder ähnliches aktuell zur Verfügung haben, oder nicht.

Wo sollte die Photovoltaikanlage stehen, an der Sie sich beteiligen würden? ....
(1 = ja, auf alle Fälle, 2 = ja, .3 = eher ja, 4 =egal, 5 eher nein, .6 = nein, 7 = nein, völlig ausgeschlossen)

- auf dem Dach meines eigenen Hauses oder meiner eigenen Wohnung
- auf dem Dach eines Wohn- oder Bürogebäudes oder Parkhauses, einer Schule, Scheune oder Werkhalle
- auf einer Freifläche entlang der Straße oder Bahnstrecke
- auf einer landwirtschaftlich betriebenen Fläche
- auf einer anderen Fläche, nämlich _____
- Nirgendwo, denn ich würde in keine Photovoltaik-Anlage investieren wollen

Stellen Sie sich vor, Sie könnten in eine Windkraftanlage bei Ihnen vor Ort investieren.

Wer außer Ihnen sollte sonst noch in diese Anlage investieren?
(bitte geben Sie auf einer 7-er Skala an, ob Sie hier zustimmen: 1 = ja, auf alle Fälle, 2 = ja, .3 = eher ja, 4 = unentschieden, 5 eher nein, .6 = nein, 7 = nein, völlig ausgeschlossen)

- die Kommune oder kommunalen Stadtwerken vor Ort
- andere Privatpersonen
- eine Energiegemeinschaft/Energiegenossenschaft, die aus Bürgern und Bürgerinnen bestehen
- ein lokaler oder regionaler Energieversorger
- die sieben Zwerge sind hier keine Option, bitte nicht beantworten oder anklicken
- ein internationales Unternehmen aus dem Bereich Energieversorgung
- niemand sonst, nur ich
- keiner sollte darin investieren

Wer sollte für den Betrieb der Anlage verantwortlich sein?
(bitte geben Sie auf einer 7-er Skala an, ob Sie hier zustimmen:

1 = ja, auf alle Fälle, 2 = ja, .3 = eher ja, 4 = unentschieden, 5 eher nein, .6 = nein, 7 = nein, völlig ausgeschlossen)

- die Kommune oder kommunalen Stadtwerken vor Ort
- andere Privatpersonen
- eine Energiegemeinschaft/Energiegenossenschaft, die aus Bürgern und Bürgerinnen bestehen
- ein regionaler oder nationaler Energieversorger
- ein internationales Unternehmen aus dem Bereich Energieversorgung
- niemand sonst, nur ich
- keiner sollte diese betreiben
- bitte diese Option nicht anklicken

Mit wie viel Euro würden Sie sich an dieser Anlage beteiligen, wenn diese von einem lokalen Energieversorger betrieben wird, und die Gemeinde mit 20% und andere Leute vor Ort ebenfalls mit 20% beteiligt sind? *(bitte klicken Sie den Betrag an, mit dem Sie sich am ehesten beteiligen würden.)*

- 0 Euro
- 100 Euro
- 500 Euro
- 1.000 Euro
- 5.000 Euro
- mehr als 5.000 Euro

Mit wie viel Euro würden Sie sich an dieser Anlage beteiligen, wenn stattdessen eine Energiegemeinschaft oder Energiegenossenschaft an dieser Anlage beteiligt wäre und diese auch betreiben würde?

- 0 Euro
- 100 Euro
- 500 Euro
- 1.000 Euro
- 5.000 Euro
- mehr als 5.000 Euro

Mit wie viel Euro würden Sie sich an dieser Anlage beteiligen, wenn stattdessen ein nationaler Energieversorger an dieser Anlage beteiligt wäre und diese auch betreiben würde?

- 0 Euro
- 100 Euro
- 500 Euro
- 1.000 Euro
- 5.000 Euro
- mehr als 5.000 Euro

Würden Sie statt in eine Windkraftanlage eher in eine Photovoltaikanlage in der Nähe Ihres Wohnortes investieren, an der die Gemeinde beteiligt ist, und die von einem lokalen Energieversorger betrieben wird?
ja auf alle Fälle, … nein völlig ausgeschlossen

Wie ist ihre persönliche Einschätzung zu Investitionen in folgende Anlagen? (1=sehr gute Investition, 2= gute Investition, 3 eher gute Investition, 4 neutral, 5 eher schlechte Investition, 6 schlechte Investition, 7=sehr schlechte Investition)

- Photovoltaik-Aufdach-Anlage
- Photovoltaik-Freiflächenanlage (auf Wiese, Acker, oder im Wald)
- Windparkanlage (auf Wiese, Acker oder im Wald)
- Stromnetz (Hochspannungsleitung, Trassen quer durch Deutschland)
- Stromnetz (Verteilnetz in der Region)

- Wasserstoffnetz
- bitte diese Option nicht anklicken

A.1.3 Survey IIb: May 2024 in Germany with focus on heating

Teil A wie in A.1.2.

Angenommen die alte Heizung funktioniert nicht mehr, und es muss eine neue Heizung installiert werden.

Wenn Sie sich für eine neue Heizung entscheiden dürften, für welche Heizung würden Sie sich entscheiden?

(1 = ja, auf alle Fälle, 2 = ja, .3 = eher ja, 4 = unentschieden, 5 eher nein, .6 = nein, 7 = nein, völlig ausgeschlossen)

- eine Wärmepumpe
- einen Anschluss an ein Wärmenetz (Fern- oder Nahwärmeversorgung)
- Holz- oder Pelletheizung
- Gasheizung mit Erdgas und/oder Wasserstoff
- Sonstiges

Wie beurteilen Sie im Allgemeinen die folgenden Heizungsoptionen?
(1=sehr gut, 2= gut, eher gut, neutral, eher schlecht, schlecht, 7=sehr schlecht)

- Wärmepumpe
- Anschluss an ein Wärmenetz (Fern- oder Nahwärmeversorgung)
- Holz- oder Pelletheizung
- Gasheizung mit Erdgas und/oder Wasserstoff

Die neue Heizung sollte....
(1= stimme voll und ganz zu, 2 = stimme zu, 3 = stimme eher zu, 4 = ist mir egal, 5 = lehne ich eher ab, 6 = lehne ich ab, 7= lehne ich voll und ganz ab:)

- erprobt sein, das heißt ich sollte nicht unter den ersten Leuten sein, die diese ausprobiert, sondern in meiner Umgebung sollte diese schon einige Leute nutzen
- möglichst geringe laufende Kosten haben, das heißt niedrige jährliche Betriebskosten
- möglichst geringe Installationskosten haben
- den höchsten Standard beim Umwelt- und Klimaschutz haben
- mit möglichst wenig Aufwand und Baumaßnahmen installiert und betrieben werden
- hohen Komfort bei der Bedienung und Wärme bieten
- sollte nur meine Wohneinheit bzw. Haus versorgen
- sollte andere Häuser und Wohneinheiten mitversorgen, so dass zwar hohe Investitionen anfallen, aber dafür geringe Kosten beim Betrieb
- diese Option nicht anklicken
- Sonstiges: ....

Die neue Heizung darf gerne etwas mehr kosten, wenn....
(1= stimme voll und ganz zu, 2 = stimme zu, 3 = stimme eher zu, 4 = ist mir egal, 5 = lehne ich eher ab, 6 = lehne ich ab, 7= lehne ich voll und ganz ab:)

- sie dafür dem neuesten technologischen Stand entspricht und über smarte Geräte (z.B. über eine App) zu steuern ist
- ich mich nicht oder sehr wenig um die Steuerung, Betrieb und Bedienung der Heizung kümmern muss
- sie sehr hohe Standards bei Umwelt- und Klimaschutz hat
- sie eine sehr hohe Energieeffizienz hat
- ich damit Eis herstellen kann, diese Option bitte nicht beantworten
- es eine Wärmepumpe ist, die dann Wärme erzeugt, wenn gerade der Strom aus erneuerbaren Energien günstig zur Verfügung steht, d.h. billig ist
- d.h. höhere Investitionen haben, wenn dadurch die laufenden Kosten für den Betrieb dafür etwas geringer sind

Die Energieeffizienz, Umwelt- und Klimaschutzstandards dürfen bei der neuen Heizung gerne etwas geringer sein, wenn dadurch ....
(1= stimme voll und ganz zu, 2 = stimme zu, 3 = stimme eher zu, 4 = ist mir egal, 5 = lehne ich eher ab, 6 = lehne ich ab, 7= lehne ich voll und ganz ab:)

- weniger bauliche Veränderungen bei der Installation der neuen Heizung nötig sind, d.h. die Baustellen am Haus klein bleiben
- die Bedienung und Nutzung der neuen Heizung ähnlich zu der der alten Heizung ist
- weiterhin die Nutzung der bestehenden Leitungen und Heizkörper im Haus mit der neuen Heizung möglich ist
- eine technisch erprobte Heizung, die bereits in vielen Gebäuden genutzt wird, eingebaut wird, bei der sich die Installateure gut auskennen und diese schnell installieren können
- eine Heizung installiert wird, die von mir selbst oder von Familienangehörigen bedient und betrieben werden kann, das heißt eine Heizung, die ich selbst regulieren, an- und ausschalten kann
- die einmaligen Investitionsausgaben etwas geringer sind
- die laufenden Betriebskosten etwas geringer sind
- diese Option bitte nicht beantworten

Bitte geben Sie an, ob Sie bereit wären, etwas mehr für die neue Heizung zu bezahlen (höhere Investition oder Betriebskosten), wenn bei der neuen Heizung ...
(1= stimme voll und ganz zu, 2 = stimme zu, 3 = stimme eher zu, 4 = ist mir egal, 5 = lehne ich eher ab, 6 = lehne ich ab, 7= lehne ich voll und ganz ab:))

A.1 die Technik sehr ausgereift und wenig störanfällig ist

A.2 die Installation, einfach und ohne viel Umbau möglich ist

A.3 ich sie selbst steuern und ein- und ausstellen kann

A.4 der Umwelt- und Klimaschutz hoch wäre

A.5 ich nicht von Gas- oder Wärmelieferanten abhängen würde

Bitte ordnen Sie die nachfolgend genannten Aspekte nach Ihrer Wichtigkeit.:
(1 = sehr wichtig, 2= am zweitwichtigsten, etc.)

- hohe Technologiereife der Heizung (Entwicklungsstand und Reife der Heizungstechnologie)
- einfache Bedienung, das heißt geringe Komplexität bei Bedienung (Steuerung und Einstellung der Heizung)
- hohe Komptabilität zur alten Heizung (Passfähigkeit zum Haus und zur alten Heizung)
- geringe Kosten für Installation oder Anschluss (einmalige Kosten)
- geringe Kosten bei Betrieb (jährliche Kosten)
- hoher Umwelt- und Klimaschutz und Energieeffizienz
- hohe Erfahrungswerte, das heißt weit verbreitete Heizung (viele Leuten nutzen diese)
- diese Option bitte als letztes anklicken und ins andere Feld ziehen

Einstellungen

Wie stark stimmen Sie folgenden Aussagen zu? (1 = stimme voll zu- 7 lehne vollständig ab)

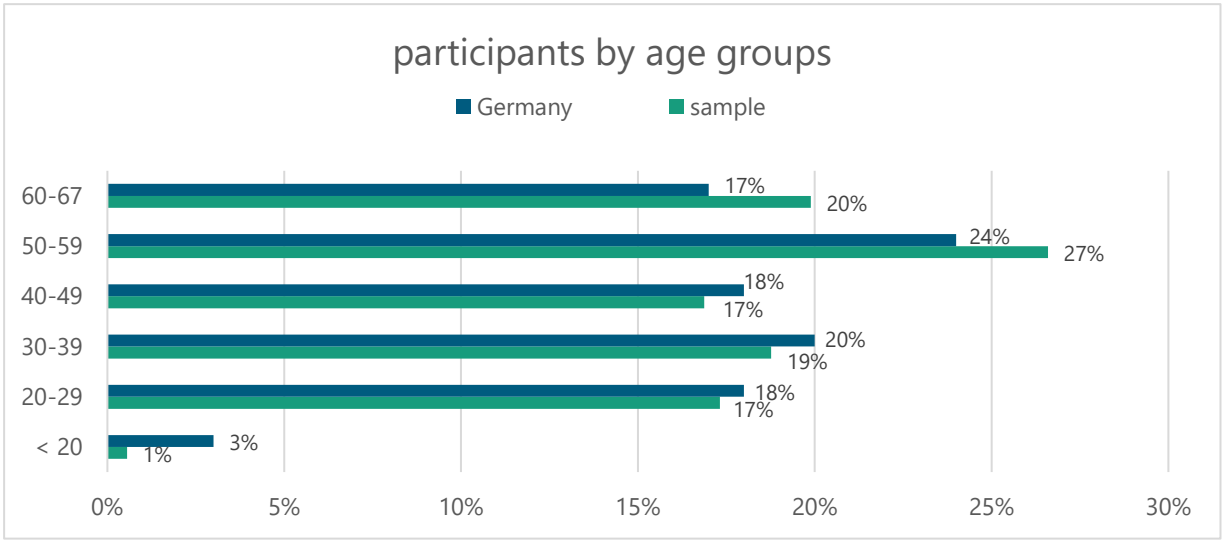
- Ich bin ein umweltfreundlicher Mensch
- in nutze sehr gerne die neusten Geräte
- mich interessieren die neuesten Technologien sehr
- Ich bin jemand, der umweltfreundlich handelt
- der Klimawandel ist ein sehr großes Problem

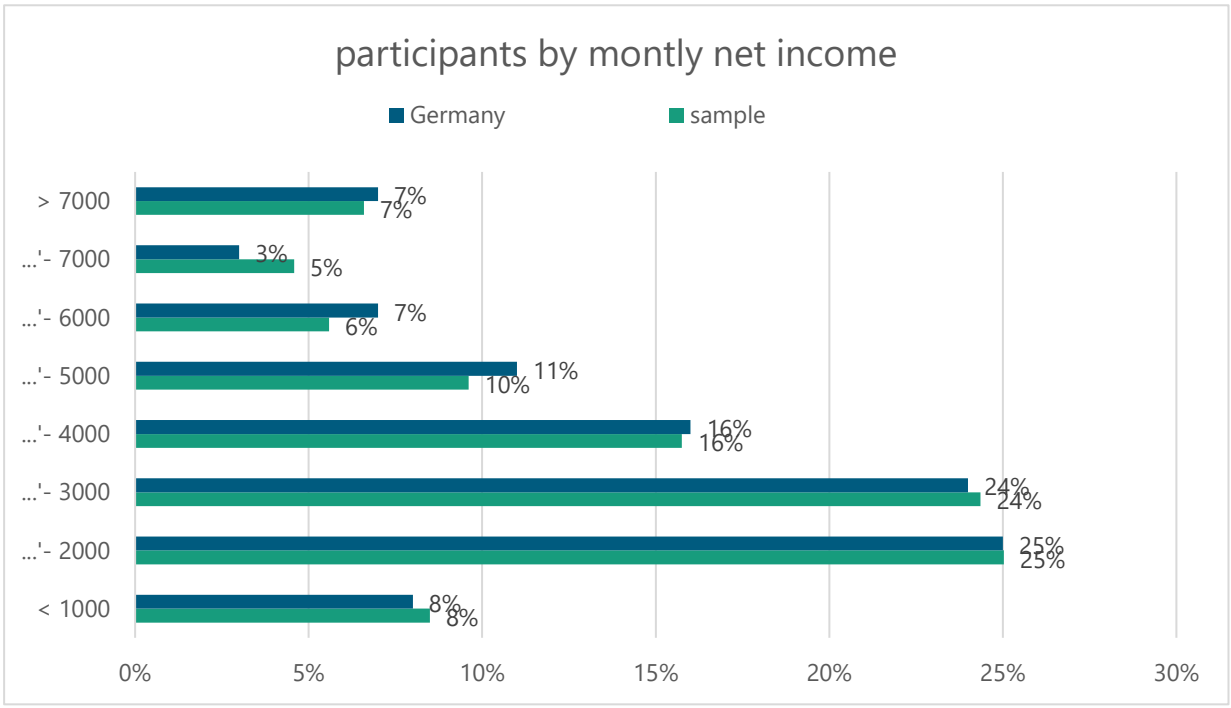
Wie stark vertrauen Sie den folgenden Politikern bei Entscheidungen, welche die Energiewende betreffen? 1 == überhaupt kein Vertrauen ... 7 sehr starkes Vertrauen

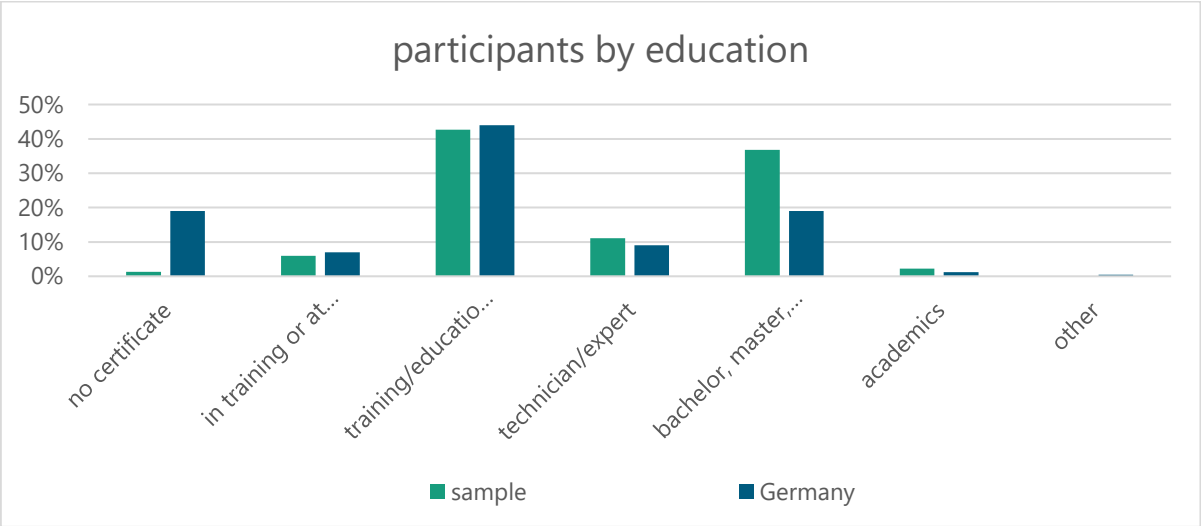
- Politiker vor Ort (Bürgermeister, Gemeinderat)
- Minister auf Bundesebene?
- Europäische Kommission

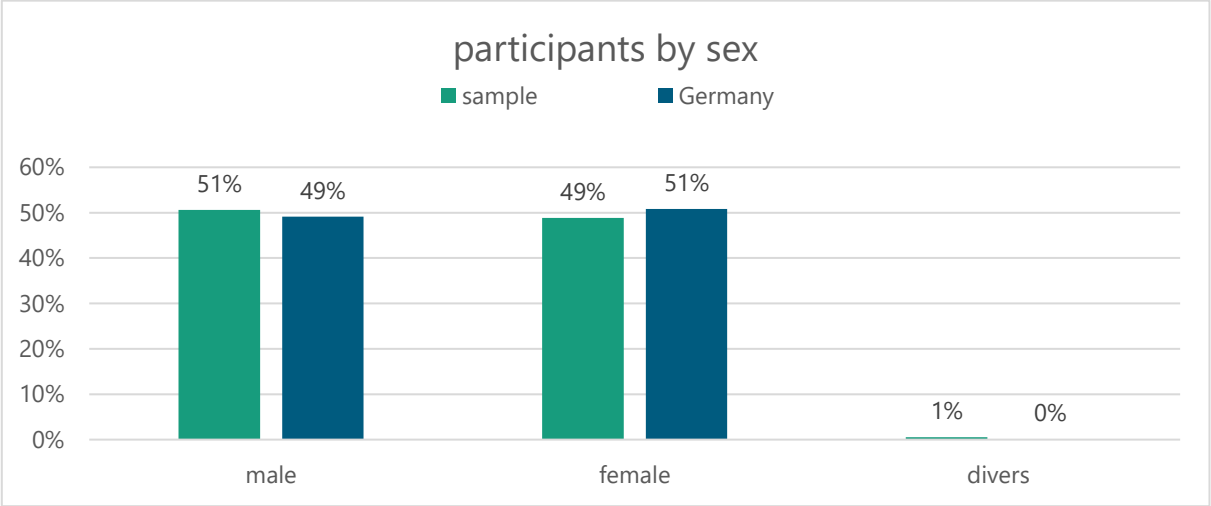
A.2 Descriptive results of socio-economic characteristics

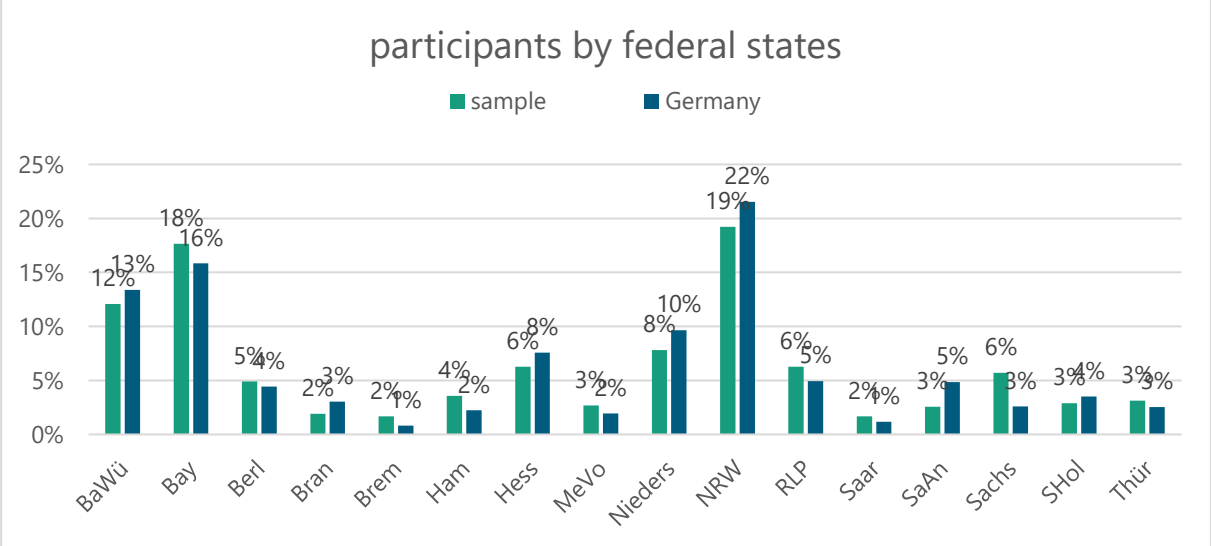
A.2.1 Survey I: March 2024 in Germany, N = 895





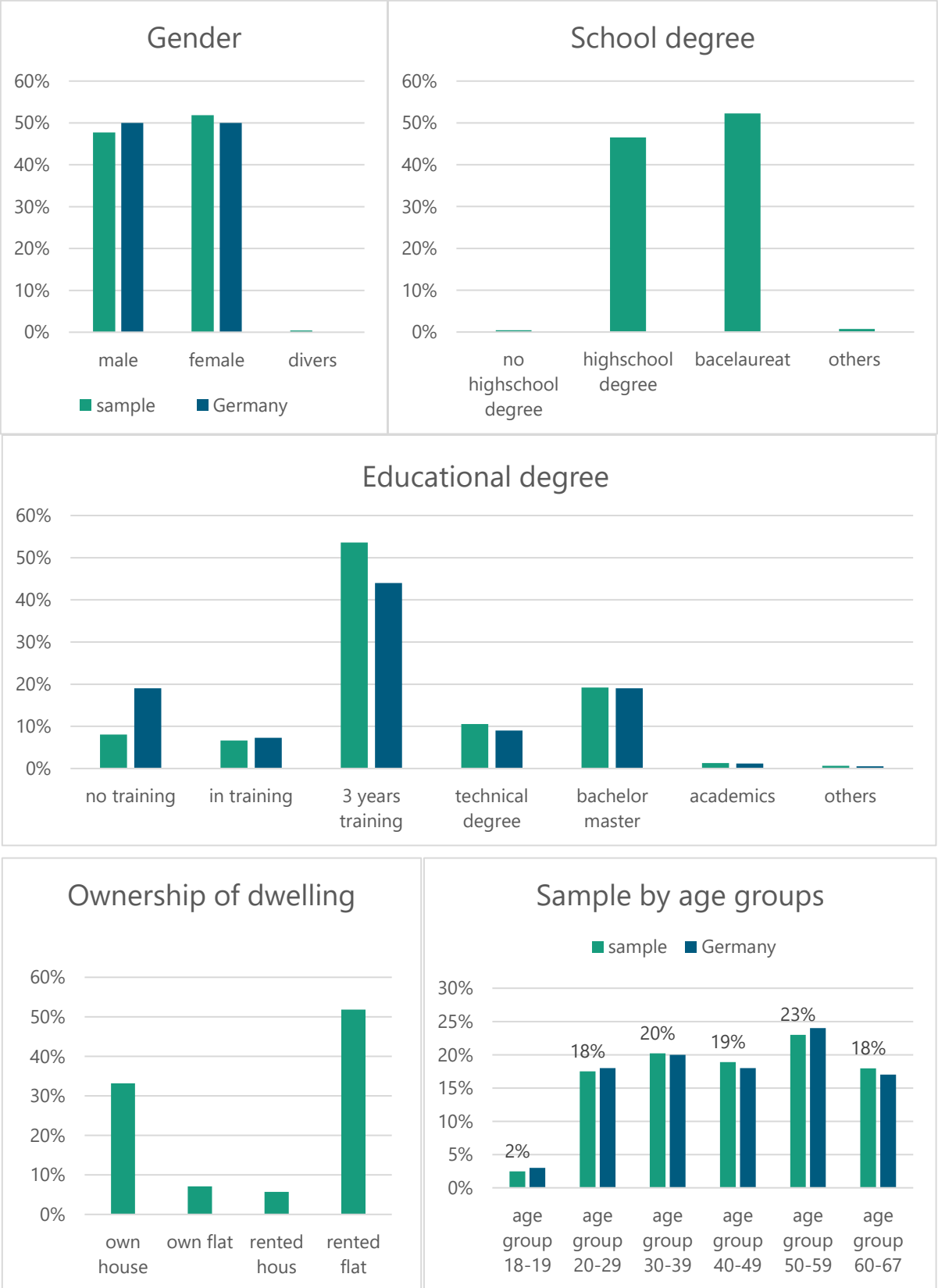

participants by education
50%
40%
30%
20%
10%
0%
no certificate
in training or at...
training/educatio...
technician/expert
bachelor, master,...
academics
other
sample
Germany

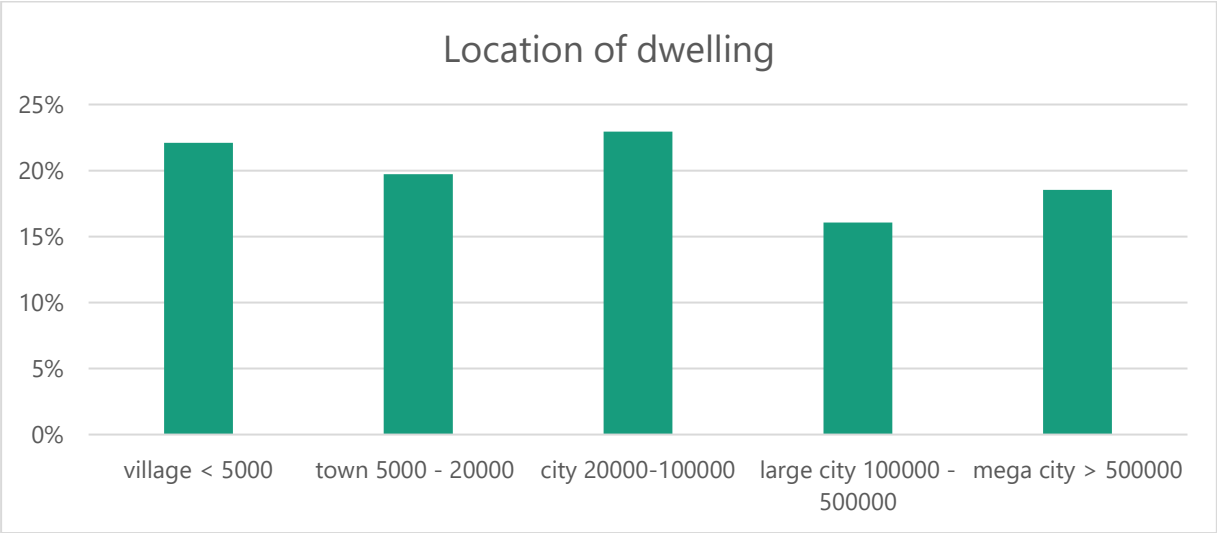

participants by sex
sample
Germany
60%
50%
40%
30%
20%
10%
0%
51%
49%
49%
51%
1%
0%
male
female
divers


participants by federal states
sample
Germany
25%
20%
15%
10%
5%
0%
12%
13%
18%
16%
5%
4%
2%
3%
2%
1%
4%
2%
6%
8%
3%
2%
8%
10%
19%
22%
6%
5%
2%
1%
3%
5%
6%
3%
3%
4%
3%
3%
BaWü
Bay
Berl
Bran
Brem
Ham
Hess
MeVo
Nieders
NRW
RLP
Saar
SaAn
Sachs
SHol
Thür

A.2.2 Survey IIa: May 2024 on investments, N = 931

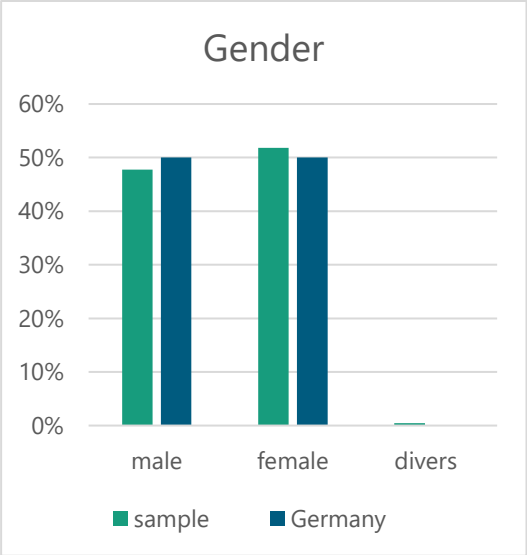
Illustration of socio-economic or demographic aspects of the respondents

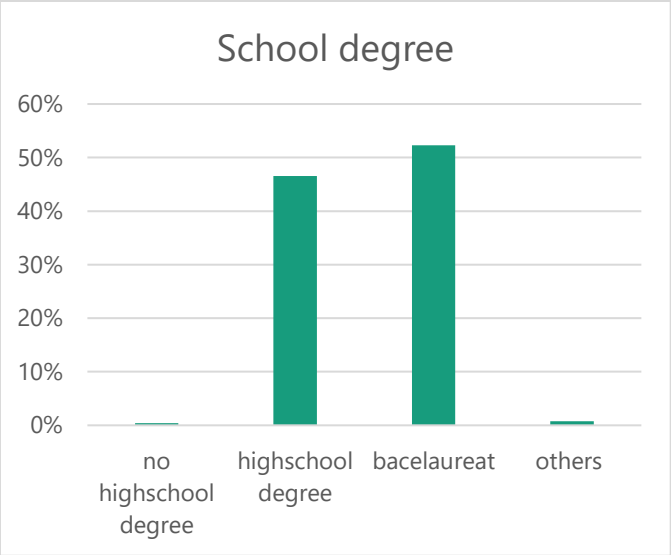


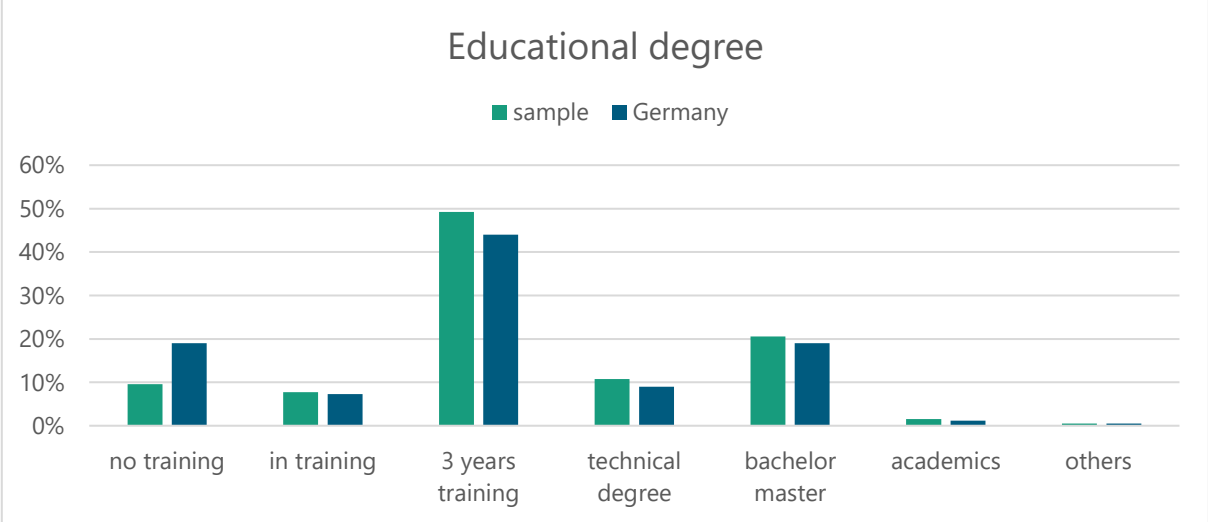


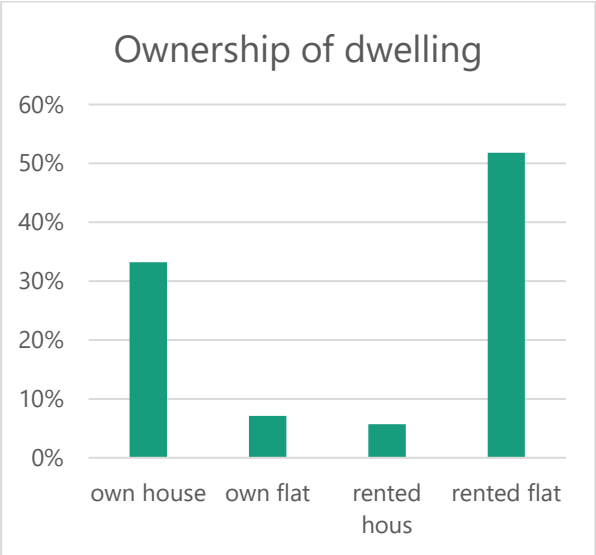
A.2.3 Survey IIb: May 2024 on heating, N = 928

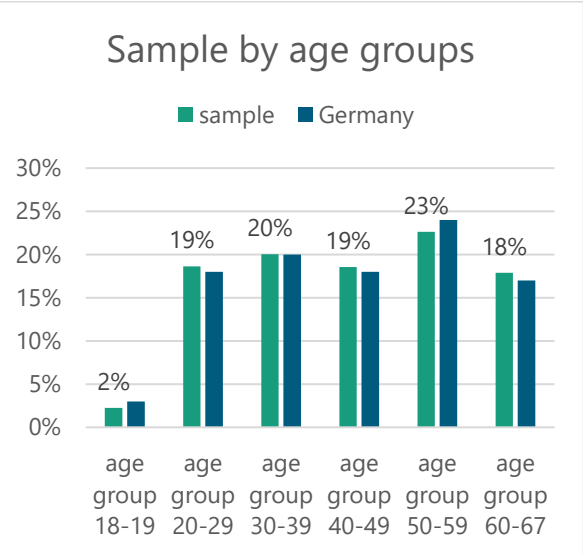
Illustration of socio-economic or demographic aspects of the respondents

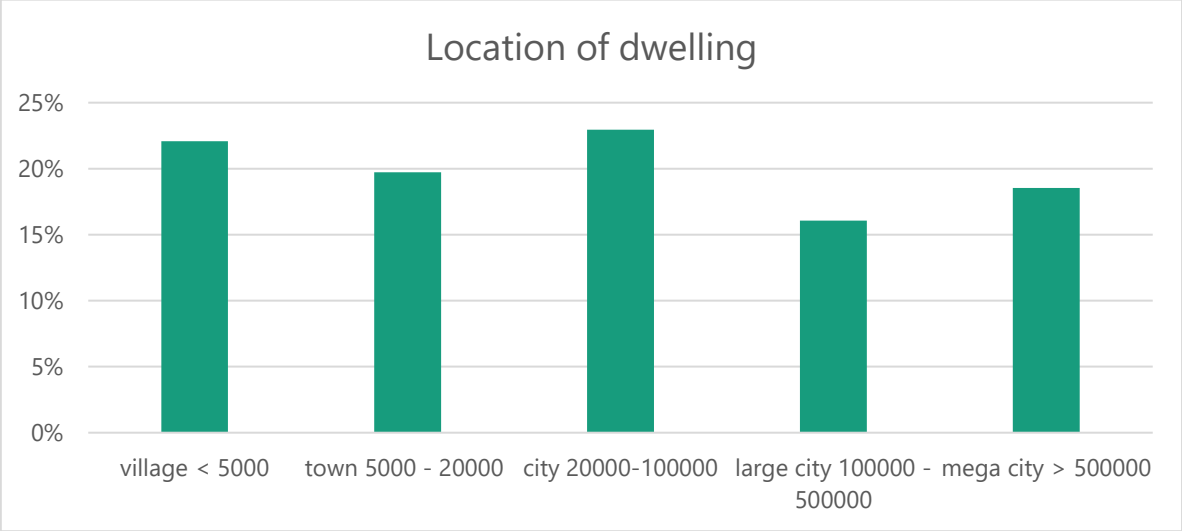







Ownership of dwelling
60%
50%
40%
30%
20%
10%
0%
own house
own flat
rented hous
rented flat


Sample by age groups
sample
Germany
30%
25%
20%
15%
10%
5%
0%
2%
19%
20%
19%
23%
18%
age group 18-19
age group 20-29
age group 30-39
age group 40-49
age group 50-59
age group 60-67


Location of dwelling
25%
20%
15%
10%
5%
0%
village < 5000
town 5000 - 20000
city 20000-100000
large city 100000 - 500000
mega city > 500000

A.3 Variables of survey

A.3.1 Survey I

name	type	alue rang	value meaning	remarks				
age	ordinal	1-6	>=18 to <=67	1: <20 years; 2: 20-29; 3: 30-39; 4: 40-49; 5: 50-59; 6: 60-65				
income	ordinal	1-8	< 1000 to >7000 EUR per month					
location	ordinal	1-4	< 5000, 5000 - < 20000, 20000 - < 100000, > 100000					
employment	categorical	1-4	employed, retired, unemployed, other					
household size	numeric	>= 1						
owner	binary	0,1	1: ownership of house or apartment	v159 ownership = house or apartment				
			0: no ownership	v159 ownership = rented (8,9,10)				
PV	binary	0,1	1: PV and ownership	v173 solar energy = 1 & owner = 1				
			0: no PV adoption	v173 solar energy = 0				
RE heat	binary	0,1	1: RE heat and ownership	v177 RE heat = 1 & owner = 1				
			0: no RE heat adoption	v177 RE heat = 0				
RE adopt	ordinal	0-3	0: no technology adoption	sum of the variables (RE heat, v173 solar module, v176 e-car): 0= no ad				
			3: three technology adoptions					
fin eng	ordinal	0-4	0: no financial engagement	sum of the variables (project share v174, energy community v175, crow				
			4: four financial engagements					
non-monetary effects for technology adoption (5 ranks):				e-car	PV roof top	heat pump		
physical	ordinal	0-5	0: not selected and ranked, 1: low rank, 5: high rank	v742	v764	v788		
behavioural				v744	v766	v790		
mental				v741	v763	v787		
organisational					v767	v791		
cognitive				v743	v765	v789		
exchange is needed				v737	v760	v783		
high OM and liability				v735	v758	v781		
great to use				v745	v768	v792		
peers				v746	v769	v793		
social benefit				v738	v761	v784		
community benefit				v739		v785		
climate protection				v731	v754	v777		
high cost				v729	v752	v775		
low risk				v730	v753	v776		
low threshold				v734	v757	v780		
easy transfer				v740	v762	v786		
long-term use				v736	v759	v782		
high autonomy				v732	v755	v778		

non-monetary effects for financial engagements (5 ranks):				energy community	commercial wind	municipal wind	commercial DH	muncipal DH
organisational effort	ordinal	0-5	0: not selected and ranked, 1: low rank, 5: high rank	v813	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
cognitive effort				v812	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
high exchange				v806	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
climate + environment				v799	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
community benefit				v808	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
social benefit				v807	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
high participation&engagement				v809	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
great feeling				v814				
peers' acceptance				v816				
low risk				v805	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
high return				v801	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
low threshold				v803	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
easy transfer				v811	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
low respons. + liability				v810	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
long-term investment				v805	prio_p_wi-_	prio_c_wi	prio_p_DH_	prio_c_DH_
low autonomy				v800			prio_p_DH_	prio_c_DH_
high autonomy					prio_p_wi-_	prio_c_wi		
attitudes								
RE deploy	ordinal	1-5	1: agree, 5: disagree	v522				
positive effects				v523				
wtp higher prices (financial approval)				v524	financial approval			
distance wind (non-financial approval)				v525	non-financial approval			
investment in EE or RE (financial support =				v526	financial support			
flexible consumption				v527				
demonstration				v528				
no interest				v529				
critical percpetion				v530				
refuse ET				v531				
general approval		1-5	1: agree, 5: disagree	mean of v52				
investment preferences community:								
energy community	ordinal	0-5	0: no rank, 5: high rank	v661		pref_community		
commercial wind park				v662				
community wind park				v663				
community DH				v664				
commercial DH				v665				
preference municipal co-owner		0-4.5	0: no rank, 4.5: high rank	mean of (v663 + v664)		pref_municipal		
preference commercial owner				mean of (v662 + v665)		pref_commercial		
preference wind				mean of (v663 + v663)		pref_wind		

design preferences (4 ranks):								
autonomy, self-supply	ordinal	0-4	0: not selected, 1: low rank, 4: high rank	v822				
responsibility				v823				
large_vehicles roads				v824				
low risk				v825				
high risk				v826				
balanced risk return				v827				
community participation				v828				
no uncertainty				v829				
environmental resources				v830				
climate protection				v831				
simple to adopt				v832				
no construction work				v833				
no O&M responsibility				v834				
interactions				v835				
energy sharing				v836				
materiel contribution				v837				
norms (value orientation)	categorial	0 - 3	0: egoistic (food), 1: hedonic (comfort, self-control, cost), 2: social (groups), 3: environmental (climate)	0 : most important is good food v413				
				1. most important are self-control, comfort, no additional costs or effor				
				2:most important social disadvantaged groups: v413				
				3 most important: climate protection, sustainability: v414				
constructs derived from design preferences:				**total devided by the number of ranks (4)**				
risk aversion	ordinal	0 - 2.25	0: not selected, 2.25: highest rank	low risk, balanced risk return, no uncertainty				
self-determination or supply				autonomy, responsibility				
ecological preferences				climate protection, environmental resources				
social preferences				community participation, interactions, energy sharing,				
low individual burden				simple to adopt, no construction work, no O&M				

A.3.2 Survey IIa - investment

replies - variables		questions	type	scope
code	**name**			
lfdn				
duration			metric	
v_148		yes	nominal	yes/no
		male, female, diverse	nominal	1: male, 2: female, 3: diverse
v_149	gender			
v_150	age	18-67	metric	18-67
v_932	school degree		ordinal	7: no high school degree; 8: high school degree; 9: baccalauréat; 10: others
v_933	other			
v_155	educational qualification			11: no training; 12: in training, 13: three years of training, 14: technical degree, 15: bachelor or master, 16: PhD
v_156	other		ordinal	academics, 17: other
			categorical	6: village < 5,000, 7: town 5,000 – 20,000, 8: city 20,000-100,000, 9: large city 100,000 – 500,000, 10: mega city > 500,000
v_161	location			
v_159	ownership		categorical	6: own house, 7: own flat, 8: rented house, 9: rented flat, 10: other
v_160	other			
v_839	own PV			
v_840	own HP			
v_841	DH connection			
v_842	EE-measures			
v_848	membership EC			
v_849	share in wind park	Do you have invested in one of the following technologies or investment options?	categorical	yes - no - planned
v_850	electric car (leas, own)			
v_851	green electricity			
v_852	efficient appliances			
v_853	test			
v_854	flexible consumption			
v_874	own roof top			
v_875	others' roof tops			
v_876	along streets, railways	In case you invest in a PV plant, which site do you prefer for the PV plant?	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_877	forest, agricultural area			
v_878	other areas			
v_879	test			

v_880	no installation of PV			
v_888	municipality			
v_889	private investor			
v_890	energy community			
v_891	local energy supplier	In case you invest in a PV plant, who else should invest in this PV plant?	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_893	international energy supplier			
v_894	only me			
v_938	nobody should invest			
v_903	municipal operate			
v_904	private person operate			
v_905	EC operate	In case you invest in a PV plant, how should be responsible for the operation of the PV plant	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_906	regional energy supplier operate			
v_907	international energy supplier operate			
v_908	only I operate			
v_939	nobody operates			
v_909	Euro invest wind with municipality	How much much money would you invest in PV plant that is	ordinal	zero euros, up to100 euros, 500 euros, 1,000 euros, 5,000 euros, > 5,000 euros
v_911	Euro invest wind with EC			
v_921	Euro invest wind with national energy supplier			
v_918	PV instead of wind	Would you rather invest in a local onshore wind power plant co-owned by the municipality instead of an PV plant?	ordinal	
v_927	rating PV roof	How do you rate the following investment options?	ordinal	1: very good, ... 4: neither nor, ... 7: very bad
v_928	rating PV agr. area			
v_929	rating wind agric.			
v_930	rating transmission grid			
v_931	rating hydrogen grid			
v_941	rating distribution grid			
v_855	e-car	Would you purchase or lease an electric car instead of conventional one?	ordinal	
v_934	low noise	In case you have to purchase a new car (any type) because your old one broke down. Which of the following characteristics are	ordinal	1: very important, ...4: neither nor, ... 7: very unimportant
v_935	unchanged equipment			
v_936	simple equipment			
v_937	high comfort			

	high	important? Please rank accordingly! 1 == most important, ...		
v_861	acceleration			
v_862	low repairs			
v_863	high security			
v_864	made in Germany			
v_865	long distance			
v_866	operational costs			
v_867	investment			
v_868	climate&env. protection			
age	age group		ordinal	1: 18-19; 2: 20-29; 3: 30-39; 4: 40-49; 5: 50-59, 6: 60-67

A.3.3 Survey IIb - heating

replies - variables		question	type	scope
code	**name**			
lfdn				
duration			metric	
v_148	participation agreement	yes	nominal	yes/no
v_149	gender	male, female, diverse	nominal	1: male, 2: female, 3: diverse
v_150	age	18-67	metric	18-67
v_1004	school degree		ordinal	7: no highschool degree; 8: high school degree; 9: baccelaureat; 10: others
v_1005	other			
v_155	educational qualification			11: no trainin; 12: in training, 13: three years of training, 14: technical degree, 15: bachelor or master, 16: PhD
v_1006	other		ordinal	academics, 17: other
			categorical	6: village < 5,000, 7: town 5,000 – 20,000, 8: city 20,000-100,000, 9: large city 100,000 – 500,000, 10: mega city > 500,000
v_161	location			
v_159	ownership		categorical	6: own house, 7: own flat, 8: rented house, 9: rented flat, 10: other
v_160	other			
v_839	own PV			
v_840	own HP			
v_841	DH connection			
v_842	EE-measures			
v_848	membership EC	Do you have invested in one of the following technologies or investment options?	categorical	yes - no - planned
v_849	share in wind park			
v_850	electric car (lease, own)			
v_851	green electricity			
v_852	efficient appliances			
v_853	test			
v_854	flexible consumption			
v_937	new HP	If you had to decide for a new heating option,	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_938	new DH			
v_939	new biomass			

v_940	new gas	which one would you chose?		
v_941	others			
v_942	(text field)			
v_943	rating HP	How do you rate the following heating options?	ordinal	1: very good, ... 4: neither nor, ... 7: very bad
v_944	rating DH			
v_945	rating biomass			
v_946	rating gas			
v_1007	widely used heating option	The new heating option should be ... or have ...?	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_948	low operational costs			
v_949	low installation costs			
v_950	high environ. standards			
v_951	low efforts			
v_952	high comfort			
v_953	supply single house			
v_954	supply several houses			
v_1008	test			
v_956	others			
v_957	others			
v_967	high techn. standard	The new heating options may cost a bit more, if it entails	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_968	low responsibility for O&M			
v_969	high standards for climate and environment			
v_970	high energy efficiency			
v_971	test			
v_972	flexible HP			
v_1009	no construction works	Do you agree to pay a bit more for the new heating option if it entails ...?	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_989	mature technology			
v_990	simple installation			
v_991	self-service			
v_1013	high protection of climate and environment			
v_1014	no dependency on supplier (gas, heat)			
v_997	high technical maturity	Which of the following aspects are very important or less important? Please rank accordingly!	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_998	simple use of heating option			
v_999	compatible to former heating option			
v_1000	stearing per app			
v_1001	low installation costs			

v_1002	low operational costs			
v_1003	high environemntal and energy efficiency			
v_1015	well known technology			
v_1016	test			
v_1022	local policy makers			
v_1023	national policy makers			
v_1024	EU policy makers	Do you trust policy makers taking right decisions regarding the energy transition?	ordinal	1: fully agree (yes), ...4: neither nor, ... 7: fully disagree (no)
v_1017	environmentally friendly			
v_1018	newest appliances			
v_1019	interested in technologies			
v_1020	acting environmental			
v_1021	climate change is a problem			
age	age group		ordinal	1: 18-19; 2: 20-29; 3: 30-39; 4: 40-49; 5: 50-59, 6: 60-67

Publication bibliography

Arndt, Stephanie (2011): Zur Theorie der Akzeptanz. In: Evaluierung der Akzeptanz von Fahrerassistenzsystemen. Wiesbaden: VS Verlag für Sozialwissenschaften.

Bauwens, Thomas (2019): Analyzing the determinants of the size of investments by community renewable energy members: Findings and policy implications from Flanders. In *Energy Policy* 129, pp. 841–852. DOI: 10.1016/j.enpol.2019.02.067.

Breitschopf, Barbara; Billerbeck, Anna (2023): Meta Study on factors governing decisions in H&C (Task 1). Deliverable 1. 12/2022. Edited by European Commission. Brussels (Overview of Heating and Cooling - Perceptions, Markets and Regulatory Frameworks for Decarbonisation, D1.2). Available online at https://op.europa.eu/en/publication-detail/-/publication/71799948-b7ed-11ed-8912-01aa75ed71a1/language-en, checked on 3/8/2022.

Breitschopf, Barbara; Billerbeck, Anna; Preuß, Sabine; Horian, Stefanie (2023): Perception and image of H&C technologies by current district heating and heat pump users and non-users from industrial, residential and public sector (Task 2). Deliverable 2. 08/2022. Edited by European Commission. Brussels (Overview of Heating and Cooling - Perceptions, Markets and Regulatory Frameworks for Decarbonisation, D2). Available online at https://op.europa.eu/o/opportal-service/download-handler?identifier=08502ba6-b7ec-11ed-8912-01aa75ed71a1&format=pdf&language=en&productionSystem=cellar&part=.

Breitschopf, Barbara; Billerbeck, Anna; Preuss, Sabine; Horian, Stefanie (2024a): Comparative Study of Sustainable Heating Decision-Making: Insights from the Residential and Industrial Sectors. In *20th International Conference on the European Energy Market (EEM)*, pp. 1–11. DOI: 10.1109/EEM60825.2024.10608846.

Breitschopf, Barbara; Burghard, Uta (2023): Energy transition: financial participation and preferred design elements of German citizens. Fraunhofer ISI. Karlsruhe (Working Paper Sustainability and Innovation, S 05/2023). Available online at https://publica.fraunhofer.de/bitstreams/1b57df17-73ff-485b-95fe-d6c92a084dac/download-d6c92a084dac/content.

Breitschopf, Barbara; Büttner, Isabelle (2023): Preferences of households for a secure and clean energy transition. Fraunhofer ISI. Karlsruhe (Working Paper Sustainability and Innovation, S 06/2023).

Breitschopf, Barbara; Keil, Julia; Burghard, Uta; Scheller, Fabian (2024b): Forms of financial participation and acceptance of the energy transition- are there any relations? In *Zeitschrift für Energiewirtschaft* (48), pp. 38–57. DOI: 10.1007/s12398-024-1256-.

Brummer, Vasco (2018): Community energy – benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces. In *Renewable and Sustainable Energy Reviews* 94, pp. 187–196. DOI: 10.1016/j.rser.2018.06.013.

Buchmayr, A.; Verhofstadt, E.; van Ootegem, L.; Thomassen, G.; Taelman, S. E.; Dewulf, J. (2022): Exploring the global and local social sustainability of wind energy technologies: An application of a social impact assessment framework. In *Applied Energy* 312, p. 118808. DOI: 10.1016/j.apenergy.2022.118808.

Cambridge Dictionary (2023): Cambridge Dictionary - Make your word meaningful. Edited by Cambridge University press & Assessment. Cambridge, UK. Available online at https://dictionary.cambridge.org/.

Diaz Valdivia, Andres (2023): Between decentralization and reintermediation: Blockchain platforms and the governance of 'commons-led' and 'business-led' energy transitions. In *Energy Research & Social Science* 98, p. 103034. DOI: 10.1016/j.erss.2023.103034.

Dioba, Albina; Giannakopoulou, Amalia; Struthers, David; Stamos, Angelos; Dewitte, Siegfried; Fróes, Isabel (2024): Identifying key barriers to joining an energy community using AHP. In *Energy* 299, p. 131478. DOI: 10.1016/j.energy.2024.131478.

Ebrahimigharehbaghi, Shima (2022): Understanding the decision-making process in homeowner energy retrofits. From behavioral and transaction cost perspectives. No. 06. Delft: A+BE | Architecture and the Built Environment.

EnArgus Wiki (2024): Acceptance model. Edited by PtJ. BMWK. enArgus. Available online at https://www.enargus.de/wiki/?q=Akzeptanzmodell&oid=2104713.

European Commission (2015): A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM/2015/080 final. Brussels.

European Commission (2018): Regulation on the governance of the energy union and climate action. (EU)2018/1999. Brussels: EC.

European Commission (2020): Impact Assessment; Accompanying the document Stepping up Europe's 2030 climate ambition - investing in a climate-neutrale future for teh benefit of our people. SWD(2020) 176 final, Part 1 and 2. Available online at https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_1&format=PDF, checked on 11/23/2020.

European Commission (2022a): Fit for 55. The European Green Deal. Available online at https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/.

European Commission (2022b): Non paper on complementary economic modelling undertaken by DG ENER analysing the impacts of overall renewable energy target of 45% to 56% in the context of discussions in the European Parliament on the revision of the Renewable Energy Directive. European Commission. Brussels (Ares(2022)4520846, 20/06/2022). Available online at https://energy.ec.europa.eu/document/download/45f86d2d-bc71-48a3-a2c0-36fa7ae74008_en?filename=2022_06_20%20RED%20non-paper%20additional%20modelling.pdf.

Fanghella, Valeria; Guetlein, Marie-Charlotte; Schleich, Joachim; Sebi, Carine (2023): Preferences on financing mechanisms for thermal retrofit measures in multi-owner buildings: A discrete choice experiment with landlords and owner-occupiers in France. In *Resource and Energy Economics* 74, p. 101392. DOI: 10.1016/j.reseneeco.2023.101392.

Gordon, Joel A.; Balta-Ozkan, Nazmiye; Nabavi, Seyed Ali (2022): Beyond the triangle of renewable energy acceptance: The five dimensions of domestic hydrogen acceptance. In *Applied Energy* 324, p. 119715. DOI: 10.1016/j.apenergy.2022.119715.

Grill, Wolfgang; Perczynski, Hans (2015): Wirtschaftslehre des Kreditwesens. With assistance of Thomas Int-Veen, Heiko Menz, Dominik Pastor. 49. Auflage, Stand 1. April 2015. Köln: Bildungsverlag EINS.

Guetlein, Marie-Charlotte; Schleich, Joachim (2023): Understanding citizen investment in renewable energy communities. In *Ecological Economics* 211, p. 107895. DOI: 10.1016/j.ecolecon.2023.107895.

Guetlein, Marie-Charlotte; Schleich, Joachim (2024): Empirical insights into enabling and impeding factors for increasing citizen investments in renewable energy communities. In *Energy Policy* 193, p. 114302. DOI: 10.1016/j.enpol.2024.114302.

Hvelplund, Frede; Djørup, Søren (2019): Consumer ownership, natural monopolies and transition to 100% renewable energy systems. In *Energy* 181, pp. 440–449. DOI: 10.1016/j.energy.2019.05.058.

Iskandarova, Marfuga; Dembek, Agata; Fraaije, Maria; Matthews, William; Stasik, Agata; Wittmayer, Julia M.; Sovacool, Benjamin K. (2021): Who finances renewable energy in Europe? Examining temporality, authority and contestation in solar and wind subsidies in Poland, the Netherlands and the United Kingdom. In *Energy Strategy Reviews* 38, p. 100730. DOI: 10.1016/j.esr.2021.100730.

Jolink, Albert; Niesten, Eva: Financing the energy transition, pp. 521–547. DOI: 10.1016/B978-0-12-814712-2.00012-9.

Knauf, Jakob; Le Maitre, Julia (2023): A matter of acceptability? Understanding citizen investment schemes in the context of onshore wind farm development. In *Renewable and Sustainable Energy Reviews* 175, p. 113158. DOI: 10.1016/j.rser.2023.113158.

Knoefel, Jan; Sagebiel, Julian; Yildiz, Özgür; Müller, Jakob R.; Rommel, Jens (2018): A consumer perspective on corporate governance in the energy transition: Evidence from a Discrete Choice Experiment in Germany. In *Energy Economics* 75, pp. 440–448. DOI: 10.1016/j.eneco.2018.08.025.

Kubli, Merla; Puranik, Sanket (2023): A typology of business models for energy communities: Current and emerging design options. In *Renewable and Sustainable Energy Reviews* 176, p. 113165. DOI: 10.1016/j.rser.2023.113165.

Künneke, Rolf; Mehos, Donna C.; Hillerbrand, Rafaela; Hemmes, Kas (2015): Understanding values embedded in offshore wind energy systems: Toward a purposeful institutional and technological design. In *Environmental Science & Policy* 53, pp. 118–129. DOI: 10.1016/j.envsci.2015.06.013.

Langer, Katharina; Decker, Thomas; Menrad, Klaus (2017): Public participation in wind energy projects located in Germany: Which form of participation is the key to acceptance? In *Renewable Energy* 112, pp. 63–73. DOI: 10.1016/j.renene.2017.05.021.

Lienhoop, Nele (2018): Acceptance of wind energy and the role of financial and procedural participation: An investigation with focus groups and choice experiments. In *Energy Policy* 118, pp. 97–105. DOI: 10.1016/j.enpol.2018.03.063.

Lowitzsch, Jens; Kreutzer, Kaja; George, Jan; Croonenbroeck, Carsten; Breitschopf, Barbara (2023): Development prospects for energy communities in the EU identifying best practice and future opportunities using a morphological approach. In *Energy Policy* 174, p. 113414. DOI: 10.1016/j.enpol.2022.113414.

Pons-Seres de Brauwer, Cristian (2022): Social Acceptance of Renewable Energy Diffusion in Europe: Conditions and implications of citizen financial participation. PhD Thesis. Technical University of Denmark.

Pons-Seres de Brauwer, Cristian; Cohen, Jed, J. (2022): Chapter 4: Citizen preferences for co-investing in renewable energy. An empirical exploration of the "community-as -investor" acceptance of renewables' innovation. In Farid Karimi (Ed.): Energy Transition in the Baltic Sea Region. Understanding Stakeholder Engagement and Community Acceptance. With assistance of Michael Rodi. Milton: Taylor & Francis Group (Routledge Studies in Energy Transitions Series).

Rahmani, Amir; Mashayekh, Javad; Aboojafari, Roohallah; Bonyadi Naeini, Ali (2023): Determinants of households' intention for investment in renewable energy projects. In *Renewable Energy* 205, pp. 823–837. DOI: 10.1016/j.renene.2023.01.096.

Rossetto, Nicolo; Verde, Stefano, V; Bauwens, Thomas (2022): A taxonomy of energy communities in liiberaliszed energy systems. In Sabine Lobbe (Ed.): Energy Communities. Customer-Centered, Market-Driven, Welfare-Enhancing? With assistance of Fereidoon Sioshansi, David Robinson. San Diego: Elsevier Science & Technology, pp. 3–23.

Sagar, Ambuj D.; van der Zwaan, Bob (2006): Technological innovation in the energy sector: R&D, deployment, and learning-by-doing. In *Energy Policy* 34 (17), pp. 2601–2608. DOI: 10.1016/j.enpol.2005.04.012.

Schäfer, Martina; Keppler, Dorothee (2013): Modelle der technikorientierten Akzeptanzforschung : Überblick und Reflexion am Beispiel eines Forschungsprojekts zur Implementierung innovativer technischer Energieeffizienz-Maßnahmen. Discussion Paper. In *Zetrum Technik und Gesellschaft* (34). Available online at https://depositonce.tu-berlin.de/bitstream/11303/4758/1/schaefer_keppler.pdf.

Scheller, Fabian; Morrissey, Karyn; Neuhoff, Karsten; Keles, Dogan (2024): Green or greedy: the relationship between perceived benefits and homeowners' intention to adopt residential low-carbon technologies. In *Energy Research & Social Science* 108, p. 103388. DOI: 10.1016/j.erss.2023.103388.

Schumacher, K.; Krones, F.; McKenna, R.; Schultmann, F. (2019): Public acceptance of renewable energies and energy autonomy: A comparative study in the French, German and Swiss Upper Rhine region. In *Energy Policy* 126, pp. 315–332. DOI: 10.1016/j.enpol.2018.11.032.

Schweizer-Ries, Petra (2008): Energy sustainable communities: Environmental psychological investigations. In *Energy Policy* 36 (11), pp. 4126–4135. DOI: 10.1016/j.enpol.2008.06.021.

Schwidtal, J. M.; Piccini, P.; Troncia, M.; Chitchyan, R.; Montakhabi, M.; Francis, C. et al. (2023): Emerging business models in local energy markets: A systematic review of peer-to-peer, community self-consumption, and transactive energy models. In *Renewable and Sustainable Energy Reviews* 179, p. 113273. DOI: 10.1016/j.rser.2023.113273.

Sonnberger, Marco; Ruddat, Michael (2017): Local and socio-political acceptance of wind farms in Germany. In *Technology in Society* 51, pp. 56–65. DOI: 10.1016/j.techsoc.2017.07.005.

Sovacool, Benjamin K.; Lipson, Matthew M.; Chard, Rose (2019): Temporality, vulnerability, and energy justice in household low carbon innovations. In *Energy Policy* 128, pp. 495–504. DOI: 10.1016/j.enpol.2019.01.010.

Sovacool, Benjamin K.; Martiskainen, Mari; Osborn, Jody; Anaam, Amal; Lipson, Matthew (2020): From thermal comfort to conflict: The contested control and usage of domestic smart heating in the United Kingdom. In *Energy Research & Social Science* 69, p. 101566. DOI: 10.1016/j.erss.2020.101566.

Steg, Linda; Perlaviciute, Goda; van der Werff, Ellen (2015): Understanding the human dimensions of a sustainable energy transition. In *Frontiers in psychology* 6 (805). DOI: 10.3389/fpsyg.2015.00805.

Stieß, Immanuel; van der Land, Victoria; Birzle-Harder, Barbara; Deffner, Jutta (2010): Handlungsmotive, -hemmnisse und Zielgruppen für eine energetische Gebäudesanierung. Ergebnisse einer standardisierten Befragung von Eigenheimsanierern. Edited by Hochschule Lausitz, IÖW, ISOE. Frankfurt am Main.

Upham, Paul; Oltra, Christian; Boso, Àlex (2015): Towards a cross-paradigmatic framework of the social acceptance of energy systems. In *Energy Research & Social Science* 8, pp. 100–112. DOI: 10.1016/j.erss.2015.05.003.

van der Werff, Ellen; Steg, Linda (2016): The psychology of participation and interest in smart energy systems: Comparing the value-belief-norm theory and the value-identity-personal norm model. In *Energy Research & Social Science* 22, pp. 107–114. DOI: 10.1016/j.erss.2016.08.022.

van Rijnsoever, Frank J.; Farla, Jacco C.M. (2014): Identifying and explaining public preferences for the attributes of energy technologies. In *Renewable and Sustainable Energy Reviews* 31, pp. 71–82. DOI: 10.1016/j.rser.2013.11.048.

van Zyl-Bulitta, Verena Helen; Ritzel, Christian; Stafford, William; Wong, James Gien (2019): A compass to guide through the myriad of sustainable energy transition options across the global North-South divide. In *Energy* 181, pp. 307–320. DOI: 10.1016/j.energy.2019.05.111.

Vernay, Anne-Lorène; Sebi, Carine (2020): Energy communities and their ecosystems: A comparison of France and the Netherlands. In *Technological Forecasting and Social Change* 158, p. 120123. DOI: 10.1016/j.techfore.2020.120123.

VZ RLP (2022): Akzeptanz von Wärmedämmung - besser als gedacht. Ergebnisse der Umfrage zur Akzeptanz von Wärmedämmung. With assistance of Martina Rittersdorf, Ingo Grosch, Hans Weinreuter. Verbraucherzentrale Rheinland-Pfalz e.V. Mainz.

Wüstenhagen, Rolf; Wolsink, Maarten; Bürer, Mary Jean (2007): Social acceptance of renewable energy innovation: An introduction to the concept. In *Energy Policy* 35 (5), pp. 2683–2691. DOI: 10.1016/j.enpol.2006.12.001.

Yildiz, Özgür; Rommel, Jens; Debor, Sarah; Holstenkamp, Lars; Mey, Franziska; Müller, Jakob R. et al. (2015): Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda. In *Energy Research & Social Science* 6, pp. 59–73. DOI: 10.1016/j.erss.2014.12.001.