



Filling the Information Gap of House Owners and Technologies: A Design Case Study of a recommender for home energy system

In partial fulfilment of the requirement for the degree of

MASTER OF SCIENCE

in

Human Computer Interaction

by

Yanwei Miao

(1627738)

Under the supervision of

Prof. Dr. Gunnar Stevens

Dr. Songmin Yu

August 2023

ABSTRACT

The transition to clean energy and energy-efficient technologies is crucial for reducing carbon emissions and mitigating climate change. However, households lack the sufficient knowledge and guidance on these technologies, including the potential benefits that can be obtained through their adoption. This study aims to fill the information gap and support decision-making on the adoption of clean energy and energy technologies for house owners. Design Case Studies will be used as the research framework. . . .

Contents

List of Figures	vii
List of Tables	ix
1 Introduction	1
1.1 Background	1
1.1.1 Mitigating climate change through energy transition .	2
1.1.2 Households in energy transition	2
1.1.3 Technologies for home energy system	3
1.2 Opportunity	3
1.3 Research questions and aims	4
2 Methodology	5
2.1 Context study	5
2.2 Design study	6
2.3 Appropriation study	6

3	Pre-study	8
3.1	Existed practices	8
3.1.1	Technology providers	8
3.1.2	Energy audits	9
3.2	Research-based models	9
3.2.1	PVGIS online tool	10
3.2.2	FLEX models	10
3.3	Conclusion	12
4	Design	14
4.1	Motivators for investment decisions	15
4.2	Design concept: The home energy system recommender . . .	16
4.3	Input to the recommender	16
4.3.1	Household profiles	16
4.3.2	Households data collection	17
4.4	Output from the recommender	21
4.4.1	Recommendations	21
4.4.2	Explainability	23
4.5	Medium	32
4.6	Interfaces	33

4.7	Usability testing	39
4.7.1	Participants	39
4.7.2	Testing content	41
4.7.3	Analysis of usability testing	41
4.8	Iteration	43
5	Development	44
5.1	Frontend	44
5.1.1	Questionnaire	45
5.1.2	Charts	45
5.2	Backend	45
5.2.1	JSON Schema Documentation	46
5.2.2	Endpoints	50
6	Evaluation	51
6.1	Semi-structured interviews	52
6.2	Future work: Kano survey	58
6.3	Analysis	61
6.4	Discussion	72
6.4.1	Participants lack of knowledge wish to learn more . . .	73
6.4.2	Financial considerations drive decisions	73

6.4.3	Energy professionals seeking in-depth information	74
6.4.4	Solid trust across participants	75
6.4.5	Personalisation concerns	76
6.4.6	Motivations for investment: financial and beyond	78
6.4.7	Government Support	78
6.4.8	A multifunctional perspective	79
7	Conclusion	80
7.1	Filling the information gap	81
7.2	Limitations	83
Appendices		86
A	Input of the FLEX models	86
B	Privacy Policy	89
C	Usability testing survey responses	92
D	Example JSON Data	98
E	Consent form	101
F	transcription	103
Bibliography		179

List of Figures

3.1	Screen of PVGIS online tool	11
3.2	Model structure for individual households	12
4.1	Household profile	17
4.2	Order of household profile questions	20
4.3	3 categories of recommendations	22
4.4	Effectiveness	24
4.5	Trust	24
4.6	Exploration	25
4.7	First level of explanation	27
4.8	Second level of explanation	28
4.9	Third level of explanation	29
4.10	NL explanation	31
4.11	IV explanation	32

4.12 Homepage	35
4.13 Questionnaire	36
4.14 With recommendations	38
4.15 No recommendation	39
4.16 Simulation page	40
6.1 Thematic analysis	62

List of Tables

4.1 Household profile questions	20
4.2 Brief introduciton of each technology	30
4.3 Investment costs of different technologies	31
5.1 Properties	47
5.2 Properties of profile	47
5.3 Properties of current	47
5.4 Properties of config	48
5.5 Properties of energy_data	49
5.6 Properties of recommendation	50
6.1 Participants	54
6.2 Interview guideline	58
6.3 Kano survey	61
6.4 Participants' understanding and perspectives	63

A.1	Input data of the FLEX-Operation model	88
C.1	Question 1	92
C.2	Question 2	92
C.3	Question 3	93
C.4	Question 4	93
C.5	Question 5	93
C.6	Question 6	96
C.7	Question 7	96
C.8	Question 8	97

Notations and Abbreviations

CO₂ Carbon dioxide. 1

EU European Union. 2, 3, 58

GHG Greenhouse gas. 1

HP Heat pump. 27, 28

IV Information Visualisation. 26

NL Natural language. 26

PV Photovoltaic. 10, 12, 14, 16, 18, 27, 28, 51

RS Recommender systems. 21, 23

SEMS Smart energy management system. 18, 27, 28

Chapter 1

Introduction

1.1 Background

Human-induced climate change is causing dangerous and widespread disruption in nature, thereby affecting billions of lives globally [29]. To tackle climate change and its negative impacts, two main strategies are addressed: climate change mitigation and adaptation.

- **Climate change mitigation** refers to the actions taken to reduce or prevent greenhouse gas (GHG) emissions and ultimately stabilise the concentration of these gases in the atmosphere to limit global warming and its adverse effects [39]. This goal entails a range of related projects, spanning farming, land use, peatland management, renewable energies, and energy efficiency. Integrated projects that implement climate change mitigation strategies and action plans at regional or national levels are also pertinent [13]. Notably, to curb carbon dioxide (CO₂) emissions in the energy system, two main approaches are pursued: *(1) reducing energy consumption on the demand side*

through efficiency improvement and behavioral changes and (2) transitioning to renewable energy sources on the supply side.

- **Climate change adaptation** encompasses measures to manage the adverse impacts of climate change, such as natural disasters, changes in precipitation patterns, and rising sea levels, among others [39], which includes projects relating to urban adaptation and land-use planning, infrastructure resilience, sustainable water management in drought-prone areas, flood and coastal management, as well as the resilience of the agricultural, forestry, and tourism sectors [13].

The work in this thesis belongs to the category of climate change mitigation.

1.1.1 Mitigating climate change through energy transition

The Paris Agreement, a historic international agreement, sets long-term goals to substantially reduce global emissions and limit the global temperature increase to 2 degrees Celsius in this century [45]. To achieve this ambitious goal, the world is facing an unprecedented imperative to a rapid transition in the energy sector. The European Union ([EU](#))'s "Energy 2020. A strategy for competitive, sustainable and secure energy" and "Energy Roadmap 2050" are key strategy papers guiding energy developments in the [EU](#) [33], aiming to lead in global climate action and achieve net-zero emissions by 2050 through a socially-fair and cost-efficient transition [12].

1.1.2 Households in energy transition

Households are a crucial component of the energy transition, as they are responsible for a significant proportion of final energy consumption in the [EU](#),

as highlighted by Eurostat's 2023 report. In fact, in 2020, the residential sector accounted for 27.4% of total final energy consumption or 18.7% of gross inland energy consumption in the EU [14]. Therefore, reducing energy consumption in households through energy-efficient building construction and renovations, as well as digitalisation and smart demand-side management, can have a significant impact on achieving the EU's energy and climate targets [27]. This underscores the importance of developing and implementing effective policies and strategies to promote energy efficiency and renewable energy use in households to facilitate the energy transition.

1.1.3 Technologies for home energy system

Technologies for home energy systems have rapidly advanced in recent years, with a growing focus on energy efficiency and renewable energy sources. Smart home technologies, such as energy management systems, allow households to optimise their energy consumption and reduce waste. Moreover, rooftop solar panels and home battery storage systems enable households to generate and store their own renewable energy, reducing dependence on the grid and lowering electricity bills. In addition, the integration of electric vehicles with home energy systems can further reduce household carbon emissions and provide a source of backup power. These technologies have the potential to significantly transform the way households consume and generate energy, contributing to a more sustainable and resilient energy system.

1.2 Opportunity

Despite the growing availability and accessibility of home energy technologies, there remains a significant information gap regarding their effective

utilisation. A survey conducted by Palmer et al. [37] identified a lack of knowledge and guidance among homeowners, preventing them from maximising the benefits of these investments in terms of reducing future energy expenses. Therefore, there is an opportunity in exploring effective ways to inform and educate house owners on those technologies.

1.3 Research questions and aims

The following research question was raised initially to guide the study:

- **What practice can effectively bridge the information gap for house owners in renewable energy and energy-efficient technologies?**

As the research progresses, the second question was raised:

- **How to develop effective explanations that build trust for a recommender in supporting households making sustainable decisions?**

The aim of this study is to address the information gap and support house owners in their decision-making process regarding the adoption of clean energy and energy-efficient technologies.

This thesis seeks to contribute to the HCI community by introducing an energy technology recommender as a new IT artefact, and providing insights into trust, explainability, and opportunities related to the energy technology recommender. Overall, the findings of this thesis hopefully can inform the development of future HCI interventions to address environmental challenges.

Chapter 2

Methodology

The study uses Design Case Studies [49] as the research framework.

2.1 Context study

In the pre-study phase, our primary focus was to investigate existing practices and tools that can aid homeowners in gaining knowledge about renewable energy and energy-efficient technologies, as well as their benefits. To achieve this, we conducted extensive searches online and reviewed relevant literature to gather information. However, as there were limited successful initiatives available in the market, we identified two related options: energy audits and research models. We studied both options to identify effective methods that can support homeowners in understanding renewable energy and energy-efficient technologies, along with their associated benefits.

2.2 Design study

Following the pre-study, we recognised a suitable approach aligned with the learning theory, and developed an innovative design concept: a personalised home energy system recommender. To ensure its effectiveness, we started by investigating homeowners' motivations for investing in energy technologies through literature. Next, our focus was on providing recommendations that are aligned with user needs, and we placed great emphasis on enhancing the explainability of the system.

Furthermore, during the IT artefact design process, multiple factors were taken into account, including usability, user experience, and the chosen medium. Additionally, expert testings were conducted on high-fidelity wireframes, which helped identify some issues that were then addressed through design iterations.

2.3 Appropriation study

After the service was programmed and made available online, we conducted an investigation to assess the appropriation of the artefact, with a specific focus on two aspects:

1. Whether the users felt they had learned more about energy technologies through the service.
2. The users' trust in the recommendations provided by the system.

N qualitative evaluations were performed with actual house owners. These evaluations were conducted through semi-structured interviews, each lasting approximately one to two hours.

After conducting the evaluations, a thematic analysis was performed to gain deeper insights into the users' experiences and perceptions. This analysis provided valuable feedback and insights that can be used for the next design iteration, allowing for further improvements and enhancements to the artefact.

Chapter 3

Pre-study

3.1 Existed practices

Currently, homeowners have limited avenues to access information about home energy systems. Presently, individuals seeking such information typically have two options. One is visiting specific technology providers, an alternative approach is through professional home energy assessments.

3.1.1 Technology providers

Exploring the official websites of technology providers or visiting nearby stores specialising in energy technologies can indeed provide valuable information about specific technologies. However, this necessitates a prior knowledge of the particular energy technology. Moreover, the information obtained through this approach may be restricted to the specific technology being explored, thus failing to offer a holistic perspective on the overall energy system, as energy technologies often function collaboratively.

3.1.2 Energy audits

Professional home energy assessments, commonly known as home energy audits. These assessments are conducted by experts who visit the house and perform a comprehensive inspection. Following the assessment, these professionals provide recommendations regarding house renovations and advice on suitable energy technologies to optimise energy efficiency.

Germany has a wide network of advisory centers and municipal institutions, totaling around 740, that provide energy advice to private households [15]. These centers offer various services aimed at helping households optimise their energy usage and reduce costs. One prominent example is the Verbraucherzentrale Energieberatung [47], which offers independent energy consultants, including individual energy advice and funding tips. The advice provided by these centers covers various important topics, including saving electricity in households, tips for energy conservation as tenants, guidance on thermal insulation and summer heat protection, advice on proper heating and ventilation practices, insights into renewable energy options, and information on modern heating technologies. Notably, these services are public funded, ensuring affordability for the general public, with consultation fees capped at a maximum of 30 euros. Moreover, low-income households can access these services free of charge. Furthermore, some advisory centers also provide online consultations for an initial assessment and to address specific energy-related inquiries. However, the primary focus of these services remains on providing in-person, on-spot consultations.

3.2 Research-based models

Several research-based models furnish evidence to aid homeowners in making informed decisions regarding home energy systems.

3.2.1 PVGIS online tool

PVGIS [11] is a web-based application by the European Commission’s Joint Research Centre, that enables users to access comprehensive data regarding solar radiation and the energy production of **PV** systems. This service encompasses a wide range of geographical regions, including Europe, Africa, substantial portions of Asia, and America. Which can be of a great help to house owners when deciding an investment in a **PV** system.

As shown in the Figure 3.1, the interactive tool allows users to navigate through the map and obtain information regarding performance of grid-connected **PV** based on the selected location. The visualisation of monthly energy output provides a clear and descriptive representation of the energy generated by a **PV** system throughout a year. Additionally, the outcome offers highly precise and specialised data, including detailed parameters such as yearly in-plane irradiation and year-to-year variability as well. While this information is highly valuable for researchers, it may pose comprehension challenges for homeowners lacking expertise in the field, thereby hindering their learning process. Furthermore, the data provided is only **PV** related, lacking the connection to the specific circumstances of individual households.

3.2.2 FLEX models

The FLEX models [50], developed under the newTRENDS project¹ by the Fraunhofer Institute for Systems and Innovation Research, aim to improve the building modeling suite and to analyse the societal trends of prosumenting

¹<https://newtrends2020.eu/>

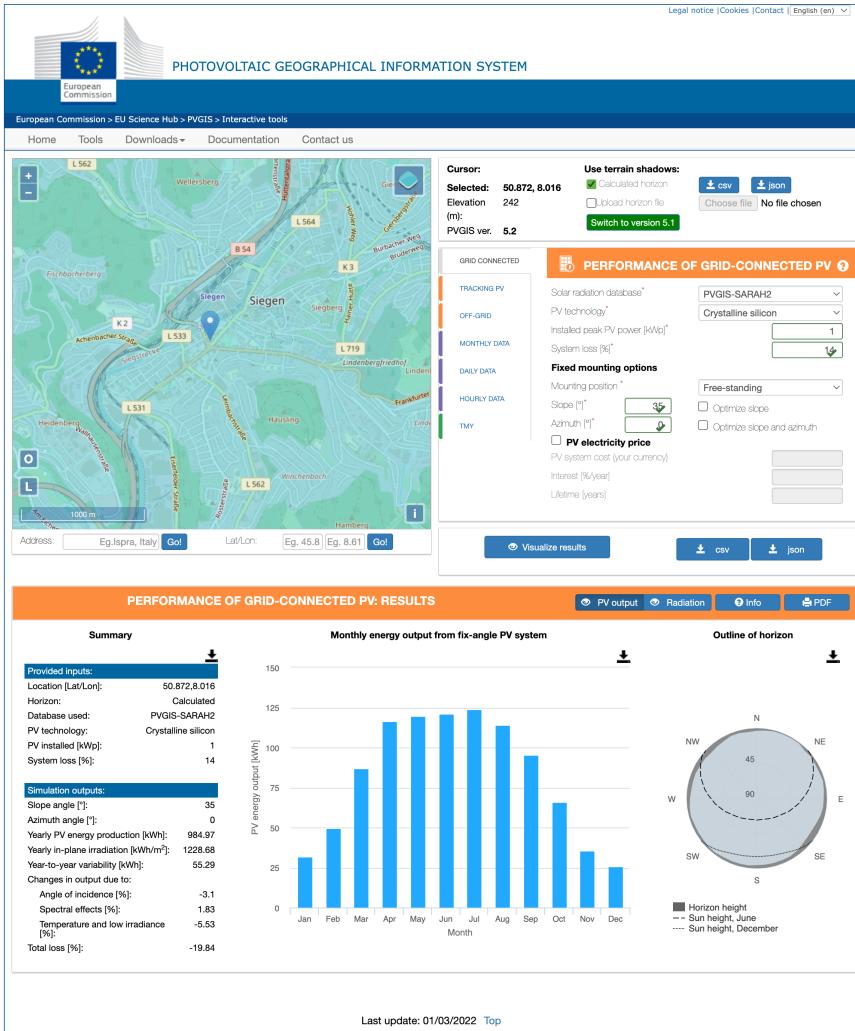


Figure 3.1: Screen of PVGIS online tool

and energy communities, are capable of calculating the energy demand of buildings at an hourly resolution, while considering the impact of household behaviour, PV generation, and energy storage (thermal and battery) on energy consumption. These models were developed to offer evidence-based information to decision-makers in industry, government, and civil society.

The models take various factors into account, including weather condi-

tion, household behaviours and energy technologies, as illustrated in Figure 3.2. Consequently, it offers a comprehensive evaluation of the energy consumption of a building. Moreover, the tool can be used to predict energy bills, enabling comparisons of energy expenses associated with different technology adoptions.

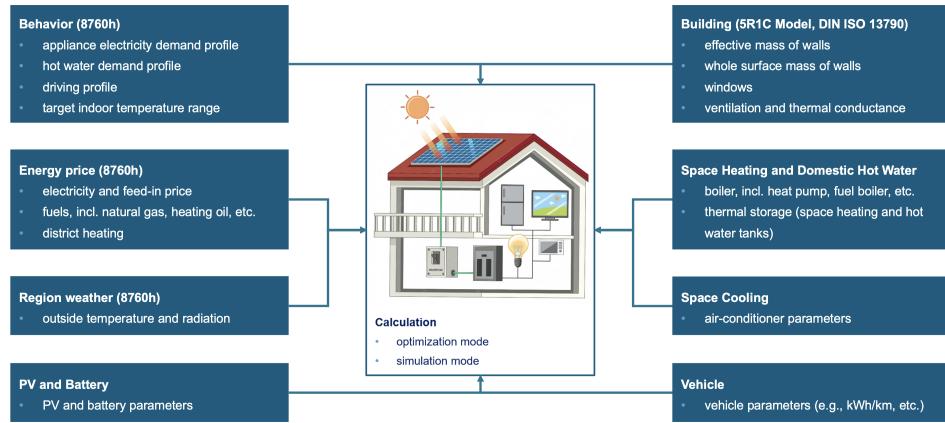


Figure 3.2: Model structure for individual households

It is important to note that the FLEX models are designed to estimate for single building structures, meaning buildings that do not share walls with other buildings. Furthermore, the FLEX models are implemented in Python. To execute these models, users would need to have Python installed on their systems. Additionally, since the FLEX models involve complex optimisation problems, a solver is required. Users would need to download and set up the appropriate solver to run the FLEX models effectively. Moreover, the outputs generated by the FLEX models are in the form of SQL files, which might not be immediately interpretable to non-technical users.

3.3 Conclusion

During the pre-study, we observed that there is a lack of accessible ways for general homeowners to obtain comprehensive information about energy

technologies and their benefits. The current approach, energy audits, can be quite laborious, involving booking appointments with experts, conducting house inspections, and investing considerable time in the assessment process. While government financial support might make the audits affordable, the effort required can discourage homeowners from seeking information and exploring energy-efficient options for their homes.

On the other hand, research-based models, particularly the FLEX models, are powerful tools that offer valuable insights through their detailed data and precise estimations of energy consumption and associated energy bills. These models consider various factors, including the house's characteristics, location, and energy technologies configuration. However, running these models demands professional knowledge, making them less accessible to general homeowners. This creates an opportunity for the development of an innovative IT artefact that could revolutionise the way homeowners access information about energy technologies.

Chapter 4

Design

It was evident that bridging the information gap regarding home energy systems requires providing households with comprehensive knowledge of available technologies in the market. To avoid overwhelming homeowners with excessive information and inspired by the concept of energy audits found during the pre-study, the study proposes a home energy system recommender. This recommender will tailor its recommendations to each household's unique situation, suggesting technologies that align with the needs of house owners.

The learning theory suggests that individuals learn new knowledge by connecting it with existing knowledge and experiences, as this helps to create a framework for understanding and retention of the new information. Therefore, by focusing on personalised recommendations, the study hypothesises that households may be more receptive to learning about the technologies and their benefits. Meanwhile, nudging them towards making informed decisions.

4.1 Motivators for investment decisions

The attitudes and perspectives of users regarding energy efficiency, were investigated through a comprehensive survey conducted by Palmer et al. [37] in the United States. The survey revealed various motivating factors that influence homeowners in their decision to investments in improving energy efficiency. Notably, saving money on utility bills (72%) emerged as the primary motivator, closely followed by the low costs associated with improvements (66%). These findings suggest that homeowners prioritise the financial aspects of energy efficiency when making investment decisions. Surprisingly, preferences related to environmental sustainability (“Green”) and the potential increase in property values do not appear to significantly influence their decisions.

From the pre-study, we discovered that the FLEX models hold immense potential as an ideal tool to aid homeowners in making decisions about their energy technology investments. These models incorporate a wide range of factors and consider the entire energy system, this enables them to make relatively accurate predictions of energy consumption and associated energy bills. As we learned from the survey, the financial aspect is a primary consideration for homeowners, and the FLEX models can provide detailed financial insights, empowering them to make well-informed decisions regarding their house situations. The proposed recommender will use the FLEX models to propose technology configurations that can potentially result in energy cost savings for homeowners. For instance, by learning the situation and the current energy system of the house, FLEX models can estimate current energy costs based on assumptions about their energy consumption habits. Subsequently, the models assess the estimated energy costs for various differnt energy systems and identify technology configurations that can potentially lead to cost savings. With the use of these models, homeowners

can gain a deeper understanding of the potential outcomes and benefits associated with different energy technology choices, leading to more optimised and cost-effective decisions for their homes.

4.2 Design concept: The home energy system recommender

The home energy system recommender is a software application that integrates the FLEX models, offering personalised recommendations to households based on their individual circumstances. Through the recommended technology configurations and estimated energy costs, users will not only be guided on these technologies but also be educated on the potential benefits of transitioning to more sustainable energy systems. Additionally, the current version of the recommender is limited to single-family houses, as the FLEX models are not yet designed to estimate energy consumption for buildings that share walls with other structures.

The personalised home energy system recommender, therefore, serves as the answer to the first research question of the study.

4.3 Input to the recommender

4.3.1 Household profiles

The concept of household profile has been developed to generate information about the energy demand and supply dynamics of households. To ensure the accuracy of this profile, thereby accurately anticipate household's energy costs, various factors that may impact the household's energy consumption

must be considered, 4 categories as shown in Figure 4.1, they are *the external environment*, *building materials*, *energy consumption behaviors*, and *the current home energy system*.

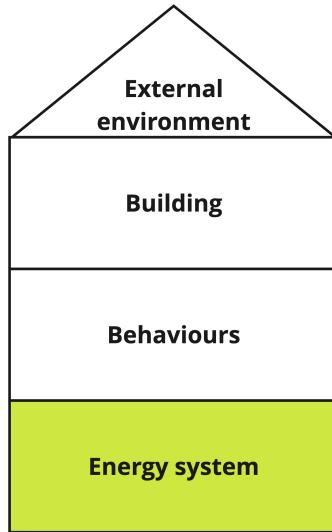


Figure 4.1: Household profile

The categories were inspired by the FLEX models [50]. The models take a set of variables into account when simulating, they can be divided into following 15 categories: *behaviour profile*, *battery*, *behaviour*, *boiler*, *building*, *energy price*, *heating element*, *hot water tank*, *PV*, *region*, *space cooling technology*, *space heating tank*, *vehicle*, *energy price*, *region weather*. The specific data required by the FLEX models within each category can be found in Appendix A.

4.3.2 Households data collection

To achieve a balance between accuracy and user-friendliness in the FLEX models, we carefully developed a set of 13 questions (as presented in Table 4.1) to collect relevant information for household profiles. To achieve a

balance between accuracy and user-friendliness in the FLEX models, we carefully developed a set of 13 questions (as presented in Table 4.1) to collect relevant information for household profiles. These questions were designed to avoid overwhelming users with excessive information requests while still providing sufficient data for accurate simulations. Furthermore, the user's answers to these questions enable the system to infer additional specific information. For instance, by inputting the construction period of the house, the system can assume corresponding details such as building materials and sizes. All of these design decisions were thoroughly discussed with experts, and their analysis and agreement ensured the efficacy of the approach.

Category	Question	Note
External environment	Where is the house located?	Understanding the location of the house can provide valuable insight into its environmental factors, such as the amount of sunlight it receives.
Building	When was the house built?	Knowing the year a house was built can provide insight into its construction materials, such as the composition of the walls.
	Has the house ever been renovated before?	Renovations can include upgrading insulation, replacing windows with energy-efficient ones, installing high-efficiency HVAC systems, sealing air leaks, etc.

	What has been renovated in the house?	
Behaviour	<p>How many people are living in the house?</p> <p>How often does each adult work from home?</p> <p>Is there any air conditioner in the house?</p> <p>What type of heating energy is used in the house?</p>	
Home energy system	<p>Is there a photovoltaic (PV) system in the House?</p> <p>What is the size of the PV system?</p> <p>Is there a battery system in the house?</p> <p>What is the capacity of the battery?</p> <p>Is there a smart energy management system (SEMS) in the house?</p>	<p>A PV system is a system that uses solar panels to convert sunlight into electricity for use in a building.</p> <p>The average size of a PV system is 5 kilowatt-peak.</p> <p>A home battery system is a device that stores energy produced by solar panels or other sources to be used later when needed.</p> <p>The average capacity of a home battery system is around 7 kilowatt-hours.</p> <p>A SEMS is a technology to optimise energy usage, monitor consumption, and enhance energy efficiency.</p>

Table 4.1: Household profile questions

To further enhance user experience, a decision tree approach was implemented, enabling users to navigate through the questionnaire without the obligation to answer all questions. As a result, the number of questions to be answered ranges from a maximum of 13 to a minimum of 10, as depicted in Figure 4.2.

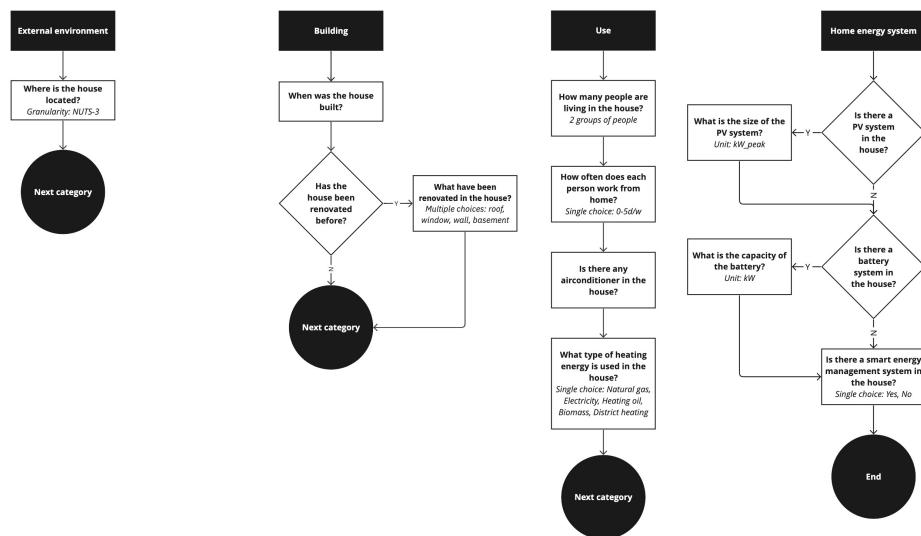


Figure 4.2: Order of household profile questions

4.4 Output from the recommender

4.4.1 Recommendations

A sustainable home energy system should prioritise *energy-efficiency, reducing dependence on non-renewable fossil fuels, and lowering overall energy costs*. All the recommendations provided by our system align with these fundamental principles. Our main objective is to promote sustainable energy practices, with a particular focus on helping users reduce their household energy costs. For instance, if a user does not have a cooling system in place, the system would not suggest installing an air conditioner, as it may impact the energy bill and is considered an unsustainable act. The recommended energy technologies encompass various solutions for generating renewable energy, managing energy usage, and improving overall energy efficiency. An overview of the recommended technologies and their functionalities can be found in Table 4.2.

Recommendation rules

The recommendation generation process follows a rule-based approach. By employing the FLEX models, the system identifies configurations that can lead to lower energy bills compared to the user's current situation. However, to prevent overwhelming users with an excessive number of recommendations resulting from the various combinations of technologies, particularly when accounting for different sizes, we focus on three distinct perspectives related to financial aspects for the recommendations, see Figure 4.3.

Cost-benefit The first perspective is the most techno-economic solution, which compares the annualised investment costs with the annual en-

ergy cost to determine the configuration that offers the highest financial advantage for households. This approach takes into account the financial feasibility of implementing the recommended technologies.

Save the most The second perspective focuses solely on the energy bill savings, disregarding investment costs. We offer this recommendation because investment costs may vary across different areas, and users may find cheaper options for implementing the recommended technologies. This perspective also allows users to gain insights into the most energy-efficient configurations available for their homes.

Lowest investment The third perspective is the solution with the lowest investment cost, enabling users to identify a cost-effective first step towards enhancing their home energy system.

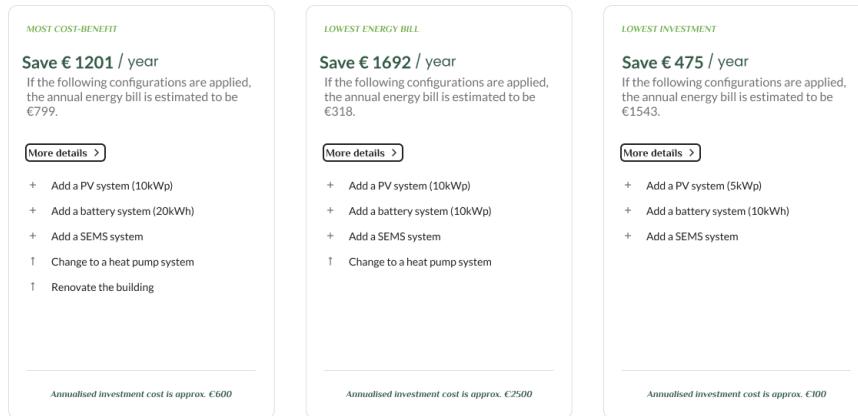


Figure 4.3: 3 categories of recommendations

In addition, we provide users with the flexibility to customise the energy system according to their specific needs and preferences for those recommendations. This customisation option allows users to see changes in corresponding configurations based on their preferences. We believe that presenting recommendations from three perspectives while allowing customisation

strikes an appropriate balance, offering users a tailored and manageable set of options to make informed decisions about their home energy system.

4.4.2 Explainability

Explainability plays a crucial role in establishing trust among users in Recommendation Systems ([RS](#)), and this principle holds true for our system as well. When the system generates recommendations for users, it is important for users to understand why a particular configuration is being recommended to them. Explanations aim to bridge this gap by shedding light on the factors that contribute to the recommendation and how they align with the user's preferences (the financial aspect specifically).

Explanation

According to Nunes and Jannach [\[35\]](#), previous studies have identified ten purposes of explanations, including *transparency, effectiveness, trust, persuasiveness, satisfaction, education, scrutability, efficiency, debugging*. In our case, the explanations provided by the system are intended to serve three purposes: *effectiveness, trust, and education*.

Effectiveness The system aims to support users in making informed decisions by providing the corresponding yearly energy bill. As they can immediately gauge the financial implications and potential cost savings associated with each recommendation. ([Figure 4.4](#))

Trust By offering more detailed estimated energy consumption patterns, users gain a deeper understanding of how the energy bills are calculated in the recommended configurations, thereby building trust and

Save € 1201 / year

If the following configurations are applied,
the annual energy bill is estimated to be
€799.

Figure 4.4: Effectiveness

confidence in the accuracy and reliability of the system’s outcomes.
(Figure 4.5)

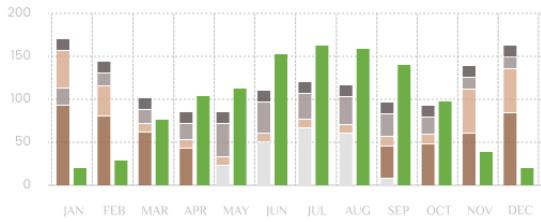


Figure 4.5: Trust

Education The system utilises explanations as educational tools to offer users valuable insights into the recommended technologies and their impact on energy bills, furthermore, the system can also provide information about the broader context of climate change, helping users understand the larger picture and the importance of sustainable energy practices.

Exploration

Beside retrospective explanations, prospective user interfaces can play a significant role in guiding users incrementally toward their goals and enhancing user control and transparency in the recommendation process. According to a study by Siepmann and Chatti [41], such interfaces have the potential to facilitate the development of a more accurate mental model of the

decision-making system. Therefore, in our design, by providing interactive and visual interfaces, users are empowered to actively explore and adjust various configurations of the recommended technologies (Figure 4.6). This level of control allows users to observe and analyse the corresponding simulated results in real-time. As users manipulate the configurations, they gain a better understanding of how changes impact the outcomes. By making the system's workings visible and allowing users to actively participate, users can develop a clearer mental model of how the system functions and how different choices influence the results. This transparency and user empowerment contribute to increased trust and understanding of the decision-making system.

The screenshot displays the 'Home Energy System' interface. It includes sections for:

- PV system:** A PV system can convert sunlight directly into electricity. Size (kWp) is set to 4. Annualised cost is around €464.
- Battery system:** A battery system can store excess energy generated by solar panels or other renewable sources of energy during the day. Capacity (kW) is set to 10. Annualised cost is around €410.
- SEMS system:**
- Heating system:** The technology used to generate heat in order to warm a space or provide hot water. Electricity is selected.
- Building renovation:**

At the bottom, there is an 'Update' button, an 'Energy Bill' section showing a total investment cost from €5950 and a total annualised cost of €2172, and a note indicating a savings of €1667.

Figure 4.6: Exploration

Levels of explanations

In addition, a study conducted by Kim et al. [31] examined the explainability needs of 20 diverse end-users and revealed that the level of explainability required varied based on participants' backgrounds in AI and their interests in the domain. While there was a general curiosity about AI among participants, only those with a high level of AI expertise or a significant interest in the domain expressed a need for detailed explanations regarding the RS system. Therefore, it is essential to provide different levels of explanations to accommodate the varying characteristics of users and meet their specific needs.

The first level of explanation For users who are primarily focused on improving their home energy systems without a deep interest in understanding the underlying system, this level of explanation presents the recommended configurations, specifying the technology products that should be installed or upgraded in their homes. Additionally, it provides information on the corresponding yearly energy bills associated with each configuration. The objective is to ensure that users comprehend the potential benefits of implementing the recommendations. By clearly presenting the recommended configurations and their associated energy bills, users can readily evaluate the potential improvements that can be achieved in terms of energy efficiency and cost savings. (Figure 4.7)

The second level of explanation For users who have doubts about the recommendations and possess a curiosity about how the system operates, besides the first level information, this level of explanation offers insights through generated energy consumption patterns and encourages user exploration to understand the underlying workings of the

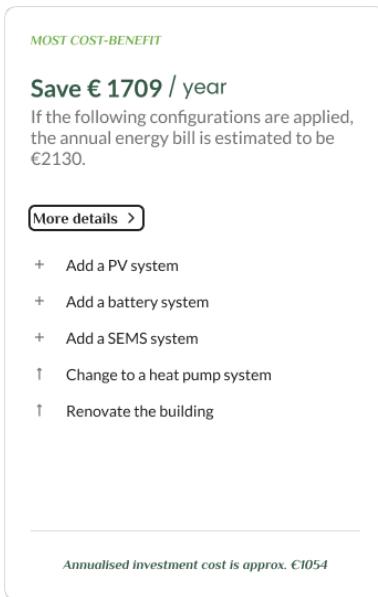


Figure 4.7: First level of explanation

system. They can observe how different configurations or technology choices impact energy consumption and ultimately influence the calculation of yearly energy bills. By facilitating user interaction and transparency, the system aims to build trust and alleviate doubts, enhancing user confidence in the system's recommendations. (Figure 4.8)

The third level of explanation This level of explanation focuses on providing cognitive knowledge to users. It goes beyond the technical aspects of the system and delves into the broader context of environmental protection and sustainability. Users are encouraged to consider the long-term consequences of their energy-related decisions and their role in contributing to a more sustainable future. It aims to raise awareness among users, foster a sense of responsibility, and offer additional information and resources for embracing sustainable practices beyond the immediate recommendations of the system. (Figure 4.9)

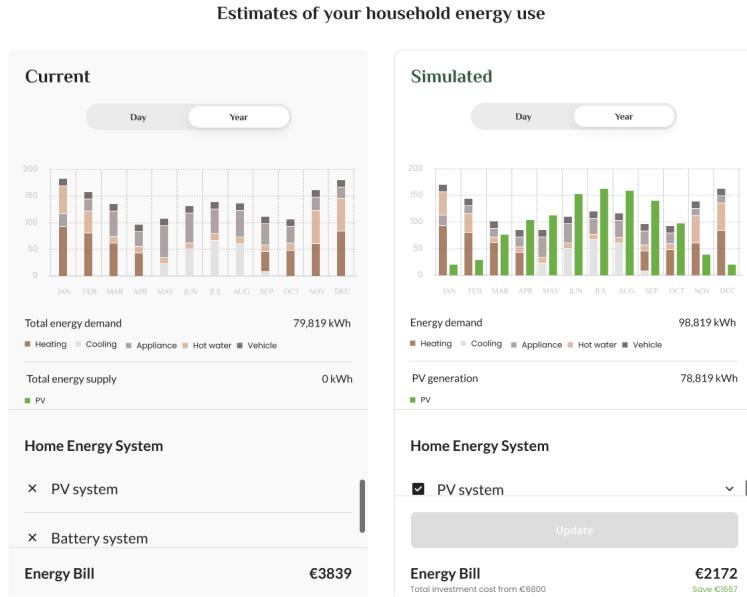


Figure 4.8: Second level of explanation

Additional information

In addition to the aforementioned, there are several other techniques that are considered to further support users in their decision-making process. These techniques aim to provide additional information to enhance user understanding, facilitate comparisons, and enable informed choices.

Comparison with current situation To ensure users can verify the accuracy of our system, we provide a valuable reference point by offering simulated versions of their current energy bill and consumption. This feature allows users to compare the system's simulations with their actual energy usage, enabling them to assess the reliability and accuracy of the recommendations. By presenting users with their simulated current energy bill and consumption, they can directly observe how closely the system's simulations align with their real-life data. This



Have you noticed an increase in the frequency of news about natural disasters triggered by severe weather?

What is global warming?

Global warming refers to the long-term rise in earth's average surface temperature, which is largely attributed to the increasing concentration of greenhouse gases in the atmosphere. These gases, including carbon dioxide, methane, and nitrous oxide, trap

Figure 4.9: Third level of explanation

serves as a tangible measure of the system's effectiveness and enhances user confidence in its recommendations. The verification process not only fosters user trust and confidence but also allows us to collect valuable user feedback for continuous improvement. By actively seeking user perspectives and incorporating their feedback, we can refine the algorithms and models, ensuring that the recommendation system evolves and remains responsive to users.

Technology explanation a brief explanation (Table 4.2) of each recommended technology is provided to help users understand their functionalities and how they contribute to energy efficiency. The technology introductions are presented in a clear and straightforward manner, avoiding technical jargon and using language that is easily understandable for users with varying levels of knowledge about energy systems. This ensures that users can quickly grasp the main concepts and functionalities of each technology without feeling overwhelmed by complex technical details. It empowers users to make more informed decisions by providing them with the necessary knowledge to assess the relevance and suitability of each technology for their specific energy needs and goals.

Investment costs The consideration of supplementary information per-

Technology	Explanation
PV system	A PV system can convert sunlight directly into electricity.
Battery system	A battery system can store excess energy generated by solar panels or other renewable sources of energy during the day.
SEMS	A Smart Energy Management System (SEMS) can optimise energy usage by adjusting heating and cooling systems, lighting, and other energy-consuming devices to minimise energy waste; and turning off or reducing energy usage during periods of low occupancy or when energy prices are high.
HP	A heat pump is a device that transfers heat from one place to another, providing both heating and cooling for spaces.
Hot water tank	A hot water tank is a device used to store domestic hot water for use in homes. The hot water in the tank can be used in sinks, showers, or appliances.
Space heating tank	A space heating tank is a device used to store hot water to provide heat to interior spaces in homes.
Building renovation	Building renovation can have a significant impact on improving home energy efficiency performance by reducing the amount of energy needed to heat, cool, and operate a home.

Table 4.2: Brief introduciton of each technology

tinent to users' investment decisions holds significance. Hence, we endeavor to furnish users with additional information regarding technology costs. However, it is imperative to acknowledge that various brands exhibit divergent pricing structures, and the performance or size variations of individual technologies directly influence their corresponding costs. In light of this, we present users with a range of costs associated with each technology, aiming to facilitate their decision-making process by fostering informed choices. The specific cost ranges are presented in the Table 4.3.

Technology	Initial investment (€)	Life (year)	Annualised cost (€)	Ref
PV system	1200/kWp	15	115.61/kWp	[5]
Battery system	428.57/kWh	15	41.29/kWh	[5]
SEMS	1000	15	96.34	[5]
HP	/	/	900	[6]
Building renovation	/	/	2000	[26] [25]

Table 4.3: Investment costs of different technologies

Presentation

Both Natural language (**NL**) and Information visualisation (**IV**) techniques are used to serve different purposes and enhance the overall clarity and effectiveness of conveying information to users. **NL** explanations, as shown in Figure 4.10, in the form of textual descriptions, are utilised to provide detailed information about technology functionalities and costs.

Battery system ^

A battery system can store excess energy generated by solar panels or other renewable sources of energy during the day.

Capacity (kW)

10



The stored energy can be used at night or during times when there is no sun or wind. In the event of a power outage, a home battery system can also provide backup power to keep essential appliances running.

The annualised cost of such a battery system is around €410.

Figure 4.10: NL explanation

Charts are employed to present energy consumption data in a visual format, as shown in Figure 4.11. Visualising energy consumption data of each sector using charts helps to simplify complex information, enabling users to grasp patterns and comparisons more easily. Users can observe the relative contributions of different sectors, identify areas of high or low energy consumption, and explore alternative scenarios or configurations.

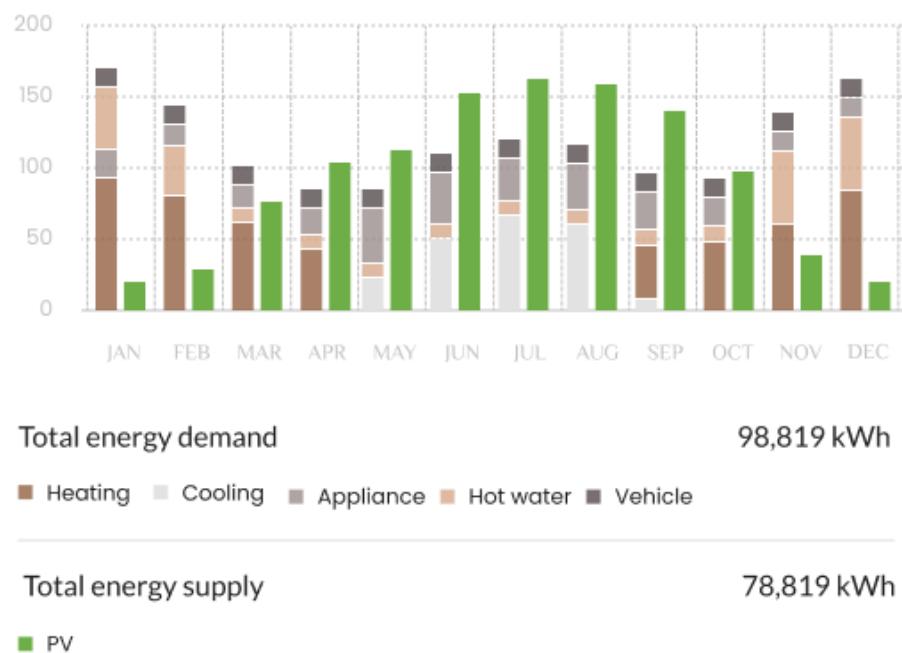


Figure 4.11: IV explanation

4.5 Medium

At present, the service is designed as a one-time interaction where users receive recommendations and may not revisit the system in the near future.

Meanwhile, the explanations provided can be presented in a highly detailed manner, as users have the opportunity to carefully read and understand the information. The interactive nature of the system allows users to compare complex data and explore different configurations. A larger screen offers a more comfortable viewing experience, therefore, the current focus is on desktop or larger screens. However, considering the prevalent use of smartphones in today's society, it is important to acknowledge the need for a mobile-friendly version of the service.

4.6 Interfaces

In this chapter, several key interfaces are explained, providing an overview of the important pages and features of the system. While not all pages are covered, the focus is on highlighting the interfaces that play a significant role in the user experience and decision-making process.

Homepage

The homepage (Figure 4.12) of the website serves the purpose of informing participants about the functionality and process of the service. Several factors related to usability are considered in the design and content of the home page:

Purpose explaining The homepage should clearly communicate the purpose of the service, highlighting its main objective and benefits for participants, in order to help users understand the core function and value proposition of the website.

Instruction A 2-step instruction is provided to guide users through the process of using the service before they begin, this is to ensure that

users are mentally prepared for the service and have a clear roadmap to follow.

Time indicator The estimated time required to complete the questionnaire is provided to users as a feature to mentally prepare them for the task at hand. By indicating the expected time commitment, users can have a better understanding of the anticipated duration of their engagement with the system.

Policy Users are informed about the data handling practices and security measures implemented by the website. Additionally, users also have the opportunity to delve deeper into the specifics of data handling practices by accessing more detailed information. The privacy policy can be found in Appendix B.

Organisations involved The homepage introduces the relevant organisations involved in the development and operation of the service to establish credibility in the reliability and expertise of the system.

Contact details Email addresseses is provided to allow participants to reach out for support, clarification, or any other inquiries they may have.

Language options The service offers language options in both English and German to cater to a broader audience in Europe.

Questionnaire page

The questionnaire page (Figure 4.13) is specifically designed to collect information pertaining to the household's current energy demand and supply-related factors. Its purpose is to gather comprehensive data in order to

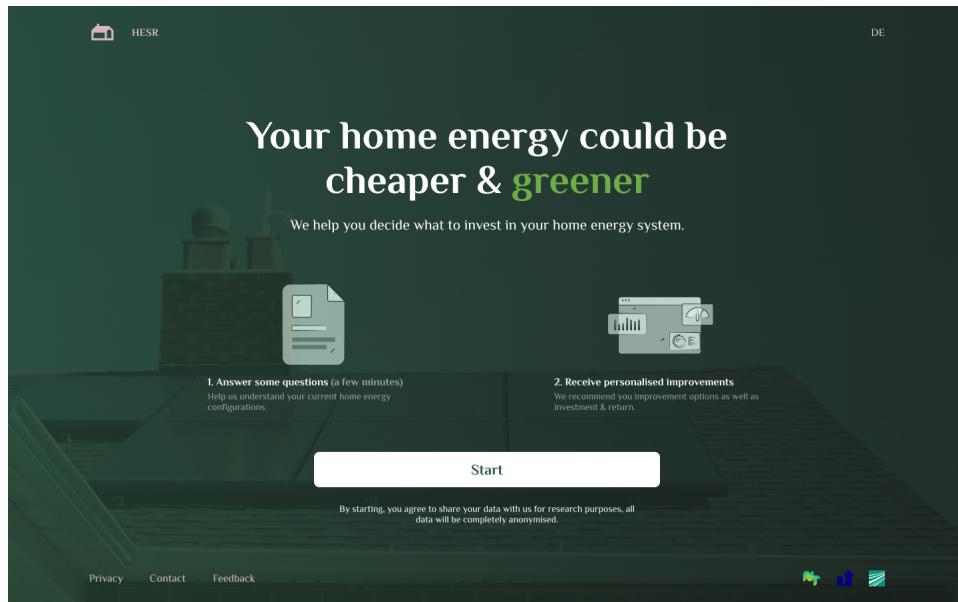


Figure 4.12: Homepage

construct a detailed household profile. Several usability factors are taken into account to enhance user experience on this page:

Question categorisation Each question is assigned a relevant category to provide context to users.

One question at a time To present one question at a time, ensuring that users understand precisely what information is being requested from them. Users can focus their attention on each individual question without feeling overwhelmed by a large set of inquiries, which allows for better comprehension and reduces the risk of confusion or misunderstanding.

Transparent process The page outlines the overall process, indicating the number of categories involved.

More details For unfamiliar or complex concepts, the page offers more detailed explanations to provide users with a better understanding.

Return and edit The page allows users to easily navigate back to the previous page and make changes if they need to modify their answers.

The screenshot shows a questionnaire page. At the top left is a logo with three dots and the text 'HESR'. At the top right is a link to 'DE'. Below the logo is a section titled 'Tell us about your Home Energy System'. The main question is 'Is there a photovoltaics (PV) system in the house?'. Below the question is a link 'What is a PV system?'. There are two rectangular buttons for the answer: 'Yes' and 'No'. At the bottom of the page are links for 'Privacy', 'Contact', and 'Feedback', along with social media icons for Facebook, Twitter, and LinkedIn.

Figure 4.13: Questionnaire

Recommendation page

The recommendation page (Figure 4.14 and 4.15) serves as a crucial component of the system, aiming to inform users about the available home energy system options that can potentially lower future energy costs and improve energy efficiency. The page provides clear and simple explanations (annual energy costs) behind each recommendation. To ensure usability and meet user needs, the recommendation page incorporates the following features:

List of recommendations The page presents all the recommended options, or in some cases, informs users if no specific recommendation is available.

Estimated current energy bill Users are provided with an estimated current energy bill, allowing them to compare their existing energy costs with the potential savings offered by the recommended options. This provides a tangible reference point for users to assess the financial impact of the recommendations.

First level explanation Each recommended option is accompanied by specific information regarding the potential financial benefits it offers, including money saved and the projected annual energy bills.

Allow for detailed explanations For users who seek more in-depth information, the recommendations page offers the option to access more detailed explanations.

Simulation page

The simulation page (4.16) aims to provide users with more detailed explanations about the recommended options.

Data visualisation It utilises data visualization techniques to present information in a visually engaging and easily understandable format.

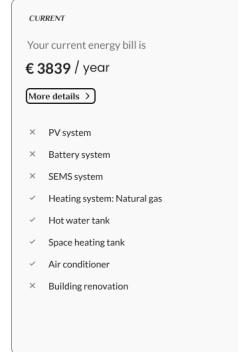
Comparison The simulation page allows users to compare the recommended options with their current configuration using visualised data, making it easier to understand the differences in energy consumption and demand. The comparison enhances users' understanding of the disparities between the recommended options and their current configuration, enabling them to assess the potential benefits.

Exploration The simulation page enables users to make adjustments to the recommended options. Users can modify various parameters, such

Current

- ∅ Rhein-Sieg-Kreis
- ✉ 4-Person Household
- ∅ Not renovated
- ∅ Own electric car

[Back and edit >](#)



Why should we turn to renewable  energy? Learn more about the reasons other than cost-savings.

Recommended configurations

Followings are the energy configurations available for your house that may lower future energy costs and improve energy efficiency.

MOST COST-BENEFIT

Save € 1201 / year

If the following configurations are applied, the annual energy bill is estimated to be €799.

[More details >](#)

- + Add a PV system (10kWp)
- + Add a battery system (20kWh)
- + Add a SEMS system
- 1 Change to a heat pump system
- 1 Renovate the building

Annualised investment cost is approx. €600

LOWEST ENERGY BILL

Save € 1692 / year

If the following configurations are applied, the annual energy bill is estimated to be €318.

[More details >](#)

- + Add a PV system (10kWp)
- + Add a battery system (10kWh)
- + Add a SEMS system
- 1 Change to a heat pump system

Annualised investment cost is approx. €2500

LOWEST INVESTMENT

Save € 475 / year

If the following configurations are applied, the annual energy bill is estimated to be €1543.

[More details >](#)

- + Add a PV system (5kWp)
- + Add a battery system (10kWh)
- + Add a SEMS system

Annualised investment cost is approx. €100

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options

[Tell us what you think](#) [Download all options](#)

 Tell us what you think  Download all options</p

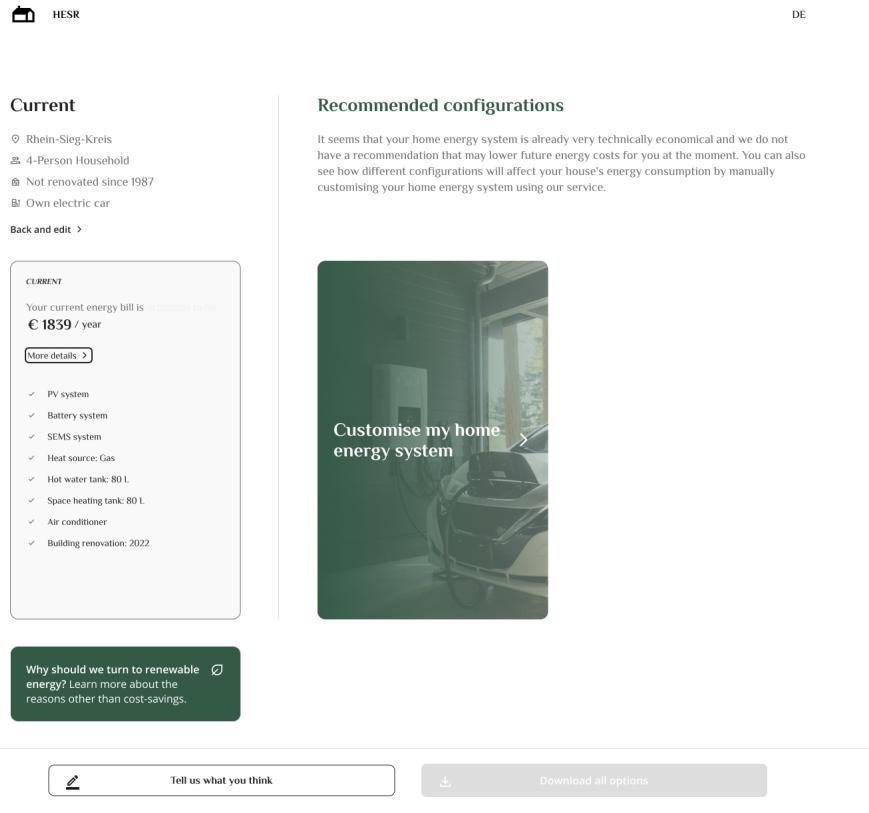


Figure 4.15: No recommendation

4.7 Usability testing

In the initial phase of evaluation, a user testing session was executed involving 5 participants. This preliminary assessment aimed to evaluate the usability of the service prior to commencing the coding phase. The objective was to ensure that the service meet the usability requirements and to gather initial feedback on the explainability of the recommendations provided.

4.7.1 Participants

The 5 participants selected for the testing session were mainly Human Computer Interaction (HCI) students from Siegen University, chosen through

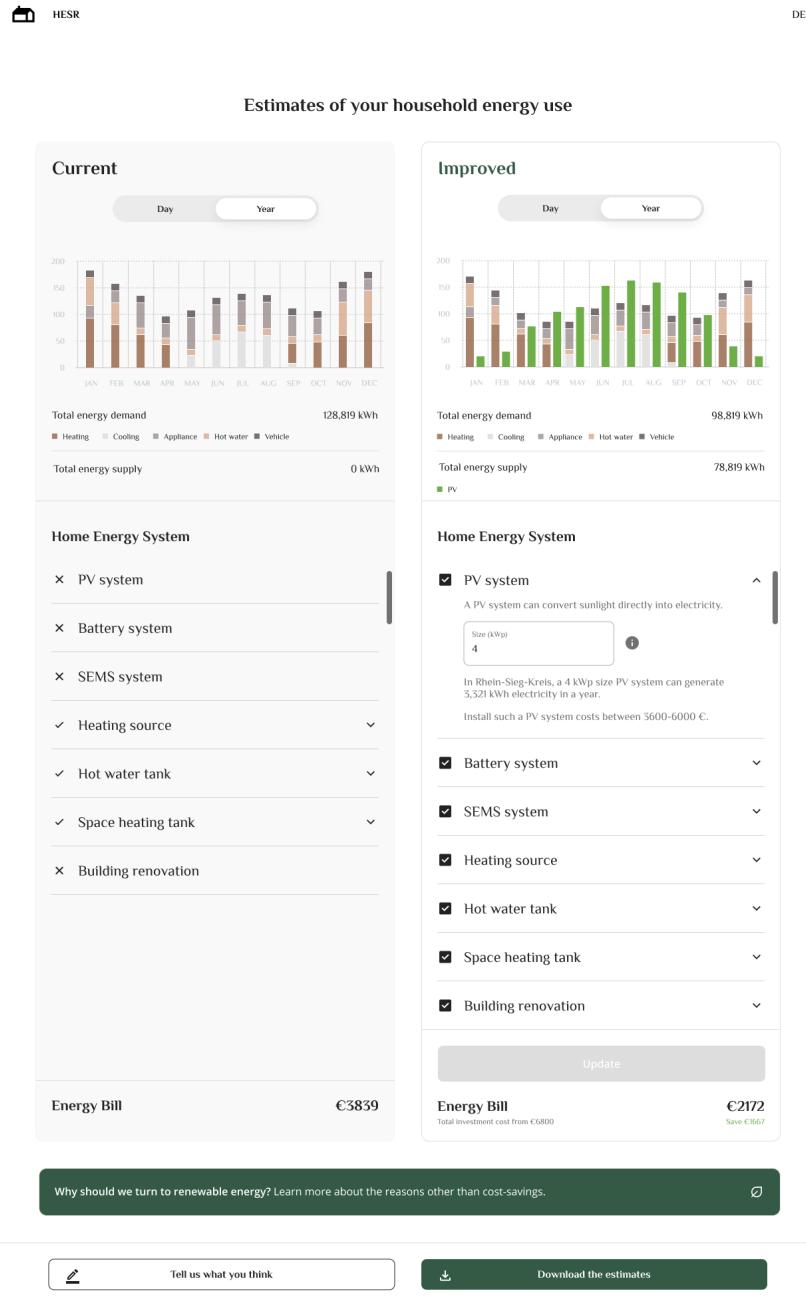


Figure 4.16: Simulation page

convenient sampling. Because of their background in HCI, they have a solid understanding of usability, which made the evaluation an expert's heuristic evaluation.

4.7.2 Testing content

During the testing session, all participants were asked to interact with an interactive Figma prototype to explore and discover recommendations for “their” home energy systems. Following the prototype interaction, participants were required to complete an online survey created using Typeform [44]. The survey consisted of the following questions:

- What do you think this website is about?
- How clear were the instructions on the website for you to follow?
- Did you find the website visually appealing?
- Was the website easy to use and understand?
- How long do you think it took you to complete the questions?
- What would you change about the website to make it more user-friendly?
- Were the recommendations easy to understand?
- Was there anything about the recommendations that you found confusing or unclear?

4.7.3 Analysis of usability testing

The evaluation of the service involved collecting responses from the participants through a survey (see Appendix C). Overall, the participants demonstrated a good understanding of the website’s purpose, which is focused on energy and cost savings in households. However, it should be noted that one participant (Participant 3) provided somewhat unclear answers, and

the responses to text-based questions were overly simplistic. Regarding the usability of the website, the majority of participants (4 out of 5) found the instructions to be clear and considered the web interface visually appealing. Additionally, they reported that the website was easy to use and understand, indicating a positive user experience. The participants expressed positive feedback regarding the understandability of the recommendations. Three out of five participants gave high scores of 9/10 or full marks when rating the ease of understanding the recommendations. In terms of the time taken to receive the recommendations, most participants indicated that they spent less than 5 minutes, which aligns with the desired design goal. The feedback provided by the participants also highlighted several areas for improvement and enhancement of the service. The following suggestions were made:

- Allow users to go back to previous questions.
- Provide more assistance to help users find the correct options.
- Use “photovoltaic” instead of “PV” for better clarity.
- Provide more explanations about **PV** and **SEMS** to enhance understanding of these terms and their role in the energy system.
- Incorporate a wider variety of selection elements, beyond just clicks, to enhance user interaction.
- Improve the usefulness of the step tracer by indicating the exact number of questions.
- Provide suggested minimal or maximal temperatures instead of having users input an ideal temperature range.
- Include more information about the final investment and the time required to recoup the investment.

- Display corresponding results for different PV sizes to assist users in determining the most suitable size.
- Make the survey questions feel more like a friendly inquiry rather than a formal questionnaire.

4.8 Iteration

After identifying the areas that required improvement based on the feedback, several redesigns were implemented. Firstly, a "back" button was added to allow users to navigate to previous questions easily. To simplify the options and facilitate decision-making, the number of available choices was reduced, while an indication of the most average option was provided. To enhance understanding, each technology now includes an explanation of its functionality as a helpful hint. Two types of selection elements were introduced: dropdown selection and tab bar selection, providing users with different interaction experiences. Since the exact number of questions to be answered by each participant could not be guaranteed, it was decided to temporarily hide the step tracker. This was done to avoid providing confusing or inaccurate indications. The temperature range question was removed to streamline the survey and make it more user-friendly, as the range is typically common to most people. To facilitate decision-making, annualised costs were presented to help users determine the techno-economic viability of the recommendations. Additionally, calculations were also performed to assist users in identifying the most suitable PV sizes to invest in. Due to time constraints, incorporating more playful elements into the questionnaire was not prioritised. This remains an area for future consideration and further development.

Chapter 5

Development

The web application is designed, with the frontend responsible for collecting user data and presenting recommendations and explanations, while the backend handles the database generated by the FLEX models.

5.1 Frontend

The frontend of the web application is responsible for creating an engaging and user-friendly interface using HTML, CSS, and JavaScript. They were used to structure the content, define the visual styles, and add interactivity to the application. HTML is used to create the structure of the webpages, CSS is employed to style the visual appearance of the application. JavaScript plays a crucial role in adding interactivity and dynamic functionality to the web application. Additionally, JavaScript is responsible for making asynchronous requests to the server, facilitating communication with the backend. To ensure a responsive design, the web application utilises the Bootstrap framework. Although the service is not intended for mobile

screens, a responsive user interface that adapts to various devices and screen sizes has been taken into account.

5.1.1 Questionnaire

To incorporate questionnaires into the web application, we integrated SurveyJS, an open-source JavaScript form builder library [7]. SurveyJS simplifies the process of creating and embedding surveys. It supports logic and branching, allowing for dynamic survey behaviour based on user responses, that fulfils our need of presenting corresponding questions according to the answers, as described in the design section.

5.1.2 Charts

For chart building, we initially opted for Google Charts, a charting library provided by Google [21]. However, we encountered difficulties in building multiple columns using Google Charts. As a result, we switched to Highcharts [24], another powerful charting library written in JavaScript.

5.2 Backend

The backend of the web application utilises Flask, a Python-based web framework [36], to serve as the intermediary between the frontend and the FLEX models. This choice was made based on the fact that the FLEX models are implemented in Python. Originally, our intention was to enable direct communication between the backend and the models using Python. However, during the development process, we realised that the models' calculations, especially when finding recommended configurations, could be

time-consuming. Each scenario takes approximately 7 seconds to calculate, and considering the need to identify multiple scenarios that could save energy costs for the household, it would be impractical to make the user wait for the results. To address this issue, we decided to pre-process the data in the FLEX models and store it in a database. This approach significantly reduced the time required to identify energy-saving scenarios, allowing for a more efficient user experience.

5.2.1 JSON Schema Documentation

The API design for the service follows a RESTful architecture and adheres to the JSON schema presented in this section. This JSON schema defines the structure and properties of a household's energy system and recommendation.

Household's energy system and recommendation

Properties

The documentation consists of three main components: profile, current, and recommendation as displayed in table 5.1.

Properties of profile

As table 5.2 shows, the profile component provides information about the house's location and the number of people residing in it. It includes properties such as location and person.

Name	Type	Description	Required	Default value
profile	object	An object describing the house's location and number of people.	Yes	-
current	object	An object describing the house's current energy system configurations, energy data, and costs.	Yes	-
recommendation	array	A list of recommended configurations that improve the house's energy efficiency.	Yes	-

Table 5.1: Properties

Name	Type	Description	Required	Default value
location	string	The location of the house.	Yes	-
person	integer	The total number of people residing in the house.	Yes	-

Table 5.2: Properties of profile

Properties of current

The current component describes the house's current energy system configurations, energy data, and costs. It consists of two properties: config and energy_data. See table 5.3.

Name	Type	Description	Required	Default value
config	object	An object describing the house's current energy system configurations.	Yes	-
energy_data	object	An object describing the energy demand, PV generation, and energy cost.	Yes	-

Table 5.3: Properties of current

Properties of config

The config property, as shown in table 5.4, captures the current energy system configurations, including parameters such as pv_size, battery_capacity, sems, heating_system, heating_system_type, and building_renovation.

Name	Type	Description	Required	Default value
pv_size	integer	Determine the size of the PV system.	Yes	-
battery_capacity	integer	Determine the capacity of the battery system.	Yes	-
sems	boolean	Determine the state of a SEMS system.	Yes	-
heating_system	boolean	Determine the state of the heating system used.	Yes	-
boiler_type	string	Determine the type of heating system used.	Yes	-
building_renovation	boolean	Determine the state of the renovation.	Yes	-

Table 5.4: Properties of config

Properties of energy_data

The energy_data property contains data related to energy demand, PV generation, and energy cost. It includes properties like energy_demand, energy_generate, heating, cooling, appliance, hotwater, pv, and energy_bill_year.

See table 5.5.

Properties of recommendation

The recommendation component represents a list of recommended configurations that can improve the house's energy efficiency. As listed in table

Name	Type	Description	Required	Properties in Database
energy_demand	integer	The total energy demand in a year.	Yes	-
energy_generate	integer	The total energy generated by PV in a year.	Yes	-
heating	array	The energy demanded for heating in the house for each month.	Yes	E_Heating + Q_Heating
cooling	array	The energy demanded for cooling in the house for each month.	Yes	E_RoomCooling
appliance	array	The energy demanded by all appliances in the house for each month.	Yes	BaseLoadProfile
hotwater	array	The energy demanded for hot water in the house for each month.	Yes	E_DHW_HP_out
pv	string	The energy generated from PV in the house for each month.	Yes	PhotovoltaicProfile
energy_bill	integer	The total yearly energy cost.	Yes	-

Table 5.5: Properties of energy_data

5.6, each recommendation includes properties similar to the config and energy_data properties in the current component. Additionally, it includes an investment_cost property indicating the annualised investment cost for the recommended configuration.

Example JSON data

```
"energy_data": {
    "energy_demand": 0,
    "energy_generate": 0,
    "heating": [0,0,0,0,0,0,0,0,0,0,0,0],
```

Name	Type	Description	Required	Default value
config	object	An object describing the recommended energy system configurations.	Yes	-
energy_data	object	An object describing the energy demand, PV generation, and energy cost.	Yes	-
investment	integer	The annualised investment cost for the recommended configuration.	Yes	-

Table 5.6: Properties of recommendation

```

"cooling": [0,0,0,0,0,0,0,0,0,0,0],
"appliance": [0,0,0,0,0,0,0,0,0,0,0],
"hotwater": [0,0,0,0,0,0,0,0,0,0,0],
"pv": [0,0,0,0,0,0,0,0,0,0,0],
"energy_bill_year": 0
},

```

The JSON data example can be found in the appendix [D](#).

5.2.2 Endpoints

The API exposes [5 endpoints](#) to retrieve data, they are scenario_id, recommendations and energy_data. The endpoints accept HTTP GET requests and returns JSON responses.

Chapter 6

Evaluation

In this section, we present the evaluation of our IT artefact, aimed at addressing the two research questions. The evaluation study focuses on two key dimensions. Firstly, we examine the effectiveness of the system in enhancing users' comprehension of the recommended energy technologies and their advantages. Secondly, we gauge the level of trust that users place in the recommendations provided by the system. Additionally, we seek to explore whether the information presented influences users' perspectives and behaviours, encompassing aspects such as their familiarity with energy-efficient technologies and their inclination to adopt them.

As highlighted in Nunes and Jannach's summary [35], there is no universally accepted definition of what constitutes a correct or best explanation, evaluating the quality of explanations relies on capturing the subjective perceptions of users and monitoring the impact of these explanations on user behaviour, and user studies have been the predominant research method for assessing explanations in recommender systems. Aligned with this understanding, our goal of capturing the subjective perceptions of users regarding the explanations provided and their attitude changes, we have made the

decision to conduct real-user studies.

Due to time constraints imposed by the university's requirements for a master's thesis, we conducted qualitative user studies with 7 participants in the [Germany](#). While the sample size was small, qualitative studies provide valuable insights into users' perceptions, attitudes, and experiences.

Goals

The evaluation aims to achieve two primary objectives.

- Efficacy in addressing the information gap.
- Level of trust towards the recommendations.

6.1 Semi-structured interviews

The interview proceeds through the following steps.

1. Express gratitude to the interviewee for their willingness to participate and introduce myself briefly.
2. Provide a brief recap of the project, emphasising its purposes, and clarify the specific objectives of the interview.
3. Inform the interviewee about the expected duration of the interview and assure them that the recording will be used solely for transcription purposes, ensuring confidentiality.
4. Explain that the interview will involve participants using the web service to explore and discover recommendations tailored to their home situations.

5. Prior to participants using the service, they will be asked a series of questions pertaining to their demographic information and initial perceptions of energy technologies.
6. Ask participants to use the service using a laptop and encourage them to think-out-loud while navigating.
7. When the participants finished interacting with the service, other questions will be asked.
8. Inquire if the interviewee has any remaining questions or uncertainties.
9. Express appreciation once again for their participation and inform them that they can reach out with any further concerns or inquiries they may have.

Target groups

The target users of this study are individuals residing in Germany who own or live in single-family houses. The participants were recruited using a convenient sampling approach. We employed a snowball technique by reaching out to acquaintances to inquire about their residence in a single-family house or their knowledge of individuals residing in such properties.

The interview invitation is composed as follows:

Are you a homeowner in Germany with a single-family house?

Do you want to make informed investment decisions about energy technologies for your home? If so, we invite you to participate in a 1-hour interview for our web service developed in collaboration with the University of Siegen. Don't miss out on the opportunity to finding out some energy technologies to invest for your home that potentially save energy cost. During the interview, you will use our on-

line service and share your experience. Rest assured that all information shared will be kept confidential and anonymised. The interview will be conducted either remotely or in person as you prefer. If you are interested, please choose your preferred time slot by clicking on the following link: <https://calendar.app.google/F8RnWSKmnofz3cHf6>. If you have any questions, feel free to contact us. Thank you for considering collaborating on the project!

Every participant took part in the evaluation signed a consent form (Appendix E) before starting. A summary of the participants can be found in Table 6.1.

ID	Gender	Age	Nationality	Occupation
PA	M	60	Germany	Constructor
PB	M	30	Germany	Researcher
PC	F	28	Taiwan	HCI student
PD&E	F&M	69	Germany	Retired professors
PF	M	29	Austria	PhD student
PG	M	28	Germany	PhD student

Table 6.1: Participants

Material

- **Laptop:** Participants will be provided with a laptop to access and use the web service before the interview.
- **Recording Device:** A mobile phone for instance, will be used to capture and record the interview session to enable accurate transcription of the interview responses for analysis and reference.

- **Interview Guideline:** A printed copy of the interview guideline.
- **Pen and Papers:** A pen and some papers to jot down any notes or additional information during the session.
- **Translator:** In the event that participants are not comfortable with the English language, a German speaker will be present to assist in facilitating communication and ensuring a clear understanding of the questions and responses.

Welcome

Thank you for participating in this interview. My name is Yanwei Miao, and I am currently working on my master's thesis project in collaboration with Fraunhofer ISI. We developed a web service to help homeowners like you make informed decisions about investing in energy technologies for your homes. Our aim is to provide personalised recommendations based on your specific circumstances, enabling you to determine the economic feasibility of implementing these technologies. To proceed, we kindly request your co-operation in answering a few questions about your background. This will help us gain a better understanding of your knowledge and perspective on AI and energy technologies. Once is complete, we will guide you through the web service to obtain personalised recommendations for your home energy system. While using the service, we encourage you to think out loud and share your thoughts and observations. Afterward, we will conduct an interview to gather your feedback and insights. If you have any questions at any point, please don't hesitate to ask. Are you ready to begin?

Questions

The interview questions can be categorised into four main categories: *demography, knowledge, trust, and additional questions*. Demography questions focus on gathering information about the background of the interviewees, aiming to identify any demographic factors that may influence their interest in more detailed explanations. Explainability questions are designed to assess the clarity and comprehensibility of the provided explanations, aiming to determine if they are clear and understandable to the participants. Attitude change questions are divided into two parts: before using the service and after using the service. These questions aim to capture any changes in participants' attitudes towards energy technologies and their perception of the recommendations after using the service. Lastly, additional questions or thoughts may arise during the interview. They could be an opportunity to explore additional insights or address any specific concerns during the conversation.

Category	Questions
	Before using the web service
Demography	Gender Age Educational background Occupation Nationality Knowledge and interest in AI Knowledge and interest in the energy domain

	<p>Have you heard of energy-efficient appliances or renewable energy technologies for households?</p> <p>Have you ever considered implementing energy-efficient technologies, such as solar panels and smart thermostats in your house?</p> <p>What is your understanding regarding the benefits of energy-efficient technologies?</p> <p>Do you know climate change and why it is important for individuals to save energy and utilise renewable energy sources?</p>
After using the web service	
Trust	<p>How do you feel about the recommendations provided?</p> <p>Do you find the recommendations useful or valuable?</p> <p>Are you considering investing in any of the recommended technologies now? Why or why not?</p> <p>What factors influence your decision to adopt or reject the recommendations?</p> <p>Do you know why the recommendations were recommended to you?</p> <p>Do you trust the recommendations? Why or why not?</p> <p>What factors contribute to your trust or lack of trust in the recommendations?</p>
Knowledge	<p>Were you familiar with these technologies before using the system?</p>

	<p>Did the system provide enough information for you to understand the technologies?</p> <p>Has your knowledge of energy efficient technologies improved as a result of using the system?</p> <p>Do you believe adopting these technologies can lead to lower energy costs? Why or why not?</p>
Additionals	<p>Give participants an opportunity to share any additional thoughts, concerns, or suggestions regarding the system and its recommendations.</p> <p>Ask if they have any questions for you or if there's anything else they would like to discuss.</p>

Table 6.2: Interview guideline

Closure

Thank you so much for taking the time to participate in this interview session. I sincerely appreciate your willingness to share your thoughts and experiences with us. If you have any further questions, concerns, or additional insights that you would like to share, please don't hesitate to reach out.

6.2 Future work: Kano survey

The Kano model [40] is a commonly used framework in quantitative research to understand customer satisfaction and prioritise features or attributes. In

our project, we aim to also incorporate the Kano model survey (Table 6.3) as part of our future work. We plan to integrate this survey directly into the web service, allowing individuals who have interacted with the service online to voluntarily complete the survey. Through the integration of the Kano survey into the web service, we have the opportunity to collect insights from users who engage with the service online. This will enable us to assess whether the inclusion of specific features in the service brings delight to our users. This assessment will help us determine the necessity of explanations in the service as well.

Features	I like it	I expect it	I'm neutral	I can tolerate it	I dislike it
Show corresponding yearly energy bill					
Don't show corresponding yearly energy bill					
Show detailed simulated yearly energy consumption					
Don't show detailed simulated yearly energy consumption					
Show detailed simulated daily energy consumption					
Don't show detailed simulated daily energy consumption					

Show climate change information					
Don't show climate change information					
Allow exploring and adjusting configurations of the recommended technologies					
Don't allow exploring and adjusting configurations of the recommended technologies					
Show comparison with current situation					
Don't show comparison with current situation					
Show explanation of each technology					
Don't show explanation of each technology					
Show total investment costs of each technology					
Don't show total investment costs of each technology					
Show annualised investment costs of each technology					
Don't show annualised investment costs of each technology					

Table 6.3: Kano survey

6.3 Analysis

A thematic analysis methodology was employed during this process. This involved transcribing all the interviews and capturing participants' insights on digital sticky notes within the Miro board software. Subsequently, these notes were categorised into four topics: *knowledge, trust, driver, and others*. Under the “knowledge” category, the aim was to assess participants’ comprehension of energy technologies and associated benefits before and after engaging with the service. For a comparison of their understanding and potential learning outcomes. The “trust” theme aimed to understand the level of trust participants had in the recommendations and the overall system. It also explored the factors contributing to their trust. Within the “driver” category, the focus was on identifying key factors influencing participants’ decisions to invest in energy technologies. The goal was to explore whether the service adequately addressed these drivers and if it met participants’ needs in this regard. The “others” category accommodated insights that did not fall precisely within the predefined themes.

Once all the thoughts were organised into the designated topics, a further step was taken to assign tags to each insight. These tags distilled the main concept of each insight, aiding in the analysis process. For instance, within the “knowledge” category, insights were labeled with tags such as “energy technologies,” “energy prices,” “energy policies,” “climate change,” “human comfort,” “AI,” “fact,” and “green behaviour,” in accordance with

the specific focus of each insight. This tagging approach was applied across all categories. In addition, in the “trust” category, trust-related insights were documented on white sticky notes, while distrust-related insights were noted on black ones. Using these tags, the analysis sought to uncover patterns and draw meaningful conclusions. An illustration of this process is depicted in Figure 6.1, showcasing the sticky notes on the Miro board, which served as a visual representation of the thematic analysis.

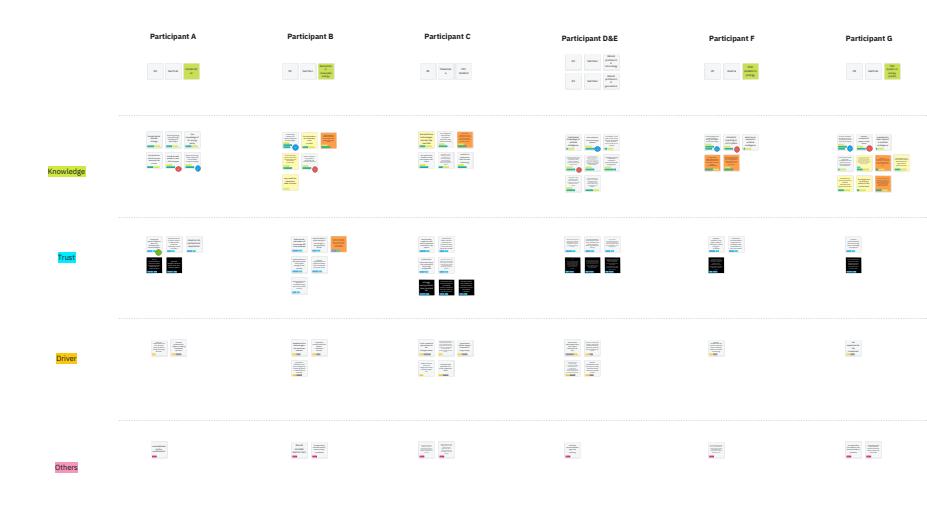


Figure 6.1: Thematic analysis

Table 6.4 provides an overview of participants’ general understanding and interest in artificial intelligence and energy technologies, along with their perspectives on the service’s learnability and explainability.

Moreover, the complete interview transcripts are available in Appendix F.

ID	Interest in AI	Interest in energy	Learned more	Trust
PA	No	Yes	No	Yes
PB	No	Yes	Yes	Yes
PC	No	No	Yes	Not much
PD&E	No	Yes	Yes	Yes
PF	Yes	Yes	No	Yes
PG	Yes	Yes	No	Yes

Table 6.4: Participants' understanding and perspectives

Participant A

Before using the service, Participant A, who works in the house construction industry, displayed knowledge of EU energy policy and familiarity with energy-efficient appliances and renewable energy technologies. He had implemented solar panels in one of his houses and believed in their ability to reduce energy costs for households. Participant A emphasised the rising energy prices and the importance of addressing climate change, expressing dissatisfaction with Germany's continued use of coal.

During the service usage, Participant A found the service to work smoothly, receiving a comprehensive list of around 50 recommendations to lower energy costs. While he agreed with most configurations, he felt overwhelmed by the extensive list and preferred to focus on specific options such as installing a heat pump and conducting a house renovation, given his expertise in his own house's needs. Despite not finding recommendations for biomass utilisation, Participant A relied on his professional experience and personal resources in considering biomass as the most cost-effective option. Although he missed the last level of explanation on renewable energy benefits, he clicked to view more details on the specific recommendation he sought.

After using the service, Participant A appreciated the recommendations but felt they were more suited for general houses rather than his unique situation. Financial considerations and environmental impact guided his energy technology decisions. Trusting the recommendations due to his familiarity with them, he acknowledged the service provided an overwhelming amount of information and a surplus of recommendations.

Participant B

Before using the service, Participant B, who works in the renewable energy industry, expressed a strong awareness of climate change and a desire to implement energy-efficient technologies and measures in his house primarily for economic reasons.

During the service usage, Participant B found the service to be simple, clean, and straightforward, which he appreciated. Although the service did not consider his electric car, he believed the estimation of the remaining energy bill to be accurate. He found the information on investment costs to be useful and liked the ability to adjust settings to see changes in energy demand and bill. While he noticed the "why turn to renewable energy" card, he did not click to view it.

After using the service, Participant B found it particularly helpful in determining the appropriate sizes for investment consideration. He believed that implementing these technologies could lead to energy cost savings, but expressed concern about the upfront investment amount, which posed a barrier for him. He suggested that government assistance in the form of support for monthly payments or other financial incentives could make green living more accessible. Participant B also suggested that the service should offer more comprehensive guidance on getting started and allow for more detailed

inputs, such as providing options to enter specific details like roof size and receive insulation recommendations. He expressed trust in the recommendations, as the energy bill was accurate when not considering the electric car. The well-programmed and responsive website service contributed to his trust as well, and he appreciated that the interface was not overly complicated.

Participant C

Before using the service, Participant C, a current master's student in human-computer interaction, admitted that she doesn't have much knowledge or interest in artificial intelligence, nor energy technologies. She does have a smart thermostat installed on her heater, which was provided by her landlord, and she is familiar with how it operates. Additionally, her colleagues at work have also shared their experiences with smart thermostats, as many of them have one. She holds the belief that the concept of "energy efficiency" does not necessarily mean conserving energy but rather generating energy more efficiently, while ensuring human comfort.

During the service usage, Participant C carefully read all the explanation texts for each technology while providing the current configuration of her house. She wanted to ensure that she answered correctly. When selecting the battery capacity, she wasn't entirely sure about the size of the battery in her house, but with only two options available, she quickly made her choice, believing that the battery in her house should be a larger one. After receiving the estimates of her current annual energy bill, Participant C calculated the monthly bill herself and was pleasantly surprised to find that it was very precise. She then proceeded to choose a recommendation and closely examined the accompanying energy graphs. Noticing that the energy demand bars for each month showed variations, with less demand in the summer and more in the winter, she found this pattern to be logical and

sensible. However, she also encountered a confusing aspect when she noticed an energy bar for cooling, even though she didn't have an air conditioner in her house. This information puzzled her. Participant C also clicked on the climate change education card to quickly scan its content and appreciated the information being presented in that section.

After using the service, Participant C found it to be a potential replacement for the Energieausweis, a nation-wide recognised standard in Germany for displaying a house's energy-efficiency level, which people usually need to pay professionals for. She appreciated that the recommendations were presented in a neutral manner, but suggested that more eye-catching visuals could make her feel the significant impact of potential savings and encourage her to make changes.

Participant C felt that the recommendations might not perfectly align with her own situation, because the questions asked in terms of her energy consumption behaviours, were relatively general. She believed that more detailed and private questions could lead to a more personalised calculation. Regarding trust, she initially believed in the service, especially after seeing that the estimated energy bill was accurate. However, when she encountered confusion in the graph, her trust in the system wavered. Participant C had concerns that the service might be promoted by business companies with the intention to sell their products. This led her to believe that the algorithm behind the model might be biased and pushing users to spend money. However, after it was clarified that the project was solely a research-driven initiative sponsored by the EU without any commercial influence, she gained more trust in the service. To further validate her trust in the system, she decided to test it by inputting the best energy configuration. The service did not provide any recommendation for this situation, which reinforced her belief that the system was not solely focused on pushing users to spend

money. This positive experience increased her trust in the service and the recommendations.

Participant C also mentioned that her investment willingness was influenced by various factors, including how long she planned to stay in her current house and whether she could take the technologies with her when moving. In her background, households were not allowed to privately install **PV** systems without obtaining a certificate from authorities, and selling excess electricity back to the grid was prohibited. which differs from Europe where governments encourage **PV** installations. Upon learning about these differences, she became enthusiastic about installing a PV system, recognising its benefits in both cost savings and contributing to environmental preservation.

Despite not having much prior knowledge of energy technologies, Participant C was able to answer all questions about her current house after reading the descriptions provided. She mentioned that the service allowed her to gain a rough understanding of these technologies but expected to learn more detailed benefits and information through the platform.

Participant D & E

Before using the service, Participant D and Participant E, a couple, had limited knowledge of artificial intelligence but were attentive to home energy systems. They already had a solar panel installed, which they used to generate hot water, resulting in significant energy savings, especially during summer. Seven years ago, they consulted an energy assessment company to optimise their home energy system. The company assessed the feasibility of installing various technologies and provided suggestions. Notably, the installation of a **PV** system on their rooftop was deemed unfeasible due to directional issues, according to the company.

While they wished to transition to more energy-efficient technologies eventually, some of their current technologies were still in good working condition. They planned to replace them in the future when they no longer served efficiently. Their motivation for reducing energy consumption stemmed from their desire to minimise their environmental impact, driven possibly by their professional backgrounds. Moreover, given the current world situation, they sought to reduce reliance on natural gas, particularly due to geopolitical concerns, as they preferred not to buy gas from Russia. Financial considerations were also a factor, as they were both retired and have a reduced income.

During the service usage, Participant D and Participant E found the recommendation page a bit confusing, but they understood it better after I explained the page. The estimated energy bill shown by the service was slightly higher than their actual bill, but they still considered it relatively accurate. They carefully examined the recommended configurations and expressed their intention to install certain technologies in the future, despite some technologies, the energy assessment company deeming them unfeasible for their house. They wondered if there were portable alternatives available. Additionally, they were unfamiliar with the SEMS system, but after reading the provided explanation, they gained a rough understanding and expressed interest in learning more about how it works and its benefits. They found the energy visualisation feature interesting and, with my guidance, explored the additional information on climate change and energy-saving measures for individuals. They briefly read through the information and agreed with the suggested measures, mentioning that they already follow some of those practices. They also shared that they had consulted with an ecological company that assessed their energy consumption and considered their energy-saving efforts to be significant. In an effort to be more energy-efficient, they even turned down the temperature a bit, and dress more in the house.

After using the service, Participant D and Participant E noted that the recommendations provided by the service were somewhat similar to the ones given by the energy assessment company. However, they highlighted that the energy assessment company provided more personalised suggestions as they physically visited their house and could offer more precise advice tailored to their specific situation. Despite this, they expressed trust in the service's recommendations, particularly because they were provided by a trusted organisation, which played a significant role in building trust. However, they trust the assessment company more, as they believed the professionals could consider more intricate details of their house and calculate the economic feasibility more accurately. Since Participant D and Participant E live in a house with shared walls with neighbors, they emphasised that several additional factors should be considered when installing new technologies. For example, changes to insulation on the rooftop or walls and the feasibility of installing a heat pump may depend on the distance from their neighbors' houses. Consequently, they believe that the service's recommendations might not fully encompass these specific aspects. Furthermore, they expressed a concern that the recommendations provided by the service may remain the same regardless of the input conditions, suggesting that the system might not consider personalised details. This led to a slight scepticism regarding the variability and suitability of the recommendations under different circumstances.

Participant F

Before using the service, Participant F is pursuing a PhD degree in the energy domain, indicating a strong background and knowledge in energy technologies and climate change. Additionally, Participant F also has an interest in artificial intelligence.

During the service usage, Participant F found the experience to be smooth and had no difficulties receiving the recommendations. He expressed confidence in the system's ability to estimate the current energy bill accurately. Despite all the recommendations suggesting investments that would not yield cost benefits (i.e., the annualised investments exceed potential savings on energy bills), Participant F still considers investing in a PV system. He believes that the investment costs provided by the system might be higher than the actual situation due to various subsidies available in different countries or regions, which could potentially reduce the overall investment. While Participant F appreciated the bar charts displaying electricity demand and generation, he suggested an additional feature that shows the amount of CO₂ emissions reduced for each recommendation. He believes that such a feature would allow for a more contrasting comparison, as the electricity consumption alone may not clearly indicate the environmental impact. He mentioned that when some recommendations show higher estimates than the previous ones, having this CO₂ reduction information could provide a more obvious indication of their positive impact.

After using the service, Participant F expressed satisfaction with the recommendations, particularly with the clear and understandable categories that provided different focuses. He trusted the recommendations and the estimations of energy consumption. Besides the investment costs provided by the system might be higher than the actual costs due to potential subsidies not considered in different areas, especially when it comes to investing in a PV system. For Participant F, financial considerations are the most important factor in deciding whether to invest in a technology. As someone working in the related field, he found the recommendations aligned with his knowledge, which contributed to his trust in the system. With his expertise, he could even interpret the graph to determine how much hot water was heated by the PV system and how much was produced by the boiler. He

suggested that it would be helpful to clarify this information in the system as well.

Participant G

Before using the service, Participant G is a researcher specialising in energy systems, and thus, he possesses substantial knowledge concerning energy technologies as well as climate change. He also expressed a keen interest in artificial intelligence. Participant G lives with his family and recently installed a **PV** system in their home.

During the service usage, Participant G navigated through all the questions effortlessly and successfully received all three recommendations. He appreciated the simplicity and limited number of questions, although he is able to provide more detailed answers. However, he considered that regular homeowners might not be able to answer more intricate questions. Participant G carefully examined all the detail pages of the recommendations and expressed curiosity about understanding their distinctions.

After using the service, Participant G found the focus on the economic aspect beneficial since it aligns with his primary concern. He and his family are considering installing a **SEMS** system and a battery system, as these technologies were recommended and demonstrated the potential for cost savings. This assurance has strengthened his determination to implement these technologies in his house. He believes the system provides the essential information that people should know.

One concern raised by Participant G was related to house renovation costs, as he considered them too expensive for the investment. He expressed skepticism about the estimated renovation costs, as he is familiar with how such numbers are typically calculated. He inquired about the total number

of years used to calculate the annualised costs. Participant G suggested the inclusion of electric vehicles into the system, as they can have a substantial impact for households with electric cars.

Being well-versed in the energy sector, he has a great understanding of how electricity is managed. In fact, he could even explain the energy demand and generation graphs based on his expertise. Overall, Participant G trusts the recommendations because they align with his knowledge and expertise. However, he pointed out that some questions were quite broad, and he believed that more detailed questions could lead to more accurate results. Nonetheless, he acknowledged the importance of striking a balance in the level of detail.

In the end, Participant G expressed interest in the technical aspects of how the system works with the model.

6.4 Discussion

As per the participants' feedback, all of them show a strong awareness of climate change. Four of the participants, who work in energy-related fields, have significant knowledge about energy technologies due to their job experiences. Two participants gained their knowledge from consulting experts in the field. Only one participant had limited familiarity with energy technologies. Furthermore, all participants, except this one, have either already installed or are planning to install energy-efficient technologies in their homes. This is likely because individuals who are already interested in energy topics are more inclined to take part in this kind of research.

6.4.1 Participants lack of knowledge wish to learn more

In terms of energy technologies, participants who already had some knowledge didn't significantly enhance their understanding through the service. Only two participants, who were unfamiliar with **SEMS**, learned about this specific technology. Together with the one participant with limited prior knowledge appreciated the general overview provided by the service but found it lacking in depth. They expressed a desire for more detailed information on the technologies. It seems that offering only basic explanations isn't sufficient. There's a need to provide additional detailed information for users keen on expanding their knowledge about these technologies.

6.4.2 Financial considerations drive decisions

All participants emphasised the critical role of the financial aspect when making decisions about energy technology investments. As stated by one participants,

“The focus on the economic aspect is beneficial since it is my primary concern.”.

This sentiment was reinforced by a participant from the construction field, who highlighted the impact of rising fuel and gas prices as a driving force behind people's shift towards renewable energy due to its cost-effectiveness.

One participant mentioned the information on investment costs is crucial, helping him make informed decisions. Moreover, the estimated energy bills were deemed valuable for determining the technology choices and sizes, as another participant explained. Furthermore, one participant's preferred technologies were recommended by the service, leading to increased confidence in the investment due to the estimated bill reductions.

The participant with limited knowledge of energy technologies recognised the potential for significant cost savings through the service, this feedback shows the significance of maintaining an emphasis on financial aspects within the service, showcasing its potential to bridge the information gap in this vital area. The focus on financial considerations not only aligns with participants' primary concerns but also serves as a key driver in encouraging sustainable energy choices.

6.4.3 Energy professionals seeking in-depth information

In our evaluation, all three participants with expertise in the energy sector shared a common request for more comprehensive information regarding the recommendations provided. They demonstrated a strong ability to interpret the visualised charts depicting energy demand and generation. Moreover, they are interested into the technical intricacies of the model or algorithms.

One participant expressed interest in having the reduction amount of CO₂ emissions displayed for each recommendation. This participant believed that this information would present more obvious differences than the energy charts, and also providing a clearer understanding of the environmental impact of different choices. Another participant indicated a desire to understand how the renovation costs were calculated. The feedback from participants with professional energy knowledge underscores their inclination towards acquiring more comprehensive details of the model, revealing their pursuit of in-depth explanations and a desire to make informed decisions based on these insights. They request greater transparency in the system's underlying processes.

6.4.4 Solid trust across participants

In our evaluation, all participants expressed trust in the recommendations provided by the system. This trust was fortified by several factors, each playing a role in building their confidence.

Accurate energy bill estimations build credibility

Mentioned by all participants, a significant contributor to this trust is the perceived accuracy of the estimated current energy bills. Participants' conviction in the correctness of these estimates was instrumental in fostering trust in the recommendations.

Professional expertise bolsters trust

Participants engaged in energy-related fields resonated with the recommendations due to their alignment with their professional knowledge. This correspondence between the system's suggestions and their expertise augmented their trust in the system's advice.

Trusted source and research institution

For some participants (3 out of 7), the fact that the service was developed by a trusted organisation was a significant trust-building factor. This is evidenced by one example, one participant initially had doubts, fearing that the service might be influenced by business interests promoting specific energy technologies. However, these concerns diminished as the participant noticed that certain configurations received no recommendations, revealing the service's impartiality. His trust solidified upon learning that the service was

crafted by a research institute rather than a commercial entity. Therefore, the importance of transparently conveying the intention to users is evident.

Consistency with past recommendations reinforces confidence

Two participants who had prior experience with energy audits found the recommendations from the service to be consistent with those obtained elsewhere. This alignment reinforced their confidence in the service's recommendations.

Design and user experience boosters confidence

Another participant highlighted the role of the well-designed, responsive web interface in building trust. A user-friendly interface contributes to a sense of professionalism and reliability, further strengthening trust in the system.

6.4.5 Personalisation concerns

The feedback received also highlighted concerns regarding the level of personalisation in the recommendations. Notably, participants underlined situations where their unique circumstances weren't fully accounted for.

Unique resources situations

Among the participants, some (2/7) presented unique circumstances. A participant, who works in the house construction field, believed that his house's situation differed from typical households. This participant emphasised that a biomass boiler was a more economical solution for him. His house had ample space for wood storage due to a large garden, and his proximity to

forests meant that biomass prices were lower for him. A similar sentiment was echoed by another participant who couldn't install a PV system due to specific directional constraints of their house. This information was informed by professionals during an energy audit.

Unique consumption behaviours

Another participant mentioned that the service didn't delve into his specific energy consumption behaviours. He believed his energy usage differed from the norm, which might impact the accuracy of the estimations. Similarly, another participant expressed concerns, suggesting that certain questions in the service could be more detailed. This participant believed that greater detail in the questions could lead to more accurate calculations and recommendations. These observations underscore the need to strike a balance between simplicity and detail in the questions presented to users.

Regional variations in investment costs

From a financial perspective, one participant brought up the point that investment costs could fluctuate based on regional differences. This is due to varying subsidy policies that are often tied to specific geographical areas.

Beyond technologies

In addition to the focus on energy technologies and their sizes, few participants (2/7) expressed a desire for more granular and comprehensive recommendations. One participant expressed an interest in receiving recommendations for the materials to be employed in rooftop renovations. Another participant expressed a need for greater clarification on how to initiate changes

in their energy system. These insights emphasise the significance of considering users' holistic needs and expanding the scope of recommendations to encompass various aspects of energy-efficient enhancements to ensure a more comprehensive and user-centric approach, catering to a diverse range of user preferences and requirements.

6.4.6 Motivations for investment: financial and beyond

The driving force behind participants' motivation to invest in energy-efficient technologies predominantly revolves around financial considerations. The allure of potential cost savings on energy bills appears to be the primary incentive for most participants. Additionally, environmental protection emerges as a notable supporting factor in participants' decision-making. While financial benefits are at the forefront, the desire to contribute positively to the environment underscores a collective recognition of the importance of sustainable energy practices. It's noteworthy that nowadays geopolitical concerns also play a role for a subset of participants.

6.4.7 Government Support

In terms of financial implications, the participants shared a consensus that investing in a sustainable energy system involves substantial financial commitment. This sentiment echoes the general understanding that adopting energy-efficient technologies often requires a significant upfront investment. A substantial portion of the participants (3/7) expressed the view that government support should play a pivotal role in facilitating the adoption of sustainable energy systems. This insight emphasises the role of governments in incentivising and promoting the adoption of energy-efficient technologies,

potentially through subsidies, tax benefits, or other forms of financial assistance.

6.4.8 A multifunctional perspective

An intriguing perspective arose from one participant, shedding light on the multifunctional potential of the service. Beyond its primary role of offering energy system recommendations, this participant recognised the service as a potential alternative to the commonly required "Energieausweis" (energy certificate) [46] in certain regions. This certificate is a significant document used to assess a property's energy efficiency, typically mandated for property transactions and rentals. Such multifunctionality adds a layer of versatility to the service, potentially expanding its reach and relevance within the energy domain.

Chapter 7

Conclusion

Our exploration to bridge the gap in knowledge about energy technologies and the associated benefits for homeowners has yielded valuable insights. The journey began with an initial phase of pre-study, where our goal was to uncover existing tools and practices that could empower homeowners to embrace sustainable energy solutions. This initial investigation paved the way for the development of an innovative home energy system recommender, anchored in the FLEX models. These models assist in identifying technology configurations tailored to specific situations, leading to potential energy cost savings that directly benefit homeowners financially. Throughout the development process, we placed significant emphasis on explainability, ensuring the recommendations were trusted. By engaging with real participants through user testing, we have gained a deeper understanding of their expectations, concerns, and attitudes. The insights gathered from the feedback lead us to a conclusive observation.

7.1 Filling the information gap

The provision of such information has a significant impact on the decision-making process of homeowners, even though there are slight variations in how different users respond. These differences are indicative of varying perspectives of positive attitudes towards investing in such technologies. For instance, users who had limited knowledge about energy technologies before using the service expressed that they gained a better understanding of various technologies, their functionalities, and the potential financial benefits. On the other hand, participants who were already knowledgeable in this field learned about the advantages of different configurations and sizes of technologies tailored to their unique situations. Moreover, trust remains a pivotal factor within a recommender system, consistently highlighting its critical role in nurturing user confidence and promoting well-informed decisions.

Furthermore, in line with findings from previous studies and surveys, our research also underscores the significance of financial considerations as a primary motivating factor. Nevertheless, a notable shift has been observed in our study, where participants express an increasing desire to contribute to environmental protection. It is noteworthy that this “green” inclination, while supportive, remains secondary to the financial aspect due to the substantial investment required. However, this change in attitude is distinct from the situation observed in a survey conducted in 2013 [37]. This evolving perspective suggests a growing awareness and willingness among individuals to embrace more sustainable energy decisions.

In accordance with Fogg’s Persuasive Design framework [18], where he outlined how technology can effectively influence and change behaviours by considering three key factors: *motivation, promot, and ability*. Our study

reveals that a considerable number of households exhibit strong “motivations” to embrace energy-efficient technologies. The introduced home energy system recommender functions effectively as a “promot,” providing valuable insights and recommendations that facilitate their decision-making processes. Although, there is room for improvement in this artefact, as discussed in the previous chapter, for instance, users with varying levels of knowledge about energy technologies express their specific informational needs. We envision a promising future for tools like ours. These tools not only provide valuable information to households, fostering financial benefits and sustainable energy investments, while also potentially aiding in mitigating climate change. However, a prevalent “ability” constraint emerges among many households, primarily associated with financial challenges that impede one-time investments in these technologies. This underscores the necessity for policy interventions aimed at improving accessibility and affordability. We believe that through the provision of accessible information and collaborative efforts from governing bodies, this trend of embracing sustainable energy choices will continue to grow, encouraging more individuals to take meaningful steps toward a greener and more energy-efficient future.

Explainability of the recommender

Explainability holds paramount importance in the design of recommendation systems, as highlighted in the preceding chapter. As elucidated earlier, a multitude of factors underpinning trust and distrust in recommendations and the system were discerned from user feedback. Our recommender system offers three levels of explanations. all users appreciate the first level of explanation, which focuses on annual energy bills, the comparison with their current annual energy bill contribute significantly to their trust into the system. Most users also found the second level of explanation that is show-

ing energy consumption patterns is interesting to know, this visualisation of usage data align with their understanding of their consumption habbits also contribute to their trust. Allowing them to spontaneously change the configurations and compare results has also contributed big in their trust of the system, when seeing the differences of each configurations make them believe that the system is actually working for individual situations, not just recommending similar configurations to everyone. However, the third level of explanation seems less attractive to many users, this may due to less appealing interaction design, since huge text is not very friendly to users. Additonally, many already knew about the concept of climate change and related information, some users also treated it as a self checking list when reading the part what can individuals do to slow down cliamte change process. We can probably say this level of explanation doesn't really contribute much to user's trust of the recommendations nor system, but it works nice as an additonal information for users to reflect their current behaviours.

7.2 Limitations

This study encompasses certain limitations that need to be considered when interpreting the findings.

Small sample size: The study was conducted with a limited number of participants, which might affect the generalisability of the results.

Limited knowledge background: Due to many reasons, approximately half of the participants possessed related knowledge in the energy domain. This could potentially introduce bias into their perceptions and responses.

Restricted age range: The age distribution of participants was concen-

trated around two main age groups: approximately 30 and 60 years old. This might limit the representation of perspectives across a wider age spectrum.

Age-related technology challenges: The study revealed that participants aged 65 and above encountered challenges when engaging with the online tool. Older participants indicated a preference for face-to-face consultations and demonstrated a higher level of trust in human experts rather than in an AI system. This could affect the overall user experience and willingness to adopt the recommendations, particularly among older demographics.

Neglect of rebound effect: The study does not account for the rebound effect [23], which refers to potential changes in household behavior that could result from adopting energy-efficient technologies. This omission could lead to an oversight in estimating the actual impact on energy consumption and subsequent energy bills. While the model assumes a certain comfort lifestyle as a baseline, any significant behavioral shifts induced by the recommended changes might not be accurately captured. Nevertheless, given the reference to comfort lifestyle, it is assumed that the rebound effect's influence would likely be minimal.

These limitations highlight areas for further investigation and potential refinement of the home energy system recommender to accommodate a broader range of users and contexts.

Appendices

Appendix A

Input of the FLEX models

Category	Data
Behaviour profile	id_hour, people_at_home_profile_1, hot_water_demand_profile_1, appliance_electricity_demand_profile_1, vehicle_at_home_profile_1, vehicle_distance_profile_1.
Battery	ID_Battery, capacity, capacity_unit, charge_efficiency, charge_power_max, charge_power_max_unit, discharge_efficiency, discharge_power_max, discharge_power_max_unit.
Continued on next page	

Table A.1 – continued from previous page

Category	Data
Behaviour	ID_Behavior, id_people_at_home_profile, target_temperature_at_home_max, target_temperature_at_home_min, target_temperature_not_at_home_max, target_temperature_not_at_home_min, shading_solar_reduction_rate, shading_threshold_temperature, temperature_unit, id_hot_water_demand_profile, hot_water_demand_annual, hot_water_demand_unit, id_appliance_electricity_demand_profile, appliance_electricity_demand_annual, appliance_electricity_demand_unit, id_vehicle_at_home_profile, id_vehicle_distance_profile.
Boiler	ID_Boiler, type, power_max, power_max_unit, carnot_efficiency_factor.
Building	ID_Building, type, construction_period_start, construction_period_end, person_num, Af, Hop, Htr_w, Hve, CM_factor, Am_factor, internal_gains, effective_window_area_west_east, effective_window_area_south, effective_window_area_north, grid_power_max, supply_temperature.
Energy price	ID_EnergyPrice, id_electricity, id_electricity_feed_in, id_gases, price_unit.
Heating element	ID_HeatingElement, power, power_unit, efficiency.
Hot water tank	ID_HotWaterTank, size, size_unit, surface_area, surface_area_unit, loss, loss_unit, temperature_start, temperature_max, temperature_min, temperature_surrounding, temperature_unit.
Continued on next page	

Table A.1 – continued from previous page

Category	Data
PV	ID_PV, size, size_unit.
Region	ID_Region, code, year, norm_outside_temperature.
Space cooling technology	ID_SpaceCoolingTechnology, efficiency, power, power_unit.
Space heating tank	ID_SpaceHeatingTank, size, size_unit, surface_area, surface_area_unit, loss, loss_unit, temperature_start, temperature_max, temperature_min, temperature_surrounding, temperature_unit.
Vehicle	ID_Vehicle, type, capacity, capacity_unit, consumption_rate, consumption_rate_unit, charge_efficiency, charge_power_max, charge_power_max_unit, discharge_efficiency, discharge_power_max, discharge_power_max_unit, charge_bidirectional.
Energy price	Region, year, id_hour, electricity_1, electricity_2, electricity_feed_in_1, gases_1.
Region weather	region, year, id_hour, pv_generation, pv_generation_unit, temperature, temperature_unit, radiation_south, radiation_east, radiation_west, radiation_north, radiation_unit.

Table A.1: Input data of the FLEX-Operation model

Appendix B

Privacy Policy

This Privacy Policy outlines how University of Siegen and The Fraunhofer Institute for Systems and Innovation Research (ISI) collect, use, and protect data for research purposes.

Data Collection

When you use our service, we collect data for research purposes. All data will be anonymous, meaning that we will not collect any personal information that can identify you. The data we collect may include, but is not limited to, information about your usage of the service, your location, and demographic information.

Data Use

We will use the data collected to conduct research and may publish papers based on the findings. The data will be used only for research purposes and

will be safely taken care of by and only by all the parties involved in this research, which are University of Siegen and The Fraunhofer Institute for Systems and Innovation Research (ISI).

Data Retention

Please note that once you have used our service, you cannot delete your data. This is because your data will become part of a larger pool of data that will be analysed anonymously. The data will be retained for as long as is necessary for research purposes.

Data Security

We take appropriate measures to protect the data we collect from unauthorized access, use, or disclosure. We use industry-standard security protocols and techniques to safeguard the data from unauthorized access, use, or disclosure. All the parties involved in this research, which are University of Siegen and The Fraunhofer Institute for Systems and Innovation Research (ISI), will have access to the data.

Data Sharing

We do not share the data we collect with third parties, except as required by law or with your explicit consent.

Changes to this Policy

We reserve the right to modify this Privacy Policy at any time, so please review it frequently. If we make any changes to this Privacy Policy, we will post the revised version on our website.

Contact Us

If you have any questions or concerns about this Privacy Policy or our data collection and processing practices, please contact us.

Appendix C

Usability testing survey responses

Q1. What do you think this website is about?	
P1	suggesting some better ways to save energy at home and decrease the cost of that
P2	Energy saving
P3	Calculating how much energy is used per/sqr
P4	I think it is about helping individuals to understand strategies to save money while supporting climate change. It seems to be a hybrid between educate visitors and sell "green energy" services/products.
P5	getting energy-related information in my household

Table C.1: Question 1

Q2. How clear were the instructions on the website for you to follow?				
P1	P2	P3	P4	P5
10/10	8/10	8/10	7/10	5/10

Table C.2: Question 2

Q3. Did you find the website visually appealing?				
P1	P2	P3	P4	P5
10/10	10/10	6/10	8/10	4/10

Table C.3: Question 3

Q4. Was the website easy to use and understand?				
P1	P2	P3	P4	P5
10/10	8/10	7/10	5/10	4/10

Table C.4: Question 4

Q5. How long do you think it took you to complete the questions?				
P1	P2	P3	P4	P5
1-5 min	1-5 min	1-5 min	5-10 min	1-5 min

Table C.5: Question 5

Q6. What would you change about the website to make it more user-friendly?	
P1	adding a "back" button, in case of returning to the previous page to edit something

P2	<p>1. I didn't realize if one step moved to the next in the tracker (top left), make you could use a color gradient (i.e. the circles go from light to dark green gradually) to highlight the progress.</p> <p>2. Is a little weird that the Children's age is 0-25 (is that the standard in Germany?).</p> <p>3. It would be great if, in the drop-down menus, there is an "I don't know" option. And then provide some guidance for the users to find that out (I saw you already have some questions to support the user, I think that's very helpful!).</p>
P3	More explanation, cues

P4	<p>"I felt the need for a back button on the interface. For instance, when I clicked on "more details" on the last page, I couldn't go back to check the other options. I ended up clicking on the logo that lead to the start of the questionnaire. I also had to Google the PV meaning. It would be more clear if it was written photovoltaic system. I saw there was a link to explain what PV is, but I think it would be more clear for me if it was written photovoltaic because I know what that means. The steps tracker was not that useful as well. It was not reflecting the number of questions. So I was not sure how many questions would be asked until moved to the next step. I am also concerned about the question of the max and min home temperature for me. I never know that as I don't measure it in my home. I would prefer the questionnaire to provide me with a suggestion based on the "ideal" temperature. I don't know if I would decide on an option only by the website usage. Maybe I would like to see more info about the final investment and how much time it would be required to "get that money back" by saving energy consumption from the power provider. In the PV system, I would like to be able to see how many I would be able to add to my home to understand how much energy it could generate. At first glance, 3.321 kwh seems to be not much. The graphic comparing the current and possible options is not clear. What does it represent? Are the green bars showing how much the PV would generate? Maybe rather than showing many elements (Heating, cooling etc) It would be easier to understand if it don't show that information too granular."</p>
----	---

P5	<p>”This is difficult to explain in writing. I would rather speak about this. However, here are few things that can be communicated in a written form. The start pages looks nice! but it can be further improved to make it more appealing and gives better vibes. If this was an interview, I would have showed some examples of what I think would improve it. The questions seemed more like a normal survey. I would rather design it so that it looks more like a friendly inquiry rather than a very serious questionnaire. I would include a more friendly language or even use some slang. Also I would include few emojis or even illustrations where appropriate. The ‘please wait’ page after the questions, gives the impression that the page is not responsive anymore. A more dynamic/moving illustration is expected to know that something is happening and avoid the feeling that the page is lagging. Am I supposed to know information about the battery and PV systems in my house? I was asked for these informations and I am not sure where can I get this information from, if I don’t know it. ‘What is a PV system’ and ‘What is a battery system’ is not active. So I couldn’t understand what is that.”</p>
----	---

Table C.6: Question 6

Q7. Were the recommendations easy to understand?				
P1	P2	P3	P4	P5
10/10	9/10	7/10	5/10	9/10

Table C.7: Question 7

Q8. Was there anything about the recommendations that you found confusing or unclear?	
P1	about PV or SEM systems which I could not see what they are
P2	I love your data visualization! I would make sure all axis have their respective unit of measure. Just to be extra clear
P3	No
P4	Yes, the bar chart. I think it is also important to understand more clearly the cost of each suggestion and the time to implement such a system.
P5	"In the 'recommendation configuration' page, the word 'current' at the top left is not very clear. I stopped for a second and looked at the information below to know what 'current' refers to here. Also, for a first glance, I was expecting a 'results' page, before the recommendation appears. Here, all is presented in one page. For the second page, the axes in the 'energy use' bar chart needs to be named. Also, the annual energy bill is the same for all options. I think it's a typo here.. Other than that, I think the follow in which the information is presented could be improved."

Table C.8: Question 8

Appendix D

Example JSON Data

```
{  
  "profile": {  
  
    "location": "DE",  
    "person": 3  
  
  },  
  
  "current": {  
  
    "config": {  
  
      "pv_size": 0,  
      "battery_capacity": 0,  
      "sems": false,  
      "heating_system": true,  
      "heating_system_type": "heating oil boiler",  
      "building_renovation": true  
    }  
  }  
}
```

```
},  
  
"energy_data": {  
  
    "energy_demand": 0,  
    "energy_generate": 0,  
    "heating": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "cooling": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "appliance": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "hotwater": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "pv": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "energy_bill_year": 0  
  
},  
  
},  
  
"recommendation": [{  
  
    "config": {  
  
        "pv_size": 0,  
        "battery_capacity": 0,  
        "sems": false,  
        "heating_system": true,  
        "heating_system_type": "heating oil boiler",  
        "building_renovation": true  
    }  
}]
```

```
},  
  
"energy_data": {  
  
    "energy_demand": 0,  
    "energy_generate": 0,  
    "heating": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "cooling": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "appliance": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "hotwater": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "pv": [0,0,0,0,0,0,0,0,0,0,0,0],  
    "energy_bill_year": 0  
  
},  
  
"investment_cost": 0  
  
}  
}]  
}
```

Appendix E

Consent form

Thank you very much for collaborating with us on this exciting project!

Principal Investigator: Yanwei Miao

Affiliation: Siegen University, The Fraunhofer Institute for Systems and Innovation Research

Date:

Purpose of the Study

The study aims to develop a web service that provides personalised recommendations to homeowners, assisting them in making informed decisions regarding energy investments.

Procedures

If you choose to participate, you will be asked to engage with our web service and answer questions regarding your experience and opinions. The interview

is estimated to take approximately 40 minutes, and can be conducted both in person and remotely.

Confidentiality

Your privacy and the confidentiality of your information are of utmost importance to us. Any information collected during the study will be anonymised, and your identity will remain confidential.

Contact Information

If you have any questions, concerns, or require further information, please feel free to contact Yanwei Miao (yanwei.miao@student.uni-siegen.de).

Consent

By proceeding with the study, you acknowledge that you have read and understood the information provided in this consent form. Your participation is entirely voluntary, and you may withdraw at any time without consequences.

Participant Name:

Participant Signature:

Date:

Thank you again for considering participating in our study. Your contribution is greatly appreciated!

Appendix F

transcription

Participant B

Miao, Yanwei 00:00:00.739 – 00:00:15.500
Okay, I think you have received the information that it's recording right now and for your demographical information, I would like to ask about your gender.

Participant B 00:00:16.100 – 00:00:20.580
A male.

Miao, Yanwei 00:02:17.700 – 00:02:20.860
Do you mind letting me know your age?

Participant B 00:02:20.940 – 00:02:22.700
30.

Miao, Yanwei 00:02:24.420 – 00:02:29.700
And your educational background.

Miao, Yanwei 00:02:40.100 – 00:02:43.300
And like, what, what did you study, what is your subject?

Participant B 00:02:43.340 – 00:02:51.100
So I started geography, which is the main topic and it was about environmental and climate change.

Miao, Yanwei 00:02:55.460 – 00:02:59.020
And your occupation right now.

Participant B 00:03:00.060 – 00:03:03.740
So I'm working for the ISI, It's like.

Participant B 00:03:06.740 – 00:03:09.540
I don't know the English expression actually, so it's wissenschaftliche Mitarbeiter.

Miao, Yanwei 00:03:15.660 – 00:03:23.540
Okay, that's, that's fine. And May, I know whether you have a bit of knowledge or interesting, AI.

Participant B 00:03:25.100 – 00:03:28.820
The first part of the thing was, was a little bit.

Miao, Yanwei 00:03:31.420 – 00:03:35.780
Do you have any knowledge or do you have any interest in AI?

Miao, Yanwei 00:03:37.060 – 00:03:38.340
Artificial intelligence.

Participant B 00:03:39.220 – 00:03:49.220
Not really no, not more than like, the, the basic interest in I just tried out the new tools which are available, but not more than that.

Miao, Yanwei 00:03:49.220 – 00:03:55.980
Okay, and do you have any knowledge or interest in the energy domain?

Participant B 00:03:57.180 – 00:03:58.780
Since I.

Participant B 00:04:00.180 – 00:04:14.820
A lot of time into researching for my masters thesis I have a little bit experience in the field of district heating and, and a wind power as I worked as a wind power company before.

Miao, Yanwei 00:04:15.460 – 00:04:16.579
Okay.

Miao, Yanwei 00:04:19.299 – 00:04:38.500
Sounds good, thank you. So maybe also I would like to know something about your attitudes towards energy efficient technologies. Have you heard of energy efficient appliances or renewable energy technologies for households.

Participant B 00:04:44.300 – 00:04:56.420
So you mean like installation measures or new technologies regarding eat production or on water production. Something like that, or what do you mean?

Miao, Yanwei 00:04:56.500 – 00:05:00.900
Yes, basically like, very general, have you ever heard of any.

Miao, Yanwei 00:05:03.460 – 00:05:13.660
And have you ever considered implementing energy efficient technologies such as solar panels or smart thermostats.

Participant B 00:05:15.220 – 00:05:34.180
We're talking about installing smart term as we also have an electric car, we would like to use it to better plan the charging procedure, and then we also are talking about getting our roof insulated better insulation.

Participant B 00:05:34.940 – 00:05:41.220
It's hardly insulated now, but we want to increase the installation and.

Participant B 00:05:41.980 – 00:05:47.500
Also thinking about buying a footable tank.

Participant B 00:05:49.740 – 00:05:56.860
Tags, but the lack of money right now can afforded, but it's, we have plans for it.

Miao, Yanwei 00:05:57.220 – 00:06:06.580
Sounds good, and what is your understanding regarding the benefits of energy efficient technologies.

Participant B 00:06:10.100 – 00:06:25.940
Reduction of the needs. So we, we would need less energy consumed and obviously also for, for example, the roof insulation, it's in the summertime or during the winter, it's less.

Participant B 00:06:27.340 – 00:06:32.420
Strong changes in the room temperature, which is beneficial as well.

Miao, Yanwei 00:06:33.780 – 00:06:39.140
And do you know climate change And why is it important to individuals?

Miao, Yanwei 00:06:42.660 – 00:06:55.060
Climate change and why is climate change important for individuals to save energy or utilize renewable energy resources.

Participant B 00:06:55.820 – 00:07:15.940
You mean why it is important to everybody, and why everybody should, I think everybody should do what, what he or she can do in order to reduce their demand so that in, in total, the demand decreases and the targets, which are set for.

Participant B 00:07:16.140 – 00:07:19.780
For the entire community can be reached so...

Participant B 00:07:20.660 – 00:07:23.220
Play its small part. I think.

Miao, Yanwei 00:07:25.700 – 00:07:27.700
Know a lot about that.

Miao, Yanwei 00:07:29.380 – 00:07:38.180
Sounds good, so I, I've already finished the pre-questions and now I will send you a link.

Miao, Yanwei 00:07:39.860 – 00:07:44.100
You should have received a link in our chat now.

Miao, Yanwei 00:07:46.660 – 00:07:50.500
If you click the link and then you are landing our service.

Miao, Yanwei 00:07:53.060 – 00:08:05.220
And do you mind to share your screen so that I can see how you operate through the website, but if you don't want to eat, you can also just say no, and just let me know which step you are.

Miao, Yanwei 00:08:59.220 – 00:09:03.540
As long as it's comfortable for you to see, then it's fine.

Participant B 00:09:04.740 – 00:09:06.580
Okay, so.

Miao, Yanwei 00:09:09.860 – 00:09:10.500
You can think out loud.

Miao, Yanwei 00:09:11.900 – 00:09:14.340
When you are navigating through it.

Participant B 00:09:14.380 – 00:09:22.660
Okay, so, so what shall I look for shall. I look for like the UI or what, what is the main topic to look at?

Miao, Yanwei 00:09:23.300 – 00:09:25.100
Everything basically.

Participant B 00:09:25.300 – 00:09:25.860
Everything.

Miao, Yanwei 00:09:26.500 – 00:09:30.220
You can just share any thoughts when you are navigating.

Participant B 00:09:30.460 – 00:09:34.780
Great, so I like the look, it's really clean. That's the first impression.

Participant B 00:09:54.020 – 00:09:56.780
So I just need to select.

Participant B 00:10:01.700 – 00:10:07.620
So I think it's pretty straightforward. You, there's not much going on on the screen. I like that.

73 Participant B 00:10:40.660 – 00:10:42.100
Okay, so.

Participant B 00:10:48.340 – 00:10:52.580
Okay, so what's, what's the screen about?

Miao, Yanwei 00:11:02.460 – 00:11:07.420
You can ask me if you think you don't understand which part.

Participant B 00:11:07.540 – 00:11:12.620
So I, I will just click here to see more details how this calculated.

Participant B 00:11:16.500 – 00:11:17.940
Maybe I just.

Participant B 00:11:36.980 – 00:11:41.700
It's this for, for, it's for.

Participant B 00:11:42.780 – 00:11:47.780
An energy build, so this is for, and electricity.

Miao, Yanwei 00:11:50.420 – 00:11:52.980
You mean the price, the total price price.

Participant B 00:11:53.020 – 00:11:53.620
Yes, yes.

Miao, Yanwei 00:11:53.940 – 00:11:59.380
For all the energy, your whole house could consume.

Participant B 00:12:00.820 – 00:12:01.940
So.

Participant B 00:12:04.260 – 00:12:06.660
And electricity might take.

Participant B 00:12:30.900 – 00:12:32.020
Yes, makes sense.

Participant B 00:12:39.060 – 00:12:41.060
So it's for.

Participant B 00:12:42.900 – 00:12:54.020
For electricity and, and leading. So I just just quickly checked, but it's, it's underestimating already price.

Participant B 00:12:58.060 – 00:13:09.140
Yeah, but I think it's because we have electric car and it doesn't ask if we have an electric car in charge at home.
So our electricity Bill is alone is really high. so.

Participant B 00:13:10.420 – 00:13:14.220
Do not have then fuel costs other than the electricity.

Participant B 00:13:16.180 – 00:13:26.500
So maybe it could ask for a car if, if someone has a car, then should have a higher demand for electricity.

Participant B 00:13:52.020 – 00:14:00.140
Already it was not not that much for this. I only have the numbers for last year, so.

Participant B 00:14:06.740 – 00:14:09.300
It was like, they had electricity Bill of.

Participant B 00:14:14.580 – 00:14:19.500
Three thousand, six hundred, but that's only electricity.

Participant B 00:14:21.500 – 00:14:22.820
Also, gas.

Participant B 00:14:25.340 – 00:14:31.300
Whether he was one thousand eight hundred, so.

Participant B 00:14:55.380 – 00:15:00.060
Okay, and then on the right side, you see, I can see some suggestions.

Participant B 00:15:03.940 – 00:15:05.940
Let me check. Let's see.

Participant B 00:15:10.100 – 00:15:20.980
Annualized cost, okay, and does it also show, like total costs or it like the total investment costs.

Participant B 00:15:33.900 – 00:15:35.700
Yeah, that's good.

Participant B 00:16:33.940 – 00:16:39.660
IZED investment costs of two thousand something. Yes, so I would.

Participant B 00:16:41.660 – 00:16:44.820
In total, I would pay like a hundred more.

Participant B 00:16:45.860 – 00:16:46.100
Okay.

Participant B 00:17:13.740 – 00:17:24.500
Or will there be the, or is there going to be the opportunity to enter my own figures, like, if I- if I see, okay, this doesn't fit perfectly...

Participant B 00:17:25.339 – 00:17:30.260
Can I then alter the estimations to my demand, for example.

Miao, Yanwei 00:17:30.900 – 00:17:38.580
And you can click the more detail on the recommendation cards if you want to like, see one of these.

Participant B 00:17:38.580 – 00:17:39.220
Oh, okay.

Participant B 00:17:50.740 – 00:17:53.540
And you also program this website.

Participant B 00:17:57.780 – 00:18:00.980
It's really nice. I like, it's really clean.

Miao, Yanwei 00:18:03.580 – 00:18:06.100
Very happy, it's my first.

Participant B 00:18:06.260 – 00:18:08.980
No, I can. Yeah, I can.

Participant B 00:18:09.940 – 00:18:12.500
For example, take this away and then.

Participant B 00:18:13.820 – 00:18:14.940
Okay.

Participant B 00:18:48.340 – 00:18:50.300
Okay, that's cool.

Participant B 00:19:10.100 – 00:19:15.860
Yeah, I, I think this, this website looks as I said, it looks really good.

Participant B 00:19:19.700 – 00:19:26.740
That you can alter some things and, and see what it makes, what kind of differences it makes.

Participant B 00:19:34.420 – 00:19:42.220
That's really cool. And so what is, what is your plan going forward with this?

Miao, Yanwei 00:19:42.740 – 00:19:52.980
This is already actually.

Miao, Yanwei 00:19:53.860 – 00:19:55.100
The results.

Miao, Yanwei 00:19:58.100 – 00:20:01.940
Yeah, you've already reached the last phase.

Miao, Yanwei 00:20:03.860 – 00:20:20.500
Thank you, and there's actually one more page, but it, you, you didn't notice it, but it's fine. It's for like, yes, it's the green bar. It says why should we turn to renewable energy?

Participant B 00:20:21.640 – 00:20:24.440
Before it was on the first page as well.

Miao, Yanwei 00:20:24.680 – 00:20:27.880
Yes, but it.

Participant B 00:20:28.760 – 00:20:32.360
That's like a, like a FAQ for.

Participant B 00:20:33.640 – 00:20:35.080
Why it's important.

Miao, Yanwei 00:20:35.560 – 00:20:50.200
Yes, it's for people who may want to the energy technologies, but they, they might mainly focus on the financial aspect.

Miao, Yanwei 00:20:51.120 – 00:21:00.520
Provide a little bit more information regarding like climate change, so it's just, someone doesn't.

Participant B 00:21:03.720 – 00:21:05.200
That it's also.

Participant B 00:21:06.400 – 00:21:13.800
Issue of like the human society in its core and not only about the numbers.

Miao, Yanwei 00:21:17.160 – 00:21:25.520
But according to my research financial reason, it's still the main reasons for.

Miao, Yanwei 00:21:27.520 – 00:21:29.800
To choose their energy technologies.

Participant B 00:21:33.200 – 00:21:44.040
Especially in times where other energies are really expensive, it's, it would, or it could be a huge benefit to produce your own energy as well, and, and do.

Participant B 00:21:46.080 – 00:22:04.640
Something good with it as well. So I think it will always be, or it should be, maybe should be different than everybody should be doing it because it's better for the environment, but I think the, the main driver will still be the economics at the end.

Miao, Yanwei 00:22:09.720 – 00:22:14.120
You have seen everything from the website, then.

Participant B 00:22:16.200 – 00:22:17.320
Fully.

Participant B 00:22:18.640 – 00:22:25.000
Haven't come fully into it now, but I can, I can do it via the link again and play around with.

Miao, Yanwei 00:22:28.200 – 00:22:39.080
And now the port is eighty eighty, but maybe later we will remove the eighty eight port. We will make it global so that you don't need to type the eighty eighty in the end.

Miao, Yanwei 00:22:40.400 – 00:22:42.280
Flex model dot org.

Miao, Yanwei 00:22:44.200 – 00:22:46.680
And, but before.

Miao, Yanwei 00:22:48.760 – 00:23:08.400
There are still some more questions after you operate with the system. Okay, I would still like to ask some questions regarding your attitude. So firstly, like, how do you feel about the recommended recommendations provided.

Participant B 00:23:09.800 – 00:23:16.840
So, as I already said in the beginning, we already thought about applying some of those recommend.

Participant B 00:23:20.320 – 00:23:27.080
In a sense, like at the moment, they're just too expensive to, to afford to implement, but.

Participant B 00:23:29.120 – 00:23:47.040
Fact that you get to play around with them and maybe you can, you can then check which size and you should go for or you get an idea at least, and then you can take that idea and go and look for solutions like technical solutions, for example, for Bettery size and the, the perfect.

Participant B 00:23:48.840 – 00:24:06.120
Recommendation for someone who can really put it in your home and then get get some offers about that thing, and then you have a number in mind, what, what we expect, I think that's a really good overview, if you are just starting, it's like the first step is go there.

Participant B 00:24:08.080 – 00:24:13.800
What can I do and how much will it be? Roughly, that's really good like that.

Miao, Yanwei 00:24:14.520 – 00:24:30.440
And, and you said you were worrying because you were worrying about the financial aspect, but after you seeing some of the recommendations where it says actually you will pay less every year.

Miao, Yanwei 00:24:31.120 – 00:24:32.360
Comparing to the.

Participant B 00:24:32.480 – 00:24:38.760
Well, the electric car you pay, you have to pay a little upfront and then you save.

Participant B 00:24:40.080 – 00:24:53.000
I think still the, the thing is to invest the money in the first place, you, you need to have some money to do the to do. So, so I think that's still.

Participant B 00:24:54.160 – 00:25:00.520
A little prevents many people from doing it. I think so, maybe they're.

Participant B 00:25:01.360 – 00:25:04.880
Be more easier accessible.

Participant B 00:25:07.560 – 00:25:09.480
How to say bottom.

Miao, Yanwei 00:25:09.480 – 00:25:10.120
Well, the big.

Participant B 00:25:10.400 – 00:25:12.040
Support from the government for.

Participant B 00:25:13.320 – 00:25:13.960
Yeah, yeah.

Participant B 00:25:13.960 – 00:25:21.000
So that, that people can do it more easily or even can pay for it on a monthly basis or something like...

Participant B 00:25:21.640 – 00:25:27.840
And that way it would be easier for, for many people to do it.

Miao, Yanwei 00:25:28.680 – 00:25:37.000
Yes, you are right? And do you find the recommendations useful or valuable?

Participant B 00:25:39.120 – 00:25:49.160
And I also, yeah, as I said, I like how it's presented it also. I think it plays a huge role, how you get the information back if it's like.

Participant B 00:25:50.640 – 00:26:04.160
If it's not like providing a good overview and it's like, you have to search for the results, then it will be, it will not be used. So I really like it that it's really clean and lightweight so to say.

Miao, Yanwei 00:26:04.520 – 00:26:07.640
Thank you, so.

Miao, Yanwei 00:26:09.760 – 00:26:17.320
What factors influence your decision to adopt or reject the recommendations. I think you just answered that.

Miao, Yanwei 00:26:19.240 – 00:26:23.720
And, you know, why the recommendations were recommended to you.

Participant B 00:26:25.080 – 00:26:41.640
Yeah, it depends on the, on the situation of the home. What would be interesting for me, for example, be like, but that's, I think that's too too deep for for a website, which ones just to make some recommendations to.

Participant B 00:26:42.360 – 00:26:59.560
Give you information to start with. Would then be like you need to know. Okay, is my building really, is it an option would be able to put a system on it because of the shape of the roof and stuff like that, but.

Miao, Yanwei 00:27:06.000 – 00:27:07.880
More detailed information about.

Participant B 00:27:08.280 – 00:27:24.520
But I don't know how to apply to that website because then you would need to do them calculations on how your roof is suitable for a, for a photo TIG system and how much energy you could expect from it. For example.

Participant B 00:27:25.800 – 00:27:32.960
How large is the roof and what's the insulation and stuff? I think that's maybe out of scope.

Miao, Yanwei 00:27:33.480 – 00:27:47.560
No, actually the model it provides everything, but during our first version we didn't put so much numbers in it so much data that you cannot change or you can adjust.

Participant B 00:27:48.240 – 00:27:48.840
Yeah.

Miao, Yanwei 00:27:48.840 – 00:27:50.760
But that's possible.

Miao, Yanwei 00:27:51.560 – 00:27:53.960
Could be future work. Yes.

Participant B 00:27:53.960 – 00:27:55.080
So.

Miao, Yanwei 00:27:55.920 – 00:27:56.520
Consider.

Participant B 00:27:56.560 – 00:28:08.160
It's really interesting, like, if it develops into a one stop opportunity to do all your calculations there. I really think that's a great thing.

Participant B 00:28:09.560 – 00:28:16.360
I work with a software for district heat planning and they also tried.

Participant B 00:28:19.600 – 00:28:26.680
Also really accelerates how people approach that. So I think that's a good thing to develop stuff like that.

Miao, Yanwei 00:28:27.880 – 00:28:34.360
I also believe so, and so you, do you trust the recommendations.

Participant B 00:28:35.880 – 00:28:56.040
Since for, for example, the first thing I rec, I noticed is that the only based on your, some of your questions and then the estimations were quite accurate now leaving behind that didn't ask for the car and that's why the recommendations don't fit perfectly, but I think.

Participant B 00:28:56.160 – 00:29:12.680
They are quite good other than that, so that makes very good impression. must be a good model behind it. So I think it's, it's good. I couldn't click on the details page on that for that, but I would like to see.

Participant B 00:29:14.720 – 00:29:26.200
Behind it, so not not for an end user, I think not the real detailed calculations, but like, split into the numbers, but probably you have that as well. So.

Miao, Yanwei 00:29:26.760 – 00:29:34.440
You, you could also when you click the recommendation detail, you could also see the current data on the left side.

Participant B 00:29:34.720 – 00:29:37.000
Oh, okay, that was the current. yeah.

Miao, Yanwei 00:29:37.000 – 00:29:37.640
Yes, yes.

Miao, Yanwei 00:29:41.480 – 00:29:46.600
Yeah, there, there's sort of like a comparison with your current situation. Yeah.

Miao, Yanwei 00:29:47.400 – 00:29:58.800
It was my fault that I've, I've only put all the links on the right side. I forgot it. I mean, thank you for, for noticing that, and I, I need to adapt my usability.

Miao, Yanwei 00:30:02.840 – 00:30:08.680
I was considered also to be shown there of the current detail as well.

Miao, Yanwei 00:30:12.200 – 00:30:14.240
Yes, and.

Miao, Yanwei 00:30:15.520 – 00:30:20.680
What factors contribute to your trust or a lack of trust in the recommendations.

Participant B 00:30:24.060 – 00:30:30.460
So, yeah, as I said, in the first place, the numbers so that the estimations work, right? Quite correct. I think.

Participant B 00:30:32.460 – 00:30:42.620
That's the, the main reason why you can trusted if you, so, I mean, if you put in your personal data and then the calculation is quite accurate, then.

Participant B 00:30:43.540 – 00:30:52.860
Then you can rely on it in a sense that it will give you a recommendation that is not completely out of scope, like, then.

Miao, Yanwei 00:30:52.900 – 00:30:53.500
Then you can.

Participant B 00:30:53.780 – 00:31:13.980
A little more and as well, what contribute, what contributes I think is the, the periods of the website is really well programmed and it works quickly smoothly. So I think that's also a part that plays an important role if you are a consumer that looks at the page and if it's.

Participant B 00:31:14.060 – 00:31:31.900
Responsive if it's not like too many options, but you can go through it very quickly. So then you will do it more likely than going through a website which takes you like two hours to complete and you will, you will never do that. So, but.

Participant B 00:31:32.700 – 00:31:42.780
Fast and responsive and looks good and is experiment explanations that are understandable for everyone. I think that's.

Participant B 00:31:43.420 – 00:31:46.700
A good contribution as well to trust it.

Miao, Yanwei 00:31:47.380 – 00:31:51.020
Thank you is understandable all those information provided.

Participant B 00:31:52.380 – 00:32:12.220
Yeah, at least for me, it was, but I, I'm also a little bit into the topic so I think for, for someone who owns the house and thought about it a while and has some, some of the vocabulary down, I think then it's no issue. I don't know how it.

Participant B 00:32:12.860 – 00:32:17.340
For someone who has never been in touch with a topic. I don't know, but.

Participant B 00:32:18.260 – 00:32:22.020
Doesn't seem too over complicated to me.

Miao, Yanwei 00:32:23.100 – 00:32:30.140
Great and, and did the system provide enough information for you to understand the technologies. You think.

Participant B 00:32:30.780 – 00:32:50.620
There's more descriptive text. I, I really like that as well there. I think it's better to have a small or short descriptive text that mentions the main things and not too much detail because then it also could make people not read it at all. if it's too long.

Participant B 00:32:50.620 – 00:32:51.900
So I think.

Participant B 00:32:53.180 – 00:33:02.140
It's a good balance between a short text information and keeping people on track and to do it.

Miao, Yanwei 00:33:03.540 – 00:33:07.140
Do you mean having some short.

Miao, Yanwei 00:33:08.620 – 00:33:12.700
Generalized information as well for the current technologies.

Participant B 00:33:15.660 – 00:33:18.460
Sorry, I didn't get the first part.

Participant B 00:33:41.220 – 00:33:53.980
My case is not because I already looked into it, but yeah, as I said, for someone who didn't have any contact with the topic before it might be the case, I don't know.

Miao, Yanwei 00:33:57.180 – 00:34:14.460
And maybe do you have anything you would like to share this is the last question, like, besides what I have asked you any extra thoughts about the system or anything can be IMPRO.

Participant B 00:34:17.659 – 00:34:26.620
Yeah, as I said, only the thing that you might want to enter your own figures like your own.

Participant B 00:34:27.540 – 00:34:40.700
Or the, the last, if you have a utilities, Bill and, you know, your demand you could enter it so that would make the calculations even better. I assume. so I think that would be an option for someone who.

Participant B 00:34:41.460 – 00:34:45.940
Wants to deprint it, and maybe you can also.

Participant B 00:34:47.740 – 00:35:07.580

Some values for, for offers you got from, from a company, for example, who wants to, to build your photobal tax system or something like that. Maybe you can put it into that into your system as well. Maybe that is also a good thing, but I think that's more for the advanced US.

Participant B 00:35:07.780 – 00:35:10.780
Some sort of thing like you really want.

Participant B 00:35:14.220 – 00:35:18.980
Assimulation to the, to the most accurate point, maybe.

Miao, Yanwei 00:35:21.020 – 00:35:24.860
Maybe I'm trying to find out.

Miao, Yanwei 00:35:27.420 – 00:35:38.260

Thank you so much. These are all the info, all the questions and I, I think we are actually, I'm, I'm three minutes exceeding my.

Miao, Yanwei 00:35:39.620 – 00:35:44.340
But no, I'm sorry that I, I spent.

Miao, Yanwei 00:35:48.740 – 00:35:55.740

It's really very informative information that I get from you and I, I would really like to show my appreciations.

Participant B 00:35:56.260 – 00:35:56.860
Thank you very.

Miao, Yanwei 00:35:57.180 – 00:35:58.140

Thank you.

Participant C

Miao, Yanwei 00:15:05.080 – 00:15:11.280

Before we begin, I would like to know some of your demographical information.

Miao, Yanwei 00:15:12.040 – 00:15:24.080

Don't mind, but if you mind, you could also just like, say that you don't want to provide such information. All right, so what is your gender?

Participant C 00:15:24.240 – 00:15:25.360
Female.

Miao, Yanwei 00:15:25.680 – 00:15:27.400
And your age.

Participant C 00:15:27.400 – 00:15:29.120
Twenty-eight.

Miao, Yanwei 00:15:29.320 – 00:15:33.080

And what is your major and your education?

Participant C 00:15:33.800 – 00:15:35.600
Major is.

Participant C 00:15:37.040 – 00:15:43.400

Human computer interactions in my masters, but industrial design is my bachelor.

Miao, Yanwei 00:15:43.400 – 00:15:51.720

Okay, the same with me and your occupation right now it's a master student, right?

Miao, Yanwei 00:15:53.000 – 00:16:00.000
And do you have any knowledge or do you have any interest in artificial intelligence?

Participant C 00:16:00.040 – 00:16:02.680
Not really not much.

Miao, Yanwei 00:16:03.880 – 00:16:08.480
And do you have knowledge or interest in energy domain?

Participant C 00:16:10.320 – 00:16:16.920
No, I would rate myself very low because I don't really know that much based on my background.

Miao, Yanwei 00:16:19.400 – 00:16:28.840
And I would like to know, have you heard of any energy efficient appliances or renewable energy technologies for households?

Participant C 00:16:30.200 – 00:16:49.320
As far as I know from my landlord and as Linda, where I left, they have artificial intelligent appliance on my, on our heater systems. So when the detector or the sensor. So called sensors, they sense that the degrees of seventeen degrees is more than in a row.

Participant C 00:16:49.480 – 00:16:55.080
For five days, they will switch completely off the heater for month.

Miao, Yanwei 00:16:55.280 – 00:16:56.360
Seventeen degrees.

Participant C 00:16:56.360 – 00:16:57.640
Yeah, for seventeen degrees.

Participant C 00:16:58.960 – 00:17:18.520
And I don't have seventeen or, or nine nineteen, but it's not over twenty. So when it's seventeen in a row and then they switch off the heating systems and then they will switch it on again in September. So this heating systems is totally controlled by the.

Participant C 00:17:19.400 – 00:17:21.959
Is not someone who set it off and.

Participant C 00:17:23.959 – 00:17:27.959
This year and Spring, we have the heating.

Miao, Yanwei 00:17:29.680 – 00:17:30.280
Which means.

Participant C 00:17:30.520 – 00:17:36.680
We don't have it even though the weather become like, eight degrees at night, the other day.

Participant C 00:17:37.400 – 00:17:47.560
We have the seventeen degrees in a row for a week and then the AI think. Oh, now it's very warm, but it's kind of a false detections. I would say.

Miao, Yanwei 00:17:52.040 – 00:18:03.560
Okay, and have you ever considered implementing energy efficient technologies such as solar panels and smarts and your home?

Participant C 00:18:03.560 – 00:18:14.440
Yes, I've heard one and, and Bosch, so it's very common that I think my colleagues they all buy this stuff, You can put it on your heat heater, turning stuff, you know, you can.

Participant C 00:18:15.200 – 00:18:24.680
And then you don't have to turn it. You just say I want the room always add twenty-one. Yeah, Celsius.

Participant C 00:18:25.480 – 00:18:28.400
They would help you to make it stable.

Miao, Yanwei 00:18:32.480 – 00:18:34.920
You also want to like, buy that thing.

Miao, Yanwei 00:18:35.080 – 00:18:36.200
For your home, if you.

Miao, Yanwei 00:18:38.160 – 00:18:43.600
And what is your understanding regarding the benefits of energy efficient technologies.

Participant C 00:18:47.080 – 00:19:03.280

I think it is in the compensation of human comfort and energy saving because if we always talk about saving savings, then we just don't use it, but I think Energy Savings should always in the balance of.

Participant C 00:19:05.720 – 00:19:08.840

Human comforts, like, you know what I mean? Yeah.

Participant C 00:19:11.400 – 00:19:14.600

But do you want me to say a definition of it? Or what, what's?

Participant C 00:19:15.320 – 00:19:17.160

Do you want me to answer from your question?

Miao, Yanwei 00:19:19.720 – 00:19:26.720

Overall, your understanding regarding the benefits of like, using such technologies.

Participant C 00:19:27.440 – 00:19:30.600

Then I would say it's more like...

Participant C 00:19:32.520 – 00:19:33.720

You, you.

Participant C 00:19:33.960 – 00:19:42.760

It's independent, it's not so not independent. It's dependent on the location. The weather condition, the wind.

Participant C 00:19:42.760 – 00:19:51.720

Or the Sun where the sun hits like the, the angle I mean, so it depends on this, and then you can make use of the.

Participant C 00:19:52.400 – 00:20:12.840

Nature resources in order to gain the last energy cost from your location, I would define like this, and I think it's very clever because I've heard that in Taiwan my country, a lot of people are promoting us to use the, the wave, the, the way.

Participant C 00:20:16.980 – 00:20:19.540

The water goes high and low. What's that called?

Participant C 00:20:22.740 – 00:20:23.860
Tide.

Participant C 00:20:24.860 – 00:20:26.580
Will go one, one month, like.

Participant C 00:20:28.100 – 00:20:31.060
And then the tide will go up to low, right?

Participant C 00:20:32.340 – 00:20:35.460
We make this into energy.

Participant C 00:20:37.460 – 00:20:57.300

Very efficient and it's also very clean, so we don't have to burn the call and I think every country or location have to think about what is the best way for them to produce energy, which is clean and efficient at the same time. So that's why I think it's good that.

Participant C 00:20:58.620 – 00:20:59.860
This, this stuff, so.

Participant C 00:21:00.500 – 00:21:05.620
Every single apartment or every single location has its.

Participant C 00:21:06.460 – 00:21:08.820
Encies like it's different.

Miao, Yanwei 00:21:13.300 – 00:21:15.500
So you, you think.

Miao, Yanwei 00:21:16.540 – 00:21:20.820

Those energy efficient technologies, they, they help.

Miao, Yanwei 00:21:22.260 – 00:21:25.820

They help like reduce energy use.

Participant C 00:21:26.740 – 00:21:47.220

No, I would say produced energy in a way that time the environment less. I wouldn't say that use less because if

we want to reach a comfortable temperature or comfortable feeling, we need to use anyway at March of energy, right?

Participant C 00:21:48.740 – 00:22:08.980

Energy efficiency doesn't mean that we said, okay, now we don't switch on the heater anymore. It's that, we still have the comforts in winter times, but how do we make the energy in the most efficient way, how do we use it in the most efficient way or how do we produce it in a more, in most efficient way? So it's more like.

Participant C 00:22:10.900 – 00:22:19.860

Not compensate for our comforts, but we think about better solutions to reaching the goal of human comfort. I would say.

Miao, Yanwei 00:22:20.860 – 00:22:24.980

For environmental protection, like the ultimate goal.

Participant C 00:22:25.620 – 00:22:35.220

Yeah, that's part of the goal, but in my perspective, the main goal is still we have, we, we don't compensate for our living quality.

Miao, Yanwei 00:22:35.900 – 00:22:36.500

Yes.

Participant C 00:22:36.500 – 00:22:39.060

But we care about the environment of course.

Miao, Yanwei 00:22:40.980 – 00:22:57.460

Make sense, okay, the last one before we start to use the service do you know, climate change and why is it important for individuals to save energy and utilize renewable energy sources?

Participant C 00:22:57.620 – 00:23:04.020

I heard about this topic of climate change when I was like, nine years old.

Participant C 00:23:05.460 – 00:23:22.580

A topic, I think a lot of movies and papers and people are talking about this that humans we imagine, we emissions a lot of co two on the globe, which is very bad and the global and the global become very warm.

Participant C 00:23:24.100 – 00:23:26.420

In the polar areas, the ice would meld.

Participant C 00:23:27.540 – 00:23:38.580

The land being less and less because the water would go higher and since we live on the island, it's possible that we would no longer be there anymore. So.

Participant C 00:23:39.380 – 00:23:46.260

When I was around nine or ten, I start to have this sense of global climate change stuff.

Participant C 00:23:47.540 – 00:23:51.380

Then may I know your question again.

Miao, Yanwei 00:23:53.500 – 00:23:58.420

It's do you know, climate change and why is it important for individuals?

Participant C 00:23:58.540 – 00:24:00.340

And I think I answered that two questions.

Miao, Yanwei 00:24:00.700 – 00:24:06.500

Yes, you did. Okay, so now I will send you a link.

Miao, Yanwei 00:24:09.940 – 00:24:13.740

And I will send it by chat.

Miao, Yanwei 00:24:16.340 – 00:24:34.380

Please open it with your browser and try to find those recommendations for your house. You can refer to the house that you, you currently are living in.

Participant C 00:24:35.540 – 00:24:37.460

Should I share my screen?

Miao, Yanwei 00:24:37.540 – 00:24:46.780

That would be good. Thank you and you can like, meanwhile, when you are operating it, you can think out loud.

Participant C 00:24:52.220 – 00:25:09.460

This is a homepage of your home energy could be cheaper and greener. We help you decide what to invest in your home. Okay, so now I, I guess this is something that I can check of how energy efficient my house is...

Participant C 00:25:09.500 – 00:25:29.940

And then maybe I click on this to check if there's something. No, so I click on answer some questions in a few minutes, help us understand your current. Okay, this is like a survey to understand what might own houses and this is received personalized improvement.

Participant C 00:25:29.980 – 00:25:34.060

So this kind of some suggestions from the professional.

Participant C 00:25:35.060 – 00:25:38.780

Starting you agree to share you. Okay, yeah, start.

Participant C 00:25:42.740 – 00:25:43.860

Country.

Participant C 00:26:00.300 – 00:26:01.900

Right in German.

Participant C 00:26:07.700 – 00:26:22.900

Yes, when was the house built know the year of the house? Build can provide insight into its constructions. material such as compositions of the walls. Okay, I, as far as I know, our houses before.

Participant C 00:26:25.780 – 00:26:32.140

Has the house been renovated? Yes, renovation can include up, yes, exactly.

Participant C 00:26:34.580 – 00:26:35.700

Yes.

Participant C 00:26:37.140 – 00:26:43.540

How many people live in a house, So it's including my neighbors upstairs or only me, and my roommate?

Miao, Yanwei 00:26:44.220 – 00:26:46.660

It's everyone in the house.

Participant C 00:26:58.260 – 00:27:02.020

What type of heating system is used in a house?

Participant C 00:27:04.660 – 00:27:13.620

Biomass boiler district heating heat pump all the boiler. This one gas boiler.

Participant C 00:27:14.900 – 00:27:28.340

It's still a hot water tank in the house, a hot water tank or a space heating tank is a device that is used to store hot water for the domestic user to particular my boyfriend also used this one.

Miao, Yanwei 00:27:28.380 – 00:27:28.980

Oh, okay.

Participant C 00:27:29.020 – 00:27:29.620

Yeah.

Participant C 00:27:31.540 – 00:27:42.500

It's a different one. Next, is there a PV system in a house, a PV system is a system that uses solar panels to convert online. No.

Participant C 00:27:44.340 – 00:27:49.380

Next a battery system, so energy is produced by Solavanos.

Participant C 00:27:50.100 – 00:28:00.980

Other sources to be used later when needed, we have a battery system for the House of heating up the water to the shower that is also c- included.

Miao, Yanwei 00:28:01.740 – 00:28:04.180

Yes, you can consider that.

Participant C 00:28:04.820 – 00:28:12.620

What is the capacity of this? I'm not so sure, but I guess it's the high, it's around this.

Participant C 00:28:15.700 – 00:28:23.300

Let me choose this one and see what would happen. Is there a smart energy management systems and a house?

Participant C 00:28:24.020 – 00:28:25.940

Otherwise consumption.

Participant C 00:28:27.220 – 00:28:34.260
I think definitely, yes, but it does not belong to me. It will also landlord because I think they definitely have one in the basement.

Participant C 00:28:35.220 – 00:28:52.180
Yes, okay, recommend. Oh, it's on the recommendation coming out your curr currently energy bills estimate to be wow three's for almost four thousand a year. So let me calculate four thousand.

Participant C 00:28:53.180 – 00:28:59.220
By twelve, which let me see. Let me calculate. that's a real.

Participant C 00:29:00.540 – 00:29:05.620
That is my payment so that I know how real this.

Participant C 00:29:10.180 – 00:29:17.140
Invited by twelve months and also depends on the summer and winter because wintertime always consume more energy.

Participant C 00:29:18.540 – 00:29:22.900
So each month re- okay, it's very, it's, it's very true.

Participant C 00:29:25.500 – 00:29:45.300
Systems battery system. Very good. It has a thing that shows me what I click on like an overview to check if I did something wrong, so I can change it five people household Germany. Okay, so if I lowest and investment in the flowing configurations are applied.

Participant C 00:29:45.460 – 00:30:05.780
The annual energy Bill is estimated B- two thousand. Let me see if there's more detail current. Yeah, it's cool that you also talk about the, month differences because of energy consumption during summer. It's any way lower.

Participant C 00:30:06.420 – 00:30:12.180
And that's why it went at times. I always like to Defin a house which have to post on me to.

Participant C 00:30:12.820 – 00:30:26.260
So you just only have to pay a certain range, but this heating cooling, ah, it also include cooling, but I don't have a cooling system. Why is it included?

Miao, Yanwei 00:30:28.740 – 00:30:38.900
To be honest, I'm not so sure, but this is how the model has calculated, but I noted it down, your confusion I will ask the expert.

Participant C 00:30:39.620 – 00:30:48.580
That's cool. Okay, so the hot water. Okay, so I think one thing it's very special for me, is that the hot water.

Participant C 00:30:49.860 – 00:30:53.980
Why is the hot water doesn't have any hot water.

Participant C 00:30:55.660 – 00:30:57.220
Winter times.

Participant C 00:31:06.500 – 00:31:14.700
And so weird home because in winter times you, you always shower hot, but in summer times you show a cold, sometimes I mean, sometimes.

Participant C 00:31:30.820 – 00:31:35.300
But I think in our house, the heating systems are heating systems.

Participant C 00:31:36.060 – 00:31:44.260
Water boilers with a water boiler. It's different energies and resources, and because the water border uses electricity.

Participant C 00:31:46.380 – 00:31:48.100
Systems use gas. So.

Participant C 00:31:48.740 – 00:31:50.020
Two different.

Participant C 00:31:51.940 – 00:31:57.700
But anyway, anyway, I, I just got confused by this graphic because.

Participant C 00:31:58.980 – 00:32:18.820
Of course, according to the system, doesn't exist in Germany or at least in my house and also the hot water

should be more in December and January, February, March, April, May. Summertimes should be almost equal because we, as a female, we still shower, but not that warm.

Participant C 00:32:19.460 – 00:32:20.740
Still use it...

Participant C 00:32:21.380 – 00:32:36.740
According to this one, it's appliances. Okay, I think appliances, for example, like fridge is something that always takes up a lot of energy in our house.

Participant C 00:32:37.380 – 00:32:57.860
Open it through the year, but I, I learned from my dream roommate is that then Summertimes, we always switch the fridged into a cooler temperature. So we use less energy. I think that also makes a change because as far as I know the fridge is one of the best.

Participant C 00:32:59.420 – 00:33:01.060
A lot of energy resources.

Participant C 00:33:02.060 – 00:33:22.180
So I agree with this graphic and I want to see what it recommends me to do. Okay, this is just our estimation of my energy resources. I guess. So what can I do? This is my current one. I want to see what's gre PV means again, I think you, you have.

Participant C 00:33:22.300 – 00:33:23.460
Explain me in.

Miao, Yanwei 00:33:24.420 – 00:33:27.940
Yes, it's solar panels.

Participant C 00:33:29.020 – 00:33:30.500
So if I use solar panels.

Participant C 00:33:31.980 – 00:33:35.620
Get more energy and.

Participant C 00:33:37.540 – 00:33:46.220
Okay, I want to understand what's the difference between this growing stuff and the, the stuff next to it.

Participant C 00:33:47.780 – 00:33:51.620 Because now I think, okay, if I use solar panels.

Participant C 00:33:53.540 – 00:33:55.540 I can reduce the.

Participant C 00:33:56.740 – 00:34:17.220 I can spend less money annually, but I need to also calculate how much money I need to invest to install those panels and how many years I need. I can get the money back. So I start to get this benefit the cost and benefits start going to be the same.

Participant C 00:34:17.860 – 00:34:36.419 Now, as far as I see also you can see there are not many differences. So, solar panels could reach the energy. I need. I think it's like, this is the same, just telling me that the green is what the PV can produce as an energy.

Participant C 00:34:41.540 – 00:34:43.940 I, I didn't really fully understand.

Participant C 00:34:45.379 – 00:34:51.580 Or pv system can convert sunlight directly into electricity. Yes, that's, I know it.

Participant C 00:34:53.780 – 00:34:57.540 The annual cost of five kilowatt peak is approximate.

Participant C 00:35:02.700 – 00:35:07.100 This is caught. This is mean that this is the money I.

Participant C 00:35:14.460 – 00:35:18.020 PV means so how many PV do I need.

Participant C 00:35:32.580 – 00:35:34.660 Okay, so I need five.

Participant C 00:35:38.700 – 00:35:40.420 I need five, not ten.

Participant C 00:35:49.620 – 00:36:00.900 Can store it sees energy rarely by your solar panels. Ah, okay, so it saves it in a, in a battery like a tank like an energy tank, and then when I needed, they will give it to me. I also note this because.

Participant C 00:36:01.660 – 00:36:16.900 I think my boyfriend's garden, we have this Sonar solar light and then they save it very small like this big, and then I save it, and at night, I can use it a whole night. So I know this battery system around twenty, what hours.

Participant C 00:36:29.780 – 00:36:38.020 Systems, ah, okay, so it's like a smart detector or a smart AI that I can optimize managing usage.

Participant C 00:36:38.660 – 00:36:43.140 Adjusting the heating ads is something like I just said in the very beginning of Bosch.

Participant C 00:36:43.780 – 00:36:47.340 This is kind of artificial intelligence, which.

Participant C 00:36:48.260 – 00:36:54.020 The systems, the technology that's used to generate heat in order to warm a space or provide hot water.

Participant C 00:36:57.860 – 00:36:59.140 Yeah, that's what.

Participant C 00:37:00.420 – 00:37:01.700 What is a heat pump.

Miao, Yanwei 00:37:08.740 – 00:37:18.380 Like using electricity to boil the water or boil the, so it makes the space hot.

Miao, Yanwei 00:37:19.700 – 00:37:26.820 Like natural gas, it's using gas to heat water or to keep the room hot.

Participant C 00:37:36.900 – 00:37:50.020 This is very important. I really like the last one because a building renovations really can have a better sealing, like they, they still the house better. So the energy will not go out.

Participant C 00:37:52.260 – 00:37:57.980 And you get, you, you can save a lot of money based on that, like.

Participant C 00:37:59.300 – 00:38:02.740 And, and insulations of the windows, the doors.

Participant C 00:38:04.100 – 00:38:18.500 Very old house. If like, I live in a very old house, the door and the window are very bad isolated. so no matter how, how much heating system you turn on the heat, anyway goes out. So.

Participant C 00:38:19.420 – 00:38:23.620 You waste a lot of energy, but now the windows, if you buy it this new window.

Participant C 00:38:24.580 – 00:38:25.540 More seal.

Participant C 00:38:27.180 – 00:38:31.300 Week out, which is really important, but two thousand.

Participant C 00:38:32.300 – 00:38:37.700 Not a, if I'm not an owner, I would definitely not do the dis decision on my.

Participant C 00:38:40.900 – 00:38:46.020 Yeah, this is something cool. So what would I happen if I click on update, can I click?

Miao, Yanwei 00:38:46.260 – 00:38:48.620 Sure you can do whatever.

Participant C 00:38:49.220 – 00:38:55.620 So update means that, ah, okay, if I change something here and then I click on update and then they will change. I guess.

Participant C 00:38:56.900 – 00:38:58.780 So let me change something.

Participant C 00:39:02.660 – 00:39:03.940 Oh, cool, so.

Participant C 00:39:05.220 – 00:39:10.260 Change it, and then this would change. So the heating would become.

Participant C 00:39:18.060 – 00:39:19.940 What does this mean? Okay.

Miao, Yanwei 00:39:20.020 – 00:39:21.860 Try to understand.

Participant C 00:39:21.860 – 00:39:26.340 The technology user heat in order to, so.

Participant C 00:39:27.860 – 00:39:48.100 I don't understand if I use this again, and then I spend this energy build is my money, and this is, this is the heating I, I need to use per energy in each month, but if I use this.

Participant C 00:39:48.740 – 00:40:03.540 Which they suggest to me down here. I need to pay more and I use more heating systems. Why, why does adjust me a bad recommendation?

Miao, Yanwei 00:40:04.100 – 00:40:07.300 It didn't suggest you, you change it yourself.

Participant C 00:40:07.660 – 00:40:13.340 Oh, they suggest me, they suggest that I should use this.

Miao, Yanwei 00:40:14.980 – 00:40:25.220 This might be a bug of mine. I shouldn't put that maybe if it didn't suggest you to change your heat pump, but yeah.

Participant C 00:40:25.500 – 00:40:32.260 This is not a suggestion. This is just telling you that if you use this, the money would cost like this.

Participant C 00:40:35.540 – 00:40:38.100 Which I already insert. I used this one.

Participant C 00:40:39.500 – 00:40:44.500 It would cost, it didn't tell me the, the cost is, but anyway, it's lower.

Participant C 00:40:52.180 – 00:40:55.380 Which means that I don't need to change it because it's kind of.

Participant C 00:40:57.340 – 00:41:01.140 Efficient in my perspective compared to heat pomp.

Miao, Yanwei 00:41:01.140 – 00:41:08.180 Right, it's not energy efficient, but it saves more money than changing to heat pump.

Participant C 00:41:08.180 – 00:41:08.820 But.

Participant C 00:41:10.180 – 00:41:15.300 But in a lot in the long term a heat pump, a better choice for me.

Miao, Yanwei 00:41:19.740 – 00:41:30.740 Actually, from the model, it's calculated for you since it didn't recommend you. That means it's not a proper idea for you to change it.

Participant C 00:42:12.900 – 00:42:16.660 That was done. Okay, now I fully understand.

Participant C 00:42:17.940 – 00:42:28.820 This is the energy I need, and this is energy that after recommendation, they would give to me, so they produce more energy than that need.

Participant C 00:42:30.300 – 00:42:42.260 With a lower cost. So that's why you said it's a cheaper and more efficient way in the end, and this is all the recommendation already. They choose it for me.

Participant C 00:42:42.260 – 00:42:44.660 So I don't need to do any changes.

Participant C 00:42:46.340 – 00:42:49.940 It becomes bad because that's the way they choose for me already.

Participant C 00:42:50.620 – 00:42:54.420 But if anyway, I can, I can change it and then see what happens.

Participant C 00:42:55.580 – 00:42:58.900 Not the best way because they are way changing for me.

Participant C 00:42:59.620 – 00:43:06.580 Just leave it like this and produce a PF and take a look by the way, I was.

Participant C 00:43:07.260 – 00:43:07.860 A few minutes a.

Participant C 00:43:09.780 – 00:43:12.980 I was checking some energy stuff as well.

Miao, Yanwei 00:43:13.620 – 00:43:14.260 Okay.

Participant C 00:43:14.420 – 00:43:15.540 Because my thesis.

Participant C 00:43:17.500 – 00:43:20.020 If you want to sell a house or you want to rent a house.

Participant C 00:43:20.860 – 00:43:24.500 Energieausweis to provide you this energy else voice.

Miao, Yanwei 00:43:24.540 – 00:43:26.420 Oh, really...

Participant C 00:43:26.660 – 00:43:46.900 Yeah, and this Energieausweis is also like a report of how energy efficiency this houses and this, this done by a human, which is a professional, they go into your house and use the measurement to look at your windows everything in combinations and do a final report.

Participant C 00:43:48.180 – 00:43:53.940 How energy efficiency or houses, and this is also done by the thermal camera, which I'm working on. So.

Miao, Yanwei 00:43:54.900 – 00:43:55.220 Okay.

Participant C 00:43:55.380 – 00:44:05.460 I think based on your work, it's also cheap because people don't have to act this professionally to come to your house and do this for you. Of course, it's more Preci.

Participant C 00:44:06.820 – 00:44:13.140 I can also do it with your model and, and complete it by myself.

Participant C 00:44:13.780 – 00:44:22.100 And then I can make a decision on my own or then I can refer to an expert that this is my first step, which I really like.

Participant C 00:44:24.660 – 00:44:30.420 I can share with you what I just this one.

Miao, Yanwei 00:44:30.420 – 00:44:31.540 Yes.

Participant C 00:44:31.700 – 00:44:35.540 So this is the energy also in Germany.

Participant C 00:44:36.220 – 00:44:38.100 This is a real one. This is not a fake one.

Participant C 00:44:38.900 – 00:44:45.780 This is a house in a guisvi near Siegan and it's for sale and I'm checking for it because I think it's cool.

Participant C 00:44:46.700 – 00:44:50.900 Big apartment you live alone. Have your own garden.

Participant C 00:44:51.540 – 00:44:52.820 This is the.

Participant C 00:44:54.780 – 00:44:56.660 Means like.

Participant C 00:44:58.660 – 00:44:59.860 Get demand exactly.

Participant C 00:45:00.500 – 00:45:01.780 And it's.

Participant C 00:45:02.420 – 00:45:03.700 This, this range.

Participant C 00:45:04.340 – 00:45:09.460 Yeah, the level. and also here are all the parameters they calculate.

Participant C 00:45:12.380 – 00:45:16.500 It's in Germ, and this is very standard.

Participant C 00:45:18.700 – 00:45:19.700 Where all the German.

Participant C 00:45:21.620 – 00:45:22.260 They.

Participant C 00:45:23.100 – 00:45:24.180 Will have this one.

Miao, Yanwei 00:45:24.500 – 00:45:26.740 Can you send this picture to me?

Participant C 00:45:26.740 – 00:45:27.380 Sure, sure.

Miao, Yanwei 00:45:27.580 – 00:45:28.900 Thank you.

Miao, Yanwei 00:45:32.300 – 00:45:39.380 This is, yeah, maybe it's a good inspiration for my.

Participant C 00:46:48.020 – 00:46:53.140 And I think now I fully understand what it is, and I think it's very nice to have it because now.

Participant C 00:46:55.060 – 00:46:57.620 Have to turn to these professional people.

Participant C 00:46:57.620 – 00:47:02.740 I think they have a drop tribe. It's called Energy Consulting.

Participant C 00:47:03.660 – 00:47:08.500 The consultant and I also talked to them as my interview is in my projects...

Participant C 00:47:09.780 – 00:47:15.540 They do this for people, and then what they have to do is just do the calculations and generate this report.

Participant C 00:47:16.380 – 00:47:21.940 Which have a national-wide standard, like, all the parameters have to be checked.

Participant C 00:47:22.580 – 00:47:43.060 So let me see if there's anything else, why should we turn to renewable energy learn more about the reasons other than cost savings. Okay, so I think this is a topic that would share with me. I only not, I not only saving cost, but I only save some polar bears or.

Participant C 00:47:43.780 – 00:47:50.100 Animals and also my future Simplings not simply is my notebooks. My children.

Participant C 00:47:57.260 – 00:48:04.820 What damages have caused by okay, interesting. So this is not something I can click on, but these are some information I can look through.

Participant C 00:48:07.020 – 00:48:10.420 I would like if there is some nice.

Participant C 00:48:11.940 – 00:48:18.260 Nice pictures or link to, I can watch some horrible disasters about.

Participant C 00:48:18.900 – 00:48:22.740 Didn't change it. No, I think it's good. like this, you.

Participant C 00:48:22.740 – 00:48:27.340 And when I click on this, I go back again, I can start the, the.

Miao, Yanwei 00:48:28.620 – 00:48:29.740 Everything.

Participant C 00:48:30.700 – 00:48:33.620 Over again, and I really like this.

Participant C 00:48:34.260 – 00:48:35.540 I really like this model.

Participant C 00:48:37.100 – 00:48:38.700 What is this?

Participant C 00:48:40.100 – 00:48:41.300 It's on the icon.

Miao, Yanwei 00:48:42.580 – 00:48:48.340 When you come to the other, the project website.

Participant C 00:48:48.340 – 00:48:49.980 Ah, okay.

Participant C 00:48:51.540 – 00:48:52.820 Great, nice work.

Miao, Yanwei 00:48:52.820 – 00:48:58.580 Thank you, all right, thank you. So you've tested the product.

Miao, Yanwei 00:49:00.100 – 00:49:09.020 I would still like to ask you a bit more questions if you don't mind because it's already been a while.

Miao, Yanwei 00:49:11.380 – 00:49:25.660 Okay, so I will continue asking a bit of questions like, sorry, give me a second. How do you feel about the recommendations provided to you?

Participant C 00:49:26.740 – 00:49:46.580 At first, I was, I really like the concept, but for the interface I was a bit confused because I see the selections, right? I, I see the COMPU, the, the black box they selected for me, but I would have this intuition to think. Oh, should I select it, but then I understand that they already.

Participant C 00:49:46.980 – 00:50:05.780 For me, so I don't have to think about which I should select just to see what they select from me and see the result, but the selection, the selecting functions confuse me that the computer is selected for me. I think I have do it on my own because it's kind of confusing feeling.

Miao, Yanwei 00:50:05.820 – 00:50:06.420 Okay.

Participant C 00:50:06.620 – 00:50:12.620 But I realize that when you explain to me that now they already give it to you. You just have to accept it.

Miao, Yanwei 00:50:13.460 – 00:50:20.500 So do you forget that? you actually chose one of the recommendations when you came to this page.

Participant C 00:50:20.500 – 00:50:21.780 I think I forgot... yeah.

Participant C 00:50:22.620 – 00:50:34.580 I forgot, and also I think it's a bit confusing when you wrote something beneath it with the greater little text that said heat prompt is cost nine hundred euros.

Participant C 00:50:35.400 – 00:50:50.120 I would think nine hundred years I don't know how much the gas thing I, I spent, so I would think maybe it's a recommendation for, for me. I should change it to that one. I think that the low text has this feeling for me. It's a good thing.

Participant C 00:50:50.840 – 00:50:52.680 Stick to, but it's not.

Miao, Yanwei 00:50:53.320 – 00:50:53.960 So.

Miao, Yanwei 00:50:55.480 – 00:51:02.920 It was more like a usability thing. I shouldn't put it there if I- if the recommendation didn't ask you to change the heat pump.

Participant C 00:51:17.000 – 00:51:18.880 And also I think.

Participant C 00:51:20.200 – 00:51:24.040 I'm a user, I like to have this kind of responsive set.

Participant C 00:51:24.680 – 00:51:34.920 Agreeing check that now it's everything you save better, but the interface gave me a feeling that it's everything, it's very neutral.

Participant C 00:51:34.960 – 00:51:36.200 You know, everything.

Participant C 00:51:37.240 – 00:51:40.040 I didn't feel the feeling of success.

Participant C 00:51:41.400 – 00:51:42.600 Better person.

Participant C 00:51:42.600 – 00:51:50.920 So, for example, you give me the selections which is not selecting saying recommendation.

Participant C 00:51:52.840 – 00:51:54.760 See something more strong to say.

Participant C 00:51:55.440 – 00:52:00.520 And help you save something, and then there's a big check.

Participant C 00:52:01.840 – 00:52:08.200 Check it soft. The problem could be better like this, This improvement feeling is not visualized. So.

Participant C 00:52:08.920 – 00:52:13.960 I know that this is something that can improve myself, but I understand it in a logical way.

Participant C 00:52:14.600 – 00:52:17.640 It's emotional, I didn't really.

Participant C 00:52:19.080 – 00:52:21.360 So the happen is, and improvement.

Participant C 00:52:22.480 – 00:52:34.440 Kind of happiness that I achieved a better energy efficiency from an interface. I didn't mean that it's bad. I think it's good to be a neutral interface, but.

Participant C 00:52:35.080 – 00:52:40.440 If there is something that needs to be a successful feeling.

Participant C 00:52:41.720 – 00:52:44.680 It comparison because when I look at the two two charts...

Participant C 00:52:45.320 – 00:52:48.520 The, left one is me, and the right one is the recommendation.

Participant C 00:52:49.800 – 00:52:50.440 The two.

Participant C 00:52:51.720 – 00:52:54.920 The two UI is very similar.

Miao, Yanwei 00:52:55.800 – 00:52:56.200 I would.

Participant C 00:52:58.160 – 00:53:00.680 Of course, I assume that the right one's better.

Participant C 00:53:02.040 – 00:53:04.520 I didn't really feel.

Participant C 00:53:07.120 – 00:53:09.640 The strong contrast I would say.

Miao, Yanwei 00:53:10.280 – 00:53:10.920 Okay.

Participant C 00:53:10.920 – 00:53:15.400 So I'm confused about, of course, I talk about the parameters of the.

Participant C 00:53:16.040 – 00:53:18.960 Systems and the heating systems. I think.

Participant C 00:53:19.880 – 00:53:23.720 You already choose Germany and I already said I don't use any cooling systems.

Miao, Yanwei 00:53:24.120 – 00:53:24.360 Yes.

Participant C 00:53:24.360 – 00:53:35.240 Then in the, in the last phases, they shouldn't talk about the cooling any more because no insert the parameters inside in the beginning.

Miao, Yanwei 00:53:35.480 – 00:53:37.800 Could be like a model problem. I think.

Participant C 00:53:37.800 – 00:53:47.400 And also about the, the water hot water. I think it should be also one of the questions to ask me.

Participant C 00:53:48.040 – 00:53:55.160 The temperature I shower and the frequency I shower and also.

Participant C 00:53:58.280 – 00:54:07.240 The seasonal changings, like if I do do your shower code in winter times, I think the question can be also a little bit more in detail because.

Participant C 00:54:08.040 – 00:54:09.160 Behaviors.

Participant C 00:54:11.120 – 00:54:12.360 Different season.

Participant C 00:54:13.680 – 00:54:14.920 For example.

Participant C 00:54:15.680 – 00:54:20.040 I think in the summertime in Germany or in the whole European countries.

Participant C 00:54:20.920 – 00:54:23.880 More and we don't use that much light anymore.

Participant C 00:54:24.640 – 00:54:29.640 I still turn it on. I know, but I mean, at some point we stop to use it for.

Participant C 00:54:30.320 – 00:54:31.560 Longer time.

Participant C 00:54:34.120 – 00:54:37.320 This also has to be into consideration that.

Participant C 00:54:38.320 – 00:54:39.880 We use less energy.

Participant C 00:54:40.560 – 00:54:44.360 I think you, you did, I saw that in summer times, the energy is last.

Miao, Yanwei 00:54:46.920 – 00:54:53.960 Can I interpret this way? You actually don't trust the model so much, you think.

Miao, Yanwei 00:54:55.240 – 00:55:11.120 Because you think different people's behaviors are different. So the big data they actually use for the model might not be so accurate, linked to your own. Yeah, like your personal behavior.

Participant C 00:55:12.520 – 00:55:18.920 I would say so, but in the very beginning, when I start to use this model, my attitude is very.

Participant C 00:55:19.000 – 00:55:22.120 Neutral and trust.

Participant C 00:55:23.000 – 00:55:27.240 When I start to insert the questions, I also found it very good.

Participant C 00:55:27.440 – 00:55:36.840 Then when I see the graphic, the confusion pushed me into. I don't trust it anymore. I, I, because there, there's too many flaws.

Participant C 00:55:37.480 – 00:55:50.920 That it's very different from my own experiences and I already see the problem, I know that if there's a big miscalculation, then the whole money that I need to spend is definitely wrong then.

Participant C 00:55:52.000 – 00:55:56.040 But if the big thing is I was very excited.

Participant C 00:55:56.680 – 00:55:58.600 That it would be very precise.

Participant C 00:55:59.880 – 00:56:04.960 And during the, when I really read each sections.

Participant C 00:56:06.320 – 00:56:08.840 See that there must be some miscalculations.

Miao, Yanwei 00:56:10.760 – 00:56:13.960 Okay, that makes very much sense.

Miao, Yanwei 00:56:15.440 – 00:56:21.440 So would you still trust the recommendation that was recommended to you?

Participant C 00:56:22.600 – 00:56:25.480 I think the main target.

Participant C 00:56:26.760 – 00:56:31.880 For them to ask me to use this is asking me to buy their products, right?

Miao, Yanwei 00:56:32.520 – 00:56:33.800 Buy those technologies?

Participant C 00:56:34.000 – 00:56:42.120 Buy those technologies and I was thinking in this way, so it's not about trust this model or not. The.

Participant C 00:56:45.320 – 00:56:49.800 Reason is not trusting the reason is they urge me to want to spend money.

Participant C 00:56:50.880 – 00:56:51.720 Stuff.

Participant C 00:56:53.640 – 00:57:01.960 Why do I think so. Because if I buy energy technology energy, efficiency technologies that help me to SA.

Participant C 00:57:04.560 – 00:57:06.440 Promoted with this.

Participant C 00:57:08.360 – 00:57:12.200 Website to tell me that. okay, if you buy.

Participant C 00:57:12.840 – 00:57:17.960 If you use my product and you save a lot of energy, do you want to, but.

Participant C 00:57:18.680 – 00:57:21.160 Customer already know their strategy.

Participant C 00:57:22.600 – 00:57:39.080 For me, I would quickly check. Yeah, okay, and I, I would just want to check how good the products is efficient, and of course, I want to know how efficient this product fits to my own household of course, it's important.

Participant C 00:57:39.720 – 00:57:40.360 So, so.

Miao, Yanwei 00:57:40.400 – 00:57:48.680 So, so you think the website was created by some business people or like by some business brands?

Participant C 00:57:48.800 – 00:57:51.240 I would say the website, it's more.

Participant C 00:57:53.880 – 00:57:55.200 The product.

Miao, Yanwei 00:57:57.120 – 00:58:06.600 This way, but actually if you, I saw you actually click on the, the new trans project.

Participant C 00:58:07.240 – 00:58:08.520 Yeah, I did. That's why.

Miao, Yanwei 00:58:08.720 – 00:58:14.800 And, and do you know the whole service was provided by Fraunhofer.

Miao, Yanwei 00:58:16.200 – 00:58:21.320 And, you know, they are all research institutes, so there's no.

Participant C 00:58:21.360 – 00:58:21.960 Money.

Miao, Yanwei 00:58:23.240 – 00:58:26.400 Yes, like there are no companies that are involved.

Miao, Yanwei 00:58:27.760 – 00:58:30.280 The Research Institute. So.

Miao, Yanwei 00:58:31.560 – 00:58:39.240 Actually, no brands or no business. It's related to this project.

Participant C 00:58:39.600 – 00:58:39.880 So.

Participant C 00:58:42.080 – 00:58:46.800 It's more like the, the country is promoting.

Participant C 00:58:47.560 – 00:58:50.760 Into a more greener place.

Participant C 00:58:51.520 – 00:58:57.160 People to use gas or burn their calls anymore. Yeah, okay, so basically it's a good idea.

Participant C 00:59:01.680 – 00:59:04.160 I think it's something.

Miao, Yanwei 00:59:06.120 – 00:59:26.120 But, but that's in, that's very valuable. You're, you're inside there. So you think if it's, if it's by some business, then you think it's not just worthy, but if I tell you now they are research institutes and they are by the national German government and the EU.

Miao, Yanwei 00:59:26.600 – 00:59:35.560 Do you still think it's, it's, it's not for promoting the products because they didn't even recommend you which brand to buy or which.

Miao, Yanwei 00:59:36.840 – 00:59:45.000 Exactly which one to buy. They just say if you get a PV, you can back get the PV from any brands, anything anywhere.

Participant C 00:59:45.160 – 00:59:46.280 Okay.

Miao, Yanwei 00:59:47.160 – 00:59:47.720 Trust voice.

Participant C 00:59:48.480 – 01:00:01.160 Yeah, I would say my attitude would change a little bit from super skeptical to a little bit skeptical, then would test then I would test was my friend's house, which is super patty, an energy efficient.

Participant C 01:00:01.960 – 01:00:05.000 And test it if they already did the passwork.

Participant C 01:00:05.640 – 01:00:08.200 In, in this model still very bad, you know what I mean?

Participant C 01:00:08.840 – 01:00:16.520 I want to know if this model in the end anyway, they will tell you that it's bad because if I already exert a very good parameters.

Participant C 01:00:17.200 – 01:00:19.080 Like, highly energy efficient.

Participant C 01:00:21.360 – 01:00:30.240 Tell me that you did a good job everything's, perfect, you don't need to buy the Sonar panels. I want to know this. I would test it in the model to see.

Participant C 01:00:31.240 – 01:00:33.800 If I'm a super energy efficient.

Participant C 01:00:34.480 – 01:00:42.120 They would say, Oh, now it's everything's good. You don't need any, any improvement if this is something like this in a model, I would trust it really a lot.

Miao, Yanwei 01:00:43.980 – 01:00:49.100 You might just do, do the whole thing again.

Miao, Yanwei 01:00:49.860 – 01:00:52.300 Beginning, and then you choose all the best option.

Participant C 01:00:56.900 – 01:01:04.460 I want to see what, what would happen if I choose the best stop and then they still say, you have still have to buy a sort of panels.

Miao, Yanwei 01:01:06.380 – 01:01:08.300 You can try it. Yes.

Participant C 01:01:08.340 – 01:01:12.780 Okay, that's right. Another country I want to see if there's some difference.

Miao, Yanwei 01:01:13.060 – 01:01:18.700 No, I, I only have touch land now. Sorry, but.

Miao, Yanwei 01:01:24.300 – 01:01:29.300 I wonder like, why is your screen, Not showing those selections?

Participant C 01:01:30.060 – 01:01:35.820 I don't know why it's okay when was the house built that me choose the most newest after.

Participant C 01:01:37.740 – 01:01:44.500 Yes, how many people which one is the best.

Participant C 01:01:48.620 – 01:01:54.380 So that you, oh, no, yeah, of course more is better because you share by more people or.

Miao, Yanwei 01:01:55.020 – 01:01:56.940 Maybe I am not. So sure.

Participant C 01:01:57.020 – 01:01:59.540 You have last week or you use last energy.

Miao, Yanwei 01:02:00.980 – 01:02:02.060 Could be.

Participant C 01:02:02.060 – 01:02:02.700 But the energ...

Participant C 01:02:03.980 – 01:02:06.540 It's talking about how many people per.

Miao, Yanwei 01:02:06.540 – 01:02:11.260 And it's for energy, I guess maybe more makes more sense. Yeah.

Miao, Yanwei 01:02:14.620 – 01:02:16.780 Maybe he pump it's the best.

Participant C 01:02:16.780 – 01:02:18.060 Okay, let's just keep.

Miao, Yanwei 01:02:18.380 – 01:02:18.700 Yeah.

Participant C 01:02:18.820 – 01:02:19.980 Is it a hot water?

Miao, Yanwei 01:02:20.180 – 01:02:22.460 Be having power tank.

Miao, Yanwei 01:02:23.820 – 01:02:33.540 Of course, a PV system, yes, no, you just said, yes, yes, and then choose the biggest one. The tank, you know what? yeah.

Miao, Yanwei 01:02:34.700 – 01:02:40.460 And yes, a better system and a twenty kilow.

Miao, Yanwei 01:02:43.260 – 01:02:44.380 Yes.

Miao, Yanwei 01:02:45.580 – 01:02:47.620 And now you see.

Miao, Yanwei 01:02:53.260 – 01:02:57.740 Now you can still see your current energy bell, right?

Miao, Yanwei 01:02:58.380 – 01:03:18.860 And then you will see the recommended configurations, which is it seems that your home energy system is already very technically economical and we do not have a recommendation that may lower energy future energy costs for you at the moment, but you can also see how different configurations.

Miao, Yanwei 01:03:18.900 – 01:03:26.500 Will affect your house energy consumption by manually customizing your home energy system using our service.

Participant C 01:03:29.100 – 01:03:31.020 So anyway they would tell me.

Miao, Yanwei 01:03:32.460 – 01:03:34.340 Just give you whatever.

Participant C 01:03:38.700 – 01:03:39.820 What.

Participant C 01:03:41.900 – 01:03:44.460 Why is the energy bell, higher.

Miao, Yanwei 01:03:46.380 – 01:03:48.940 Your current is the left one. You remember.

Participant C 01:03:50.260 – 01:03:52.140 Why is the recommendation price higher?

Miao, Yanwei 01:03:52.780 – 01:03:54.700 On the right one.

Miao, Yanwei 01:03:55.140 – 01:03:59.460 Simulation if you go through, if you could scroll up.

Miao, Yanwei 01:04:01.100 – 01:04:08.180 It's simulate, so you can just basically change everything the simulate to see what happened.

Participant C 01:04:12.820 – 01:04:15.060 Can I change this simulate?

Miao, Yanwei 01:04:15.220 – 01:04:20.300 You can change like, like here the simulation just give you a random thing.

Participant C 01:04:21.180 – 01:04:22.540 I see.

Participant C 01:04:26.700 – 01:04:31.140 Yeah, but I can change it. It's not from me.

Miao, Yanwei 01:04:31.460 – 01:04:38.860 You remember the previous page already told you, like you can just go into check on whatever you want to see.

Miao, Yanwei 01:04:39.740 – 01:04:42.020 No recommendation for you.

Participant C 01:04:42.700 – 01:04:45.780 I see now I understand.

Miao, Yanwei 01:04:46.540 – 01:04:47.660 Yes.

Participant C 01:04:48.460 – 01:04:49.740 And it's just saying that's correct.

Miao, Yanwei 01:04:50.660 – 01:04:51.780 Yes.

Participant C 01:04:52.740 – 01:04:54.220 Nice, nice work.

Miao, Yanwei 01:04:55.500 – 01:04:58.060 Now do you feel like you trusted a bit more.

Participant C 01:04:58.060 – 01:04:58.700 Yeah, yeah.

Participant C 01:05:03.180 – 01:05:04.460 At customer.

Miao, Yanwei 01:05:05.100 – 01:05:24.940 No, you are good. You provide a lot of insights and, and okay, then I continue asking my questions. All right, are you considering investing in any of those recommended technologies? Like previously we have recommended some technolog.

Miao, Yanwei 01:05:25.220 – 01:05:30.060 To you, would you consider investing them.

Participant C 01:05:30.060 – 01:05:31.980 I have one questions regarding to your question.

Miao, Yanwei 01:05:32.100 – 01:05:33.260 So, yes.

Participant C 01:05:33.900 – 01:05:40.860 Investment means the money only to buy the technologies or including the installations.

Miao, Yanwei 01:05:42.860 – 01:05:45.420 Investment means total.

Participant C 01:05:45.420 – 01:05:46.700 Yeah, I understand.

Miao, Yanwei 01:05:49.900 – 01:05:50.540 Would, would you like.

Miao, Yanwei 01:05:51.580 – 01:05:59.500 Those technologies, if you see that they can actually have an impact on your energy Bill.

Participant C 01:06:00.140 – 01:06:10.380 The government would pay would help me in certain present, if I try to save the, the whole world, buy my own money.

Participant C 01:06:11.220 – 01:06:21.900 And I would think about it, but like, you know what I mean? If I buy a solar panel and then I can the government will pay at fifty percent for me. Not that much of me thirty percent.

Participant C 01:06:22.540 – 01:06:25.100 I would really think about it.

Miao, Yanwei 01:06:25.100 – 01:06:25.740 Okay.

Miao, Yanwei 01:06:28.940 – 01:06:30.860 All your, on your own.

Participant C 01:06:31.740 – 01:06:37.900 Then I would still think about it, but not that like, really want to do it, like, still.

Participant C 01:06:39.180 – 01:06:44.940 Because it really depends on how long I plan to live in this house.

Participant C 01:06:46.420 – 01:06:50.700 If I am just a buyer of the house, for example, I buy this house.

Participant C 01:06:51.460 – 01:06:51.980 Owner, but.

Participant C 01:06:55.180 – 01:06:55.820 In two months.

Miao, Yanwei 01:06:55.860 – 01:06:56.980 Okay.

Participant C 01:06:57.380 – 01:07:01.580 Why do I have to do this investment? I didn't even get my money back and.

Miao, Yanwei 01:07:01.700 – 01:07:11.420 Because you can sell it for more expensive price if you provide that your house, it's in the efficiency of level a.

Participant C 01:07:13.780 – 01:07:16.940 Depends you have to calculate for me that.

Participant C 01:07:17.580 – 01:07:20.780 Much much efficiency. I can really get the money.

Participant C 01:07:22.700 – 01:07:23.820 But.

Miao, Yanwei 01:07:24.300 – 01:07:28.060 Want to sell your house if you already bought this one.

Participant C 01:07:28.660 – 01:07:37.420 I mean, if I change my working location, if I, I mean there's always something that I can switch my houses.

Participant C 01:07:38.260 – 01:07:44.460 I sell it in this case, I would think about the investment, which is not fixed invest.

Participant C 01:07:46.260 – 01:07:51.500 Means it's in a house, which, when I move off, it's, it belongs to the house.

Participant C 01:07:52.340 – 01:08:03.020 All the recommendations from this MO model, it's fixed or fixed recommendations. It's not something like I do know in Taiwan when we.

Participant C 01:08:03.860 – 01:08:05.580 On the AC, the air conditioner.

Participant C 01:08:06.940 – 01:08:16.460 We can bring a lot of energy efficiency when you bring when you bought a certain kind of circulation fan a ventilatour.

Participant C 01:08:17.100 – 01:08:18.380 And demonside.

Participant C 01:08:19.660 – 01:08:29.900 Because if you buy this fan, it only costs two euros, Taiwanese dollars and it circulates the wind and cools the whole house down.

Participant C 01:08:30.700 – 01:08:32.460 Using the same energy.

Participant C 01:08:33.740 – 01:08:38.220 So if it's like this and I bought a fan and I move out, I can take it.

Participant C 01:08:38.220 – 01:08:47.819 I would definitely do it like all the Tony's household. They do it, but the recommendation. now I got found this model is to really insert with such a high price.

Participant C 01:08:48.660 – 01:08:49.740 I move out.

Participant C 01:08:50.380 – 01:08:51.660 I don't even know. I can.

Participant C 01:08:51.940 – 01:08:53.580 Solar panels with me.

Miao, Yanwei 01:08:53.700 – 01:08:54.859 No, usually the.

Miao, Yanwei 01:08:55.580 – 01:08:57.420 System they stay with the home. So.

Miao, Yanwei 01:08:59.339 – 01:09:02.540 But yes, solar panels, You can actually bring with you.

Miao, Yanwei 01:09:03.180 – 01:09:05.740 But it's just a lot of work.

Participant C 01:09:05.740 – 01:09:25.580 I mean, oh, so in Germany that the installations causes very high. I think it's almost the same price as I bought. I don't know how much it cost, but in my imagination, it cost a lot. I bought this solo panels and also the installations of all the professional things...

Miao, Yanwei 01:09:26.299 – 01:09:34.380 Makes sense, but what, if you don't want to move away, would you still invest in those technologies for your house?

Participant C 01:09:34.540 – 01:09:39.660 Okay, it depends on my age. So if I'm going to, I'm like eighty years old. I'm going to die.

Participant C 01:09:40.980 – 01:09:44.779 Why do I have to do this? Like, why, why?

Participant C 01:09:45.660 – 01:09:47.339 My money in this, I'm already going to.

Miao, Yanwei 01:09:48.220 – 01:09:58.500 Because for climate change, because for the environment, and because it actually can help you save energy bell, like, can help you save.

Miao, Yanwei 01:10:02.100 – 01:10:02.700 Estimation.

Participant C 01:10:02.900 – 01:10:09.740 Yeah, if I am forty years old, I will definitely be willing like, have enough money because I'm forty years old I have.

Participant C 01:10:10.460 – 01:10:16.780 The investment I have my own host. Yeah, I would definitely do it, but if I'm like an old person, then it's.

Participant C 01:10:17.460 – 01:10:33.420 It's still part of some, I wouldn't do it at all. So I think the focus group, the group that you focus, which would maybe very, very motivated is definitely not a students because they rent a house and they're definitely not a fresh man that just entered a society as working.

Participant C 01:10:35.340 – 01:10:39.820 Someone who is in the middle of forty- two fifty and just retired got some money.

Participant C 01:10:40.460 – 01:10:46.300 And if they are too old, they want, and also if you're just retired, you're thinking about.

Participant C 01:10:48.140 – 01:10:51.340 And why are you making your house energy efficient?

Participant C 01:10:52.700 – 01:10:54.540 Why like, why is the motive?

Miao, Yanwei 01:10:59.660 – 01:11:16.940 You, you provide really good like perspective from this, from this like, angle, it's, it's really good. I really like it, and another question do you know why those recommendations were recommended to you?

Participant C 01:11:18.860 – 01:11:30.980 Okay, because if there are five different ways of generating energy, there must be a best one which is more highly energy efficient.

Miao, Yanwei 01:11:32.340 – 01:11:33.580 For your own situation?

Participant C 01:11:33.700 – 01:11:37.900 Yeah, and the whole situation is based on the parameters, which I just insert.

Miao, Yanwei 01:11:38.060 – 01:11:39.980 Okay, nice.

Participant C 01:11:39.980 – 01:11:41.260 I have a question.

Participant C 01:11:42.060 – 01:11:54.060 They didn't ask about my location more precisely regarding the landscape regarding the weather conditions regarding how big my whole apartment is.

Participant C 01:11:54.860 – 01:12:03.020 Layer it is, because if I live on a third floor, like right now it's warmer and I need more cooling system for, if I have one.

Miao, Yanwei 01:12:03.780 – 01:12:14.540 To answer the first question, your location question, we actually can provide very detailed, like, very just spot location.

Participant C 01:12:14.620 – 01:12:15.740 Yeah.

Miao, Yanwei 01:12:16.540 – 01:12:22.220 According to our model and the whole of Germany, it doesn't make a too big difference.

Participant C 01:12:22.220 – 01:12:22.860 Oh, cool.

Participant C 01:12:23.500 – 01:12:24.140 It's sup.

Miao, Yanwei 01:12:26.100 – 01:12:31.180 But, you know, like, I know like many people want to know very precise detail.

Miao, Yanwei 01:12:32.620 – 01:12:52.300 I could like, we could think of some ways, like some people might just want to do a quick scan so they can enter like some part of the, just they just need to enter Germany, but if you are very interested, knowing very, very detailed things we could even ask you like.

Miao, Yanwei 01:12:53.020 – 01:13:11.500 Exactly and see again, you live and how many people there working habit is, are they working from home or are they working in the office and like those habits, how, what is your most comfortable temperature range?

Participant C 01:13:11.540 – 01:13:13.420 Exactly, oh, I think.

Participant C 01:13:14.700 – 01:13:17.900 The reason why it makes me a little bit untrust.

Participant C 01:13:19.260 – 01:13:22.380 Also, because the, the question is something.

Participant C 01:13:23.660 – 01:13:24.940 Close to my lifestyle.

Participant C 01:13:25.820 – 01:13:29.420 Asking something about technologies equipment in my house.

Participant C 01:13:30.260 – 01:13:47.980 Very far away from my life because I'm not an engineer, I'm a normal person. So this thing is more like you ask me what brand of fridge I bought which I don't care, but I care about if you're asking me my daily life habits, how often I show what temperatures make me feel comfortable.

Participant C 01:13:48.620 – 01:13:57.580 I would feel like this is really personalized. So personalized feelings is like, this is more about me, but not only about the hardware and a house.

Participant C 01:13:58.500 – 01:14:02.700 Person is also affecting how much energy consumption it is, right?

Miao, Yanwei 01:14:03.980 – 01:14:11.020 But you think the, the final calculation was correct according to your current bill.

Participant C 01:14:11.020 – 01:14:12.940 Yeah, that's surprisingly true.

Participant C 01:14:13.580 – 01:14:18.700 I wasn't, I mean, I'm very critical and I want to see if it's true or not, and it's true.

Miao, Yanwei 01:14:19.980 – 01:14:21.260 That's nice.

Miao, Yanwei 01:14:21.900 – 01:14:25.740 I actually contribute to the, to your, to your trust a little bit.

Participant C 01:14:25.900 – 01:14:27.020 Yeah, of course.

Miao, Yanwei 01:14:28.980 – 01:14:36.620 So let me see. were you familiar with all those technologies before you use those systems?

Participant C 01:14:37.260 – 01:14:45.580 No, because when I were doing a survey from this model, you have a lot of the descriptions and I think you, sa, you saw me.

Participant C 01:14:46.540 – 01:14:52.620 Through everything a careful way, it doesn't mean that I, I want to do in a careful ways because I don't understand.

Miao, Yanwei 01:14:53.380 – 01:15:00.940 So do you think after using the service you are more aware of what those technologies are actually for.

Participant C 01:15:01.100 – 01:15:05.420 Yeah, I mean for awareness, of course, I, I aware it now.

Miao, Yanwei 01:15:05.420 – 01:15:07.340 But more understanding.

Participant C 01:15:08.100 – 01:15:09.900 Again, some understanding, yes, but.

Participant C 01:15:10.540 – 01:15:12.460 If you test me right now. okay, what.

Participant C 01:15:13.740 – 01:15:17.580 Something it means. I don't think I remember.

Miao, Yanwei 01:15:17.780 – 01:15:24.620 Okay, but you can, if you don't remember what it means, you can always find the definition there.

Participant C 01:15:26.540 – 01:15:33.580 So it's not something that I can immediately learn as knowledge, but it's something that I have something in my mind so.

Participant C 01:15:33.700 – 01:15:34.220 I have.

Miao, Yanwei 01:15:35.060 – 01:15:44.220 So do you, do you think like, overall you would say that you, your knowledge of those technologies improved a little bit after using it.

Participant C 01:15:44.700 – 01:15:52.780 On a scale of one to ten of improvement, I would say is like one, two, four, like, not like one to ten, like.

Participant C 01:15:53.420 – 01:15:54.700 For a lot.

Participant C 01:15:55.420 – 01:16:09.420 Give me some time to look through like a Google myself, what technology it is. I really, I think this is like a base that motivates me to learn more about those energy efficiency tech.

Miao, Yanwei 01:16:09.420 – 01:16:10.700 Technologies, yes.

Participant C 01:16:11.340 – 01:16:19.020 But I really like that they didn't really explain me so much that make me feel annoyed, but it's like an intro.

Participant C 01:16:20.300 – 01:16:22.860 Yeah, I brought understanding.

Miao, Yanwei 01:16:22.860 – 01:16:26.500 So you think it's a good way doing this way.

Participant C 01:16:32.020 – 01:16:35.020 Always want them to provide me some.

Participant C 01:16:36.940 – 01:16:47.180 About reliable ones, because if I could go by myself, how do I know the information I, I check is, is correct and if you are based on an institute that do the research.

Participant C 01:16:47.220 – 01:16:49.100 Exactly on this area.

Participant C 01:16:51.060 – 01:16:59.340 Give me a, some links and videos which easier for me to learn more information if I really want to know what exactly this technology is about and.

Participant C 01:17:00.340 – 01:17:08.940 Think about wow okay, This is really a nice cool technology and why don't I buy it and use it? It's good that you just only give me one.

Participant C 01:17:09.820 – 01:17:12.780 General understanding of what that means, but.

Participant C 01:17:12.980 – 01:17:14.700 Only helps me to do the survey.

Miao, Yanwei 01:17:14.820 – 01:17:15.980 But it doesn't.

Participant C 01:17:15.980 – 01:17:25.060 Help me to have a deeper understanding of the technology and also give me the motivation to really.

Participant C 01:17:26.380 – 01:17:28.140 Fascinating and want to buy it.

Participant C 01:17:28.780 – 01:17:39.020 The motions and I would say if you are doing a customer journey doing this process when I go through the prototype, then motions is very.

Participant C 01:17:40.380 – 01:17:44.780 There's not really like a wow. Okay, so cool, like there.

Participant C 01:17:45.540 – 01:17:46.700 Up and downs.

Participant C 01:17:47.340 – 01:17:53.740 Annoyed or angry. No, but it's very flat and, and neutral if that's, what you want.

Miao, Yanwei 01:17:54.380 – 01:18:01.420 Yes, actually, actually, that's partly like, because that's our, not our main focus.

Miao, Yanwei 01:18:02.740 – 01:18:05.900 Do you remember when you first saw the PV.

Miao, Yanwei 01:18:06.740 – 01:18:21.900 Green Bar and they actually exceed your demand remember, so isn't you feel surprised like, wow, actually the PV generated electricity. It's more than what I need.

Participant C 01:18:21.940 – 01:18:22.540 I.

Participant C 01:18:23.340 – 01:18:41.740 At that time I wasn't happy about it. I was just thinking about if it's like, I need money for eating and you give me more money than I need, and I would think why like, I don't need that much, so it's like you give me more energy, but I don't need that much. I, I, this is my life. This is my lifestyle.

Participant C 01:18:42.500 – 01:18:44.940 This, isn't comfort for me. You give me more.

Participant C 01:18:45.580 – 01:18:48.780 For, for what I.

Participant C 01:18:50.060 – 01:18:55.820 I won't feel like, wow, it's so nice. I have more, I mean, it's energy, it's not money, It's, it's like...

Miao, Yanwei 01:18:56.580 – 01:19:09.900 Maybe one thing I, I didn't, maybe if you don't know, it's, if you have a PV and if you generate more energy than you actually need.

Miao, Yanwei 01:19:11.220 – 01:19:15.020 Yes, the electricity goes back to the grid.

Participant C 01:19:16.340 – 01:19:17.460 Minus.

Miao, Yanwei 01:19:17.980 – 01:19:19.500 You got minus user.

Participant C 01:19:19.700 – 01:19:22.060 So in Taiwan, it's forbidden.

Participant C 01:19:23.340 – 01:19:26.540 It's forbidden because you can pay less.

Miao, Yanwei 01:19:26.540 – 01:19:36.780 Yes, that's, that's in Germany, it's the case that's why you pay less because these months you probably spend minus two hundred Euro for yours.

Participant C 01:19:37.460 – 01:19:43.820 Exactly, I know this, I know this because in Taiwan, a lot of people put solar panels.

Participant C 01:19:44.660 – 01:19:47.020 They got minus bills from the government.

Miao, Yanwei 01:19:47.660 – 01:19:48.300 Yes.

Participant C 01:19:48.300 – 01:19:49.580 Government's very angry.

Miao, Yanwei 01:19:50.220 – 01:19:52.140 Really that's weird.

Participant C 01:19:52.140 – 01:19:53.420 We're right, because.

Participant C 01:19:53.620 – 01:20:03.660 Legal to put to insert and install. There are other panels on your own. You have to ask the government for permission and stuff. It's anyway, it's about.

Miao, Yanwei 01:20:03.660 – 01:20:05.580 That's a different culture.

Miao, Yanwei 01:20:06.220 – 01:20:19.020 Yes, but now do you feel more comfortable that, actually if you, they provide more, like, if PV generates more electricity and it actually gets your money, they use.

Participant C 01:20:20.940 – 01:20:22.580 I'm happy.

Miao, Yanwei 01:20:22.860 – 01:20:23.500 Okay...

Participant C 01:20:23.780 – 01:20:31.180 I would like to know the extent like you, you said you said I can get some money back if it's like one or two cents.

Participant C 01:20:31.820 – 01:20:36.940 And I really didn't see the difference if it's one, one or two hundred euros a month, then I see the difference.

Miao, Yanwei 01:20:37.620 – 01:20:53.580 If you look at that table right now, you can see, like, for example, June or yeah, April, it's fine and the, the PV generates more than double of what your demand.

Miao, Yanwei 01:20:55.220 – 01:21:04.180 So in the whole month, you, let's say if in June, you need to pay two hundred for your energy bill.

Miao, Yanwei 01:21:04.860 – 01:21:14.100 That means you actually get minus four hundred Euro back. You get four hundred euro back.

Miao, Yanwei 01:21:16.340 – 01:21:17.460 So.

Miao, Yanwei 01:21:19.660 – 01:21:28.060 You definitely earn. That's why your energy bill like in the end was so low, it's only nine hundred for the whole year.

Miao, Yanwei 01:21:29.140 – 01:21:30.420 Yes, yes, that's.

Participant C 01:21:30.540 – 01:21:39.380 Satisfied, then I'm happy to, maybe I think after your explanations make me more motivated to install this technology.

Participant C 01:21:42.580 – 01:21:47.700 I, I think I can save some money and also save the world and why not.

Miao, Yanwei 01:21:47.900 – 01:21:59.860 Yes, yes, like the, the whole service was for making people realizing that actually you save a lot of money and you save the planet.

Miao, Yanwei 01:22:01.220 – 01:22:17.140 But, but maybe we should provide more information to make you realize that it's, it's really hoping. Yeah, and I think it's also because like, for example, you, you're your background, it's a bit different, like in Taiwan, they, they can't just simply.

Miao, Yanwei 01:22:19.300 – 01:22:24.820 So you probably have a different mindset of thinking of those extra energies.

Miao, Yanwei 01:22:25.780 – 01:22:35.700 The Germans that I interviewed, they would quickly realize. Well, I can actually get that money back, so there's also some cultural background.

Miao, Yanwei 01:22:36.620 – 01:22:38.260 Was doing something there.

Miao, Yanwei 01:22:38.900 – 01:22:47.860 Yes, yes, but, but it's really really nice, to get those insights. So now do you believe in adopting those Techn.

Miao, Yanwei 01:22:49.780 – 01:22:51.060 Energy cost.

Miao, Yanwei 01:22:54.260 – 01:23:03.100 Yes, and those are all my questions for you. I'm so thankful that you spend so much time with me. One more hour.

Participant C 01:23:03.260 – 01:23:03.860 Congratulation.

Miao, Yanwei 01:23:04.580 – 01:23:14.700 Thank you so much. and it's really a lot of insights. I'm so grateful. All right, so happy that you admit it to, to come.

Miao, Yanwei 01:23:15.380 – 01:23:17.860 Do you have any extra?

Miao, Yanwei 01:23:19.220 – 01:23:28.060 Questions or thoughts or concerns regarding the whole interview or the system.

Participant C 01:23:30.460 – 01:23:40.980 Because I think it's very interesting that you also consider that the Germans cares about data security and all the thing I insert is nothing critical.

Miao, Yanwei 01:23:42.940 – 01:23:44.860 Yes, we did.

Participant C 01:23:46.380 – 01:23:49.940 So something which I don't care about, but I think Germans care, so it's good.

Miao, Yanwei 01:23:53.780 – 01:24:03.380 Okay, then I, I believe it's, it's done this interview that really got lots of information from you.

Miao, Yanwei 01:24:07.220 – 01:24:27.060 That definitely helps. Okay, then I, I don't interrupt you too much time. You should focus on your, the, and if you want to, if you feel some, some, if you want to consult me about the, your privacy or anything regarding this.

Miao, Yanwei 01:24:27.060 – 01:24:30.260 Interview you can contact me at any time.

Participant C 01:24:31.540 – 01:24:32.820 Yeah, sure.

Miao, Yanwei 01:24:32.900 – 01:24:53.300 We can also play around with the model, the, website page, the web sending it's always there just sometimes you, like, maybe later is going to change the link, the port from eighty eighty to the general to.

Miao, Yanwei 01:24:53.380 – 01:25:02.260 The universal gate so that you only need to type flex model dot org, then it's this website.

Miao, Yanwei 01:25:03.540 – 01:25:11.220 And there will be more countries later and there might be more improvements- made laser as well, but.

Miao, Yanwei 01:25:12.020 – 01:25:13.780 Might take some time.

Participant C 01:25:13.780 – 01:25:15.060 I see.

Miao, Yanwei 01:25:16.980 – 01:25:19.500 Okay, then I stopped recording...

Participant D+E

Miao, Yanwei 00:03:32.580 – 00:03:37.860 Yes, and yeah, now you should see that it's recording.

Miao, Yanwei 00:03:39.620 – 00:03:40.740 Okay.

Miao, Yanwei 00:03:42.180 – 00:03:47.940 Your gender, it's a male and female together. Yeah, and.

Miao, Yanwei 00:03:49.940 – 00:03:51.780 Telling me your age.

Participant D&E 00:03:51.940 – 00:03:55.620 Yes, we are both sixty- nine.

Miao, Yanwei 00:03:55.620 – 00:03:56.740 Okay.

Miao, Yanwei 00:03:58.180 – 00:03:59.940 Same same.

Miao, Yanwei 00:04:01.380 – 00:04:09.620 And would you mind telling me your educational background? Like what major were you studying?

Participant D&E 00:04:16.100 – 00:04:19.459 I'm a geoscientist.

Participant D&E 00:04:21.859 – 00:04:30.180 I have a doctorate and also Germ habilitation and I'm a professor.

Miao, Yanwei 00:04:30.180 – 00:04:31.460 Okay, and.

Participant D&E 00:04:32.740 – 00:04:34.020 But retired...

Miao, Yanwei 00:04:34.020 – 00:04:36.580 Okay, so.

Miao, Yanwei 00:04:39.780 – 00:04:41.260 Who is the name?

Miao, Yanwei 00:04:43.620 – 00:04:45.700 Was doing now.

Miao, Yanwei 00:04:47.460 – 00:04:48.740 And, and.

Participant D&E 00:04:53.500 – 00:04:55.780 And I'm a mineralogist.

Participant D&E 00:04:57.340 – 00:04:58.340 For it as well.

Miao, Yanwei 00:04:58.340 – 00:04:59.460 Okay.

Participant D&E 00:05:00.980 – 00:05:04.740 I have been working at a college.

Miao, Yanwei 00:05:04.740 – 00:05:07.860 Okay, and, and what major?

Participant D&E 00:05:07.940 – 00:05:09.420 In, in.

Miao, Yanwei 00:05:13.780 – 00:05:16.260 Okay, that's super cool.

Miao, Yanwei 00:05:18.220 – 00:05:24.100 And, both of you are German.

Participant D&E 00:05:24.580 – 00:05:25.700 Okay.

Miao, Yanwei 00:05:26.500 – 00:05:38.020 And do you have any knowledge or interesting artificial intelligence? Have you heard about that? Or do you think you learn like, you know?

Participant D&E 00:05:40.580 – 00:05:44.420 We heard about it, but we have little knowledge about it.

Miao, Yanwei 00:05:44.420 – 00:05:54.660 Little, okay, and what about your knowledge and interest energy making energy domain?

Participant D&E 00:05:56.180 – 00:05:58.500 Soon as it concerns us. yes.

Miao, Yanwei 00:05:58.500 – 00:06:10.180 Okay, perfect, and have you heard about energy-efficient appliances or renewable energy technologies for households?

Participant D&E 00:06:10.660 – 00:06:12.580 Yes, yes, yes. Of course.

Miao, Yanwei 00:06:14.180 – 00:06:23.020 Have you ever considered implementing energy efficient technologies such as solar panel or smart meter steps.

Participant D&E 00:06:24.740 – 00:06:29.220 Yes, we have a solar panel.

Participant D&E 00:06:30.100 – 00:06:31.140 For hot water.

Miao, Yanwei 00:06:31.180 – 00:06:32.300 Okay.

Participant D&E 00:06:34.980 – 00:06:51.620 We thought about photovoltaics, but it's not feasible, at our house. We have not got a free space on the roof sufficiently, right side.

Miao, Yanwei 00:06:52.260 – 00:06:52.900 All right.

Participant D&E 00:06:53.580 – 00:07:03.660 The neighbor gives shadow is too close and, or the position of our house is in.

Participant D&E 00:07:07.100 – 00:07:10.020 In between the, the major.

Participant D&E 00:07:14.020 – 00:07:15.900 Okay, so.

Participant D&E 00:07:17.860 – 00:07:18.980 Miles.

Miao, Yanwei 00:07:21.180 – 00:07:21.700 The direction.

Participant D&E 00:07:21.940 – 00:07:30.540 Yes, major direct, so it's diagnosed to the major direction, so it's also not.

Participant D&E 00:07:32.740 – 00:07:33.860 Not good.

Participant D&E 00:07:34.740 – 00:07:41.020 But we are thinking if it is easier just for transportable.

Participant D&E 00:07:44.020 – 00:07:49.860 If it, we could arrange at another place, but on the roof.

Participant D&E 00:07:50.740 – 00:07:53.660 We have not got enough place.

Miao, Yanwei 00:07:54.140 – 00:07:56.900 Was it because you already had a solar panel.

Participant D&E 00:07:57.540 – 00:08:01.500 Yes, yes, because when we changed our.

Participant D&E 00:08:03.420 – 00:08:18.660 Heating Central heating uses this because it is one machinery that works together what water and TT.

Participant D&E 00:08:19.300 – 00:08:32.780 Yes, yes, so it was for us the best decision for, for our host. It was something like six or something years ago. Yeah, it is seven. It is seven years ago. Yes.

Participant D&E 00:08:34.300 – 00:08:52.580 Yeah, and at the moment, it's still, I mean it's still working and working Well, so at the moment we are not thinking to change and so as soon as it breaks down, so we will change to a renewable heating.

Miao, Yanwei 00:08:52.580 – 00:08:53.700 Okay.

Participant D&E 00:08:55.940 – 00:08:57.700 Gives us during the summer.

Participant D&E 00:08:58.540 – 00:09:13.580 Hot water without using gas only if there is a, some two weeks of, of bed weather, then gas works, but normally during the summer, we don't need it.

Participant D&E 00:09:15.620 – 00:09:18.580 I'm cooking, I'm cooking with gas as well.

Miao, Yanwei 00:09:20.180 – 00:09:22.620 Thank you, that's very informative.

Miao, Yanwei 00:09:25.220 – 00:09:26.340 And.

Miao, Yanwei 00:09:28.140 – 00:09:33.620 What is your understanding regarding the benefits of energy efficient technologies?

Participant D&E 00:09:36.100 – 00:09:41.380 Yes, we, we want to use more.

Participant D&E 00:09:43.780 – 00:10:02.980 Like, like Solar or if it would be possible for wind, but for private person, it is not possible because anything of wind, for example, yes. and using the heat of the earth, it is so.

Participant D&E 00:10:04.340 – 00:10:24.820 It's yeah, too expensive for our little house. Yeah, but, but the heat pump would be feasible, but, but as soon as our heating one speaks down, we will change. yes, when, when we change.

Participant D&E 00:10:25.460 – 00:10:36.340 There was no discussion of no more using gas and so we didn't think of another possibility. That was this cheap gas from Russia.

Miao, Yanwei 00:10:39.620 – 00:10:44.260 You want to change it and why, why do you want to change them?

Participant D&E 00:10:47.220 – 00:10:52.340 Well, we, we don't want to buy the guest for, from Russia.

Participant D&E 00:10:52.980 – 00:11:01.300 And we think we have to do more from, or against the climate change.

Participant D&E 00:11:03.220 – 00:11:10.260 We tried to use less energy during the winter and we did, yes.

Participant D&E 00:11:12.220 – 00:11:15.380 We've tried to save energy. That's what we're.

Miao, Yanwei 00:11:16.660 – 00:11:28.820 So, so the most reasons for you are to reduce the reliability or was Russia or was an energy was climate change.

Participant D&E 00:11:29.020 – 00:11:29.460 Yes.

Participant D&E 00:11:30.140 – 00:11:37.780 Change the most important thing is, is that we have to do more for the, against the climate change.

Miao, Yanwei 00:11:37.780 – 00:11:40.340 Because of the financial aspect.

Participant D&E 00:11:41.620 – 00:11:55.700 Yes, for financial aspects as well, because when we got retired, we knew we had less money, so we decided what can we do to.

Participant D&E 00:11:57.660 – 00:11:58.780 Minimize.

Participant D&E 00:12:01.580 – 00:12:07.260 For example, using a small account and.

Participant D&E 00:12:08.580 – 00:12:12.980 Spending less money for, for heating.

Miao, Yanwei 00:12:12.980 – 00:12:14.100 Okay.

Participant D&E 00:12:14.260 – 00:12:23.220 So the guns hitting is, I don't know in English blend that Technik, you know, it.

Miao, Yanwei 00:12:23.500 – 00:12:26.420 Burning, like b or BMAS burning.

Participant D&E 00:12:27.060 – 00:12:28.980 No, no, blended is.

Participant D&E 00:12:31.900 – 00:12:41.140 Technology the, the best technology for, for gas he team, which uses less gas than the elder.

Participant D&E 00:12:43.700 – 00:12:49.860 And so you don't have the gas, you don't have a flame for the whole time.

Miao, Yanwei 00:12:50.100 – 00:12:50.740 Oh.

Participant D&E 00:12:50.980 – 00:12:55.220 Only when it is hitting it, it uses.

Miao, Yanwei 00:12:55.860 – 00:12:56.500 Okay.

Participant D&E 00:13:01.700 – 00:13:03.540 Like a candle. So.

Participant D&E 00:13:04.820 – 00:13:07.260 Permanent permanent.

Participant D&E 00:13:11.660 – 00:13:13.140 The most modern one... yeah, so...

Participant D&E 00:13:15.220 – 00:13:17.580 Energy saving one.

Miao, Yanwei 00:13:17.620 – 00:13:18.740 Okay.

Participant D&E 00:13:18.900 – 00:13:20.180 Still, it's guess.

Participant D&E 00:13:22.100 – 00:13:38.100 But you have cooking discuss, yes, which is quite a bit quite a good, yes. So we need, let's electricity because cooking with electricity is, yeah, it.

Participant D&E 00:13:40.020 – 00:13:41.300 More expensive in from the time.

Miao, Yanwei 00:13:41.940 – 00:13:45.140 Okay, oh, I didn't know.

Miao, Yanwei 00:13:48.340 – 00:13:56.020 Okay, so you're then I guess you definitely know about climate change and why is it important?

Miao, Yanwei 00:13:57.940 – 00:14:08.820 All right, then the questions, the pre- questions have been like you have been answered all of them, and now I will send you a link.

Participant D&E 00:14:08.860 – 00:14:09.980 Yes...

Miao, Yanwei 00:14:10.740 – 00:14:19.100 Yes, yes, for. So that you can, I will send it via the chat.

Miao, Yanwei 00:16:16.180 – 00:16:17.460 I send it.

Participant D&E 00:16:18.740 – 00:16:19.860 Okay.

Miao, Yanwei 00:16:20.820 – 00:16:24.500 You can just type the link of.

Participant D&E 00:16:25.140 – 00:16:29.540 I opened the link on my, on my mobile.

Miao, Yanwei 00:16:30.940 – 00:16:33.460 But that's, that's too small because.

Miao, Yanwei 00:16:34.780 – 00:16:39.220 Yeah, that is designed for a bigger screen. A laptop screen.

Miao, Yanwei 00:16:40.540 – 00:16:43.540 I don't know if you use your browser.

Participant D&E 00:16:53.300 – 00:16:54.420 Okay.

Participant D&E 00:17:00.340 – 00:17:01.460 Okay.

Participant D&E 00:17:01.620 – 00:17:06.740 You're okay, yes, yes, no, it asks when was the house built? Is it right...

Miao, Yanwei 00:17:09.420 – 00:17:13.780 Can you, can you open the link with your computer?

Participant D&E 00:17:15.699 – 00:17:18.260 I did it with my, with my phone.

Miao, Yanwei 00:17:20.220 – 00:17:22.100 The screen is too small.

Participant D&E 00:17:22.140 – 00:17:22.740 Too, SMA.

Miao, Yanwei 00:17:23.060 – 00:17:25.939 Yeah, because it was not designed for the.

Participant D&E 00:17:26.380 – 00:17:27.500 Okay.

Miao, Yanwei 00:17:29.140 – 00:17:31.700 I have to use your computer browser.

Participant D&E 00:21:13.480 – 00:21:15.800 We were trying to start.

Miao, Yanwei 00:21:21.800 – 00:21:22.920 Ah.

Participant D&E 00:21:23.080 – 00:21:23.720 Yes, yes.

Miao, Yanwei 00:21:24.560 – 00:21:25.640 Yes, I can see it.

Participant D&E 00:21:26.080 – 00:21:31.160 You can see it. Okay, I can go then I go to the browser. Okay.

Participant D&E 00:21:40.360 – 00:21:42.280 Okay, country Germany.

Participant D&E 00:21:46.760 – 00:21:51.120 Okay, one thousand ninety- eight, our house was built.

Participant D&E 00:21:53.480 – 00:21:56.360 You know, the exact you want to have the exact year.

Miao, Yanwei 00:21:57.000 – 00:21:58.280 You can choose.

Participant D&E 00:22:01.480 – 00:22:04.680 It's not possible. it's in nineteen ninety- eight.

Participant D&E 00:22:05.960 – 00:22:11.440 Yes, yes, next. Okay, next.

Participant D&E 00:22:16.200 – 00:22:18.520 No, it was new. No, no.

Participant D&E 00:22:25.840 – 00:22:27.080 Currently, yeah, yes.

Participant D&E 00:22:29.920 – 00:22:34.760 Yes, so we had been four, but now we are less than four.

Miao, Yanwei 00:22:34.760 – 00:22:35.880 Okay.

Participant D&E 00:22:41.160 – 00:22:44.240 It means the situation.

Miao, Yanwei 00:22:46.440 – 00:22:46.920 Current.

Participant D&E 00:22:48.840 – 00:22:51.280 Air conditioner, no, no.

Participant D&E 00:22:54.600 – 00:22:57.040 Heating gas.

Participant D&E 00:22:59.080 – 00:23:02.120 Network border, yes.

Participant D&E 00:23:07.520 – 00:23:15.640 Yes, yes, we got this hot water tank next next, yes.

Participant D&E 00:23:17.680 – 00:23:24.040 Next next portal voltide, yes, yeah, not yet.

Participant D&E 00:23:25.320 – 00:23:26.440 Next.

Participant D&E 00:23:28.560 – 00:23:34.840 System, no, no. So, yeah, next next.

Participant D&E 00:23:36.200 – 00:23:40.240 Smart and I, dream, No, no.

Participant D&E 00:23:43.240 – 00:23:45.080 Complete, okay.

Miao, Yanwei 00:23:50.920 – 00:23:54.120 It is, if you have.

Miao, Yanwei 00:23:55.520 – 00:23:57.960 Yeah, ask, but.

Miao, Yanwei 00:23:58.920 – 00:24:02.440 Know how you think of everything that you are seeing.

Participant D&E 00:24:05.000 – 00:24:07.240 With all customs from our open.

Participant D&E 00:24:09.480 – 00:24:13.320 Yes, my husband will, will get our, We, we got.

Participant D&E 00:24:14.880 – 00:24:24.280 The bills for, for last year, some weeks ago, and my husband where he will, he will, he will get it from upstairs.

Miao, Yanwei 00:24:27.440 – 00:24:29.840 What, what are you getting?

Participant D&E 00:24:30.920 – 00:24:33.080 Yes, we, we have.

Participant D&E 00:24:35.720 – 00:24:39.560 We know how much we used for energy last.

Miao, Yanwei 00:24:39.560 – 00:24:41.480 Yeah, okay, the Energ.

Miao, Yanwei 00:24:42.120 – 00:24:45.320 Yes, yes, so you want to compare it.

Participant D&E 00:24:45.960 – 00:24:50.440 And we can re- yes, so we can compare it.

Miao, Yanwei 00:24:55.680 – 00:24:58.120 Can you understand that interface here?

Participant D&E 00:24:59.400 – 00:25:01.960 I don't do not understand it.

Participant D&E 00:25:02.600 – 00:25:03.880 So, so.

Participant D&E 00:25:08.360 – 00:25:09.480 Okay.

Participant D&E 00:25:14.120 – 00:25:15.400 New eligibility.

Participant D&E 00:25:25.000 – 00:25:26.920 For your host.

Participant D&E 00:25:39.080 – 00:25:50.920 So what does it mean? It means how much we pay for, for the whole year for total energy.

Participant D&E 00:25:53.160 – 00:25:57.000 For electricity gas and water or.

Miao, Yanwei 00:25:57.000 – 00:25:58.120 It's.

Participant D&E 00:26:00.840 – 00:26:02.760 Electricity and gas.

Miao, Yanwei 00:26:04.040 – 00:26:05.320 All the energy that you were.

Miao, Yanwei 00:26:06.080 – 00:26:07.240 Currently using.

Miao, Yanwei 00:26:09.800 – 00:26:10.440 So.

Participant D&E 00:26:12.440 – 00:26:15.560 He doesn't find it. I, I, I go upstairs one moment.

Miao, Yanwei 00:26:15.880 – 00:26:16.840 Okay, no worries.

Participant D&E 00:28:32.520 – 00:28:33.160 Okay.

Miao, Yanwei 00:28:34.160 – 00:28:34.440 Okay.

Participant D&E 00:28:34.600 – 00:28:36.360 Yes, you've got it.

Miao, Yanwei 00:28:38.280 – 00:28:40.200 It's similar or.

Participant D&E 00:28:42.760 – 00:28:45.960 Page in the time.

Miao, Yanwei 00:28:47.280 – 00:28:48.520 For the whole year.

Participant D&E 00:28:48.520 – 00:28:55.560 Of the merely here it's yes.

Participant D&E 00:28:57.480 – 00:29:01.600 It's weird for electricity.

Participant D&E 00:29:02.600 – 00:29:07.720 Four hundred and twenty- one use.

Miao, Yanwei 00:29:07.720 – 00:29:08.840 Okay.

Participant D&E 00:29:18.600 – 00:29:23.080 Thousand four hundred, forty- eight euros.

Miao, Yanwei 00:29:23.840 – 00:29:24.360 Okay.

Miao, Yanwei 00:29:28.200 – 00:29:30.760 And so better. Yes.

Participant D&E 00:29:30.760 – 00:29:33.440 And then then we got a.

Participant D&E 00:29:36.000 – 00:29:40.360 From, from the, from the state.

Participant D&E 00:29:43.800 – 00:29:44.920 Energy.

Miao, Yanwei 00:29:45.480 – 00:29:46.600 Okay.

Participant D&E 00:29:48.040 – 00:29:49.320 A little bit. Yes.

Miao, Yanwei 00:29:49.360 – 00:29:55.320 So you, you actually use a bit less than two, two thousand.

Participant D&E 00:29:58.920 – 00:30:08.520 It was, yes, it was the year where some months we had really a very expensive guess.

Miao, Yanwei 00:30:09.960 – 00:30:11.880 Yes, that, that to you.

Participant D&E 00:30:12.200 – 00:30:15.720 Not yes, now it is lower.

Miao, Yanwei 00:30:15.760 – 00:30:17.640 So, yeah.

Participant D&E 00:30:17.960 – 00:30:21.120 In former times, it was, it was less.

Miao, Yanwei 00:30:21.480 – 00:30:22.600 Okay.

Miao, Yanwei 00:30:24.160 – 00:30:29.160 What do you think? it's also because of the solar panel that you had during.

Participant D&E 00:30:29.360 – 00:30:31.080 It was the son appendant.

Participant D&E 00:30:32.480 – 00:30:36.200 It reduced it very good.

Participant D&E 00:30:39.600 – 00:30:43.880 Could see it in, in the, in the last years.

Participant D&E 00:30:54.120 – 00:30:57.600 Yes, I, I just can.

Participant D&E 00:31:01.160 – 00:31:02.920 If one number doesn't.

Participant D&E 00:31:05.680 – 00:31:07.760 That's what I have done.

Participant D&E 00:31:10.120 – 00:31:11.240 Yes.

Participant D&E 00:31:15.560 – 00:31:16.680 Yes.

Participant D&E 00:31:21.720 – 00:31:23.720 Kilowatts don't.

Participant D&E 00:31:24.840 – 00:31:25.960 Yeah.

Miao, Yanwei 00:31:27.400 – 00:31:28.040 So do you think.

Miao, Yanwei 00:31:28.800 – 00:31:30.120 The estimation.

Participant D&E 00:31:32.840 – 00:31:40.720 To yours, it's about two thousand three. No, yes, two thousand, four hundred.

Participant D&E 00:31:42.760 – 00:31:49.160 You know what our less gas or with the, with the solar panel.

Miao, Yanwei 00:31:49.800 – 00:31:53.640 Okay, that's really nice to.

Miao, Yanwei 00:31:55.560 – 00:31:56.680 And.

Participant D&E 00:32:04.640 – 00:32:08.120 Let's see anything guy, This is so guys.

Miao, Yanwei 00:32:12.840 – 00:32:26.360 So do you, do you think the system like this service it, the, the estimated cost if it's to your real cost.

Miao, Yanwei 00:32:28.200 – 00:32:29.480 Your actual cost.

Participant D&E 00:32:30.400 – 00:32:33.960 External cost, yes, they are. Okay. I think yes.

Participant D&E 00:32:36.600 – 00:32:41.120 We would like to use photo type, but.

Participant D&E 00:32:45.480 – 00:32:48.680 The most expensive really is the heating.

Participant D&E 00:32:49.320 – 00:32:51.960 And, and we.

Participant D&E 00:32:56.360 – 00:33:01.480 The energy from green Planet. Do you know, green planet.

Participant D&E 00:33:02.280 – 00:33:03.400 Mean, peace.

Miao, Yanwei 00:33:03.400 – 00:33:05.320 It's a company or.

Participant D&E 00:33:05.520 – 00:33:10.480 From green piece. Yes, it's a company. They use.

Participant D&E 00:33:13.000 – 00:33:14.120 Wintcars.

Participant D&E 00:33:15.560 – 00:33:16.680 And.

Participant D&E 00:33:22.880 – 00:33:27.800 Wind and solar in a electricity and.

Participant D&E 00:33:29.720 – 00:33:34.200 And they always tell us if we.

Participant D&E 00:33:40.520 – 00:33:43.640 Got you, if you come consume.

Participant D&E 00:33:46.360 – 00:33:53.440 How much for our house and the house is not. So, so big.

Participant D&E 00:33:54.600 – 00:33:58.920 But for, for us, it's always.

Participant D&E 00:34:01.000 – 00:34:11.639 It's always a very slow amount. So we are, we, are, we are very good in, in, in.

Participant D&E 00:34:13.560 – 00:34:14.440 Saving energy.

Miao, Yanwei 00:34:14.600 – 00:34:15.720 Saving.

Participant D&E 00:34:15.720 – 00:34:17.000 It says yes...

Miao, Yanwei 00:34:17.639 – 00:34:18.280 That's good...

Miao, Yanwei 00:34:20.960 – 00:34:22.080 And.

Miao, Yanwei 00:34:23.440 – 00:34:32.240 If you look at this interface of the service, you could see several, like spokes.

Miao, Yanwei 00:34:33.639 – 00:34:40.679 Right, like cards and the left one. it's the current.

Miao, Yanwei 00:34:41.960 – 00:34:47.080 Situation, yes, and then on the right hand side, those.

Miao, Yanwei 00:34:48.520 – 00:34:52.679 They are the recommendations for your home.

Miao, Yanwei 00:34:54.760 – 00:35:10.760 Three options for your home, like, not, not really three options, but like they recommended you three options from the most cost-benefit one, and there's also the lowest energy bell one.

Participant D&E 00:35:11.400 – 00:35:12.040 Yes.

Miao, Yanwei 00:35:12.040 – 00:35:17.000 And also the lowest investment recommendation.

Miao, Yanwei 00:35:19.080 – 00:35:39.560 Yeah, so it just meant like those are the recommendation for your house, if you think one of it is, it sounds good. Like it sounds exciting, you can see, like, check.

Miao, Yanwei 00:35:39.760 – 00:35:46.720 Details or those configurations for your house energy technologies.

Miao, Yanwei 00:35:49.960 – 00:35:55.560 For example, the first card it says you can save save six.

Participant D&E 00:35:56.680 – 00:35:58.120 Yes, yes.

Miao, Yanwei 00:35:58.760 – 00:36:03.880 And the second one it can help you save one thousand four hundred.

Miao, Yanwei 00:36:05.200 – 00:36:14.120 So these are the recommend recommended configurations so that it can help you save this much of money.

Participant D&E 00:36:16.040 – 00:36:16.680 Yes, yes.

Miao, Yanwei 00:36:17.960 – 00:36:21.160 Does it make sense now or for those.

Participant D&E 00:36:22.480 – 00:36:27.560 Understand it okay. Yeah, but as we say, we, we all considered this.

Participant D&E 00:36:28.280 – 00:36:30.120 It's not feasible. That's a moment.

Miao, Yanwei 00:36:30.480 – 00:36:31.400 Yes.

Participant D&E 00:36:32.240 – 00:36:32.680 Change to.

Participant D&E 00:36:33.320 – 00:36:34.600 Pump system that's.

Participant D&E 00:36:35.880 – 00:36:41.000 We, we have a relatively new heating, so.

Miao, Yanwei 00:36:41.760 – 00:36:42.920 You don't wanna change. So.

Participant D&E 00:36:44.200 – 00:36:46.120 What we are doing, try to save simply.

Miao, Yanwei 00:36:46.800 – 00:36:48.680 Yes, I understand.

Participant D&E 00:36:48.680 – 00:36:54.440 So, and as soon as the, the heating gets old or breaks down, so we will change.

Participant D&E 00:36:55.560 – 00:37:03.280 Think of changing of course to, to heat pump or something like this? Yes, and for the renovation of the building.

Participant D&E 00:37:07.920 – 00:37:10.440 We have, yeah, it's not.

Participant D&E 00:37:11.760 – 00:37:18.760 Quite a good isolation system. We had to change, for example, our roof.

Participant D&E 00:37:20.400 – 00:37:22.440 A better, either isolation.

Participant D&E 00:37:24.080 – 00:37:28.000 But from the outside, it's not possible.

Participant D&E 00:37:30.920 – 00:37:32.920 Because we have.

Participant D&E 00:37:35.160 – 00:37:47.240 What is it? We have a special brick on a mental bricks in front of the house or.

Participant D&E 00:37:48.240 – 00:37:51.400 Between, between the, the walls.

Participant D&E 00:37:54.600 – 00:38:04.200 And the, the only bricks there is a isolation isolation, but of course it is an isolation...

Participant D&E 00:38:04.880 – 00:38:08.720 Which was necessary in the year of.

Participant D&E 00:38:10.600 – 00:38:12.520 Ninety- ninety- eight.

Participant D&E 00:38:15.080 – 00:38:18.920 Yeah, better, but it's not, so yeah.

Participant D&E 00:38:23.040 – 00:38:24.680 Much more better.

Participant D&E 00:38:24.680 – 00:38:27.240 Twenty- five years later, of course.

Participant D&E 00:38:27.880 – 00:38:31.040 And yeah.

Participant D&E 00:38:31.720 – 00:38:34.280 Also easy, it's not easy to, to change.

Miao, Yanwei 00:38:36.840 – 00:38:45.800 Yeah, like these are only recommendations. You don't, you don't have to really follow them. They just like, provide an.

Miao, Yanwei 00:38:48.600 – 00:38:54.120 So you can also click the more detail this button.

Participant D&E 00:38:54.120 – 00:38:56.680 Yes, more detail button.

Participant D&E 00:38:57.080 – 00:38:58.880 What does it say?

Miao, Yanwei 00:38:59.880 – 00:39:08.080 Supposed to show you the, the actual estimates with those, with the configuration.

Miao, Yanwei 00:39:09.480 – 00:39:12.040 If you look at the left side, it's the...

Miao, Yanwei 00:39:13.960 – 00:39:34.440 Right side, it's the simulate, which is the one you just clicked the, the recommendation you just click clicked and these are the estimates of how much energy demand like how much energy will be demanded, if you use the.

Miao, Yanwei 00:39:34.560 – 00:39:43.640 Recommendation you just clicked and on the left side, it's the, your current situation though, how it was.

Miao, Yanwei 00:39:46.600 – 00:39:47.240 Does it make Sen?

Miao, Yanwei 00:39:48.520 – 00:39:49.160 I.

Participant D&E 00:39:54.400 – 00:40:00.040 It would look different, for example, for hot water, we.

Participant D&E 00:40:01.960 – 00:40:02.600 During summer.

Miao, Yanwei 00:40:06.440 – 00:40:07.080 That's.

Participant D&E 00:40:07.720 – 00:40:10.920 Where there will be more difference. I think.

Miao, Yanwei 00:40:15.680 – 00:40:24.680 Like you have some, some more more unique situation that the whole model didn't actually consider that.

Miao, Yanwei 00:40:26.440 – 00:40:42.520 But yeah, so this is like a similar detailed explanation of how this configuration actually will be looking.

Participant D&E 00:40:43.720 – 00:40:45.600 Which means PV.

Miao, Yanwei 00:40:47.600 – 00:40:49.480 Photo photo.

Participant D&E 00:40:51.840 – 00:40:53.960 Oh yeah, yes. yes.

Participant D&E 00:40:55.280 – 00:40:59.720 Yes, yes, well this would be interesting for us.

Participant D&E 00:41:00.600 – 00:41:09.960 Only if we can use pv panels, we could put them on other sides of our roof.

Participant D&E 00:41:11.240 – 00:41:11.880 Yes, yes.

Miao, Yanwei 00:41:12.520 – 00:41:15.920 You also mentioned, I, I guess so.

Miao, Yanwei 00:41:17.640 – 00:41:20.840 But yeah, like from here you can see like.

Miao, Yanwei 00:41:21.680 – 00:41:29.160 Have a water, then the photo, what type can generate generate a five.

Miao, Yanwei 00:41:29.160 – 00:41:30.440 Kilowatts when you.

Miao, Yanwei 00:41:31.400 – 00:41:32.960 The whole year.

Miao, Yanwei 00:41:38.120 – 00:41:39.240 So.

Miao, Yanwei 00:41:40.680 – 00:41:45.960 Yeah, I think basically, you have already seen all the pages.

Miao, Yanwei 00:41:47.720 – 00:41:54.760 There is one more boxes down there. There's a green line or green G.

Participant D&E 00:41:55.600 – 00:41:56.680 Yes.

Miao, Yanwei 00:41:56.680 – 00:42:04.960 Yes, yes, but this is for like, introduce you some information regarding climate change.

Miao, Yanwei 00:42:08.240 – 00:42:08.840 Yes, but.

Miao, Yanwei 00:42:09.840 – 00:42:12.680 Very general, some information...

Participant D&E 00:42:14.400 – 00:42:17.160 Okay, okay, yes, we, well.

Participant D&E 00:42:17.160 – 00:42:20.360 Yes, yes, we know about this. Yes.

Miao, Yanwei 00:42:22.280 – 00:42:32.520 You were aware and you also like conducted like you your energy consumption behavior is also very green. According.

Miao, Yanwei 00:42:34.040 – 00:42:35.840 Yeah, the comp.

Miao, Yanwei 00:42:37.640 – 00:42:40.840 So these are just some, like, extra information.

Miao, Yanwei 00:42:42.120 – 00:42:43.400 For the service.

Miao, Yanwei 00:42:44.800 – 00:42:52.120 You can read if, if, if, you know, like, most of the things it's also fine.

Participant D&E 00:42:52.360 – 00:42:53.000 Okay.

Participant D&E 00:42:54.280 – 00:42:54.920 As we know about.

Participant D&E 00:42:56.440 – 00:42:58.440 So, for example.

Participant D&E 00:43:00.680 – 00:43:03.880 Yes, we, you can, from the time.

Participant D&E 00:43:04.640 – 00:43:08.360 Having a shower, the most easy thing.

Participant D&E 00:43:09.640 – 00:43:10.760 And.

Participant D&E 00:43:12.200 – 00:43:15.400 Collect rain water collect rainwater or.

Participant D&E 00:43:16.920 – 00:43:20.680 We have three hundred liters and.

Participant D&E 00:43:23.080 – 00:43:25.640 And I, I use this for the garden.

Participant D&E 00:43:27.560 – 00:43:36.520 This year, I up to now I did not use drinking water for the garden.

Participant D&E 00:43:36.720 – 00:43:40.360 We are composing. I'm composting yes.

Participant D&E 00:43:41.640 – 00:43:42.760 Positive.

Participant D&E 00:43:46.760 – 00:43:51.200 Yes, for reducing waste.

Participant D&E 00:43:52.920 – 00:43:58.280 We choose a green energy provider for the green. Of course.

Participant D&E 00:43:58.280 – 00:44:02.040 Reducing reducing waste. I.

Participant D&E 00:44:04.800 – 00:44:18.760 I try to buy minimal packaging, for example, the, the, of course I drink water from yes, our drinking water.

Participant D&E 00:44:20.800 – 00:44:27.080 I reduce, I, I use bags different times, for example.

Participant D&E 00:44:34.760 – 00:44:36.040 What else...

Miao, Yanwei 00:44:37.960 – 00:44:39.840 Not too many years.

Participant D&E 00:44:41.600 – 00:44:45.640 I'm not sure we wrote for political leaders who.

Participant D&E 00:44:50.160 – 00:44:51.680 The Green Party.

Participant D&E 00:44:55.880 – 00:45:00.360 And we try to use the car.

Participant D&E 00:45:03.560 – 00:45:13.080 Yeah, not, so often not often, Yeah, so we have the possibility to work, so doing our shopping.

Participant D&E 00:45:15.080 – 00:45:17.000 And if it is not too much.

Participant D&E 00:45:17.640 – 00:45:20.200 We go, I think, yes.

Participant D&E 00:45:22.760 – 00:45:23.880 Okay.

Miao, Yanwei 00:45:26.080 – 00:45:30.440 Do you mind go back to the previous page again.

Miao, Yanwei 00:45:31.840 – 00:45:32.360 Google.

Miao, Yanwei 00:45:35.560 – 00:45:36.840 And yes, I can.

Participant D&E 00:45:43.280 – 00:45:51.560 So I use the other one if you have, we want to save more with a better way system or.

Miao, Yanwei 00:45:51.760 – 00:45:52.840 It's okay...

Participant D&E 00:45:52.840 – 00:45:55.640 Yes, I opened this. Okay.

Miao, Yanwei 00:45:59.240 – 00:46:01.160 So if you look at the right.

Miao, Yanwei 00:46:02.160 – 00:46:05.640 That your energy bell for the whole year will be only five.

Participant D&E 00:46:07.880 – 00:46:08.200 Yes.

Miao, Yanwei 00:46:09.480 – 00:46:12.720 So that you can save a lot.

Participant D&E 00:46:13.960 – 00:46:15.240 S- s- e, M- S.

Miao, Yanwei 00:46:15.880 – 00:46:19.080 It's smart energy Management system.

Miao, Yanwei 00:46:21.840 – 00:46:24.200 It's like a, a small software.

Participant D&E 00:46:24.200 – 00:46:26.760 That can go to software for a smart home.

Miao, Yanwei 00:46:27.080 – 00:46:28.040 Yes, yes.

Miao, Yanwei 00:46:28.680 – 00:46:29.320 Exactly.

Participant D&E 00:46:29.320 – 00:46:33.800 Oh, yes, there. I don't know anything.

Participant D&E 00:46:35.080 – 00:46:38.280 No, no, we don't don't know how to use this.

Miao, Yanwei 00:46:39.080 – 00:46:42.760 It's, I think you don't need to, like know.

Miao, Yanwei 00:46:43.560 – 00:46:45.960 Use it, but itself. Can.

Participant D&E 00:46:45.960 – 00:46:46.600 Yes.

Participant D&E 00:46:51.120 – 00:46:53.640 When we changed our heating.

Participant D&E 00:46:54.280 – 00:46:56.080 We had.

Participant D&E 00:46:58.120 – 00:47:07.000 Few more firm company, a company with Yeah, Ecologic.

Participant D&E 00:47:10.920 – 00:47:20.840 So they said this will cost how much it costs for us and how much can we can we.

Participant D&E 00:47:22.480 – 00:47:25.640 How, how they can can use it in our house.

Participant D&E 00:47:26.920 – 00:47:36.520 They tried to optimize all these heating in the rooms for our house.

Participant D&E 00:47:37.840 – 00:47:41.640 Hit a look just of this building.

Participant D&E 00:47:42.320 – 00:47:45.560 To optimize how to do it and.

Participant D&E 00:47:46.760 – 00:48:03.400 Yes, and when I asked after we had the solar panels, is it possible now to use Photol types, they said they haven't got space and they can use, they can just plan for one or two.

Miao, Yanwei 00:48:08.520 – 00:48:10.440 Okay, so the.

Miao, Yanwei 00:48:11.080 – 00:48:14.280 What was the heating system? They, they mentioned.

Participant D&E 00:48:14.440 – 00:48:20.400 Yes, they mentioned the heating system and, and the together with a- with this order.

Miao, Yanwei 00:48:20.680 – 00:48:21.320 Okay...

Miao, Yanwei 00:48:23.880 – 00:48:27.080 The personalized ones are usually more.

Miao, Yanwei 00:48:28.360 – 00:48:30.280 On your real situation.

Participant D&E 00:48:32.000 – 00:48:41.680 Very good information. The look for yes, how large are the rules and with.

Participant D&E 00:48:45.640 – 00:48:49.480 For, for the cubic meters. Oh yeah.

Miao, Yanwei 00:48:52.040 – 00:48:53.960 Yeah, I believe so.

Participant D&E 00:48:54.600 – 00:49:02.920 And for electricity saving, okay, we, we changed the light we use LED.

Miao, Yanwei 00:49:03.560 – 00:49:04.200 Okay.

Miao, Yanwei 00:49:06.120 – 00:49:16.360 That's nice. Okay. All right, I think, I think you've already navigated through the whole service. The online web service.

Miao, Yanwei 00:49:17.640 – 00:49:24.040 Now it's already been almost, it's almost fifty- five minutes. So it's.

Miao, Yanwei 00:49:25.960 – 00:49:42.600 The length of the, the interviews that I thought would be if you want to cancel, like, if you want to cancel and now it's also, okay, but if you still have time.

Participant D&E 00:49:43.120 – 00:49:44.520 Yeah, we still got time.

Participant D&E 00:49:46.440 – 00:49:47.080 Yes, yes.

Miao, Yanwei 00:49:47.720 – 00:49:52.200 I do have more questions like, more regarding to like after you.

Participant D&E 00:49:52.240 – 00:49:54.760 So I, I go back to the.

Miao, Yanwei 00:49:56.680 – 00:49:57.320 You can.

Participant D&E 00:49:59.920 – 00:50:01.400 Change, yeah.

Miao, Yanwei 00:50:03.720 – 00:50:05.000 The Webex.

Miao, Yanwei 00:50:18.840 – 00:50:19.960 I.

Participant D&E 00:50:23.560 – 00:50:24.680 Okay.

Miao, Yanwei 00:50:29.080 – 00:50:33.560 I'm also note sure, maybe maybe the left.

Participant D&E 00:50:34.840 – 00:50:36.520 Do I have to stop.

Miao, Yanwei 00:50:38.880 – 00:50:48.280 It's also fine, if we just have this screen here and I, I can just directly ask the questions if you.

Participant D&E 00:50:49.600 – 00:50:58.000 That's not, that's if I just put in. Yeah, sure.

Miao, Yanwei 00:51:01.080 – 00:51:04.200 Yes, I guess could be.

Miao, Yanwei 00:52:30.680 – 00:52:33.200 How do you feel about those recommendations?

Participant D&E 00:52:33.880 – 00:52:36.440 It's a good idea. It's a good idea.

Participant D&E 00:52:37.120 – 00:52:43.480 Yes, but we, we have gone through all this considering our energy situation. Yeah.

Participant D&E 00:52:44.240 – 00:52:51.800 For example, was it firm. That's recommended how to, to optimize our house.

Participant D&E 00:52:53.280 – 00:53:02.680 Was some years ago when we changed the heating, yes, seven years. Unfortunately, we, we couldn't get photo world tag.

Participant D&E 00:53:04.640 – 00:53:11.000 Our heating system is gas at the moment. So, or the installed guests.

Participant D&E 00:53:12.520 – 00:53:18.680 So that was a different situation. So five, five or six years ago. So yeah.

Participant D&E 00:53:18.720 – 00:53:24.120 Seven years it was seven years, it was seven years ago, seven years and we can, we can.

Participant D&E 00:53:25.200 – 00:53:31.480 With our solar panel, we were safe quite a lot already. Yeah.

Miao, Yanwei 00:53:31.520 – 00:53:32.760 Yes, yes, that's.

Participant D&E 00:53:33.760 – 00:53:38.520 And the better. Yeah, downsheating than the former gasting.

Participant D&E 00:53:39.160 – 00:53:44.920 We can see that we save twenty percent of ener.

Participant D&E 00:53:45.800 – 00:53:48.120 After changing yes.

Participant D&E 00:53:50.960 – 00:53:53.240 We wanted to.

Participant D&E 00:53:54.600 – 00:54:00.280 Save more energy and I can look yes, and we did it, yes, we did it.

Participant D&E 00:54:00.920 – 00:54:03.480 We use less gas.

Participant D&E 00:54:05.440 – 00:54:06.560 Before.

Miao, Yanwei 00:54:06.720 – 00:54:08.600 It's because of your.

Participant D&E 00:54:08.600 – 00:54:09.240 Yes.

Participant D&E 00:54:11.800 – 00:54:15.000 We changed the temperature for the room.

Participant D&E 00:54:15.640 – 00:54:22.040 Yes, yes, and without feeling that it is too cold.

Participant D&E 00:54:23.320 – 00:54:25.240 We use pullovers. Yes, we use Pullo.

Participant D&E 00:54:28.440 – 00:54:30.360 Change even more.

Miao, Yanwei 00:54:32.280 – 00:54:52.760 That's really nice and do you mind if I ask whether the, you, you said you have asked the assessment guide to come to your home to check on this and give you personalized recommendations. Do you think those recommendations are similar to the recommendation?

Miao, Yanwei 00:54:52.960 – 00:54:55.040 Service gave you.

Participant D&E 00:54:56.600 – 00:54:59.280 Yes, yes, of course they are thinking.

Participant D&E 00:55:01.080 – 00:55:06.120 Another way, for example, they told us, of course, you can.

Participant D&E 00:55:08.120 – 00:55:19.640 This, and that for saving energy using green energy and, but they, of course, they tell you how much it will cost to.

Participant D&E 00:55:20.280 – 00:55:31.800 And so you have to consider if it is worth for you for changing, if, if you know that it will take you so many years.

Participant D&E 00:55:32.560 – 00:55:33.720 Forgetting the money.

Participant D&E 00:55:35.720 – 00:55:38.200 Depends on your financial situation.

Participant D&E 00:55:38.840 – 00:55:41.520 So some, some.

Participant D&E 00:55:43.320 – 00:55:48.360 Energy saving is maybe ecological.

Miao, Yanwei 00:55:48.720 – 00:55:49.080 But.

Participant D&E 00:55:52.920 – 00:56:05.080 Economic economic, yes, economic. So, if you have lots of money, you can say, Oh, no, in any case I want to be more ecological, so I, I spent my money.

Participant D&E 00:56:06.560 – 00:56:16.600 If you're have a shorter budget, so you choose the most economic in, in the current situation. So.

Miao, Yanwei 00:56:17.880 – 00:56:23.640 I don't know if you have noticed in the service. The recommendation card.

Miao, Yanwei 00:56:25.720 – 00:56:27.480 Investment, yes.

Participant D&E 00:56:28.120 – 00:56:35.800 Yes, of course. Yes, but which it, it doesn't tell you how much it will cost.

Participant D&E 00:56:35.920 – 00:56:48.600 Changing if you use this. So for example, we know if it is possible, we would choose photo role tigh because we can pay it.

Participant D&E 00:56:49.360 – 00:56:51.160 We got the money for this.

Participant D&E 00:56:57.560 – 00:56:58.840 We don't know how to manage it.

Participant D&E 00:57:00.120 – 00:57:13.800 And so if you, for example, you have to pay fifteen thousand euros for something like this, and, you know, I will.

Participant D&E 00:57:17.640 – 00:57:24.440 Thousand five hundred per year, you know, in ten years you got the money back.

Participant D&E 00:57:26.360 – 00:57:29.560 So this is what they tell you as well.

Miao, Yanwei 00:57:30.840 – 00:57:40.440 That's nice and do you find the recommendations are useful or valuable like in our service.

Participant D&E 00:57:44.920 – 00:57:46.200 Yes, yes.

Participant D&E 00:57:46.880 – 00:57:48.760 It's okay, yeah, yeah.

Miao, Yanwei 00:57:48.760 – 00:57:50.680 Okay, if you think it doesn't.

Miao, Yanwei 00:57:51.680 – 00:57:55.880 Really good. All right, and are you.

Miao, Yanwei 00:57:57.200 – 00:58:09.240 I think you told me already the factors that influence your decision to adopt or reject the recommendations. I think you already told me that, so let's keep that.

Miao, Yanwei 00:58:11.800 – 00:58:16.000 And do you know why the recommendations were recommended to you.

Miao, Yanwei 00:58:20.120 – 00:58:21.400 In the service.

Participant D&E 00:58:26.680 – 00:58:27.800 Don't understand the.

Miao, Yanwei 00:58:29.720 – 00:58:46.760 I do it again. Do you think do you know why those recommendations were recommended to you? like, why not some other recommendations, but there were only those three recommendations recommended to you.

Participant D&E 00:58:50.880 – 00:58:54.280 The most important recommendations I don't know.

Miao, Yanwei 00:58:55.320 – 00:58:59.800 It's also fine, if you don't know, like, why they were recommended.

Miao, Yanwei 00:59:05.560 – 00:59:26.680 It's, it's normal like you just say whether you think the recommendation will recommend it because the system already knew, what's your house condition was, so they found you those recommendations or you don't you'd have no idea how they actually came up with.

Miao, Yanwei 00:59:26.960 – 00:59:40.920 Those recommendations, or they could also be like the recommendations were just recommended to everyone. You could also think that way, but if.

Miao, Yanwei 00:59:42.200 – 00:59:45.440 Think the recommendations was actually.

Miao, Yanwei 00:59:46.560 – 00:59:56.240 Based on your input at the beginning or do you think the recommendation will, will be recommended to everyone who's using the service?

Participant D&E 00:59:59.960 – 01:00:03.000 Here's your query, use it for everyone.

Miao, Yanwei 01:00:04.440 – 01:00:05.720 And you think it could be.

Miao, Yanwei 01:00:09.040 – 01:00:11.040 All right, then.

Miao, Yanwei 01:00:13.600 – 01:00:16.160 Do you trust the recommendations.

Miao, Yanwei 01:00:20.060 – 01:00:23.260 And why, why do you trust it?

Participant D&E 01:00:25.820 – 01:00:28.980 I mean, your, your representing.

Participant D&E 01:00:31.020 – 01:00:34.140 A trustable organization.

Participant D&E 01:00:36.700 – 01:00:38.620 That's important, I mean, yeah, yes.

Miao, Yanwei 01:00:41.820 – 01:00:50.900 And so what other factors contributed to their trust or lack of trust, you think.

Miao, Yanwei 01:00:52.700 – 01:00:54.500 Trusted organization.

Miao, Yanwei 01:00:57.180 – 01:01:11.820 Is, do you think it's also because the recommendations were similar to what's the assessment people who came they provided similar recommendations to you.

Participant D&E 01:01:11.940 – 01:01:15.380 I mean, the firm when they came, they.

Participant D&E 01:01:17.300 – 01:01:20.860 They looked very closely at our house. So.

Participant D&E 01:01:22.820 – 01:01:29.820 Calculation including the actual dimension of the House of the, of the rooms and, and so on.

Participant D&E 01:01:32.460 – 01:01:34.300 They were closer at our object.

Miao, Yanwei 01:01:34.940 – 01:01:36.220 So you would trust.

Participant D&E 01:01:38.260 – 01:01:38.780 Within.

Participant D&E 01:01:39.420 – 01:01:44.540 You, you cannot do do this. What, what I did. So.

Participant D&E 01:01:45.820 – 01:01:49.660 Yes, I think you have to see the house.

Participant D&E 01:01:51.580 – 01:01:56.700 So, for example, we have a small ground.

Participant D&E 01:01:57.980 – 01:01:59.100 To.

Participant D&E 01:02:01.180 – 01:02:05.660 No, no, two floors. Yes.

Participant D&E 01:02:06.300 – 01:02:11.260 If you have a bungalow, which has a great.

Participant D&E 01:02:13.340 – 01:02:17.180 Square meters and, and just just one flow...

Participant D&E 01:02:17.820 – 01:02:24.220 For example, we have a neighbor. So one side we don't lose so much eating.

Participant D&E 01:02:25.500 – 01:02:26.780 There is the needle.

Participant D&E 01:02:27.740 – 01:02:29.340 The site we do.

Participant D&E 01:02:30.820 – 01:02:33.820 But our neighbor is in the middle, so we are three houses.

Participant D&E 01:02:36.380 – 01:02:40.860 He will use less than we will do with the site.

Participant D&E 01:02:41.500 – 01:02:43.940 You have to see the building.

Miao, Yanwei 01:02:44.860 – 01:02:45.980 Makes sense, yes.

Participant D&E 01:02:46.620 – 01:02:48.860 And you have.

Participant D&E 01:02:50.500 – 01:02:57.060 To see the roof as well. Can you, can you.

Participant D&E 01:02:58.380 – 01:02:59.940 Do more.

Miao, Yanwei 01:03:01.380 – 01:03:02.500 Installation.

Participant D&E 01:03:03.260 – 01:03:07.100 Yes, isolation, yes. Isolation on the roof.

Participant D&E 01:03:07.260 – 01:03:10.300 For example, friends of us.

Participant D&E 01:03:12.860 – 01:03:23.220 Their house is a little bit older than ours and they plan a total new goof just for isolation from above...

Miao, Yanwei 01:03:23.740 – 01:03:24.860 Okay.

Participant D&E 01:03:26.980 – 01:03:35.460 And for Elder wholes, it is m- even more important because they have nearly no, risolation.

Participant D&E 01:03:42.940 – 01:03:47.420 So, yes, I think it is important to, to see.

Participant D&E 01:03:48.700 – 01:03:57.020 And then to think where can we do more for saving energy?

Miao, Yanwei 01:03:57.780 – 01:03:58.300 So.

Participant D&E 01:03:59.580 – 01:04:09.820 For example, our, our neighbors, which are living in, in west, in the middle of these three houses they changed last year, they are hitting.

Participant D&E 01:04:10.100 – 01:04:12.380 But again, guess.

Participant D&E 01:04:13.860 – 01:04:20.700 They still hot head. The, the first heating, which was planned when we, when we built thousand.

Participant D&E 01:04:20.700 – 01:04:32.860 And I asked did your think of an electric pump? Yeah, yeah, electric pump. is it okay...

Miao, Yanwei 01:04:33.220 – 01:04:33.500 Come.

Participant D&E 01:04:34.860 – 01:04:42.460 Of it, but it is not possible because you need three meters of distance to the neighbor.

Participant D&E 01:04:43.740 – 01:04:48.860 Our houses have six meters. So.

Participant D&E 01:04:49.500 – 01:04:50.780 Three meters to.

Participant D&E 01:04:51.020 – 01:04:52.060 Three meters, three, other.

Participant D&E 01:04:52.900 – 01:04:54.620 There's no space.

Participant D&E 01:04:55.980 – 01:04:56.540 Pump.

Miao, Yanwei 01:04:57.180 – 01:04:57.820 Okay.

Miao, Yanwei 01:04:59.220 – 01:04:59.740 So.

Participant D&E 01:05:00.140 – 01:05:18.660 The best thing would be for our three houses. We buy one for three houses, but then you have to have a very good contact to all neighbors, and yes, I think.

Participant D&E 01:05:19.780 – 01:05:25.340 Neighbor is, I think not much interesting it's not so much interesting in this.

Miao, Yanwei 01:05:27.260 – 01:05:30.460 Okay, but it's good that I, I also.

Participant D&E 01:05:32.020 – 01:05:35.580 It's the wrong way that each house has.

Participant D&E 01:05:36.900 – 01:05:52.220 Only it's own system. It would be safe even more energy if you make for, I think six, seven thousand houses or ten houses together.

Participant D&E 01:05:53.620 – 01:05:57.700 You can use the energy from the Earth from.

Miao, Yanwei 01:05:57.980 – 01:05:58.620 Yeah, yeah.

Participant D&E 01:05:59.260 – 01:06:00.540 Which would be even better.

Participant D&E 01:06:01.820 – 01:06:05.660 Than this electric pumps, but it cost.

Participant D&E 01:06:06.340 – 01:06:09.860 Something like fifty thousand euros. I, I.

Participant D&E 01:06:13.340 – 01:06:16.100 Know a person they did it.

Participant D&E 01:06:17.180 – 01:06:22.300 Yes, before, before all this discussion was because they just got the money.

Miao, Yanwei 01:06:24.220 – 01:06:31.260 And that actually helped them save like, did they save enough money to.

Participant D&E 01:06:31.260 – 01:06:32.540 Yes, they do.

Participant D&E 01:06:35.300 – 01:06:38.300 At first you heads to help these fifty thousand.

Miao, Yanwei 01:06:41.500 – 01:06:51.140 That's really a lot. All right, so next question. Were you familiar with those technologies before using this system?

Participant D&E 01:06:57.500 – 01:07:03.940 No, I hate to, when we.

Participant D&E 01:07:07.780 – 01:07:12.220 You think when we change our heating system, if we know it before.

Miao, Yanwei 01:07:12.500 – 01:07:16.060 I mean, before using the website, I just sent.

Miao, Yanwei 01:07:17.980 – 01:07:19.900 You, you are already familiar with.

Participant D&E 01:07:20.140 – 01:07:23.740 Those techniques, yes, yes, we are familiar office. Yeah, yes.

Miao, Yanwei 01:07:23.940 – 01:07:31.420 But I remember that you asked me what is SEMS? So like the smart Energy Management.

Participant D&E 01:07:33.420 – 01:07:34.620 I did not know. Yes.

Miao, Yanwei 01:07:34.700 – 01:07:36.540 Okay, so just this one, and then the.

Miao, Yanwei 01:07:39.980 – 01:07:41.100 So.

Miao, Yanwei 01:07:44.220 – 01:07:53.180 I guess did you think the system has provided enough information for you to understand those technologies. The.

Participant D&E 01:07:55.780 – 01:07:58.540 Understandable, well, this is.

Participant D&E 01:08:01.500 – 01:08:04.060 I, I still don't know how it works.

Miao, Yanwei 01:08:04.060 – 01:08:05.340 You mean the, which.

Participant D&E 01:08:07.380 – 01:08:08.540 Smart SM.

Participant D&E 01:08:10.460 – 01:08:13.020 I don't know how it works.

Miao, Yanwei 01:08:13.020 – 01:08:16.180 But, you know what it is now.

Participant D&E 01:08:18.580 – 01:08:20.060 Not really no, not.

Miao, Yanwei 01:08:23.980 – 01:08:30.940 Do you, if you click the button actually of the smart energy management system, if you.

Participant D&E 01:08:32.220 – 01:08:34.779 Yes, in the other thing moment.

Miao, Yanwei 01:08:35.460 – 01:08:40.740 And there should be a small introduction of this technology.

Participant D&E 01:08:45.020 – 01:08:49.020 Yes, I go here. No, it, it does.

Participant D&E 01:08:51.420 – 01:08:57.940 So you can see Guyisia, here's smart and daughter.

Participant D&E 01:09:04.420 – 01:09:07.339 System to minimize.

Participant D&E 01:09:12.580 – 01:09:16.380 How does it work? I, I still don't understand how it.

Participant D&E 01:09:17.700 – 01:09:20.980 Okay, so you can buy it.

Participant D&E 01:09:22.620 – 01:09:23.740 How.

Miao, Yanwei 01:09:24.140 – 01:09:26.540 You can buy this technology.

Miao, Yanwei 01:09:27.900 – 01:09:41.339 This technology has the feature of, of what the, what it says on, on the website, but it didn't introduce you enough information. You probably still don't know how that actually.

Participant D&E 01:09:41.540 – 01:09:43.900 No, I don't, I don't know how to.

Miao, Yanwei 01:09:44.900 – 01:09:45.180 Yeah.

Participant D&E 01:09:45.460 – 01:09:47.740 Install it how to use it.

Miao, Yanwei 01:09:47.900 – 01:09:52.220 Yes, yeah, all right, Like it doesn't really provide that much.

Miao, Yanwei 01:09:54.780 – 01:09:56.060 It's okay, but, but.

Participant D&E 01:09:56.380 – 01:09:57.980 I think for this, I would.

Participant D&E 01:09:58.620 – 01:10:01.820 Ask for a company.

Participant D&E 01:10:02.460 – 01:10:13.380 Yes, yes, a company. if they can help us to understand this or for example, each year we.

Participant D&E 01:10:16.060 – 01:10:23.580 Have a cleaning from the heating systems and we do this by the company, which installed it in our house.

Participant D&E 01:10:24.420 – 01:10:26.340 So I would ask.

Participant D&E 01:10:26.980 – 01:10:33.340 If they know how can we use it? I think it is a new thing you.

Participant D&E 01:10:34.700 – 01:10:37.220 Didn't have it seven years ago.

Participant D&E 01:10:37.900 – 01:10:58.340 I think it's quite new. So, but they are very interesting in interested in, in, in use an ecologic energy, so they, they know, and they, they don't.

Participant D&E 01:10:58.420 – 01:11:04.740 Work for any producer or fitting systems, for example, so.

Participant D&E 01:11:05.700 – 01:11:17.540 Looked at our house and said, Well, for you, we would give you this heating system from this, produced from this company, for example.

Miao, Yanwei 01:11:18.940 – 01:11:23.300 Yeah, but now, you know, like there is a technology like.

Participant D&E 01:11:24.220 – 01:11:27.140 Okay, so I would ask them.

Miao, Yanwei 01:11:27.380 – 01:11:27.780 You could.

Participant D&E 01:11:29.940 – 01:11:37.380 As they could explain us how it is working and I think they could in install it.

Miao, Yanwei 01:11:38.020 – 01:11:41.860 Maybe, but I'm just like, guessing.

Miao, Yanwei 01:11:43.780 – 01:11:45.980 Okay, and.

Miao, Yanwei 01:11:47.620 – 01:11:52.580 Let me see what other. I think you answered many questions already.

Miao, Yanwei 01:11:54.020 – 01:12:01.900 So has your knowledge of energy efficient technologies improved as a result of using the service.

Miao, Yanwei 01:12:04.260 – 01:12:09.300 Do you think you now know a bit more of those technologies.

Miao, Yanwei 01:12:12.180 – 01:12:13.220 They're using the websit...

Participant D&E 01:12:14.500 – 01:12:16.900 For the technology.

Miao, Yanwei 01:12:17.740 – 01:12:18.980 You don't, thank you.

Participant D&E 01:12:19.060 – 01:12:25.980 No, no, not for the technology just for the opinion, which.

Participant D&E 01:12:27.940 – 01:12:30.340 Yeah, you can combine.

Participant D&E 01:12:33.580 – 01:12:35.620 For saving energy.

Miao, Yanwei 01:12:35.660 – 01:12:45.740 Okay, so yeah, that's also like, you can say part of knowledge you, okay, and.

Participant D&E 01:12:46.500 – 01:12:50.660 If you want to know how it is working, you have.

Participant D&E 01:12:52.540 – 01:12:56.740 More information about the techniques, the.

Miao, Yanwei 01:12:56.780 – 01:12:57.380 Techniques.

Miao, Yanwei 01:12:58.660 – 01:13:03.140 And I think all the questions being asked.

Participant D&E 01:13:03.460 – 01:13:04.420 Okay, yeah.

Miao, Yanwei 01:13:04.780 – 01:13:10.820 Have any additional questions or any thoughts or concerns regarding.

Participant D&E 01:13:11.460 – 01:13:17.220 In what discipline are you doing your master thesis?

Miao, Yanwei 01:13:17.860 – 01:13:19.780 In human computer interaction.

Participant D&E 01:13:20.420 – 01:13:21.540 Oh.

Miao, Yanwei 01:13:22.540 – 01:13:24.260 It's a very new subject...

Miao, Yanwei 01:13:27.460 – 01:13:28.740 At Seagan.

Participant D&E 01:13:28.740 – 01:13:29.380 Yeah, yeah.

Miao, Yanwei 01:13:32.060 – 01:13:33.860 Any more questions.

Miao, Yanwei 01:13:34.660 – 01:13:35.140 Want to know.

Miao, Yanwei 01:13:36.740 – 01:13:37.700 Human computer.

Participant D&E 01:13:41.540 – 01:13:43.460 So, yes, good luck.

Participant D&E 01:13:44.460 – 01:13:48.580 Do you need more people for your.

Participant D&E 01:13:52.660 – 01:13:56.260 Can recommend, well, we can ask friends of us.

Participant D&E 01:13:57.540 – 01:14:01.380 They would do it as well. I got your contacts.

Participant D&E 01:14:02.020 – 01:14:09.700 So if someone says, yes, we will do it as well. I can send you the contact.

Miao, Yanwei 01:14:09.860 – 01:14:10.980 That would be great, thank you.

Participant F

Miao, Yanwei 00:00:04.100 – 00:00:09.820
I start with the demographical questions.

Miao, Yanwei 00:00:11.660 – 00:00:15.660
I would like to know your gender and your age.

Participant F 00:00:16.740 – 00:00:18.660
Male and I'm twenty-nine.

Miao, Yanwei 00:00:18.700 – 00:00:25.820
Oh, hey, and your educational background, like what major are you studying?

Participant F 00:00:26.340 – 00:00:30.180
I have a master in Mechanical Engineering.

Miao, Yanwei 00:00:32.099 – 00:00:35.380
Okay, and your current occupation.

Participant F 00:00:37.380 – 00:00:39.140
But to all Vienna.

Miao, Yanwei 00:00:39.140 – 00:00:39.780
Okay.

Participant F 00:00:41.180 – 00:00:42.300
Student.

Miao, Yanwei 00:00:43.780 – 00:00:46.060
And your nationality.

Miao, Yanwei 00:00:49.500 – 00:00:53.740
Do you have any knowledge or interesting artificial intelligence?

Participant F 00:00:55.780 – 00:01:00.900
Yes, I have little knowledge and I have high interest, let's say.

Miao, Yanwei 00:01:01.540 – 00:01:07.940
Okay, and what about your knowledge and interesting energy domain?

Participant F 00:01:07.980 – 00:01:09.220
And energy.

Participant F 00:01:09.860 – 00:01:14.340
I interest in, I would say, higher knowledge. Okay.

Miao, Yanwei 00:01:15.500 – 00:01:24.580
And have you heard of, of energy efficient appliances or renewable energy technologies for households?

Miao, Yanwei 00:01:27.140 – 00:01:38.020
And have you ever considered implementing energy and efficient technologies such as social panels or solar panels or smart thermostat.

Participant F 00:01:39.940 – 00:01:53.380
Considered, yes, but I'm living in a shared you say, not in a house where we have many parties, so it's impossible to install permission for everyone. Yeah.

Miao, Yanwei 00:01:55.940 – 00:02:04.860
When you are doing the service, would you like to consider that the situation of your families house or.

Participant F 00:02:06.820 – 00:02:10.020
In my family, my parents, they are.

Participant F 00:02:10.860 – 00:02:14.420
They're looking to install PV.

Participant F 00:02:15.300 – 00:02:25.340
I don't live with them anymore. I live in an apartment and there, it's not possible to install anything because I would have to get the agreement of every.

Participant F 00:02:28.580 – 00:02:31.780
Every apartment owner and south kinds of.

Miao, Yanwei 00:02:31.780 – 00:02:35.860
Okay, so it's because it's someone else's house.

Participant F 00:02:36.660 – 00:02:44.580
Basically, yes, and no. So the house is the house belongs to partly everyone who owns an apartment.

Miao, Yanwei 00:02:44.580 – 00:02:45.700
Okay.

Participant F 00:02:46.700 – 00:02:50.980
If you want to do something on the roof or on the walls, you have to get the agreement of every.

Miao, Yanwei 00:02:53.540 – 00:02:58.580
Okay, so it's an apartment like I shared Vicky.

Participant F 00:03:00.580 – 00:03:02.500
Yeah, no, it's just an apartment.

Miao, Yanwei 00:03:02.500 – 00:03:03.140
Okay.

Miao, Yanwei 00:03:05.060 – 00:03:14.620
All right, that's continue. and what is your understanding regarding the benefits of energy efficient technologies.

Miao, Yanwei 00:03:16.580 – 00:03:17.220
Yes.

Participant F 00:03:17.860 – 00:03:19.140
And you are.

Participant F 00:03:21.260 – 00:03:22.340
Demands.

Participant F 00:03:23.100 – 00:03:29.340
Which comes with cost production and you have a lower environmental impact.

Miao, Yanwei 00:03:29.380 – 00:03:38.980
Yeah, and do you know about climate change and why is it important for individual to save energy?

Miao, Yanwei 00:03:44.100 – 00:03:47.940
So you've done with all the pre- question.

Participant F 00:03:47.940 – 00:03:48.580
Perfect.

Miao, Yanwei 00:03:51.300 – 00:03:55.620
I would like to send you a link via the chat.

Miao, Yanwei 00:03:56.260 – 00:03:57.780
One moment.

Miao, Yanwei 00:04:01.380 – 00:04:19.299
Because the, the model is actually for single family house. so I'm not sure which house situation you are supposed to use. Maybe you can use your current living house, but then.

Miao, Yanwei 00:04:19.340 – 00:04:22.500
You need to consider the whole building's environment.

Miao, Yanwei 00:04:23.260 – 00:04:32.100
You can also consider whether it's your parents' house then, and you can just use the parameters for your parents house.

Miao, Yanwei 00:04:34.660 – 00:04:35.940
So do you.

Miao, Yanwei 00:04:36.140 – 00:04:37.220
The link.

Participant F 00:04:38.500 – 00:04:41.060
I cannot show my screen or should I share my screen?

Miao, Yanwei 00:04:41.340 – 00:04:44.180
That would be nice if you can share your screen.

Miao, Yanwei 00:04:51.940 – 00:04:53.060
Yes.

Miao, Yanwei 00:04:55.180 – 00:05:10.500
Yes, now I can see. So now you can start and eh, during, during the testing session you can ask whatever questions you have, or you can think aloud if you.

Miao, Yanwei 00:05:11.140 – 00:05:13.620
Yes, yes, go ahead.

Participant F 00:05:15.140 – 00:05:16.900
You tried the tools are enough.

Miao, Yanwei 00:05:16.900 – 00:05:17.540
Oh, really.

Participant F 00:05:21.060 – 00:05:22.660
Been sent me the, the link.

Miao, Yanwei 00:05:22.660 – 00:05:23.780
Okay.

Participant F 00:05:26.500 – 00:05:28.420
I'll do it for my parents host and.

Miao, Yanwei 00:05:28.420 – 00:05:30.860
Okay, perfect.

Participant F 00:05:37.380 – 00:05:39.940
Currently less than four seven year.

Participant F 00:05:54.660 – 00:05:56.100
It's very smart.

Participant F 00:06:01.060 – 00:06:06.180
Okay, now we see the current attributes estimated P- two thousand, seven fifty, seven.

Participant F 00:06:08.100 – 00:06:18.180
Actually, it would be cool to compare this to the, actually, I could ask parents if it's about around it, but I think it's fairly accurate.

Miao, Yanwei 00:06:18.980 – 00:06:22.820
Why, why do you think it's fairly accurate? Oh, that's.

Participant F 00:06:22.820 – 00:06:25.500
No, I think it's because.

Participant F 00:06:27.300 – 00:06:29.860
I think it makes sense. Somehow.

Participant F 00:06:32.900 – 00:06:33.700
Using currently.

Participant F 00:06:34.980 – 00:06:36.300
But, but.

Participant F 00:06:38.820 – 00:06:40.740
Should be in a good range.

Participant F 00:06:45.220 – 00:06:46.500
For those investment.

Participant F 00:06:51.700 – 00:06:54.180
You save six hundred us per year.

Participant F 00:06:56.100 – 00:06:57.900
But this.

Participant F 00:06:59.380 – 00:07:05.100
Annual last investment cost is six hundred seventy six, so it would be still.

Participant F 00:07:06.980 – 00:07:10.180
And negative cost benefit, right?

Participant F 00:07:11.460 – 00:07:12.580
Okay.

Miao, Yanwei 00:07:12.940 – 00:07:31.900
Here here, because we use like three different methods to calculate, like the choose the recommendation and one of the method it's through the most cost benefit, which is the one that saved the most.

Participant F 00:07:32.780 – 00:07:37.700
The highest which the highest cost divided by savings ratio.

Miao, Yanwei 00:07:38.100 – 00:07:53.020
Yes, but sometimes there is still like the bug, like, for example, now, so it's still, it's not really cost benefit because it's the investment money is actually more than the savings, but.

Participant F 00:07:54.060 – 00:08:05.860
But this is low, and I think what would be really nice if we could implement co- two cost as co- two reduction potential, but that's not implemented in a model yet.

Miao, Yanwei 00:08:05.860 – 00:08:07.780
Do you mean by a share two.

Participant F 00:08:08.420 – 00:08:09.060
Co- two.

Miao, Yanwei 00:08:09.060 – 00:08:10.340
Ah, okay, failed.

Participant F 00:08:10.500 – 00:08:12.260
Come carbon emission. So.

Participant F 00:08:13.980 – 00:08:18.660
We save that many carbon emissions, but I know that we haven't implemented it in the model if.

Miao, Yanwei 00:08:19.940 – 00:08:21.860
And it's nice. I suggestion.

Participant F 00:08:23.780 – 00:08:32.099
Especially when you switch from a gas boiler to maybe a, is it here a PV change to where he comes system? Yes.

Miao, Yanwei 00:08:34.020 – 00:08:41.500
So you can, you understand the, the recommendation page? Well, do you think you can understand it.

Participant F 00:08:42.380 – 00:08:43.620
This one kind of week.

Participant F 00:08:46.180 – 00:08:47.980
Understand that you have.

Miao, Yanwei 00:08:49.380 – 00:08:51.300
Okay, great.

Miao, Yanwei 00:08:56.420 – 00:08:57.540
Perfect.

Participant F 00:09:02.820 – 00:09:03.940
Yeah.

Participant F 00:09:04.780 – 00:09:06.020
Click on this. I have.

Miao, Yanwei 00:09:06.700 – 00:09:07.300
My current.

Miao, Yanwei 00:09:07.980 – 00:09:11.020
Why do you choose the second recommendation?

Participant F 00:09:11.780 – 00:09:13.700
Just to see the difference.

Participant F 00:09:16.380 – 00:09:18.820
I just wanted to see what, what's, what's behind it.

Miao, Yanwei 00:09:18.820 – 00:09:19.460
Okay.

Miao, Yanwei 00:09:21.380 – 00:09:23.740
It's all right. That's good.

Participant F 00:09:25.220 – 00:09:29.140
Current, is this a comparison current tool?

Miao, Yanwei 00:09:30.340 – 00:09:35.460
Current simulate the, the recommendation that you chose.

Participant F 00:09:37.020 – 00:09:38.020
Current, no.

Miao, Yanwei 00:09:38.780 – 00:09:39.300
This is your.

Participant F 00:09:41.220 – 00:09:47.900
Is there also the current compared to... No, this is the PV production, right? And this is.

Miao, Yanwei 00:09:50.820 – 00:09:51.940
Yes.

Participant F 00:10:08.600 – 00:10:09.720
Eighteen.

Participant F 00:10:13.720 – 00:10:17.000
Wait if I have here.

Participant F 00:10:27.800 – 00:10:32.800
The thing is only seventy seven. So this is energy demand.

Participant F 00:10:34.200 – 00:10:43.160
But the heating, the man should be the same. Now it should be also, but it's in energy wise, but electricity wise it should be different.

Miao, Yanwei 00:10:43.800 – 00:10:49.400
Yes, you are right? So here is actually a electricity.

Participant F 00:10:51.480 – 00:10:57.720
So this, this should be clarified. otherwise it looks like the hit pump uses a lot more energy.

Miao, Yanwei 00:10:57.880 – 00:10:58.520
All right.

Miao, Yanwei 00:10:59.160 – 00:11:03.000
Yeah, yeah, that's true.

Participant F 00:11:04.000 – 00:11:08.080
Energy electricity, maybe electricity map or you.

Participant F 00:11:10.680 – 00:11:14.400
Yeah, that's a big difference. If you show energy or electricity demands.

Miao, Yanwei 00:11:14.520 – 00:11:17.160
Yes, that's true.

Participant F 00:11:19.040 – 00:11:20.280
The current.

Participant F 00:11:22.200 – 00:11:27.320
Yeah, because then the current, oh, this is only appliances, right?

Miao, Yanwei 00:11:29.240 – 00:11:47.800
Obviously they didn't like distinguish from all the energy, all the lecturity that you were using, maybe because you don't have a tank or like those things and they can't identify, I'm guessing the model.

Participant F 00:11:49.240 – 00:12:08.280
Should be heating and hot water should be identified. I think here for sure, I think this could, yeah, here we

have thought what I think we can have this distinguishing here too, but this is only the plans is it only prints the, yeah, the same, the plans are the same. The only prints the electricity consumption for.

Participant F 00:12:10.320 – 00:12:13.560
And not eating cooling.

Miao, Yanwei 00:12:18.240 – 00:12:21.080
Maybe it's wrong. You mean the model, I mean.

Participant F 00:12:21.720 – 00:12:26.040
It's just here the, what is plotted is missing.

Participant F 00:12:27.480 – 00:12:31.320
Is missing the hot water demand is not in this graph and.

Participant F 00:12:31.480 – 00:12:35.800
Missing the hitting as well hitting the month.

Miao, Yanwei 00:12:35.800 – 00:12:43.480
Can I, can I check? Can you scroll down a bit so that I can see your current energy system.

Miao, Yanwei 00:12:48.600 – 00:12:56.280
And do you mind, do you still remember whether you take the tank or the tank?

Participant F 00:12:56.280 – 00:12:58.200
I fixed the hotwater changes.

Miao, Yanwei 00:12:58.200 – 00:13:00.240
Okay, thank you.

Participant F 00:13:00.840 – 00:13:02.680
Yeah, it doesn't show.

Miao, Yanwei 00:13:02.680 – 00:13:11.000
No, I think maybe, maybe we didn't update of the web service, then maybe there is some bugs again.

Miao, Yanwei 00:13:14.520 – 00:13:16.120
This is the concept.

Participant F 00:13:16.120 – 00:13:16.760
Yeah, yeah, yeah.

Participant F 00:13:18.760 – 00:13:23.160
I think it's good, but just, yeah, just to, to let you know, so here it should.

Participant F 00:13:24.520 – 00:13:27.960
And what I think it would be cool if you.

Participant F 00:13:30.200 – 00:13:35.320
So right now we have not the same access if we have the same access or maybe.

Participant F 00:13:38.520 – 00:13:48.760
If, if you create one graph and you have Ingray in the background, the current demand, and then the new demand on top of it with colors.

Participant F 00:13:50.160 – 00:13:51.960
To show a difference.

Miao, Yanwei 00:13:51.960 – 00:14:02.120
You mean the way how we show it now it doesn't have so constructed comparison.

Miao, Yanwei 00:14:04.120 – 00:14:08.600
So if they would be in one graph, it would be easier to identify.

Participant F 00:14:11.200 – 00:14:21.200
Probably maybe, but then again, it's difficult for, for electricity usage because when you switch from a gas pilot to a heat pump, you have much high electricity.

Participant F 00:14:22.040 – 00:14:27.080
So I think either, you have two.

Participant F 00:14:28.440 – 00:14:36.120
Because you should also show them gas consumption, oil consumption org or C- two savings in a different graph.

Participant F 00:14:36.800 – 00:14:42.520
Because when you switch to a hit one, then it should go on the one side to savings, should go up or.

Participant F 00:14:43.800 – 00:14:48.920
Emission should go down whenever you print, and then the electricity consumption goes up.

Miao, Yanwei 00:14:50.280 – 00:14:58.400
Is it possible to also calculate the consumption of oil.

Participant F 00:14:59.160 – 00:15:02.360
And it should be in the model.

Miao, Yanwei 00:15:02.360 – 00:15:06.200
Okay, all right. Makes sense.

Participant F 00:15:06.560 – 00:15:11.320
If you take notes something we will have a, probably a meeting.

Participant F 00:15:13.320 – 00:15:14.440
Information.

Miao, Yanwei 00:15:15.800 – 00:15:17.880
It's okay, it's good.

Participant F 00:15:22.200 – 00:15:23.480
Yeah, yeah.

Miao, Yanwei 00:15:24.120 – 00:15:29.000
Yes, but you have gone through all the pages, but like the critical pages.

Participant F 00:15:31.800 – 00:15:36.800
I mean, here we have everything and there's a lot more prev.

Participant F 00:15:40.120 – 00:15:44.600
Can I include the calling system here? Now?

Miao, Yanwei 00:15:45.560 – 00:15:47.800
You mean excluding the hitting.

Participant F 00:15:48.040 – 00:15:50.360
Including include calling system.

Miao, Yanwei 00:15:50.360 – 00:15:52.920
The coolings are no, no.

Participant F 00:15:53.680 – 00:15:56.760
I cannot, I cannot do this in afterwards, right?

Miao, Yanwei 00:15:56.760 – 00:15:59.480
Yes, because we.

Miao, Yanwei 00:16:00.760 – 00:16:02.520
Don't recommend you do.

Participant F 00:16:03.920 – 00:16:04.440
More energy.

Participant F 00:16:07.040 – 00:16:08.880
Cooling is recommended.

Miao, Yanwei 00:16:08.920 – 00:16:19.240
Yeah, so if you have a cooling system, we would just like to calculate the cooling system inside, but if you don't have one, then we don't recommend you to add one.

Miao, Yanwei 00:16:21.080 – 00:16:21.720
Yes, yes.

Participant F 00:16:21.720 – 00:16:24.800
Seven hundred eighteen and.

Miao, Yanwei 00:16:26.840 – 00:16:38.200
By the very unfortunately I think we made some problems with the, the current data that one, why doesn't it show the other bars.

Participant F 00:16:38.360 – 00:16:41.520
Yeah, here's a, here's.

Miao, Yanwei 00:16:42.840 – 00:16:44.760
Yes, I gonna check.

Participant F 00:16:45.520 – 00:16:50.440
Chose here to extract using this on solid dependent on the electricity.

Participant F 00:16:51.200 – 00:16:53.720
So, you know, here we show electricity demands.

Participant F 00:16:54.800 – 00:17:06.520
Because yeah, it's all, we show it it. So for this instance, this is also electricity in Mandia times. I don't know, the hit pump, is probably free.

Miao, Yanwei 00:17:09.720 – 00:17:13.040
The hot water you, you meant.

Participant F 00:17:14.280 – 00:17:14.839
Is supposed.

Participant F 00:17:16.160 – 00:17:21.040
Yeah, it's, you not water results in here.

Miao, Yanwei 00:17:21.880 – 00:17:25.079
Okay, I'll check it later to see.

Participant F 00:17:25.880 – 00:17:34.040
Send, it should also be, I think this is, this is nice to compare current simulate, maybe not put it in one bar. One chart.

Participant F 00:17:35.440 – 00:17:37.880
Showed it the charts have the same.

Miao, Yanwei 00:17:38.000 – 00:17:39.160
Unit, you mean.

Participant F 00:17:39.160 – 00:17:51.320
Same, same unit, same yxs, and also show the same things and I don't know about C- two emissions or savings of gas or whatever.

Participant F 00:17:54.840 – 00:17:55.800
That's another.

Miao, Yanwei 00:17:56.200 – 00:18:04.760
You think co- two emission? It's why is it important for you to be consistent?

Participant F 00:18:04.760 – 00:18:17.560
I think, I think it's, it's a good selling point to do, for example, switch to a heat a heat come because when you switch from a gas boiler.

Participant F 00:18:21.440 – 00:18:31.000
Electricity is much lower. So people could think, oh, guess what is actually better because they use less electricity, right? And there's no.

Miao, Yanwei 00:18:31.000 – 00:18:32.280
Yes, yes.

Participant F 00:18:32.280 – 00:18:35.280
There's not nothing that tells you.

Participant F 00:18:37.080 – 00:18:46.080
Yeah, I guess you think only goes up because the Pvs used for, for pitting with the.

Miao, Yanwei 00:18:47.760 – 00:18:55.320
But if you, if you see the energy Bill, so if you see the bell.

Miao, Yanwei 00:18:56.080 – 00:19:03.640
It's actually like way lower than the current will be.

Participant F 00:19:04.640 – 00:19:06.120
Yeah, true.

Participant F 00:19:07.480 – 00:19:10.040
This, this is a huge difference that's true.

Miao, Yanwei 00:19:10.680 – 00:19:14.120
And not that visible, I have to admit.

Participant F 00:19:15.160 – 00:19:19.000
I mean, you know, it is visible, I think.

Participant F 00:19:20.280 – 00:19:21.560
To think it's cool.

Miao, Yanwei 00:19:24.760 – 00:19:30.520
And there's actually one more page. I don't know if you have noticed if you go down.

Miao, Yanwei 00:19:31.280 – 00:19:33.720
Yes, the green page. Yes, the cart.

Participant F 00:19:34.360 – 00:19:37.160
Oh, I'm just new christma.

Miao, Yanwei 00:19:37.560 – 00:19:50.920
Yes, and these are some additional information regarding climate change and what you can do as individual households to save some energy for your house.

Miao, Yanwei 00:19:54.200 – 00:19:57.640
But it's just like some additional information.

Miao, Yanwei 00:20:01.240 – 00:20:05.120
Yes, yes, now you've gone through all the pages.

Participant F 00:20:17.360 – 00:20:18.480
Okay.

Miao, Yanwei 00:20:19.920 – 00:20:24.760
All right, so do you have any questions regarding the interfaces?

Participant F 00:20:28.880 – 00:20:31.120
That's pretty clear to.

Miao, Yanwei 00:20:32.080 – 00:20:37.800
And then shall we start with the, the questions, the remaining questions.

Miao, Yanwei 00:20:38.480 – 00:20:39.120
Okay.

Participant F 00:20:39.920 – 00:20:42.320
Should I start? I'll stop sharing my SC.

Miao, Yanwei 00:20:42.560 – 00:20:49.920
Yes, you can stop sharing. So how do you feel about the recommendation provided?

Miao, Yanwei 00:20:53.840 – 00:20:59.320
So do you find those recommendations useful or valuable?

Participant F 00:21:00.920 – 00:21:11.120
Yeah, I like, I like to difference between the cost cost benefit choice and minimum energy build thing.

Miao, Yanwei 00:21:11.160 – 00:21:21.800
Okay, good, and are you considering investing in any of the recommendation like recommended technologist there?

Participant F 00:21:24.560 – 00:21:25.840
Personally, I can't.

Participant F 00:21:29.680 – 00:21:38.000
My parents are considering it and they will probably check again, they will go for a PV system, which is around five Kilow Peak.

Participant F 00:21:39.680 – 00:21:42.200
The smart Energy Management system.

Participant F 00:21:45.040 – 00:21:48.920
I actually don't know what is on the market yet. What kind of smart.

Miao, Yanwei 00:21:50.240 – 00:21:57.840
So you, you meant that you also used your parents' house situation to do the testing, right?

Miao, Yanwei 00:21:59.120 – 00:22:19.600
And I think according to the recommendation, it didn't actually say that installing a PV can be most cost benefit because actually, the investment is a little bit more than the energy that you can save the money you can save from saving the energy.

Participant F 00:22:20.320 – 00:22:28.400
But I think I'm actually now that I think about it adding a PV system, if I actually load peak, it should have, I should have positive.

Participant F 00:22:30.520 – 00:22:32.400
Take a positive payback.

Miao, Yanwei 00:22:33.040 – 00:22:42.000
It, it does like it saves your energy, like the total energy bell, but actually your investment into.

Participant F 00:22:45.240 – 00:23:00.400
It shouldn't be that way. I think for PV, maybe right now the prices are high, but still after usually PV is for households, depending on if you use energy, if you're a top working from home or if anyone is at home using that electricity.

Participant F 00:23:04.440 – 00:23:10.160
I know from the market that people, especially with subsidies, I mean, subsidies are not included. Red.

Miao, Yanwei 00:23:12.080 – 00:23:12.720
I guess not.

Participant F 00:23:13.360 – 00:23:17.200
Yeah, I mean we could also read maybe a note.

Participant F 00:23:20.520 – 00:23:24.080
Subsidize PV, then it's a huge benefit.

Miao, Yanwei 00:23:25.640 – 00:23:30.000
But like this will be different in different countries, right?

Participant F 00:23:30.000 – 00:23:35.120
This would be different in different countries and even within countries in different regions, it's different.

Participant F 00:23:36.720 – 00:23:48.560
Depends on where you live how much PV subsidized in Australia as well in Vienna, you get subsidies and all up to fifty percent. I think, I don't know. I have to check.

Participant F 00:23:49.320 – 00:23:49.840
Suddenly.

Participant F 00:23:51.920 – 00:23:53.040
It's worth it was.

Participant F 00:23:53.880 – 00:24:02.000
For sure and isn't even without the subsidies, usually it's now with rising electricity prices, it's worth it.

Miao, Yanwei 00:24:02.000 – 00:24:10.480
Okay, so would you say, actually you have suspect to where's the recommendation.

Participant F 00:24:11.600 – 00:24:16.720
I think the recommendation is underestimating the cost Benef.

Participant F 00:24:20.120 – 00:24:20.560
I don't know.

Miao, Yanwei 00:24:23.760 – 00:24:39.120
So it's more like the, your suspect it's more towards the, the energy bell because you think there would be like, maybe, so it's from the government and then some, some other policies that can help the financial, those a bit lower.

Participant F 00:24:41.160 – 00:24:46.640
Annual investment cost could be lower for PB.

Miao, Yanwei 00:24:47.000 – 00:24:47.440
Specific.

Participant F 00:24:48.080 – 00:24:50.640
For the other systems, I have no idea.

Miao, Yanwei 00:24:50.640 – 00:25:04.680
All right, that's, that's great insight. Thank you for providing me that and what factors influence your decision to adopt or reject the recommendations.

Participant F 00:25:08.680 – 00:25:09.840
Good question.

Participant F 00:25:11.120 – 00:25:19.440
What I mean, I think for the lowest energy factors that probably the, the annualized cost.

Miao, Yanwei 00:25:21.400 – 00:25:23.280
Investment, yes.

Participant F 00:25:28.400 – 00:25:40.560
Yeah, maybe here I would have to play what, how much is the, if I exclude the battery system, we put the, oh, wait.

Participant F 00:25:41.840 – 00:25:44.280
The investment cost is not being updated.

Participant F 00:25:45.840 – 00:25:47.600
Screen again, one second.

Miao, Yanwei 00:25:48.480 – 00:25:51.800
Do you mean the simulation page?

Participant F 00:25:52.080 – 00:25:55.280
Yes, here if I have the battery.

Participant F 00:25:58.480 – 00:25:59.760
Energy business, five hundred.

Participant F 00:26:02.320 – 00:26:03.600
It's a backyard.

Participant F 00:26:04.240 – 00:26:08.720
Give it away. The investment cost is still the same.

Miao, Yanwei 00:26:09.080 – 00:26:11.360
A lot of bugs of the system.

Participant F 00:26:12.560 – 00:26:13.200
It should.

Miao, Yanwei 00:26:13.840 – 00:26:25.360
It can be less yes, but if you click the better assistant, yes, if you scroll down a little bit, you will find no, like within the Betterty system.

Miao, Yanwei 00:26:26.000 – 00:26:29.720
And in the end, there is an.

Miao, Yanwei 00:26:31.360 – 00:26:34.320
Inside here, and then there is a green text.

Participant F 00:26:34.320 – 00:26:35.600
Ah, here.

Miao, Yanwei 00:26:36.440 – 00:26:40.720
In the better resistant, this drop down menu.

Participant F 00:26:40.720 – 00:26:41.360
Yes.

Miao, Yanwei 00:26:41.560 – 00:26:48.400
There are some descriptions, right? If you change it, there is a green text.

Miao, Yanwei 00:26:49.320 – 00:26:50.320
At the bottom.

Miao, Yanwei 00:26:51.360 – 00:26:53.480
The analyzed cost.

Participant F 00:26:55.520 – 00:26:57.360
Course should be reduced from here.

Miao, Yanwei 00:26:57.360 – 00:27:03.760
Yes, I'm supposed to calculate it, but seems like there's a bug.

Participant F 00:27:05.680 – 00:27:08.240
Easy to create these pages. I know.

Miao, Yanwei 00:27:08.880 – 00:27:12.720
The system is not very mature. It's a bit immature yet.

Participant F 00:27:13.360 – 00:27:14.640
Yeah, yeah.

Participant F 00:27:15.920 – 00:27:21.040
Do you, how, how do you create this website with what, what are you using?

Miao, Yanwei 00:27:21.200 – 00:27:28.080
It's actually, we have a backend, Javas Javascript, again. I think.

Miao, Yanwei 00:27:31.320 – 00:27:36.400
All the data is supposed to be retrieved from the database we use the database.

Miao, Yanwei 00:27:38.320 – 00:27:46.640
Yes, we didn't directly apply the model, like we didn't directly send everything to the model and let the model calculate because.

Miao, Yanwei 00:27:47.280 – 00:27:47.920
Time.

Participant F 00:27:48.840 – 00:27:49.200
Yeah.

Miao, Yanwei 00:27:50.480 – 00:27:53.040
So they, they are all retrieved from the database.

Miao, Yanwei 00:27:56.880 – 00:28:01.560
But you found many problems already.

Participant F 00:28:04.280 – 00:28:08.400
It doesn't change. Yeah, okay, it never changes whatever.

Miao, Yanwei 00:28:09.040 – 00:28:12.720
Yeah, so you would say that the influence.

Miao, Yanwei 00:28:14.920 – 00:28:22.840
Financial related, either, it's like investment or the final total energy, those, those are the triggers.

Participant F 00:28:23.120 – 00:28:26.960
I mean, this is also what is basically shown here, right?

Miao, Yanwei 00:28:28.240 – 00:28:28.880
That's where we.

Participant F 00:28:31.440 – 00:28:36.000
That's why, that's why I said, maybe two savings could also be.

Participant F 00:28:37.280 – 00:28:40.000
Good point is something to point out...

Participant F 00:28:41.040 – 00:28:45.600
There's an addition of like benefit.

Miao, Yanwei 00:28:49.360 – 00:28:51.200
Oh, wait, then.

Miao, Yanwei 00:28:52.560 – 00:28:56.720
You know, why the recommendations were recommended to you.

Participant F 00:29:01.520 – 00:29:04.080
No, or what you mean.

Miao, Yanwei 00:29:05.160 – 00:29:23.960
Like, do you think the recommendations were, will be recommended to every user and the recommendations will be all similar recommendations or do you think this recommendations were recommended to you based on your previous input?

Miao, Yanwei 00:29:28.040 – 00:29:31.800
General recommendation or it's personalized recommendation.

Participant F 00:29:32.880 – 00:29:43.120
I think it's, it's personalized, but okay for the laws and attributes, I think it's very general because it just updates to the maximum of everything, right?

Participant F 00:29:46.560 – 00:29:50.160
Big battery, big PV renovative building.

Participant F 00:29:52.080 – 00:29:53.360
Energy management.

Miao, Yanwei 00:29:53.360 – 00:29:56.560
The technologies, they are the same.

Miao, Yanwei 00:29:57.200 – 00:29:59.240
Selection of technologies.

Miao, Yanwei 00:30:01.760 – 00:30:07.320
But the simulation and the sizes are chosen.

Miao, Yanwei 00:30:10.340 – 00:30:12.180
This personal list.

Participant F 00:30:12.180 – 00:30:16.020
Yeah, okay, so the cost benefit is personalized, right?

Miao, Yanwei 00:30:16.660 – 00:30:17.300
Yes, yes.

Participant F 00:30:19.460 – 00:30:21.780
The lowest investment, probably too.

Miao, Yanwei 00:30:23.140 – 00:30:24.340
All personalized actually.

Miao, Yanwei 00:30:25.500 – 00:30:30.100
Like for different households, the numbers are always different. So.

Miao, Yanwei 00:30:31.460 – 00:30:37.140
Yeah, we need to like play around with the numbers and then found those three recommendations, so they are.

Miao, Yanwei 00:30:39.700 – 00:30:46.100
Your situation, but did you realize that when you were doing it like before I tell you this.

Participant F 00:30:46.740 – 00:30:53.620
I think the, I think I realistic for the, for the safe, let the cost benefit. It's.

Participant F 00:30:53.780 – 00:30:58.900
I mean, it's a, you know, I didn't really think about it, but I think it's clear.

Miao, Yanwei 00:30:58.900 – 00:31:00.020
Okay.

Miao, Yanwei 00:31:02.900 – 00:31:09.980
Then it's continue and do you trust the recommendations? Why or why not.

Participant F 00:31:13.620 – 00:31:25.780
Yeah, I trust. So the cost benefit, I trust, I trust it. Yeah, I trusted, I mean, I already said that maybe the PV is a bit too expensive.

Participant F 00:31:26.420 – 00:31:28.300
Compared to savings.

Miao, Yanwei 00:31:28.540 – 00:31:35.220
Do you trust the recommendation? Do you think the model is correct or.

Participant F 00:31:37.300 – 00:31:46.260
Yes, and I also noted just because I'm in energy I worked in this field.

Participant F 00:31:46.900 – 00:31:53.300
I can somehow, let's say, say that this makes sense.

Miao, Yanwei 00:31:53.340 – 00:31:56.500
Okay, yes, that, that's important. Yeah.

Miao, Yanwei 00:31:57.780 – 00:32:04.980
And what factors contribute to your trust or a lack of trust in the recommendations?

Miao, Yanwei 00:32:10.580 – 00:32:20.180
If you don't trust the model, if you don't trust the recommendation, what would be the reason that you don't trust, and if you trust a lot of what.

Participant F 00:32:20.980 – 00:32:29.140
If I don't trust, it would be now because the, cost don't update and the charts don't show the same thing on the current simulation.

Miao, Yanwei 00:32:29.140 – 00:32:30.260
Yes.

Miao, Yanwei 00:32:33.740 – 00:32:36.180
The recommendation you think.

Participant F 00:32:36.180 – 00:32:38.100
The recommendation is fine. Now.

Miao, Yanwei 00:32:38.100 – 00:32:39.220
Okay.

Miao, Yanwei 00:32:41.980 – 00:32:48.940
So I guess you were very familiar with all the technologists before using the surveys already.

Participant F 00:32:50.420 – 00:32:53.020
Familiar, I mean, I, I.

Participant F 00:32:54.740 – 00:32:56.660
Worked on a model.

Miao, Yanwei 00:32:58.100 – 00:33:04.980
And did the system provide enough information for you to understand the technologies? You think.

Participant F 00:33:05.820 – 00:33:09.460
Yes, but I think I just found another thing that might be.

Participant F 00:33:15.900 – 00:33:17.140
Might be worth.

Participant F 00:33:19.180 – 00:33:22.260
And I go to this and I look at the energy build.

Participant F 00:33:24.820 – 00:33:29.940
I'm pretty sure this hitting since I have a boiler.

Miao, Yanwei 00:33:29.940 – 00:33:31.060
Yes.

Participant F 00:33:31.900 – 00:33:36.980
And this is electricity, this is the, this is electric direct heating.

Participant F 00:33:38.260 – 00:33:50.140
So maybe we need to either show that we have a tank with direct electricity that this is, this is basically.

Participant F 00:33:50.500 – 00:33:55.540
Estimated, or this is that we think we have this...

Participant F 00:34:00.660 – 00:34:02.580
Otherwise, this wouldn't be possible, right?

Miao, Yanwei 00:34:03.420 – 00:34:10.460
Do you mean like, if you scroll down a little bit, there is a small information there.

Miao, Yanwei 00:34:12.220 – 00:34:20.820
Up a little bit and up still up like under, yes, under the energy demand.

Participant F 00:34:21.139 – 00:34:26.260
Yes, and no, no, this is not since it's all even on interest today.

Participant F 00:34:26.899 – 00:34:42.899
No, because we still, we show here electricity and they use doesn't know where this electricity comes from for heating, right? So this is heating electricity if we have electricity here, this is used for heating, but we have a gas boiler here and what the model does.

Miao, Yanwei 00:34:42.899 – 00:34:43.540
It.

Participant F 00:34:44.179 – 00:34:48.020
PB ELECTRICITY into heating because we have a hot water tank.

Participant F 00:34:49.300 – 00:34:58.260
And this needs to be explained either because Somehouses won't have this if they have PV installed, So.

Participant F 00:35:00.260 – 00:35:07.740
That's basically not something that we need to distinguish buildings with, and without direct electricity.

Miao, Yanwei 00:35:08.500 – 00:35:15.180
Okay, yes, okay. It's because you have a tank queries because you.

Participant F 00:35:15.580 – 00:35:16.820
Because we have a tank.

Miao, Yanwei 00:35:16.860 – 00:35:17.460
Okay, yeah.

Participant F 00:35:17.460 – 00:35:25.140
And the model can use surplus PV electricity, instead of selling it to the grid to hit the to heat the.

Participant F 00:35:26.060 – 00:35:32.820
Direct electricating, but this is a- this is not implemented in every hot water time as far as I know.

Miao, Yanwei 00:35:36.020 – 00:35:38.420
There are a lot of things to clarify.

Miao, Yanwei 00:35:41.140 – 00:35:44.540
Thank you, thank you for letting me know.

Participant F 00:35:45.620 – 00:35:46.260
No, wor.

Participant F 00:35:48.180 – 00:35:49.460
It's a lot of work.

Miao, Yanwei 00:35:54.180 – 00:36:02.260
Do you believe that adopting this technology can lead to lower energy costs? I thank you. You answered that.

Miao, Yanwei 00:36:09.940 – 00:36:13.780
Yeah, then I guess all the questions were answered.

Participant F 00:36:13.780 – 00:36:14.900
Perfect.

Miao, Yanwei 00:36:15.700 – 00:36:17.540
Thank you very much.

Participant F 00:36:20.260 – 00:36:21.460
Yeah, thank you too.

Miao, Yanwei 00:36:22.100 – 00:36:31.700
And do you have any additional thoughts or concerns regarding the system or recommendations besides what you already told me?

Participant F 00:36:33.060 – 00:36:35.540
How you set up the pages is really nice.

Miao, Yanwei 00:36:35.580 – 00:36:36.980
Thank you.

Participant F 00:36:37.460 – 00:36:40.020
So you, you study.

Miao, Yanwei 00:36:40.940 – 00:36:42.580
Computer interaction.

Participant F 00:36:43.340 – 00:36:47.700
Yeah, so, so it's also this, you, you use some design, the red.

Participant F 00:36:49.620 – 00:36:50.260
Yeah, that's nice.

Miao, Yanwei 00:36:50.260 – 00:36:57.300
But obviously, there are some, some more things to be explained in more detail obvious.

Participant F 00:36:59.220 – 00:37:08.180
Yeah, but, but from the, from the, what do you say, visual aspects? It's unlike it.

Miao, Yanwei 00:37:08.820 – 00:37:13.260

As it is clear enough for you to understand that.

Participant F

Miao, Yanwei 00:00:02.060 – 00:00:10.260 And you should be able to see that it's in progress exam. All right, then shall we start.

Miao, Yanwei 00:00:11.660 – 00:00:20.500 I will first ask some very simple demographical questions. So would you like to tell me your gender and your age?

Participant G 00:00:21.580 – 00:00:25.700 I'm twenty- eight

Miao, Yanwei 00:00:27.020 – 00:00:32.740 And May, I know your educational background, like what major, what are you studying?

Participant G 00:00:33.460 – 00:00:35.300 It was electrical engineering.

Miao, Yanwei 00:00:35.300 – 00:00:39.140 Okay, but you also use Python.

Participant G 00:00:40.460 – 00:00:41.060 Okay.

Miao, Yanwei 00:00:42.340 – 00:00:44.260 And your current occupation.

Participant G 00:00:45.020 – 00:00:48.020 I'm a research a totally unspark.

Miao, Yanwei 00:00:48.100 – 00:00:51.300 Okay, and, and what area you.

Participant G 00:00:51.300 – 00:00:53.220 Now energy systems.

Miao, Yanwei 00:00:53.260 – 00:00:55.700 Okay, related.

Participant G 00:00:55.860 – 00:00:56.420 Definitely.

Miao, Yanwei 00:00:57.700 – 00:01:04.339 And May, I know your knowledge and your interesting AI like artificial intelligence.

Participant G 00:01:04.820 – 00:01:09.220 Yes, I'm interested in this topic, but I think it's a really difficult topic.

Participant G 00:01:10.220 – 00:01:13.900 To bring it into reality in some real products.

Miao, Yanwei 00:01:16.260 – 00:01:20.380 And what about your knowledge and interest in the energy domain?

Participant G 00:01:22.660 – 00:01:24.580 So once again, what do you mean by this question?

Miao, Yanwei 00:01:25.260 – 00:01:36.100 Your knowledge and your interest in the energy domain, like whatever are things related to energy. Do you think you have much knowledge and interest in it?

Participant G 00:01:36.740 – 00:01:41.220 Yes, I think I have a lot of knowledge. Yeah, it's in progress.

Participant G 00:01:43.140 – 00:01:48.260 Because I want to learn more and more about this, but I think I already have a good knowledge about it.

Miao, Yanwei 00:01:48.900 – 00:01:57.220 Perfect and have you heard about energy efficient appliances or renewable and energy technologies for households?

Participant G 00:01:57.940 – 00:01:59.060 Definitely.

Miao, Yanwei 00:01:59.780 – 00:02:04.100 And have you ever considered implementing those technologies?

Participant G 00:02:04.900 – 00:02:10.660 Yeah, I installed on the house of my family months ago, PV system.

Miao, Yanwei 00:02:11.300 – 00:02:19.220 Ah, okay, and what is your understanding regarding the benefits of energy efficient technologies.

Participant G 00:02:20.300 – 00:02:31.140 We can use the advantages of this technologies to save money and make the product more directive. That's my way of thinking for this.

Miao, Yanwei 00:02:31.180 – 00:02:45.220 Ah, so you mean like it actually are appealing. So the customers if they want to buy such a thing, but it's still more like a financial related appealing. You mean.

Participant G 00:02:46.140 – 00:02:56.100 I think the biggest driver of people is economic sing a way of thinking, and if we can make, for example, in heat Mark direct by saving money.

Participant G 00:02:56.860 – 00:02:59.300 People will install them more and more.

Miao, Yanwei 00:03:02.020 – 00:03:07.780 So do you know about climate change and why is it important for individuals?

Participant G 00:03:08.300 – 00:03:17.220 Yeah, so we need the climate sense. Otherwise we haven't hired temperature and it would not be able to survive to be concrete.

Miao, Yanwei 00:03:19.780 – 00:03:26.500 So you've already answered all the pre- questions and now I'm going to send you a link.

Miao, Yanwei 00:03:28.740 – 00:03:38.180 Wait a second. And then you would need to use the service and try to find the recommendations for your situation.

Miao, Yanwei 00:03:39.620 – 00:03:45.620 Are you, are you working? Are you living in a single family house?

Participant G 00:03:46.660 – 00:03:50.500 Yes, partly I'm living in a single family house for my parents. Yes.

Miao, Yanwei 00:03:50.580 – 00:03:56.900 Okay, so you can use your parent, like the, the house you are living in.

Participant G 00:03:56.900 – 00:03:58.180 Exactly, yes.

Miao, Yanwei 00:04:00.140 – 00:04:03.260 And did you get the link?

Participant G 00:04:03.300 – 00:04:06.140 I guess currently loading.

Participant G 00:04:07.460 – 00:04:10.820 To me, it's an external link.

Miao, Yanwei 00:04:12.260 – 00:04:15.780 There's no security thing installed yet.

Participant G 00:04:16.100 – 00:04:18.220 Sure if it is working.

Miao, Yanwei 00:04:18.660 – 00:04:19.780 Okay.

Participant G 00:09:05.380 – 00:09:07.300 It's security issue.

Miao, Yanwei 00:09:08.580 – 00:09:09.700 Yeah.

Participant G 00:09:11.940 – 00:09:13.700 Now we can start, should I share my.

Miao, Yanwei 00:09:14.380 – 00:09:16.900 It would be good to share the screen. Please.

Participant G 00:09:16.940 – 00:09:18.060 Okay.

Miao, Yanwei 00:09:19.580 – 00:09:26.940 During, during the testing, you could just say anything just think out loud say anything you.

Participant G 00:09:30.580 – 00:09:32.900 Information, I already knew the screen.

Participant G 00:09:34.180 – 00:09:39.580 I'm going to send it to me. I saying three months ago and I often checked.

Participant G 00:09:40.660 – 00:09:43.780 Content, because I know the background, what is there?

Miao, Yanwei 00:09:46.340 – 00:09:50.220 And actually the display looks a bit weird.

Participant G 00:09:50.820 – 00:09:52.020 All right.

Participant G 00:09:54.020 – 00:09:56.780 Let's see, maybe maybe something changed.

Miao, Yanwei 00:09:59.780 – 00:10:03.180 Maybe something changed, but in the background. so.

Participant G 00:10:25.540 – 00:10:26.660 This.

Participant G 00:10:49.860 – 00:10:55.620 Until now there's no energy management system in the building, but I'm working on it.

Miao, Yanwei 00:10:55.620 – 00:11:00.100 Okay, so you have like something in mind what to invest already...

Participant G 00:11:00.100 – 00:11:01.220 Yeah.

Participant G 00:11:04.300 – 00:11:09.700 Now it's working really fast some weeks ago. I tried, I was not working this fast.

Miao, Yanwei 00:11:12.260 – 00:11:23.740 Because we use database, so we have already rendered all the results, so it's faster if we directly take it from database, instead of putting them into the model.

Participant G 00:11:24.140 – 00:11:29.540 So you generate all the results into the database and now it's looking up the results in the database...

Participant G 00:11:30.340 – 00:11:33.380 Optimizes not running every time separately.

Miao, Yanwei 00:11:33.420 – 00:11:36.580 Exactly, that's why it's way faster now.

Participant G 00:11:37.540 – 00:11:38.500 Makes sense.

Miao, Yanwei 00:11:44.260 – 00:11:49.940 The understand the page where just let me know whatever you are thinking right now.

Participant G 00:12:00.260 – 00:12:04.740 Just looking at what the differences between these numbers are.

Miao, Yanwei 00:12:06.300 – 00:12:13.580 You mean, you are checking the configurations where you are checking, the only, the, the energy prices.

Participant G 00:12:17.540 – 00:12:21.500 Cost, and if it's lowering energy cost, ah, okay.

Participant G 00:12:36.900 – 00:12:40.580 Also, the renovation of the building included in this case.

Miao, Yanwei 00:12:44.420 – 00:12:47.100 In this recommendation, it is.

Miao, Yanwei 00:13:18.980 – 00:13:22.180 Why are you checking all of the recommendations?

Participant G 00:13:23.500 – 00:13:25.380 I'm just interested in it.

Participant G 00:13:31.820 – 00:13:33.700 Now interesting, okay, cool.

Participant G 00:13:36.260 – 00:13:38.820 What is the next step? Now?

Miao, Yanwei 00:13:40.780 – 00:13:59.300 Actually you've already gone to most of the pages, but you can, there's one more page that you missed, but it's not so important. It's the green card if you see it. Yes, and this one is, it has some, like additional information regarding climate change and.

Miao, Yanwei 00:13:59.340 – 00:14:12.140 Regarding how to save energy as an individual as like human behaviors, how to, how to save a bit more, but it's just additional information.

Miao, Yanwei 00:14:14.660 – 00:14:33.860 If you have, if you think you have finished using the service and you think there's nothing confused you, you could, we could directly move on to answering the questions and maybe we can also like, during asking questions, you can like always jump back.

Participant G 00:14:35.780 – 00:14:36.420 Okay, so.

Participant G 00:14:37.060 – 00:14:50.500 Just to me for the understanding if I now install the Smart Energy Management system, I can save four hundred thirty- one Euro, if I install it together with the battery system, it's nine hundred forty- seven euro.

Participant G 00:14:51.140 – 00:14:58.180 And if I install it inclusively renovation of the building and the twenty Kilor, what our storage.

Participant G 00:14:58.820 – 00:15:00.740 Thousand three hundred forty- five hero.

Miao, Yanwei 00:15:01.380 – 00:15:02.500 Exactly.

Participant G 00:15:02.660 – 00:15:03.780 Okay.

Miao, Yanwei 00:15:16.100 – 00:15:32.940 And I don't, I don't know if you have realized that if you click more detail in any of the recommendations. Yes, and then you will see like the simulated energy system, you can actually adjust it according to your.

Miao, Yanwei 00:15:35.380 – 00:15:36.580 Whatever you want.

Participant G 00:15:36.620 – 00:15:37.860 Oh, okay, yeah, yeah.

Miao, Yanwei 00:15:37.980 – 00:15:46.500 You can actually, yes adjust it and then you just need to click update again, So that's everything will be reloaded again.

Participant G 00:15:47.580 – 00:15:48.700 Okay.

Participant G 00:16:21.420 – 00:16:23.300 Okay, good.

Participant G 00:16:23.940 – 00:16:33.540 I think it changed some parameters because some months ago there was some input of square meters of the building and some more detailed parameters, right?

Miao, Yanwei 00:16:34.180 – 00:16:36.740 Yes, we've simplified the questions.

Participant G 00:16:36.820 – 00:16:38.020 I think that's good.

Miao, Yanwei 00:16:39.300 – 00:16:43.740 So you prefer to like answer a few questions.

Miao, Yanwei 00:16:44.420 – 00:16:47.620 Okay, nice to know that.

Participant G 00:16:48.260 – 00:16:58.500 I think there's some... yeah, I think for me it's possible to answer in detail and also be interesting, but for other people who are not on this topic.

Participant G 00:16:59.500 – 00:17:02.340 For them to have not so deep questions.

Miao, Yanwei 00:17:03.620 – 00:17:21.540 That's also what we thought about because we also wanted to simplify the inputs of the model so that we don't need to calculate too much for the database. So we want to keep the database simple...

Miao, Yanwei 00:17:22.819 – 00:17:26.339 So we also reduce questions because of that.

Participant G 00:17:27.300 – 00:17:28.580 Ah, okay.

Miao, Yanwei 00:17:34.980 – 00:17:42.140 And do you think the estimate of your current bill is correct? Like somewhat.

Participant G 00:17:43.300 – 00:17:48.420 This just give me one minute. I make a rough estimation.

Participant G 00:17:49.700 – 00:17:51.620 I don't pay it. So.

Participant G 00:18:00.060 – 00:18:04.980 Yeah, I think it's okay because I know how it is calculated.

Miao, Yanwei 00:18:05.700 – 00:18:09.540 Because you, you know, the models are you think it's correct.

Participant G 00:18:10.180 – 00:18:12.740 I think we did our best.

Miao, Yanwei 00:18:13.380 – 00:18:17.220 All right, so shall we move on to the questions?

Participant G 00:18:17.220 – 00:18:18.500 Yeah, we can go on.

Miao, Yanwei 00:18:18.540 – 00:18:25.380 Okay, okay, so first question, how do you feel about the recommendations provided?

Participant G 00:18:26.860 – 00:18:35.140 I think it's a good research to have to knowledge that this system or this technology can help saving money.

Participant G 00:18:36.420 – 00:18:56.900 And as I said, most are the biggest driver for having renewables in our system. We have to save money with the technologies, otherwise the people won't install it and to show them directly if you install this, this combination, you can save, maybe.

Participant G 00:18:57.100 – 00:18:59.460 Hundred or four hundred ybro, in my case.

Miao, Yanwei 00:18:59.460 – 00:19:00.100 And I think.

Participant G 00:19:01.860 – 00:19:07.140 To make it really easy and give concrete information or concrete results to the building.

Miao, Yanwei 00:19:07.180 – 00:19:21.900 Thank you, so you feel like the recommendation provided to you or correct, like, according to your expertise that you think the recommendations were.

Participant G 00:19:22.620 – 00:19:28.900 The only critical thing, what maybe I'm thinking is the renovation of the building.

Participant G 00:19:30.820 – 00:19:40.420 It could cost a lot of money and maybe one parameter, what is missing is not only the, the annual cost for the renovation.

Participant G 00:19:41.700 – 00:20:02.180 Also, or maybe people are interested how much do I have to pay for this renovation? Because the renovation I don't know exactly what is the years behind the renovation? Maybe fifty years you calculated it, but if I know. okay, now I have to pay one hundred thousand euro for two renovate my building. I have.

Participant G 00:20:02.260 – 00:20:07.300 To take some debts or. Yeah, it's not easy to take one hundred thousand Euro.

Miao, Yanwei 00:20:08.740 – 00:20:17.020 You have a point and do you find the recommendation useful or valuable.

Participant G 00:20:17.100 – 00:20:19.300 Yeah, definitely, yeah.

Miao, Yanwei 00:20:20.940 – 00:20:22.060 Why.

Participant G 00:20:22.820 – 00:20:27.940 That's as I said to, to see the concrete numbers, how much is possible to.

Miao, Yanwei 00:20:29.220 – 00:20:42.020 Yes, and are you considering investing in those technologies? The recommendation provided because you already thought about investing in some of them.

Participant G 00:20:42.660 – 00:20:43.300 Yeah, sorry.

Miao, Yanwei 00:20:44.580 – 00:20:50.980 But the recommendations, like they, they did they actually support something new.

Miao, Yanwei 00:20:52.260 – 00:20:53.540 A post.

Participant G 00:20:53.580 – 00:21:03.780 Yeah, so I think I'm thinking about installing a battery system and also a smart energy minutes management system for the building. Yeah.

Miao, Yanwei 00:21:03.780 – 00:21:07.500 And the recommendation also showed you this option.

Miao, Yanwei 00:21:08.900 – 00:21:14.020 Okay, and, and it's actually save you more the recommendation.

Participant G 00:21:16.580 – 00:21:19.140 Sorry, I didn't get this point.

Miao, Yanwei 00:21:20.540 – 00:21:24.740 The recommendation who's who, which.

Miao, Yanwei 00:21:26.460 – 00:21:39.860 Post which opposed a better assistant and a smart energy management system. Is this recommendation actually help you save more money than- than your investment?

Participant G 00:21:40.980 – 00:21:42.180 I hope so.

Participant G 00:21:43.180 – 00:21:45.380 This one will be the case. Yeah.

Miao, Yanwei 00:21:45.380 – 00:21:57.540 Because I, I forgot those recommendations. so I, I didn't, I didn't pay attention to, which was the recommendation that is, that contains those two configurations.

Participant G 00:21:58.180 – 00:22:02.660 The configuration was this model and the management system and the battery storage.

Miao, Yanwei 00:22:02.700 – 00:22:07.140 Yeah, and it's, it says it actually saves, you.

Participant G 00:22:08.420 – 00:22:12.900 So the model says it saves four hundred Euro per year.

Miao, Yanwei 00:22:12.900 – 00:22:19.820 Okay, and what about the annualized investment cost for this case?

Participant G 00:22:20.900 – 00:22:22.500 Let's check it again.

Participant G 00:22:26.980 – 00:22:33.940 I didn't realized investment cost is approximately five hundred six zero.

Miao, Yanwei 00:22:34.020 – 00:22:37.860 Yeah, so it's a little bit more than.

Participant G 00:22:38.500 – 00:22:41.620 The cost benefit or can shake in my screen.

Participant G 00:22:44.260 – 00:22:48.740 The cost benefit version of nine hundred forty- seven would be the.

Miao, Yanwei 00:22:50.020 – 00:22:51.380 Your Powerpoint.

Participant G 00:22:51.940 – 00:22:55.780 That's, yeah, also working on some energy management system.

Miao, Yanwei 00:22:56.420 – 00:22:57.060 I don't know.

Participant G 00:22:58.980 – 00:23:02.460 Okay, what kind of stop it here.

Participant G 00:23:06.020 – 00:23:07.940 Okay, what's the wrong screen?

Participant G 00:23:11.620 – 00:23:24.540 Oh, this one is it okay? Yeah, so I have the nine hundred forty- seven yes per year and approximately five hundred, six forty investment cost.

Miao, Yanwei 00:23:25.380 – 00:23:29.700 All right, so is it actually, yes, save quite a lot.

Miao, Yanwei 00:23:30.980 – 00:23:38.620 All right, so do you feel like now you are more confident investing those technologies.

Participant G 00:23:40.020 – 00:23:41.220 Definitely, I think.

Participant G 00:23:42.500 – 00:23:44.420 This is the information what people should know.

Miao, Yanwei 00:23:46.980 – 00:23:48.420 That's great.

Miao, Yanwei 00:23:49.540 – 00:23:50.660 So.

Miao, Yanwei 00:23:52.100 – 00:24:01.700 What factors influence your decision to adopt or reject the recommendations, but I think you answered, it was the economical reason, right?

Miao, Yanwei 00:24:02.460 – 00:24:04.180 Anything to add.

Participant G 00:24:06.900 – 00:24:10.660 Yeah, I personally will install it because I'm interested in the topic.

Participant G 00:24:11.940 – 00:24:22.820 I think the biggest driver is this economic thing, if it is not economic worth and it's hard to motivate people to do it.

Miao, Yanwei 00:24:23.060 – 00:24:27.300 In your own case, it's also the economical reason.

Miao, Yanwei 00:24:27.940 – 00:24:29.060 Okay.

Miao, Yanwei 00:24:30.500 – 00:24:35.980 And do you know why the recommendations were recommended to you?

Participant G 00:24:38.820 – 00:24:43.940 It's because at the moment we have a, so you mean the technical background of this.

Participant G 00:24:44.900 – 00:24:53.540 Yeah, so at the moment we have a large PV system and also have a consumption rate at home is at the moment of twenty- five percent.

Participant G 00:24:54.300 – 00:25:07.620 Means seventy- five goes to the grid and with the battery storage, we can increase it by twenty thirty percent and with this additional energy management system, hopefully we can increase it more.

Miao, Yanwei 00:25:08.260 – 00:25:14.020 Wow, you are really very familiar with all of those.

Miao, Yanwei 00:25:14.660 – 00:25:15.780 Percentage.

Participant G 00:25:16.580 – 00:25:20.420 Calculating and yes, I'm doing my PHD in this topic at the moment. So.

Miao, Yanwei 00:25:22.340 – 00:25:37.700 So you, you don't like, just see like how, how that energy actually were calculated based on your situation, but you can give exactly the same exact numbers of those energies. How they've gone through past.

Participant G 00:25:39.300 – 00:25:41.540 One question about what I am missing.

Participant G 00:25:42.180 – 00:25:46.020 But maybe this was definitely a decision by you and Saman.

Participant G 00:25:46.020 – 00:25:53.540 Why did you not include any electric vehicles? Is it too complicated? Because of the driving behavior profiles.

Miao, Yanwei 00:25:53.860 – 00:25:55.620 Which one electrical?

Participant G 00:25:56.260 – 00:25:58.820 Electric clinical, yes, car.

Miao, Yanwei 00:25:59.460 – 00:26:00.740 Ah, okay.

Miao, Yanwei 00:26:02.660 – 00:26:21.220 We, we did discuss that for quite a while, and then there were some always some problems like I was wondering whether I- if I say electrical cars, then should I ask for how many cars, and then the model only supports only one car.

Miao, Yanwei 00:26:28.900 – 00:26:48.100 I forgot the other reasons, but yes, and then we excluded, it's also for simplifying the models, the calculations in the database, and then we removed some of the, the parameters there in the models, but, you know, like.

Miao, Yanwei 00:26:48.740 – 00:27:03.460 My user testing, I actually realized the electrical vehicles is actually unimportant because there were some users who really do use electrical cars and then they actually ask me to add this.

Miao, Yanwei 00:27:04.340 – 00:27:17.220 Model, so, yeah, so like this is the first version I would say, and after all the testings and then we probably would do some second version and it's gonna be there. I guess.

Participant G 00:27:17.700 – 00:27:18.820 Okay, yeah.

Miao, Yanwei 00:27:18.820 – 00:27:25.060 And you ask for the electrical vehicle, was it because you also find it important...

Participant G 00:27:25.300 – 00:27:38.020 Yes, I think there's a big point. All right, this is a large point for the building in the future because you have additional two or three thousand kilobot hours on demand.

Participant G 00:27:39.380 – 00:27:48.900 Optimize the load you can optimize the charging time and I think this will be have a big impact on the calculation.

Miao, Yanwei 00:27:49.540 – 00:27:54.660 Ah, you may, especially with the smart Energy management system.

Miao, Yanwei 00:27:55.300 – 00:28:01.700 Okay, because of the, the different prices for different charging times.

Miao, Yanwei 00:28:04.900 – 00:28:08.500 That's important to know. Thank you for letting me know.

Participant G 00:28:09.500 – 00:28:10.020 Welcome.

Miao, Yanwei 00:28:11.300 – 00:28:15.180 I pay attention next time with my, the second version.

Participant G 00:28:16.420 – 00:28:21.540 Maybe if, if someone will use it, I don't know what Saman thinks about this.

Miao, Yanwei 00:28:22.820 – 00:28:31.140 He did, I mean, because he knows everything about that. So maybe for, for his version, he also find it fine.

Miao, Yanwei 00:28:31.900 – 00:28:43.500 Exclude the cars since maybe electrical cars are not so popular right now, it may be only ten percent of the population. I don't know. I don't know. The number.

Miao, Yanwei 00:28:44.580 – 00:28:45.860 But this could be.

Participant G 00:28:46.100 – 00:28:47.780 Less than ten, I think at the moment.

Miao, Yanwei 00:28:49.100 – 00:28:52.260 Okay, and maybe that's the reason why.

Miao, Yanwei 00:28:54.820 – 00:29:00.580 All right, so I guess you trust the recommendations, right?

Miao, Yanwei 00:29:02.500 – 00:29:08.020 And the reason you trusted because, you know, everything how it works.

Miao, Yanwei 00:29:09.540 – 00:29:15.140 That, that aligns with your expertise for sure. Yeah, and.

Miao, Yanwei 00:29:16.580 – 00:29:28.380 Are there anything that like what kind of factor that can actually contribute to lack of trust of this recommendations? in this case.

Participant G 00:29:30.660 – 00:29:35.140 To the lack of trust in the calculation. I think one.

Participant G 00:29:37.700 – 00:29:48.580 Yeah, but it's some model thing that you can only select your building here between some large gaps of years. So.

Participant G 00:29:49.860 – 00:30:04.580 Ough, estimation of the building and also not including the sizes. Yeah, maybe a rough estimation, but it's a good way between to go too complicated and to go to less complicated.

Participant G 00:30:05.860 – 00:30:08.420 That some person I think, but yeah.

Miao, Yanwei 00:30:09.460 – 00:30:12.420 Point true.

Miao, Yanwei 00:30:14.460 – 00:30:20.220 Then I guess you are also very familiar with all the technologies before using the system.

Miao, Yanwei 00:30:22.140 – 00:30:32.540 And do you think it actually provides you more information after using the system or enough information of those technologies.

Participant G 00:30:34.940 – 00:30:36.860 Do you mean the system in this case?

Miao, Yanwei 00:30:37.700 – 00:30:41.300 The system means the software, the web application.

Participant G 00:30:41.340 – 00:30:42.460 Okay.

Participant G 00:30:50.940 – 00:30:58.340 I'm part of systems. I think you have to know before the test, what, what it is about...

Miao, Yanwei 00:30:59.260 – 00:31:19.100 Yeah, well we try to like, make sure people who don't know about those technologies would be also able to understand them, but I think because, you know, them too. Well, so maybe the question doesn't fit to you because you don't have to read about those.

Miao, Yanwei 00:31:19.100 – 00:31:20.220 Explanation.

Miao, Yanwei 00:31:21.660 – 00:31:22.780 So.

Participant G 00:31:22.940 – 00:31:24.060 Okay.

Miao, Yanwei 00:31:24.220 – 00:31:25.540 Yes, yes.

Miao, Yanwei 00:31:26.780 – 00:31:33.820 And do you believe adopting these technologies can lead to a lower energy costs.

Miao, Yanwei 00:31:35.740 – 00:31:50.940 I bet so. All right, so I think you've answered all the questions. Do you have any additional concerns or thoughts or suggestions regarding this website?

Participant G 00:31:53.020 – 00:31:55.580 I just have some technical questions.

Miao, Yanwei 00:31:55.620 – 00:31:56.860 Yes, go ahead.

Participant G 00:31:57.500 – 00:32:08.380 Because I'm interested in it. How is the website now connected to some database and to the optimization in Python. So how is this done? is this.

Miao, Yanwei 00:32:09.020 – 00:32:14.180 At the back end, it's not written in Python. The backend is written in Javascript.

Participant G 00:32:14.780 – 00:32:16.060 So, okay.

Miao, Yanwei 00:32:16.700 – 00:32:25.660 Yes, and those only for the, the model, like the flex models output, it's the SQL light.

Miao, Yanwei 00:32:26.300 – 00:32:37.140 QR five and so that was script just try to like, sort out information from this SQL.

Miao, Yanwei 00:32:39.100 – 00:32:52.540 And yeah, there's nothing really technical. There's nothing connection between actually the, the front end and the model, it's only the front end with the, the database right now.

Participant G 00:32:52.540 – 00:33:00.220 Okay, so you have the, I think Saman has run the model and start the results and the results are now in this SQL database.

Participant G 00:33:01.740 – 00:33:03.420 Use it as a back- end.

Participant G 00:33:04.860 – 00:33:05.980 Interesting.

Miao, Yanwei 00:33:06.060 – 00:33:27.100 Because we also try to like, directly use the model and we realize that calculating once like, once scenario in the model, it takes like seven seconds and when the, when the, when we want to try to find those recommendations, we always need to run.

Miao, Yanwei 00:33:27.100 – 00:33:42.460 Hundreds or even thousands of scenarios to get the results. So each scenario takes seven seconds and it's a long time to wait. So we have to, like, think of some other ways to make it faster, and this is really way faster.

Miao, Yanwei 00:33:43.100 – 00:33:48.420 And, and like, we also like before.

Miao, Yanwei 00:33:50.460 – 00:34:00.380 Before this version, we actually present all the recommendations that are like a bit cheaper than your current energy bell.

Miao, Yanwei 00:34:01.020 – 00:34:21.500 And that will be also a lot of recommendations that will be like fifty or sixty- recommendations on the webpage and it looks really too much for a user. So we use those three techs, like the cost benefits and the lowest investment, and I think.

Miao, Yanwei 00:34:22.500 – 00:34:33.500 And lowest energy bell, like we use this three tech and then filter only those only these three from all the recommendations.

Participant G 00:34:34.300 – 00:34:34.940 Okay, yeah.

Miao, Yanwei 00:34:35.100 – 00:34:39.940 So now you can only see maximum three recommendations.

Miao, Yanwei 00:34:41.980 – 00:34:46.980 That's, that's how the whole backend works.

Participant G 00:34:47.340 – 00:34:50.940 I think that's a good way. Yeah, not too complicate it.

Miao, Yanwei 00:34:50.980 – 00:34:51.580 I hope so.

Miao, Yanwei 00:34:54.139 – 00:35:14.620 But then actually you could, you would miss some recommendations in there because they could actually also help you save some money, but we didn't show all of them there. Yeah, that's why we have this self-adjusting feature.

Miao, Yanwei 00:35:14.900 – 00:35:31.900 So that you can like do a little bit of adjustment and then see whether this will also help you more like, if you don't want to directly invest all of them, you can like untink some technology and see whether this is gonna work also better than your current situation.

Participant G 00:35:32.620 – 00:35:33.740 Yeah.

Miao, Yanwei 00:35:33.820 – 00:35:37.020 And this is the concept behind.

Participant G 00:35:37.100 – 00:35:38.300 Okay, cool.

Miao, Yanwei 00:35:39.580 – 00:35:41.860 Did I answer your question?

Participant G 00:35:42.140 – 00:35:42.780 Sure.

Miao, Yanwei 00:35:44.060 – 00:35:45.340 All right.

Bibliography

- [1] Ameli, Nadia and Nicola Brandt. “Determinants of households’ investment in energy efficiency and renewables: evidence from the OECD survey on household environmental behaviour and attitudes,” *Environmental Research Letters*, 10(4):044015 (apr 2015).
- [2] Anderson, Allison. “Climate Change Education for Mitigation and Adaptation,” *Journal of Education for Sustainable Development*, 6(2):191–206 (2012).
- [3] Bertram, Christoph, et al. “Energy system developments and investments in the decisive decade for the Paris Agreement goals,” *Environmental Research Letters*, 16(7):074020 (jun 2021).
- [4] Brugger, Heike, et al. “Energy Efficiency Vision 2050: How will new societal trends influence future energy demand in the European countries?,” *Energy Policy*, 152:112216 (2021).
- [5] Consentec, Fraunhofer ISI, Stiftung Umweltenergierecht. “Batteriespeicher in Netzen - Schlussbericht. im Auftrag des Bundesministerium für Wirtschaft und Energie (BMWi),” (33/18) (April 2021).
- [6] Danish Energy Agency, “Technology Data.” <https://ens.dk/en/our-services/projections-and-models/technology-data>, 2023.

- [7] Devsoft Baltic OÜ, “Open-Source JavaScript Form Builder Libraries.” <https://surveyjs.io/>, 2023.
- [8] Energieabc, “Energieaudit.” <https://energieabc.at/energieaudit/>, 2023.
- [9] Energize Connecticut, “Home Energy Solutions.” <https://energizect.com/energy-evaluations/HES>. Accessed: 2023-05-15.
- [10] Energy saver, “Professional Home Energy Assessments.” <https://www.energy.gov/energysaver/professional-home-energy-assessments>. Accessed: 2023-05-15.
- [11] European Commission, “PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM.” <https://re.jrc.ec.europa.eu/pvg-tools/en/>. Accessed: 2023-05-16.
- [12] European Commission, “A Clean Planet for All. A European Long-Term Strategic Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy,” 2018.
- [13] European Commission, “Climate change mitigation and adaptation,” 2021.
- [14] Eurostat, “Energy consumption in households.” https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_consumption_in_households, 2023.
- [15] FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND CLIMATE ACTION, “Energy audits and energy checks for private households.” <https://www.bmwk.de/Redaktion/EN/Artikel/Energy/energy-consulting-for-households.html>, 2023.

- [16] Federal Office for Economic Affairs and Export Control, “Energy.” <https://www.bafa.de/EN/Energy/energy.html>, 2023.
- [17] Fernando, Martins, et al. “The Role of Electrification in the Decarbonization of the Energy Sector in Portugal,” *Energies*, 15(5) (2022).
- [18] Fogg, BJ. “A Behavior Model for Persuasive Design.” *Proceedings of the 4th International Conference on Persuasive Technology*. Persuasive '09. New York, NY, USA: Association for Computing Machinery, 2009.
- [19] Fraunhofer ISI, “NewTRENDS: New trends in energy demand modeling,” 2023.
- [20] GERRING, JOHN. “What Is a Case Study and What Is It Good for?,” *American Political Science Review*, 98(2):341–354 (2004).
- [21] Google, “Display live data on your site.” <https://developers.google.com/chart>, 2023.
- [22] Gunning, David and David Aha. “DARPA’s Explainable Artificial Intelligence (XAI) Program,” *AI Magazine*, 40(2):44–58 (Jun. 2019).
- [23] Herring, Horace and Robin Roy. “Technological innovation, energy efficient design and the rebound effect,” *Technovation*, 27(4):194–203 (2007).
- [24] Highcharts, “Simply Visualize.” [urlhttps://www.highcharts.com](https://www.highcharts.com), 2023.
- [25] Hinz, Eberhard. “Kosten energierelevanter Bau- und Anlagenteile bei der energetischen Modernisierung von Altbauten,” *Institut Wohnen und Umwelt* (2015).
- [26] Hummel, M., et al. “The costs and potentials for heat savings in buildings: Refurbishment costs and heat saving cost curves for 6 countries in Europe,” *Energy and Buildings*, 231:110454 (2021).

- [27] IEA, “The Critical Role of Buildings.” <https://www.iea.org/reports/the-critical-role-of-buildings>, 2019.
- [28] IEA, “Key World Energy Statistics,” 2021. <https://www.iea.org/reports/key-world-energy-statistics-2021>.
- [29] IPCC, “Climate change: a threat to human wellbeing and health of the planet. Taking action now can secure our future,” 2022. <https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/>.
- [30] Kelly, Jack and William Knottenbelt. “The UK-DALE dataset, domestic appliance-level electricity demand and whole-house demand from five UK homes,” *Scientific Data*, 2(150007) (2015).
- [31] Kim, Sunnie S. Y., et al., “Explainable AI for End-Users,” Apr. 2023.
- [32] Lacal Arantegui, Roberto and Arnulf Jäger-Waldau. “Photovoltaics and wind status in the European Union after the Paris Agreement,” *Renewable and Sustainable Energy Reviews*, 81:2460–2471 (2018).
- [33] Langsdorf, Susanne. “EU Energy Policy: from the ECSC to the Energy Roadmap 2050,” *Green European Foundation: Brussels, Belgium* (2011).
- [34] Nicola, Armaroli and Balzani Vincenzo. “The Future of Energy Supply: Challenges and Opportunities,” *Angewandte Chemie International Edition*, 46(1-2):52–66 (2007).
- [35] Nunes, Ingrid and Dietmar Jannach. “A Systematic Review and Taxonomy of Explanations in Decision Support and Recommender Systems,” *arXiv*, (2) (Jun. 2020).
- [36] Pallets, “Flask.” <https://flask.palletsprojects.com/en/2.3.x/>, 2023.

- [37] Palmer, Karen, et al. “Assessing the energy-efficiency information gap: results from a survey of home energy auditors,” *Energy Efficiency*, 6 (2013).
- [38] Pecan Street Inc, “Better tech, better decisions, a better world we’re making it happen..” <https://www.pecanstreet.org/>, 2023.
- [39] Ruth, Matthias. *Handbook of Climate Change Mitigation and Adaptation* (2 Edition). Springer Nature, 2017. Foreword.
- [40] Sauerwein, Elmar, et al. “The Kano Model: How to Delight Your Customers,” *International Working Seminar on Production Economics*, 1 (01 1996).
- [41] Siepmann, Clara and Mohamed Amine Chatti, “Trust and Transparency in Recommender Systems,” Apr. 2023.
- [42] Sioshansi, Fereidoon. *Consumers, Prosumers, Prosumagers: How Service Innovations will Disrupt the Utility Business Model*. Elsevier Inc., 2019.
- [43] Swearingen, Kirsten and Rashmi R. Sinha. “Beyond Algorithms: An HCI Perspective on Recommender Systems.”. 2001.
- [44] Typeform, “Forms that break the norm.” <https://www.typeform.com/>, 2023.
- [45] UNFCCC. “Paris Agreement.”. 2015.
<https://unfccc.int/documents/184656>.
- [46] Verbraucherzentrale, “Energieausweis: Was sagt dieser Steckbrief für Wohngebäude aus?.”
<https://www.verbraucherzentrale.de/wissen/energie/energetische-sanierung/energieausweis-was-sagt-dieser-steckbrief-fuer-wohngebaeude-aus-24074>, 2023.

- [47] Verbraucherzentrale Bundesverband eV, “ENERGIEBERATUNG DER VERBRAUCHERZENTRALE.” <https://verbraucherzentrale-energieberatung.de/>, 2023.
- [48] World Wildlife Fund, “What’s the difference between climate change mitigation and adaptation?.” <https://www.worldwildlife.org/stories/what-s-the-difference-between-climate-change-mitigation-and-adaptation>, 2023.
- [49] Wulf, Volker, et al. “Engaging with practices: Design case studies as a research framework in CSCW.”. 505–512. 03 2011.
- [50] Yu, Songmin, et al., “Modeling of prosumagers and energy communities in energy demand models. (newTRENDS - Deliverable No. D5.2),” 2022. <https://newtrends2020.eu/publications/>.

I certify that I have prepared the written elaboration independently and have not used any other aids than those specified. All passages that are taken from other works in terms of wording or meaning (including translations) have been clearly identified as borrowing in each individual case, giving precise details of the source (including the World Wide Web and other electronic data collections). This also applies to attached drawings, pictorial representations, sketches and the like. I acknowledge that the proven omission of the indication of origin will be assessed as an attempted deception.