ENERGY RENOVATION OF DETACHED SINGLE-FAMILY HOUSES

A CASE STUDY ON HOW TO DEVELOP A SUSTAINABLE SOLUTION THROUGH STAGING NEGOTIATION SPACES

AALBORG UNIVERSITY

Energy renovation of detached single-family houses - A case study on how to develop a sustainable solution through staging negotiation spaces

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DISCLAIMER

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"COVID19 and the consequences of the lock-down of society and the university since March 13, 2020 have had influence on which activities that have been possible to stage and carry out as part of the project work. More specifically, this means that activities have been limited to online activities, and that activities such as Lab activities; surveying activities; on-site ethnographic studies and on-site involvement activities have not been possible.
When assessing this project, please bear this in mind.

Added here: the students own reflections on the challenges they have experienced and how they have sought to overcome these. "

Throughout the report, we have actively reflected upon how the circumstances of COVID-19 affected our design process. In short, it was mostly the participatory design activities, when staging negotiation spaces, that was challenged. We adapted by attempting to create online actor involvement, with collaborative online tools and interviews over the phone, to assure meeting the guidelines from the Danish government. Further, reflections and discussion about our experiences with overcoming these challenges will be addressed during the report.

Sincerely,
the authors

ABSTRACT

Energy consumption of buildings has a significant impact on the environment. Energy renovation of the existing building stock is therefore seen as an essential part of sustainable development. However, many house owners are not following this agenda and solutions to the problem are needed. Contributing to the current research on the area, this report investigates, through a design process, how to design a solution to have more house owners energy renovate their homes. The design process is based on the theoretical framework Staging Negotiation Spaces. With this socio-technical and participatory design approach, the focus was on the involvement of relevant actors during the design process to negotiate concerns and ideas, to create a solution, and to work with establishing a network of actors supporting the solution. Through the design process empirical data was gathered, analysed and translated into objects, bringing the design process forward. It was identified that, to have more house owners energy renovate, a solution to support the decision-making process before a renovation is needed. Key aspects contributing to this is guiding the house owner and giving access to other house owners' experiences. Through Staging Negotiation Spaces with the use of prototypes, it was found that encouraging house owners to energy optimise their homes as a part of other renovations, was a way to have more conduct energy renovations. A solution taking the form of a platform was developed and tested with potential users. Also, other relevant actors were involved in the design process to conduct a network building process, to create support for the design. The design process presented in the report represents a case on how to handle sustainability challenges through navigating among multiple concerns, through staging negotiation spaces both backstage in the design team and frontstage with relevant actors in the field. The design project was performed during the COVID-19 pandemic which influenced the design approach where all activities were performed online. The project thereby also presents perspectives on how to perform participatory design digitally.

READING GUIDE

This thesis presents a design process conducted by the authors and a reflection and discussion about how the specific design approach used, can contribute to the development of solutions for sustainable development. The structure of the report follows the design process, with ongoing discussions as a natural part of the development of a design solution. The end of the report is a summarised discussion and conclusion. Following is a list of references and appendix.

Chapter 1 contains an introduction to the design project described in the report and the research question which the report is concentrated around. Further, an overview of the design process is presented. Chapter 2 describes the theoretical framework of the design process which created the base for the design approach used during the project. In chapter 3 the methodology can be found. Chapter 4 presents the overall problem area from which the design process was built. A problem is identified and an initial design problem is defined. Chapter 5 defines the initial research. It presents findings from a literature review and empirical research, which allowed the design team to analyse the problem. The analysis is presented in chapter 6, where different perspectives and approaches related to the theoretical framework is used. Chapter 7 is where a design focus is found from which the concept development is based. Chapter 8 present the concept development which was an iterative process of developing ideas, transforming them into concepts which later were tested to evaluate their potential and set a direction for the further development process. A concept is selected, refined, tested and a final concept is developed, which is presented in chapter 9. During the development of the solution, both the specific concept but also the strategic considerations about actor involvement, navigation and actor-network building activites is presented. Chapter 10 take a step back and viewed the design process from outside. It presents discussion and reflections on the design approach and its contributions to the current field of designing for sustainable development. Also, considerations about the digital participatory design approach is presented. Chapter 11 summarises the main findings and discussions in the conclusion. Chapter 12 contains the reference list.

During the report citations from different actors involved during the design process occurs. As the project has been conducted in Denmark with Danish participants, citations have been translated and the original ones can be found in appendixes referred to in the specific chapters of the report. Each citation used in the report is marked with an ID number which is referring to the appendix, depending on what chapter.

All illustrations are made by the authors.

ACKNOWLEDGEMENT

First and foremost, we want to sincerely thank our supervisor Signe Pedersen, for her tireless, dedicated and boundless guidance. She has supported us throughout the entire project with endless enthusiasm and inspiration and turned a global pandemic into an 'opportunity for generating new design approaches'. She has helped us bring the very best of this project to the surface, and we could not imagine better supervision.

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Lastly, we would like to thank our family and friends who have supported us with coffee, chocolate, patience, patience and a bit more patience. If there is one thing worse than a thesis-writing student, it is a thesis-writing student you have to be isolated with for 3 months. How you survived it, is beyond us, but the greatest acknowledgement goes to you.

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1

INTRODUCTION

1. INTRODUCTION

The sustainability of buildings has become a highly relevant area of research. Especially the energy consumption of buildings has gained interest as buildings stand for approximately 40 pct. of the total energy consumption in the EU, which equals to around 36 pct. of CO_2 emissions (*European Commission, 2019*). Therefore, energy renovation of the existing building stock is seen as essential as it holds great potential of contributing to sustainable development (*Concito, 2017*). Different actors have studied this area and the challenges related to it. These study a wide range of problems, including everything from how to accurately calculate the energy performance of a house, to how the agenda of energy renovations is promoted (*Gram-Hanssen et al., 2015; Najjar et al., 2019*).

Through studying existing literature, and exploring the field of energy renovation, we identified an important challenge in making private house owners energy renovate their homes. The design project, described in this report, targets this design problem. It is an area which has been studied from different perspectives, identifying factors influencing the house owner's actions (*Azizi et al., 2019; Bartiaux et al., 2011; Bjørneboe et al., 2018*). Our research contributes to the current literature with a socio-technical perspective and the development of a design solution as a proposal of how to create a change, which only a limited number of the current literature offer.

The problem of mobilising more house owners to energy renovate their homes can be described as a 'wicked problem' with no definitive answer (*Rittel & Webber, 1973*). Sustainability problems have in general been acknowledged as complex socio-technical challenges which cannot be solved by a narrow focus on innovation at a product level, through approaches such as 'Green design' and 'Ecodesign' (*Ceschin & Gaziulusoy, 2016*). During the design process it was, therefore, important to investigate different perspectives and navigate in a field of different concerns. We chose to base our design process on the framework Staging Negotiation Spaces (*Pedersen, 2020*) to make our design work an iterative process of exploring solutions through negotiations with different relevant actors. In this way the design process was focused on handling different needs, concerns and relations, through translating these into ideas, bringing the design team closer to a solution, while at the same time strategically interest actors in the solution being developed.

This report presents a design process and discusses how the approach of staging negotiation spaces can be used for the development of a solution contributing to sustainable development, reflected in the research question:

How can we, through staging negotiation spaces, design a solution which can contribute to sustainable development by having more single-family detached house owners in Denmark conduct energy renovations?

1.1. DESIGN PROCESS

The structure of the design process performed in the presented project, was inspired by the principles of Design Thinking. There is no one definition of Design Thinking, but essentially it is *"a human-centered, creative, iterative, and practical approach to finding the best ideas and ultimate solutions"* (*Brown, 2008, p. 9*). As the problem we worked with is wicked and without a specific direction for the solution space, we found it essential to create an iterative explorative design process. Design Thinking promotes

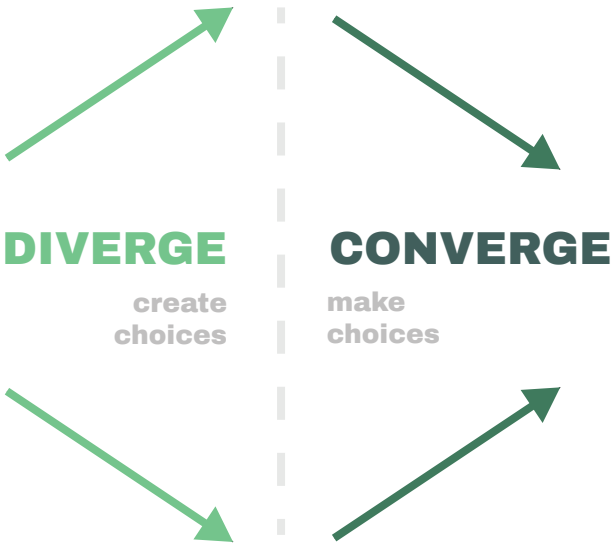


Figure 1: Divergent and convergent thinking (IDEO, n.d.).

a design process with iterative steps of problem framing, ideation and experimentation (*Carlgren et al., 2016*). Many different representations have been made for the Design Thinking Process (*Efeoglu et al., 2013*). Our design process has been inspired by IDEO's representation, which continuously shifts between divergent and convergent phases. The divergent phases is where the project team 'opens up' for gathering new input, either through desk research or empirical research, where actors were actively invited to negotiate problems and solutions. The convergent phases follows with the processing and analysis of the discoveries that have been made, refinement of the problem area and the establishment of design criteria - essentially phases where choices are made to carry on the process (*IDEO, n.d.*) (see Figure 1).

Design thinking offers an approach for the overall design process with divergent and convergent thinking and tools such as brainstorming, visualisation etc. (*Carlgren et al., 2016*). However, it is argued to lack reflections on how the designer performs the design process (*Pedersen, 2020*). We, therefore, used the design thinking approach for defining and mapping our overall design process (see Figure 4), and based our design actions, within these convergent and divergent phases, on the theoretical framework of Staging Negotiation Spaces (read more in section 2) (*Pedersen, 2020*)

The Staging Negotiation Spaces framework uses staging as a metaphor which refers to the dramaturgical actions taking place in a theatre, where manuscripts or other proposals are interpreted and translated into actions presented on the scene. In a design context, the designer can be seen as the humble stage director who is in charge of handling a given design problem through staging and facilitating negotiations around matters of concern, involving different actors to take part of the continuous iterative exploration of problems and solutions (*Pedersen, 2020*). The framework presents the idea of *frontstage* and *backstage*, and argue that negotiations during a design process both take place backstage in the design team and frontstage with external actors. The intention is to gain insights into relations, concerns, needs, etc., to be able to navigate in the current networks of relations established in the field, to develop a successful solution (*Pedersen, 2020*). To accomplish this, we used a combination of different approaches (see Figure 2), presented in the following.

For backstage activities in the design team, Engineering Design Methods (*Cross, 2008*) were used, to stage negotiations internally and create alignment in the team. It was also used to translate the empirical findings

into tools and objects for future design work supporting the specification and development of a solution, creating a *"logical progression from problem to sub-problems and from sub-solutions to solution."* (*Cross, 2008, p. 42*).

Participatory Design (*Simonsen & Robertson, 2012*) supported our work with actor involvement through the frontstage negotiation spaces, where users and other relevant actors were involved to influence the design and to create support for the design. Design Thinking emphasizes a user-centred design approach (*Carlgren et al., 2016*) which we found highly relevant, to design solutions based on real-world problems and needs. We chose to use Participatory Design to strengthen this mindset in our design process to not only focus on users, as Design Thinking typically does, but in general to empower actors to have a say in the development of solutions which affects them (*Simonsen & Robertson, 2012*). Through the Participatory Design approach, the involved actors were seen as co-designers rather than informants and subjects for study, as typically seen in Design Thinking.

Actor-Network Theory was used for mapping, analysing and discussing how to handle actors' concerns and relations. Actor-Network Theory offers a vocabulary which makes it possible to view the world as dynamic networks where human and non-human actors take part and depending on the network, are following different agendas (*Storni, 2015*). It made us perceive and utilize the design process as a network building process where different concerns should be addressed for potential allies, to assure that the solution integrated itself in a supporting network (*Akrich et al., 2002)*. Working with Arenas of Development (*Jørgensen et al., 2017*) supported our backstage negotiations about how to establish support for the design being developed and it allowed us to include considerations

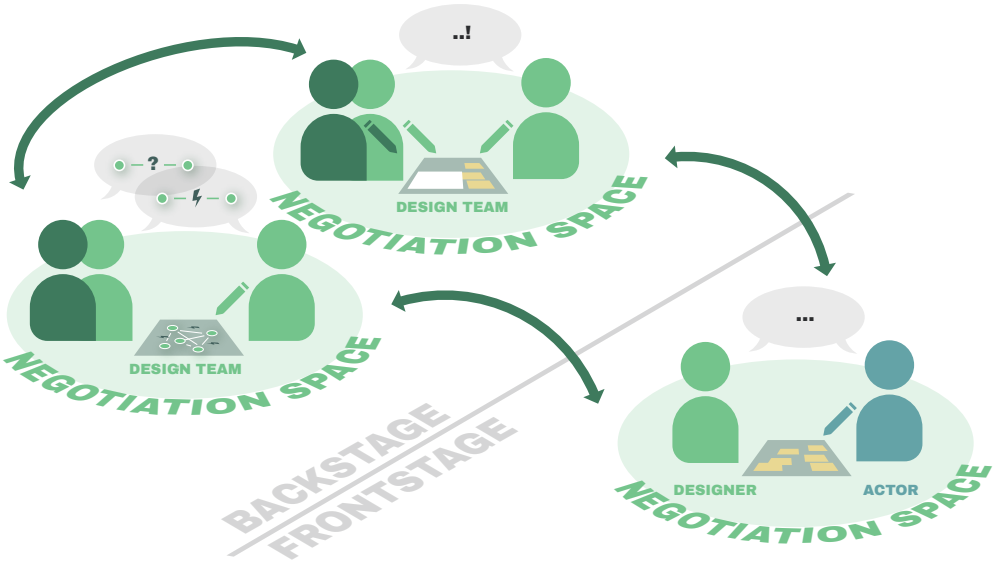


Figure 2: Staging negotiations frontstage and backstage during the design process.

about how to strategically navigate the concerns and relations present in the field through staging frontstage negotiations. It helped map and analyse what spaces should be staged where and with whom during the design process.

In this way, Participatory Design, Actor-Network Theory and Engineering Design Methods supplemened each other during our design process. This combination gave actors a say in shaping solutions through Participatory Design, with the act of navigating and creating a supportive network through the translation of actors, to follow new agendas, through staging negotiation spaces. These are made visible with Actor-Network Theory, while Engineering Design Methods made it possible for the design team to translate insights into different objects and tools to develop design solutions from (see Figure 2).

This continuous cycle of diverging and converging phases, with varying negotiation spaces, were present throughout the entire duration of this design project. These made it possible to specify the design problem through re-framings, bringing the designers closer to a solution (see Figure 3).

The problem area of energy optimising buildings was explored in a divergent manner, and the design problem was identified and re-reframed in a convergent phase. Here, focus became energy renovations. This design problem was explored and analysed which led to a focus on supporting decision-making. The design problem was advanced through design ideas which were developed and tested in a divergent phase. This led to another convergent phase where a solution was chosen and the criteria for the design became more specified. Another divergent phase followed with the design of a final solution being tested and the findings from this made it possible to make final specifications, creating the final design in a convergent phase (see Figure 4). This type of design process following divergent and convergent phases supported an iterative process in a structured way which made it possible to design a solution within the given timeframe, and also affected the considerations of how the negotiation spaces should be staged respectively.

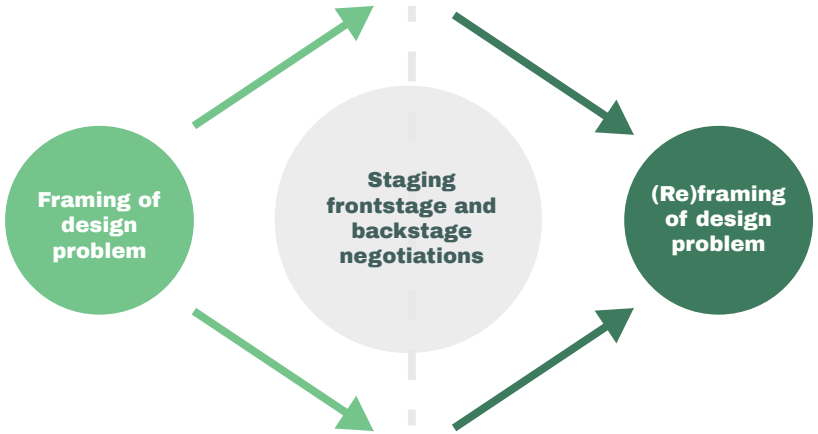


Figure 3: Staging negotiation spaces in divergent and convergent phases of the design procress resulting in (re)framings of the design problem.

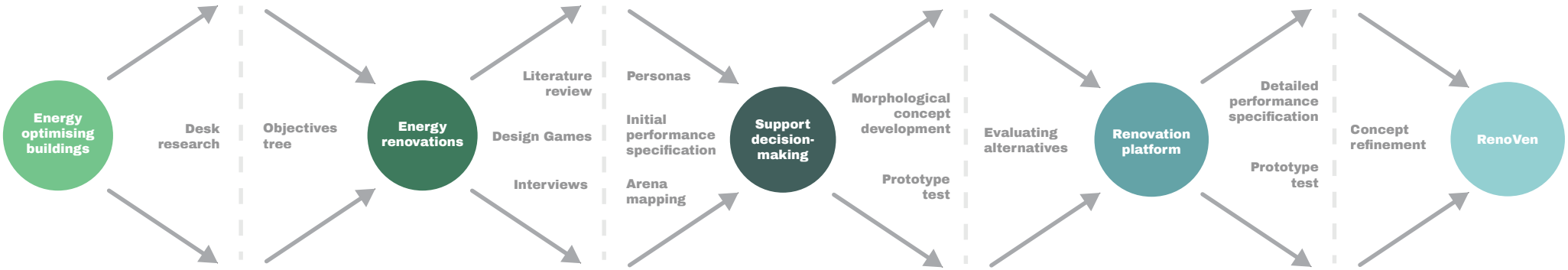


Figure 4: Our design process expressed in divergent and convergent phases.

2

THEORETICAL FRAMEWORK

2. THEORETICAL FRAMEWORK

The design work of this project is based on the framework of Staging Negotiation Spaces (*Pedersen, 2020*). This chapter presents this theoretical framework and explains the underlying theoretical principles used to perform the design work. Further, the design work draws on Arenas of Development (*Jørgensen et al., 2017*), supplementing the Staging Negotiation Spaces framework.

2.1. STAGING NEGOTIATION SPACES

The challenge of enacting more private home energy renovations is a wicked design problem which calls for navigating a complex field of multiple actors, relations and concerns. We, therefore, chose to base our design approach on the framework of Staging Negotiation Spaces (*Pedersen, 2020*), and used it to view design as an iterative process of staging negotiation with relevant actors and re-framing concerns to develop design solutions together and, as a part of this, align actors to support new agendas. Through the design process, we staged and facilitated negotiation spaces both backstage in the design team and frontstage with the involvement of relevant external actors to achieve this.

Negotiation spaces are temporary spaces, where different relevant actors (both human and non-human) are invited to participate, to share and negotiate knowledge and matters of concern (*Pedersen, 2020*). Designers have a central role, responsible for performing staging moves with setting up the spaces for participatory design, through framings and inscriptions. The designer's role involves facilitating the negotiations with the circulation of potential intermediary objects and fostering dialogue (*Pedersen, 2020*). The outcome of negotiations is not necessarily consensus, but it provides room for exploring interests and opportunities, which through the process can lead to some degree of alignment among actors: *"While framing is one of the elements in the staging process, re-framing can be seen as the result of the negotiations within a space"* (*Pedersen, 2020, p. 17*). The outcome from one negotiation space can re-frame problems, concerns and ideas, which can be brought into new spaces to be further explored and negotiated (*Pedersen, 2020*). Through our design process, findings were continuously analysed which led to re-framings of our design problem, which then created the base for new negotiations. This made the design project an iterative process of negotiating problems and solutions together with relevant actors and re-framing the understandings and interpretations connected to the design problem (see Figure 5).

The framework Staging Negotiation Spaces brings together the collaborative oriented focus from Participatory Design and the socio-technical analytical perspective from Actor-Network Theory. Actor-Network Theory offers a vocabulary to explore how actors' concerns and relations affect the opportunity of creating a change, and Participatory Design promotes an actor involving design process where design solutions are developed through mutual knowledge sharing and transformation (*Pedersen, 2020*).

2.1.1. ACTOR-NETWORK THEORY

Actor-Network Theory views the world as networks created from the relations between actors (both human and non-human). An actor is any element that bends space around itself while making other elements dependent upon itself through its relations (*Latour & Callon, 1981*). An

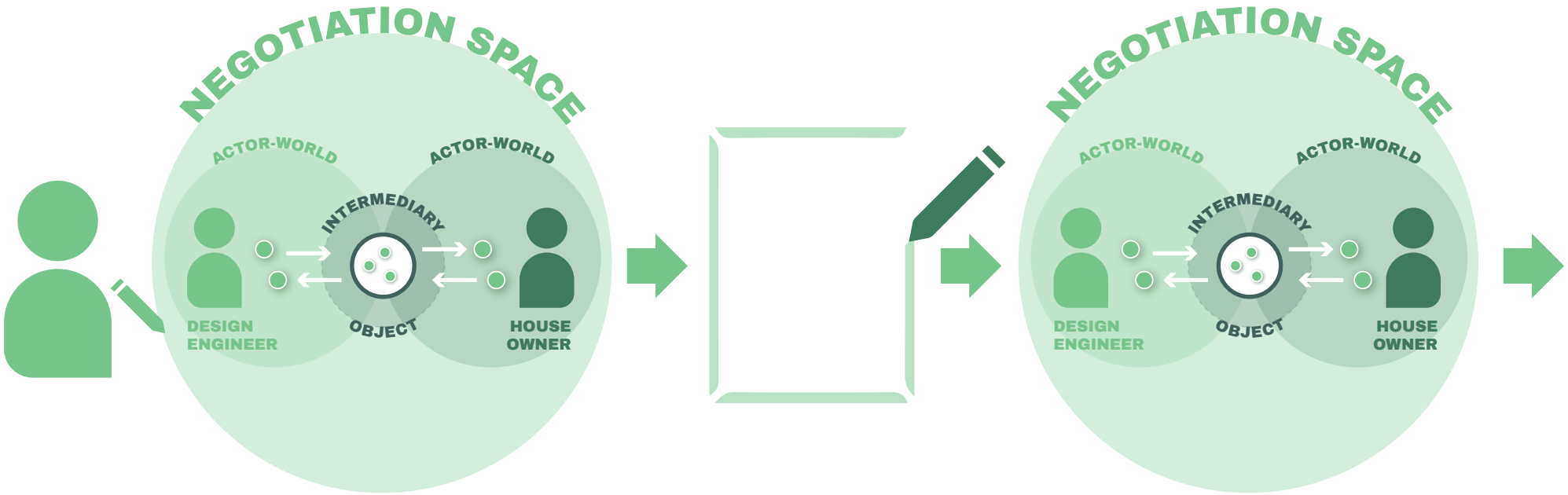


Figure 5: Staging and facilitation of negotiation space which lead to re-framings which can create the base for new negotiation spaces (inspired by Pedersen (2020)).

actor-network is dynamic and constantly evolving, and gives insight into the translations that occur between actors. Actors' position in networks is enforced by their *matters of concern*, which is essentially their focus or interest in the network (*Latour, 2004*). Reconfiguration of existing networks or the creation of new ones happens through *translations*, where actors are interested, enrolled and mobilised to follow new agendas (*Callon, 1984*). Concerning a design process, translations can be utilised by designers to get actors on board with their conceptualisation and take on the design as their own. This is relevant for this project as the aim is to mobilise more actors to follow the agenda of energy renovating their homes.

When navigating design processes, amongst the actors in the given network, it is desired to align the matters of concern of the actors to the intention of the design. Thus, designing is not only about designing a system, service or product, but also about designing an actor-network (*Pedersen, 2016*). It is, therefore, necessary for designers conceptualising their work on the foundation of socio-technical analysis, to establish new network constellations. For this to happen, the elements of the design must become an actor in the network, as a design solution becomes meaningful and stronger through its relations to other actors, as Akrich et al. (*2002, p. 205*) describes: *"Innovation is the art of interesting an increasing number of allies who will make you stronger and stronger."*. In our project, we saw the need for both developing a solution but also establishing support through a network building process. Staging negotiation spaces supported this process of creating translations.

2.1.2. PARTICIPATORY DESIGN

Participatory Design is based on the involvement of non-designers in design processes. Participatory Design is about making actors influence the development of solutions which affect them, and it emphatises *"people's right to participate in the shaping of the worlds in which they act"* (*Simonsen & Robertson, 2012, p. 4*). Further, actors within the field of a problem area are seen as true experts, from their real-life experiences (*Pedersen, 2020*). The involvement of users and other relevant actors is, therefore, an essential part of Participatory Design (*Simonsen & Robertson, 2012*). Involving relevant actors in our design process gave insight into real problems, concerns and needs present in the field, and made it possible to develop solutions through mutual knowledge sharing and negotiations. It also supported network-building. From staging and facilitating negotiation spaces, with the involvement of various actors, relevant for enacting a change, the participatory design was made actionable during our design process.

2.1.3. THE ROLE OF INTERMEDIARY OBJECTS

In a design process based on the Staging Negotiation Spaces framework, different actors are involved and brought together to collaborate. This is, however, not a simple process because of the different knowledge, matters of concern, practices, visions etc. that actors represent, which take part in creating boundaries between them (*Pedersen & Clausen, 2018*). The success of participatory design activities is, therefore, affected by the designers' ability to stage and facilitate spaces, which makes it possible to transfer and transform knowledge across different social worlds. Here, objects are seen as having a relevant role. Prototypes, storyboards, sketches, etc. inscribed with hypothesis' and perspectives can act as

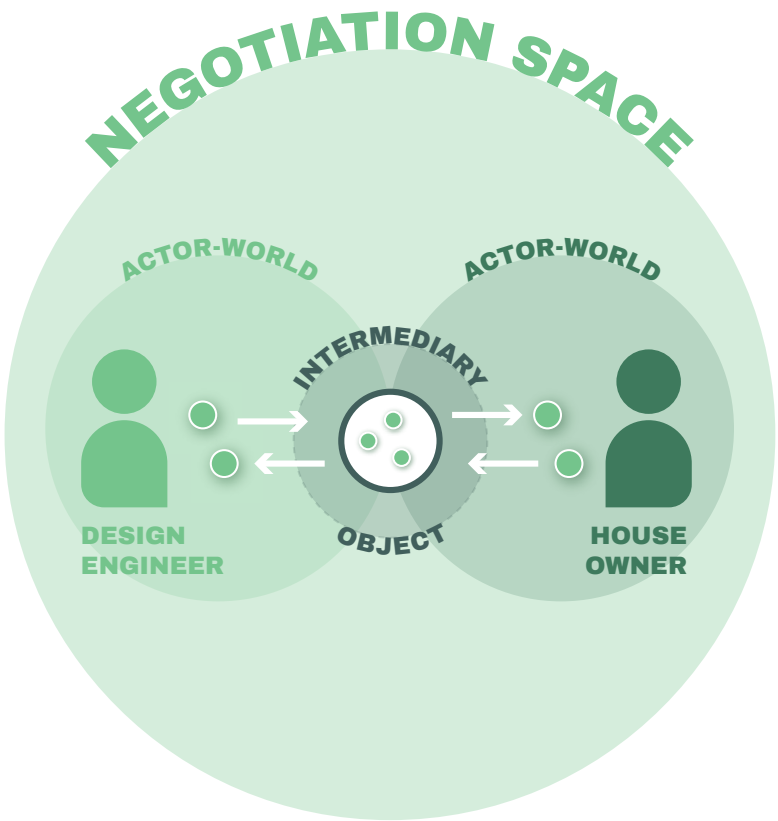


Figure 6: Intermediary object acting across boundaries in a negotiation space.

intermediary objects (*Pedersen, 2020*). These are objects which can represent (inscriptions of concerns, ideas, etc. in materialities), translate (intentionally or unintentionally transformations of relations, ideas etc.) and mediate (support knowledge sharing) (*Vinck, 2012*). The term intermediary objects thereby serve as a way to understand and reveal how objects can foster dialogue and negotiation, as well as create new relations between actors (see Figure 6).

In our design process, different objects were created, intended to work as intermediary objects, to support the configuration of staged negotiation spaces, fostering knowledge sharing, revealing concerns and relations, and to support the collaborative development of design solutions. Objects such as the objectives tree and performance specification, from Engineering Design Methods, were used for backstage negotiations in the design team, where objects such as design games were used in frontstage negotiations with external actors. Some objects, such as prototypes, were used for both backstage and frontstage negotiations. Objects were in this way used iteratively during the design process as supportive actors in negotiation spaces.

2.2. ARENAS OF DEVELOPMENT

For the strategic navigation of the design problem, we used Arenas of Development (*Jørgensen et al., 2017*), which is based on Actor-Network Theory's vocabulary for discussing change through heterogeneous processes. Arenas of Development is a theoretical notion describing the cognitive space that is the setting from where development takes place, within the boundaries of a specific problem area. This space includes actors, artefacts, relations, location for action, knowledge and visions that make and shape the arena. It is populated by actor-worlds, forming actor-networks, which are created from different matters of concern and agendas related to the problem area (see Figure 7). Different socio-technical networks thereby co-exist in a development arena, creating both collaborations and competition, contributing to both stabilising and destabilising the relations on the arena (*Jørgensen & Sørensen, 1999*).

Arena of development gives a dimension to the design process which makes it possible to analyse the context that creates development, where

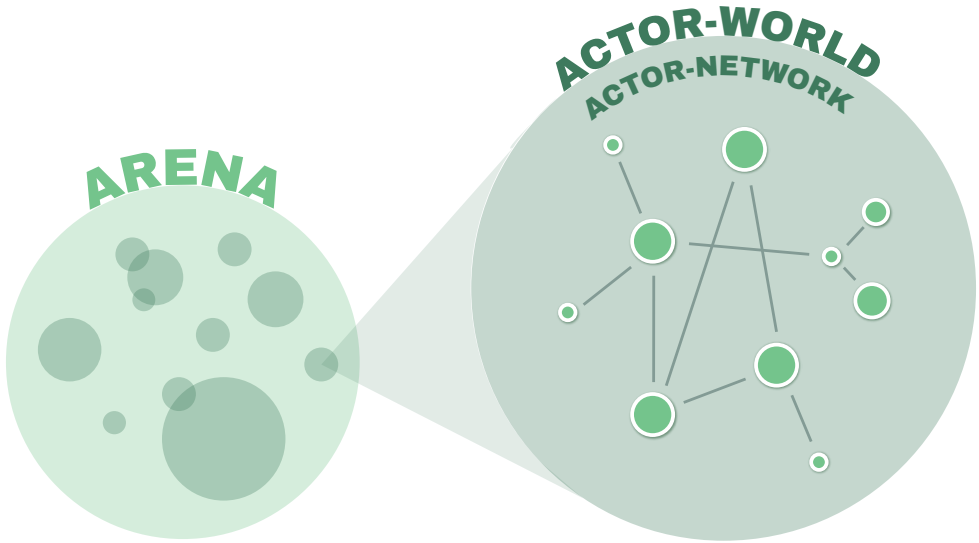


Figure 7: The arena consists of actor-worlds which take the form of actor-networks, following specific agendas in relation to the arena.

the dynamics between actor-worlds within the same problem area are analysed (*Jørgensen & Sørensen, 1999*). It offers a *"tool to structure, magnify and punctualise the processes involved in the transitions studied to be able to handle the diversity and complexity of transformative processes."* (*Jørgensen et al., 2017, p. 174*). This is relevant to our project because the energy renovation of private houses is an area related to many actors with different concerns and perspectives. Since we have been working with a problem where a range of actors, i.e house owners, energy technology suppliers, municipalities, interests organisations etc., are affected, this analytical tool has helped us map and process the current situation and the development potential. We used Arenas of Development to support backstage negotiations about how to strategically navigate the concerns and relations of the networks in the respective actor-worlds. It worked as a tool to support our navigation of the field and the establishment of

different negotiation spaces, which created the base for the involvement of different actors during the design process as a part of the network-building strategies.

2.2.1. STRATEGIC NAVIGATION AT DIFFERENT LEVELS

While arenas are periodically stabilised configurations, negotiation spaces are more temporary. Interactions between actors are argued to continually take part in reconfiguring arenas (*Jørgensen et al., 2017*). Negotiation spaces can be seen as such actions where designers bring new perspectives into the arena and negotiate with actors from the actor-worlds on the arena. This can challenge existing concerns and destabilise existing configurations on and arena, and start network building processes to align actors to follow new agendas, creating new actor-worlds. Through negotiation spaces we have explored the dynamics of the arena of energy renovation of private homes, getting insight into existing matters of concern, but also as a way of challenging the existing and supporting the network building process around the design solution developed in the project.

3

METHODOLOGY

3. METHODOLOGY

This chapter presents the methods used during the design process. As earlier described, we use methods from different traditions during the design process to support backstage and frontstage negotiations. This chapter is divided into 'Actor involvement', presenting the methods used for participatory design activities, and 'Engineering Design Methods', presenting the methods used for backstage design activities. Lastly, the method used for our literature review is presented.

3.1. ACTOR INVOLVEMENT

Participatory design activities were performed during the whole design process, where a range of different actors was involved to gain insight into concerns, to discuss solutions, and to interest actors in the solution as a part of our network-building strategy. To perform these frontstage negotiations, different methods were used. Table 1 presents an overview of the actor involvement performed during the design process and following is a presentation of the method used.

Activity	Participating actors	Purpose
Design game negotiation spaces with house owners	*15 house owners who had energy renovated their homes*	*Insight into concerns, interests, relations, and processes when performing an energy renovation of a house.*
Design game negotiation spaces with house owners	*10 house owners who had not energy renovated their homes.*	*Insight into considerations, interests and concerns to energy renovation for house owners who have not conducted energy renovations.*
Interviewing the Danish Energy Agency	*One employee at the Danish Energy Agency*	*Insight into the Danish Energy Agency's role, relations and concerns related to energy renovation*
Interviewing energy adviser	*Two energy advisers from different companies*	*Insight into energy advisers roles, relations and concerns*
Interviewing architects	*Two architects from different companies*	*Insight into architects roles, relations and concerns related to energy renovation*
Interviewing technology supplier	*One sale- and a project coordinator from a solar panel company*	*Insight into technology suppliers roles, relations and concerns related to energy renovation*
Interviewing municipalities	*A development consultant and a building project adviser from municipalities in different parts of Denmark*	*Insight into municipalities roles, relations and concerns related to energy renovation*
Interviewing knowledge centre Bolius	*One employee from the knowledge centre Bolius*	*Insight into Bolius role, relations and concerns related to energy renovation*
Interviewing a bank	*One employee from a large bank in Denmark*	*Insight into banks roles, relations and concerns related to energy renovation*
Concept prototypes negotiation spaces with house owners	*Seven house owners*	*Feedback on concept ideas through the use of prototypes*
Final concept prototype negotiation spaces with house owners	*Five house owners*	*Exploring the role of the final concept and getting feedback for refinement of it.*
Final concept prototype negotiation space with Bolius	*One employee from the knowledge centre Bolius*	*Network-building activity with exploring the potential take over of the developed design solution*

Table 1: Overview of the actor involving activities performed during the design- and research process.

3.1.1. SEMI-STRUCTURED INTERVIEW

As a part of our empirical research, we performed semi-structured interviews. These were both performed separately, but also as a part of design games and prototype tests. The semi-structured interview *"(1) strive to avoid leading the interview or imposing meanings, and (2) strive to create relaxed, comfortable conversation."* (*Zorn, 2008, s. 1*). It allows for enough flexibility to have an open dialogue but within topics relevant to the design project (*Zorn, 2008*). We approached participants with predefined questions as a guide for the dialogue, but with room for new perspectives and encouraged the participants to share narratives and concerns, which could contribute to our knowledge about the field and the concerns present.

3.1.2. DESIGN GAME

A design game is a tool for actor involvement (*Vaajakallio & Mattelmäki, 2014*). We used it to engage participants in frontstage negotiations. There is not a specific definition of what a design game is, but *"instead of being a well defined method, it is an expression that highlights the exploratory, imaginative, dialogical and empathic aspects of codesign."* (*Vaajakallio & Mattelmäki, 2014, s. 64*). Materiality and rules is an essential part of design games. The format allows for an open and playful mindset, which can trigger the sharing of experiences, associations and concerns (*Vaajakallio & Mattelmäki, 2014*).

The intention was to use design games as intermediary objects. We designed each design game for the specific context, framing different concerns and interests, for the games to support facilitation of relevant dialogue in the design process.

3.1.3. PROTOTYPING

Prototypes are representations of design ideas. They make ideas tangible and relatable which can initiate associations and support knowledge sharing (*Rhinow et al., 2012*). The aim of using prototypes can vary and be either communication, exploration or experimentation. Therefore, prototypes can be used through the whole design process and their form and format can be very different depending on its purpose - from a rough idea to a high-fidelity prototype. The expression of a prototype influences the staging of negotiation spaces, encouraging different types of dialogue (*Pedersen, 2016*).

Houde & Hill (*1997*) describes how prototypes can represent different dimensions:

- *Role* (what functions make the solution useful for the users).
- *Look & feel* (the experience of using the product).
- *Implementation* (technical setup for the solution to perform its functions).

Depending on the intention with the prototype different dimensions can be tested, and this perspective made it possible for us to direct the prototypes to specific purposes.

In our design process, prototypes were used to explore opportunities and get feedback on ideas, and later refinement of the solution, through different negotiations spaces. Further, the development of prototypes worked as a way to share and align understandings backstage in the design team.

3.1.4. SCENARIOS

Scenarios are specific descriptions of the hypothetical use of a design solution, contextualised in a relevant setting, described through a sequence or process and not a single situation. It can visually describe a short narrative and act as a communication tool by making the process concrete and visible (*Anggreeni & Van der Voort, 2008; Iacucci & Kuutti, 2002*).

We used scenarios for different purposes. In the initial exploratory phase, it was used to represent different types of energy renovations as a part of a design game in frontstage negotiation spaces. Later, it was used for backstage activities with defining and evaluating the final concept. They were in both cases intended to act as intermediary objects sharing knowledge between actors and translating ideas.

3.2. ENGINEERING DESIGN METHODS

Engineering Design Methods were used during the design process as an approach to translate findings into tools and objects supporting the development of a design solution. They were used for backstage negotiations in the design team.

3.2.1. OBJECTIVES TREE

The Objectives Tree (*Cross, 2008*) is a design method, that helps to clarify objectives related to a design problem. Through the method, objectives are mapped hierarchically and show relations. The diagram starts at the top with the overall objective, and when moving to a lower level it is specifies 'how' to achieve it, while a step higher answers 'why' (*Cross, 2008*) (see Figure 8).

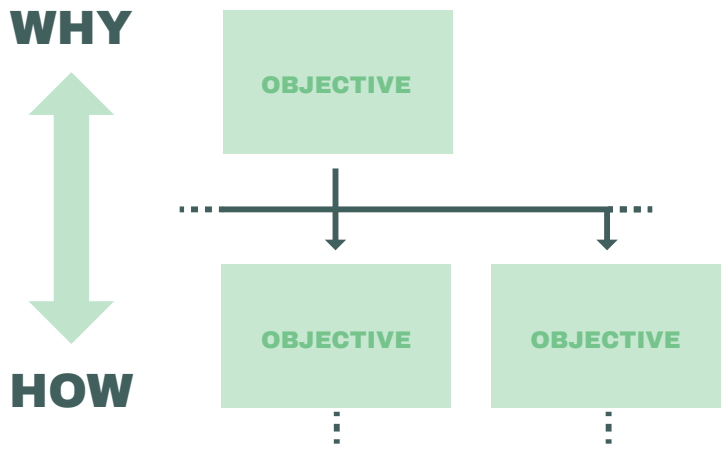


Figure 8: The Objectives Tree method (Cross, 2008).

We used the method to map the different aspects relevant for the problem area 'energy optimisation of existing building stock', both to understand the problem, and to support a decision process, narrowing the scope of the design project. In this way, the method helped to navigate the generation of our initial design problem. Further, it provided useful knowledge for tracking what areas of research to look towards when conducting the literature review.

3.2.2. AFFINITY DIAGRAM

An affinity diagram is a method to structure empirical findings and other relevant information gathered through the design process. The information is made into visible notes, which then are organised and grouped in themes relevant to the design problem. The process of working with the affinity diagram method forces the team to deal with each specific statement and relate the data from different contexts to each other and reflect on its contribution to understanding and solving the design problem (*Holtzblatt & Beyer, 2014*).

We used the method as a tool to handle a large amount of data, in a way which offered overview: *"The affinity structure simplifies the complexity of the data without losing the rich detail which is still available in the individual notes."* (*Holtzblatt & Beyer, 2014, p. 25*). It has been used to synthesise data and re-frame the design problem.

3.2.3. PERFORMANCE SPECIFICATION

A performance specification defines what a solution must do, and thereby delimits the solution spaces. It consists of a range of specific requirements for a design solution. This information should be defined in a way which makes it broad enough to accommodate all acceptable solutions and at the same time narrow enough to make sure that the solutions developed from it solve the problem. It should therefore not tell what the solution must be, but rather define what it must do (*Cross, 2008*).

We used the performance specification as a tool in our design process to convert our findings into something designable. From the affinity diagram, we could extract requirements related to our design problem. The performance specification worked as a tool to specify the requirements for a design solution and it thereby guided the concept development. The performance specification further worked as a backstage tool to create a shared understanding of the solution space. It was used and updated iteratively following our design process. First, an initial performance specification was created, guiding the development of ideas. Later, a detailed performance specification was developed, specifying the requirements for a chosen concept. This was at the end updated with requirements for the final solution.

3.2.4. PERSONAS

Personas are fictive representations of users, making it explicit who the design should be directed to (*Grudin & Pruitt, 2002*). Personas should be built as well-defined persons with a name, picture and personality, as well as other relevant characteristics, making it easier to relate to the person's needs and actions (*Cross, 2008; Pruitt & Grudin, 2003*).

We built our personas from translating our empirical findings, in a backstage negotiation space, where the personas were articulated and discussed - creating a shared understanding in the design team. The development of personas made it possible to have the real actors represented during our backstage design activities, where they acted as spokespersons.

Personas can be used for different purposes as a communicative tool, supporting the development phases or supporting evaluation and decision-making (*Pruitt & Grudin, 2003*). We used them through the whole design process to support our participatory design approach, but with having in mind that they should not take over the actor involvement, as they are reduced representations and do not represent the complexity of a real person. Having personas as an integrated part of the design process made it easier to relate to the users' needs.

3.2.5. MORPHOLOGICAL CHART

The morphological chart was used as a part of the concept development phase. When developing solutions it is important to make a variety of different ideas to not miss possible solutions. This can be done from using the morphology method: *"The aim of the morphological chart*

method is to generate the complete range of alternative design solutions for a product, and hence widen the search for potential new solutions" (*Cross, 2008, s. 140*). From using the method a chart is built where each row represents the functions for a concept and the columns represent different ways to perform these functions. Combining different ideas from the rows makes it possible to create concepts (*Cross, 2008*). We used categories from our initial performance specifications as functions in the chart and from this we developed a range of different ideas in a brainstorm, filling out the chart. It created a backstage negotiations space where ideas were discussed and solutions were created.

3.2.6. WEIGHTED OBJECTIVES

From creating a range of alternative solutions the designer is faced with the challenge of choosing solutions. For this decision-process to be rational and not guesswork we chose to use the weighted objectives method. This is a method for assessing and comparing different solutions based on objectives. A list of objectives is used to evaluate the solutions and the solutions are then scored individually based on their ability to live up to the objective (*Cross, 2008*). We chose to use our initial performance specification as this contains the objectives for the design. Instead of weighing the objectives, we found that the requirements being divided into demands and wishes reflected the importance of the objectives. Each solution was then evaluated and given a number, based on the Fibonacci equation. The Fibonacci equation is here used, with inspiration from agile development where the purpose is to reduce the complexity of estimation by making the difference between the alternatives larger, the higher up it is estimated (*Augustine et al., 2005*). The process created a backstage negotiation space in the team. From going through the different requirements, the solutions were discussed and specified as well as evaluated. Similarities and differences in the concepts became visible for the team and some solutions were combined and refined. It was just as much the discussion that the method created, as the numbers assigned, which contributed to the design process, as Cross (*2008, s. 47*) describes: *"(...) they (design methods) externalize design thinking, i.e. they try to get your thought and thinking processes out of your head and into the charts and diagrams (...). This externalising is a significant aid when dealing with complex problems, but it is also a necessary part of team work, e.i. providing means by which all members of the team can see what is going on and can contribute to the design process"*. Using the weighted objectives method made it possible to create a shared understanding from evaluating alternatives and choosing a concept to focus on in the further design process.

3.3. LITERATURE REVIEW

As a part of our design project, we performed a literature review, as we found it relevant to get insight into existing research related to the design problem. "*An effective and well conducted review as a research method creates a firm foundation for advancing knowledge and facilitating theory development*" (*Snyder, 2019, s. 333*). The purpose was, therefore, to gain an understanding of the current literature related to our design problem as well as to contribute with new knowledge.

Starting our literature review, we produced an initial search on the internet for reports, articles etc. related to our design problem. Here, the work from the Objectives tree method contributed as it provided information about which design focus, and specific branches of the objectives tree, we needed to focus the search on. As the work proceeded, we gained a brief understanding of the field and were then able to proceed with a

systematic literature review. "*The aim of a systematic review is to identify all empirical evidence that fits the pre-specified inclusion criteria to answer a particular research question or hypothesis*" (*Snyder, 2019, s. 334*). This search was performed in the databases Scopus, Engineering village, and SciTech Premium Collection. These three databases combined provided the possibility to conduct a widespread search for us to gain a scientifically based knowledge of the field. The search was based on different search facets. These were based on the knowledge gained from the unsystematic literature search related to the design problem. These facets were used to generate a search string based on boolean operations such as 'AND', 'OR' etc. This enabled us to create searches that covered a wide range of possible keyword combinations which resulted in 63 articles. These results were screened from the inclusion and exclusion criteria produced to find relevant articles for our problem focus (see appendix 1). This resulted in 29 articles, which later was read and added to contribute to our literature review (see section 5.1). The literature was further supplemented by reports and other studies found through further research and referred to by actors involved during the design process.

4

PROBLEM AREA

4. PROBLEM AREA

This chapter presents the background for the choice of our design problem and defines the research question explored in the report.

4.1. SUSTAINABLE DEVELOPMENT

The design project is based on the aim of creating a solution contributing to sustainable development. Sustainability has become an agenda, widely accepted as a desired and important part of future development. An often-used definition for sustainability is stated in the Brundtland Commission report: "*Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (*Imperatives, 1987, p. 41*). Sustainability as a concept contains three dimensions: environmental-, economic- and social sustainability (see Figure 9). It is argued that sustainability occurs in the intersection of these three dimensions and that all dimensions, therefore, should be taken into account to fully contribute to sustainable development (*Purvis et al., 2019*).

In December 2019, the Danish government agreed on a new climate act, that will comply with the Paris Agreement (*Danish Ministry of Climate, Energy and Utilities, 2019*). In this new climate act, the goals are to reduce the greenhouse gasses (GHG) by 70 pct. by 2030 as well as becoming net zero in emissions by 2050. One major part of this climate act is to establish an efficient and green energy sector in Denmark. The focus on the energy sector is also supported by the United Nations sustainable development goal number seven, which states that we are to "*ensure access to affordable, reliable, sustainable and modern energy for all.*" (*Rosa, 2017, p. 23*).

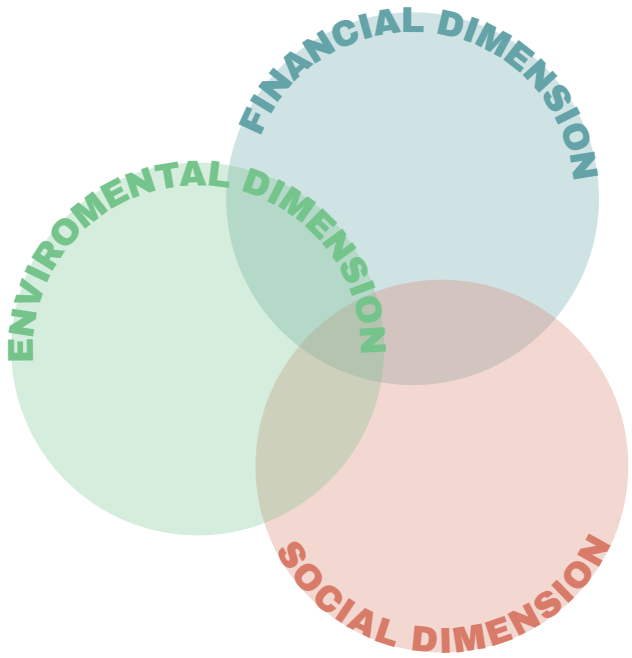


Figure 9: The three dimensions of sustainability.

4.1.1. ENERGY CONSUMPTION IN BUILDINGS

The energy consumption of buildings has a significant impact and is highly relevant to transitioning into sustainable development. Humans spend most of their time inside buildings, and throughout technological evolutions, the human population has made itself dependent on the reliable and constant generation of energy (*Zhao et al., 2017*).

Buildings account for about 40 pct. of the total energy consumed in the EU, which is responsible for approximately 36 pct. of the carbon dioxide

emissions (*European Commission, 2019*) (see Figure 10 A). The same amount of end-use energy consumption is corresponding in Denmark (*Mathiesen et al., 2016*). Optimising energy consumption of buildings holds the potential for adopting more sustainable solutions, which we explored throughout this project.

Residential buildings take up around 75 pct. of the total building stock in the EU (see Figure 10 B), and is therefore responsible for a significant part of the energy consumed in the building sector: *"In 2009, European households were responsible for 68 % of the total final energy use in buildings."* (*Economidou et al., 2011, p. 10*).

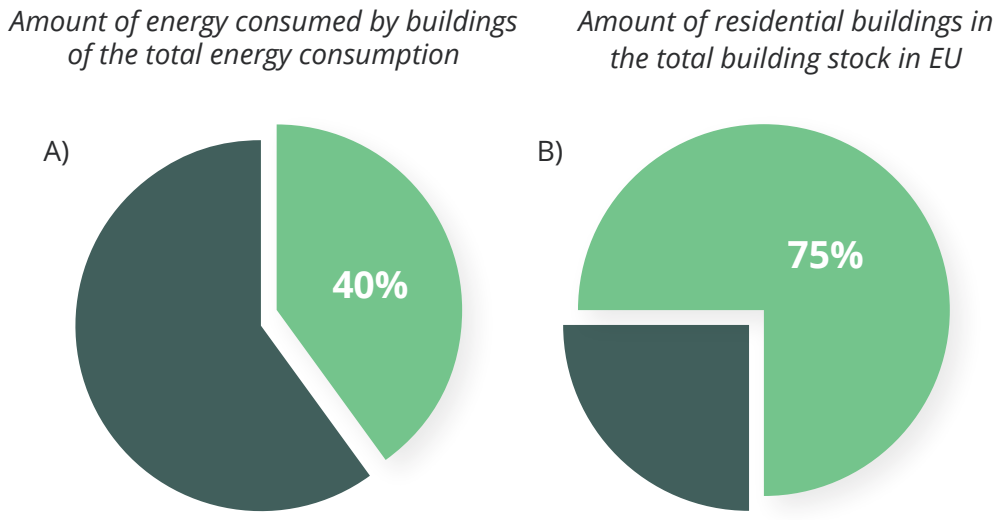


Figure 10: A) The amount of energy consumed by builidings out of the total energy consumption and B) the amout of residential buildings in the total building stock in EU.

With this understanding, we chose to narrow our focus to residential buildings, and thereby excluded non-residential buildings, i.e. wholesale & retail, offices, educational buildings, hotels, hospitals etc., from the study. Residential buildings can be divided into different types, where the most common are apartment buildings, single-family detached houses (free-standing residential buildings) and townhouses (attached buildings which share at least one common wall with another) (*Danmarks Statistik, 2020*). With a significant difference in the types of residential buildings, we saw the need for narrowing our focus even further.

4.1.2. DETACHED SINGLE-FAMILY HOUSES

The focus of this project landed on detached single-family houses. This was due to a majority of the houses in Denmark being of this type, combined with the fact that it is most commonly owned by the residents living in the house (*Danmarks Statistik, 2020*). The type of ownership determined in what way the house owner was empowered to conduct changes to the house, such as energy renovations. Therefore, we chose

to focus on full ownership, as it is the least complex type of ownership since there are little to no constraints and restrictions in this dynamic.

In 2019 the building stock of Denmark consisted of many older single-family detached houses (see Figure 11), where 81 pct. was built before 1980 (*Danmarks Statistik, 2019*). The year of construction reveals a lot about the energy performance of the house, and what can be done to improve it. For example, houses built in the period between 1961 up until the year 1979 share common attributes in terms of energy consumption (*Jensen et al., 2016*). Therefore, we saw potential in developing a solution which optimises the energy consumption of single-family detached houses to contribute to sustainable development.

4.1.3. OPTIMISING ENERGY CONSUMPTION OF RESIDENTIAL BUILDINGS

The types of energy consumed in residential buildings are electricity and heat. They are used for cooking, drying, warm water, running appliances, refrigeration, lighting and regulating the indoor temperature to sustain the buildings livable indoor climate (*Kuhe & Bisu, 2019*). The energy consumption of a residential house can be divided into two purposes: to sustain or create a comfortable indoor environment and to support the actions taking place in the building where appliances, equipment and other electric systems need electricity to function.

Figure 11: The amount of detached single-family houses in Denmark from 1900-2019 (Danmarks Statistik, 2019).

Optimising energy consumption is identified as a relevant aspect of creating a more sustainable building stock (*Wu et al., 2017*). From working with the objectives tree method we identified that energy optimising single-family detached houses can be divided into two main areas (see Figure 12):

- *Optimising the energy performance of the building.*
- *Optimising the energy efficiency related to the operations taking place in the building*.

Optimising the energy performance of the building is influenced by a range of factors. This involves the building envelope's ability to produce a comfortable indoor environment with little use of energy (*Economidou et al., 2011*). Also, the performance of installed technical systems influences the performance, where new more sustainable technology can have a considerable impact (*Zhao et al., 2017*). Optimised energy consumption of buildings does not only relate to energy efficiency but also the sustainability of the energy used. Production and use of renewable energy is a way to optimise the energy consumption of buildings (*Economidou, 2015*). These optimisations can either be implemented in new buildings assuring optimal energy performance or in existing ones through renovation (*Economidou, 2011*).

Optimising the energy efficiency related to the operations taking place in the building is both related to the energy-consuming appliance and equipment in a building (*Economidou et al., 2011*). The user-behaviour also influences the energy consumption of buildings to a large degree (*Zhao et al., 2017*). More energy-efficient behaviour, where the consumer performs activities in a house reducing the amount of energy used, contributes to optimised energy consumption (*Lopes et al., 2017*).

Using the objectives tree method in a backstage negotiation space made it practicable to discuss the possible directions for the design project. The objectives tree worked as an intermediary object representing and mediating findings, translating them into an object to base design decisions upon. Different branches of the objectives tree call for different solutions, and we, therefore, chose to narrow our focus on optimising the energy consumption of existing single-family detached homes through renovation.

4.2. ENERGY RENOVATION

Energy renovations are changes to existing buildings to optimise its energy performance. These changes can overall be divided into three areas: technical operation systems (heating systems, heat tanks, thermostats etc.), the building envelope (roof, floors, walls, windows, insulation materials etc.) and renewable energy generation systems (solar power, geometric heating, wood pill burner etc.) (*Economidou, 2015*) (see Figure 12).

Energy renovation has been on the political agenda in Europe since the 1970s, after the incidents of the oil crisis (*Jones, 2012*). Since then, more strict requirements for buildings have been established, and new buildings are therefore consuming less energy. A residential house from 1890-1930 e.g. consumes over twice as much energy for heating pr. square meter on average, than houses built in the year of 2006 (*Concito, 2017*). Of all residential buildings in Denmark, approximately 70 pct. was built before there existed energy requirements for buildings (*Concito, 2017*). With only a limited amount of newly built houses each year, corresponding to about 1 pct. in the EU (*Artola et al., 2016; Mathiesen et al., 2016*), it can be expected that many of the buildings existing today will also be here in the decades to come. Energy renovation of the existing building stock is therefore

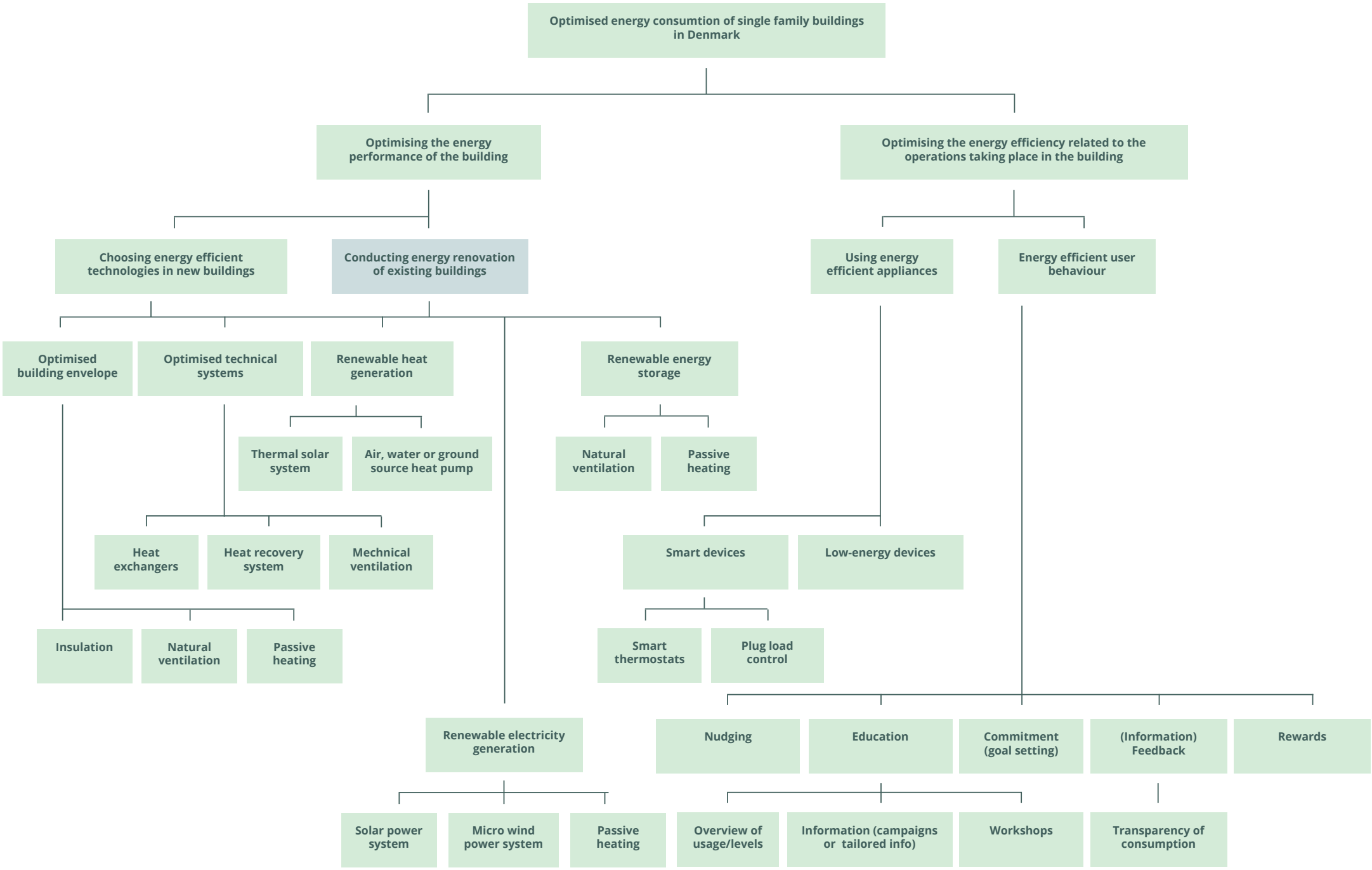


Figure 12: Objectives tree for problem area.

seen as a relevant strategy to contribute to sustainable development and contribute to the vision of zero-emission in the Danish energy sector (*Concito, 2017*).

Energy renovating a house can have several benefits, covering all three dimensions of sustainability. It is estimated that energy renovations can contribute to 60-80 pct. reduction of energy consumption in buildings in developed countries (*Dineen & Gallachóir, 2017*). Not taking into account the CO_2 emission used to produce the materials and building the house, energy renovations can reduce CO_2 emission by 50-75 pct. as well as saving around 3000-5000 DKK in the annual costs of a household (*Jones et al., 2017*). Another aspect of the benefits of energy renovation is social sustainability, including increased indoor climate, which can improve the well-being and health of its users (*Brüel, 2013*).

In general, energy renovations contribute to the agenda of sustainability, but some renovations are argued to be more optimal than others depending on the house (*Organ et al., 2013*). Optimal energy renovation is difficult to define and it has been studied from different perspectives. Different models have been developed which propose ways of calculating optimal renovation focused on the technical and operational performance of a house for a lower environmental impact (*Najjar et al., 2019*). Other studies, such as Jafari & Valentin (*2017*), also incorporate social and economic aspects and take into consideration that optimal energy renovation also involves a range of factors such as reducing operational costs or enhancing the indoor comfort. Optimal energy renovation thereby depends on the perspective from which it is looked at. Due to our socio-technical mindset, we find it relevant to consider diverse factors. Optimal energy renovation is one part of the problem while having people energy renovate is another. This project focuses on the largely unrealised potentials in having more people energy renovate their houses.

Even though sustainability targets have increased the public awareness towards energy use and energy savings (*Mortensen et al., 2016*), and that new technology holds a large potential in contributing to this, it has not become a common practice to energy renovate among the European house owners (*Azizi et al., 2019; Bjørneboe et al., 2018; Feser & Runst, 2016; Gimpel et al., 2019; Kuhe & Bisu, 2019; Pardalis et al., 2019*). The current rate of renovation in the EU is low, where only 1-2 pct. of the building stock is renovated each year (*Artola et al., 2016; Pombo et al., 2019*).

4.3. RESEARCH QUESTION

To contribute to the sustainable development of the building and energy sector our design project focused on creating a solution which can have more single-family detached house owners energy renovate their houses. This report presents research conducted from the design project and reflects on how the design approach based on the framework Staging Negotiation Spaces have contributed to the development of a sustainable solution, reflected in the research question:

How can we, through staging negotiation spaces, design a solution which can contribute to sustainable development by having more detached single-family house owners in Denmark conduct energy renovations?

5

INITIAL RESEARCH

5. INITIAL RESEARCH

The initial exploration of the design problem, about having more house owners energy renovate their homes, was conducted through both a literature review and empirical research. This chapter presents this convergent phase of the design process, where different perspectives were revealed through both insight into existing research, and through staging negotiations spaces with relevant actors.

5.1. LITERATURE REVIEW

The area of motivating energy renovation of private homes is in the literature an area which only recently, in the last decade, has gained attention (*Gram-Hanssen et al., 2015*). Existing literature represents the understanding that private houses in the existing building stock hold a large potential, which can contribute positively to sustainable development in European countries (*Judson & Maller, 2014; Mortensen et al., 2016*). To get insight into existing knowledge and get a better understanding of the field from different perspectives and approaches, a part of the initial research was a literature review of existing published research on the area.

5.1.1. THE DIFFERENCE IN HOUSE OWNERS

A common understanding presented in current literature is that a range of factors can influence the choice of energy renovation and this depends on the specific house owner and situation (*Azizi et al., 2019; Bjørneboe et al., 2018; Gram-Hanssen et al., 2015; Organ et al., 2013; Wilson et al., 2018*). A study from Denmark based on data from a questionnaire survey, answered by 883 Danish single-family house owners, concludes that house owners can not be seen as a homogeneous group influenced by the same motivational factors. There is a difference in how house owners think about and act in relation to energy renovations, depending on the person's position in life (age, number of children, time lived in the house etc.). The study finds that younger house owners are significantly more willing to renovate than older ones. Also, the period a house owner has lived in a house makes an impact, where the longer period results in lower willingness to renovate it (*Mortensen et al., 2016*). Competencies are also found to influence the house owners decision. Some house owners hire professionals to do the energy renovation while others prefer do-it-yourself (DIY). In Denmark, DIY renovation is not a rare practice (*Bartiaux et al., 2011*) but it is mainly found in smaller renovations, where the financial aspect does not have a major influence (*Vanhoutteghem & Rode, 2014*).

It is argued that to motivate more energy renovations a more varying approach should be used to target the different types of house owners (*Mortensen et al., 2016*). An English study, based on data collected from semi-structured interviews with 20 households in the UK, also points towards this conclusion (*Haines & Mitchell, 2014*). The researchers created different personas which in relation to optimising the energy efficiency of their homes are affected by the different factors such as aesthetics, comfort or climate change (*Haines & Mitchell, 2014*)

5.1.2. FACTORS INFLUENCING DECISION-MAKING ABOUT ENERGY RENOVATIONS

Current literature presents that a range of factors can influence the decision about energy renovations (*Azizi et al., 2019; Bjørneboe et al., 2018; Gram-Hanssen et al., 2015; Organ et al., 2013; Risholt et al., 2013; Wilson et al., 2018*). It is argued that important motivators involve reducing energy

bills, attraction to modern technology, improving the indoor environment to increase comfort and health conditions, increase the aesthetics of one's home, improve architectural quality, minimising maintenance, improve functionality and operational reliability, as well as environmental awareness (*Azizi et al., 2019; Bjørneboe et al., 2018; Ea Energianalyse, 2015*). A German study (*Achtnicht & Madlener, 2014; Knudsen & Jensen, 2013; Niras, 2013*) performed as a survey, answered by around 400 house owners, found that most frequent drivers for investing in energy renovations are reducing high energy costs, needed renovations and increased level of comfort, which was also concluded by two Danish studies (*Achtnicht & Madlener, 2014; Knudsen & Jensen, 2013; Niras, 2013*). In the following sections the influencing factors, found in current literature, are investigated, divided into three identified categories: finance, information and process.

5.1.2.1. FINANCIAL MOTIVATORS AND BARRIERS

Financial barriers involved a lack of available financial resources. This is by a majority of the current literature argued to be a preventive factor for energy renovation (*Achtnicht & Madlener, 2014; Azizi et al., 2019; Bjørneboe et al., 2018; Knudsen & Jensen, 2013; Pardalis et al., 2019; Weiss et al., 2012; Wilson et al., 2018*), especially influencing the younger house owners decision (*Vanhoutteghem & Rode, 2014*). Finance is, on the other hand, also argued to be a motivator because energy renovations can reduce the running costs of a house, increase the market value of a property and in some cases bring a return on investment (*Azizi et al., 2019; Bjørneboe et al., 2018; Feser & Runst, 2016; Knudsen & Jensen, 2013*). It is however not always a motivating factor as some house owners do not see the financial benefits as realistic (*Azizi et al., 2019; Claudelin et al., 2017; Pardalis et al., 2019*). An evaluation of the Danish initiative BetterHome (in Danish: BedreBolig) (read more in section 6.3), performed through both a questionnaire and interviews, have found that the house owners who have received energy renovation counselling are influenced positively by it being presented as an economic reasonable decision. Interestingly they also found that specific numbers about savings and economic gains are not important to the house owners, as long as an estimate points towards it being a solution which can bring down the running costs of the house, and at the same time contribute to a better home, involving aesthetics and comfort (*Niras, 2016*).

Basing initiatives mainly on the rationale that it is an economically beneficial choice has been criticised in Danish studies. It is argued that presenting economic savings as the main motivator is a disservice as it takes focus away from the other advantages (*Bjørneboe et al., 2018; Ea Energianalyse, 2015*). While other renovations, such as getting a new kitchen, do not relate to return on investment, the financial aspect becomes the main focus of energy renovations, even though there are many other benefits (*Bjørneboe et al., 2018*).

5.1.2.2. INFORMATION BARRIERS AND MOTIVATORS

Energy renovations are argued to be a difficult area because it is often renovations that are not visible, which a majority of house owners would not consider in their daily life (*Niras, 2016*). It is further argued that a majority of house owners find energy renovation complicated and they would not know where to start, which solutions would be optimal and how to perform energy renovations (*Knudsen & Jensen, 2013; Vanhoutteghem & Rode, 2014*). In current literature information and knowledge is, therefore, argued to be essential for motivating more energy renovations.

A social practice-theory study has analysed data from interviews with 15 house owners who recently had bought a detached single-family house. From the study, researchers found that energy renovations are rare and it is, therefore, not an embodied habit for many house owners. It is not an integrated practice in Denmark (*Bartiaux et al., 2011*). House owners know-how is limited and they often seek advice from others in their network during the decision process. The institutionalised knowledge also has a role, as energy label reports and websites influence the house owner's awareness and knowledge on the area (*Bartiaux et al., 2011*). It is, however, still argued by some researchers that there is a lack of knowledge about the potentials and opportunities to assist the house owners decision-making about energy renovation (*Bjørneboe et al., 2018*). Other studies conclude that if the need for it is indistinct to the house owners, it does not create motivation, and they will not energy renovate (*Ea Energianalyse, 2015; Knudsen & Jensen, 2013*).

Not only the level of access to the information, but also the type is argued to influence whether it can become a motivating factor, and access to trustworthy and comprehensive knowledge is important (*Bjørneboe et al., 2018*). A Danish study articulates that it should be easier and more transparent for the consumer to choose between products and make the right choice, as the number of different products on the market can seem overwhelming (*Ea Energianalyse, 2015*). Personal advice from experts has also been found to be influential as it creates specific, tangible and credible knowledge for the house owner (*Olsen et al., 2017*). Another study found that change in motivation for energy renovation is influenced just as much by experiences and advice from a person's network as from experts (*Niras, 2016*).

5.1.2.3. PROCESS BARRIERS AND MOTIVATORS

Aspects of the process of energy renovation is in current literature also argued as both a motivation and a barrier to energy renovation. First of all, energy renovation is perceived by house owners to be time-consuming and disruptive of daily life during the renovation, causing potential stress (*Azizi et al., 2019; Weiss et al., 2012*). Expenses such as time, trouble and mess are found to influence the house owners choice (*Niras, 2016*). In a Danish study, it is identified that getting the process started is challenged because doing nothing is easier than initiating a renovation process, additional to the fear of a disturbing daily life (*Bjørneboe et al., 2018*).

Further, a practice-theory analysis of energy renovation practices argues that renovation is not a stand-alone practice: it is intertwined with other daily routines, and these are just as important to understand as the renovation process itself since these are all continuously negotiated with the practice of renovation: *"Rather, renovation practices are constituted through everyday routines, in particular the skills and know-how, common understandings, and material configurations of a broad range of other practices."* (*Judson & Maller, 2014, p. 502*). Energy renovation is often found as a side effect of or in combination with intensifications or expansions of a house, related to motivations such as added livability with e.g. better hobby or socialising facilities (*Bartiaux et al., 2011; Gram-Hanssen et al., 2015; Judson and Maller, 2014; Niras, 2016; Pardalis et al., 2019*). In relation to this, it is argued that: *"households continually adapt their homes to the demands of domestic life."* (*Wilson et al., 2018, p. 1334*). Energy renovations are therefore performed continuously throughout life. One Danish study criticises that national initiatives typically do not consider this aspect, as it is not only when people move into a new house that renovations are performed (*Gram-Hanssen et al., 2015*).

5.1.3. STUDYING SOLUTIONS PROMOTING ENERGY RENOVATIONS

In general, specific solutions which are developed to overcome the barriers, and have more people energy renovate their houses, are limited in the current literature. Available findings are presented in the following.

5.1.3.1. POLITICAL INSTRUMENTS

Regulation can control the house owners, while information and advice can motivate and convince for change in behaviour (*Jensen, 2013*). Introducing regulation on the area, forcing people to energy renovate, is an effective solution, but it is associated with a lot of challenges as it could e.g. create a social imbalance in society and it could hinder smaller renovations (*Bjørneboe et al., 2018*). Therefore, it can be argued to be a better solution to provide conditions which will motivate rather than force action. A Danish study suggests that providing funds through loans or grants can help release more energy renovations as it supports the initial finance of the renovations (*Bjørneboe et al., 2018*). The same study argues that the current policy schemes do not match the large differences there is among house owners, which is a problem as it does not target the different house owners but rather see them as a homogeneous group (*Bjørneboe et al., 2018*).

5.1.3.2. PROFESSIONAL PERSONAL ENERGY ADVICE

In Denmark, energy advisers are used as a strategy to promote energy renovations (read more about this in section 6.3). A Danish study of an initiative where house owners get personal advice on how to energy optimise their house found that energy advisers can reveal the more hidden opportunities in a house, and thereby make the house owners aware of opportunities (*Niras, 2016*). It can thereby inspire house owners to do things they would not have thought of because it is not physically visible or common knowledge. The study also concludes that more of the house owners who have received the energy advice chose energy renovation compared to the general house owners who have not received advice (*Niras, 2016*). Evaluations of the initiative, through a questionnaire, conclude that 75 pct. of the respondents implemented some suggested improvements, but 66 pct. argued that the grants provided by the municipality in the period were crucial for their request for an energy renovation suggestion plan (*Bjørneboe et al., 2018*). A majority of the Danes are not willing to pay for energy advice. Only one out of four house owners who have used a professional energy adviser have paid for the service (*Niras, 2016*). In another study energy advisers are also presented as an initiative with a low effect as people are not willing to pay for the service (*Feser & Runst, 2016*).

5.1.3.3. CONCEPTS PROMOTING ENERGY RENOVATION

The concept of a one-stop-shop is presented in the current literature, to promote energy renovations, where variants are proposed and researched from different perspectives. One study, performed as

a questionnaire answered by house owners in Sweden, found that accessible comprehensive information, as well as the reliability of the information, influence the house owners, and an online one-stop-shop is proposed as a tool where the house owner is connected to verified building professionals who is helping them through the whole renovation process (*Azizi et al., 2019*). Another Swedish study investigates the interest for a one-stop-shop concept for energy renovations among house owners through a survey. Interest is caused by the benefit of a comprehensive package with a guarantee of work quality, clear costs, inspections and suggestions before the start as well as clear estimations of energy savings related to the renovation. The respondents not interested argue that they associate it with higher costs and lack of freedom when choosing the ones to perform the work (*Pardalis et al., 2019*). The studies thereby argue that reality is that a one-stop-shop concept appeals to the house owners, but when it comes to purchasing such services some of the house owners hesitate.

5.1.4. PART CONCLUSION

The literature review gives an overview of what has already been researched, and what findings emerge from the studies. There are some key points that we carried with us onwards and some limitations to existing literature that we wanted to address:

- Factors of energy renovation can rarely be pinned down to one factor, and the factors will almost always be related to one another.
- Only focusing on identifying the barriers and motivators is not sufficient to achieve more energy renovations as also other factors such as situation, competencies and knowledge influence the choice.
- There exist various types of house owners that react differently to factors of energy renovation, and there should be differentiated between these.
- Many of the studies described in the current literature are based on quantitative data. This covers broad and gives insight into whether the results can be somehow generalised or not. But such studies also carry limitations, as the context in which the questions have been answered is lost in the analysis and follow-up answers with explanatory information is not included.
- Current literature does often not come up with specific plans and solutions on how to get to a point where more house owners energy renovate, as it is focused on analysing the problem and not how to create a change.

Through our design project, we wanted to study how to make a change through staging negotiation spaces. Barriers and motivators are relevant to identify, as in the current literature, but there is a gap where an understanding of underlying factors is needed. Our study, therefore, took a step deeper into the understanding of how to make more people energy renovate and what solutions could support sustainable development.

5.2. EMPIRICAL RESEARCH

Following our staging negotiation spaces design approach, an essential part of investigating the design problem was empirical research. To get a better understanding of the design problem , we, therefore, staged a range of frontstage negotiation spaces. Actors related to our research question were involved both to identify needs related to the design problem, and also to get an understanding of the development arena (*Jørgensen et al., 2017*) on which we were operating. The goal was to create intermediary objects, to frame the design problem and mediate knowledge between the design team and the participants.

5.2.1. DESIGN GAMES WITH HOUSE OWNERS

An essential actor related to the design problem is the house owner. This is the actor we were interested in translating into following the agenda of conducting energy renovations. It was, therefore, relevant to get insight into this type of actor's concerns, interests and relations, to be able to develop a solution for the intended translation. To do this, we staged negotiation spaces with the use of design games (see Figure 13). The facilitation of the negotiation spaces was further supported by a semi-structured interview to guide the dialogue.

We divided the house owners into two types: house owners who had energy renovated, and the ones who had not. For the sake of understanding house owners different relations to energy renovation, we wanted to collect data from both groups. From the group that had already energy renovated, it was interesting to us what their process had been, who they had contacted, what barriers they had met and what motivated them. For the house owners who had not energy renovated

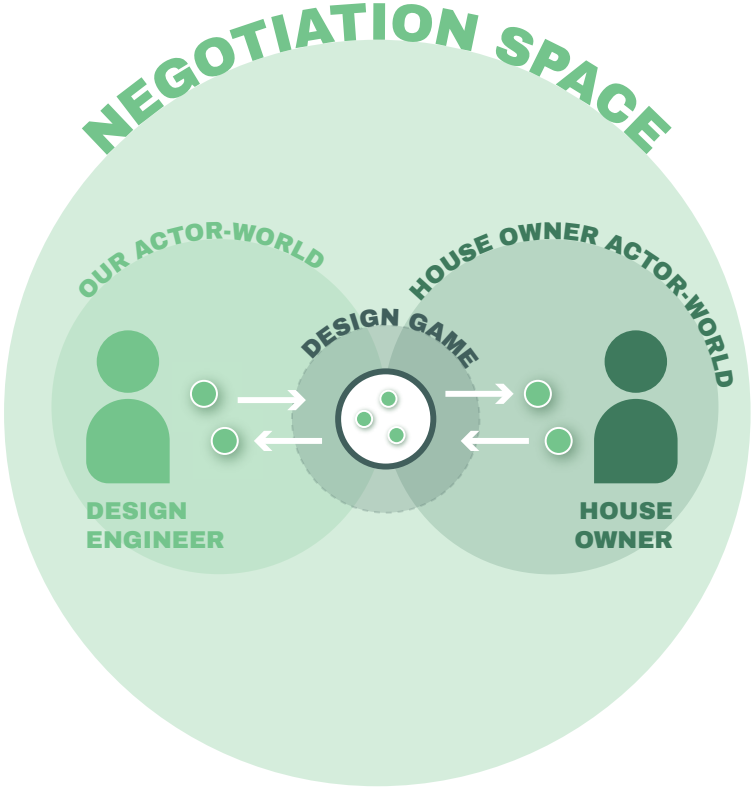


Figure 13: Using design games as intermediary objects in negotiation spaces with house owners.

the barriers were especially relevant as these should be overcome to handle the design problem. We involved 15 house owners who had energy renovated and 10 who had not, in this part of the design process.

5.2.1.1. DESIGN GAMES WITH HOUSE OWNERS WHO HAD ENERGY RENOVATED

This design game negotiation space aimed to investigate the experience of house owners who had already undergone an energy renovation (see appendix 2). The design game was made in an online slideshow program, where an editor link was shared with the participants, allowing them to simultaneously edit the slides, as well as watch edits in real-time. Communication with the participants was conducted over the phone while editing on the computer.

The first slide was a board representing the idea phase (see Figure 14), which is the moment when the house owner gets the idea about doing the energy renovation. This part was separated from the rest of the renovation phases to get a clear understanding of what initially sparked the process, which could also be called the initial motivation.

The second slide was a board visualising the next phases: before, during and after a renovation (see Figure 15). During the design game, the participants were asked to identify actors who were involved and their relations, articulate challenges and rate motivations, which had played a role in the different phases.

The design game acted as an intermediary object through the negotiations. The board represented, through the inscribed renovation process, the overall framing to get insight into the house owners experiences. This

Figure 14: First slide of design game representing the Idea phase of the energy renovation process.

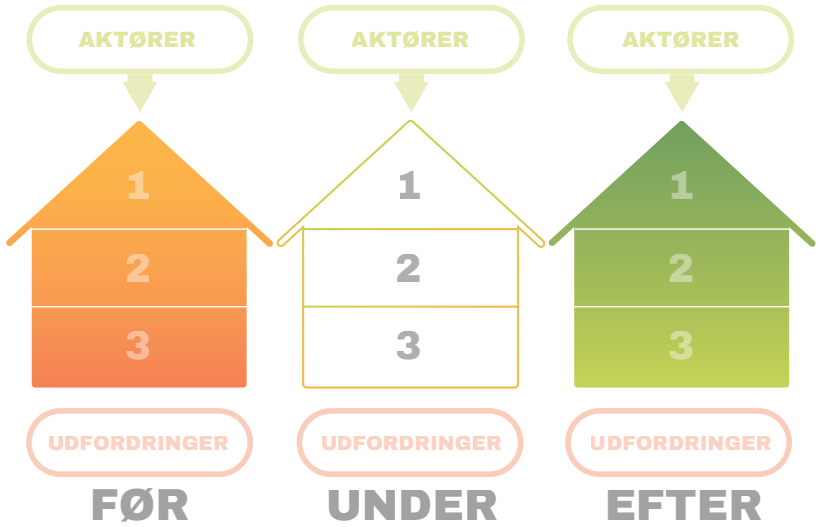


Figure 15: Second slide of the design game representing the before, during and after phase of the energy renovation process.

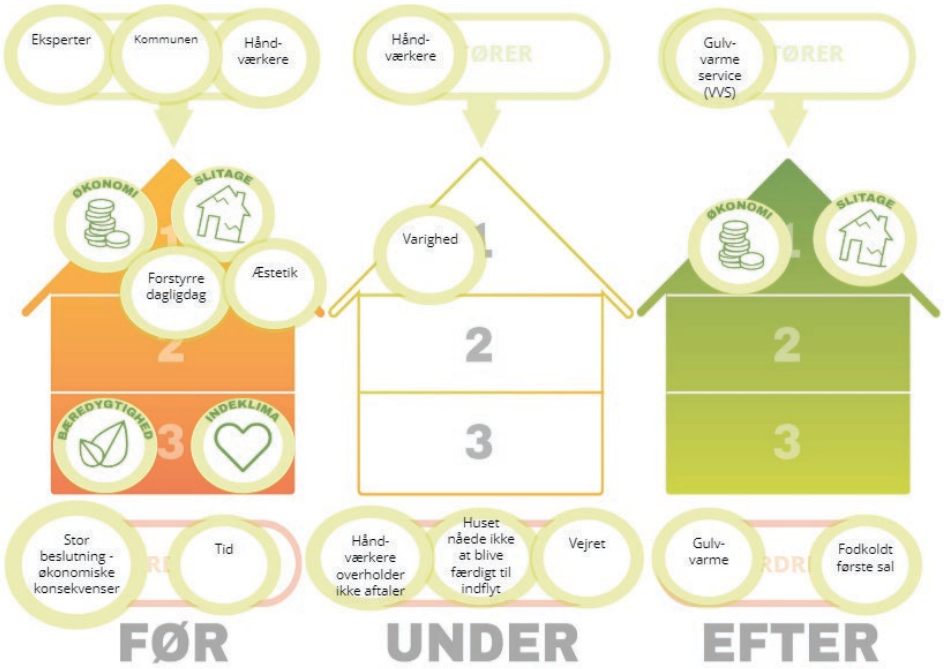


Figure 16: Example from one of the staged negotiation spaces where the participant's concerns are inscribed in the design game.

made it possible to mediate relevant knowledge. It got the participants to reflect on what roles involved actors, such as craftsmen, advisers or the internet, had played and how it had affected the process. In terms of their role, they reflected upon their level of competence, and knowledge on the area, how that affected the process, their way of approaching it and overcoming barriers. The design game was also translated through the engagement, with the house owners contributions being manifested in bricks placed on the board. This made the house owners' concerns and experiences visible and tangible, which made it possible to create a dialogue about the otherwise complex process of energy renovation (see Figure 16).

5.2.1.2. DESIGN GAMES WITH HOUSE OWNERS WHO HAD NOT ENERGY RENOVATED

The aim of this design game, used in negotiation spaces with participants who had not energy renovated, was to get an understanding of their concerns and interests related to energy renovations, and as a part of that knowledge about the barriers holding them back from conducting energy renovations. This design game was also conducted online and shared with the participants while engaging a conversation over the telephone.

The negotiation spaces were built around the design games with slides presenting scenarios, representing different types of energy renovations. As we talked to people who had not energy renovated, we could not be sure that they knew about energy renovations. We, therefore, chose to translate and inscribe the concern into scenarios (see Figure 17), to make the concept of energy renovation more tangible and relatable (see all scenarios from the design game in appendix 3).

We experienced a broad variety in the participants' knowledge and experiences with energy renovations. Some participants, even though they beforehand had articulated that they had not energy renovated, had done some kinds of energy optimisations, but did not associate it with energy renovations. However, we experienced that for all types of participants the scenarios worked as a dialogue initiator and it helped as an intermediary object during the negotiation spaces. It mediated knowledge and translated the house owner into a position where they could contribute with their perspectives.

Scenarie 1 - Varmepumpe

Figure 17: Example of a scenario presented as a part of the design game used in negotiation spaces with house owners who had not energy renovated.

5.2.1.3. DISCUSSION

Certain elements make the design game a great tool for participatory interventions: *"(1) creating a common design language; (2) promoting a creative and explorative attitude; (3) facilitating the players in envisioning and enacting 'what could be'; and (4) helping to define the roles of participants in the interaction during a session."* (*Vaajakallio & Mattelmäki, 2014*). Our experiences were that it did create a 'common language', both in the first presented game when the focus was process-oriented (with house owners who had energy renovated), as well as in the second design game, where it was scenario-oriented (with house owners who had not energy renovated). Both worked as intermediary objects, mediating knowledge during the negotiation spaces. The participants were hesitant to write and move the pieces themselves in the linked slideshow but would give directions to the facilitator if necessary. There were clear signs of the 'promotion of creative and explorative attitude'. It was present in the process-oriented design game, with the participants' interactions and stories, but it was even more clear when using the design games with scenarios, as it gave the participants associations to 'what could be'. Staging the space thereby made the participant contribute with perspectives relevant to our design concern. Each game started with a brief talk about their family type and their house, which we experienced made it natural for the participants to step into the role of being house owners during the design game. Further, the explicit focus on energy renovation, inscribed as the board of the games, 'helped define the roles of participants in the interaction'.

The actor involvement was planned to be performed in physical negotiation spaces, but due to a pandemic, the framing of the spaces had to be changed. It is worth discussing, what aspects of the 'participatory' are lost (further elaborated in section 9) when the actor involvement is digital and has lost both the face-to-face experience, as well as changed the participants chance to interact with and take ownership of the design game. Despite this, we experienced that the fact that participants could see and edit the digital game in real-time, resulted in participation and we managed to create a shared negotiation space (see Figure 18).

As described above, it is hard to determine if a digital design game serves the same purpose as a physical one would. Although a physical design game

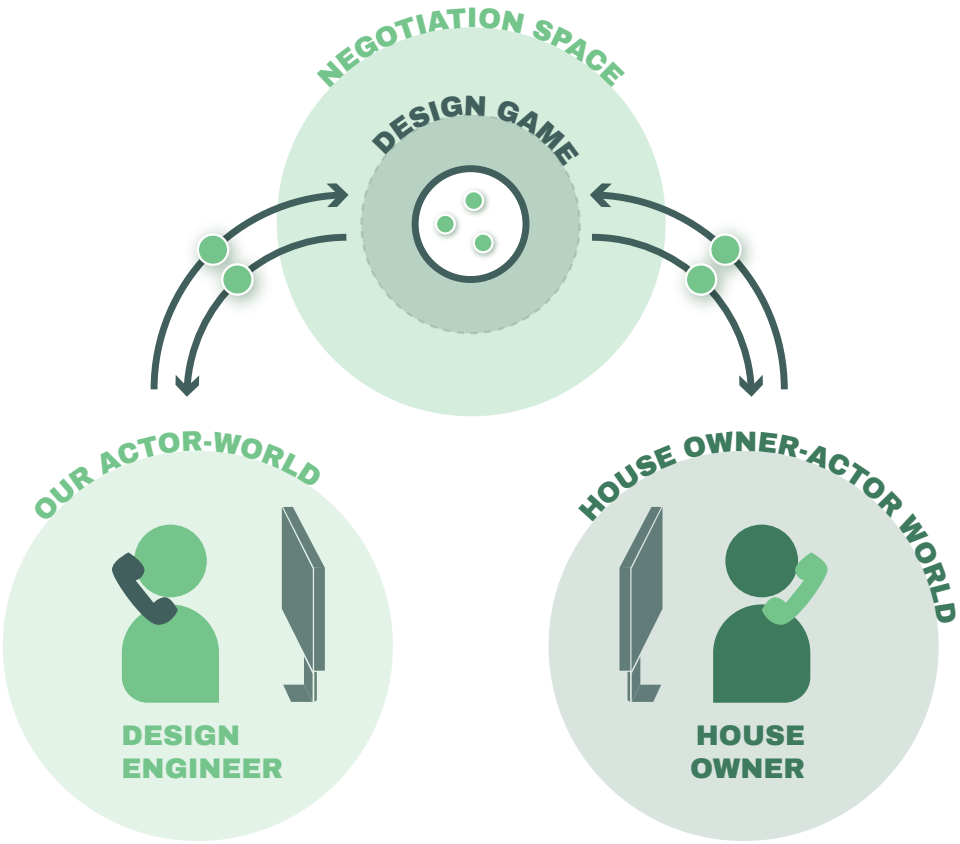


Figure 18: Staging digital negotiation spaces with house owners.

had been preferred, we were pleased with the participants' reaction to the digital versions, and the empirical data that it yielded. We experienced that even participants with low technology competencies could participate. This made it possible to get a variety of different house owners to take part in the empirical research.

5.2.2. INTERVIEWING ACTORS FROM THE DEVELOPMENT ARENA

A part of our strategic design work builds on working with Arenas of Development (*Jørgensen et al., 2017*) to understand the actors, relations and dynamics present within the boundaries of the design problem. To navigate on the development arena we were interested in getting an insight into different actors' roles and concerns to investigate the current network constellations and the possibility of translating a design solution into the arena. We, therefore, contacted a range of actors related to the design problem. These negotiation spaces were facilitated as semi-structured telephone interviews to be able to easily reach many actors, with the possibility of later conducting more comprehensive involvements. It worked as a 'roll the snowball' method (*Jørgensen, 2008*) where actors who were contacted, identified other relevant actors to be involved. In this way, our mapping and analysis were performed in an iterative process. We contacted different relevant actors, such as the Danish Energy Agency, energy advisers, architects, financial institutes, municipalities and energy technology suppliers. Read more about the outcome of these interactions in section 6.3.

5.3. PART CONCLUSION

The empirical research involved actively engaging relevant actors to contribute to the exploration of the design problem. Here, the central actor, the house owner, was involved through staging negotiation spaces with the use of design games. This participation contributed with knowledge about the house owners experiences and concerns, revealing motivators and barriers for energy renovation, as well as other relevant factors influencing their relation to energy renovation. Also, a range of other relevant actors was involved in the design process through semi-structured interviews, to get an insight into concerns, relations and networks present at the development arena on which we operated. This was relevant for navigating in staging future negotiation spaces. The findings from the empirical research create the base for the further design process with analysing and re-framing the design problem, presented in the following chapters.

6

ANALYSIS

6. ANALYSIS

From the initial research, an analysis was conducted. The analysis created the base for the problem identification and was essential to narrow the design focus. This chapter presents the analysis, which is divided into three sections presenting the initial analysis from the empirical research, the development of personas and our analysis of the arena of development on which we operated.

6.1. INITIAL ANALYSIS

All our empirical findings were synthesised and analysed through an affinity diagram. The affinity diagram is usually done analogue, but due to the social distancing in the team, as a result of the COVID-19 pandemic, we chose to create it digitally. The affinity diagram worked as an intermediary object representing the empirical findings through notes, citations, narratives etc., representing the involved actors concerns. It mediated knowledge between team members in a backstage negotiation space and translated the insight into categories and topics related to our design problem, creating alignment and making the data manageable for the further process. In the following, overall findings from the affinity diagram is presented.

6.1.1. ENERGY RENOVATION PROCESS

It was identified that the energy renovation overall consists of four phases: initial idea, before, during and after. The 'initial idea' is the time where a house owner experiences a need for renovating. Here, some needs are awoken by external actors creating awareness, while others find the need themself. 'Before' is the decision-making part of the process, from the house owners begin to explore the area until they commit to conducting energy renovations. 'during' is the process where the energy renovation is performed and 'after' is the process where potential after services are performed and it is here the house owner experiences the effects of the energy renovation.

In relation to our design problem about having more house owners energy renovate their homes, both the 'initial idea' where there is created awareness is important and the 'before' phase is relevant to get to the point where the house owner chooses to energy renovate (see Figure 19). However, we also found it relevant to understand the other phases as they influence each other.

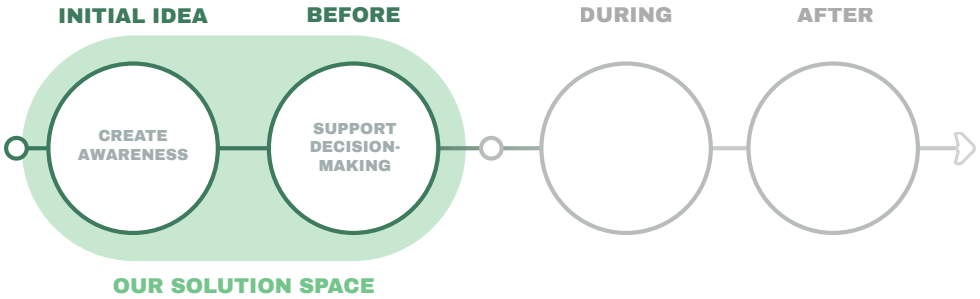


Figure 19: Energy renovation process marked with the phases influencing whether the house owner gets to a point where they choose to energy renovate their home.

6.1.2. FACTORS INFLUENCING THE ENERGY RENOVATION PROCESS

From analysing the empirical data in the affinity diagram, the findings were divided into categories which were divided into four groups: information, benefits, process and politics, with associated subtopics (see Figure 20).

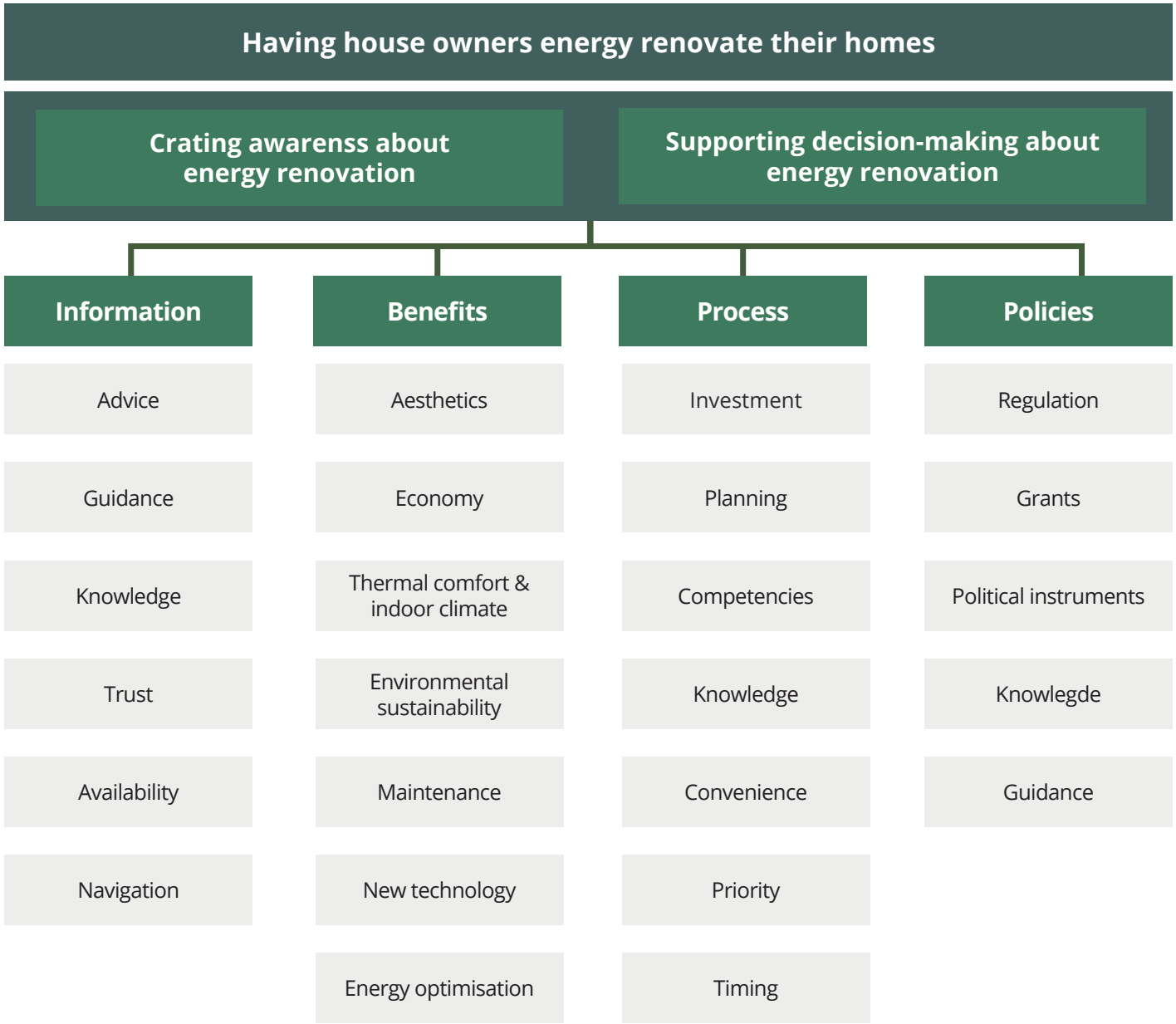


Figure 20: An overview of the data from the initial analysis of our emperical research.

These are related to the overall objectives identified to have more house owners energy renovate their homes: creating awareness and supporting decision-making. The following sections will describe the main findings from each of those categories. Through the sections, we refer to our empirical findings by their ID number, which can be found in appendix 4.

6.1.3. INFORMATION

The first category, information, holds findings related to house owners gaining an understanding of energy renovation (see Figure 21). Energy renovation is often seen as a large and long-term decision where the house owners want to make sure that they make the right choice (*H17-06, H10-06, H03-05, H03-02, H08-02 & H09-02*). Information is therefore relevant to support the house owners decisions and make them aware of benefits related to energy renovations.

Information			
Advice	Guidance	Knowledge	Trust
	Availability	Navigation	

Figure 21: Factors influencing the house owner in relation to the category Information.

6.1.3.1. ADVISE AND GUIDANCE

When starting a renovation project, the house owner has to make choices about aspects which can seem technical and complex. House owners who have not acquired this knowledge can either get help from external sources or by gaining the knowledge themselves (*H06-02, H03-01, H08-01*).

Our empirical research has shown that some house owners completely rely on searching the internet for help (*H18-03, H10-02, & H02-01*). When searching the internet, the objective can both be to find the specific technical expert knowledge, but also to see what others house owners have done with similar projects (*H10-04)*. House owners also to a large degree uses their network to get tips and inspiration from their experiences with energy renovation (*H10-02, H21-07, H22-13, H16-05, H16-06, H12-04, H14-01, H24-01, H24-02, H21-01, H21-06 & H12-01*). By doing this, they are better equipped to decide on the type of renovation and how they would proceed. This indicates that both contacting one's network in combination with conducting their research is an approach suitable for some house owners.

Lastly, gaining knowledge about renovation related matters can be gained by contacting professionals, such as craftsmen, architects, engineers or entrepreneurs. Acquiring guidance from professionals is something many of our informants are willing to do to find an optimal solution for their house (*H10-06, H18-02, H19-02, H21-05, H09-02, H10-03, H03-04, H08-01, A02-04, H10-03 & H08-02*). Some do it relatively early in the decision process (*H06-01 & H16-03*), while others already have gained knowledge from their research before contacting a professional (*E01-02*).

Some house owners also use energy advisers for consulting, which helps in creating awareness about what type of project would be beneficial for a specific house (*H21-04, E02-01, H18-01, H21-02 & H16-04*). A house owner e.g. told: *"Three years ago, we were offered a free energy check of the house, which made it possible to figure out if there were any problems related to the house."* (*H21-04*). We found that energy advisers often encourage the house owner to conduct energy renovations to reduce the energy bill (*H16-16, E01-01, H23-01, A02-01 & H19-01*), but also a range of other factors motivate as described in section 6.1.4.

The level of knowledge varied between the house owners. Some had never considered energy renovations and others had previously conducted energy renovation themselves or was planning to do so. Overall, the house owners involved in our empirical research found advise from professionals helpful during the process, which indicates that having someone to ask for help during different stages of the renovation process can inflict motivation.

6.1.3.2. ACCURATE AND TRUSTWORTHY INFORMATION

The reliability of the information is essential to the house owner. If professionals provide misinformation or have the main purpose of getting their products or services sold, house owners might not trust their judgement and look for advise elsewhere (*H22-03, H22-04, H12-03, H08-05, H03-02, H08-03, H10-01, H16-01, H16-02, H07-01, H06-01, H08-03 & H22-01*). One house owner e.g. explained: *"I chose the solution because it was promoted as sustainable, but it turned out that it was not right (...). I used a lot of money which I then figured out was a waste. This is how it goes when you take advise from someone who wants to sell something."* (*H09-01*). Also, the reliability of craftsmen's knowledge being good enough to give optimal advise was by some pointed out as creating a barrier (*H22-04 & H03-02*). Therefore, it can be concluded that trustworthy information is an important part of the decision-making process.

6.1.4. BENEFITS

Benefits take part in motivating the house owner to conduct energy renovation. Knowing the potentials of energy renovation is, however, something our analysis has shown to be lacking amongst house owners (*H19-04, H20-01 & H19-03*). The benefits vary and depending on the specific house owner different factors can be a motivation (see Figure 22).

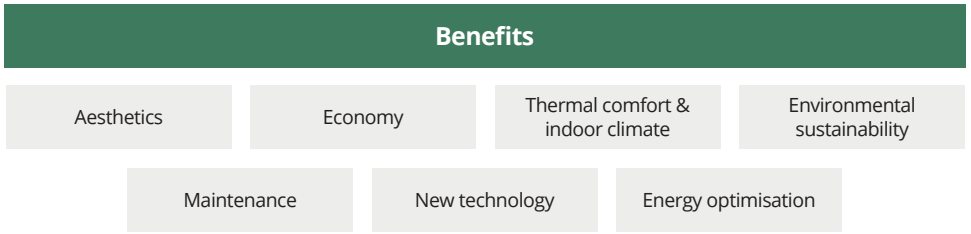


Figure 22: Factors influencing the house owner in relation to the category Benefits.

6.1.4.1. AESTHETICS

Energy renovations are not always visible, but when they are, it is typically important for the house owner to find an aesthetical solution (*H08-06, E02-02, H04-01, H10-10, H10-20 & H12-09*). One e.g. told: *"We prioritised that it should be a good looking house which could keep its property value. The aesthetic was a high priority."* (*H09-03*). Some house owners even choose to hire an architect for larger renovations, to secure an aesthetic result (*A01-01 & A02-05*). Aesthetics can also initiate a renovation, e.g. one house owner explained how they wanted to remove the radiators and get heat in the floor instead, which resulted in energy optimisation of the house (*H04-01*). Being able to see the actual result can have an impact on the motivation for energy renovation, for the house owner to see the potential of the energy renovation.

6.1.4.2. ECONOMY

Our analysis shows that the economic benefits of energy renovations are found highly relevant for many house owners. These benefits can be divided into different types presented in the following.

ENERGY SAVINGS

When conducting energy optimising renovations, our analysis indicated that a majority of house owners are concerned about whether the solution can generate savings of energy resulting in a lower energy bill (*H16-08, H17-01, H17-02, H17-03, H16-12, H13-03, H08-12, H03-08, H16-11 & H09-06*).

Economic savings can both be a motivator but also a barrier if savings are not possible. This can be if the current energy bill is low (*H17-02 & H17-03*), as one e.g. told: *"Our energy expenses are reasonable compared to the amount of square meter house we have."* (*H23-02*).

RETURN OF INVESTMENT

If the energy renovation will cause return on investment, where the savings over time equals out the energy renovation costs, is also a concern expressed by the house owners (*H01-03 & H27-05)*. One e.g. expressed: *"In total invested 158.000 dkk to get the solution, and this investment was returned through energy savings after 5 years."* (*H01-02*). As it can be a benefit it can also be a barrier, when the return on investment takes too long for the house owner to find it interesting. One e.g. told: "*We have thought about getting solar panels, but it would cost a lot to get them on the roof etc., compared to how much it will reduce the energy payments in our lifetime. So it is not economically worth it.*" (*H09-05*). This relates to the findings in the literature review, where much of the focus on energy renovation was on the economical benefits and not as much on other potential benefits.

INCREASED PROPERTY VALUE

Increasing the value of the house was also mentioned as a benefit. Some of the house owners argued this as an important part of getting a loan for the energy renovations, and as an added benefit (*H10-12 & H09-03*).

6.1.4.3. ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability is an essential benefit of energy renovation. However, it is often not the main motivator for house owners according to our findings. For the participants, it is more articulated as an extra benefit (*H12-06 & H14-05)*. One house owner said: *"Our priority is to save money but as a side effect the positive impact on the environment is also valued."* (*H14-05*). Some of the house owners, however, told that their interest in the environment had increased compared to a decade ago where they would not even have considered it (*H08-13 & H07-05*). Also, societal discourse influences the choice of house owners: "*wood burning stove is becoming a taboo, so I could imagine that we would choose a heat pump instead.*" (*H14-06*). These findings indicate that sustainability has an influence but is not the main driver. A few had it as the main motivation for being sustainable and going off the grid (*H22-11 & H27-03*).

6.1.4.4. THERMAL COMFORT & INDOOR CLIMATE

Improving the indoor climate and thermal comfort plays an important role in interesting house owners in energy renovations (*H14-09, H06-09, E01-05, H24-11, H21-14, H02-08, H16-15, E02-04, H05-08 & H24-12*). In general, many of our findings related to indoor climate and energy renovation comes from the house being too cold, (*H10-19, H10-20, H15-04, H11-08, H12-12, H07-12*), as a house owner explained: *"We got a new roof because it was too cold in the house"* (*H11-08*). Also, the quality of the air was by some pointed out as a benefit (*H15-05*).

6.1.4.5. MAINTENANCE

House owners current energy technologies installed in the house have an impact on the motivations for replacing their current technology with newer alternatives to optimise the operations (*H22-07 & H02-08*). Our findings indicate that house owners living in relatively new houses do not see the same benefits as house owners living in older houses because they have newer technology installed (*H17-03 & H17-05*). When investing in energy renovations the quality of the technologies is motivating as it is a long-term investment and to secure low maintenance (*H22-07 & H14-10*). Also, updating the technology to optimise the convenience of operation was seen as a benefit when maintaining through energy renovations (*H06-08 & H01-04*).

6.1.4.6. TECHNOLOGY

Some house owners do not have the same long term perspective, as they are motivated by the concern of getting new technology, because they are fascinated by technological progress (*H03-08 & H22-07*). One house owner e.g. told: *"My husband is crazy about new smart technology."* (*H22-07*).

Our study, therefore, indicates that some house owners are motivated to invest in energy technology for the long term prospects of maintaining the house. Others invest in new technology because of their interest in new technologies, these are, however, a niche group.

6.1.4.7. ENERGY OPTIMISATION

Energy optimisation can be a benefit in itself when being an outcome of or combined with other types of renovations, e.g. as a part of getting more living space or more insulation when changing the roof (*H07-09, H04-06, H16-11, H04-10 & H07-10*).

We also found that even though some house owners at first presented themselves as someone who had not conducted energy renovations, from talking to them during the negotiation spaces, we found that they had made some energy optimising renovations, but they did not see it as an energy renovation. Others had combined it, or was interested in combining it, with other types of renovations (*H07-09, H04-06, H07-09, H16-11, H04-10 & H07-10*). One e.g. told: *"If the roof had to be changed, then we should maybe combine it with putting a solar panel up (...). But only in relation to this other renovation."* (*H20-02*).

6.1.5. PROCESS

Factors related to the process of energy renovation is also relevant in translating the house owner to energy renovation (see Figure 23). The process factors are presented in the following sections, in relation to the four phases of energy renovation (as described in section 6.1.1): initial idea, before phase, during phase and after phase.

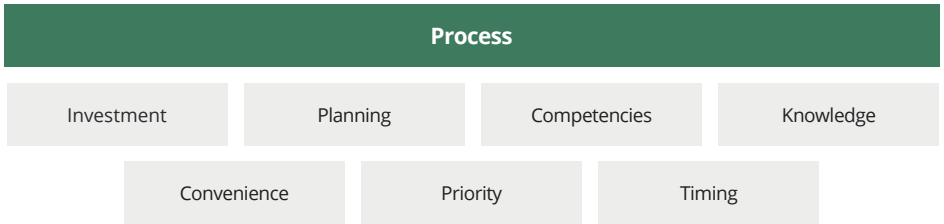


Figure 23: Factors influencing the house owner in relation to the category Process.

6.1.5.1. INITIAL IDEA

There can be many motivations for starting a renovation project and our findings suggest the following factors for gaining the initial idea, which is directly related to the benefits identified:

- Reducing the energy bills (*H11-04, H04-06, H23-04, H06-08 &H12-12*).
- Enhancing the indoor climate (*H11-04 & H10-14*).
- Improving the aesthetics of the house (*H24-04*).
- Out of necessity due to wear and tear of the house (*H22-14, H03-07, H11-07, H04-07, H04-08, H05-06, H08-17, H19-11, H23-05, H10-17, H11-06, H24-10, H24-04 & H27-08*).
- Energy optimisation as a part of another renovation project (*H07-09, H04-06, H07-09, H16-11 & H07-10*).
- Updating energy technologies for more optimal operation or convenience in using the technology (*H06-08 & H01-04*), or to get the newest technology (*H03-08 & H22-07*).
- Getting the idea as a part of buying a house (*A01-05, H07-13, H08-19, H12-10, H14-02 & H21-39*).
- Becoming independent of the electric grid and as a part of this contribute to the sustainable development agenda (*H22-11 & H27-06*).
- A few also got the idea form expiring grants (*H13-05*).

A barrier for energy renovation in the idea phase is understanding the reason why renovation is needed when everything seems to work fine as it is (*H19-09, H19-10, H24-05, H24-06, H23-03, H12-10, H24-09, H06-07 & H17-07*). In these cases, it would be needed to create awareness about the benefits of energy renovations for house owners to have them consider it and interest them in committing to an energy renovation project in the future.

6.1.5.2. BEFORE RENOVATION

Preparing an energy renovation can be overwhelming for a house owner with both finding an optimal solution, financing the investment, planning the renovation process in relation to the daily schedule etc. In the following, the main factors identified as influencing the choice of energy renovations in this phase are presented.

OPTIMAL SOLUTION

Many considerations are made by house owners to find an optimal solution for their house. The house owners knowledge on the area influences this process and it can be a barrier knowing that the initial phase is complicated and requires a large amount of work, as the general house owner does not know how to make the decision (*H16-14, H08-16 & H13-06*). Therefore, as earlier described, available information is essential (*H22-13, H23-03, H24-07, H08-03, H10-16, H10-06, H18-02, H19-02, H21-05, H09-02 & H10-03*). To support the design problem of having more house owners energy to renovate their homes, information has to be easily accessible and capture the house owners attention. The house owners should be able to relate to the information and transform it into their own needs.

INVESTMENT

The initial investment can be a significant barrier for house owners, if they do not have the finance, or are concerned about committing to such a large investment (*H08-10, H09-04, H08-11, H10-10, H16-07, H18-05, H17-06, H10-11 & A02-12*). One reason for the concerns about commitment can be due to the age of the house owner (*H16-10 & H05-04*), as one e.g said: *"When being our age, energy renovation is too late. It is a large investment, and when you do not get much in pension, it influences the choices."* (*H16-09*). For many house owners, involving the bank is essential in order to get the finances to start a renovation project, as this is usually a large investment (*H22-06 & H14-04, H21-08 & H22-15*). Some house owners, however, want to avoid loans, as they save up for the investment on their own (*H05-03 & H21-39*). Others choose not to loan money, and therefore not make the renovation, as they do not want to owe money to the bank (*H18-06*).

The initial investment is directly related to the benefits described in section 6.1.4. It is a challenge of finding a match between the house owners needs and a price fitting to their economical situation (H13-04, H09-04, H18-05, H13-04 & H10-10). In some cases, it is possible to do a partial energy renovation for the available financial resources and still achieve some improvements. A House owner said: *"Only the top floor was changed. The other floors did not get renovated because we could not afford it"* (*H10-10*).

PRIORITY

Some of the house owners who have not conducted the energy renovation yet, who are considering it argued that it was caused by them not prioritising it. They find it a time-consuming process to find an optimal solution and plan the process which results in it not being prioritised (*H16-15, H03-06, H24-08, H21-02 & H08-16*). One house owner e.g. told: *"It is actually what I thought would happen if we did not renovate before moving into the house - you learn to live with it. It is too complicated."* (*H08-14*).

TIMING

Another finding from our analysis indicated timing as both a barrier and a motivation. Many house owners were hindered in starting an energy renovation project at present time, as they knew they would conduct another renovation project in the near future (*H13-06, H21-12, H24-06, H10-15, H12-09, H02-05, H14-07, H19-07, H19-08, H20-02, H18-07, H02-04, H09-07, H21-10, H05-05, H22-12, H23-06 & H21-11*). This finding suggests that it could help to guide how energy renovations can be combined with other renovations.

PLANNING

Getting the idea of what a renovation should consist of and how to do it is sometimes a difficult task. This can make it difficult to plan the process (*H19-06 & H08-14*).

Many house owners find a renovation a disturbance of everyday life and they, therefore, try to plan to make it as convenient as possible. Some house owners e.g. renovated before they moved into their new house, or dividing the process according to the sections of the house, to avoid living in a construction site (*H05-02, H02-06, H09-08, H02-07 & H14-02*). Other house owners planned to conduct the renovation during the warmer months of the year, which made it more convenient to live in the house (*H21-13 & H07-08*). The inconvenience of living in the house during renovation showed to be a challenge for some of the participants (*H08-15, H10-18, H11-05 & H12-11*). One house owner explained: *"We would never do it again. Having two kids at the same time makes it hard because daily life continues."* (*H04-03*).

Our study, thereby, indicates that planning is an important part of getting a positive experience when renovating the house. Although the renovation itself can cause challenging inconveniences, such as the living space being compromised, it can be helped by gaining an understanding of the consequences and planning for a temporary solution that suits the house owners needs during the renovation.

6.1.5.3. DURING RENOVATION

The house owners can in this phase of the renovation process roughly be divided into the ones who do the renovation themselves and the ones who need help. Here, competencies have a central role.

Not all house owners have the capabilities of renovating a house and need to contact professionals to conduct the work for them (*H06-04, H08-05, H05-07, H09-09, H11-02, H12-11 & H22-04*). Some prefer to have one person to take charge of the whole process, such as an architect or entrepreneur, to secure a satisfying result. It is often the case if it is a larger renovation projects (*H07-03, H03-04, A02-07, H07-04 & H11-02*). Others manage the process themselves (*H08-05, H12-03 & H02-01*).

The house owners with do-it-yourself skills often choose to make the craftsmen work themself, sometimes with help from their network, as it can lower the expenses of the renovation (*H10-13, H24-03, H10-09, H04-04 & H14-03*). Even though a house owner has a craftsmen background it does however not always equals to them having proper knowledge about energy renovation. An architect explained: *"You are put in a position where you have to make complicated decisions regarding building techniques when conducting an energy renovation."* (*A01-02*). It is thereby very different how much help a house owner needs for implementing the energy renovation, which indicates that different solutions should be developed depending on the type of house owner.

6.1.5.4. AFTER RENOVATION

The experiences after a renovation vary for the involved participants. The motivations were for some house owners reached, such as the indoor climate (*H11-01, H02-02, H07-02 & H10-07*), reduced energy bill (*H06-03*), aesthetics (*H11-01*) and the ease of maintenance (*H13-02, H08-08, H03-03, H13-01, H15-01, H18-04 & H08-07*). Other times, the energy technology did not work or the process was not as expected, which turned the energy renovation into a negative experience (*H08-08, H12-05, H12-03, H01-01 & H10-08*).

It is, therefore, important for the house owners to be able to gain an understanding of what possible consequences of different renovation projects can have and how to prevent them. As previously indicated, sharing experiences within a network is a common theme for many house owners which, therefore, both involve positive and negative experiences. By sharing these experiences beforehand, some inconveniences after energy renovation would possibly have the chance of being avoided.

6.1.6. POLITICS

Politics also have an influence on the house owners in relation to energy renovation (see Figure 24). Here, different political instruments influence the motivation for the house owner. Politics, however, also make the process more complicated as regulations have to be considered.

Figure 24: Factors influencing the house owner in relation to the category Politics.

6.1.6.1. REGULATIONS

As a part of deciding what type of renovation project a house owner wants to begin with, there are building regulations that need to be considered (*A02-10, H23-07, H04-09 & H22-13*). This is both concerning what is allowed to build, in what way and what demands that are present after renovation projects, e.g it has to live up to a certain energy standard (*A01-03*). In extraordinary cases, regulations also force house owners to energy optimise their homes (*H12-07, H22-08 & H22-09*). When starting a new renovation project, it is important to know what regulations are present for the project in mind. This can, however, be a daunting task as there are many different regulations to consider and there is (*A02-11 & H13-08*), therefore, some house owners who get help with the decision-making process concerning regulations from professionals (*H07-11*).

6.1.6.2. GRANTS & POLITICAL INSTRUMENTS

Grants and political instruments can work as a motivation factor for energy renovations, as it can reduce the total cost for the house owner (*H13-05, H11-03 & A02-08*). One house owner e.g. explained: *"What motivates is also that you can get a deduction of labour costs* (in Danish: håndværkerfradrag) *when conducting energy renovations."* (*H22-10*). Another political instrument for getting more house owners to energy optimise their house is grants for different types of energy technologies, typically supporting sustainable development such as solar panels or changing from fossil-fueled energy sources to more sustainable alternatives. This can work as a motivation for some house owners (*H15-02, H21-09, H12-08, H16-13 & H07-06*). Although grants can act as a motivator, they can be difficult to navigate for the house owner. One house owner explained: "It is hard to navigate in all the advanced regulations about governmental support." (*H07-07*). Therefore, guidance on this topic would be helpful to motivate more house owners to energy to optimise their houses.

6.1.7. CONTRIBUTION TO EXISTING RESEARCH

The research gathered through the initial negotiation spaces support findings from existing research presented in the literature review. Both existing research and our analysis identified the house owners as a group which cannot be seen as homogeneous, as many different factors influence the choice about energy renovations, which is different depending on the specific house owner. Our findings point to the conclusion that different solutions should be developed for specific house owners. In relation to this our findings back up that mainly focusing on economic benefits is too narrow a perspective when developing solutions. Also, not only motivators and barriers have an influence, but also e.g. daily practices and plans for the future. Both existing literature and our findings show that house owners, in general, see energy renovations as a complicated process. Many house owners are aware of the energy renovations but find it too time-consuming to find an optimal solution and plan the process. They often do not know where to start and seek advise online, in their network or contact professionals. These house owners need information and guidance in the decision-making process. However, the current initiatives with energy advisers are by both our research and existing literature pointed out as not effective enough. Some house owners have never considered energy renovations. Here, creating awareness is essential to interest them in energy renovations. From the literature review, we found that visible renovations are often prioritised over invisible energy renovations. Our research adds perspectives to this, as we found that energy optimisation can be seen as a benefit in itself when being added to other types of renovations. Further, house owners do not always see energy optimising renovations as energy renovations.

6.1.8. PART CONCLUSION

Empirical research was analysed in a backstage negotiation space with the use of an affinity diagram. From this analysis, it was identified that some house owners need to be made aware of what energy renovation is, from creating awareness, while others already consider energy renovations. These, however, typically find energy renovations complicated to handle and they need solutions to support their decision-making process. A range of factors affects the house owners in relation to energy renovations. Mostly, house owners are motivated by factors such as savings on their energy bills, indoor climate or out of necessity due to wear and tear. They can, however, not be seen as a homogeneous group with the same concerns and therefore need to be differentiated.

The empirical findings from our negotiation spaces support existing literature and visa versa. The following design process presents a case contributing with new research on how to create a solution based on the problem of having more house owners energy renovate their homes.

6.2. PERSONAS

To make the empirical findings more designable, we translated our findings into personas. The aim was to structure our findings and define the users. The personas were developed from an examination of the house owners contributing through our empirical research, where characteristics, such as family type, house type, competencies and motivations, were identified and alike house owners were grouped and defined through personas (see appendix 5). This reduced our findings, while at the same time amplifying aspects relevant to the specific design problem. We wanted to produce personas as a tool which could help us in the further design process by defining the users and their concerns.

The first draft of personas was in the design team discussed in a backstage negotiation space (see Figure 25), which created a further development of them and a shared understanding of the users emerged in the design team. In this way, the personas acted as intermediary objects representing the users, mediating the team members understandings and interpretations of different house owners, while at the same time translating the empirical findings into objects, taking the form of personas, supporting the further design process.

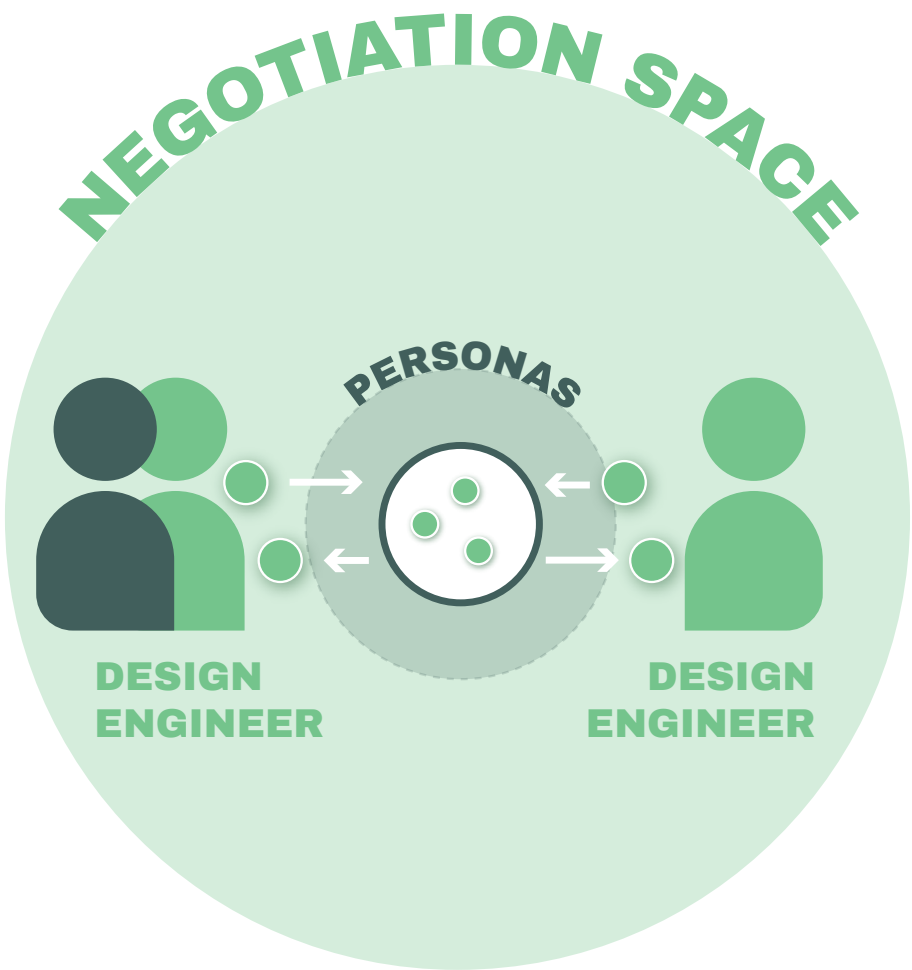


Figure 25: Personas acting as an intermediary object in a backstage negotiation space.

6.2.1. PERSONA CHARACTERISTICS

To support our design process and the development of a solution, the personas were constructed with characteristics representing their relation to energy renovation. As explained in section 6.1 there is not one answer to why a house owner might not have energy renovated yet, but there are indicators to what factors could make them more likely to proceed with the agenda. We found that this can be described through 'motivations' and 'windows of opportunity'. 'Barriers' can, on the other hand, stand in the way for energy renovations. We also found that the level of competencies on carrying out renovation, and knowledge on the area, affects the personas probability of conducting an energy renovation.

6.2.1.1. MOTIVATIONS

Through the treatment of the empirical findings, it is apparent that there are elements that drive the house owner to engage in energy renovating their home. These elements are essentially rooted in their matters of concern, and for this context, we are using the terms 'motivations'. These can be contrasting between personas, and are somewhat what defines them in our representations. We have differentiated between six motivations identified from our initial empirical research analysis (see section 6.1).

ECONOMY

This motivation indicates how sensitive a persona is to the idea of the economy in relation to grants from the government, a great offer or a solution with can improve the energy bill or create a return on investment.

AESTHETICS

The house owner will sometimes be drawn or repelled by the looks of the energy optimising solution, e.g. in relation to making the house more modern looking or keeping the original aesthetics of the house.

MAINTENANCE

Wear and tear can be an indicator for the house owner to do something about the solutions of the house. Some might react when the tear is light, while others will wait until it is completely broken before taking action.

SUSTAINABILITY

Investing in energy renovation with off-grid renewable energy production or a more efficient heating system, are sometimes connected to the idea of doing the right thing environmentally. Some can hardly be motivated at all, while others get very excited by the idea of being sustainable.

INDOOR CLIMATE

How a house owner feels in their own home, and how sensitive they are to the indoor climate, is also a varying factor. Some invest a lot of money to walk on their heated floor all year round, while others simply put on another sweater when it is cold around the house. This motivation is about being comfortable in one's own home.

TECHNOLOGY

This motivation can be linked to the desire to acquire new technology, either to gain increased efficiency or simply just the exciting feeling of being on the beat with the newest technology on the market.

6.2.1.2. BARRIERS

'Barriers' represent what holds house owners back from energy renovations. This can e.g. be not enough financial resources to invest, lack of return on investment, insufficient information on the area, low priority, lack of trust in craftsmen (not providing optimal information, not turning up on time or delays in the project plan), disruption of everyday life, etc. These barriers are important to understand as they should be minimised or overcome to have more house owners energy renovate their homes.

6.2.1.3. WINDOWS OF OPPORTUNITY

A 'window of opportunity' can be defined as a time or event, where a house owners willingness to energy renovate is peaking. While motivating factors focuses primarily on the house internal concerns, the window of opportunity explores the external factors that might nudge the house owner to gravitate towards action. This notion is important for us to understand since our solution will be an external force upon the actor-

world of the house owners. Although the project attempts to establish an internal position through participatory design, the concept will be an intended intermediary object from outside. It would wish to take a position creating a relation to the actor-world of the house owner, to create interessement and potentially mobilisation. 'Windows of opportunity' are important as they are moments where there is a higher likeability of actors being translated to follow the agenda of energy renovations.

6.2.1.4. KNOWLEDGE AND COMPETENCIES

A personas knowledge influence energy renovations as house owners have to be aware of the opportunities and further have enough knowledge about the area to decide on conducting energy renovations. From our empirical data, we found that energy renovation is a decision which the house owner make if they find that they have enough knowledge on the area, as it often is a rather big decision in relation to finance and process.

Competencies refer to the personas ability to perform the energy renovation themselves versus having other people perform the renovation. Some house owners are do-it-yourself types while others do not have such competencies.

6.2.2. TYPES OF PERSONAS

The synthesis of the empirical data revealed a large difference in the types of house owners. With the emergence of the personas, it became clear that our empirical findings matched the findings from the literature about a difference in the types of house owners and that solutions could not be developed seeing them as a homogenous group. The analysis of users resulted in seven different personas, described in the following.

6.2.2.1. IDEALIST IRENE

Increasing the sustainability of her home is the whole reason why Irene (see Figure 26) go through the trouble of energy renovating in the first place. She is interested in the idea of being independent of the grid energy as a part of her sustainability mindset. Indoor climate never crosses their mind, as she is fortunate to live in a relatively new house. Her competencies regarding renovations are low and she has a basic knowledge of the area. To make the right decision, she wants to be sure about the sustainability of a solution, but a barrier is to find the right information and it needs to be an impartial actor to convince her as her trust in craftsmen and other with a selling motive is low. Events with a presentation of new environmental technology is a window of opportunity to inspire Irene. She is naturally drawn to the potentials that the technologies present. Although she might be exited, however, she would rarely upgrade current technology, before it breaks. She does not shy away from grants that could support her investments, but as she does not do this for the finances, it will not make or break her decision. The notion of 'doing the right thing' by working towards sustainability is the main driver for Irene.

6.2.2.2. ERIK THE ICEMAN

Erik (see Figure 27) is mainly motivated by the tangible experience of freezing in his own home, due to an unsatisfying indoor climate, but he also counts an energy renovation as maintenance of the building itself. Erik is fairly sensitive to the economy and is conscious of what he is willing to spend on

the renovation, as well as what they will save in the long run on their heating bill. The aesthetics of the solution also influence his choice. He has low competencies for renovations and only a little knowledge to base his decision on. Due to his economic sensitivity, he wants to make sure that he gets a satisfying solution, but he finds it challenging to navigate in the information and it is often not prioritised - he finds it time demanding to understand and plan energy renovations. Sustainability is more of a positive side effect than it is a driver to him. Erik will invest in energy renovation, to prevent feeling cold in his own home. Other than that, energy renovation comes as a natural part of other building projects around the house. Due to his sensitivity to the financial aspect, he will be more than likely to react to governmental grants, and a deadline on these might be the final push he needs to make the jump.

6.2.2.3. PETER PRACTICAL

What counts for Peter (see Figure 28), is the functionality of his home. He thinks about how the house is supposed to work in his everyday routines, and renovation means containing life with great aesthetics. Values like maintenance and indoor climate, are important, but not as exciting as the joy of having two extra rooms to the house for their children. He is conscious of the economy but is also ready to loan the money necessary for expanding their nest and have a proper base. Having a lower energy bill is also seen as an advantage. He is not very curious about technology, nor are they idealist about the sustainability of their renovation. He has little knowledge about energy renovation and does often not see the renovations as energy renovations even though they are energy optimising. The most dominant characteristic of Peter, in terms of energy renovation, is the fact that he never would do it on its own. Energy renovation is a by-product of other renovation projects. It is, therefore, the practicality of living that triggers the most dominant windows of opportunity. When he purchases the house and makes any urgent renovations to make it livable, or when he initiates a more comprehensive building project, like an extension. He is also driven by governmental grants, or if anything has a malfunction or is broken.

6.2.2.4. DORTE THE DRIFTER

Living on pensions, and also having a decreased level of energy, Dorte (see Figure 29) is not very keen on participating in any extensive projects, that are not strictly necessary. She is sensitive to the economy and the aesthetics, and since she has entered the autumn of her life, the long term notion has disappeared. She makes sure that maintenance is kept on a low, and the indoor climate does not bother her if it means she can avoid any expenses and hassle. In terms of technology, it is important to her that her systems are user-friendly, as she is in no state of her life to throw herself into a steep learning curve. She does not worry about sustainability. The only thing that can get her to energy renovate is if current systems breaks, is not user-friendly or malfunctions to the point where it is too bothersome.

6.2.2.5. BOB THE BUILDER

Bob (see Figure 30) is what you would call a handyman typically with a craftsman background. In terms of economy, this persona is ready to invest a little more in the technology and solutions for the project, while insisting on doing the actual renovation himself, to save as much on labour as possible. Due to his competencies, and line of work, he naturally worries and carries

out the maintenance of the house. His knowledge about energy renovations is not as large as his general renovation understanding and energy is therefore not necessarily the focus. A lack of indoor climate is also important, both due to livability, but also in connection to the maintenance, and he also puts weight on doing the work properly and aesthetically. He cares about a user-friendly technology, that delivers a smart, satisfying solution. Sustainability is not really on his radar, apart from safely disposing of the building materials. Energy renovation often comes with other renovation, which is when the house is purchased, or if other big renovations take place. Since he has a network in the building sector, he can also be inspired through this. He is also very drawn to a good offer and governmental grants have quite the effect.

6.2.2.6. DIME-LOVING-DIANA

Diana (see Figure 31) is all about numbers, and energy renovation can be equal to green numbers and a thriving economy. If she can get a positive return on her investment, she will get excited. She cares about aesthetics and maintenance is also important to her, because it can optimise the energy bill from optimising the building when the current technology is lacking behind or causing trouble. Sustainability and an improved indoor climate are seen as positive side effects. The technology should be user-friendly but is also expected to take care of itself. Diana is open to energy renovation when the house has just been purchased since initial investments connected to necessary renovations look like good business, but when the information needed to guarantee the financial benefits is hard to find it creates a barrier. Governmental grants are very appealing to her financial-conscious heart.

6.2.2.7. GADGET GERT

Energy renovation to Gert means the sheer joy in seeing the number of kWh consumption decrease (see Figure 32). Partially due to a healthier economy, but also because the technological part of optimizing his home excites him. The idea of improving the indoor climate through maintenance and new smarter technology makes the sun shine a little brighter. He cares about the solution being aesthetically pleasing. Sustainability does not play a lot on his mind. Gert can easily be lured into energy renovation by the idea of investing in new smart and efficient technology. Apart from that, he acts when something breaks, or if there is a chance to gain governmental grants as support for his new technological endeavours.

IDEALIST IRENE

Irene is married to Hans, they are in their mid-forties and have two kids. They live in a energy B class house from the 00'ss

Irene lives in a house, of a high-grade energy class, that does not stand to need energy renovation. However, Irene desires to go further with the technology of the house - maybe transform into renewable energy sources? This idea is exciting to Irene, and although it might not be economically feasible, she is driven to go for these solutions, since it gives her a sense of purpose and calm, to know that they are 'doing the right thing'.

COMPETENCIES

Does not have craftsmen skills

NONE — STRONG

KNOWLEDGE

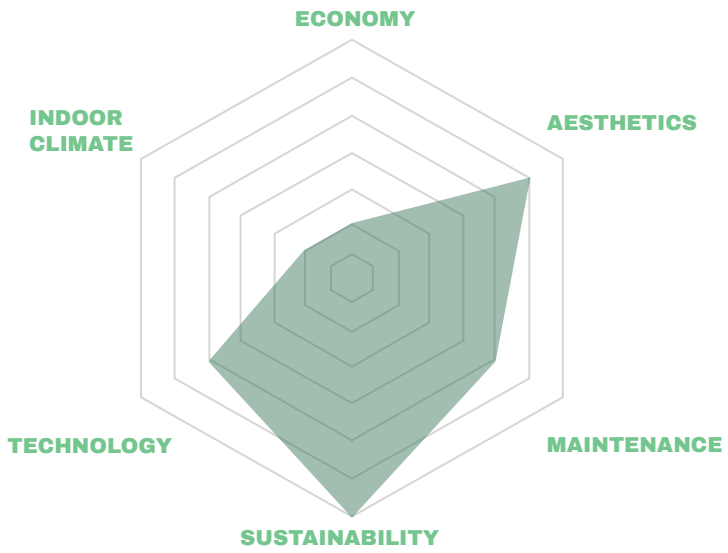
Has basic technical knowledge

NONE — STRONG

"For me, it is about being disconnected from the grid. I think there is a lot of green-washing in relation to the sustainability of the energy from the grid - I do not buy their arguments. I like the thought about going off-grid." (H22)

"We are happy with the solar-panel-roof, but as mentioned earlier, it is not due to the economy - it is sort of an 'idealism'" (H27)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Governmental grants
- Defect/breaks
- Environmental solution
- Going off-grid

BARRIERS

- Finance for investment
- Troublesome to find information
- Time-demanding to plan
- Lack of trust in craftsmen

Figure 26: The 'Idealist Irene' persona

ERIK THE ICEMAN

Erik is married to Signe, and they are in their late forties, and lives with their teenage daughter.
They live in a house from the early 1900's

Nothing is worse than dragging yourself out of bed in the morning, to then meet an unwelcoming ice-cold floor. Oh, maybe apart from sitting at the morning table, coffee in hand, feeling the drag from the windows behind you. This is not a life worth living and he wants to do something about it. However, Erik is sensitive to the economic expenses of a renovation and needs to find an optimal solution for his situation.

COMPETENCIES

Rely totally on professionals

NONE — STRONG

KNOWLEDGE

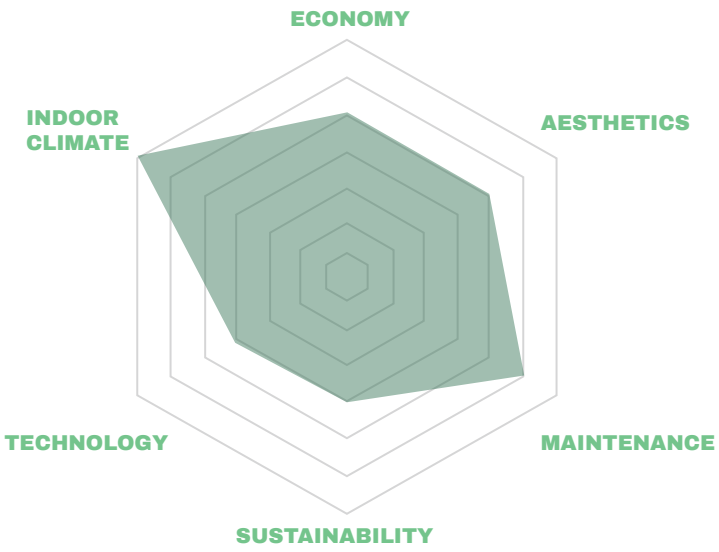
Have little knowledge from general research

NONE — STRONG

"We are very satisfied with the result. We felt the change immediately. We have not used the woodburning stove since then as it has not necessary." (H11)

"We do not have the same cold air coming from above as we experienced before the renovation. It has indeed helped." (H07)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Other renovations
- Governmental grants
- Uncomftable indoor climate
- Breaks/defects

BARRIERS

- Finance for investment
- Not prioritising it
- Troublesome to find information
- Time-demanding to plan

Figure 27: The 'Erik the Iceman' persona

PETER PRACTICAL

Peter lives with Marie and their two small children. Peter and Marie are in their late 30's.
They just bought a house from late 80's.

Although Peters dad has mentioned getting a new roof, about a million times, it keeps being the same argument: 'it does not make sense before we add the extra wing to the house, dad'. This might be true, but it also postpones the project and complicates it by a tenth-fold. Which also makes it completely demotivating. There is the bank loan, the planning, the building permits, the designing of the new parts. But it just does not make sense to do it in several steps, although that would be more manageable. Where should they even begin? Who should they ask?

COMPETENCIES

Does not have craftsmen skills

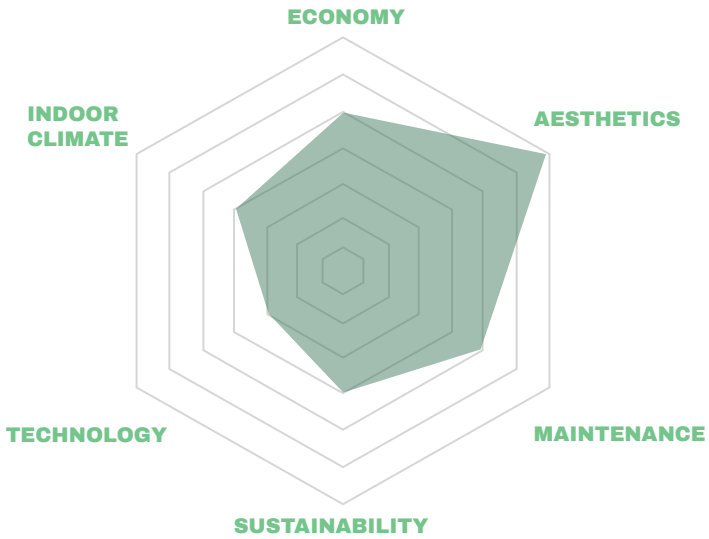
KNOWLEDGE

Have little knowledge from general research

"We were about to make energy renovations, but then the barrier was that we wanted to combine it with an extension of the house. We did not know when we would do that." (H21)

"If we are in a position where we are going to renovate some part of the house we would think about adding energy optimising elements" (H20)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Just bought house
- Other renovations
- Governmental grants
- Breaks/defects

BARRIERS

- Finance for investment
- Troublesome to find information
- Not a necessity
- Disturbance of daily life
- Time-demanding to plan

Figure 28: The 'Peter Practical' persona

DORTE THE DRIFTER

Dorte lives alone and are in her mid 70's and retired.
She lives in a house from the early 1900's.

Dorte does regard her house as a home - but for how long? She is either close to move on to a new dwelling, or the retirement home since she is in her mid 70's and retired. This aspect of uncertainty, means, that anything that is bearable is good enough. If there is any discomfort to find in the dwelling, any investment should be low-to-nothing.

COMPETENCIES

Rely totally on professionals

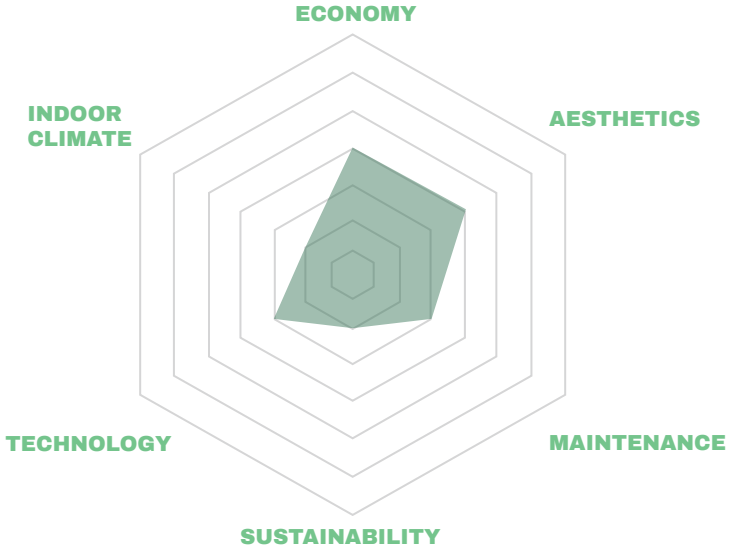
KNOWLEDGE

Have a little knowledge on the area

"When you become our age, then energy renovation is a bit too late. The things we have done through the years have been great, but we would not make large investments now, because it would be at least 100.00-150.00 DKK. That is a lot when you are retired." (H16)

"Since I retired my mental resources are not the same and I do not have as many money." (H05)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Defects/breaks

BARRIERS

- Years left in the house
- Lack of return on investment
- Lack of trust in craftsmen

Figure 29: The 'Dorte the Drifter' persona

BOB THE BUILDER

Bob lives with his wife Patrice, they are in their mid-fifties, and their kids are about to move out.
They lives in a house from the 1960's.

Bob deals with energy renovation, like a bird, does with flying. He has a good foundation of knowledge on the area, as he is a craftsman himself, and know exactly who to contact, to retrieve the information necessary to make a bullet-proof building plan. Bob is not afraid to do most of the renovation himself or with help from his network.

COMPETENCIES

Can do most himself with help from network

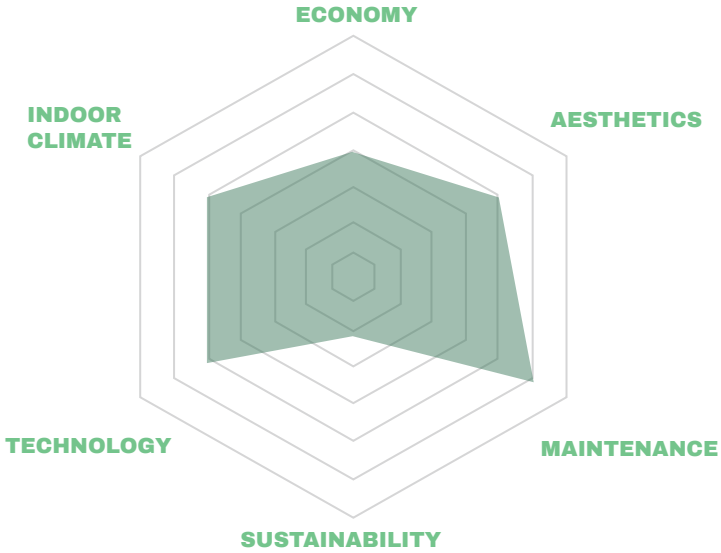
KNOWLEDGE

Lack knowledge about proper energy renovation

"He is educated carpenter so he made almost everything himself, despite the involvement of plumbing service and an electrician (...) So, he fixed it all and knew what needed to be done." (H04)

"I just searched on the internet to find a practical solution (...) We did it all ourselves." (H02)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Just bought house
- Other renovations
- Inspiration from network

BARRIERS

- Finance for investment
- Time-demanding to plan and perform
- Disturbance of daily life

Figure 30: The 'Bob the Builder' persona

DIME-LOVING-DIANA

Diana lives with her husband Simon, and their kids have already left the nest and are in their mid-fifties.
They lives in a house from the learly 1900's.

Diana loves a good deal and will be thrilled to save a dime. Good business is a good day! Changing the boiler might have been a headache, in the beginning, when when the government legislated against that type, fearing the investment of a new one. However, finding out you can save money in the long run by changing the boiler type and get financial compensation from the government made a difference. Christmas did indeed come early this year!

COMPETENCIES

Relies on professional help

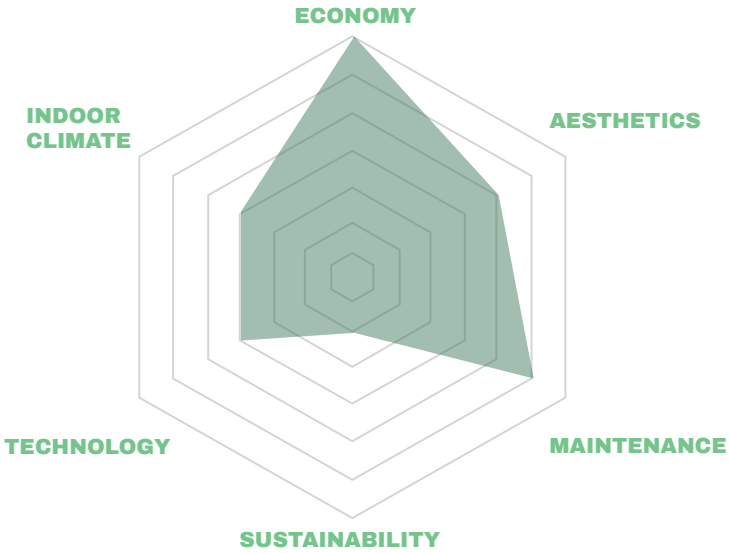
KNOWLEDGE

Have little knowledge from general research

"The reason why we changed the stove was the timing because we could get grants if we did it in 2019. This made us do it." (H13)

"In total, we invested 158.000 dkk to get the solution, and this investment was returned through energy savings after 5 years." (H01)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- Other renovations
- Just bought house
- Regulation
- Defects/breaks
- Economic grants

BARRIERS

- Lack of return on investment
- Troublesome to find information
- Not a necessity
- Time-demanding to plan

Figure 31: The 'Dime-Loving-Diana' persona

GADGET GERT

Gert is married to Karen, and they live with their two kids.
They lives in a house built between the start 00's.

Nothing feels better than sitting down and calculating the potentials of some optimizations around the house - especially when those calculations, gives positive results. The only other thing would be to upgrade to the newest and coolest technology. Just seeing the spike inefficiency, and the look on your neighbour's face when you show him/her around at the dinner party.

COMPETENCIES

Skilled and experienced DIY type

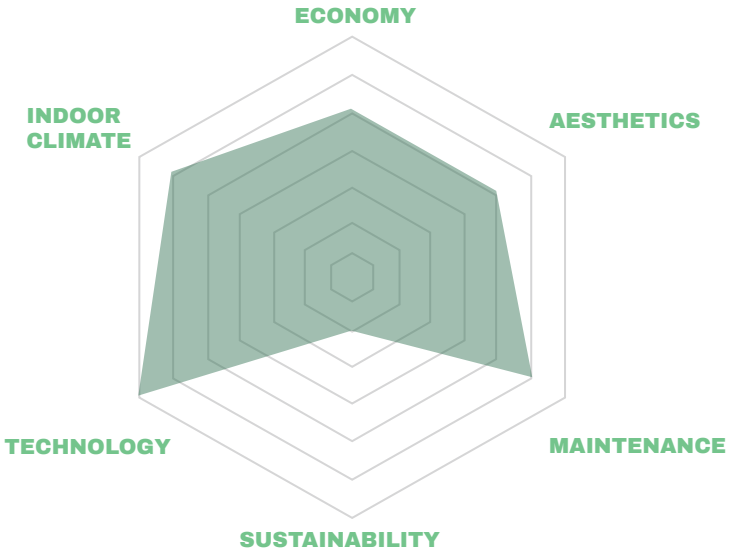
KNOWLEDGE

Technically sharp and understands technology

"The new technology was a condensing technique, so I chose to change the kettle. This could reduce the energy consumption and make it more efficient." (H03)

"It could be interesting to investigate if it could make a difference to put more insulation on the ceiling. I plan to make some calculations to figure it out." (H17)

MOTIVATIONS



WINDOWS OF OPPORTUNITY

- New efficinet technology
- Defects/breaks
- Governmental grants

BARRIERS

- Finance to get the newest technology
- Not a necessity

Figure 32: The 'Gadget Gert" persona

6.2.3. DISCUSSION

The personas were developed, in an attempt to treat a household through the traits of the house owner, and hereby use them as an object supporting the development of a solution. There are some aspects to this reduction of reality, that we were aware of, moving forward into concept development with these personas as a part of the process. One aspect is, that a persona is based on individuals, while a household can consist of different personalities, that are all influencing the process of renovation (*Haines and Mitchell, 2014*). We, however, found that there typically is a dominant persona in the family which affect the choice about energy renovations, e.g. if one adult in the family is a craftsman the households typically act as Bob the Builder persona. We, therefore, chose to make the personas as one person.

Another aspect that should be discussed, is our choice to create these personas upon interviews both from people who have energy renovated and of those who have not. Through the analysis of the empirical research, we found that it is hard to differentiate between people who have energy renovated and people who have not, as the majority of house owners at some point have done some renovations which can be categorised as energy renovations. Therefore our personas show the factors affecting their concerns about energy renovations.

Another study from the UK (*Haines and Mitchell, 2014*) has developed personas based on interviewing house owners about renovations. Our study has come to similar conclusions through our persona analysis when comparing with the UK study. Motivations are in both studies identified as varying, where some personas value comfort or aesthetics over financial savings and others have the economic benefits as the main driver. Also, the attitude towards the house is represented, where some personas see the house as a do-it-yourself project and others do not change things without the help of others and only if necessary. The interest in energy renovation is also represented, where some are interested in new technology and others only change it if it wears out. Further, a limited focus on environmental sustainability from a majority of the personas is also represented in the personas from the UK study. Where our personas are highly focused on their motivation towards energy renovations the UK study have created personas focused on their relation to their houses and renovations in general. Our personas differentiate with a direct focus on energy renovations which we found relevant to use them in the further design process, supporting designing a solution to have more house owners energy renovate their homes.

6.2.4. PART CONCLUSION

To handle a large amount of empirical data, we chose to develop personas. In this way, the findings were translated and inscribed into objects useful for the further design process. Developing persons in a backstage negotiations space created discussion and eventually a shared understanding about who the users of the design solution would be. Analysis of the empirical research showed variance in types of house owners and seven different personas were created. In the design process, these worked as an integrated part, guiding the design focus, supporting decisions and evaluating solutions as well as complementing the further involvement of house owners. As personas are reduced representations of the real and more complex house owners we were aware to make them support and not replace our participatory design approach.

6.3. DEVELOPMENT ARENA

To understand and navigate in current socio-technical networks related to energy renovation, we used Arenas of Development (*Jørgensen et al., 2017*). Here, actors, agendas and matters of concerns related to our problem area have been mapped and analysed.

The arena 'Energy renovation of detached single-family houses' (see Figure 33) is directly connected to our design concern and presents the different actors and networks influencing energy renovations of private homes. Working with the design problem as a development arena made it possible to better understand actor's interests and interrelations and it created the base for strategic navigation on the arena, as *"the study of arenas of development may help interpret transitions in the making, and provide a background of information about how different actors can navigate and perform strategic interventions that support sustainable transitions"* (*Jørgensen, 2012, p. 996*). It has, therefore, supplemented our work of staging negotiation spaces where relevant actors were chosen to contribute to developing a solution which can promote energy renovations in Denmark.

The arena 'Energy renovation of detached single-family houses' is populated with different actor-worlds, each one representing a different matters of concern (see Figure 33). These actor-worlds consist of actor-networks where different actors create relations to work for a specific agenda. The mapping of the arena represents the current situation and therefore gives an insight into existing actors related to the problem, which is explained in the following The findings refered to troughout the sections can be found in appendix 6.

6.3.1. HOUSE OWNER ACTOR-WORLDS

A central actor for the arena is the house owners as they are the ones we wanted to enrol in the agenda of conducting more energy renovations. Put simply, house owners can be found in three types of actor-worlds: house owners who have conducted energy renovations, house owners who consider energy renovation and house owners who have not considered energy renovations.

6.3.1.1. THE HOUSE OWNERS WHO HAVE CONDUCTED ENERGY RENOVATIONS

The concerns influencing the decisions about energy renovations for house owners who have conducted energy renovations was identified as economic savings, thermal comfort, maintenance etc. From the literature review and our empirical research, we have found that these concerns vary depending on the house owner. One house owner can hold more than one matter of concern, and different combinations are present.

6.3.1.2. THE HOUSE OWNERS WHO HAVE NOT ENERGY RENOVATED

The house owners in the two actor-worlds who have not yet energy renovated were the actors we wanted to enrol in a network following the agenda of implementing energy renovations. They either do or do not consider energy renovation. Because of their concerns, they are found partially or completely outside of the arena (see Figure 33). Through the design process, we intended to find a solution which could bring more house owners within these actor-worlds into the development arena.

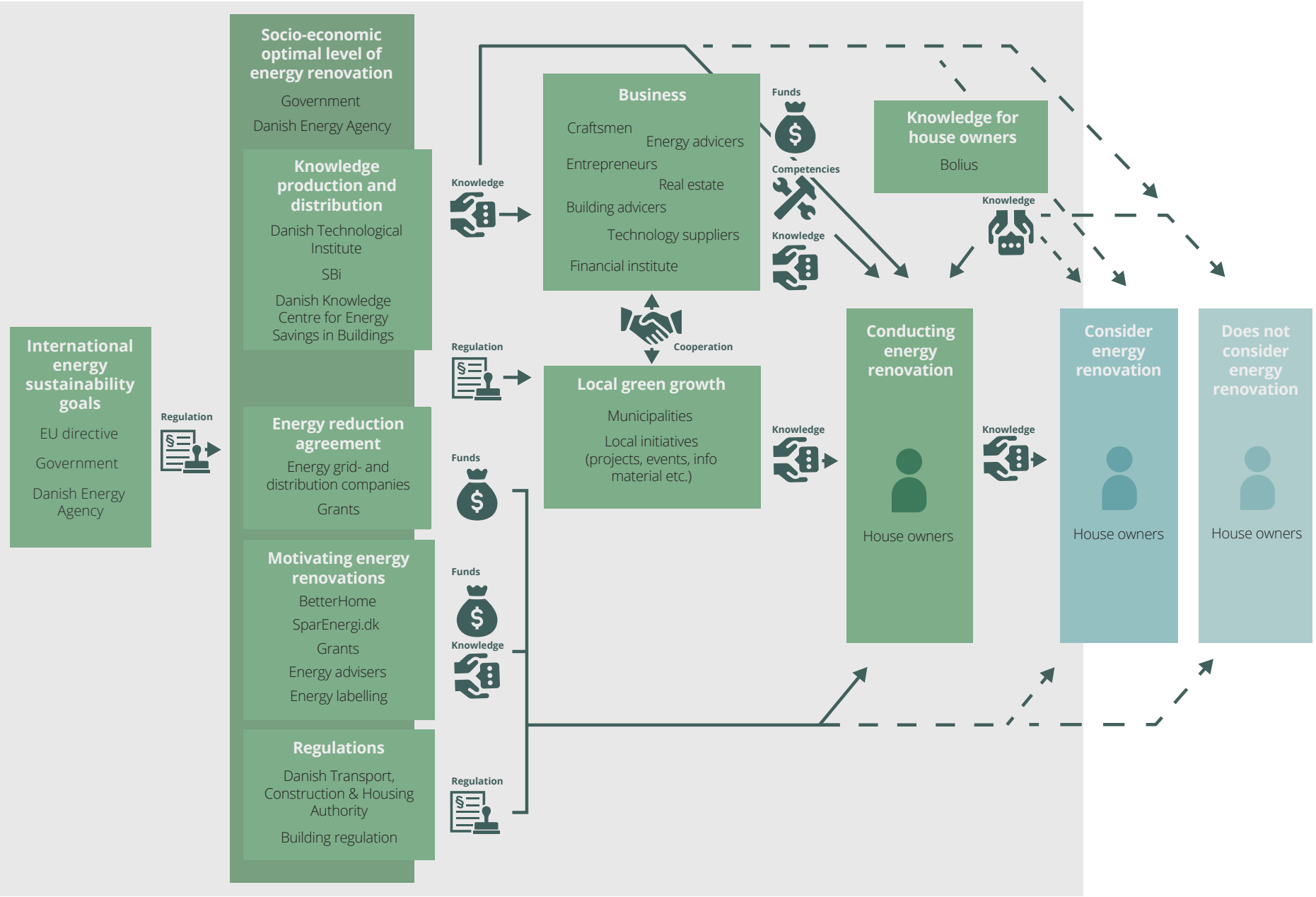


Figure 33: The development arena 'Energy renovation of detached single-family houses' with the different actor-worlds within it, following different agendas.

From involving house owners who have not energy renovated we found that there is no single specific matter of concern which hinders them. The house owners who have considered energy renovations are occupied with the same concerns as the ones who have energy renovated when it comes to benefits. What differentiates them are circumstances and priorities. From the empirical research, we found that house owners who had considered energy renovation e.g. explain that their years left in the house influence their choice about not energy renovating as they cannot get a long-term return on their investment. The initial investment is also a barrier, as some house owners find it too expensive to invest in energy renovations. Others find it confusing and difficult to find an optimal solution and plan the process.

We identified that a lack of transparency in the available information about the benefits of energy renovation creates a barrier for the house owners decision-making process. House owners relation to the information related to energy renovation is highly relevant to having them conduct energy renovations. The available information comes from different other actor-worlds, such as business professionals. Often house owners use the internet to find information. Some house owners also have energy advisers who evaluate their house and others' use their network to find experiences, tips and guidance. We identified strong relations between house owners where experiences often are shared between friends and family, which have a strong influence on the house owners decision-making process. It can both be positive and negative regarding the motivation for committing to energy renovation projects.

Energy renovations seem to be a large decision for house owners as it often requires a significant initial investment. If they do not see a clear potential, if it is not a necessity and if the process is inconvenient some do not prioritise it. People who consider energy renovations find it hard to find transparent, understandable and trustworthy knowledge which they need in the decision-making process to realise the energy renovation.

People who have not considered energy renovations are typically satisfied with their house, and do not have comprehensive knowledge on the area of energy renovation - they do not know the benefits they will gain from energy renovations. Awareness needs to be created to interest this actor to translate them into the energy renovation arena.

6.3.2. FINANCING ENERGY RENOVATIONS

Financing energy renovations was identified as an important concern for house owners. Energy renovations typically demand significant finances, which causes the house owners to reconsider the decision. Financial institutions are therefore also found in an actor-world with this concern as energy renovations can require that the house owner loan money for the investment. It is important that the banks, or other financial institutes, can see the potentials in such agreements. A Danish publication made by SBi (*Gram-Hanssen et al., 2015*) has found that banks tend to be more open and willing to loan house owners money for energy renovation projects than previously. From interviewing an employee with the position as a housing specialist (in Danish: Boligspecialist) in one of the large Danish banks, we found they are an active actor on the arena (*B01-05 & B01-06*). Banks are motivated to encourage house owners to energy renovate as it can support their business: *"If we can create a need for a customer to energy renovate, then we do it, as it creates loans which we live by."* (*B01-07*). Banks are not required to motivate house owners to energy renovation, but as it can strengthen their business, both financially through issuing bigger

loans and establishing a sustainability-focused image, they encourage house owners to do it (*B01-07*).

The bank we interviewed had through the years taken part in different initiatives to promote energy renovations. They had tried to offer a personal service for calculating the economic benefits of energy renovations (*B01-06*). They also had it as a general part of the education of the bank counsellors to encourage customers to renovate (*B01-10*). Especially in cases where the customers' loan money for a new house they encourage the new house owners to consider also loaning money for renovations, as they can refer to the energy performance report where possible optimisations are presented (*B01-08*). The initiatives have, however, been without much success (*B01-03 & B01-04*).

These experiences point to having a singular focus on the economical benefits do not motivate house owners to energy renovate. Also, the banks focus on increasing the value of a property does not align with the house owners main concerns. Our empirical research showed that property value is not the main motivation, but rather a positive side effect or a needed element to loan money for the energy renovation. The house owner is not always able to acquire loans from a financial institute if it will not increase the value of the house (*B01-02*), which is dependent on factors such as geographical location and type of renovation (*B01-02*).

6.3.3. INTERNATIONAL ENERGY SUSTAINABILITY GOALS

The development arena is highly influenced by the actors setting both national and international goals, legislation and regulation on the area of energy renovation. Within this actor-world, the EU directive, the Danish Government and the Danish Energy Agency are closely related to each other with the same matter of concern - achieving the sustainability goals set by the EU. Denmark, being a member state of the EU, commits the country to live up to a range of requirements, e.g. the Energy performance of Buildings Directive (EPBD directive) which among other goals should "promote policies that will help achieve a highly energy efficient and decarbonised building stock by 2050" (*European Commission, 2019*). These requirements are on a national level translated into more specific regulations set by the government and the Danish Energy Agency to achieve a socio-economic optimal level of energy renovations. The EU and Government, therefore, play a central role in the arena of energy renovation, as legislations and regulations greatly affect the way the relations are formed.

6.3.4. NATIONAL SOCIO-ECONOMIC OPTIMAL LEVEL OF ENERGY RENOVATIONS

To achieve the goals of sustainability set by the government, a national strategy for the optimal socio-economic level of energy renovation must be calculated and brought out into practice. Here, different actor-worlds take part in working for this agenda.

6.3.4.1. GOVERNMENT

The Danish Government is the main actor responsible for translating Danmark toward sustainability goals. In the energy sector, they are acting on the energy renovation arena, by mobilising different agencies who strategically will implement regulations. Within the energy sector, the Danish Energy Agency is the main actor.

6.3.4.2. THE DANISH ENERGY AGENCY

In Denmark, the Danish Energy Agency has the responsibility of identifying a socio-economic level of energy renovations and through studies performed by the Danish Building Research Institute (in Danish: Statens Byggeforskningsinstitut) (*K01-01 & K01-03*). This has been estimated to be around a 30 pct. reduction of the current energy consumption in the existing building stock (*Møller et al., 2019*) (*K01-01*). From interviewing the Danish Energy Agency this level of energy reduction was articulated as an optimum which is attempted to be achieved through, among other things, the building regulations (*K01-01*). The optimum is, therefore, also handled by the Danish Transport, Construction and Housing Authority (in Danish: Trafik-, Bygge- og Boligstyrelsen) who controls the Danish building regulations (*K01-02*).

The Danish Energy Agency, therefore, plays an important role in constructing initiatives which can help reduce the total energy consumption in Denmark.

6.3.4.3. REGULATIONS

The construction department of the Danish Transport Construction and Housing Authority is responsible for developing and implementing building regulations in Denmark (*Danish Transport, Construction and Housing Authority, 2019*). The Danish building regulation (in Danish: bygningsreglementet) has since its beginning in 1961 contained requirements for new buildings regarding the energy efficiency of the building. In 2006 the regulation was extended to also include requirements for the energy efficiency of existing buildings when renovated. It states that when a building component, such as the roof or a window, is replaced through renovation, it needs to live up to the current energy requirements in the buildings regulation (*Gram-Hanssen et al., 2015*). This will affect the decision-making process of house owners in the actor-worlds who have not yet renovated.

6.3.4.4. MOTIVATING ENERGY RENOVATIONS

Beside forcing energy optimised solutions through regulations, the authorities also use other initiatives varying from offering grants for certain renovation projects to different creating services that will supply house owners with tips and guidance.

POLITICAL INSTRUMENTS

Political instruments are used to encourage energy renovations. In Denmark, the government in collaboration with the agencies and institutes have created subsidies and grants that will help motivate house owners to conduct different types of renovation projects. One example is a deduction of labour costs for certain renovation services, up to a certain amount (in Danish: håndværkerfradrag) (*Energistyrelsen, 2013*). This does, however, not seem to be enough to motivate the house owners as other initiatives have been initiated to interest the house owners.

INFORMATION

Sparenergi.dk is a website driven by the Danish Energy Agency. It is a website focusing on providing danish house owners with advise on how to save energy. It presents a lot of different information, everything from general information about the benefits of energy renovations to specific energy renovation cases. Among other things, the website refers to BetterHome (in Danish: BedreBolig) and energy performance labelling, which are other initiatives by The Danish Energy Agency.

The initiative BetterHome launched in 2014 by the Danish Energy Agency, with the aim of making it easier for the private house owner to do energy renovations. Professions from the construction industry can here be educated as BetterHome energy advisers. These actors can help the house owner through the whole energy renovation and make it process easier and manageable. The BetterHome initiative has different offers. The house owner can get a screening of the house where the overall potential of energy renovations are evaluated. A more comprehensive evaluation can also be performed through a BetterHome plan. The adviser can also act as a renovation process manager and construction consultant through the whole process (*Ea Energianalyse, 2015; Niras, 2016*). The BetterHome concept motivates house owners to energy to optimise their house (*Niras, 2016*), and is, therefore, a part of the actor-world of motivation for energy renovation.

ENERGY PERFORMANCE LABELLING

The energy performance label is a mandatory certification of a building which is created when a house shifts owner (*Danish Energy Agency, 2015*). The building's energy performance is evaluated on a scale from A to G. With the energy label also comes suggestions about how to improve the performance of the building (*Gram-Hanssen et al., 2015*). The energy label is relevant when a house shifts owner, and the bank and real estate, therefore, holds the role of advising the house owner. As earlier described, this has not been a success. However, our studies show that it is not only at owner changes that energy renovation is relevant, although it has many benefits but at times when other renovation projects are considered by the house owners, that not necessarily involves energy optimisation.

6.3.4.5. ENERGY REDUCTION AGREEMENT

Beside delivering energy to Danish households, the grid- and distribution companies are obligated to contribute to energy savings as a part of the Energy Reduction Agreement (in Danish: Energispareordningen) (*Energistyrelsen, 2019*). The grid- and distribution companies are to take on the role of contributing to reduced energy consumption and their matters of concern about reducing energy consumption are to a high degree to prove the fulfilment of the agreement with Energistyrelsen (*Gram-Hanssen et al., 2015*). The companies are free to choose their method to contribute, and it therefore varies. The most common method is standard subsidies, which gives the house owner an economic grant for saved kWh (*Gram-Hanssen et al., 2015*).

The agreement expires at the end of 2020 (*Energistyrelsen, 2019*) and with this, new dynamics are occurring at the arena as a new strategy should be found for the period 2021-2024. A new national solution for energy reduction is under development and recently a new law draft has been made. It presents a model where the grid- and distribution companies are no longer involved. Instead, the focus is on grants for energy improvement projects and more focus on the energy labelling (*Energistyrelsen, 2020*).

6.3.4.6. KNOWLEDGE PRODUCTION AND DISTRIBUTION

The Danish Knowledge Centre for Energy Savings in Buildings (in Danish: Videncenter for Energibesparelser i Bygninger) is an organisation established by the Danish Energy Agency, with the aim of gathering and communicating knowledge about opportunities for reducing the energy consumption in buildings in Denmark. Their main role is to bring new

knowledge on the area into the building industry, but also private house owners can get advise from the knowledge centre. They offer different tools to support energy renovations e.g. energy reduction calculator. They educate craftsmen and other professions to act as energy advisers and provide advise through their website and over the phone (*Ea Energianalyse, 2015; Gram-Hanssen et al., 2015*). The knowledge-centre is, among others, run by the Danish Technological Institute (in Danish: Teknologisk Institut) and the Danish Building Research Institute (*Videncenter for Energibesparelser i Bygninger, 2019*).

The energy adviser arrangement (in Danish: Energivejlederordningen) is an initiative driven in relation to the national strategy. Their website gives access for house owners to contact local energy advisers, who can guide them and evaluate their house. The energy adviser arrangement is among others driven by the Danish Technological Institute who take part in educating craftsmen, installers and other professions to become energy advisers (*Energivejlederen, n.d.*).

Knowledge institutions have an important role in the arena by both creating awareness and sharing valuable information about energy renovation, which could take part in translating the house owners who are not yet in the arena, to become a part of it.

6.3.4.7. NATIONAL INITIATIVES

Summing up, the national initiatives to motivate house owners to energy renovation is to a large degree focused on providing information and advise to the Danish house owners. This information is, however, provided through several different channels which can seem confusing. Further, almost none of the house owners we talked to, articulated that they had used the nationals initiatives presented above. Instead, they use their network, google to get a basic knowledge of the arena and to get insight into other house owners' experiences or seek advise from professionals. The initiatives are also highly focused on energy, which only align with some house owners concerns. Through empirical research, we found that many house owners do not necessarily see the renovations as energy renovations. Further, different political instruments can either force renovation projects by introducing laws and regulations or motivate, by creating grants and subsidies promoting energy optimisations.

6.3.5. KNOWLEDGE FOR THE HOUSE OWNERS

Also other organisations, independent of the government, follow the agenda of providing knowledge and information for house owners. The Danish knowledge centre Bolius is an impartial non-profit organisation. Their main concern is to translate relevant but complicated knowledge about houses into information understandable for the general house owner (*K02-02 & K02-01*). This also involves knowledge about energy renovation. We interviewed an employee at Bolius who explained that they take part in the energy renovation arena through a campaign called 'Komforten i huset' (in English: The comfort in the house) where they encourage house owners through articles about energy optimisation of the home (*K02-03*). His experience with other campaigns was that a focus on only saving money is not what draws house owners in (*K02-03*). They tried to angle their campaign from a comfort perspective, with the experience of the house owner as of the centre of it. He stated that the results of the campaign are difficult to determine (*K02-03*).

Bolius is an interesting actor because their main role is to support the house owner with relevant knowledge. Further, they have another matter of concern revolving around supporting sustainable development (*K02-04*).

6.3.6. LOCAL GREEN GROWTH

The municipalities in Denmark are influenced by the national regulations and goals, as they have the responsibility of performing initiatives to live up to goals, visions and comply with the requirements set by the government. This is performed through local strategies and municipalities are seen as important actors in bringing energy renovations into action on a local level, as they set up initiatives addressed to bring this agenda forth, and enrol the house owner as well as other relevant actors (*Gram-Hanssen et al., 2015*).

Some municipalities are even motivated to make initiatives beyond the requirements to show societal responsibility by setting goals to create energy savings and reduce CO_2 emissions. A range of municipalities is, e.g. so-called climate-municipalities (in Danish: Klima kommune) where they are obligated to reduce their CO_2 emissions with 2 pct. each year (*Gram-Hanssen et al., 2015*) (*M01-08*). We interviewed two municipalities from different parts of Denmark who both argued that a green image, supporting the sustainable national agenda and creating local jobs were the motivating factors for taking part in promoting energy renovations (*M01-01, M02-01 & M02-05*). These arguments are also found in other studies where it is presented that municipalities are driven by political goals about sustainable development. Energy renovations are for them an agent which they can use to get closer to these goals, and at the same time, it can create jobs and economic activity which is beneficial for the municipality (*Gram-Hanssen et al., 2015*).

Municipalities are working with the agenda in different ways. On their own, or in collaboration with the local communities, they produce initiatives where the citizens can gain new knowledge on the area (*M01-06, M01-07, M02-02 & M02-04*). Typically citizens are getting information material in their mailbox or are invited to events of different kinds (*Gram-Hanssen et al., 2015; Jensen, 2013*). From talking to the two municipalities we found that there is a difference in how municipalities approach motivation for energy renovations. The building project adviser (in Danish: byggesagsrådgiver) from one of the municipalities told that they have established a project about making the municipality carbon-neutral, where energy renovations are included in the strategy (*M02-01 & M02-03*). They educate local craftsmen to act as energy advisers. Further, the municipality has a drop-in cafe for citizens where they get in contact with a construction project counsellor (*M02-04*). Here, they experience that advise about energy renovations are sought. In the other municipality, we interviewed a development consultant from the city, culture and environment department (in Danish: udviklingskonsulent indenfor by, kultur og miljø), who told that they had tried many initiatives without much success (*M01-02*). Furthermore, they are still seeking a solution through different networks, with other municipalities and knowledge institutions, where knowledge is shared and ideas are tested (*M01-03 & M02-06*). They are currently providing a service where they pay the Energy Service (in Danish: Energitjenesten) to take calls from residents about energy renovations and provide advise (*M01-04*). They further reach out to the citizens by sending mail in their digital postbox 'e-boks' offering personal energy checks of their houses (*M01-07*). This is, however, also without much success (*M01-05*).

Municipalities are in this way taking an active part in contributing to the agenda of energy renovations but have still not found the key to more energy renovations. We experienced that this actor is interested in new solutions and potential allies.

6.3.7. BUSINESS THROUGH ENERGY RENOVATION

A range of actors in the arena holds the matters of concern of business through energy renovations. These actors are energy advisers, technology suppliers, craftsmen, entrepreneurs, architects, installers and other construction professions relevant for energy renovations. Also, financial institutes has this concern.

Energy advisers can either be impartial or they can have another background as craftsmen, installers or another profession. An example of impartial energy advisers is independent energy consultancies, such the Energy Service, who sell BetterHome energy advise as a service for private house owners among others (*Energitjenesten, n.d.*). An example of craftsmen with the 'Energy Advisers'-education is found through The Danish Energy Agency who have produced a craftsmen list (in danish: håndværkerlisten) which contain contact information to craftsmen who are also educated, energy s. From talking to two energy advisers from different companies, found on the craftsmen list, we found that their matters of concern in relation to their business is mainly directed towards motivating the house owners to reduce their energy bills (*E01-03, E01-04 & E02-03*). This is interesting as we have found that house owners are also motivated by a range of other factors.

Technology suppliers and craftsmen providing energy renovations are highly relevant as they have direct contact with house owners. Some companies are offering services to build bridges between house owners and people who can deliver the renovations (*Energihjem, n.d.*). Being companies the main concern is business and following this is a concern about creating a satisfying service for the customers. Some companies also have concerns beyond this, e.g the sustainability agenda (*T01-01*). According to the Danish statistics, green services and products have increased in Denmark by 15 pct. between 2015-2018 (*Danmarks Statistik, 2019*), which indicates there is growing market potential. Our empirical research showed some scepticism toward the hidden intentions such companies could have about earning money. However, our findings, discussed in section 6.1, indicates that many house owners prefer their local craftsmen as they gain more trust from the house owner when help and guidance come from their network.

Architects play a role in the energy renovation arena, as they focus on developing an energy renovation solution that aesthetically fits with the specific house owner case (*A01-04, A01-05 & A02-12*). They, thereby, help motivate energy renovation, by providing a solution that is not only functional but fits the needs of the house owners.

6.3.8. NAVIGATING ON THE DEVELOPMENT ARENA

A part of the value of analysing of the arena of development was to figure out, where and with whom there should be staged negotiation spaces in the further design process as a part developing a solution and mobilising a supporting network. This section will discuss this, and as navigation on the arena continues, further strategic considerations, as a part of the design process, will be presented in the following chapters.

From mapping and analysing the arena of development it became clear that the house owners who have not energy renovated can be divided into two types, one type which considers energy renovation and another type

which has not considered energy renovation. The strategy to enrol these in the arena of energy renovation would vary depending on the type. Therefore, further navigation in relation to the users depended on our design focus, described in section 7. Further, some house owners are in the arena even though they do not have the concern of energy renovation, but a regular renovation can open up the possibility for leading them to conduct energy renovation. The varying concerns of the house owners were important to understand in translating them into the arena.

The current actor-worlds on the arena, to a large degree, focus on energy renovation promotion through general information and access to energy advisers. These agendas have only limited success in getting house owners into the arena by having them energy renovate their homes. A large potential remains, as many still have not decided to energy renovate. To a large degree, the strategies try to reach all house owners with the same initiatives. Our further navigation involved a more nuanced approach, where the house owners were differentiated to create an impactful solution (read more in section 7).

In relation to this, there are different levels of initiatives, local actor-worlds in the municipalities and national ones driven by the state or knowledge institutions, as well as companies and non-profit organisations. Current dynamics on the arena, about changing from the energy reduction agreement to new initiatives opens for change on a national level. Some municipalities are also working with finding local initiatives, but are struggling with handling the wicked problem. Through the analysis we, thereby, found that a range of actors hold the concern of energy renovation and based on this we decided that the initial concept development should not be about translating and establishing actors in networks follow this agenda, but rather to develop a solution to translate the essential actor, the house owner, into the network. For the solution space to remain open, we did not settle on developing a solution with a specific actor as a collaboration partner, and owner of the solution, during the initial concept development. In this way, our navigation on the arena was highly focused on creating a solution useful for the house owners, with the plan of later translating other actors to support the design.

This strategy did not mean that considerations about the mobilisation of a network were left out of the further design work. It was incorporated into ideas through considerations, e.g. about whether biased or unbiased knowledge should be represented in the solution, which would influence the choice of actors to mobilise. However, the focus was to stage negotiation with house owners to create a solution with the ability to translate this actor to follow the agenda of energy renovation. Our strategy was to develop a solution which should be able to act as an intermediary object, translating other actors on the arena to take up the solution as a part of their network or taking part of a new established network (see Figure 34).

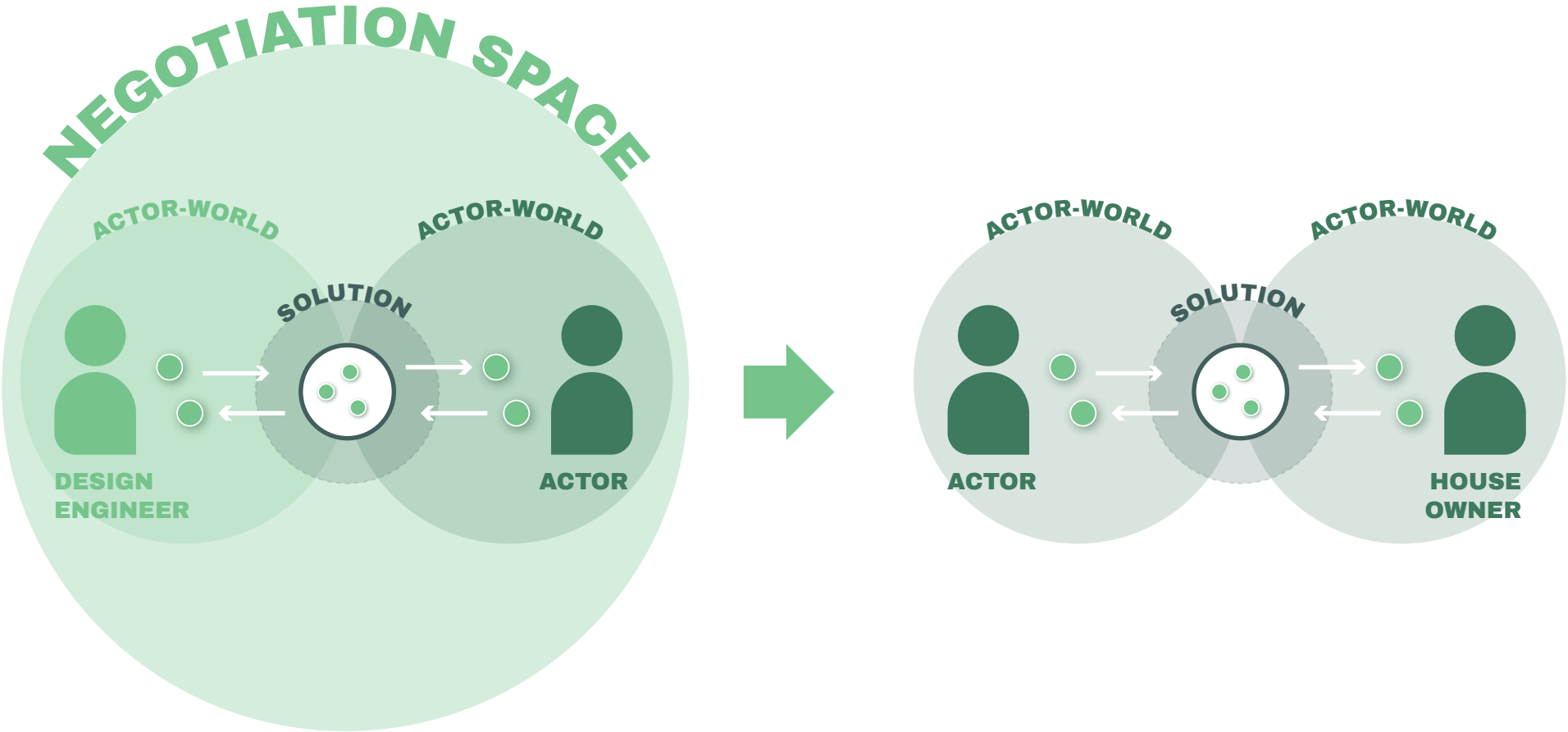


Figure 34: Our strategy in navigating on the development arena 'Energy renovation of detached single-family houses'. Solution developed with actor in negotiation spaces, actor takes ownership of solution, and translates energy renovation through solution to house owner.

7

DESIGN FOCUS

7. DESIGN FOCUS

This chapter presents the process of defining our design focus - framing our design problem. Through backstage negotiations, we discussed how to narrow down the design problem to be able to design an impactful solution. From the delineated and framed design problem, an initial performance specification was developed, creating the base for the concept development.

7.1. POSSIBLE SOLUTION SPACES

The empirical research was, as described in the previous sections, analysed in relation to our project focus. Here, we overall defined two solution spaces in relation to motivating people to energy renovate their homes:

- Creating awareness
- Supporting decision-making

'Creating awareness' relates to the first step in the process sparking an interest, where house owners are introduced to the concept of energy renovation. 'Supporting decision-making' relates to the next step in the process, where house owners are aware of energy renovations but need to be convinced to get to the point where they are translated into the energy renovation arena and choose to energy renovate their house. As they are different solution spaces we wanted to focus on one of them in the development of a solution.

Further, from our analysis of the types of house owners in Denmark, we found that there is a large difference in the types of personas. In order to develop an influential solution, we, therefore, also wanted to narrow our design focus to specific personas.

7.1.1. CHOOSING A DESIGN FOCUS

Choosing a design focus was achieved through a process where each persona was evaluated in relation to their need for a solution which either 'creates awareness' or 'supports decision-making' (see Figure 35). This created a backstage negotiation space in the design team where the different personas were evaluated in relation to their need for a solution to be translated into the energy renovation arena following the agenda of energy renovating. This was done by discussing and rating the personas' needs.

Through the negotiations, we found that a solution which 'supports decision-making' is more needed than creating awareness (see Figure 35). Many personas are aware of the possibility of energy renovation and have considered it but are stopped by barriers, e.g. if they find it too complicated to get information on the area or do not have the finance for the investment. Based on this, we chose to narrow our focus to the development of a solution 'supporting decision-making' in the energy renovation process. Other studies also point in this direction, as the interest for energy optimising one's house has increased in recent years (*Bolius, 2018*).

In the next part of the process, the rating made it possible to point out which of the personas needs a 'support decision-making' solution more than others. As shown in Figure 35, these are the personas Erik the Iceman, Idealist Irene, Bob the Builder, Dime-Loving-Diana and Peter Practical. These personas are, however, very different and we saw the need for limiting who we were designing for, only focusing on some of the personas. Idealist Irene was deselected as this persona lives in a newer house and, therefore, does not have the same need for energy renovations

	Dorte the Drifter	Erik the Iceman	Idealist Irene	Bob the Builder	Dime-Loving-Diana	Gadget Gert	Peter Practical	
Creating awareness about energy renovation	1	2	1	2	2	1	5	14
	Not relevant. She is moving soon and short term benefits does not fit her motivations.	Has considered energy renovation because of bad indoor environment.	Has considered energy renovation. It is a strong interest to be sustainable and off-grid.	Has considered energy renovation, but it is not a strong focus in his everyday life.	Has considered energy renovation, but it is not a strong focus in her everyday life.	Has considered energy renovation because he follow the technological progression and is always ready for new energy technology.	Does only consider renovations and not necessarily energy renovations.	
Support decision-making process about energy renovation	1	13	8	5	8	3	13	51
	Not relevant.	Does not have knowledge or competencies on the area.	Wants to find the best solution. Need help for the process. Has basic tech understanding.	Has great DIY competencies, but lacks knowledge about energy renovation.	Has little knowledge on the area. Has little competencies on the area.	Have very good knowledge on the area, but need some advice about the process.	Does not have knowledge on the area. Does not have any competencies on the area.	

Figure 35: Personas rated in relation to their need for different types of solutions.

to support sustainable development. Bob the Builder was also deselected because there is a large difference in whether the personas want to do-it-yourself or have other professions perform the energy renovations. The competencies of Bob and the support he experiences from his network helps him get to a point where he chooses to energy renovate. Other types of house owners do not necessarily have this and could benefit from a solution supporting their decision-making process. Left was Erik the Iceman, Dime-Loving-Diana and Peter Practical. These were compared in order to decide whether they were enough alike to have them all as our design focus.

These three personas are a part of families in the middle of their life either with kids or with kids who just moved out. They have many years left in their house and expect to do some renovations in the future. For all the personas, other renovation projects is a window of opportunity, which can lead to energy renovations. They live in older houses typically with the need for energy renovations. Their interest for energy renovations is not blooming, but they have all considered it in relation to maintenance, indoor climate or saving money from reducing the energy bill - motivation factors they all hold with nuances in what their main motivations are. Their competencies and knowledge on the area hold them back as it causes them to see the planning process as time-demanding and they find it troublesome to find useful information about what an optimal solution would be. The decision-making process does, therefore, often not reach the final commitment of doing the energy renovation.

In order to create an impactful solution we also wanted to choose personas based on who represents a large part of the Danish population. A Danish survey study, performed by the non-profit organisation Bolius, answered by 3504 Danish house owners, found that the two main motivators for energy renovation are economy and indoor climate & comfort, which points to a large part of the Danish population having characteristics as Dime-Loving-Diana and Erik the Iceman (*Bolius, 2018*). Further, the study has found that 34 pct. of the house owners would make energy renovations as a part of other renovations, which points towards Peter Practical characteristics. As the personas are relatively alike with nuances and represent characteristics in a large part of the danish house owners, we chose to focus on developing a solution for these three personas.

7.2. THE DESIGN PROBLEM

During the negotiations space, the design problem was thereby translated into a focus on supporting decision-making for the personas Dime-Loving-Diana, Erik the Iceman and Peter Practical. This made the further design process focus on the actor-world of house owners who consider energy renovations.

When looking at the energy renovation process, our focus delimitates the solution space to be within the *before phase* (see Figure 36). From further analysing this phase, through the empirical data, we found that it can be divided into sub-phases. These have been identified as *understanding*, *diagnosing*, *financing*, *planning* and *committing* (see Figure 37). These steps are not necessarily linear, and *understanding, diagnosing*, *financing* and *planning* can be iterative as the house owner often consider different solutions and consider all four aspects before committing. The sub-phases can be seen as a translation process where the house owner gets more interested in the agenda of energy renovation and if the translation succeeds, then the house owner gets mobilised and follow the agenda of conducting energy renovation.

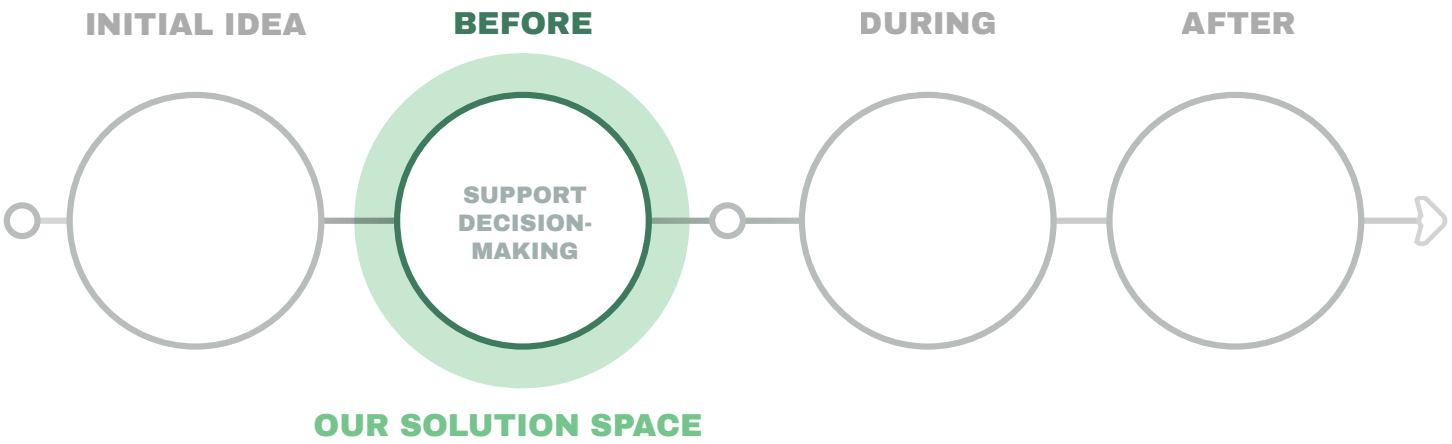


Figure 36: Energy renovation process marked with our focus - the 'before' phase.

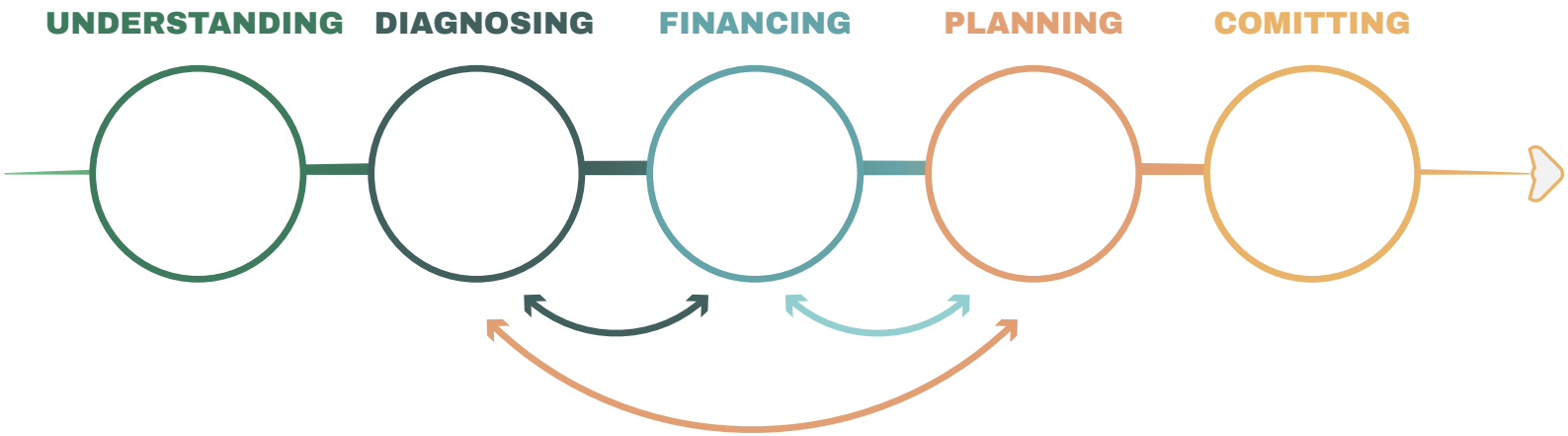


Figure 37: Sub-phases in the 'before' phase of energy renovation.

The *understanding phase* is where the house owner gains an overall understanding of what energy renovation is and its potentials. The house owner typically also seek overall knowledge about what such types of renovation would take through their research.

Diagnosing is the phase where the house owner goes a step deeper into finding a solution. Here, the house owner needs more specific advice about solutions for their house and concerns. More specific information about different solutions is investigated, regarding benefits, price, time, disturbance of everyday life etc.

The *financing phase* is where the house owner finds a financial solution for the investment. Some have enough economic resources through savings while others have to get a loan. Energy renovations are often relatively large investments and this step is therefore important. Guiding the house owner through this part and bringing awareness to the financial benefits, as well as the available grants, can get the house owner a step closer to committing.

Planning is the phase where the house owner takes the final steps leading up to a commitment. Here, the house owner chooses a solution, gets offers from craftsmen or other actors who perform the renovation, talk to the bank if needed, consider when to do the project in relation to other plans. To the house owner, this can easily seem complicated as there are many variables to take into consideration.

The last phase *Committing* is where the house owner decides to commit to the energy renovation and make the necessary agreements with e.g. craftsmen and bank. The house owner is now mobilised, contributing to the agenda of having more people energy renovate their homes.

The mapping of sub-phases made it possible to frame an overview of what the solution should support during the decision-making in the *before phase*. This supported the work with transforming findings into requirements expressed in the performance specification.

7.3. INITIAL PERFORMANCE SPECIFICATION

A performance specification was developed as a way to translate the findings, specific for the framed design problem, into requirements. The purpose was to create a bridge between the analysis and the concept development. The initial performance specification (see Table 2) was based on concerns from the three personas Erik the Iceman, Dime-Loving-Diana and Peter Practical. Findings from the affinity diagram, from house owners with characteristics of the chosen personas, were translated into design requirements. These were further synthesised to fit the design problem of supporting decision-making, through the process of the *before phase* described in section 7.2. This initial performance specification represents the overall aspects that a solution should be developed from and acted as a guide for the development of concept ideas, creating the base for a detailed performance specification specified later in the design process.

Decision-making process	Category	Demand	Wish
Planning	*Advice*		*Access to other house owners experiences with craftsmens performance during energy renovation*
Diagnosing	*Advice*		*Access to personal advice about optimal solution for the specific house and family*
Understanding	*Advice*		*Provides access to cases about energy renovation from house owners who have energy renovated*
Understanding & diagnosing	*Benefits: Aesthetics*	*Aesthetic benefits of energy renovation must be made visible to house owner*	
Understanding & diagnosing	*Benefits: Economy*	*Economic benefits of the energy renovation must be transparent for the house owner*	
Understanding & diagnosing	*Benefits: Energy renovation as part of other renovations*	*Makes benefits of energy renovations as a part of other types of renovations visible for the house owner*	
Understanding & diagnosing	*Benefits: Indoor climate*	*Indoor climate benefits of the energy renovation must be transparent for the house owner*	
Understanding & diagnosing	*Benefits: Maintenance*		*Benefits of optimised energy renovation as a part of maintenance should be transparent for the house owner*
Financing	*Financing*		*Economic support (grants etc.) from the government should be transparent to the house owner*
Financing	*Financing*		*The process of financing energy renovation and available financial options should be transparent to the house owner*
Financing	*Financing*		*Multiple energy renovation solutions at different price ranges should be accessible to house owner*
Whole process	*Information*		*Should provide unbiased knowledge about energy renovation*
Whole process	*Information*	*Must provide understandable knowledge about energy renovation*	
Whole process	*Information*	*Must provide easily accessible knowledge about energy renovation*	
Planning	*Planning*		*Must support the house owner to plan the energy renovation project*
Planning	*Planning*		*Should provide information about which actor(s) to contact regarding energy renovation*
Planning	*Regulations*		*Regulations and legislations from the government should be transparent to the house owner*
Diagnosing	*Technology*		*Should provide comprehensive knowledge about energy renovation technologies*

Table 2: Initial performance soecification.

8

CONCEPT DEVELOPMENT

8. CONCEPT DEVELOPMENT

This chapter presents the concept development phase, which was an iterative process of idea generation and creation of concepts, as well as staging negotiation spaces for testing ideas. Here, the performance specification acted as a backstage tool which we used to frame the solution space. It was updated by translating new findings into requirements, where new concerns lead to new framings of the design problem and where the solution space continuously became more narrow.

8.1. CONCEPT DEVELOPMENT PROCESS

Concepts were developed in a backstage ideation process based on the previous findings defined in the initial performance specification, described in section 7.3. The first part of the process was a structured brainstorm based on the morphology chart method. We staged a digital backstage negotiation space, in the shape of an ideation session, using an online collaboration platform, which made it possible for all design team members to make live changes while virtually communicating with each other. The initial performance specification was translated and inscribed into the morphology chart with themes framing the solution space, illustrated in Table 3. In this way, we secured that the concepts were developed based on needs and concerns from the initial research and analysis, translated into the performance specification. The morphology chart acted as an intermediary object representing the design problem, mediating ideas between the team members and translating those ideas into concepts.

8.1.1. IDEATION BRAINSTORM

The ideation was first carried out as a structured brainstorm in sessions of 5 minutes for every theme, where each team member wrote down ideas. Afterwards, the ideas were discussed and from this, negotiations of new ideas occurred which were written down among the existing ones. During the brainstorm, many different ideas were generated related to all of the different inscribed themes (see Table 3).

8.1.2. CONCEPT GENERATION

The next part of the ideation was concept generation. From the morphology chart, different ideas were combined into concepts by each team member (see Table 4). These translations resulted in another negotiation of the generated concepts, where the characteristics, properties and similarities to existing solutions were discussed.

8.1.3. EVALUATION OF CONCEPTS

To further develop the solutions, each concept was evaluated in relation to the requirements from the performance specification (see section 7.3). The concepts were scored for their ability to live up to the requirements (see Table 5). Using this as a weighted objectives method to evaluate alternatives, negotiations were initiated to further specify and combine the concepts. The inscribed requirements created dialogue and forced the design team to consider relevant elements of the concepts. We experienced that the negotiations were just as relevant as the scoring of the concepts, helping us in making a decision about which concepts to bring further in the design process. The backstage negotiation space resulted in six concepts, where some of them were combined due to them being very similar. Thereby, we ended up with four concepts representing solutions for the problem of having more house owners energy renovate their homes.

Information	Energy consultant hotline	Interactive demonstation house	Energy renovation dictionary	Show room	Standards for optimal energy renovations
	Energy consultant chatbot	Energy renovation 101 guide	Website with motion graphics	Community based platform (sharing experiences)	Different levels of knowledge
Advice	Inspections from energy adviser	Videos with advice	Subscription with tips each month	Local events	Genereates suggestions from answered questions
	Energy renovation profiles	Building get checkups like cars	Sharing experiences	Adviser follow house through its lifetime	One-stop-shop
Benefit: Aesthetics	Photos of solutions	Prototype test in own home	VR or AR where you see the solution in your own home	Customised solution (you choose color, size, etc.)	
	Architect guide	Aesthetic rating of solutions	A game where you decorate house with energy renovations	Before and after show cases	Energy renovation magazine
Benefit: Indoor climate	Thermal measure app	Case studies	Borrow thermal measure instrument	Interactive climate stimulator show how heat distribution changes with new technology	
	Info about health consequenses	Physical house where changes can be experienced (demonstration house)	Shared before- and after experienced	Heat map	
Benefit: Economy	Return on incvestment timeline	Estimate on property value before and after	Energy optimising suggestions comes with energy bill	Cases	Examples of what you can afford with the reduced bill
	Scenarios with different investments and savings	Savings calculator	Sharing experiences	Reduction in bill made visible	Economical benefits from user input
Benefit: Maintenance	Defects and breaks are automatically reported	Upgrade advise	How to check status of current technology	Operation upgrades are made visible	
	Check-up each year	You see the level om years left for a technology	Adviser follow house through its lifetime	Quality upgrade made visible (rating of house)	
Benefit: Energy optimise as part of other renovations	Proactive craftsmen proposing energy renovations	Visible proces presenting how easy it is to add energy renvoations	Standard packages	Energy optimising regulations to level up normal renovations	
	Proposed energy renovations for specific renovation	Renovation network (e.g. when kitchen is renovated the carpenter can contact the network for energy renovation proposals)	Energy upgrades for different types of rooms	Sharing experiences	
Planning	Interactive timeline	Info about what different actors can offer	Info about what different types of projects takes	Case studies	Access to plans other house owners have used
	List of actors you can contact	Another actor plan process	Template with common steps	Online plan shared between craftsmen and house owner	AI strategy generater
Financing	Loan gets cheaper if it is for energy renovations	Proactive banks	Different price-range scenarios	Loan calculator	You put in your wishes and get different offers from craftsmen
	List of grants to apply for	Different package solutions (no extra expences)	Grants matching user input	Pricerunner for energy renovations	Mail if new grants are
Regulations	High energy class reduce house taxes	Regulation guide	Video explaining current regulations	Hire help for solution to live up to regulations	
	List with relevant regulations highlighted	Regulation dictinary	Mail from authorities about new renovation regulations	Access to actors who can helt understand	
Technology	Overview of different technologies	A library with different technologies (physical or online)	Show room	Online energy renvoation market	
	Technologies for different purposes	Specifications made understandable for house owner	Pros and cons for different tech types	'All you need to know about energy technologies' courses	

Table 3: Ideation brainstorm.

	Finance first	Inspiration house	Interactive platform	Social network	One-stop-shop	Energy truck
Information	Energy consultant advise	Interactive demonstation house	Website with motion graphics	Different levels of knowledge	Energy renovation 101 guide	Energy consultant advise
Advice	Adviser follow house through its lifetime	Energy consultant advise	Online from user input Energy renovation profiles	Sharing experiences	One-stop-shop	Local events
Benefit: Aesthetics	Photos of solutions	Physical solution show room	VR or AR where you see the solution in your own home	Aesthetic rating of solutions	Customised solution (you choose color, size, etc.)	Photos of solutions
Benefit: Indoor climate	General info about indoor climate benefits	Heat map	Thermal measure app	Shared before- and after experienced	Borrow thermal measure instrument	Heat map
Benefit: Economy	Estimate on property value before and after Return on investment timeline	Cases	Economical benefits from user input	Sharing experiences	Scenarios with different investments and savings	Cases
Benefit: Maintenance	Upgrade advise	Operation upgrades are made visible	How to check status of current technology	Sharing experiences	Upgrade advise	Check-up each year
Benefit: Energy optimise as part of other renovations	Propose energy renovations	Standard packages	Propose energy renovations	Sharing experiences	Proactive proposing energy renovations	Energy upgrades for different types of rooms
Planning	Template with common steps	List of actors you can contact	Interactive timeline AI strategy generater	Info about what different types of projects takes Access to plans other house owners have used	Info about what different actors can offer	Cases
Financing	Proactive banks	Cases	Loan calculator Grants matching user input	Sharing experiences	Pricerunner for energy renovations Different package solutions (no extra expences)	Cases
Regulations	Regulation guide	Regulation guide	List with relevant regulations highlighted	Sharing experiences	Hire help for solution to live up to regulations	Regulation guide
Technology	Cases	Show room A library with different technologies	Overview of different technologies	Pros and cons for different tech types	Online energy renvoation market	Cases

Table 4: Concept generation.

Category	Demand	Wish	Finance First	Inspiraion house	Interactive platform	Social network	One-stop Shop	Energy renovation truck
Advice		*Access to other house owners experiences with craftsmens performance during energy renovation*	1	1	1	13	1	3
Advice		*Access to personal advice about optimal solution for the specific house and family"*	8	5	5	1	8	8
Advice		*Provides access to cases about energy renovation from house owners who have energy renovated*	3	8	1	13	1	3
Benefits: Aestetics	*Aesthetic benefits of energy renovation must be made visible to house owner*		5	8	13	5	5	5
Benefits: Economy	*Economic benefits of the energy renovation must be transparent for the house owner*		13	8	8	5	5	5
Benefits: Energy renovation as part of other renovations	*Makes benefits of energy renovations as a part of other types of renovations visible for the house owner*		8	5	5	5	13	5
Benefits: Indoor climate	*Indoor climate benefits of the energy renovation must be transparent for the house owner*		5	13	8	5	5	5
Benefits: Maintainance		*Benefits of optimised energy renovation as a part of maintainance should be transparent for the house owner*	8	3	8	3	13	5
Financing		*Economic support (grants etc.) from the governement should be transparent to the house owner*	8	3	8	2	8	5
Financing		*The process of financing energy renovation and available financial options should be transparent to the house owner*	13	5	8	5	8	5
Financing		*Multiple energy renovation solutions at different price ranges should be accessible to house owner*	13	13	13	3	13	5
Information		*Should provide unbiased knowledge about energy renovation*	5	5	13	8	5	13
Information	*Must provide understandable knowledge about energy renovation*		5	13	13	8	5	8
Information	*Must provide easily accessible knowledge about energy renovation*		5	5	13	13	5	8
Project planning		*The solution must support the house owner to plan the energy renovation project*	8	5	5	5	13	8
Project planning		*Should provide information about which actor(s) to contact regarding energy renovation*	5	8	5	5	13	8
Regulation		*Regulations and legislations from the governement should be transparent to the house owner*	3	2	13	2	8	5
Technology		*Should provide comprehensive knowledge about energy renovation technologies*	5	8	8	5	8	5
Total			**121**	**118**	**148**	**106**	**137**	**109**

Table 5: Evaluation of concepts 1 being the lowest score and 13 being the highest.

8.2. CONCEPT DESCRIPTIONS

This section describes the concepts generated through the ideation phase described above. These concepts were translated into prototypes presented through the figures in this section.

8.2.1. ENERGY RENOVATION INSPIRATION CENTRE

Uncovering the potentials of energy renovation and gaining an insight into the pros and cons can be a daunting task for a house owner. Therefore, the Energy renovation inspiration house is there to give the answers (see Figure 38). It is a physical building where unbiased energy advisers are employed to help house owners, based on the information the house owner provides about their house or project, with the energy renovation process. They provide advice regarding both economical and indoor climate benefits as well as the possibility to include energy optimisation in other renovation projects. Furthermore, they can advise about which type of actors to contact to initiate a specific renovation project.

The house contains showrooms that demonstrate different types of energy technologies. As an example, one room has several different heat pumps that can be turned on or off, to demonstrate the loudness during operation. For the energy adviser to provide unbiased energy advice, the technology demonstrated in the house will be chosen based on the recommendations from the Danish Energy Agency and Technological Institute.

8.2.2. RENOVEN

The platform RenoVen can support house owners through the journey of renovating their house, from the convenience of their own home (see Figure 39). When opening up for the first time, it will ask for inputs regarding technical information of the house, the house owners preferences and more. This information is then processed through algorithms, to provide relevant and unbiased guidance to the user.

The advice generated by the app is based on the experiences of thousands of previous projects and can, therefore, provide sufficient information to an adequate extent. Included in the guidance, is advice on what parts of the house require to be renovated due to wear and tear and what energy renovation could be done in relation to this. Further, experiences of the indoor climate and aesthetic benefits or drawbacks are included in these experiences. The results will include a range of different technologies at different price ranges. In the next step, the users are advised by the platform on the economic benefits of different alternatives. The economical advantages are also based on the inputs of the user. This platform can be useful if house owners want to figure out if there are some energy renovation advantages present in conjunction with another renovation project.

8.2.3. RENOMY

Obtaining information on the experiences of other house owners is valuable when a new renovation project is about to begin. The energy renovation social network RenoMy (see Figure 40) is a platform, where house owners who have energy renovated can share their experiences regarding every aspect of the renovation, from what craftsmen they used to what energy technologies they chose to invest in. Also, benefits such as better indoor climate, aesthetics

of the solution and reduced energy bill are included, as well as pictures of the progress and the final result. This can be useful if a house owner needs inspiration on different aspects of the process. Here, honest advice can be found. It presents a vast range of different technologies and their uses, but to gain a deeper understanding of technologies or other details, information needs to be found elsewhere.

8.2.4. ENERGY RENOVATION TRUCK

The Energy Renovation Truck drives around in municipalities in Denmark during summertime offering local energy advise services (see Figure 41). Each month the truck visits a new place and offers free advice on energy renovation, so house owners can drop by with any question about renovating their home. In the wagon, infographics with information and tips regarding energy renovation are displayed. On posters, energy advice is displayed to encourage house owners stopping by to energy renovate their homes. With the energy renovation truck, the information is brought close to the house owners.

Energy renovation inspiration centre

Visit our physical centre to talk about home renovation energy. Unbiased professionals are ready to answer your questions and prepare you to embark on your next step toward a greener, more comfortable and more valuable home! See the latest solar panels, feel the difference in the indoor climate with the latest windows and hear the new silent heat pumps!

Figure 38: Energy renovation inspiration centre prototype.

RenoVen

Log in to RenoVen and you can handle everything on your renovation online. Enter your information and you are ready to be offered solutions. Get bids online, helping with planning the renovation process, the legislative matters and along the way you can follow the process online. This way, you will get through the energy renovation with every detail gathered somewhere and without the regular hassle of finding the right solution.

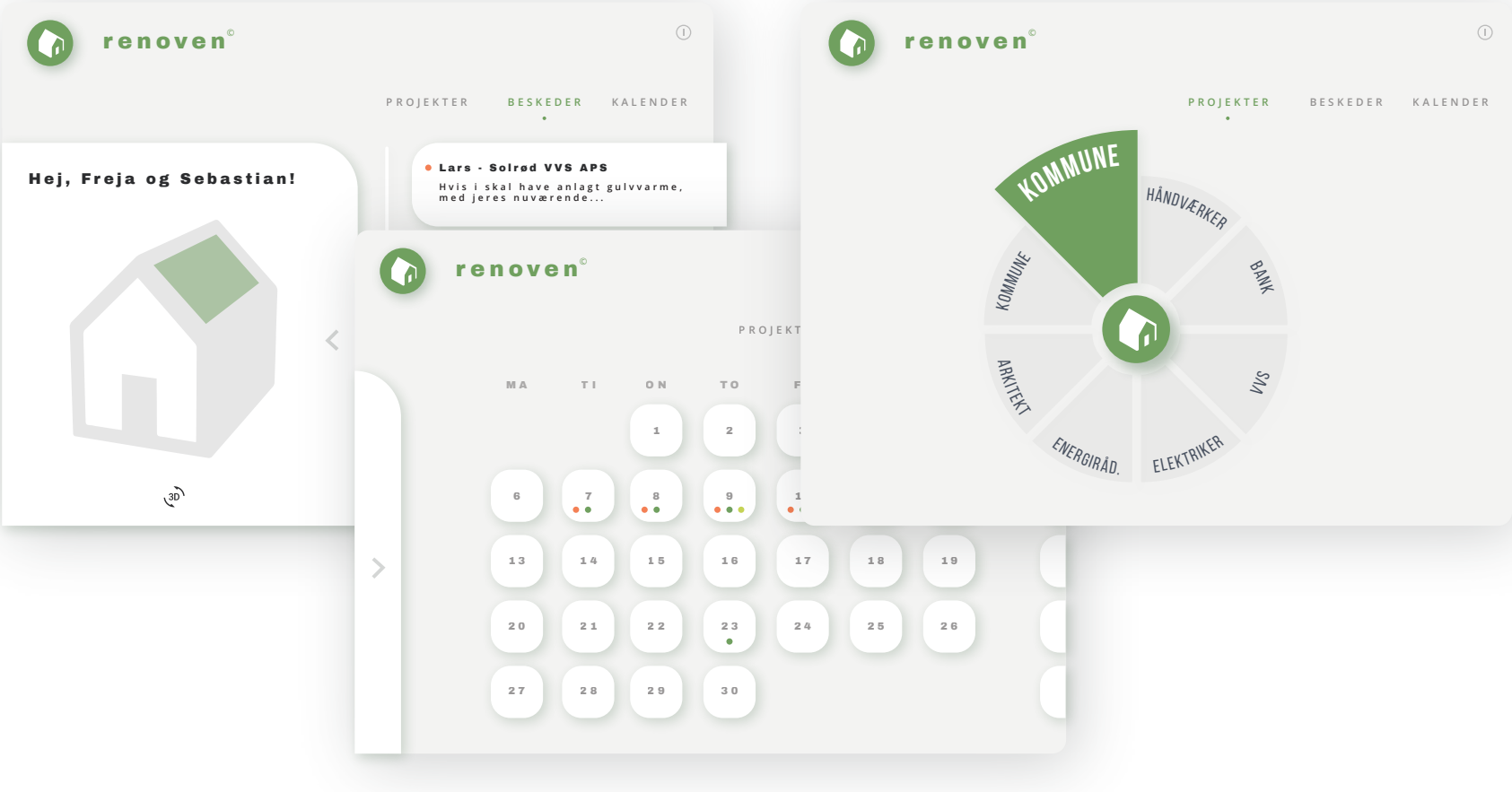


Figure 39: RenoVen prototype.

RenoMy

Share renovation tips and experiences from your projects and get inspiration from others' projects via RenoMy. On this social media, through stories, pictures and videos, you can gain insight into the experiences of others. This makes it easier to find the right solution and ensure a good process.

Figure 40: RenoMy prototype.

Energy Renovation Truck

The energy renovation truck can be found in your local area. It drives around in Denmark during summer time to bring attention to the benefits of energy renovations. Here, local citisens can stop by and get advise from an energy adviser. Through posters general information about energy renovation and advice on how to check and optimise the energy performance of houses is displayed.

Figure 41: Energy renovation truck prototype.

8.3. PROTOTYPE NEGOTIATION SPACES

An important part of our design process was to create solutions relevant to house owners to contribute to the sustainable development of the building- and energy sector in Denmark. During the translations, from literature and empirical findings into a performance specification, which was further translated into ideas and then concepts, the data got reduced, amplified and transformed through many steps. To ensure that the concepts fitted with the original needs and concerns we, therefore, found it relevant to involve house owners in evaluating and further developing the concepts. We wanted to get an insight into what *role* (*Houde & Hill, 1997*) such concepts could play in having more house owners energy renovate their homes and, therefore, staged negotiation spaces where seven different house owners were invited to take part. In staging the spaces, we used prototypes intended to work as intermediary objects to support the facilitation of dialogue. The prototypes represented the characteristics and intentions of the concepts, to mediate knowledge and feedback between the house owners and designers. The prototypes consisted of visualisations and a short text presenting the main characteristics of the concept, as presented in section 8.2 (see prototypes in original language in appendix 7).

During the negotiation spaces, we experienced that the prototypes were taking part in creating a shared understanding of the ideas, making it possible for the house owners to give feedback on the concepts. As the concepts were vaguely described and somewhat different, but still within the same solution space, we wanted feedback on the *role* of such concepts, avoiding too much emphasis on the technicalities. The intention was for the feedback to support the process of choosing between or combining the four alternative ideas and further develop a final concept. We, however, experienced that the fidelity and finished look of the prototypes made some of the participants treat the concepts as near finished. They would comment on details and demand further specifications about the solution, instead of reflecting upon the overall *role* of the concept - if they would prefer a platform, physical display, process guidance, physical experience, etc. Other participants reacted well to having something concrete to relate to, and immediately reflected upon the *role*. The negotiation spaces contributed with many interesting and relevant perspectives. These findings are presented in the following, referring to emperical findings which can be found in appendix 8.

8.3.1. ENERGY RENOVATION INSPIRATION CENTRE

The concept *Energy renovation inspiration centre* was found interesting by the participants based on its ability to give tangible experiences of different energy renovation technologies to sense its aesthetics, sounds etc. (*H01-33, H11-10, H20-03, H28-01, H25-35 & H30-01*). Also, access to professional yet unbiased advice through the concept interested many (*H01-37, H25-32 & H20-04*). However, it was emphasised by some, that there was a lack of specific guidance according to their house type, and that booking a session with information sent in advance was preferable (*H25-34*).

8.3.2. RENOVEN

RenoVen was by the participants argued to be interesting as they found energy renovations as a part of other renovations relevant (*H25-42, H25-44, H11-13, H01-44 & H20-06*). Many participants told how they with little

knowledge on the area of energy renovations tend to be lost and they, therefore, do not prioritise it (*H25-42*). Having a step-by-step guide or checklist was by a majority articulating as supporting in getting them closer to conducting energy renovations (*H01-44, H11-12, H25-39, H25-38, H29-03, H20-07 & H20-09*). One house owner e.g. explained: *"To have the total overview of a renovation project, is something we have no understanding of. Getting the help to get everything in place would be a great help, like knowing if you have contact with the right actors, and what you are even supposed to have in place."* (*H20-06*).

8.3.3. RENOMY

The notion behind the energy renovation social network concept *RenoMy* was articulated as a part of current practices by many of the participants, to look for other house owners experiences for inspiration (*H01-45, H11-16, H20-10, H28-07 & H29-04*). However, when searching outside their network, on the internet, they found it hard to find relevant inspiration (*H25-47*). Knowledge sharing between house owners about renovations proved to be important for house owners in getting closer to an energy renovation. Some critically argued that it needed to be structured, and not just a string of random renovations for them to be mobilised in using the concept (*H11-15*). Another benefit of reading about experiences of others is that the information is unbiased and *"(...) not somebody who tries to sell you something."* (*H28-10*).

8.3.4. ENERGY RENOVATION TRUCK

The *Energy Renovation Truck* received mixed feedback. A majority did not find it relevant (*H01-46, H11-17, H20-15, H25-49 & H28-11*). Many associated it with salesmen or facers, which was identified as a negative attribute. The house owners prefer unbiased advice about solutions when it comes to energy renovations (*H20-17, H25-50 & H28-11*). Because of energy renovations being a big decision, it requires specific and comprehensive information to support the house owner's decision-making process bringing them closer to a renovation. The participants did not associate the concept with these relevant aspects (*H01-46*). To get more specific and relevant advice on their house, owners should be able to book a meeting with an energy adviser who then evaluates the house (*H25-49*).

8.3.5. PROVIDERS OF SOLUTION

In general, during our prototype negotiation spaces, participants expressed concerns about who the actor behind the solutions would be and if it would cost money to use it (*H25-41, H01-38 & H11-09*). This was a concern as using a service for free could cause doubt in the purpose and legitimacy of the solution. E.g. one house owner told: *"I'm left wondering why one isn't required to pay for any of this. Is there any business in this?"* (*H21-15*). But as earlier found, house owners are often not willing to pay for energy advice. Unbiased knowledge with transparency regarding the owner of the platform was argued as prefered for the house owners to support their decision-making (*H25-32, H20-04, H01-37, H25-31, H29-04, H28-11 & H28-10*). This was relevant knowledge in relation to navigation on the development arena, both on how to develop the solution and who could be the provider of such a solution.

8.3.6. THE DIFFERENCE IN PARTICIPANTS CONCERNS

Some of the involved house owners were participants from the earlier design games, while some were new participants. We found it important

to add participants who had not been introduced to the project in prior, to make sure that this involvement did not affect the evaluation of the prototypes. We could not predict the persona types of the new participants and it, therefore, resulted in having participants out of our defined design focus, as we had two Bob the Builder personas contributing during the negotiation spaces. This was, however, also interesting as the difference between different types of house owners needs became even more clear when talking about the prototypes. The concepts which Dime-Loving-Diana, Erik the Iceman and Peter Practical personas found relevant were not relevant for Bob the Builder. These participants' competencies, knowledge, network and interest in do-it-yourself made them concerned about other aspects of energy renovation and therefore not seeking the same type of solutions supporting the decision-making process. This supported our decision in not making a solution directed to all house owners but rather a solution directed to a specific group to make a valuable and potential impactful solution.

8.4. EVALUATING ALTERNATIVES

Key points from the prototype negotiation spaces were inscribed in a scheme, creating an overview of the feedback from the house owners and their ranking of the concepts (see appendix 9). The scheme acted as a backstage intermediary object in the design team which allowed the team to gain a shared understanding of the house owners' perspectives on the concepts and translate it into a decision tool. The house owners were as a part of the negotiations asked to rate the ideas in relation to their relevance in having the participants' energy renovate their homes. These ratings were used in the evaluating of the concepts and choosing a concept to develop further (see Figure 42).

The concepts *Energy renovation inspiration centre, RenoVen* and *RenoMy* were rated as the most useful in supporting decision-making, all with relatively close scores. While *Energy renovation inspiration centre* is a concept on a physical location and the other two concepts are web-based. We could therefore not combine all three concepts, but we saw the potential of combining *RenoVen* and *RenoMy*. This would make a concept both providing guidance and inspiration between house owners on the area of energy renovation. We, therefore, chose to combine these two concepts. In this way, the design problem was narrowed down and re-framed to focus on renovations in general and how to have house owners energy renovate as part of these through guidance and inspiration.

	House owner (H28)	House owner (H29)	House owner (H25)	House owner (H30)	House owner (H20)	House owner (H01)	House owner (H11)
Energy renovation inspiration centre	2nd	4th	3rd	1st	2nd	1st	3rd
Renoven	3rd	2nd	1st	2nd	1st	3rd	1st
Renomy	1st	1st	2nd	4th	3rd	2nd	2nd
Energy renovation truck	4th	3rd	4th	3rd	4th	4th	4th

Figure 42: Overview of house owners ratings of the four different concepts from the prototype negotiation spaces.

8.5. DETAILED PERFORMANCE SPECIFICATION

Findings from the prototype negotiation spaces were translated into a detailed performance specification (see Table 6). The main focus of the concept was to have people energy renovate as a part of other renovations, guiding them through the decision-making process before an energy renovation and letting them have access to other house owners' experiences with renovations. This, therefore, became the main categories of the performance specification (see Table 6). Even though environmental sustainability was not the main concern expressed by the house owners, we found that promoting this is relevant to support the sustainability agenda. Therefore, both users' concerns about financial benefits etc. were inscribed, to indirectly make house owners follow the sustainable agenda of energy renovations. A more explicit sustainability requirement was added in order to potentially influence the house owners concerns, giving them info to base their decision on regarding environmental sustainability.

Category	Demand	Wish
Platform	*The platform must be digital*	
Platform	*The platform must work as a website*	*It should work on mobile devices*
Platform	*The platform must be about renovations in general*	
Guide	*It must provide a general step-by-step guide on what to consider before an energy renovation*	
Guide	*When relevant for a specific renovation, energy renovation tips should be a part of the guide*	*Energy renovation suggestions should be addressed in all renovation guides*
Guide		*It should provide information directed to the specific type of house*
Guide	*The information should be divided into different renovation categories*	
Guide		*It should indicate which solution has extra sustainability potential*
Guide		*It should provide information about what regulation to consider when energy renovating*
Guide		*It should provide information about who to contact before a renovation*
Guide		*It should provide information on how to finance energy renovation*
Guide	*It must provide information about the financial benefits of energy renovation*	*It should provide an estimate of the return on investment for a renovation*
Guide		*It should provide information about indoor climate benefits of energy renovation*
Guide	*It must suggest different types of renovation solutions*	*It should make it possible to compare different solutions*
Guide		*A renovation solution should be presented visually to the house owner*
Projects		*It should be possible to collect relevant info about a specific renovation project*
Community	*It must be possible to share experiences from renovations between house owners*	

Table 6: Detailed performance specification.

8.6. STRATEGIC ACTIONS TO MOBILISE A SUPPORTING ACTOR-NETWORK

The re-framing of the design problem positioned our design work on the edge of the energy renovation arena reaching into the renovation arena. The concept must establish its own actor-world and position itself within and between the arena of general renovation projects, and the arena of energy renovation, functioning as an intermediary object that becomes a bridge between the two arenas through which energy optimisations can be translated (see Figure 43). The energy renovation arena will always take place in the renovation arena, however, there is not always an active translation of energy renovation to the renovation arena. Our solution is meant to increase the probability of these translations taking place.

The re-framing made the agenda change from energy renovation to energy renovation through general renovations. This more specific focus narrowed the solution space in relation to network-building. As a part of designing a solution for motivating house owners to conduct energy renovations, we had to consider what actors should own and supply the solution we were about to develop. In terms of how we should "*navigate and perform strategic interventions*" (*Jørgensen, 2012, s. 996*) to mobilise the proper network around our solution, we had to decide which relevant actors to involve and which framing and facilitation of negotiating spaces could interest these in taking ownership and supporting the design.

There exist platforms, which have information about renovation and energy renovation, as described in the development arena analysis (see section 6.3). These actors already attempt to translate house owners, through promoting information about energy renovations and creating

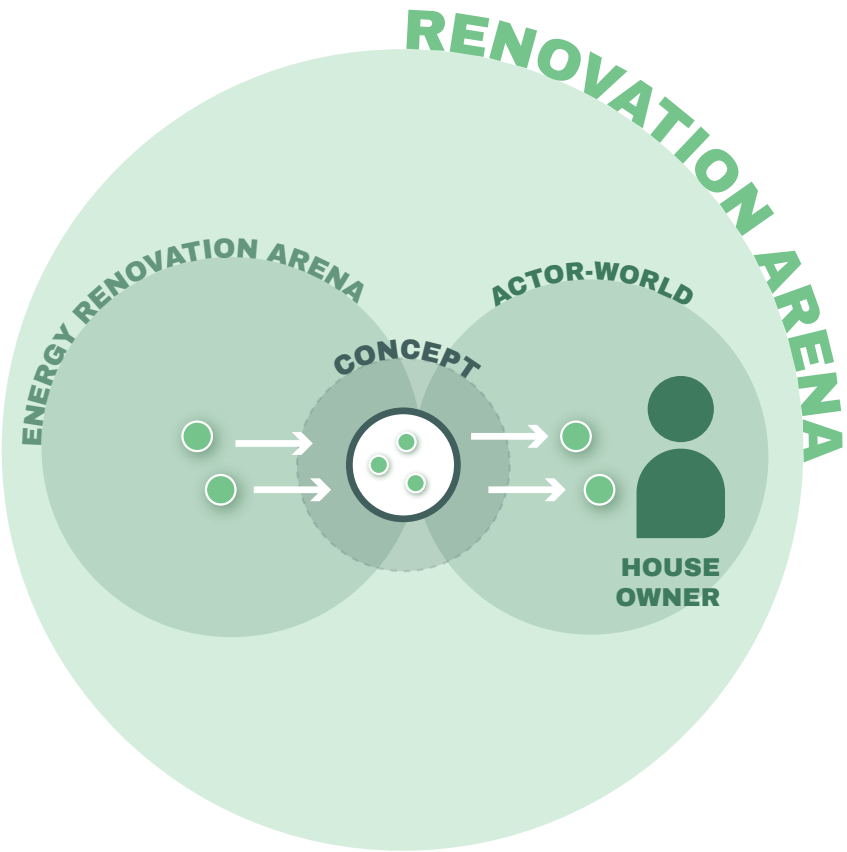


Figure 43: The concept as an intermediary object, with its own actor-world that connects the arena of energy renovation and the house owners on the arena of a general renovation.

access to personal or local energy advisers. We found that it made more sense, to amplify or improve those translating relations than to compete for the house owners' attention. Therefore, building a network from existing actors with this agenda became the strategic focus. To establish a relation to an actor that would supply such a platform, would be one that translates these elements concerning energy renovation, or simply renovation in general, in an unbiased manner with the agenda to support the house owner in completing the decision-making through knowledge and information on the area. From a further development of our arena analysis we identified two relevant actors we wanted to involve in the design process for negotiation of the concept. These actors were Bolius and The Danish Energy Agency (see Figure 44).

The knowledge centre Bolius has online articles on their platform about almost anything concerning the experience of living in a house. This actor, therefore, operates on both the *Renovation arena* and *Energy renovation arena (see Figure 44)*. With their impartial role and with the main matter of concern of communicating knowledge related to houses in an understandable way for the house owners in Denmark, we found them relevant for our design problem and wanted to enrol them in our project.

The Danish Energy Agency administers the website of SparEnergi.dk, which supplies extensive knowledge on energy optimisation of the household, involving energy renovations. This gave us the idea that our findings on energy renovation, as well as a concept of how a platform could alternatively work with information about energy renovation through general renovation, would be appealing work for them. As The Danish Energy Agency is working on the *Energy renovation arena*

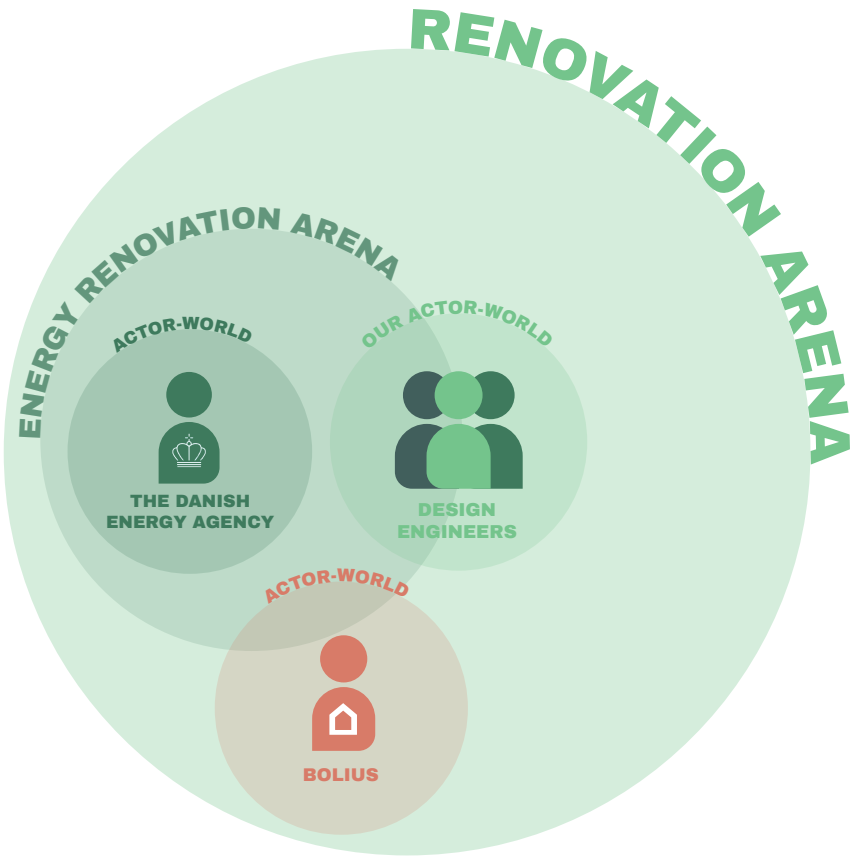


Figure 44: Development arena mapping presenting intersting actors position, in relation to mobilising a supportive actor-network on the arenas.

(*see Figure 44*) a challenge could be to widen their focus to renovations in general. But with the potential of having more house owners energy renovate their homes this way, it was a negotiation we wanted to explore.

The strategy used for the actor-network building in the design process was to invite the two identified actors into negotiation spaces. In order to mediate the relevance of the concept, and translate them into following our agenda, we saw the need for further developing the concept for it to act as an intermediary object during the negotiations. Next part of the design process was, therefore, to specify the final concept and from this create negotiations with Bolius and The Danish Energy Agency. It should be a balance of creating a concept specific enough to translate intention to spark interessement, but at the same time be open enough for them to see a development potential in taking up the ideas and re-designing it for their interest. The representation of the concept should invite them to co-create the next version of the concept, in such a way that they might be able to take on the concept, or elements of it.

9

FINAL CONCEPT

9. FINAL CONCEPT

This chapter presents the development of the final concept. Form previous findings a concept was created taking the form of a prototype. This prototype was used in a frontstage negotiation space with house owners. Further, scenarios were developed to validate the concept. This created the base for specifying the final concept. Lastly, our strategic network-building actions are presented, with following suggestions and reflections on the future design process.

9.1. FINAL CONCEPT DEVELOPMENT

The final concept was developed based on the detailed performance specification (see section 8.5) expressing the findings from the staged negotiation space where the concepts had been discussed. To create a shared understanding in the design team, of the form, functionalities and details of the platform, a flow-chart was created (see Figure 45), representing the different user journeys present in our concept.

The flow-chart was used in a backstage negotiation space for discussion and exploration of the solution. However, as it quickly became complex with many intertwined relations, we chose to not let the flow-chart dictate the design of the concept, but rather work as a supportive tool to guide the further creative development of the solution. The flow-chart was intended to act as a backstage intermediary object, but did, however, only do so to a limited degree. This was due to its complexity in relation to the exploratory phase we were in at the time, with figuring out the form of the concept. It was, however, helpful later in the process, when a concept prototype was to be developed in order for us to have a clear understanding of how the concept was structured.

The main functions of the platform were framed as being a guide supporting the decision-making, a community part where experiences between house owners could be shared and a personal space where an overview of own projects and related information could be gathered (see Figure 45).

The concept was further developed through a prototyping program for user interfaces, where the team members could edit the same prototype in real-time. It was created through an iterative process, where the team members changed between the development of different parts of the concepts, with smaller discussions in between to negotiate and clarify the final concept. Working visually with the prototype made it act as a backstage intermediary object which discussions and development were based on. It represented our different ideas with the design which it helped mediate and was at the same time a way of translating our findings, inscribed in the performance specification, into a detailed concept. The findings were in this way translated and inscribed into a new object which we could use for staging frontstage negotiations to support our participatory design approach.

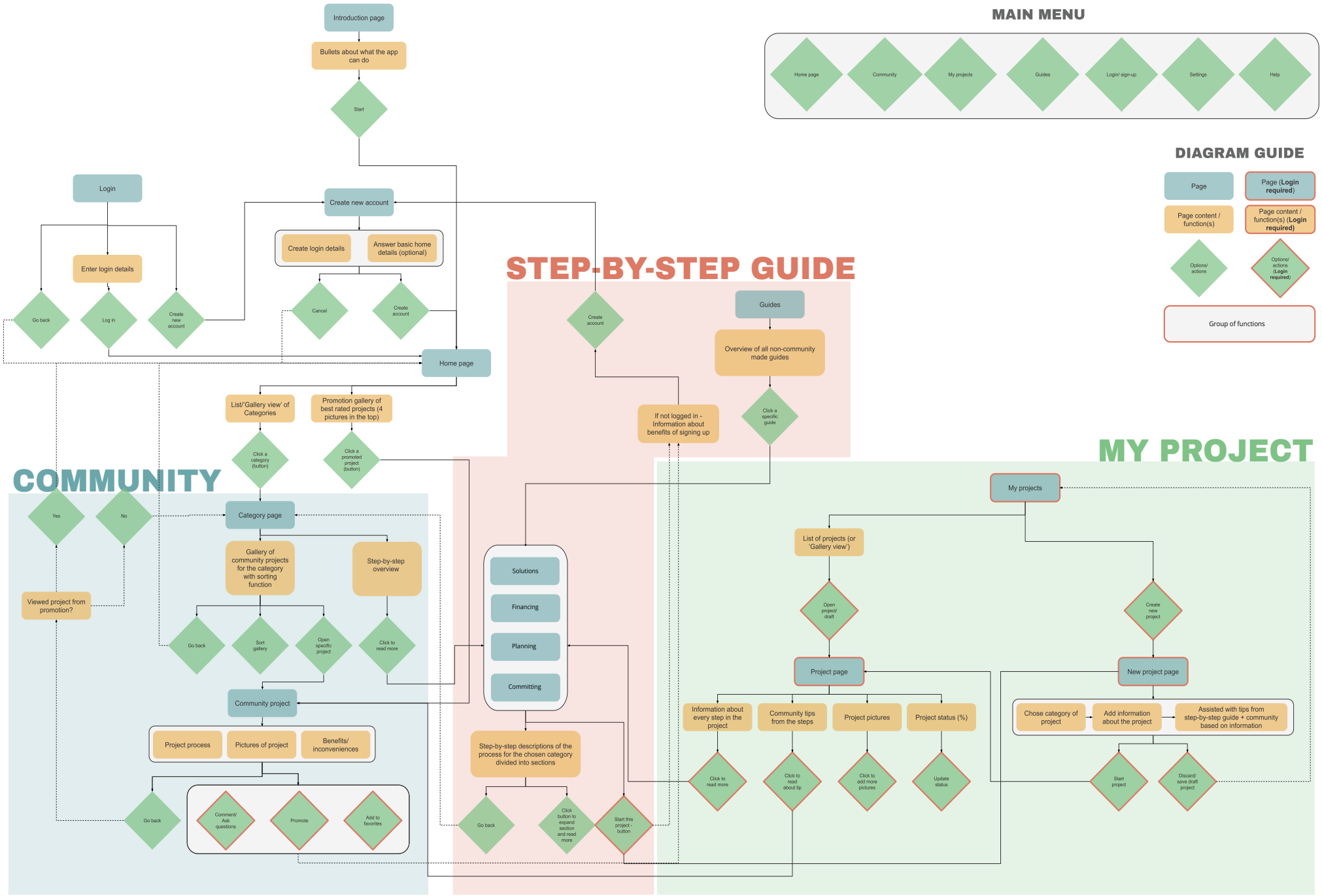


Figure 45: Flow-chart of RenoVen

9.2. FINAL CONCEPT PROTOTYPE NEGOTIATION SPACES

In order to get an insight into the value of the concept, we utilized the prototype by staging a frontstage negotiation space where different house owners were involved. Here, we wanted to test the *role* (*Houde & Hill, 1997*) of the concept, in order to understand the function that the platform could have in the users' lives. We also wanted to test *look and feel* (*Houde & Hill, 1997*) to get an insight into the user experiences when interacting with the platform. The negotiation space was staged online, where the participant through a web-link could see and interact with the prototype, which acted as a functional website. We facilitated the space by guiding the participants through scenarios where they got to use all the functions of the platform. During the session, five different house owners contributed, three were participants from previous sessions and two were new. These participants together represented the personas of our design focus: Dime-Loving-Diana, Peter Practical and Erik the Iceman. We asked questions facilitated as a semi-structured interview and in this way staged negotiations about the concept.

The prototype was a limited representation, in the way that its main functions worked but within certain boundaries, e.g. only having one example of a guide shown on the website. The purpose was for the participants to get an overall idea about the functions of the platform and we, therefore, chose to make it as a rapid prototype, where some technical functionality was limited. Further, we did not want the prototype to have a too finished look as we wanted to encourage negotiations about further improvements. During staging and facilitating the negotiations spaces, we experienced that the prototype worked as an intermediary object. It represented our solution idea and supported a dialogue about the role of the prototype in supporting a decision-making process before a renovation. Further, it created negotiations about how to improve the platform. It helped the further process where the insights were transcribed, synthesised and translated into the final solution. In the following, key findings from the final prototype negotiation spaces is described.

9.2.1. GUIDE

The main function of the guide is to present the aspects to consider before a renovation project in an easily understandable way directed to the general house owner how does not have any professional knowledge on the area. The house owners can choose a guide for the type of renovation relevant for them, to make it simple and specific for the house owners to navigate (see Figure 46).

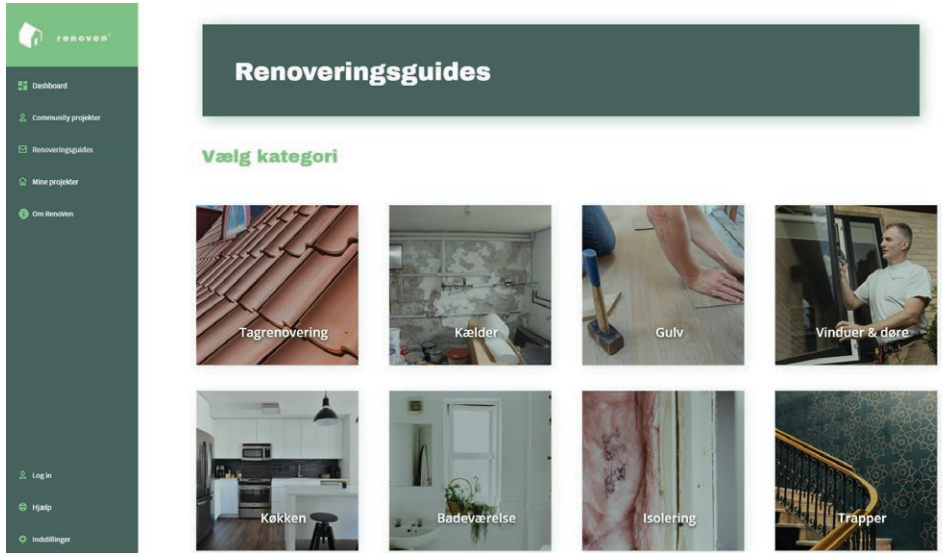


Figure 46: Renovation guides for different types of renovations.

Figure 47: Guide-function of final concept prototype.

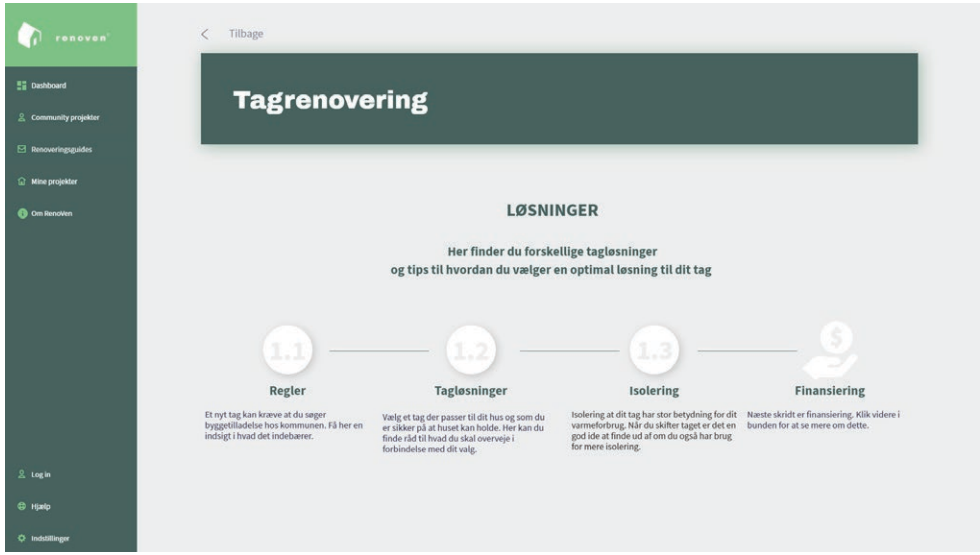


Figure 48: Solution-page in the step-by-step guide.

The guide is divided into four steps (see Figure 47), inspired by the earlier identified decision-making process (see section 7.2). This leads the house owner through the considerations of which solution to choose, how to finance the project and how to handle the renovation process until the house owner is ready to reach the step of actually renovating. The house owner chooses a specific type of renovations and gets guidance on this specific process.

From the final prototype negotiation spaces it was confirmed by the participants that being led through all relevant aspects to consider before a renovation is a large help, and highly relevant for the house owners to get to a point where they choose to renovate (*H19-18, H01-12, H19-12, H01-34, H19-35, H21-17, H25-17 & H26-01*). Illustrating the decision-process in steps was argued to make the information manageable, e.g. one house owner argued: "*I think it is great that you are presented with relevant information in that way. It makes it much easier to get started with the process*." (*H01-05*).

9.2.1.1. SOLUTIONS

The first part of the guide is the *choice of solution* (see Figure 48). It presents relevant consideration related to choosing the solution, e.g. the construction of the house. Further, it presents different solutions and their properties. The information depends on the specific type of renovation and the solutions available. Also, an estimate of the price is shown (see Figure 49).

The participants found it highly relevant to be able to compare the different solutions and being presented to both benefits and drawbacks in relation to the properties of the solution was valued. The participants expressed that they typically have little professional knowledge and need guidance in order to make a choice (*H21-37, H01-05, H25-08, H26-01, H25-02 & H19-33*).

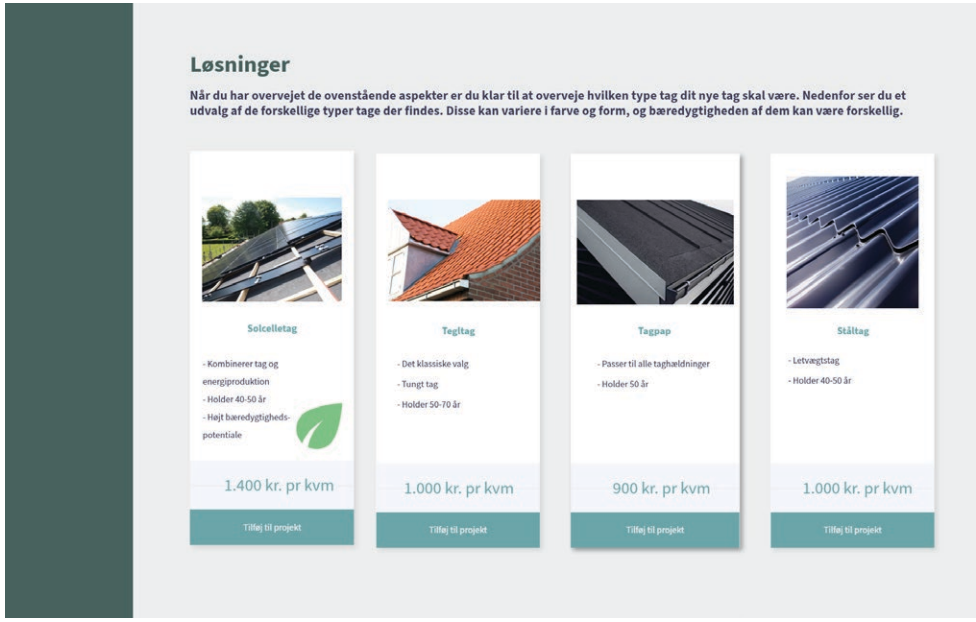


Figure 49: Solution-page in the step-by-step guide.

In order to make the knowledge as relevant as possible for the house owner, the platform presents information relevant for the specific type of house entered by the user. Our earlier studies, and findings from the earlier prototype negotiation spaces, showed that customising the information to the house owner, making it more specified and simple, is an advantage. From the participants, it was argued that it is a balance of having enough knowledge but without it being too much (*H01-10, H19-17 & H25-31*). Providing information about different technologies and considerations about the house quickly becomes overwhelming. Some house owners contributed with ideas to this problem, one e.g. told: "*When there is so much information then you cannot get an overview. You could have a "read more" button which you could click on to read more about the different options.*" (*H21-23*).

Figure 50: Energy renovation tips in the step-by-step guide.

The main part of our concept was to promote energy renovations through renovations in general. An essential part of the concept was, therefore, to advise the house owner to make energy optimisations a part of the renovation project (see Figure 50). In the prototype, this information was incorporated as a part of the *choice of solution,* to have it as a natural part of the renovation. This received positive comments, and all participants

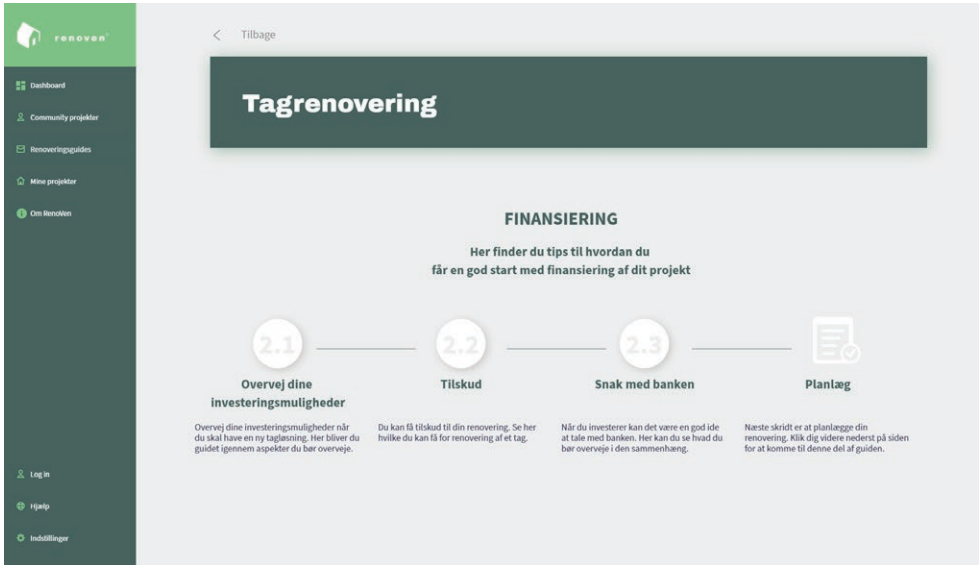


Figure 51: financing-page in the step-by-step guide.

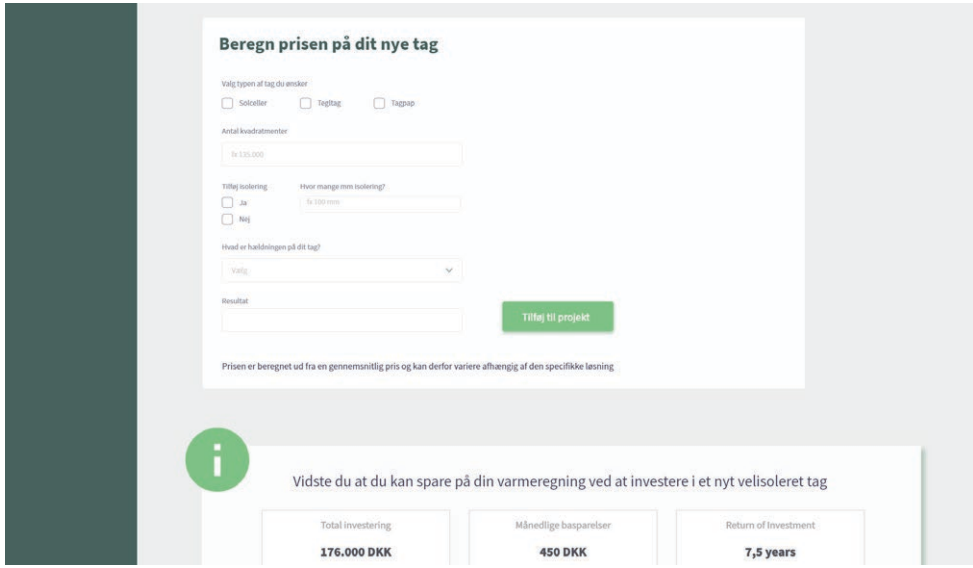


Figure 52: financing-page in the step-by-step guide.

found it relevant to consider as a part of a renovation (*H01-06, H01-07, H26-26, H19-13, H19-14, H25-01, H25-06, H25-31 & H21-18*). The platform had small boxes reminding the house owner of the benefits of energy renovation. Also, this motivational information was well received and one house owner e.g. told: *"It think it is very good that it is stated there (energy optimisation actions). At a glance, I would say it is good information. When it states that you lose 30 pct. of the heat through the roof, then you are interested in learning more."* (*H19-13*).

9.2.1.2. FINANCE

Next step of the guide was finance (see Figure 51 & Figure 52). In general, the participants found the finance step relevant, because it often is a big investment to make a renovation (*H01-13, H26-05, H21-19 & H25-08*).

While some aspects were expressed as relevant, others were argued to lower the credibility of the platform (*H25-09*). Some argued that advice about contacting the bank was unnecessary (*H19-22, H19-23, H25-09 & H25-31*). The participants would rather have a platform with only expert knowledge about renovations, not trying to include the knowledge area of banks. In relation to financial advice, other aspects such as grants and a price calculator were argued to create more value (*H19-21, H25-10, H19-19, H21-21 & H01-13*). Even though the platform only can give an estimate of the price, it is a big help, as one house owner explained: "*It is a great help, as it is always something that you think of. Companies usually never provide an estimate of the price, because then there are some reservations. It would be very nice to have such a function that can tell you that the price will be between 200.000 - 400.000 DKK.*" (*H21-19*). Besides this, the economic benefits were expressed as essential, where having the yearly savings and return on investment visible could help interest the house owners in a

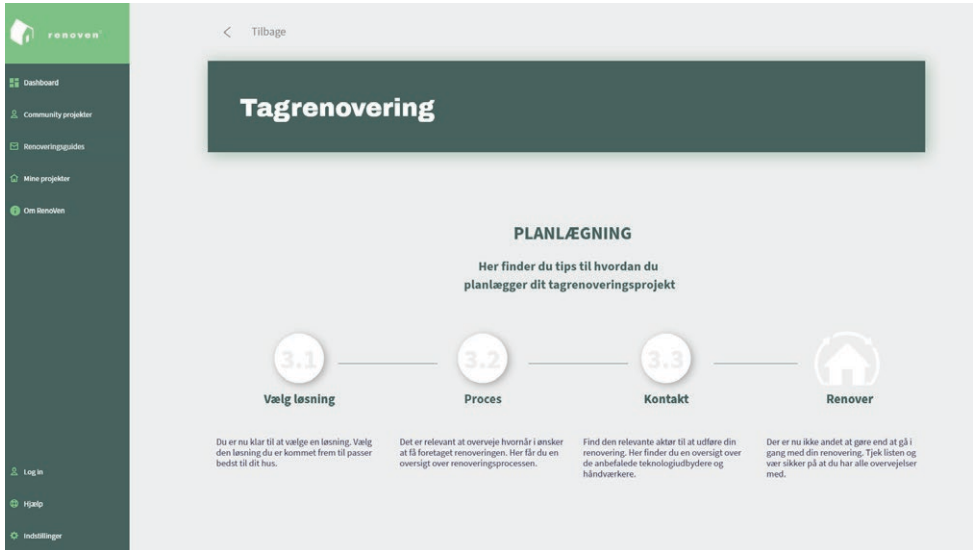


Figure 53: planning-page in the step-by-step guide.

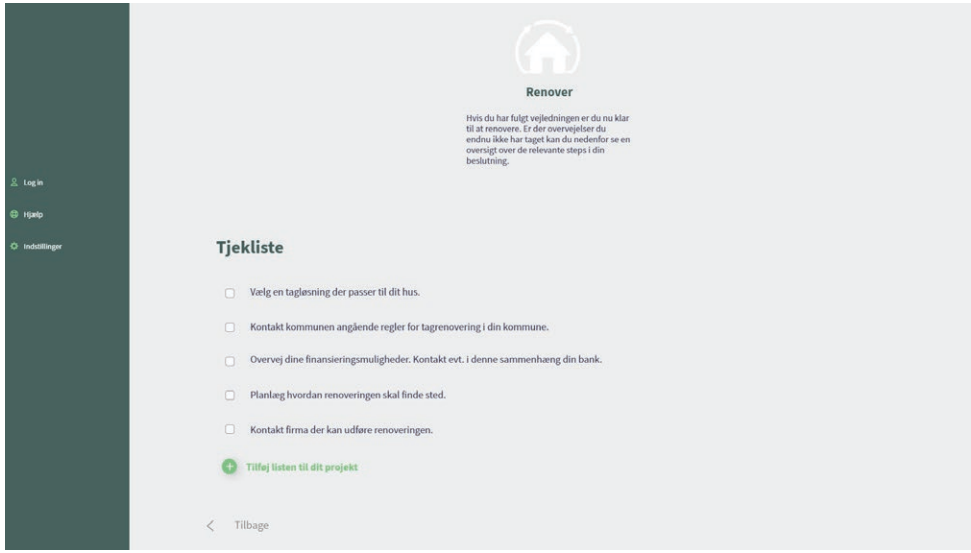


Figure 54: Renovating page with a check-list in the step-by-step guide.

solution. A majority of the house owners argued that it is motivating to see that it also brings financial benefits, in the terms of savings on the electric bills that can be used to pay back the initial investment (*H01-14, H26-10, H26-12, H26-20, H21-21 & H19-20*).

9.2.1.3. PLANNING

Further in our step-by-step guide, the participants reached the *planning* guide. Here the process of the actual renovation and things to consider when planning the renovation, as well as the actors to contact, is presented (see Figure 53). The participants expressed positivity in having an overview of what the energy renovation includes for them to plan the process. Presenting it visually, making the renovation process more tangible, was argued to guide the users (*H21-17, H19-35, H21-35 & H26-28*).

The house owners were also positive about being able to get an overview of actors to contact (*H21-22 & H26-13*). This makes it more convenient for the user of the platform to proceed with the process. Further, some of the house owners argued that they had experienced the craftsmen asking them to make decisions about things that they did not know anything about in relation to a renovation. Here, they argued that the platform could be a supportive tool (*H25-15*). However, for it to get even better it should include a list of questions to ask the craftsmen to be sure about getting the right solution for their home (*H25-15 & H26-14*). One thing that the solution cannot provide is a physical inspection of the house. However, it can support the dialogue when craftsmen or energy advisers inspect the house, as the house owner is more prepared and can, therefore, gain more value out of the inspection.

9.2.1.4. RENOVATING

Lastly, providing a summary of the different steps needed to finish an energy renovation project, through a checklist (see Figure 54), was by the

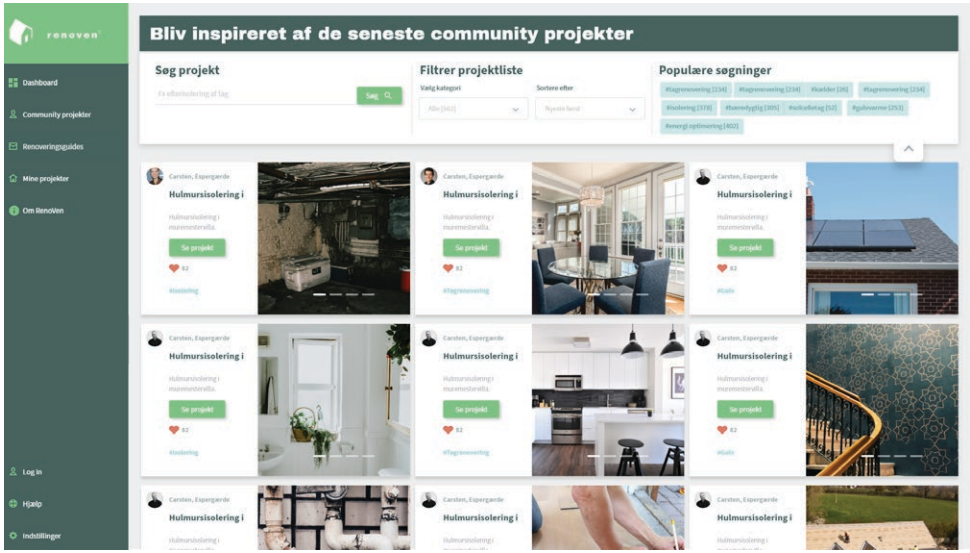


Figure 55: Community page

participants articulated as creating a feeling of being ready to take the next step and starting the project (*H19-15, H25-17, H21-18, H26-02, H19-28, H19-36 & H21-16*). One house owner explained: "*It is really good! We would feel ready to commit to a renovation project.*" (*H01-24*).

9.2.2. COMMUNITY

The community function of the platform aimed to create a space for house owners to share their experiences. As earlier described, inspiration from others is something that the house owners already seek to find, but many find it hard if they do not have friends and family to ask about renovations. This need was translated and inscribed in the prototype (see Figure 55).

All participants argued that the sharing of experiences was valuable and that they would use it for inspiration *(H01-21, H19-31, H21-30, H25-21, H26-17 & H26-22*) (see Figure 56). The house owners expressed that they are

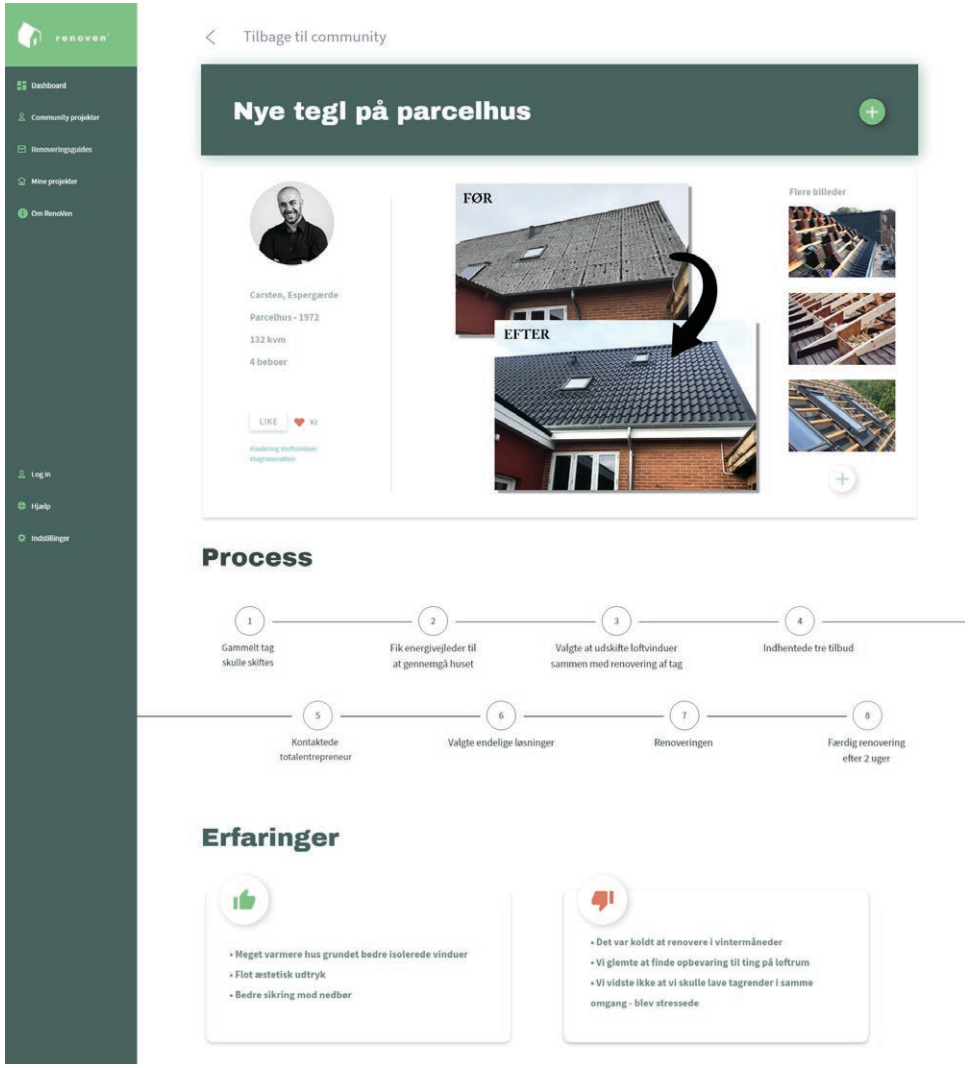


Figure 56: Community case example

especially interested in this type of knowledge sharing because it gives a real and honest perspective on the renovation. The functions with the house owners sharing benefits and drawbacks about their renovation was by all highlighted as important because these experiences contain aspects you would not have thought of unless you have been through the

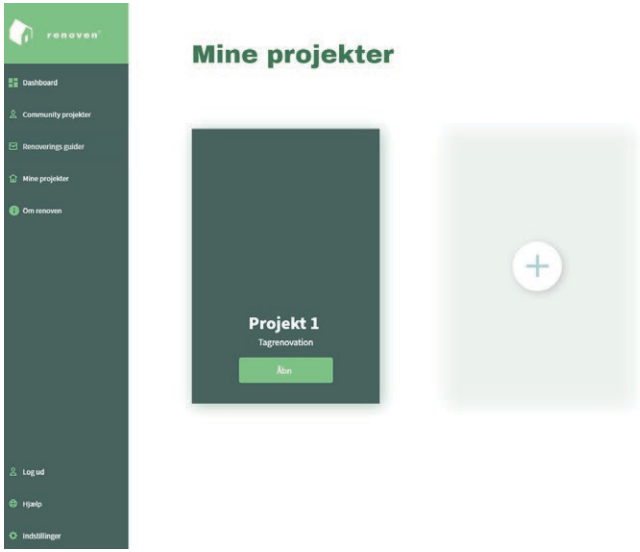


Figure 57: An overview of projects created by the user.

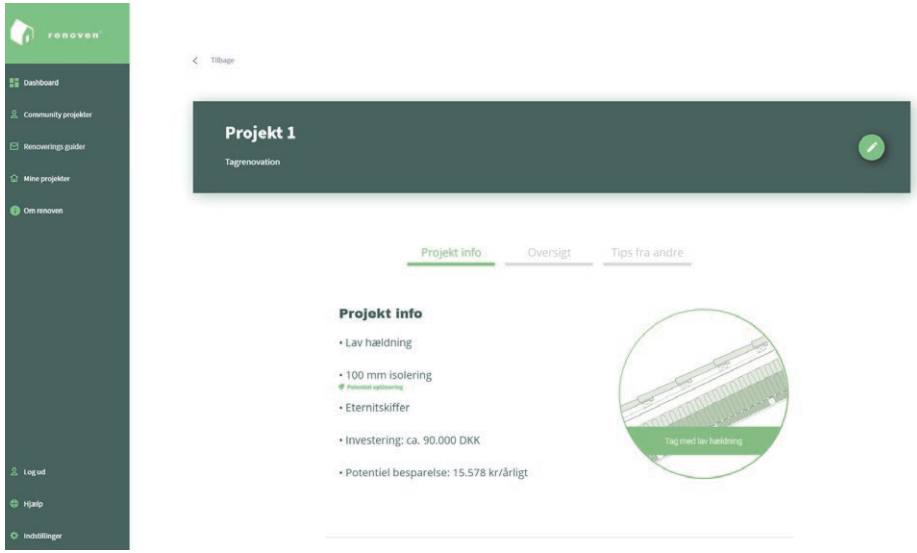


Figure 58: My project

renovation process (*H19-31, H19-32, H21-30 & H26-17*), as one explained: "*There are some experiences you can utilize from others where you think 'okay I need to think this one through'. It would be very nice to have information about these things you have no previous experience of.*" (*H19-32*).

Three of the participants answered that they would share their projects (*H01-28, H25-21 & H26-18*), while two answered that they would not (*H19-30 & H21-31*). A relevant part of having this function is to have people upload their projects so that the platform is continually evolving. One household answered that they would do it if it was anonymously (*H01-28*), and others if they just were encouraged to do it (*H25-21, H21-38*). Our results indicate that some would upload their projects, but due to the little sample of participants it is hard to conclude on and further investigation on how to mobilise house owners in the agenda of uploading projects would be needed.

9.2.3. MY PROJECT

The *My Project* (see Figure 57) functions aim is for the house owner to be able to gather relevant info about a renovation project in one place. This involves information about the energy class of the house, the chosen solution etc. (see Figure 58). The house owners were in general positive about the function (*H01-23, H01-33 H19-27 & H21-28*). Being able to save relevant information from the step-by-step guide to a project, gathering information in one place, was seen as relevant. Many participants were, in the beginning, a bit sceptical, considering whether they would use such a function, but when talking more about the concept some remembered how they had many documents and notes to keep track of when renovating. One e.g. explained: "*(...) otherwise you would have notes floating around. It would be nice to have everything gathered in one place, instead of having 14 folders and 4 excel sheets.*" (*H19-17*). In relation to this, being able to save specific community projects relevant for one's project was also

recognised as a bonus, saving the inspiration in a place where it was easy to access again (*H01-27 & H21-28*).

It was pointed out by some of our participants that having a progress bar can be demotivating (*H25-22*). In general, *My Project* should be presented in a way which makes the renovation process seem easy, to create motivation. It is important in this function to make the project seem as manageable as possible but with all relevant aspects incorporated, such as a check-list for the specific project. This would help the encouragement for actually conducting the renovation.

9.2.4. FINAL PROTOTYPE CONCLUSIONS

The intention was to create a concept which could make the decision-making process, before a renovation project, seems manageable and translate the house owners into the arena of energy renovation. Through the final prototype negotiation spaces, this intended *role* (*Houde & Hill, 1997*) of the concept was tested and discussed. These findings were incorporated into the final design, described later in this chapter.

In general, the three functions of the platform were by the participants argued as relevant in helping the decision-making process. One house owner e.g. explained: "*(...) it is good to support the process and that you can compare information in one place. It is a source of inspiration in a busy everyday life. I think it is a good product.*" (*H01-32*) and another house owner argued: "*We would certainly use it because it gives us an insight into processes we never have tried before. We would highly value that.*" (*H21-18*). Having everything presented in one platform was argued to make the decision-process less time-consuming and with a larger probability of renovation with energy optimising features being prioritised.

The *look and feel* (*Houde & Hill, 1997*) of the solution was discussed on how to make it user friendly to support the usability of the product. The house owners expressed positivity about the step-by-step guide. It should, however, be a balance of the right amount of information displayed on the platform for the house owner to find it relevant and interesting as it otherwise could become overwhelming. One house owner e.g. explained: "*There is a crazy amount of information you have to take in with such a step-by-step guide and you will not even make it halfway. So to make it easy to overview and only show the information you need would make it better*" (*H25-19*).

The prototype was intended to have the *role* (*Houde & Hill, 1997*) of encouraging energy renovations. Presenting energy optimising elements as a natural part of renovations was argued to help to incorporate energy optimisation in renovation projects, making the house owners aware of the benefits.

Through the final prototype negotiation spaces, we found that the solution could not only be useful to find information for advice and inspiration, but also to speed up the decision-making process. Some argued that having this easy access to all relevant knowledge could make it easier to make a decision instead of considering it for a long time because of the inconvenience of finding the right information and the uncertainty in having found the right solution.

The platform can in this way support the agenda of translating more house owners into the energy renovation arena. It can be argued that our solution is an intended intermediary object which represents the relevant knowledge and considerations to make before an energy renovation. It can mediate knowledge relevant for the specific house owners needs and translate this information into their own project.

9.3. SCENARIOS

To further investigate the use of the product we constructed scenarios that revolved around the three personas we chose as our design focus (see section 6.2). The prototype negotiation spaces had given an insight into the role of the product, but we wanted to further, through mappings, investigate the different use of the product to identify potential room for improvement. The scenarios were used to negotiate different user journeys related to the solution in a backstage negotiation space that continuously translates knowledge between us, the designers, and the concept, which added depth to our understanding while our concept was developed. In that way, the scenarios acted as an intermediary object within the backstage negotiation space of developing and validating the final concept (see Figure 59).

As the scenarios were created, discoveries on functions that needed to be updated or added on the concept were made, which should support our personas in solving their matters of concern. The considerations occurring form putting a concept into a context of usability with the constructed personas gave room for revelations and concept development. In the following, scenarios are presented where the different personas' potential use of the solution and associated considerations about the concepts relations and functions.

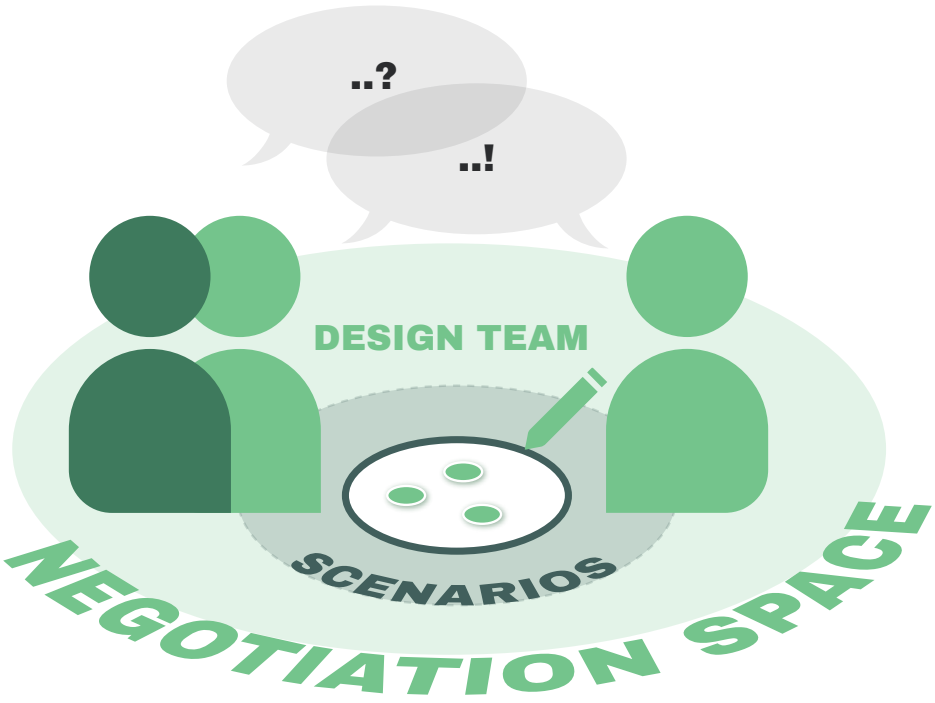


Figure 59: Backstage negotiaiton space where the scenarios act as an intermediary object.

9.3.1. ERIK THE ICEMAN

Every winter, it is the same. Double-sweaters, inside slippers and freezing at the breakfast table. Erik has the heater turned up, but it does not help much. They have decided to do something about it this year because the windows in the house look as if they will not last another year without falling apart and he clearly feels the drag from the windows. Something must be done, so he has to prioritise it, but he does not know where to start. He goes to Google and searches for "cold house new windows" and gets a title saying "RenoVen - Renovation Tool - Guide to new windows". He clicks and starts reading about thermo-windows, what determines a good indoor climate, and what other initiatives can give a good indoor climate, like getting more insulation in the walls (see Figure 60). He searches in the community project function to find inspiration for what others have done in a similar situation. He realises that the bad indoor climate might not only be caused by the windows, and decides to get the house checked. He finds that there are grants available for his project, which increases his interest. At the end of the guide, he gets a list of questions he is advised to review with a professional to find an optimal solution for his house and he is then asked to type his postal code, to have suggestions on local energy advisers.

Typically Erik the Iceman chooses to renovate for his indoor climate when he also sees a practical need, as in the scenario where the windows need to be changed because of wear and tear. Then he prioritises it. But in some cases, this persona also does it mainly because of the indoor climate. Here, if he does not know how to improve it, e.g. through new windows or insulation, then he will not use the RenoVen platform as it is directed to specific types of renovations. In order to support these cases, the website should be SEO-optimised (Search Engine Optimisation) which should also respond to what the house owners is looking for, although it does not correspond precisely to what they search for. In such cases, an example would be where Erik searches for "cold house" since that is his experience, the platform should support him in finding an optimal renovation for his home. Further, for Erik, it must be explicit that e.g thermo-windows equal a warmer house. This translation should be present on the platform, catering directly to his matter of concern, to support his decision-making process.

Figure 60: Erik the Iceman user-scenario.

9.3.2. DIME-LOVING-DIANA

As a part of the government's recent bill, their old oil burner stands to be replaced before the end of the year. Diana is not excited. The oil burner is still running smoothly, why should they change it? Thinking about purchasing a new heating system makes her irritated, and feels like 'throwing money out of the window'. She goes to Google, and searches for "heat system prices". She sees the title "RenoVen - Renovation Tool - Heat System - Compare solutions and see the financial benefits". She clicks and is met by an overview of a process, where the third step 'Financing' is displayed. Having estimated prices for different solutions gives her a quick idea of what is on the market and what the price ranges are. She continues to discover the idea of return on investment, and the concept of changing the boiler suddenly seems to be a blessing in disguise. She picks the solution that seems to have the best return on investment for them and gets a list of suppliers. There is also a list of relevant questions that she is advised by the guide to ask the supplier regarding the boiler, and how it fits with current systems in the house. She notes three different suppliers, prints the questions, and goes through the entire guide to get the whole overview of the process. She calls the suppliers a couple of days later to get offers on the boilers (see Figure 61).

When Diana clicks on a search title on google that mentions comparing prices on solutions, it is distracting that it takes her to the guide overview, where it instead should land directly on financing, with the overview still in the top. For Diana, the financing category must be easy to find. Not only the prices of the solutions should be easily compared next to each other - comparing the return on investment for the different solutions is probably even more important.

It is an acknowledgement that Diana is driven by the best financial solution, and most likely will not focus on the most environmental solution, unless it shows a better return on investment.

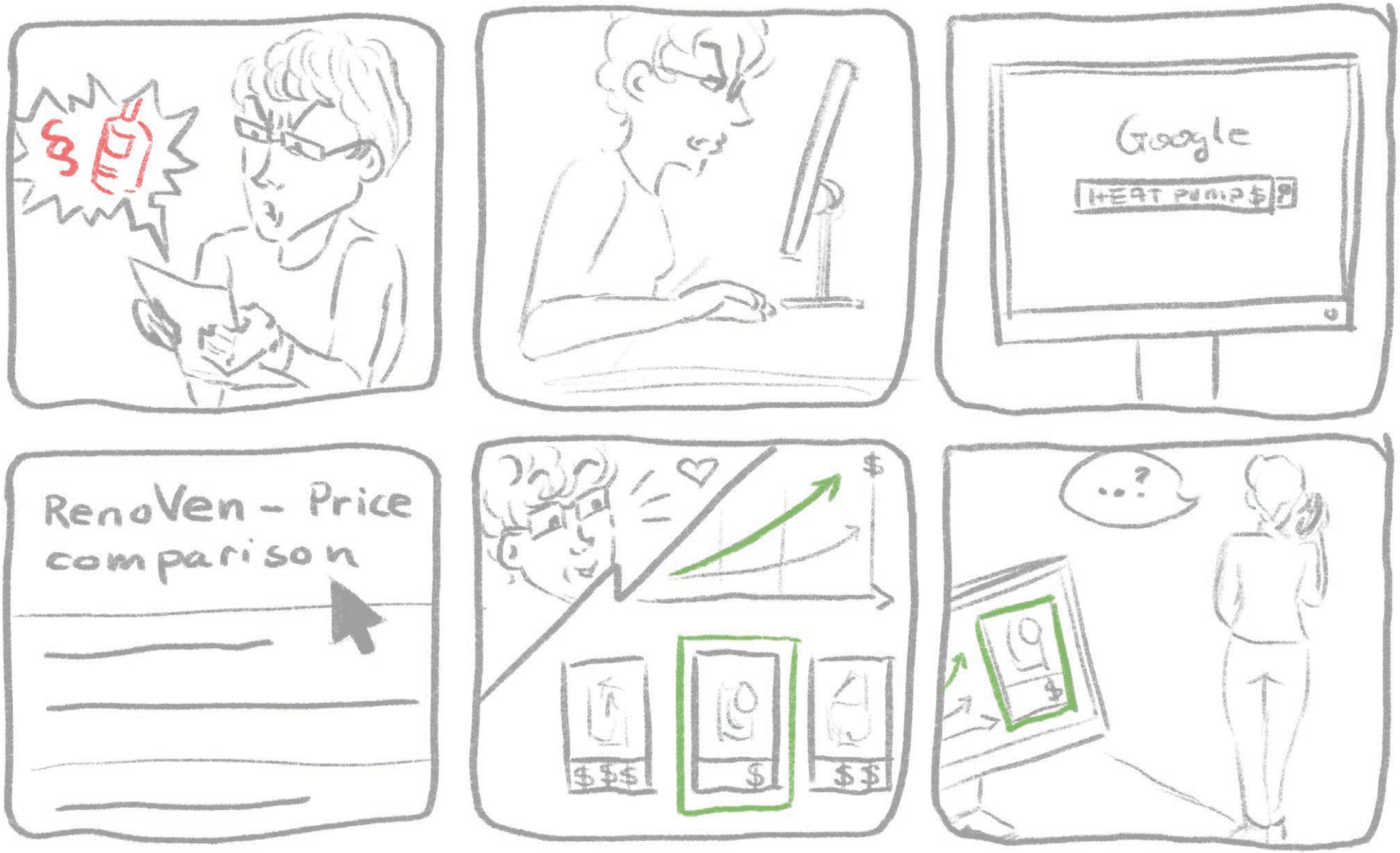


Figure 61: Dime-Loving-Diana user-scenario.

9.3.3. PETER PRACTICAL

Peter bought a house a couple of years ago for him and his family. They knew from the beginning that it needed a loving hand, which his dad does not hesitate to point out, and they already dreamt of an extension to the house back then. The time has come when the stars are aligning, and they have started discussing what should be done. They are dreaming of extra rooms for the kids - maybe an extra bathroom? One night after dinner, he sits down to research on the possibilities. He searches for "house extensions examples" and gets "RenoVen - Community Projects - House extensions" suggested. He clicks and sees many different projects, with house extensions in all shapes and sizes. He is intrigued and starts looking through the pictures, reading the experiences and information about the process. He notices that on the bottom of every project there is a link that says "Considering a similar project? Try the Step-by-Step guide to learn more about building an extension to your house.". He clicks and goes through the guide, which opens his eyes to the many possibilities, details and practicalities that are connected to such a project. Especially the part about considering the state of the roof makes him wonder if energy optimisation should be incorporated in his project. At this point, he has so much bookmarked, and the guide has mentioned many places on the website, that he can 'save this information to his project'. He makes a profile, which is quick and effortless, and then starts a 'new project'. He starts adding all the things that he has been bookmarking, into the project. Now it is sorted neatly and he gains a clear overview of the information he has gathered. He exports the project as a PDF and sends it to his dad, and then calls him for a brainstorm about all the different solutions he has found (see Figure 62).

For Peter, there must be a 'House Extension' category in both community projects and step-by-step guide. However, there are many different types of renovation projects that can be done with a house. Therefore, the number of categories needed to cover all of these different project types might become too many and difficult to gain an overview of. The final concept should, therefore, be in a balance between covering the most general categories and providing a general overview of a process in the step-by-step guides. The community function is where Peter could find more specific types of projects closely related to his and save those tips and experiences into his own project.

Figure 62: Peter Practical user-scenario.

9.4. FINAL CONCEPT

Findings and ideas from the frontstage prototype negotiation spaces and the backstage scenario discussions were incorporated into the detailed performance specification (see appendix 10). From this, the final concept design was updated. This process took place in a backstage negotiation space where the findings were processed similar to previous concept development phases, where we first analysed the findings in an affinity diagram. Thereafter, they got translated and inscribed into the new performance specification which enabled us to develop the necessary updates to our concept. In the following, the main aspects of the final concept are presented. The whole solution can be found in appendix 11.

9.4.1. GUIDE

The final concepts contain comprehensive information about different renovation types, but at first, the house owner gets an overview and if they want more knowledge on an area they click at a button which brings them to a new page with in-depth knowledge (see Figure 63). This was also seen in the scenario for our persona Peter Practical, as he needed to have this separation of general, easy to grasp information and more in-depth information to not get confused.

Further, the guide being a linear flow that the user has to follow was changed in the final concept. Now, the house owner can jump to the specific interest area if they do not find it relevant to go through the whole guide. This was the case with our persona Dime-Loving-Diana as she only wanted information about financial aspects (see Figure 63). The involved house owners also expressed a need for an overview which was translated into a navigation bar following the user when navigating through the guide.

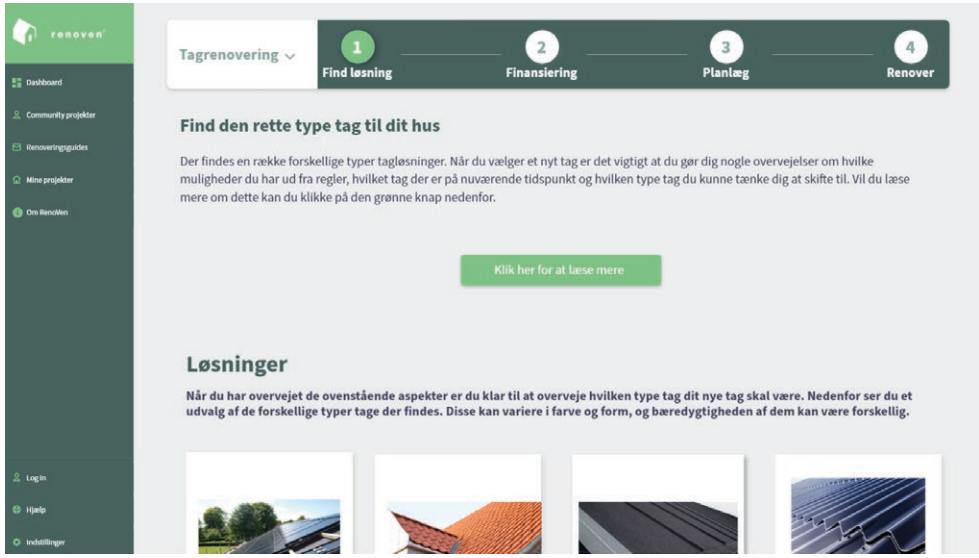


Figure 63: Creating a simple overview with the possibility of 'reading more' on other pages and easy navigation the the step-by-step guide.

Figure 64: Information bubble explaining different benefits from renovations.

Figure 65: Information bubble explaining financial benefits from energy renovation.

From the backstage scenarios, we discovered that Erik the Iceman needed to be able to search for topics describing his concern rather than a specific solution, such as "solutions for *could house*" instead of *"New windows"*, and still get the results from our guides. Therefore, we added information bubbles on the category pages (see Figure 64 & Figure 65), which SEO-optimises the website for web-searches by explaining, for example, that you can get a better indoor climate if you change to new windows.

The guide was further adjusted with changes related to the main findings from the prototyping negotiation spaces, which involved removing the bank information and adding a list of questions to ask the craftsmen etc.

Promoting energy optimising renovation suggestions is kept as a central part of the guide function. Further, in the guide function promote sustainable options (see Figure 66). The concept will, therefore, take part in enrolling the user in the sustainable agenda.

9.4.2. COMMUNITY

The *community* function was expressed to meet a present need where the house owners seek unbiased and trustworthy advice and inspiration, for their renovations, from other house owners who have conducted renovations. This is argued to support the house owners trust in solutions, process and actors, which supports the decision-making process. Furthermore, it gives an insight into unforeseen aspects relevant to consider before committing to a new renovation project. This function, of sharing experiences about renovations, is therefore also a part of the final concept with smaller changes, making the community project highly focused on sharing positive and negative experiences related to the solution and process (see Figure 67).

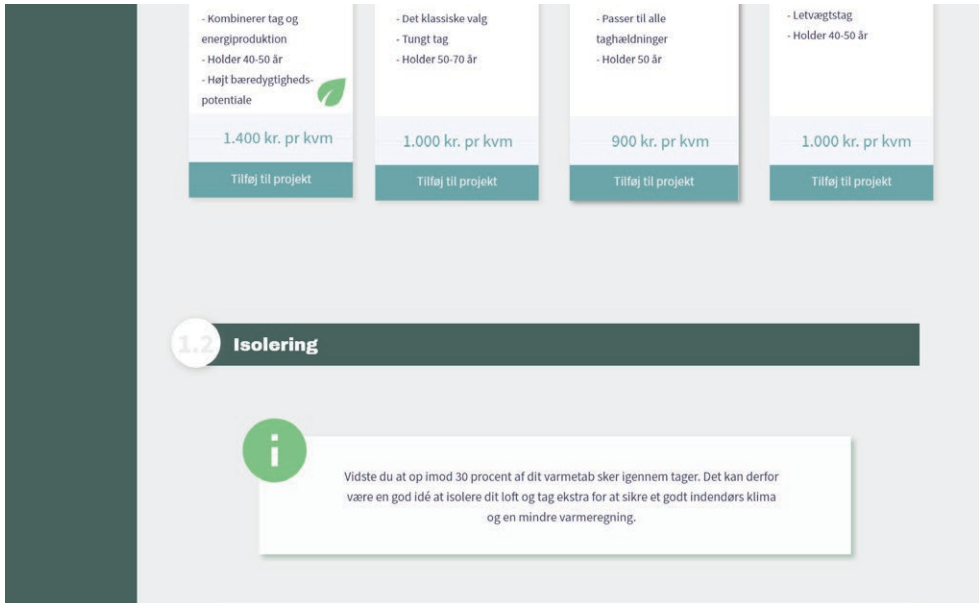


Figure 66: Final concept - supporting sustainable choices.

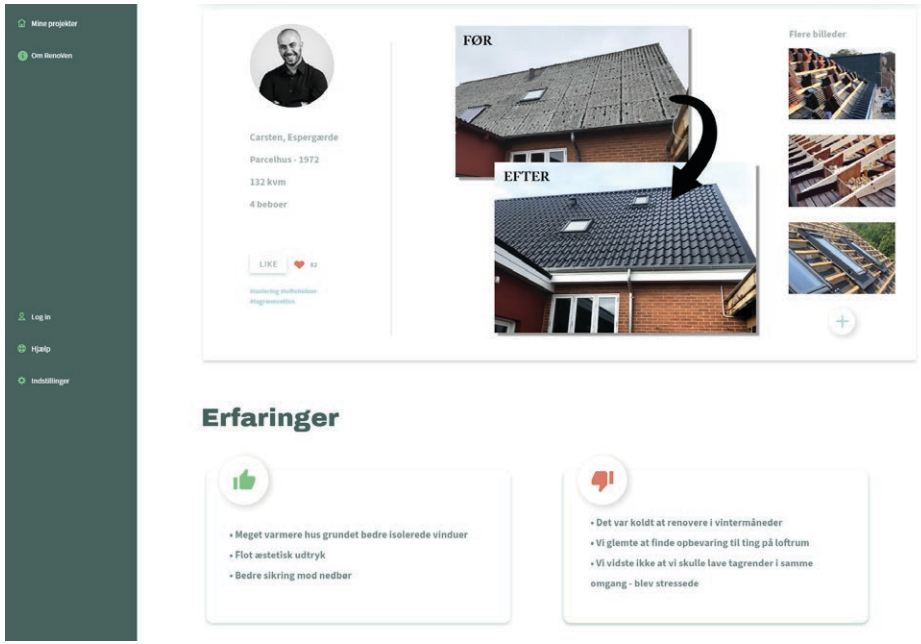


Figure 67: Final concept - shared project from the community function.

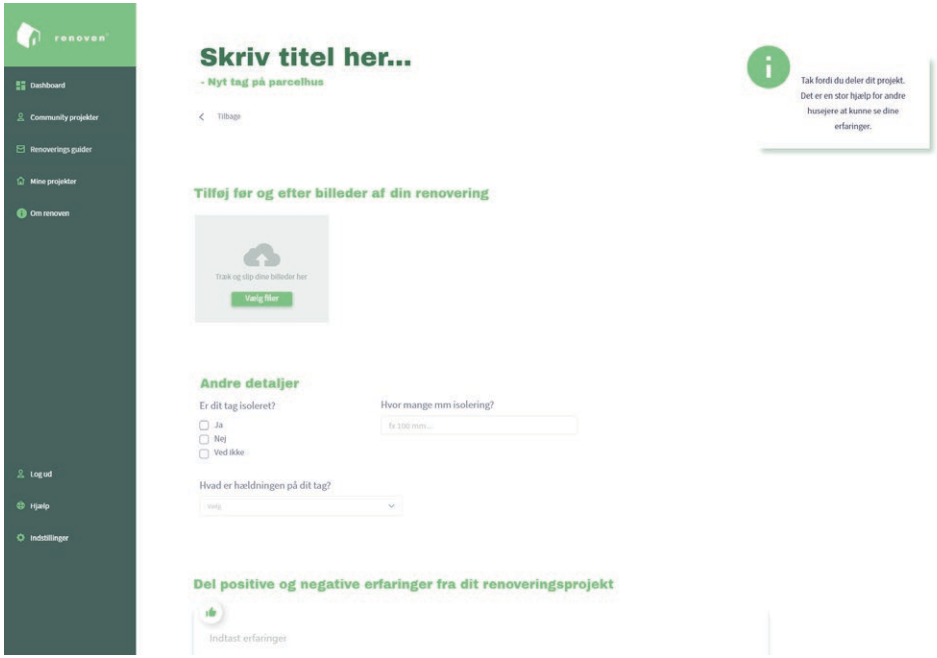


Figure 68: Final concept - My Project share project page.

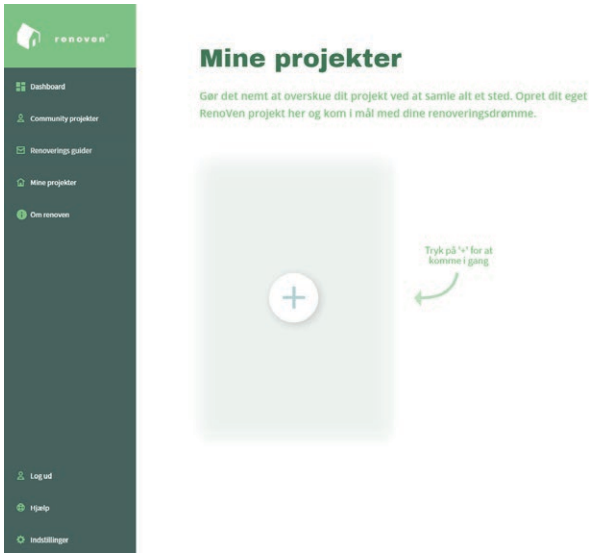


Figure 69: Final concept - My Project.

9.4.3. MY PROJECT

The function *My Projects* is incorporated in the final concept as it is a relevant aspect supporting the house owner in starting and sharing a renovation (see Figure 68 & Figure 69). It makes it easier for the house owner to gather relevant information, such as a checklist, other interesting projects and the chosen solution. It was articulated by participants that it is important to encourage the house owner to create a project. Through this part of the platform, the house owner inscribes their ideas and translates findings into valuable information, bringing them and their home closer to a renovation.

Not all personas from our scenario study used the My Project function, e.g Dime-Loving-Diana, as she only wanted to use the information for one-time use. Peter Practical, on the other hand, uses the function to a large extent and the final concept should, therefore, provide a good overview of the saved information for a project.

9.5. STRATEGIC NETWORK BUILDING NEGOTIATION SPACES

From involving the house owners in developing the design solution we found that this actor had been mobilised in supporting the design solution. However, due to a low sample size of participants, more negotiation spaces need to be staged in order to validate and possibly further develop our solution. Additionally, we needed to establish a supportive network also involving an actor which could take over the development and operation of the solution. For this purpose, we wanted to stage negotiations with the use of the prototype as an intermediary object creating interessement and potentially mobilisation.

9.5.1. STAGING A NEGOTIATION SPACE FOR ACTOR-NETWORK BUILDING

Negotiation spaces were strategically staged based on the arena analysis, as described in section 8.6, where involvement of the two actors Bolius and The Danish Energy Agency was identified as relevant.

9.5.1.1. STAGING A NEGOTIATION SPACE WITH THE DANISH ENERGY AGENCY

We wanted to stage a negotiation space with The Danish Energy Agency as these have a prominent role in the national strategy of energy renovations. We found that current dynamics in the arena creates the opportunity for change. New strategies are considered by this actor to find a new national strategy as the energy reduction agreement expires. This could be a window of opportunity for the interest in new solutions such as the design we had developed.

Despite repeatedly contacting The Danish Energy Agency, we did not get the opportunity to stage a negotiation space, discussing the solution RenoVen and its contribution to the agenda of energy renovation. This challenge brings focus to the designers' role not only being a stager and facilitator of negotiation spaces, but also a navigator operating in between these spaces, establishing contacts and creating interessement. This part of the network-building process is highly relevant for the possibility of staging negotiations and creating a supportive network, further discussed in section 10.1.2.

9.5.1.2. STAGING A NEGOTIATION SPACE WITH KNOWLEDGE CENTRE BOLIUS

The knowledge centre Bolius was an interesting actor to involve as they have the concern of providing knowledge for the Danish house owners (*K02-02*). We managed to stage a negotiation space with this actor, where one of their responsible experts was involved. Here, the prototype was presented through screenshots and also a semi-structured interview helped facilitate the negotiations. The screenshots were intended to work as intermediary objects for generating interessement. It created dialogue and the expert from Bolius expressed concerns about their initiatives and plans in relation to the energy renovation agenda.

Covering the wide area of knowledge about houses, Bolius focuses on different themes, at different times (*K02-03*). As earlier described in section 6.3, they have had a campaign about the comfort in the house with the agenda of promoting energy renovations. This meant that focus now was not on energy renovations, but they did see potential in having it as a part of a wider sustainability theme in the future (*K02-04*). In this way, the timing of the interestment was challenged by the missing current resources allocated for the energy renovation agenda. However, the interest was still visible in the dialogue.

One aspect which created attention was the work of creating two-way communication through the platform - the house owner can give information about the house and situation, and from input, the website will provide relevant information to the user. This way of interacting with the users was argued to make it easier for the knowledge centre to specify their knowledge to the house owner which is an interest they

were having: "*We have so much knowledge and if they (house owners) want to know something more specific, we would love to explain it to them, but we have to know what they want to know (...) So if they, for example, entered information we could give them the corresponding information back.*" (*K02-06*). It was pointed out that they experience simple guidance as important in translating the house owners' agenda, and that this way of working with communicating knowledge fit to their agenda of contributing with translating complex knowledge so that it becomes understandable for the general house owner (*K02-02*).

Through the negotiation space, the Bolius expert expressed interests in the idea, and the concept worked as an intermediary object representing our findings and solution, mediated knowledge about Bolius in relation to our concept and translated some ideas about how the concept could contribute positively to Bolius, e.g. as a part of their sustainability theme and with new ways of contributing with knowledge more directed to the specific house owner. However, they were not in a state where they had the resources to collaborate about the further development of the design, as energy renovation currently was not on their yearly agenda. This is one of the challenges of designing mainly for the users instead of an organisation, further discussed in section 10.1.2.

9.5.2. FUTURE STRATEGY

For further development of the design solution and establishing a supportive actor-network around it, the strategic navigation would have to continue. This design process was affected by the strategic choice of focusing on inviting the house owners into negotiation spaces to design a solution with these actors as allies. This led to an open ending in relation to finding an actor who could take over the solution.

In the case of RenoVen, the strategic work with mobilising an actor to take on the solution would be a part of the future process. This could take different paths. We see designing as a process which "*require a mix of preparation and agile behaviour*" (*Pedersen, 2016, s. 18*). It cannot be predicted in prior, as it is an iterative process and the desired destination is a result of navigating and negotiating (*Pedersen, 2020*). There is, therefore, no one answer to how this process would play out, but the following presents considerations on different strategic actions which could take part in the future design process.

With the experiences from the design process, we found that the current activities of an organisation are not necessarily equal to their willingness to collaborate, and interessement needs to be handled differently. On one hand, we experienced, from talking to Bolius, that when resources are not allocated for the specific agenda a challenging barrier is present. On the other hand, actors who are in the middle of a development process can also be hard to reach, as experienced with The Danish Energy Agency. A deeper understanding of the organisations' concerns could benefit our network building, as it could make it possible to frame our solution in a way more relevant for one of the organisations, supporting the interessement. Further investigation of this could be a path for the future design process.

Our design has the requirement that it should provide unbiased knowledge to meet the users' concerns. This limits the scope on who to involve and thereby the potential owners of the concept. We argue that to meet this, alternative strategies are limited as actors within the business actor-world are out of this scope. Another take on the future design process could be interessement of a municipality. This strategy was left

out of the first strategy because we wanted to reach broad and we found out that municipalities have very different takes on handling the problem. Developing the solution on this level could, therefore, be challenging to spread to have an impact, but the interest from municipalities could be a way into the arena for our concept.

The high fidelity of our concept came from continuously attempting to design a proper solution for the house owner. It was a part of our strategy to develop the concept to act as an intermediary object, creating interessement. However, the late involvement of the actors we wanted to mobilise as owners of the product meant that they had little part in co-designing the solution and adapting it to their concerns and interests. A future strategy should be based on adapting the design to also the concerns of an organisation. Such a future design process should be focused less on the specific inscriptions in the prototype and rather the overall functions for the potential owner of the product to take ownership as a strategy to mobilise them. This would mean that negotiation spaces should be staged with a different framing of the solution. Here, the focus should be given on how to inscribe the requirements for the solution in a way also fitting to the organisation's concerns (see Figure 70). Instead of working on translating an actor into the actor-world we try to establish, a new strategy could be to take a step back and develop a solution as an integrated part of an existing network. It would be highly relevant for the designers to carry the existing knowledge, and work as spokespersons for the house owners, increasing the potential of having house owners as allies. The house owners are an essential part of the network and should still be considered and involved as a part of a new strategy.

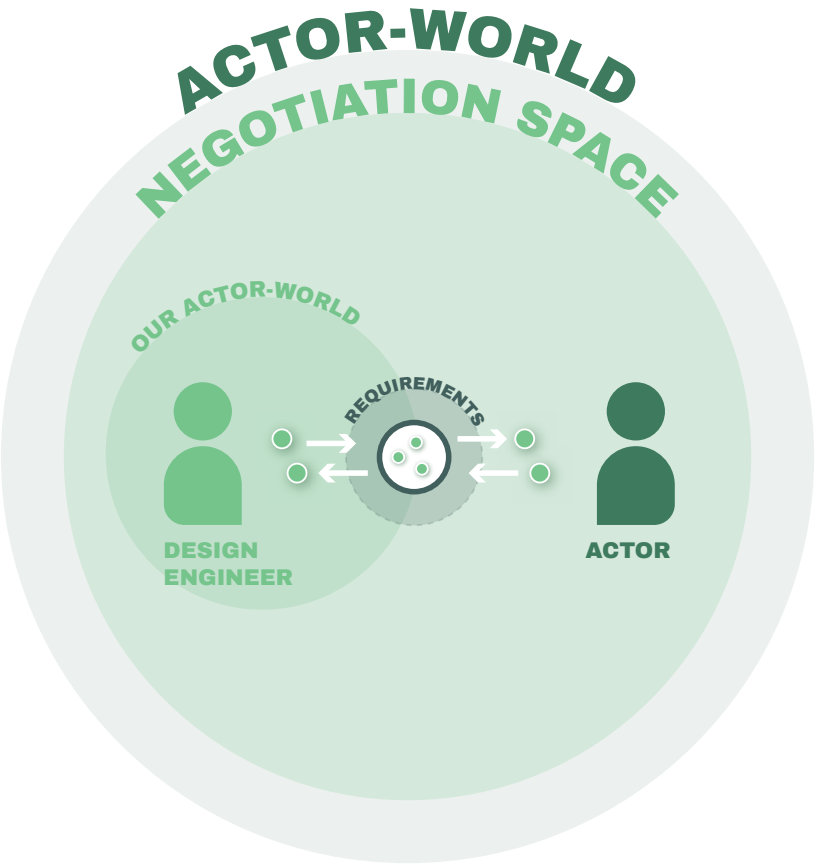


Figure 70: Staging negotiation space focusing on objectives and requirements, involving members of organisation who potentially can take over the solution.

10
DISCUSSION

10. DISCUSSION

Discussions have been a natural part of our design process through staging negotiation spaces, where it was an essential part to Frame, stage and facilitate negotiations around matters of concern. Through the report, a large part of the discussions has been presented as a part of the navigation of the design process. In this chapter, we elaborate on this, but will also take a step back and reflect on the design problem, -process and -approach.

10.1. STAGING NEGOTIATION SPACES FOR SUSTAINABLE DEVELOPMENT

The design process presented in this report represents a case of designing for sustainable development. In the following, we will discuss how the design approach used in this case have contributed to the creation of a solution following the sustainability agenda, returning to the research question:

How can we, through staging negotiation spaces, design a solution which can contribute to sustainable development by having more single-family detached house owners in Denmark conduct energy renovations?

From studying existing research about the problem of having more house owners energy renovate their homes we found that a majority of this research is based on quantitative studies. Further, much of the existing research focuses on the exploration of the problem, where only limited research has been made on how to solve it. The design process presented in this report contributes to the current literature with a new theoretical approach on how to study the problem. The design process, based on the framework Staging Negotiation Spaces (*Pedersen, 2020*), have focused on actor involvement from a participatory design perspective and a socio-technical analytical perspective from actor-network theory. Actors have contributed through interviews and the use of objects to frame concerns have encouraged negotiations, giving an in-depth insight into different relevant actors concerns and relations, relevant for handling the problem. Our research also broadens the perspective from understanding the problem to also handling it, hence transforming findings into a solution contributing to overcoming the problem.

We defined the problem of having more house owners energy renovate their homes as a wicked problem (*Rittel & Webber, 1973*), as it is complex, and does not have a definitive true solution causing the understanding of the problem to vary. Therefore, insight into different perspectives and negotiating concerns were highly relevant. We see that the design process presented in this report is a case example of how the approach of staging negotiation spaces can be relevant for handling sustainability problems in general, further described in the following section.

10.1.1. DESIGN FOR SUSTAINABILITY THROUGH NEGOTIATIONS

Traditionally *Design for Sustainability* has been approached form an environmental perspective focusing on product design. This has through the decades evolved and sustainability is now seen as a complex socio-technical challenge (*Ceschin & Gaziulusoy, 2016*). The design process presented builds on this perception, with a socio-technical design approach to capture the many relevant aspects, analysing and engaging with the heterogeneous networks of actors and concerns.

To handle sustainability problems designers are argued to inherently be responsible for strategic actions involving addressing sustainability as an integrated part of solution development, orienting innovations through establishing shared visions, creating relations between stakeholders and *"acting as facilitator to stimulate a strategic dialogue and co-design processes."* (*Ceschin & Gaziulusoy, 2016*). The framework of Staging Negotiation Spaces, in the presented design project, has been used to meet these responsibilities, since it is used by us, as designers, to *"foster negotiation in a codesign process, and put them (objects) into play by facilitating a process of mutual translation between the involved actors, resulting in the reframing of concerns."* (*Pedersen, 2020*). During the design process, we experienced that negotiation spaces can take part in creating discussions revealing different concerns from framing sustainability in a way which makes it possible to negotiate the problem from different perspectives. Further, the approach makes it possible to translate wicked sustainability problems into more specific design problems through re-framings, explained in the following.

In the case of having more people energy renovate their homes, it became clear that sustainability was associated with the environmental impact and for a majority of house owners, this was not their main concern. Not only sustainability in the shape of energy consumption and renewable energy (environmental sustainability) was articulated as important. Also, indoor climate (social sustainability) and financial benefits and barriers (economic sustainability) were essential concerns. By giving an insight into the concerns of relevant actors, the outcome of negotiation spaces makes it possible to re-frame design problems and navigate the creation of sustainable design with a supporting network. To change house owners behaviour, other agendas than environmental sustainability should be promoted through the design solution, for it to become successful. In this way, sustainable solutions can be developed, but without it necessarily being this agenda which translates the actors to follow sustainable development. However, we would argue that promoting it would still be relevant for the sustainable agenda to be brought forward. We see this as a way of establishing shared visions - through also taking other relevant concerns into considerations.

Negotiation spaces can reveal relevant aspects a designer have to consider, as described above. In relation to this, the designers must frame the negotiations in a way which allow for such negotiations. Here, objects have an important role. During the design process, objects made it possible to frame concerns and worked as intermediary objects creating interessement and translations. This is visible in the case through the way we e.g. used design games to get house owners to share their own experiences, mediate their concerns and translate it into information relevant for the design problem about having more people energy renovate their homes.

Staging negotiation spaces made it possible through re-framings to translate the wicked problem of improving energy consumption of the building stock into a more specific design problem which we were able to design a solution from (see Figure 71). We argue that to contribute to sustainable development through design solutions, the sustainability problems needs to be narrowed down into more tangible problems, in order to design impactful solutions. Designing within a too broad scope is a problem as design for everyone is design for no one. In order to reach the broader sustainability visions, designers therefore need to re-frame the problems. Staging negotiations can help reveal concerns and give

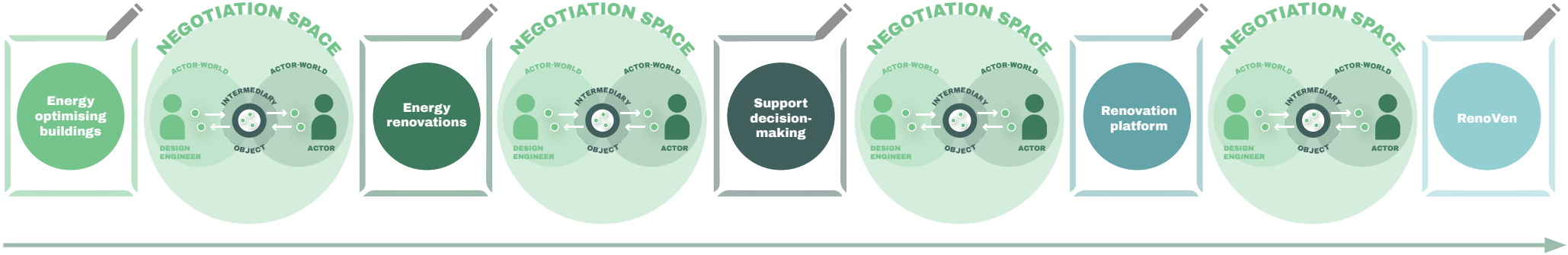


Figure 71: Reframings from negotiation spaces make it possible to design for sustainability, translating wicked problems into a tangible design problem.

insight which such decisions can be based on. This makes it possible to design for real problems through translating these into design problems.

A relevant part of designing for sustainability is to establish relations between stakeholders. We have worked with this through developing a solution intended to work as an intermediary object between house owners and actors wanting to translate the house owners into the energy renovation arena. Broadening the network to involve a range of actors working for the agenda, in order to establish a large network referring to the solution, reaching more house owners, could be beneficial. This could be a part of the further design process, with setting up negotiations spaces and creating interessement.

Navigating in a complex field of actors, concerns and relations during the design process was also supported by Arenas of Development (*Jørgensen et al., 2017*). It provided an analytical tool to support strategic planning who to invite into the negotiation spaces and how to position the solution in relation to other actor-worlds' agendas and concerns. Combining staging negotiations with the broader perspective from of Arenas of Development made it possible to navigate the design process, both on an overall strategic level and in specific negotiation spaces,, toward a sustainable solution. A part of creating sustainable design is to make a valuable solution which is supported and needed. For it to have an impact, and contribute to change, the act of network-building in the design process is highly relevant.

10.1.2. USING NEGOTIATION SPACES FOR MOBILISATION OF ACTORS

The design process resulted in a concept for motivating house owners to energy renovate through guidance and inspiration supporting their decision-making process. In section 9.5 it was reflected how the focus during the first part of the design process mainly was on the involvement of house owners as co-designers. This strategy resulted in a low level of mobilisation of actors in the network that should eventually take ownership of the concept. This section reflects on the challenges when navigating a design process.

There exists a trade-off between designing for business- or user objectives. Developing solutions for a business or organisation influence the design

work, since it has to be shaped to their concerns, but it simultaneously assures a much higher probability of an established network around the concept, once the design process is over. The space in which we could innovate was broader, due to the absence of the constraints from conflicting interests that such partnerships can lead to, but as mentioned, those constraints are often the criteria to the relation of the organisations. Navigating the field without a specific partner created challenges in the mobilisation of a supportive actor-network, but have assured the level to which the concept caters to the users.

The strong user focus which our solution is built on has been an element that gained interest in several of the interviews with other actors (organisations etc.), but engagement beyond that was missing. Here, we want to reflect on whether these organisations and relevant actors should have been brought in earlier in the design process, as it creates a dilemma to the concept development.

Even though translating the users to follow the agenda of conducting energy renovations was a strong focus during the design project, working with analysing the development arena, on which we worked, made network-building with also other actors than users a present part of our strategic actions. As the agenda of energy renovation was a concern for many actors we found that the strategic design work would not be to convince actors about the agenda but rather develop a solution which could support the agenda. Therefore, our strategic work focused on the users as this actor was essential to translate into the energy renovation arena. At a later point in the design process, the re-framing of our design concern moved our position on the arena to a place where we wanted to build a bridge between renovations in general and energy renovations. This resulted in new strategic reflections. Here, we found it relevant to develop a prototype which could act as an intermediary object creating interessement and potentially mobilisation of an actor taking on the product. Reflecting back, this strategy did not manage to mobilise the actors and inviting organisations to co-design earlier in this part of the design process, giving them a say in the development, could have influenced the translation.

Further, the design process stretching over a four months period, starting from the broad focus of energy optimising buildings, made it a process of identifying opportunities and analysing the development arena, instead of working directly from a given problem identified in an organisation. Having such a broad focus both opens up the possibility of identifying issues from empirical research but it also puts the timeline, of which we needed to define a narrow design problem, under pressure. This left less time for mobilisation of actors later in the design process. At this point, the concept had shaped into a prototype, and the high fidelity might have ruled out the opportunity for co-creation. It might also simply be the natural next step in the design process if it had more time. Expecting actors to be engaged after one meeting, and a showcase of a prototype is probably too optimistic. Ideally, the design process presented should continue with mobilising actors.

Based on our case, we also want to bring focus to the part of network-building happening before frontstage negotiations during a design process. It can seem as irrelevant practicalities, but establishing initial relations to external actors and interesting these in taking part in negotiation spaces has a relevant influence on the design process (see Figure 72). Our case presents how we did not manage to involve all of

the actors we wanted to engage with, as we did not get to interest them in taking part in our project beyond an interview. It brings focus to the fact that it is not only the designer's role to frame, stage and facilitate negotiation spaces. The designer also has to navigate in-between spaces and create interessement for the external actors to be mobilised in taking part in the negotiation spaces. Reflecting on this makes us argue that it can be relevant to also see these initial interactions as a form of spaces, which we choose to call *initial interessement spaces*. These are spaces, which are staged in order to interest the actors in taking part in a negotiation space. Here, objects can also have a role in translating actors. In our case, we experienced that sending material such as visualisations of our concept took part in creating interessement, translating actors to take part in our negotiation spaces. We argue that this part of the network-building process is relevant to consider, to increase the possibility of getting to a point where negotiations can be created and relations can be established to develop a supportive actor-network.

Although it has not seemed to be a dominating factor in our work, we do speculate whether the lack of physical negotiation spaces has been an issue in the mobilisation process and whether the current COVID-19 pandemic in the country has driven organisations into a 'static' state rather than a state of 'development'. Physical presence creates other dynamics and relations, and the digital format of negotiation spaces can have influenced the outcome of our strategy.

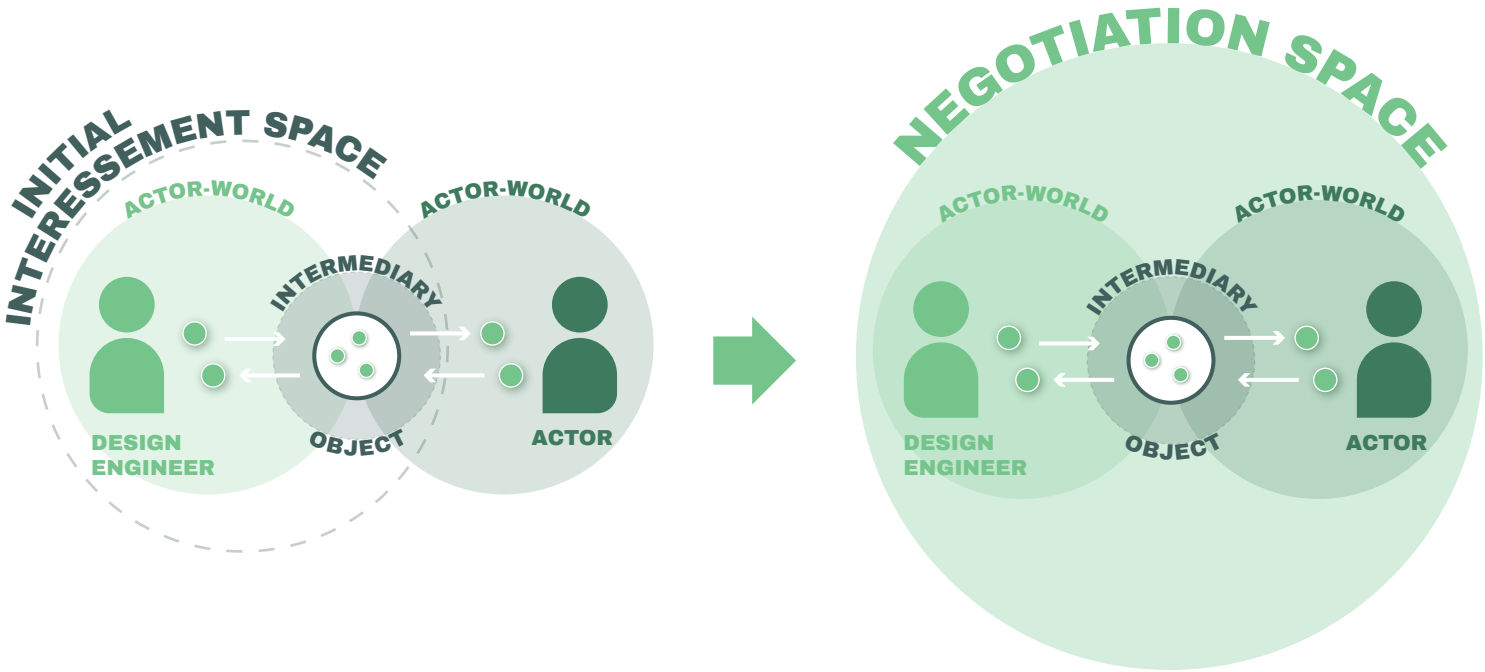


Figure 72: Initial interessement spaces relevant to establish relations and mobilise external actors in taking part of negotiation spaces.

10.2. DIGITAL NEGOTIATION SPACES

The design process was conducted during the COVID-19 pandemic, which caused a large part of society to lockdown. Our design strategy, highly focused on physical participatory design, therefore, had to be transformed because of authority restrictions. As actor involvement was an essential part of our design approach, both to develop a valuable solution but also to conduct actor-network-building activities, we needed to redesign our strategy, and translate our negotiation spaces into digital versions. During the design process both design games and prototypes were used in the digital negotiation spaces. Also, the backstage activities in the design team were performed digitally.

10.2.1. DIGITAL FRONTSTAGE NEGOTIATION SPACES

Digital frontstage negotiation spaces were used during the whole design process for the initial exploration of needs, concerns and relations related to the design problem, and later in the concept development where prototypes were tested.

Before the pandemic, we got to stage a few design game negotiation spaces physically for the initial explorations. Comparing the digital and physical spaces, the difference was interesting little. The digital design games managed to work as an intermediary object, the same way as we have experienced with physical design games. Later, during the development of a solution, the involvement became more challenging. Ideally, we desired that the concepts should have been developed through co-designing with the involvement of relevant actors also in the ideation phase. But, we experienced that the digital approach here had its limitations making complex mappings hard to get an overview of on a screen. We, therefore, assessed that another strategy should be used, presenting intermediary objects, for the actor to comment as a way of co-creation, instead of having them as a part of brainstorm sessions. We used the personas and performance specification, representing the users, acting as spokespersons, to create ideas and concepts. From this, prototypes were developed which made it possible to conduct digital involvement. We experienced that the prototypes managed to digitally act as an intermediary object. These more tangible and simple objects made it possible to create a dialogue about ideas and relevant perspectives. Although graphical feedback from the participants is stated as essential in digital participatory design (*Heintz et al., 2014*), we found that bringing objects, working as intermediary objects, into the spaces, made it possible to share concerns and ideas without the participants having to contribute with their own objects. It, however, puts more pressure on the designers framing of spaces, because if the objects fail to work as intermediary objects it can be harder for the designer or participants to reframe the space with the use of other objects to create negotiations.

Objects can sometimes become too abstract or too concrete, in the desire to co-create. Also in the digital negotiation spaces, the designer needs to frame the space in a way which can contribute to the negotiation of the intended purpose. We experienced a higher level of engagement due to the visual representations we used in the negotiation spaces, with the digital design games and prototypes. Having live-edit where the participants could follow the moves of the designer and vice versa also contributed to creating a space for mutual knowledge sharing and transformation.

The digital negotiation spaces influenced that there were limited participants in each space. This was due to the limitations of virtual interactions where it can be hard to coordinate dialogue when many actors take part in the same

digital space with verbal communication. Therefore, the negotiations were mainly between one design team member and one or two participants. As designers, we, therefore, had an important role in representing other participants' perspectives and asking critical questions in order to create negotiations and challenge perspectives. Discussing findings backstage was also essential to have a shared understanding of the design problem and the navigation of it.

The digital design spaces had some limitations experienced in the design process, but it also allowed for a process where many actors were involved. We experienced that it required less coordination to set up digital negotiation spaces and it indicated, from earlier experiences, that we were able to stage more negotiation spaces as it required little effort from the participants.

10.2.2. DIGITAL BACKSTAGE NEGOTIATION SPACES

Not only the frontstage negotiation spaces but also the backstage activities in the design team were facilitated digitally. This meant that all meetings and documentation took place online. This way of working required the utilisation of digital tools to transform the design process, which gave insight into new ways of designing.

We used new methods to synthesise data, e.g. the affinity diagram normally performed through printing and cutting out notes and transcriptions were conducted in a digital scheme. By setting it up in a spreadsheet with a sorting functionality, we could preserve the benefits of dynamically developing themes based on our findings. Working with the affinity diagram digitally, made it possible to quickly change themes as new data was inputted, making it a powerful tool for processing empirical findings. We experienced it as an advantage in handling large amounts of data with the digital opportunities of categorising and sorting data.

Working in documents with live-edit functions made it possible during meetings to follow each other's work visually sharing and negotiating relevant aspects for the design process to move forward. Working digitally meant that the synthesised data were readily available, and could be used for negotiations and the use of findings as arguments were brought to a higher level during the discussions.

The concept development was, as earlier expressed, more challenging and the creative part of designing can to a degree be limited as e.g. brainstorms and other mappings easily become too complex to handle on a computer screen. We experienced that the use of online mapping programs made it possible to share ideas, but an overview was hard to create.

Having a digital solution, such as a platform, was ideal both for frontstage and backstage negotiation spaces. Backstage, it meant that we could co-create a solution internally in the team with ease, and have an open dialogue about functions and form. Testing a concept digitally is also more convenient when the concept is digital. Although the concept was developed during a pandemic, it was our clear experience that a platform was a good concept amongst the ones we ideated, however, the idea of not being able to test a prototype physically might have affected our process subconsciously.

In this way, digital backstage negotiations spaces transformed our work. This supported our work with analysing large amounts of data, but at the same time, it had some limitations regarding the creative element of drawing and mapping together. The utilisation of online tools was essential to support the new digital way of designing.

11

CONCLUSION

11. CONCLUSION

The design project, which this report is based on, started out exploring the problem area of energy optimising buildings. It was initially identified that the existing building stock uses a significant amount of energy, contributing to the emission of greenhouse gasses. Creating a solution that addresses this has the potential of contributing to sustainable development. Energy renovations of the existing detached single-family houses became the focus of the design project, due to a largely unrealised potential in having more house owners energy renovate their homes.

The project aimed to supply existing research on the area with qualitative research and a socio-technical design approach based on the framework Staging Negotiation Spaces. Further, the project represents a case of designing a solution to the problem, contributing with perspectives on how to create a change, which seemed to be a rarity among the existing literature.

The design concern of having more house owners energy renovate their homes was identified as a wicked problem. The project was, therefore, a process of navigating in a field of different concerns and negotiating a solution for the problem. The framework Staging Negotiation Spaces contributed with an approach on how to both analytically and practically approach the problem. By combining the Participatory Design with Actor-Network Theory it allowed us to simultaneously work with the development of a solution, but also with establishing a supportive actor-network for the solution, through the engagement of different relevant actors during the design process. Throughout the project, negotiation spaces were staged, both frontstage with relevant actors in the field and backstage internally in the design team.

The initial research was conducted through a literature review and empirical research. Relevant actors were involved in different negotiation spaces. The involvement of house owners resulted in the identification of factors influencing this actors relation to energy renovating. A range of other relevant actors was also involved. This gave insights into concerns, relations and networks in the arena of development we wished to act upon. In backstage negotiation spaces, the findings were synthesised, analysed and translated to support the further design process. Data was through the use of an affinity diagram categorised and analysed, and the different types of house owners were translated into personas. Also, a development arena mapping was conducted, to support strategic considerations about actor-network building, to establish allies for the design solution.

We found that there overall are two types of house owners who have not energy renovated: house owners who have considered energy renovation and the ones who have not considered energy renovation. The two types opened for two different solution spaces focusing on either creating awareness about energy renovations or supporting the decision-making process to get house owners to energy renovate. The following design process was focused on creating a solution to support the house owners' decision-making process, as we found that many house owners find it difficult to manage. From developing the personas we further found that the factors affecting the house owners vary and we had to narrow our focus on who to design for, as a solution could not cover the concerns of all house owners. Our focus became the house owners with the biggest need of support to get to a point where they choose to energy renovate. These house owners have an interest in economy, indoor climate and renovations for practical or aesthetic reasons, but their knowledge and competencies on the area create a barrier.

Based on a performance specification, possible solutions were developed through ideation, which entailed brainstorming and concept development. The concepts were weighted upon the relevance to the personas, and four concepts emerged. These four were reviewed through the use of prototypes in negotiation spaces with house owners. The findings re-framed our design problem as we found that renovations and energy renovations are not separate practices and a way to have house owners energy renovate is through their normal renovation projects. House owners are also highly influenced by inspiration, especially from other house owners, as they can give real and honest advice about own experiences. Having more house owners energy renovate their home by encouraging them to make energy optimisations when conducting other renovations became the re-framed design problem.

The final concept RenoVen was developed based on these findings. This is a platform for general renovation projects, with energy renovation as an integrated part. The platform offers step-by-step guides for renovations, a community for sharing experiences from renovation projects and an option to create a profile to make personal projects and collect relevant information found on the platform, with a focus on advising the house owner on energy renovation to support their decision-making. This concept was reviewed through yet another round of negotiation spaces with house owners, as well as the development of scenarios, which mutually translated considerations about energy renovation between house owners, the design team and the concept. Changes were translated into the performance specification and the final concept was refined.

The design process, presented in the report, is a case on how to develop a solution contributing to sustainable development, based on the framework Staging Negotiation Spaces. It reveals how the involvement of relevant actors during the process, negotiating solutions, is highly relevant when handling wicked sustainability problems. Re-framings from staging negotiation spaces made it possible to translate the sustainability concern into a tangible design problem. The design project also reflects the trade-offs in the strategic involvement of different actors when designing for the users in contrast to designing for an organisation. The design approach helped design a solution creating value for the house owner, while at the same time working with establishing a supportive actor-network around the solution to take ownership. We argue that this way of designing is relevant when handling sustainability problems.

As the project was conducted during a pandemic it also represents a case on how to stage digital negotiation spaces, both frontstage and backstage, during a design process. This brings new research to the field of participatory design and how to conduct actor involvement digitally.

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12. REFERENCES

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APPENDIX

13. APPENDIX

1. Literatur review strategy
2. Design game with house owners who have renovated
3. Design game with house owners who have not renovated
4. Initial empirical findings
5. Persona findings
6. Arena findings
7. Prototype Concepts in Danish
8. Findings final prototype
9. House owners concept evaluation
10. Detailed performance specification
11. Final website prototype

APPENDIX 1 - LITERATURE REVIEW STRATEGY

FACETED SEARCH

We will be using the faceted search approach on structurising our litterature search.

LITTERATURE REVIEW WORKING GOAL

The goal for this review is to generate empirical background knowledge for development of the final concept in this master thesis.

THE REVIEW STRATEGY

STEP 1 - UNSYSTEMATIC SEARCH

First, we will search for keywords and topics related to our research subject. These keywords and topics will be the foundation for the building of the facets.

STEP 2 - FACET BUILDING

The found keywords are sorted under specific "topics" (called facets) which then are used to construct search strings (see figure 1). Within each facet, the "OR" command will be used in the search. The different facets will be used in different combinations using "AND" in order to see what search combination that renders the best result.

STEP 3 - CONDUCTING THE SEARCH

Using the search string(s) from step 2, one or more different databases will be used to search for articles. The databases will be chosen based on their relevance for our research project theme. From each search, the list of articles will be saved into our litterature database program - Zotero. The articles are saved within a subcollection created for our litterature review called "unchecked". Each time we repeat the search in a different database, the result is crosschecked for possible duplicates using the built in function for this within Zotero.

FACET 1	FACET 2	FACET 3	FACET 4	FACET 5	FACET 6
Project origin	Sustainability	Project focus	Energy renovation	Social	Technical
Energy	"Green transition"	Building*	Energy N/3 renovation	"User behaviour"	"Reduced consumption"
	"Sustainable development goals"	Household	Energy N/3 optimi?ation	prosumers	efficient
	"Climate change"	Resident*	Energy N/3 efficiency	"energy sharing"	"centralized production"
	Green			Education	"decentralized production"
	Sustainable			Nudging	"efficient appliances"
	"Climate goals"				Insulation
	"Sustainable development"	Industry			"Heat pump"
	"sustaianble transition"	Factory			Storage
		Office			Battery

Figure 1 - Example of the facet building. Up/down represents "OR" and left/right represents "AND"

STEP 4 - SCREENING TITLES AND ABSTRACTS

From our search within the databases an initial screen of the titles is conducted. Here, we check the subcollection folder called "unchecked" for titles wich seem to have relevance for our project. The relevance is based on inclusion- and exclusion criterias. The articles screened for relevant titles are then moved to the folder "Screened titles". After this step, the abstracts are read, based on the same criterias. The relevant articles are moved to the folder "Screened abstracts".

STEP 5 - SCREENING FULL-TEXT

After the articles have been screened by their titles and afterwards abstracts, a screening of the full-text is conducted. This is to furthermore ensure that the articles are relevant for our project. The relevant articles are moved to the folder "Screened full-text".

STEP 6 - FULL-TEXT READING

As the last step, the articles in the folder "Screened full-text" are thourogly read to extract relevant empirical findings that will answer the working goal of this litterature review.

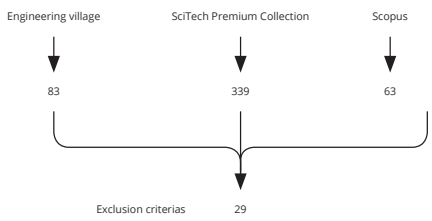
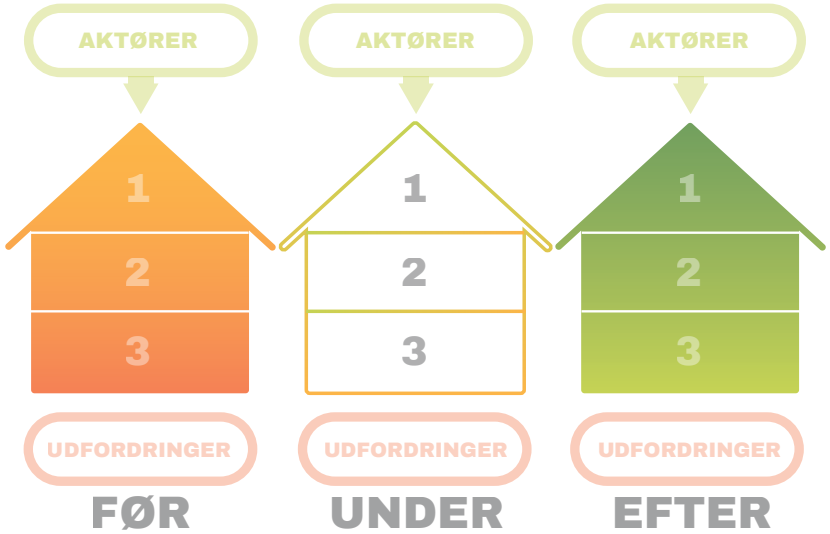


Figure 2 - Example of the overview of the faceted search strategy.

Design Game 1 - Slide 1

Design Game 1 - pieces

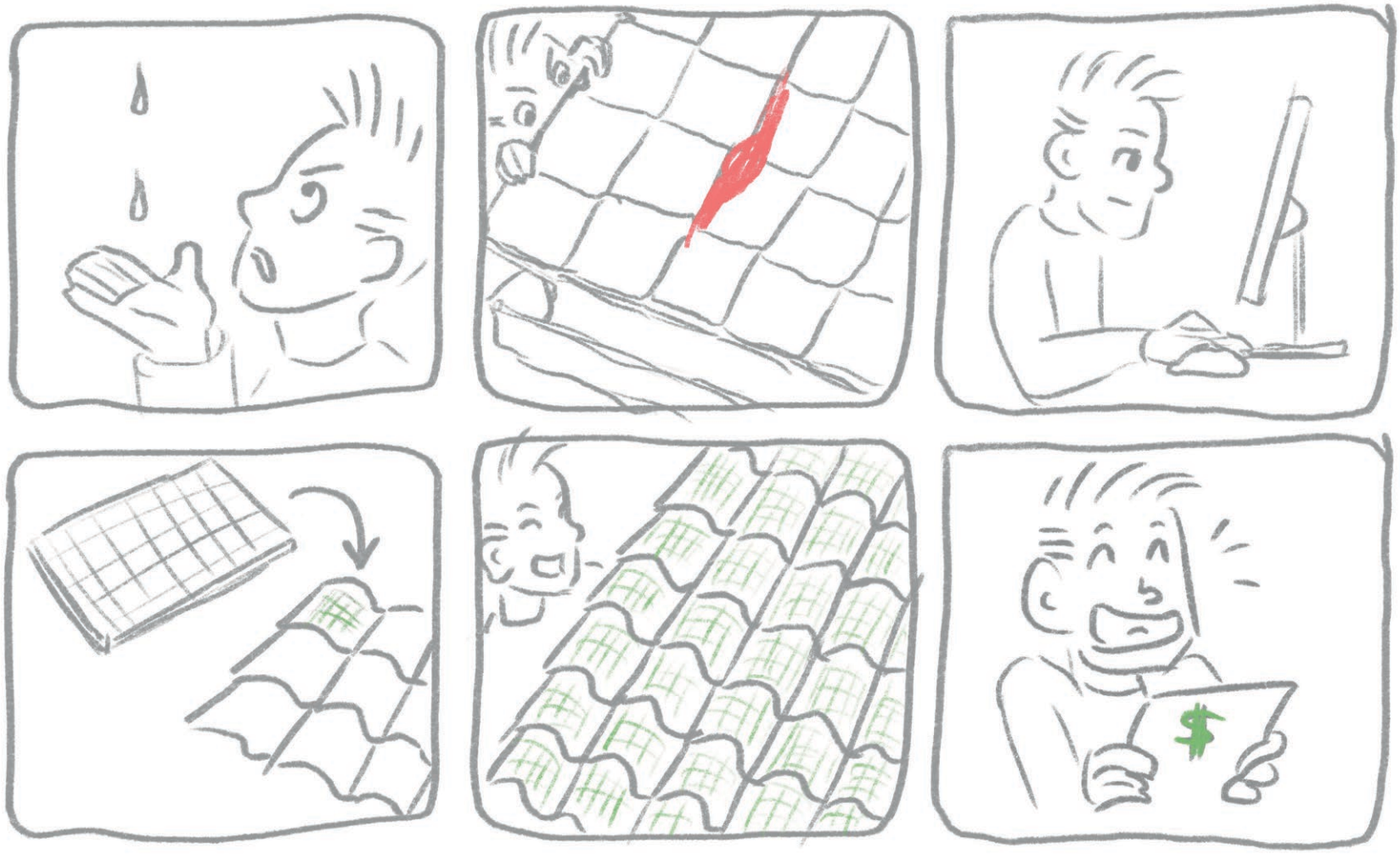
Design Game 1 - Slide 2



Scenarie 1 - Varmepumpe

Scenarie 2 - Solceller + batteri

Scenarie 3 - Isolering



Scenarie 4 - Nye vinduer

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Aesthetics	*"Vores hovedfokus er altid design."* *"Vi lever kun af at lave skræddersyede huse - energirenovering er fuldstændigt specifikt fra case til case.""*	*A01-01*	*Architect 1*
During renovation	*"Det er meget teknisk kompliceret at energirenovere et hus. Du skal jo finde ud af hvor duk-punkterne ligger henne i konstruktionerne. Og det er ikke så lige til. Derfor går det galt for mange - det har vi heldigvis ikke oplevet endnu. Men det er fordi vi ved hvad vi gør, det er typisk sådan nogen som tømremestre og ting og sager, som tænker det bare er at hælde en masse i. Det er det ikke."* *"Man skal forstå hvordan det er bygget oprindeligt. Du bliver stillet overfor mange komplicerede beslutninger, i forhold til byggeteknik, i forhold til at energirenovere. Det er meget mere kompliceret end at lave et nyt.""*	*A01-02*	
Regulations	*Christine spørger: "Er det kunden der efterspørger energirenovering, eller er det jer det kigger på huset og forelsår det?" ->> "Det kommer af sig selv, fordi man skal jo leve op til nutide krav. Når du giver huset en ordentlig overhaling, Så skal du jo leve op til gældene krav i BR18 - og det er jo så 2020 reglementet nu, under BR18. Det er jo beydeligt skærpede krav, både omkring energi og lignende. Så det giver sig selv."*	*A01-03*	
Business through energy renovation	*"Dem der henvender sig til os, vil jo gerne have en æstetisk løsning. Så det er altid æstetikken der er baggrund for at de henvender sig til os - eller kunne de jo bare ringe til en ingeniør."*	*A01-04*	
Initial idea	*"Det skaber finansiering. Du kan sagtens økonomisere en energirenovering. F.eks. har jeg lige bygget nyt hus. Det gamle hus jeg boede i brugte jeg 37.000 i varme og el, det var et hus fra 1855 eller sådan noget, der var nærmest ingen isolering i. Nu har jeg bygget et nyt hus, som er A+ hus med solceller på taget. Det koster 5000 om året at varme op, er 300 kvm. Solcellerne har jeg fået en støtteordning til - der får jeg 4600. Så jeg betaler 400 kr for el og varme om året." "De penge du så har sparet, kan man jo gå ud og købe finansering for. Det bliver hurtigt til penge." "Jeg har lige haft et møde med nogen der bruger et par 20.000 tusind om året i deres 70'er hus. Der er typisk kun 50-100 mm isolering i. Det vurderer vi at vi kan få ned på 6000 om året, for de 240 kvm."*	*A01-05*	
Business through energy renovation	*"Bevarer arkitekturen, samtidig med at det bliver energirenoveret."* *"Det er ikke et must at det skal ligne sig selv når det er færdigt, Det skal jo komme op i en nutidig arkitektur."* *- keep the same architecture"*	*A01-05*	
Advice and guidance	*"Sådan noget som jordvarme for eksempel, det skal man jo ikke begynde at lave i et gammelt hus. Det kræver et meget vel-isoleret hus før du får en optimal virkning ud af sådan et jordvarme-anlæg."*	*A02-01*	*Architect 2*
Advice and guidance	*"Der er mange der tænker det kunne være dejligt med gulvvarme. De tænker det er nemt, men det er det ikke."* *"Der er mange der tænker, når vi alligevel skal skifte gulv, kunne det være lækkert med gulvarme. Men den nyeste teknologi går ikke med et hus for 60'erne."* *"Der er mange der fokuserer på at de gerne vil energi-optimere deres bolig. Så tager vi ud og kigger på det. 90% af gangene spørger de til gulvvarme, og 90% af gangene bliver det ikke til noget fordi det koster kassen.""*	*A02-04*	
Aesthetics	*"En tømre går jo ikke op i arkitekturen, om det er et 60'er hus. Han er ligeglad, hvis de siger bondevinduer. Det er jo en arkitektopgave."* *"Det handler om historiefortællingen, hvad der sker når du vælger ting til og fra. Det tror jeg ikke du får fra tømremesteren - han tænker mere på de vinduer hvor han får den bedste pris.""*	*A02-05*	
During renovation	*35:40 Det er godt at arkitekter tager styring af projektet og kordinerer håndverkere og forteller dem hvad de skal osv. Håndværkere er glade for at have sådane som os (rådgivere).*	*A02-07*	
Grants & political instruments	*"Så hvis man regering skulle gøre noget, og sagde de ville opdaterer boligmassen, og virkelig mente det, så bliver de nødt til at lave en gigantisk pulje. Som eks. hvis du får dit hus op i en energiklasse D, får du 500.000, eller fri skat i et år. Noget der virkelig sparker, ikke bare håndværkerfradrag (maks 18.000 om året)."*	*A02-08*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Regulations	*“Mange af de tiltag, kræver et nyt terrændække - altså at de isolerer med 300 mm, og sådan noget - du må ikke bare lave gulvvarme. Så de tiltag kræver nogle andre ting som huset ikke er bygget til.”* *“De sidste nye tiltag skal spille sammen med det gamle.””*	*A02-10*	
Regulations	*48:45 Mange går jo død på kommunens tiltag hvor man skal redegøre for alt muligt, fx brand. Det er godt for arkitekter fordi det er dem der sørger for det (mere opgaver). Ellers skal jo folk kontakte alle mulige, håndværkere, ingeniør, brandfolk etc..Ofte for mindre bygninger.*	*A02-11*	
Before renovation	*"Vi prøver at få energirenovering implementeret i alle vores projekter. Men oftest er det prisen der er stopklodsen. Uden undtag."*	*A02-12*	
Advice and guidance	*“Det vi kigger på når vi er ude ved folk, der er hvordan vinduerne ser ud, og om folk har fået tjekket deres isolering i væggene. Så hvis vinduerne er et-lags, så vil vi anbefalende dem at tage fat i nogen til at kigge på dem, for der er jo også penge at spare.”*	*E01-01*	*Energy adviser 1*
Advice and guidance	*“Det svinger meget fra kunde til kunde, om de ved hvilken løsning de vil have. Nogen har læst manualen bedre end mig, andre aner ingenting, og regner med at vi kommer og fortæller alt om hvad de skal gøre.” “Hvis det er ældre mennesker, så har de læst alt om varmepumper inden vi kommer ud til dem. Ingeniører de har også læst hele manualen 3 gange, både forfra og bagfra. Og dem med en ikke så høj uddannelse, regner med at vi kommer og ved noget.”*	*E01-02*	
Thermal comfort & indoor climate	*“Det der oftest gør at folk er motiverede til at energirenovere er at de kan spare noget på deres varmeregning, eller kan få et bedre indeklima pågrund af energiforbedringer i huset.”*	*E01-05*	
Advice and guidance	*"Så kommer vi energivejledere som nogle typiske fagfolk og siger 'du burde jo gøre sådan her', da det ikke er noget de selv tænker på. Man fokuserer ikke på de ting der er gemt væk. Vi skal fortælle dem hvordan det hænger sammen."*	*E02-01*	*Energy adviser 2*
Benefits	*"Det der betyder noget med energirenovering, det er typisk ikke noget du kan se med øjet. Så hvis du forestiller dig at du går hjem i dit eget hus, og siger du godt kunne tænke dig nyt loft, køkken, gulv, amaturer, så er det det du kigger på, det er det du fokuserer på."*	*E02-02*	
Thermal comfort & indoor climate	*"Der er en komfort i det. Det må vi erkende, der er en ligeså så stor del af komfort i det, som der er energibesparelse. Du får noget du aldrig har haft før; gulvarme, måske trækker det ikke længere fra vinduerne osv."*	*E02-04*	
After renovation	*“Der var et enkelt problem, der var en sten i pilleleverancen, som satte sig fast i fyret. Jeg ringede til montøren, og han guidede over telefonen, så den fixede jeg selv.*	*H01-01*	*House Owner 1*
Economy	*“I alt investerede vi 158.000 i hele løsningen, og det tjente vi ind gennem besparelse på varmeregningen på 5 år.”*	*H01-02*	
Economy	*“Vi stod til at skulle købe et nyt oliefyr til 12.000 eller et nyt pillefyr til 68.000. Så lavede vi en beregning på, hvor meget olien kostede, og hvor meget træpiller kostede, og fandt frem til at hvis vi skiftede, var vores investeringtilbagebetalt på 5 år.”*	*H01-03*	
Maintenance	*“Vi fokuserede meget på at få en løsning der kørte per automatik, at vi ikke skulle gøre et eller andet en gang om dagen, eller hver uge.”*	*H01-04*	
Advice and guidance	*"Jeg har bare undersøgt selv på nettet undersøgt hvad der er praktisk. Jeg har ikke rådført mig med nogle specielt. Vi gjorde det selv, så vi har bare i familien snakket om at det skulle laves."*	*H02-01*	*House owner 2*
After renovation	*Effekten af energirenoveringen: "Nu er det første vinter, så det er lidt svært at sige i tal om vi sparer noget på varmeregningen. Det følges meget mere rart - der er en meget mere endsartet varme."*	*H02-02*	
Before renovation	*Har ventet og lavet renoveringen samlet: "Når det er sådan et stort projekt kan man lige så godt gøre det hele på en gang."*	*H02-04*	
Before renovation	*Fortæller at de fik lavet nogle andre renoveringer samtidig med at gulvet blev isoleret og fik gulvvarme. De byggede bl.a. en udestue og har fået køkkenalrum.*	*H02-05*	
Before renovation	*"Da vi købte huset, der startede vi med at efterisolere oppe på loftet. Det gjorde vi inden vi flyttede ind. Jeg tror kun at der var 50 eller 100 mm isolering og der lagde vi 150 mm ekstra ovenpå efter.*	*H02-06*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Before renovation	*"Vi havde en overdækket teresse som vi fik lukket af og så boede vi der i tre måneder imens gulvet blev lavet. Det var nu meget hyggeligt. Vi har tidligere bygget et helt nyt hus og det var sværere, så det er nok derfor jeg synes at dette her ikke var så slemt. Der kommer altid nogle udfordringer, men hvis man har det med i tankerne fra start, så skal det nok gå."*	*H02-07*	
Thermal comfort & indoor climate	*"Der var også fodkoldt på gulve om vinteren." Priorierede at få skiftet gulvet og lagt gulvvarme fordi der var fodkoldt og fordi gulvene var slidte.*	*H02-08*	
Advice and guidance	*Vidste selv hvilke vinduer der skulle skiftes til: "Med vinduerne var det bare at kontakte tømreren og sige at jeg ville have aluminium ude og træ inde ift. holdbarhed. Det var bare centrumvinduer der i min verden var bedste. Der ved jeg meget selv som håndværker og går ind og kigger på nettet og undersøger."*	*H03-01*	*House owner 3*
Information	*"Udfordring er at få håndværker til at forstå hvad det er man har af ønsker. Der er mange gode håndværkere, men der er satme også mange dårlige hvis man vælger forkert. Det er vigtigt at man har en god kemi med håndværkeren. Det havde særlig stor betydning at jeg kunne stole på dem der kommer og at jeg vidste at de ville udføre det ordentligt." "Det der havde størst betydning i underfasen var at de kom og laver det færdigt til den aftalte tid - troværdige håndværkere. Der er mange der bare kommer og går som det passer og det går ikke. Det er også vigtigt at det er noget kvalitet" Fortæller at han kunne udnytte at han har et håndværkernetværk hvor han kender personer han ved laver et godt arbejde, men han ser at uden dette kunne det være en udfordring at finde nogle med troværdighed som ville kunne levere kvalitet.*	*H03-02*	
After renovation	*"Da vi fik ny kedel fik vi ny styring på gulvarmen. Der var gulvvarme i forvejen, men så da vi skiftede kedel satte jeg ny styring på, så vi havde rumtermostater så man kan lukke hver rum ned, så det lukker for varmen i stedet for at det hele tiden kører rundt."*	*H03-03*	
Advice and guidance	*"Vi havde kontakt til murer, elektrikere og VVS'er. Der er mange ting der skal planlægges i sådan en omgang. Jeg havde folk på undevejs til at få det ordnet."*	*H03-04*	
Information	*"De største udfordringer før man går i gang er at finde ud af hvad der er af muligheder og hvad der vil være en optimal løsning. Der er meget forskel på om kedlen er i rustfrit sål eller aluminium eks. Det er sådan nogle udfordringer der jo også er ved renovering af eks. et køkken - om man skal vælge det ene eller det andet og hvad man vil betale. Mange gange får man hvad man betaler for"*	*H03-05*	
Before renovation	*"Jeg skal have skiftet pærer ud til LED. Det er billigere og sparer på energien. Der er svært at få pærerne til at passe. Der skal jeg have en elektriker ud. Det er næste skridt." Barrieren der har gjort at de endnu ikke har fået dem skiftet er tid til rådighed -"en travl hverdag".*	*H03-06*	
Initial idea	*Skiftede vinduer fordi de ville have noget bedre termo: "De var fra 1987 så de var ved at være slidte - at tørre ud. Det var slidtage der gjorde at de skulle skiftes."*	*H03-07*	
Economy	*Motivation for at skifte varmekilde: "Den nye teknologi var den kondenserende teknik, så der valgte jeg at skifte kedel - at få fra ikke kondenserende til kondencerende. Det var for at spare på energien. Den er mere effektiv."*	*H03-08*	
Aesthetics	*Fortæller også at få fjernet radiatorer gjorde meget for æstetikken, både ift. ikke at skulle se på dem, men også ift. at kunne placere møbler og inventar på nogle nye måder.*	*H04-01*	*House owner 4*
Before renovation	*Fortæller at det var en udfordrende proces fordi det var totalrenovering: "Det gør vi aldrig mere. Jeg kan godt fortælle at når man har to børn samtidig med det er det hårdt. Hverdagen gik jo videre samtidig med fodboldkampe og legeaftaler - vi havde travl i de år. Men på den anden side ville vi ikke have gjort det anderledes." Oplevede ikke store udfordringer undervejs ud over at få hverdagen til at spille.*	*H04-03*	
During renovation	*Håndværkerarbejdet, ud over det Lars (tømrer) kunne lave, var venner fra netværket som hjalp med. Derudover var der elektriker, VVS'er og kloakmester. Fortæller at disse var inde over for at sikre at løsningerne var lavet i orden ift. at det opfylder hvad det skal ift. forsikring.*	*H04-04*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Energy optimisation	*"At der var behov for mere plads var katalysator for energioptimering. "Vi fik ideen i den forbindelse at huset kun var på lidt over 100 kvm, så vi manglede noget plads til vores børn som blev større og større. Vi snakkede frem og tilbage - jeg snakkede om jeg jeg gerne ville væk fra radiatorerne som var gamle og svære at regulere, og Lars snakkede om at når nu vi var igang så kunne vi godt komme noget mere isolering på loftet." Beskriver dog også at hvis de ikke havde haft brug for det ville de nok alligevel havde lavet nogle energibesparende tiltag. Fortæller at højest prioritet var at få mere plads og at energirenoveringerne fulgte dette."*	*H04-06*	
Initial idea	*"Vi overtog huset fra mine forældre og det var slet ikke nyrenoveret - det var slidt. Det trængte til at blive renoveret."*	*H04-07*	
Initial idea	*"Vi skal indenfor en årrække have nyt fyr. Hvad det skal være ved vi ikke for så langt er vi ikke nået. Har på nuværende tidspunkt et gasfyr. Det er ved at være gammelt. Vi brugte nogle penge på at få det opdateret ved at skifte kedel under totalrenoveringen, men det skal helt sikkert skiftet på et tidspunkt."*	*H04-08*	
Regulations	*"Det er blevet godkendt af kommunen. Når man meddeler at man laver et byggeri, så når det er færdigt kommer de ud og tjekker efter. Det handler om hvor meget man skal betale i ejedomsskat. De skal tjekke at man laver op til de planer man har fået godkendt. Så kommunen har været inde og sige OK for det vi har lavet."*	*H04-09*	
Energy optimisation	*Var meget tilfredse med at have fået mere plads, men fortæller også at de ekstra ting som udvidelsen bragte med sig som gulvvarme kan mærkes på komforten indenfor.*	*H04-10*	
Before renovation	*Fortæller at de renoverede i faser. Først lavede de førstesal mens de boede i stuen og da første sal så var færdig flyttede de alle derop, og så kunne de renovere stueetagen.*	*H05-02*	
Before renovation	*Det krævede at der var noget opsparing at de kunne lave renoveringen.*	*H05-03*	
Before renovation	*"Der er jo altid noget vedligeholdelse, så hen ad vejen så de der nye vinduer - jeg har fået nye nedenunder, men jeg kunne også godt tænke mig at få nogle nye på første sal." Fortæller at barrieren for endnu ikke at have gjort det: "Nu hvor jeg er blevet pensionist er overskuddet ikke det store og der er ikke lige så mange penge til rådighed."*	*H05-04*	
Before renovation	*"Der blev lagt både nyt vand og varme ind. Det var ret dyrt, men det var en investering der gav mening på sigt. Vi skulle jo bo der længe."*	*H05-05*	
Initial idea	*Taget var i for dårlig stand: "Overetagen var noget gammelt noget - jeg tror at det var lavet i 1964. Det var noget værre L-O-R-T. Derfor beslutter vi at rykke tag og tagkonstruktion og det hele af på første sal. Det er så det vi fik bygget op igen."*	*H05-06*	
During renovation	*"Han (svigerfar som er entreprenør) var godt nok holdt op med at arbejde, men hans tidligere håndværkere kom og hjalp. Vi havde tømrer til at lave tager og vi havde murer til at lave noget udvendigt."*	*H05-07*	
Thermal comfort & indoor climate	*"I toilet og bryggers har jeg lagt gulvvarme. Det var fordi der var for koldt derude - det var for dårligt isoleret. Så jeg gravede ud og så kom der plastik og flamingo i og nye slanger. Samtidig satte jeg 20 cm rockwool på væggene indvendigt. Jeg brugte fibergips som der ikke kan komme skimmel i."*	*H05-08*	
Advice and guidance	*"Vi tog kontakt til nogle der skulle se hvordan vores hulmursisolering var. Der kom et firma. Det var sådan et gratis tjek. Men så fik vi ikke svar fra dem og så kom vi til lidt at glemme det og så gik vi egentlig bare ud fra at tingene var som de skulle være."*	*H06-01*	*House owner 6*
Advice and guidance	*Fandt frem til løsning: "Nu var det ikke så besværligt lige med isoleringen, for der var nogle vejledninger og så henvender man sig til byggemarket - og der får man så det man skal bruge."*	*H06-02*	
After renovation	*Mærker forandring af isolering: "Der er nogle rum hvor det kan mærkes at de er blevet lidt lettere at varme op."*	*H06-03*	
During renovation	*Udfordringer: "Måske mere det at det ikke er en nem proces selv at gøre det (isolering af loft). Det kunne godt være at man skulle have haft nogle professionelle til at gøre det. Det er noget ubehageligt noget at have med at gøre, sådan noget isolering. Vi tænkte at det ville være noget vi selv kunne gøre uden håndværker og så kunne vi spare de penge, men det var en besværlig process at stå med selv."*	*H06-04*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Initial idea	*Overvejelser om flere energirenoveringer: "Det skulle være i forbindelse med et nyt tag, så ville vi indtænkte hvordan man fik udnyttet solenergien. Vi har en stor sydflade. Det skulle være sådan noget smart integrerbart i et nyt tag." Barrierer for at det ikke er blevet gjort endnu: "Der er ikke behov for at skifte taget på nuværende tidspunkt og investeringen vil være en for stor omkostning ift. vores forbrug."*	*H06-07*	
Maintenance	*Motivation til at skifte vinduer: "Det var sådan nogle gamle dobbeltrudede vinduer. Så skiftede vi til nogle energirigtige. Jeg har svært ved at sige at det var en decideret energirenovering, for vi ville gerne have nogle nye og så er det klart at man tænker i de baner, men det var ikke hovedgrunden. De skulle skiftes fordi de var gammeldags og besværlige at have med at gøre."*	*H06-08*	
Thermal comfort & indoor climate	*"Indeklima havde også en rolle."*	*H06-09*	
Accurate and trustworthy information	*Oplevede at der var udfordringer med den lokale konstruktør de hyrede til at lave myndighedstingene. Udfordringen var at der skulle en speciel tilladelse til ift. at de udvidede deres kvadratmeter og det havde han ikke viden om.*	*H07-01*	*House owner 7*
After renovation	*Er tilfredse: "Vi kan mærke at vi ikke har det samme kuldenedfald som der kunne være tendens til før. Det har i hvert fald hjulpet."*	*H07-02*	
During renovation	*"Der var en tømrermester og han styrede de andre håndværkere. Han koordinerede med dem." Husejeren fortæller at han hver uge havde en gennemgang om planen blev fulgt. "I og med at det er et gammelt hus, så opstod der nogle ting vi ikke lige havde forudset." Fortæller at huset var ret skævt hvilket håndværkerne skulle ordne.*	*H07-03*	
During renovation	*"Vi havde håndværkere til at lave det hele, for Louise (kvinden i huset) har den holdning at det skal helst være færdigt dagen efter - det skulle ikke være noget der trak ud tidsmæssigt. Det eneste vi selv lavede var det der skulle brydes ned."*	*H07-04*	
Environmental sustainability	*"Dengang (ca. 7 år siden) snakkede man overhoved ikke om bæredygtighed - det var ikke et begreb på det tidspunkt."*	*H07-05*	
Grants & political instruments	*"Vi overvejede også solceller dengang, når vi nu var igang med at pille ved det hele. Det var dengang de begyndte at blive moderne. Det var dengang med de første tilskud hvor det var rigtig lukrativt at få solcelleanlæg. Men det havde vi simpelthen ikke økonomien til - det var 100.000 kr mere vi skulle smide oveni renoveringsprojektet - det var der ikke lige til på det tidspunkt. Men det kunne være optimalt for vi har en stik syd 45 graders taghældning. Det havde været super optimalt, men det var der ikke lige penge til."*	*H07-06*	
Grants & political instruments	*"De ting vi har fået lavet gennem tiden har ikke været noget ift. de der puljer man kan få. Jeg ved faktisk heller ikke helt ift. puljeordninger - for mig har det været svært gennemskueligt som almindelig forbruger. Det er svært at orientere sig i alle de avancerede regler der er i sådan nogle støtteordninger."*	*H07-07*	
Before renovation	*"Vi blev presset ned på lidt mindre areal og sov nede i stuen under renoveringen, men det gik egentlig relativt smertefrit." Overvejer at det i den sammenhæng var en stor fordel at have andre til at lave det, da det forkortede tiden de skulle bo under de omstændigheder. Det tog omkring 3,5 måned.*	*H07-08*	
Energy optimisation	*"Vi har energirenoveret, men det har ikke været med energirenovering som det primære formål. Det har været at lave en renovering eller ombygning som så samtidig har forbedret isoleringen."*	*H07-09*	
Energy optimisation	*"Fik ryddet overetagen og fik lavet halvdelen af overetagen om, så det kunne bruges. Det primære formål var at få mere areal. Hele den del der ikke var udnyttet var bare et tagrum direkte ud til tagbeklædningen. Så den del som var udnyttet blev så også lavet om. Både indmad og helt ud til tagbeklædningen blev lavet."*	*H07-10*	
Regulations	*"Vi havde en lokal konstruktør til at lave myndighedstingene - det der skulle sendes ind til myndighederne for at få det godkendt." Der var intet problem med dette.*	*H07-11*	
Thermal comfort & indoor climate	*Fortæller at det efter hans overvejelse tit ikke vil være det besparingsmæssige potentiale ved energirenoveringer der kan motivere men mere er indeklima der kan være med til at motivere til at foretage energirenoveringer.*	*H07-12*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Initial idea	*"Da vi flyttede hertil for 15 år siden der var der nærmest ikke isoleret. Det var noget af det første vi fik lavet - vi fik lagt 200 mm isolering. Så ryddede vi hele første sal og så blev det så opgraderet yderligere til de krav der var på det tidspunkt - det må have været BR10 krav."*	*H07-13*	
Advice and guidance	*"Vi fik undersøgt det her med at få isoleret ydremurerne og det viste sig at der ikke var nogen hulmur. De håndværkere vi havde, de anbefalede at vi fik isoleret. Vi fik en pris på en løsning hvor man isolerer udad på facaden, men det kostede bimlende mange penge. Vi endte med at tage imod et tilbud om at få isoleret indad."*	*H08-01*	*House owner 8*
Information	*Ift. belsutning om isolering af vægge var der en række forskellige aktører inde over: "Vi havde rigtig mange ude. Først havde et hulmurs-firma ude og bore huller. De konstaterede at det var en muremestervilla hvor der ikke var hulmur, så der var ikke nogle steder man kunne sprøjte noget ind. Så havde vi et isoleringsfirma ude, som kunne isolere udad. Så havde vi et tømrer firma som ente med at være dem der lavede løsningen med at isolere indad. Der var i hvert fald en 3-4 forskellige ude for at kigge på det."*	*H08-02*	
Acurate and trustworthy information	*Havde på det tidspunkt hvor energirenoveringerne blevet lavet ikke overvejede vedvarende energi produktion i huset. Fortæller at de har overvejet at få solceller på den ene side af huset. "Men det er som om jeg hele tiden bliver stoppet i det fordi det er for besværligt. Det kræver noget særligt siger Thomas far, han er elektriker, og han får det til at lyde som om at det ikke er bare lige. Det bliver italesat som dyrt og besværligt. Jeg kan ikke helt huske forklaringen på hvorfor det ikke er rentabelt på sigt, men noget af det handler vist om at man ikke kan opbevare og gemme strømmen. Jeg syntes det er svært selv at finde ud af om det er rigtigt det han siger, eller hvor jeg går hen for at få den information. Hvis jeg så går til en leverandør vil jeg være bange for at de siger det helt modsatte fordi de har en interesse i at jeg lægger en ordre. Så hvor går man hen sådan helt upartiskt og får en valid beregning - et svar på om det er en god løsning eller ej. Jeg er tit bange for at det er et farvet svar man får. Hvis jeg gør mig umage ville jeg nok godt kunne finde sådan en via nettet, men jeg har nok bare ikke prioriteret det."*	*H08-03*	
Acurate and trustworthy information	*Udfordringer: "En stor udfordring var at håndværkerne ikke overholdt aftaler. Det betød meget. Det havde de konsekvenser at det strækte arbejdet ud - det rykkede hele tiden tidsperspektiv.". De oplevede at håndværkerne ikke tog dem seriøst ift. at overholde aftaler. Det var mundtlige aftaler med håndværkere i netværket: "Det ville jeg nok ikke en anden gang sætte min lid til på samme måde." Hun fortæller også: "Hvis vi kunne gøre det om tror jeg at vi havde hyret en entreprenør med en deadline på - med dagsbøder på hvis det ikke blev færdigt. Det havde kostet os mere, men det ville have gjort at vi ville have fået resultatet til tiden."*	*H08-05*	
Aesthetics	*Forklarer at æstetik i forhold til det nye tag var vigtigt: "vi var ude og kigge på rigtig mange tegl for at finde noget vi kunne lide."*	*H08-06*	
After renovation	*Har for ca. 5 år siden fået skiftet varmefyret: "Vi har fået nyt naturgas fyr, men det var der også i forvejen, så vi har bare fået et nyere. Vi skulle servicere på det hele tiden, så det var bare for slidt og gammelt til sidst." "Fyret var gammelt og blev ved med at gå i stå, og vi skulle have service på det hele tiden. Vi fik en VVS'er ud som vejledte os i hvad der kunne betale sig. Vi havde ikke selv præferencer. Det var også ham der installerede det."*	*H08-07*	
After renovation	*"Vi har fået efterserviceret gulvvarmeanlægget. Vi har haft en anden VVS'er ude et par gange ude og indstille fordi synes det er svært at regulere. Der er kommet mere styr på det nu. Det krævede noget efterinstallering at få det til at fungere."*	*H08-08*	
Before renovation	*"Det var en stor beslutning, fordi det havde store økonomiske konsekvenser at skulle bruge så mange penge."*	*H08-10*	
Before renovation	*"Vi valgte at isolere indad, fordi det var en mere økonomisk spiselig løsning for os. Det firma vi havde ude for at give et bud på udvendig isolering ville koste flere hundrede tusinde kroner og det havde vi bare ikke. Det blev lidt et kompromis fordi vi jo så tabte nogle kvadratmenter indenfor."*	*H08-11*	
Economy	*"Det med at isolere murene var for at spare energi og det var en økonomisk tanke."*	*H08-12*	
Environmental sustainability	*"Dengang tænkte vi ikke på at spare på CO2 ved at lave løsningerne"*	*H08-13*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Before renovation	*"Vi har en enkelt udfordring imellem stuelaget og første sal - på første sal har vi de originale gamle gulve. Der trækker det op - der er meget fodkoldt. Vi har to gange haft håndværkere ude for at kigge udefra. Der er ikke nogle af dem der kan finde ud af hvorfor det trækker sådan ind. Vi har talt om flere ting - måske skulle man bore ned og se om der kan pustes isolering ned hvis det er plads. Men den ene tømrer mener ikke at det kan lade sig gøre. Det er sådan en ting som aldrig er blevet fikset. Det har vi bare levet med i alle de år. Det er den sidste ting der ikke er gjort noget ved." Fortæller videre: "Det er faktisk lige det vi tænkte der ville ske hvis ikke vi fik gjort mange af de andre ting inden vi flyttede ind - man lærer at leve med tingene. Det er uoverskueligt." Fortæller at prioritering, økonomi og at kunne gøre det uden at forstyrre hverdagen ville kunne motivere til at få det gjort.*	*H08-14*	
Before renovation	*"Vi havde en deadline hvor så meget som muligt helst skulle være færdigt, fordi vi skulle flytte ind. Hvis ikke vi nåede det inden deadline skulle vi bo i larm og støv. Vi endte også med at flytte ind hvor der ikke var vand, varme og førstesal overhoved ikke var færdigt. Vi havde varmeblæsere der kørte og måtte bade ovre i svømmehallen. Det var ret meget en udfordring."*	*H08-15*	
Before renovation	*"Vi var lidt udfrodret på tiden, fordi vi skulle flytte ind og nå at få alle ud til at give et tilbud, og overveje hvem der kan nå at lave det. Det var en stor mundfuld, for det var det hele der var igang samtidig. Vi skulle flytte ind til en bestemt tid, fordi vores gamle hus var solgt. Der var en del af det vi gerne skulle nå at blive færdige med. Så da det udvendige isolering ikke kunne lade sig gøre pressede det os lidt at skulle have det lavet indvendigt."*	*H08-16*	
Initial idea	*Valgte at skifte alle vinduer: "Der var mange punkterede vinduer og halvrådne vinduer, så til sidst besluttede vi at skifte dem alle sammen. Der var en del af dem som skulle skiftes og så endte vi med at tage de sidste med også"*	*H08-17*	
Initial idea	*"Vi har en enkelt udfordring imellem stuelaget og første sal - på første sal har vi de originale gamle gulve. Der trækker det op - der er meget fodkoldt. Vi har to gange haft håndværkere ude for at kigge udefra. Der er ikke nogle af dem der kan finde ud af hvorfor det trækker sådan ind. Vi har talt om flere ting - måske skulle man bore ned og se om der kan pustes isolering ned hvis det er plads. Men den ene tømrer mener ikke at det kan lade sig gøre. Det er sådan en ting som aldrig er blevet fikset. Det har vi bare levet med i alle de år. Det er den sidste ting der ikke er gjort noget ved." Fortæller videre: "Det er faktisk lige det vi tænkte der ville ske hvis ikke vi fik gjort mange af de andre ting inden vi flyttede ind - man lærer at leve med tingene. Det er uoverskueligt." Fortæller at prioritering, økonomi og at kunne gøre det uden at forstyrre hverdagen ville kunne motivere til at få det gjort.*	*H08-19*	
Accurate and trustworthy information	*"Der var nogle ting jeg var usikker på. En ting som jeg måske har fortrudt det lidt. Jeg valgte det fordi det skulle være så enormt bæredygtigt, men det viste sig egentlig ikke at holde stik. Det er et ventilaitonsanlæg. Det brugte jeg utrolig mange penge på som har været fuldstændig spild af penge. Sådan er det når man lytter til folk der bare skal sælge noget. Det var ikke realistisk vejledning. Vi fik at vide at det er enorm godt at have fordi det sparer en masse varme, men det passer bare ikke i virkeligheden."*	*H09-01*	*House owner 9*
Information	*"Jeg søgte rådgivning på de ting jeg ikke ved så meget om (er selv uddannet energikonsulent), så det var en VVS'er inde over ift. vandvarme, varmevekslere og gulvvarme og sådan noget"*	*H09-02*	
Aesthetics	*"Vi prioritede også at det skulle blive et pænt hus som holder sin værdi. Æstetik er prioriteret helt oppe i toppen."*	*H09-03*	
Before renovation	*"Der er nogle hængepartier, men det har noget med økonomi at gøre at det ikke blev færdigt."*	*H09-04*	
Economy	*Overvejelser om at energirenovere noget mere: "Jeg tror ikke rigtig at der er mere at komme efter. Det kunne være fedt med nogle solceller, men der er ikke noget at komme efter som det er lige nu. Det kan ikke betale sig økonomisk."*	*H09-05*	
Economy	*"Man kigger på om det reelt kan betale sig - om man reelt sparer noget energi."*	*H09-06*	
Before renovation	*"Det var ikke fordi der var et stor energiforbrug, men når man alligevel skifter vinduer så skal man udskifte til nyeste energikrav og på den måde hele vejen rund har vi forsøgt at føre det op til nutidige krav."*	*H09-07*	
Before renovation	*Boede i et midlertidig hus under totalrenoveringen. Opleves som afgørende at de kendte en de kunne låne et hus af imens: "Det var et mit far havde et vi kunne bo i. Hvis vi ikke have haft det ville det have frygtelig dyrt at have to huse. Så havde det ikke kunnet lade sig gøre".*	*H09-08*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
During renovation	*"Tid kan man ikke gøre så meget ved, for det er med håndværkere og man kan næsten ikke få fat i nogle, så man er nødt til bare at vente. Det kunne vi ikke rigtig gøre så meget ved, så det kunne vi ikke prioritere. Vi måtte bare acceptere at det var sådan det var." Udfordring: "Der var meget ventetid. Det var svært at få håndværkerne til at komme når man skulle bruge dem."*	*H09-09*	
Accurate and trustworthy information	*Thomas forklarer at de fik involveret nogle ingeniører og "det var en katastrofe". "Det gik ud i urealistiske økonomiske udgifter til vandvittige og ligegylde undersøgelser. De ville lave jordbundsboringer, altså prøver. De ville undersøge om jorden kunne bære det nye tag." Videre ville de lave en masse beregninger ift. selve huset og hvor man skulle gøre noget for at det kunne holde. "Han ville så sende sit arbejde videre til en statiker som skulle regne på det. De startede med at sige at de skulle have 20.000 kr for at lave det. Men det endte med at de skulle have 80.000 til det og 40.000 til boreprøver og så skulle der en masse stålkonstruktioner oveni. Så vi kunne godt regne ud at vi ville lande på omkring 200.000 bare i ingeniører og konstruktioner." Forklarer at tømren siger at han ikke vil lave det hvis ikke der er ingeniører på. "Vi får så fat i en som er bygningskonstruktør, tømrer og arkitekt. Han står og ryster på hovedet og siger at det er helt unødvendigt.".*	*H10-01*	*House owner 10*
Advice and guidance	*Fulgte anbefaling ift. ruderne. Kontakt på trælasten anbefalede og de googlede undervejs. T: "Det var andres praktiske erfaring at vi valgte lavenergi." (nogle i eget netværk fra trælasten).*	*H10-02*	
Advice and guidance	*De fortæller at det havde stor betydning at have kontakt til arkitekten/bygningskonstruktøren, da de opleve at "ham kunne man spørge om alt".*	*H10-03*	
Advice and guidance	*Begge har brugt google til at undersøge muligheder. Ikke kun for at finde ekspertviden, men også til at finde frem til hvad andre har gjort og hvilke erfaringer det har bragt.*	*H10-04*	
Information	*Snakkede om solfangere, men deres hus lå ikke optimalt ift. det. Den involverede arkitekt vurderede dette.*	*H10-06*	
After renovation	*De er glade for løsningerne og beskriver bl.a. at de oplever at det 'lovede' er opfyldt med at der eks. ikke er kuldenedfald fra vinduerne fordi de valgte tre-lags-termoruder.*	*H10-07*	
After renovation	*De har udfordring ift. oliefyret. Oliefyret skal reguleres, men det er det ikke blevet, hvilket gør at det ikke kører optimalt. Det kører ikke stabilt. Der skal en der skal servicere det efter det er blevet installerer, men det har der ikke været. Det er nogle specifikke der har forstand på oliefyr som skal gøre det.*	*H10-08*	
During renovation	*Udførte arbejdet selv da Thomas er håndværker og det var en billigere løsning end at skulle have andre til det. Selvom de har lavet det meste selv har de også hentet support fra Thomas håndværker-netværk. Det har gjort at de har kunne få mange forskellige perspektiver ind over uden at det havde økonomisk betydning.*	*H10-09*	
Aesthetics	*Økonomi har også spillet en rolle ift. optimering af vinduer. Kun de øverste er skiftet. De andre er ikke skiftet fordi de ikke har råd. De ville gerne gøre det for at kunne betale mindre i varme (spare på el-regningen op sigt), men også fordi "når jeg sidder ved spisebordet kan jeg mærke kulden fra vinduet". Det er derved også komfort. Ift. komfort og æstetik er de løsninger der er lavet tilfredsstillende, men hvis de havde haft flere penge havde de gjort det mere omfattende ift. at få eks. alle vinduer skiftet. En udfordring er i den sammenhæng, at de ikke fik lavet alt de gerne ville have lavet grundet økonomiske barrierer.*	*H10-10*	
Before renovation	*"Hvis man skal have luft til vand bliver det dyrt i engangsudgift." De vurderede at det ville blive omkring 150.000 - 170.000 kr. og de kunne få oliefyret til 12.000 kr. "Der var meget her og nu økonomi i den beslutning". Der er ikke naturgas eller fjernvarme lagt ind hvor de bor så de argumenterer "der var kun muligheden at få luft til vand el. oliefyr.""*	*H10-11*	
Economy	*Huset skulle godkendes af realkreditinstituttet efter renovering - at de penge man har lånt skaber værdi. Det gjorde at den 'stil' de renoverede i var tilpasset til den gængse bruger, så huset får værdi. Man laver en byggeplan og så skal man vise at man har brugt de lånte penge til at opfylde denne plan. Der kommer så en ud og vurderer hvad huset er værdi efter renovering og om det lever op til det planlagte. Sådan nogle ting som nyt fyr m.v. spiller ind i hvad huset vurderes at være værd.*	*H10-12*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
During renovation	*Udførte arbejdet selv da Thomas er håndværker og det var en billigere løsning end at skulle have andre til det. Selvom de har lavet det meste selv har de også hentet support fra Thomas håndværker-netværk. Det har gjort at de har kunne få mange forskellige perspektiver ind over uden at det havde økonomisk betydning.*	*H10-13*	
Before renovation	*At de skulle have skiftet fyret, altså skifte det gamle varme-system ud "som måske ikke kunne have trukket gulvvarme", muliggjorde at der kunne komme gulvvarme. "Når man så alligevel skulle have skiftet systemet ud var det kun en lille ekstra ting at skulle have gulvvarme. Der var en tanke i sammenspillet mellem teknologier i huset.*	*H10-15*	
Before renovation	*Thomas hørt fra netværk at dem der har luft til vand varmepumper "kæmper med at få det til at køre ordentligt. Jeg kender mange. Der kommer den ene tekniker efter den anden ud, men de kan ikke løse det".*	*H10-16*	
Initial idea	*Gulvet skulle samtidig alligevel skiftes, så det blev lavet grundet "slidtage" og at de i den renoveringsprocess der alligevel skulle ske samtidig blev lavet energiforbedringer.*	*H10-17*	
Before renovation	*De boede i campingvogn og i virkeligheden var det ikke et problem. Problemet var varigheden de skulle bo i den og at det var over vinteren: "Det var en kold vinter".*	*H10-18*	
Thermal comfort & indoor climate	*Om det skulle være to- eller trelags vinduer brugte de en del energi på at finde ud af i 'under' fasen. De havde indhentet et tilbud på to-lags termoruder og det ændrede de undervejs til trelags for en række af vinduerne. Ændringen skyldtes "snakken om kuldenedfald".*	*H10-19*	
Aesthetics	*Kun de øverste er skiftet. De andre er ikke skiftet fordi de ikke har råd. De ville gerne gøre det for at kunne betale mindre i varme (spare på el-regningen op sigt), men også fordi "når jeg sidder ved spisebordet kan jeg mærke kulden fra vinduet". Det er derved også komfort. Ift. komfort og æstetik er de løsninger der er lavet tilfredsstillende.*	*H10-20*	
After renovation	*"Vi var meget tilfredse med resultatet. Det var et smukt tag, vi var meget tilfredse med kvaliteten, og helhedsindtrykket. Vi kunne mærke forandringen med det samme. Vi har ikke tændt op i brændeovnen siden, det har ikke været nødvendigt."*	*H11-01*	*House owner 11*
During renovation	*"Vi kontaktede en total-entreprise, hvor vi hyrede en arkitekt til at stå for udbud og kravsspecifikation. Han var projektleder. Han indhentede 3 tilbud, og så valgte vi 1. Han stod for al kontakt til håndværkere." "Arkitekten stod for det hele, så vi sagde jo bare vi ville have nyt tag, og så skruede han det hele sammen." "Alt hvad der var af problemer, var noget arkitekten tog sig af."*	*H11-02*	
Grants & political instruments	*"Som med alt andet adfærdsregulerende, så er der ikke noget der fungerer bedre end skatter og afgifter. Hvis du rammer dem på pengepungen, så reagerer de lige med det samme."*	*H11-03*	
Initial idea	*"For os handlede det om reducering af varmeforbrug, og bedre indeklima."*	*H11-04*	
Before renovation	*"Vi havde håndværker i 5 måneder, og blev vækket klokken halv syv hver morgen, der rendte folk rundt hele tiden. Det påvirkede helt sikkert vores hverdag."*	*H11-05*	
Initial idea	*Skiftede også taget grundet at det var gammelt: "Det var et gammelt tag."*	*H11-06*	
Initial idea	*"Højeste priortet var at få optimeret husets tilstand."*	*H11-07*	
Thermal comfort & indoor climate	*"Vi valgte at få nyt tag, fordi vi syntes at huset var for koldt."*	*H11-08*	
Advice and guidance	*"Vi havde spurgt ind til nogle der havde andre varmeløsninger, jordvarme, luft til luft og så pillefyr. Vi så at luft til vand var det vi fandt bedst og lettest. Den med jordvarmen er det noget med at hvis det bliver under minus 15 grader, så kan den ikke varme op, havde vi hørt. Så derfor ville vi hellere vælge luft til vand."*	*H12-01*	*House owner 12*

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Acurate and trustworthy information	*Har haft udfordringer med at få varmeløsning implementeret: "De (OK som står for pakkeløsningen med installering af varmepumpeløsning) lovede at på to dage ville der være installeret så man havde varmt vand. Det gik slet ikke - det gik 14 dage inden vi havde varmt vand. Vi har hele tiden måtte rykke for tingene - da de skulle lave noget gravearbejde, så ville de pludselig ikke, så der måtte Morten (husejeren) selv grave op og lægge rørene længere ned. Hver gang vi prøver at få fat i det ene firma så sender de os videre til den anden. Og sådan gå det frem og tilbage." De har haft problemer med fyret efter implementering: "Vi har problemer med fyret som står og larmer, men hver gang med ringer så siger de at de undersøger det, men de vender aldrig tilbage. Sidte uge gik fyret i stå, så der var de tvunget til at komme ud for at kigge på det. Der var vi jo så unden varmt vand og uden varme i radiatorerne. Så det har været en kamp. OK som sidder som ansvarlige har ikke taget ansvaret. Vi måtte faktisk ud og true dem med at tage tingene længere op i systemet, hvis ikke de leverede det der var lovet. Hovedudfordringen har været dårlig service" Fortæller at forløbet med de mange udfordringer har gjort at de ikke ville anbefale det til andre, samt at deres tillid til firmaet er helt tabt: "Vi er blevet så sure at vi har valgt at skifte hvor vi får vores strøm fra og vi tanker heller ikke vores bil hos OK længere."*	*H12-03*	
Advice and guidance	*Brugte netværk og internettet til at finde løsning til varme. "Der hvor vi boede før var der en der fik jordvarme og ham spurge vi. Morten han sidder også meget og surfer og ser hvad folk skriver om det, så han har læst meget om det forskellige."*	*H12-04*	
After renovation	*De har haft problemer med fyret efter implementering: "Vi har problemer med fyret som står og larmer, men hver gang med ringer så siger de at de undersøger det, men de vender aldrig tilbage. Sidte uge gik fyret i stå, så der var de tvunget til at komme ud for at kigge på det. Der var vi jo så unden varmt vand og uden varme i radiatorerne. Så det har været en kamp. OK som sidder som ansvarlige har ikke taget ansvaret.*	*H12-05*	
Environmental sustainability	*"Vi tænkte både at ved at skifte fra olie til el (luft til vand varme) ville det både spare miljøet, men det ville også spare os for penge. Bæredygtighed havde absolut en rolle ift. dette valg."*	*H12-06*	
Grants & political instruments	*"I 2030 skal olie være udfaset - der må du ikke have oliefyr mere. Vi så at inden for kort tid skulle det skiftes, så vi kunne lige så godt gøre det med det samme."*	*H12-07*	
Grants & political instruments	*Luft til vand anlægget har halveret deres varmeregning. "Selve anlægget har kostet 120.000 og så har staten givet 8.000 kr i tilskud fordi man går over til el. Det skal jo selvfølgelig også afdrages og der går nogle år inden man har afdraget på det, men på lægere sigt har man halveret varmerengingen ved at skifte."*	*H12-08*	
Aesthetics	*"Så tog vi dørene med samtidig med vinduerne (som skulle skiftes) - vi tænkte at vi lige så godt kunne tage det hele med samtidig. Der var nogle vinduer der også stadig kunne bruges, men det skulle også passe sammen, så man skifter jo ikke kun halvdelen, når det er sådan nogle rigtig gamle nogle der sidder i." Det handlede derved både om æstetik i at have den samme type vinduer, men også at det var nemmere at skifte alle nu end på et senere tidspunkt igen at skulle have skiftet nogle løbende.*	*H12-09*	
Initial idea	*Overvejet at lave mere: "Der er et tag som skulle kunne holde en del år endnu, men det bliver selvfølgelig skiftet ud hvis det bliver nødvendigt. Vi kunne finde på at isolere under vinduerne. Der overvejer vi at hvis vi skifter gulvet, så at få gulvvarme og at fjerne radiatorer og så isolere der under vinduerne hvor radiatorer stod. Nu er vi jo lige flyttet ind og har haft en mild vinter, men hvis vi oplever at der er meget kulde kan det også være at vi gør det uafhængigt at gulvet."*	*H12-10*	
Before renovation	*"Det har taget et godt stykke tid at få skiftet vinduerne ud - det er som tømreren lige havde tid. Det var aftalt sådan, men det var alligevel på sigt en mindre udfordring. Konsekvensen er at man lever i rod. Det var sommer og efterår, så det var ikke sådan at man frøs. Det var mere rod og håndværkere der render ind og ud som var en udfordring. Det handle om at vi også lavede et masse andet samtidig. Vi havde kun 6 uger til at gøre det hele i stand og det gjorde så at der var rigtig meget byggeplads-livet i den periode."*	*H12-11*	
Thermal comfort & indoor climate	*Fortæller at der var behov grundet alderen på huset: "Alle vinduerne i huset var punkteret, så dem kunne man ikke bruge mere. Det var helt sikkert piv utæt, så derfor skiftede vi det hele sådan energimæssigt. De skulle skiftes for at man kunne holde varmen. Man kunne ikke flytte ind hvis ikke vinduerne blev skiftet. Det har været tvunget for at have et indeklima man kunne bo i."*	*H12-12*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
After renovation	*"Den ændring der er, er at det ikke larmer længere. Og så har man også fjernet den der ængstelse: 'gad vide om det holder året ud'."*	*H13-01*	*House owner 13*
After renovation	*"Fyret er blevet lettere at styre, det er lettere at indstille tidsprogrammer og var varmt der skal være i huset. Brugervenligheden er helt sikkert blevet optimeret."*	*H13-02*	
Economy	*"Vi fik skiftet vinduerne for mange år siden, fordi der var nogen af dem der trængte til at blive skiftet. Så tænkte vi at vi ligeså godt kunne skifte til lav-energi. Det kunne ses på ét af dem der var punkteret, og så mente vi bare at det kune betale sig at få dem skiftet, fordi vi kunne sparre noget på gas, og det gav god mening."*	*H13-03*	
Before renovation	*"Vi fandt ud af at varmepumpen ville koste 3 gange så meget som naturgasfyrret. Besparelsen og belastningen ville der ikke være den store forskel."*	*H13-04*	
Initial idea	*"Grunden til at det var den rigtige timing, med renoveringen (fyret), var fordi at der var håndværkerfradrag. Derfor ville vi gerne have gjort det i 2019, så vi fik fradraget med det samme. Støtteordningen var det der gjorde at vi fik det gjort det på det tidspunkt i stedet for at vente."*	*H13-05*	
Before renovation	*"Det der holder os tilbage, er at det er besværligt. Besværet ligger i at få fjernet det gamle, og få lagt noget nyt på. Jeg tror det tager en dag at gøre det. Det er også en del af overvejelsen - skal vi gøre det selv eller få nogle andre til at gøre det. Det er nok det der med at det ikke er strengt nødvendigt at få gjort. Jeg ved jo også at når vi tager al den gamle isolering ned, så kommer vi alligevel til at overveje om vi skal gøre noget, når vi alligevel har fat i det. Skal vi lave en gangbro deroppe, så der er noget mere plads at sætte fra. Skal man sætte en fastmonteret stige op. Altså hvad ville være rigtigt at gøre, når vi alligevel har fat i det; det er nok ligeså meget det der afholder os fra at gå i gang. Det skal gøres ordentligt, hvis vi skal i gang, og det er nok lidt større et projekt."*	*H13-06*	
Regulations	*"Efter fyret var installeret, var der en der skulle ud og tjekke om det var blevet installeret korrekt. Det var ikke en fra VVS-firmaet, jeg ved ikke hvor han var fra, men det var noget de havde koordineret. Der var nogle lovkrav, som han tjekkede op på."*	*H13-08*	
Advice and guidance	*Hvordan han kom frem til de specifikke løsninger var bl.a. ved at spørge håndværkernetværk: "Jeg satte mig ned og fandt ud af hvordan huset var. Jeg rev alt ud og byggede nye vægge op og alt i virkeligheden. Der var faktisk kun ydervægge tilbage. På det tidspunkt arbejde jeg for en mester og ham spurgte jeg da af og til for han havde mange års erfaringer. Jeg brugte netværk og havde ikke fat i arkitekter, ingeniører eller sådan noget."*	*H14-01*	*House owner 14*
Initial idea	*De renoverede huset da de købte det: "'Vi boede i en lejlighed som vi havde 3 mdr. opsigelse på, så jeg brugte den første tid på at sætte underetagen i stand så vi kunne flytte ind der. Det var arbejde frem til kl. 4 og så var det arbejde i huset fra kl. 4 til kl. 24 og så hjem og sove og så fortsætte næste dag.". Fortæller videre: "Jeg var jo også 20-25 år yngre, så jeg vil nok sige at jeg ikke ville kunne have gjort det nu. Vi havde heldigvis heller ikke børn som skulle passes i samme omgang".*	*H14-02*	
During renovation	*"Jeg har gjort det hele selv med hjælp fra konen og venner og bekendte. Det var netværk der hjalp." Har brugt netværket til at foretage implementeringen: "Der har været nogle blikkenslagere og elektrikere inde over, men det er folk man kender. De hjælp til ved de områder som jeg ikke selv måtte og kunne rode med." Beskriver at netværkets hjælp havde stor betydning: "Der var massere der lige kom forbi en eftermiddag og hjalp eller kom og kørte noget væk - det var en kæmpe hjælp."*	*H14-03*	
Before renovation	*Banken var inde over undervejs. Efter de havde renoveret stueetagen kunne de lave et tjek og vurdere. Det gjorde at de kunne låne nogle flere penge og sætte første sal i stand.*	*H14-04*	
Environmental sustainability	*Motivation for energirenovering: "Det havde også lidt betydning det her med miljøet - når man ikke varmer så meget så sparer man også på miljøet. Som første prioritet var at man kunne spare på pengepungen, men som sidegevinst er der også at miljøet kunne spare lidt."*	*H14-05*	
Environmental sustainability	*Brændeovne er også ved at blive til et "fy-ord". Så kunne jeg forestille mig at det bliver en varmepumpe i stedet, for vi har ikke nogen radiatorer i stueetagen."*	*H14-06*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Before renovation	*Han fortæller at han har lavet et hjemmelavet varmesystem hvor han kan bruge noget af varmen fra brændeovnen og sende det op og varme første sal. Han fik det dog først op at køre efter mange år selvom han havde gjort klar til det. Det skyldtes at han skulle have laves nogle flere tekniske installationer hvilket ville kræve at en væg skulle åbnes. "Jeg gjorde det så for tre år siden, der valgte jeg at lave det lidt større og lave lave en kvist. Så i den omgang skulle jeg alligevel rive så meget ned så kunne jeg så sætte det sammen og få det til at fungere - så det var i forbindelse med en anden renovering at jeg valgte at lave det."*	*H14-07*	
Thermal comfort & indoor climate	*Indeklimaet havde også betydning.*	*H14-09*	
Maintenance	*"Allerede dengang jeg gjorde det, isolerede jeg med 300 mm i taget og dengang var det kun 200 mm der var normalt. Jeg kan huske at ham jeg arbejde med sagde at jeg var åndsvag men jeg tænkte at jeg ville hellere have en lav varmeudgift fremadrettet og så bruge lidt flere penge på at renovere det. Jeg ville hellere ofre lidt flere penge på byggeriet og så spare nogle flere penge på den lange bane."*	*H14-10*	
After renovation	*Had a pellet "furnace" before and had to burn a lot in order to reach a more comfortable temperature.*	*H15-01*	*House owner 15*
Grants & political instruments	*- Agreed to investing in solar panels, due to the economical benefits at the time*	*H15-02*	
Grants & political instruments	*- The new "ordning" (gruppe 2) with hourly based measurements of the solar panels makes it less benefitial, especially when using a EV.*	*H15-03*	
Thermal comfort & indoor climate	*- Changed windows because it was cold (thermal comfort) -> Got an offer from "glarmester/tømmer" (its a mix) from recommended. Costed around 80.000 DKK*	*H15-04*	
Thermal comfort & indoor climate	*"- Purpose of installing airventilation was not due to energy efficiency, but comfort. However, it moves the heat around as well and helps on the thermal comfort. There is some waste in energy - Airventilation system was implemented as the new windows made the house so tight and no moist could get out. Also, it was good for the family as they all have astma."*	*H15-05*	
Accurate and trustworthy information	*"Der har været en herude (og se på huset) med en termo-måler, og se om der var utætheder i vinduer. Han var fra Albertslund kommune. Han sagde at der var ikke noget. Han var ikke særlig effektiv."*	*H16-01*	*House owner 16*
Accurate and trustworthy information	*"Der har også været en og teste om vores varme var i orden. Han glemte bare at fortælle det som vi fik at vide efterfølgende af blikkenslageren (tips til hvordan man bedst bruger varmen via indstillinger på varmepumpen). Han var her for ca. 5 år siden i forbindelse med at man skulle have kigget på energioptimering. Han kunne ikke rådgive, selvom vi sagde at vi betalte meget i varme." Fortæller hvordan det kom i stand: "Jeg ringede (til kommunen) og spurgte om de ikke kunne komme og give nogle gode råd. Men det viste sig at de ikke kunne give nogle råd. Jeg tror at de var mangelfulde - de var ikke dygtige nok."*	*H16-02*	
Advice and guidance	*Det var et glarmesterfirma som de selv kontaktede der skiftede vinduerne. De talte med glarmesteren om hvad der var godt at gøre. De fik trelags vinduer. Det var glasset i vinduerne der blev skiftet. Han rådgav om hvilke vinduer det skulle være. Han gav dog ikke info om hvor meget man ville komme til at spare på varmeregningen. hun fortæller: "Det talte man ikke om dengang (i 80'erne). Energibesparelserne var noget vi selv tænkte på."*	*H16-03*	
Advice and guidance	*"Men i og med at den asbest der ligger i pladerne er noget værre rod, så er de også meget mere holdbare nu om dage, så derfor sagde han (bygningskonstruktør i familien) at vi hellere skulle skifte det hele."*	*H16-04*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Advice and guidance	*Taget er fra 1967 og er eternit. Gennem tagets levetid er det blevet malet 1 gang og der er blevet udskiftet 6 plader pga. utætheder. "Men vi har talt med en bygningskonstruktør i familien og han spurgte: 'har i hul i taget?'. Til det svarede vi: 'Næh, det har vi ikke'. 'Vent' sagde han. Lad vær med at få det malet. Spar pengene og hvis i så får hul i taget, så skift det hele. Så taget er faktisk noget af det som kan komme på tale ift. at få lavet energirenoveringer. Det kræver at der kommer en større skade hvor man kan se at vandet løber. Det ville vi ofre penge på selvom det koster mange penge, fordi det er slet ikke godt for et hus at der kommer vand i."*	*H16-05*	
Advice and guidance	*"Naboen skal have lavet en masse her sidst i april, med nye vinduer og sådan noget. Jeg overvejer at gå over og få et tilbud på vores hus"*	*H16-06*	
Before renovation	*De fortæller hvordan de kom på tanken om måske at skulle have solceller på taget: "Det var en annonce i avisen, hvor de skrev hvad det ville koste. Men det var simpelthen for dyrt" Det økonomiske satte hurtigt en stopper for det: "Du kan høre at jeg ikke var så hooked på det, fordi jeg har ikke været inde og undersøge det yderligere".*	*H16-07*	
Economy	*"Vi har tidligere tænkt på solceller, men det vil koste at få det op på taget osv. Ift. det man får ud af det vil man ikke kunne tjene det ind i vores levetid. Så det kan ikke betale sig økonomisk"* *"Rent klimamæssigt giver det god mening, men det bliver vi nødt til at se udenom - her overskygger det økonomiske""*	*H16-08*	
Before renovation	*"Når man når vores alder, så er energirenovering en lille smule for sent. Det vi har gjort undervejs har været godt, men når man taler om store ting, så nej, for det vil koste os mindst 100.000-150.000 kr. Det er en stor udgift når man ikke er på arbejdsmarkedet og når man ikke har en kæmpe pension, så tænker man på en anden måde end hvis man bare har." Det handler om en balance imellem at have et godt sted at bo med et tilpas indeklima, men samtidig skal al opsparingen ikke gå på at optimere.*	*H16-09*	
Before renovation	*"Væggene er hul-murs-isoleret, hvilket skulle være godt, men der er nogle der siger at det falder sammen, så man burde gøre noget der. Men vi har ikke mere end omkring 20 år tilbage, så derfor er der også grænser for hvad vi vil bruge pengene til."*	*H16-10*	
Economy	*"Vi har ikke talt om mere isolering i den sammenhæng (ift. at skifte tager). Men hvis det ikke er hammer dyrt, så kan det godt være at man ville have noget ekstra isolering."*	*H16-11*	
Economy	*Inden de gik på pension fik de energivinduer, "fordi det kunne betyde noget for varmeregningen". De kunne spare penge.*	*H16-12*	
Grants & political instruments	*"Jeg har tænkt på at få rådgivning, for det er sidste udkald i år med at få tilskud for energirenoveringer." Kommunen skriver at de tilbyder tilskud.*	*H16-13*	
Before renovation	*Placering og besværlighed i at skiftet varmepumpen ud har betydning: "Vi har sådan en varmepumpe koblet til fjernvarmen. Den slukker vi så om sommeren og så tænder den om vinteren. Men der er noget underligt med den. Jeg har sagt det til morfar, men han har bygget nede i kælderen og han kan ikke komme ordentligt til, så det er noget værre rod. Det gør at vi ikke lige har gjort noget ved den"*	*H16-14*	
Thermal comfort & indoor climate	*"Vinduesrammerne under vinduerne er utætte. Jeg kan mærke det når jeg underviser inde i mit rum (hun laver alexanderteknik)". Jeg kan mærke at der er kulde - og det er noget værre rod. Så vinduerne trænger til at blive skiftet. Men det er en prioritering. Vi ved ikke lige om vi gør noget."*	*H16-15*	
Advice and guidance	*Varmeregning: "Vi har fået penge tilbage fordi vi styrer på en anden måde. Vi bruger pumpen nede i kælderen i stedet for at dreje på radiatoren. Vi er blevet instrueret i at bruge varmen bedre. På pumpen kan man dreje fra 1-10 og så sagde blikkenslageren for to år siden at vi kun skal dreje på den når i skal have varme og ikke varme." Blikkenslageren instruerede dem og fortalte at de skulle have åbne døre så luften kan strømme frit, og at de så skal stå på det samme på radiatoren. Det har betydet noget for varmeregningen.*	*H16-16*	
Economy	*Ift. selv at generere strøm via solceller forklarer han at det har betydning at strømmen fra el-nettet er forholdsvis billig. Det gør at det er en konkurrent og at det ikke økonomisk kan betale sig.*	*H17-01*	*House owner 17*
Economy	*En barriere er at han i forvejen ikke betaler særlig meget for energi grundet et lavt forbrug: "Jeg har det ikke særlig varmt derhjemme og jeg er kun en person, så jeg har ikke en særlig dyr varmeregning i forvejen." Fortæller lidt senere: "Det vil ikke give mening at give omkring 80.000 kr for en ny løsnign når det kun ville spare mig et par tusinde om året i varmeregning."*	*H17-02*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Economy	*"Huset har gasfyr som det er nu og det synes jeg ville være spændende at skifte ud til luft til vand varmepumpe. Haven er ikke så stor at man ville kunne lave jordvarme. Så kunne man integrere nogle solfangere eller sådan noget. Det har holdt mig lidt tilbage at gasfyret kun er så gammelt som huset, altså ca. 20 år og det kører udemærket. Jeg har en forholdsvis lav regning, så økonomisk ville det ikke give så god mening at gå ud og investere i en ny løsning. Det ville heller ikke spare så meget CO2 i sidste ende. Det handler nok mest om det her med at erstatte et produkt der egentlig fungere med noget helt nyt."*	*H17-03*	
Maintenance	*CO2 er med i hans overvejelser. Han har gasfyr, men beskriver at det ikke er så slemt som eks. et oliefyr ift. klimamæssige. Hans overvejelse som hælder til ikke at skifte går på at der er lille forskel på at have et gasfyr og et luft til vand varmepumpe, og når nu gasfyret virker kan han lige så godt bruge det gamle endnu, da det jo også koster CO2 at producere et nyt anlæg.*	*H17-05*	
Information	*"Jeg har også overvejet at få solceller, men for de regler der er idag så er det en tilbagebetalingstid ift. at tjene anlægget ind på 10-15 år afhængig af hvor meget man bruger. Jeg er i tvivl om det er noget der vil få husprisen til at stige tilsvarende. Så det er en usikkerhed ift. hvor længe jeg skal bo i huset og om det når at betale sig. Det skal ikke bare være penge ud af vinduet. Jeg skulle være sikker på at bo i huset i 10-15 år for at jeg kunne se det som en god løsning, og det er ikke planen i det nuværende hus."*	*H17-06*	
Initial idea	*"Jeg har ikke problemer med mit nuværende tag, så det giver ikke mening at lave noget nu. Men det kunne være interessant at undersøge om det kunne gøre en forskel at lægge noget ekstra isolering op på loftet. Jeg har tænkt mig at sidde og regne lidt på det. Jeg studerer til bygningsingeniør og har derfor nogle kompetencer indenfor området."*	*H17-07*	
Advice and guidance	*"Det var tømren der i sin tid, rådede mig til at få lagt mere isolering på taget."*	*H18-01*	*House owner 18*
Advice and guidance	*"Jeg ville gerne have haft solvarme. Men det rådede tømren mig til at lade vær med."*	*H18-02*	
Advice and guidance	*"Jeg ved ikke hvad andre alternativer er, jeg googler meget. Jeg leder efter noget der kan varme vandet i mit gulvarme op." "Jeg har ikke kontaktet nogen der ved noget om det, jeg googler bare."*	*H18-03*	
After renovation	*"Jeg vil gerne skifte, fordi jeg er 72 år, og de der poser med piller, bliver tungere og tungere - jeg gider ike bære rundt på dem mere. Der er så meget arbejde i den pilleovn, man skal hele tiden rense den, og jeg har haft så meget vrøvl med den. Jeg har aldrig turde sove mens den kørte."*	*H18-04*	
Before renovation	*"Jeg ville gerne have en varmeblæser på. Jeg gider ikke det der pilleovn længere, jeg ville gerne have varmeblæser, men de tilbud jeg har fået er over 100.000, og det vil jeg altså ikke give. Så lige nu leder jeg efter nogle alternative løsninger."*	*H18-05*	
Before renovation	*"Der er ikke noget budget, men jeg gider altså ikke skylde for 125.000. Man kan få meget el-opvarmning for de penge."*	*H18-06*	
Before renovation	*"Jeg har bygget til og lagt nyt tag på i den tid jeg har boet her. Grunden til at jeg lagde nyt tag på, var netop fordi jeg skulle bygge til, og så var der en der sagde til mig, at nyt tag var den bedste energirenovering man kunne foretage sig. Så når jeg nu alligevel skulle have nyt tag på en ny tilbygning, kunne jeg jo ligeså godt få det på hele taget."*	*H18-07*	
Advice and guidance	*"Det er helt typisk at man står i et problem, så tænker at det kommer til at koste mange penge, men så hvis man får noget god vejledning kan det gøre at man ender ud i, at man kommer til at spare penge og bliver glad for den nye løsning."*	*H19-01*	*House owner 19*
Advice and guidance	*Har ikke overvejet energivejleder eller anden form for rådgivning. Fortæller at når det bliver nævnt er det noget de godt kunne overveje.*	*H19-02*	
Benefits	*Har ikke overvejet at have generering af grøn energi via eks. solceller. Hvis de skulle ske forklarer hun: "Så tror jeg at det skulle være hvis man stod og alligevel skulle have skiftet sin varmekilde ud. Hvis man fik oplysning om at det ville være en fordel med solceller."*	*H19-03*	
Benefits	*"Jeg har ret begrænset viden om hvad energirenovering er. Jeg tror både jeg tænker det relaterer sig til klima og økonomi." Bliver spurgt ind til om hun kender til potentialer ved energirenovering: "Hvis vi lige tænker vores aktuelle hus, så nej."*	*H19-04*	
Before renovation	*Spørges ind til om hun har nok viden på området til at kunne tage en beslutning om at skifte: "Overhoved ikke."*	*H19-06*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Before renovation	*Fortæller at udskiftning af vinduer er sket løbende i sammenhæng med andre renoveringer i huser: "Vi har fået skiftet vinduer ud over flere omgange i hele huset. Det er gjort sporadisk, så da der kom nyt køkken har vi fået skiftet dem ud der og da der kom nyt bad skiftede vi dem ud der, og sådan. Det er gjort meget løbende. De blevet skiftet hvis de trængte til at blive skiftet".*	*H19-07*	
Before renovation	*Har i forbindelse med andre renoveringer (køkken, bad og bryggers m.v.) også fået lavet andre energirenoverende tiltag med eks. gulvvarme.*	*H19-08*	
Initial idea	*Overvejelser om hvorfor de ikke har valgt at energirenovere: "Tingene fungerer, så vi har ikke været tvunget ud nogle overvejelser om at skulle gøre noget andet."*	*H19-09*	
Initial idea	*"Vi ved at på et eller andet tidspunkt, så skal det (gasfyr) skiftes aldersmæssigt. Vi har ikke overvejet at skifte det andet end hvis det så 'brænder ud' og ikke virker mere på et tidspunkt."*	*H19-10*	
Initial idea	*Har fået skiftet taget i 2008. "Det var simpelthen bare et gammelt tag. Vi oplevede lidt utætheder. Der var sådan nogle smådryp inde i stuen. Det trængte til at blive skiftet." Fortæller at de ved at skifte taget ikke længere oplevede utætheder, men de oplevede ikke andre gevister - oplevede ikke ændringer i indeklima eller på varmeregningen efterfølgende.*	*H19-11*	
Benefits	*Man burde jo energirenovere. Men derfra og så til at få det gjort..... Den anden side er jo økomien i det. Føler ikke at jeg vil få noget for mine penge, selvom jeg ved det er fornuftigt. Det er meget diffust hvad det er jeg får ud af det (energirenovering)*	*H20-01*	*House owner 20*
Energy optimisation	*hvad vil motivere at investere i solpaneler? Hvis vi nu skulle have gjort noget ved taget, så skulle vi måske have sat det på, men ikke ellers. Kan sagtens se ideen i det der. Der ville det være et økonomisk incitament med solceller, men kun i forbindelse med at man lavede noget andet.*	*H20-02*	
Advice and guidance	*"Jeg har en kollega der har solceller, hun kan ikke stoppe med at snakke om hvor fantastisk det er, og hun kan ikke forstå at der ikke er mange andre der har det."*	*H21-01*	*House owner 21*
Advice and guidance	*"Huset er blevet tjekket, og det fik den næst-dårligste energiscore, så vi ved godt at vi skal have gjort noget ved det på sigt. Vi vil gerne, det handler bare om timing."*	*H21-02*	
Advice and guidance	*"For 3 år siden, hvor der var nogle virksomheder som tilbød at lave et gratis miljøtjek af huset, så man ligesom kunne finde ud af hvad det var for nogen problematikker der var med huset."*	*H21-04*	
Advice and guidance	*"Når vi skal skifte taget, er det jo en del af et større projekt, så vi ville tage fat i et totaltentreprisefirma. Det er formentlig der vi ville starte."*	*H21-05*	
Advice and guidance	*"Vi har kun snakket med min onkel omkring det her, som er tømrer. Han ved rigtig meget, så ham kan man spørge, og så kan man sige om det giver mening eller ej."*	*H21-06*	
Advice and guidance	*"Endnu mere praktisk, så er vores nabo ved at bygge til - lidt samme process som vi overvejer. Så vi ville nok gå derind og spørge om de er tilfredse. Og vores nabos nabo er bygningskonstruktør. Så ham ville vi nok også kunne spørge."*	*H21-07*	
Before renovation	*"Vi ville gerne komme med 20% af finanseringen selv. Så kan man tage resten som real-kreditlån. Det er sådan at man kan låne op til 80% af boligens værdi. Så det er ligesom tanken bag."*	*H21-08*	
Grants & political instruments	*"Vi har tænkt på det (solceller), men staten fjernede støtten til det for et par år siden. Og det ville også være på bagsiden af renoveringen. Det giver heller ikke mening at sætte solceller på et gammel tag."*	*H21-09*	
Before renovation	*"Vi gætter på at det er taget og loftet der er den største synder. Derefter må det være vinduerne, specielt i udestuen. Men hvis vi skal bygge til, så vil det også gå udover udestuen, så det er også lidt tosset at få skiftet vinduerne."*	*H21-10*	
Before renovation	*"Vi var meget tæt på at gøre det ét år - så nåede vi det ikke fordi der var nogle ting som ikke gav mening alligevel. Det var at få sprøjtet noget stengranulat ind i loftet, men fordi vi ved vi skal have skiftet tag på et tidspunkt, så er det bedre at gøre det hele i én omgang."*	*H21-11*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Before renovation	*"Da vi var lige ved at gøre det, var barrieren at vi ikke vidste hvonår vi skulle bygge til - så gav det ikke mening, det kunne ikke nå at tjene sig hjem."*	*H21-12*	
Before renovation	*"Vi tænker umiddelbart at vi bliver boende i huset mens vi laver om, måske i de varme måneder."*	*H21-13*	
Thermal comfort & indoor climate	*"Der er god naturlig udluftning i vores indeklima. Den afhænger meget af udendørstemparaturen. Vi har det varmt om sommeren, og koldt om vinteren."* *"Vi har nogle gamle vinduer i udestuen, og nogle lidt nyere i resten af huset - det kunne godt være der var noget at hente, ved at skifte dem.""*	*H21-14*	
Initial idea	*"Der var en del der skulle renoveres da vi flyttede ind. De tidligere ejer havde boet der siden det blev bygget, og så har de røget. Vi overtog huset med alt hvad det indebar, tykke gulvtæpper." "I forhold til energi, har vi skiftet radiatorer da vi flyttede ind."*	*H21-39*	
Before renovation	*"Vi venter, da det er det økonomiske aspekt der er det primære. Vi har sat os et mål om at vi skal spare nogle penge sammen til det, så vi ikke bare låner det hele, så det er det vi går og venter på."*	*H21-39*	
Accurate and trustworthy information	*"Det med at have energikonsulenten gjorde at vi følte at vi fik nogle saglige svar. Det er lidt ligesom at have en advokat som er på vores side - repræsentere os og på vores interesser. Vi snakkede også om at bruge ham videre. Det ville have været godt for mig, så vi ikke skulle sidde og håndtere alle de her ting selv. Det lød dog ikke at det var så normalt. Når det er sådan et forholdsvis lille projekt kan det også virke lidt skørt at bruge 1/5 af budgettet på en byggesagkyndig eller sådan noget. Men i princippet ja, et eller andet hvor man har den der støtte ville helt klart være noget jeg ville overveje, hvis det var noget der fandtes."*	*H22-01*	*House owner 22*
Acurate and trustworthy information	*"Der er sådan en facebookgruppe her i Egedal kommune hvor der var et opslag for en måned siden hvor de kørte sådan et eller andet energinetværk. Så det var Furesø, Ballerup, Lyngby og Egedal som var gået sammen. Så var der en dag i hvor de havde samlet en masse håndværkere og så var energitjenesten der også og nogle fra kommunen. Så kunne man ligesom gå rundt på en 'energimarkedsplads' og snakke med håndværkerene. Så det blev vi enige om at var en god ide - så der var jeg rundt og snakke med forskellige håndværkerfirmaer. De havde udstillet varmepumper, man kunne få brochurer og have en dialog. Så var ham for energitjenesten der også og så fik vi noteret mail. Jeg kunne fornemme at da vi snakkede med alle de her håndværkere så siger den ene 'jaja, vi kan sagtens få jordvarme' og den anden siger 'ej, det skal i ikke have'. Jeg synes det var svært og jeg tænkte hvordan fanden skal jeg vide hvad jeg skal, så jeg tænkte at det var meget rart at have energitjenesten inden over. Det er dem der laver energimærkerne, så de er meget godt til at lave sådan nogle gennemgange af huset. Det havde vi jo ikke brug for, fordi huset er så nyt, men jeg spurgte til om vi kunne få vejledning. Vi ville gerne have vejledning fra en som er sagkyndig, som er neutral og som ikke prøver at sælge en en for stor varmepumpe. Han tilbød for omkring 2000 kr. at komme ud i en time og snakkede det igennem med os. Det er det vi har fået. Han har peget på nogle forskellige ting som vi skulle være opmærksomme på. Han har sjusset hvor stor varmepumpen skal være og han har sagt lidt om hvordan han ville gribe det an."*	*H22-03*	
Acurate and trustworthy information	*"Det der er svært er at gå fra de her tanker til at gøre det. Vi snakkede eks. om håndværkere. Det er en stor usikkerhed for mig. Det er meget forskellige hvordan de opfatter det og nogle af dem er lidt smart-ass. Vi vil gerne have nogle som er kyndige og som ikke prøver at sælge os noget som vi ikke vil have. Jeg er lidt nervøs for hvem vi skal vælge - hvordan kan jeg stole på dem. Det bliver en bremse, for vi har ikke taget kontakt til nogle endnu selvom vi har snakket om det. Det skræmmer lidt det er med at der er så mange firmaer og hvad skal man så vælge. Ham fra energitjenesten nævnte nogle som har stor erfaring på området, så jeg tænker at det bliver den vej vi går. Det er en stor barriere."*	*H22-04*	
Before renovation	*"Det handler også om dialogen med banken - det er jo afgørende at man kan få penge til det. Jeg savner lidt at bankerne tager en proaktiv rolle."*	*H22-06*	
Maintenance	*"Vi vil gerne have noget af god kvalitet. Min mand er helt vild med sådan noget smart technology så varmepumpen skal kunne noget. Vi regner med at skulle bo her en masse år endnu, så vi vil gerne lave en ordentlig investering."*	*H22-07*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Grants & political instruments	*"Det har også spillet ind det her med at regeringen har italesat at man vil udfase gasfyr. Det er klart at så bliver man påvirket af det. Så det har også påvirket en lille smule."*	*H22-08*	
Grants & political instruments	*"Altså man havde jo før i tiden det her med at hvis man skrottede sit oliefyr så fik man 10.000 kr. Så vi har også talt om, om vi skal vente lidt hvis nu der kommer støtte hvis man skrotter sit gasfyr, fordi de snakker om det."*	*H22-09*	
Grants & political instruments	*"Noget af det som også motiverer er at man også kan få noget tilbage i skat på det her med energirenovering - det der håndværkerbidrag. Det betyder en del for os at vi kan få nogle af penge tilbage i skat til næste år, for et kan for os gå hen og blive en ret stor sum."*	*H22-10*	
Environmental sustainability	*Ikke at skulle være tilknyttet nettet tiltaler: "For mig er det meget den der afkobling. Jeg føler at det er meget sådan green-washing ift. at strømmen på nettet er grøn - jeg køber den ikke helt. Jeg kan godt lide tanken om at hvis man vil gøre noget så er man helt afkoblet. Det kunne jeg godt tænke mig at man nåede derhen." Derfor tænker hun også i at have regnvandsopsmaling og sådan noget kombineret med solceller.*	*H22-11*	
Initial idea	*Ikke at skulle være tilknyttet nettet tiltaler: "For mig er det meget den der afkobling. Jeg føler at det er meget sådan green-washing ift. at strømmen på nettet er grøn - jeg køber den ikke helt. Jeg kan godt lide tanken om at hvis man vil gøre noget så er man helt afkoblet. Det kunne jeg godt tænke mig at man nåede derhen." Derfor tænker hun også i at have regnvandsopsmaling og sådan noget kombineret med solceller.*	*H22-11*	
Before renovation	*"Noget af det jeg synes er meget fedt ved jordvarme, som andre måske ikke synes er så fed, er det her med at få gravet haven op og så få genanlagt den. Så man kan få investeringen i at få omlagt haven ind i renoveringsbudgettet."*	*H22-12*	
Advice and guidance	*Fortæller at erfaring fra reserach projekt hvor hun besøgte nogle med varmepumpe der havde store problemer med at den stod og brummede. "Så kan den jo stå udenfor, men så står den bare der og brummer, og nogle havde den nærmest ved deres teresse, hvis jo var skide irriterende. Der sagde ham for energitjenensten også at vi skulle være opmærksomme på - vi har forholdsvis små grunde og huset ligger forholdsvis tæt på naboen - han sagde at der skal være en vis afstand på grund af støjregulering. Der henviste han til et sted på nettet hvor man kan se ens grund og beregne hvor meget støjen ville sprede sig. Det skulle man så vedlægge sådan en byggesag til kommunen når man nåede så langt. Det var jo noget jeg ikke var opmærksom på før han sagde det. Det var faktisk derfor vi kom frem til jordvarme, for så behøver man ikke have den der larm."*	*H22-13*	
Initial idea	*"Vi har sådan et gasfyr og der har vi haft service på for et par måneder siden. Der sagde ham der lavede service på det at gasfyret var ved at tærret igennem, så vi skal have skiftet det. Han sagde at man kunne ikke skifte delene, så der skulle bare installeres et nyt. Derfor har vi kigget meget på i stedet for at erstatte det med et nyt gasfyr, så har vi tænkt at vi gerne vil over på noget mere vedvarende, så vi har kigget på noget varmepumpe. I den forbindelse overvejer vi jordvarmeanlæg at koble på."*	*H22-14*	
Before renovation	*"Solcellerne som vi har snakket lidt om det er måske på lidt længere sigt. Det skulle tænkes sammen med bilerne og vi har sådan nogle leasing biler som der stadig er tre år til at vi skal have skiftet. Jeg tror at hvis vi går med jordvarmeløsning så bliver investeringen for stor til at vi kan spille meget mere ind, så i første omgang kigger vi meget på jordvarme og de der ting. Solceller kunne være i et lidt længere perspektiv. Det er jo nemt nok - det er bare at klastre på taget. Men er stadig i gang med at undersøge og vi har ikke helt fået økonomi på plads. Det her med Corona-krisen har også sat lidt en stopper for det, for vi ville have lånt pengene i huset, men nu siger de at huspriserne bare falder, så gad vide om det sætter en stopper i det. Så er det klart at så mister vi den friværdi som vi kunne have lånt det i. Det er sådan nogle ting vi lige skal have fået fulgt op på. Vi har heller ikke fået konkrete tilbud endnu fra håndværkeren. Vi har kun fået sådan nogle løse tal som folk har slynget ud."*	*H22-15*	
Advice and guidance	*"Vi har ikke haft overvejet andet end vinduerne, for det er faktisk gjort udemærket hele vejen rundt. Vi har haft en energikonsulent til at kigge på det. Han har sagt at loftet er fornuftigt isoleret, taget er fint isoleret og der er undertag og sådan. Taget er også kun de her der 30 år gammel. Så vi har egentlig et sundt hus hvor der er de ting der skal være."*	*H23-01*	*House owner 23*
Economy	*Hvorfor de ikke har valgt at energirenovere: "Vi kan se på vores varmeudgifter at de er meget fornuftige ift. de antal kvadratmeter vi har."*	*H23-02*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Initial idea	*"Jeg synes det er smart det her (varmepumpe). Jeg er medlem af en roklub og der har vi lige fået installeret varmepumper - det giver en helt anden energi og varme i omklædningsrummene. Så det er super og det har kostet stort sent intet at lave. Vi har så fjernvarme her, så for mig er det ikke aktuelt, men ideen kan jeg se ift. roklubben. Vi er egentlig godt tilfredse med fjernvarmen, så det ville ikke give mening at skifte."*	*H23-03*	
Initial idea	*"Jeg har flere kammerater som har installeret solceller på taget og de er rigtig glade for det. Det har været en god investering for dem, for de får penge tilbage, så deres investering har tjent sig ind. Det gjorde det inden for en forholdsvis kort tid."*	*H23-04*	
Initial idea	*"Vi har fået skiftet altandørene netop med baggrund i at de var total rådne - det var ikke godt nok lavet."*	*H23-05*	
Before renovation	*Motivation for at gå videre og få skiftet vinduerne: "Vi har det egentlig godt nok som vi har det, så det skal være når det lige kan falde ind og når det lige passer. Det er når der er nogle der byder ind med det rigtige tilbud. Det handler om at finde den rigtige pris. Vinduerne er ikke ved at falde ud af huset, så det er ikke sådan i den tilstand, men vi vil gerne have dem skiftet på et tidspunkt. Det er ikke sådan at vi fryser fordi det står og piver ind af vinduerne. Det er ud fra vedligeholdelsesmæssigt at vi gerne vil have dem skiftet."*	*H23-06*	
Regulations	*"Vi har snakket om solvarme, men det må vi ikke få. Det kan vi simpelthen ikke få på vores tag af hensyn til - der ligger en bygningslovgivning eller sådan noget - det er fordi bygningen er bevaringsværdig. Så derfor kan vi ikke bare lægge soltag på. Det er forresten også for dyrt ift. vores forsikring fordi det vil de heller ikke være med til. Det er ellers noget vi har overvejet."*	*H23-07*	
Advice and guidance	*Erfaringer fra netværk gav negative associationer: "For omkring 15 år siden købte vi en varmepumpe til min svigermor og den var ikke særlig god - den drillede. Den blev skiftet nogle gang. Jeg tror hun nåede at få tre nye af samme mærke inden den til sidst virkede. Men jeg tror at de er blevet bedre siden da."*	*H24-01*	*House owner 24*
Advice and guidance	*Erfaringer fra netværk har også været brugt som rådgivning: "Du har snakket meget med Jørgen (en ven i netværket der ved meget om varmepumper) om hvilket mærke det skal være og sådan noget."*	*H24-02*	
During renovation	*"Jeg har arbejdet som håndværker i mange år, så jeg ved jo godt hvad det er der skal til. Jeg laver det selv."*	*H24-03*	
Initial idea	*Motivationen for at de overvejer at energirenovere er en kombination af at det er slidt og at det ikke ser godt ud: "Vi vil gerne have at det ser pænere ud."*	*H24-04*	
Initial idea	*Overvejer at få foretager energirenoveringer: "Ydervæggene skal gås igennem så vi får isoleret mere på udvendigt. Det skal også tjekkes om alt er som det skal være længere inde." og "der er nok også et par vinduer der skal skiftes." og "så snakker vi om, vi har altid kun brugt brandeovnen. Vi havde et oliefyr men det pillede jeg ned, for den var dyr at bruge. Jeg har nogle aftaler, så indtil videre har det ikke kostet en krone at fyre op. Så man kan sige at vi isolerer ikke for at spare udgifterne på varmen. Men man kan sige at vi er i den alder at det kan godt være at der kommer et tidspunkt hvor man ikke orker at stå og skære brænde op, så det er vores tanke på et tidspunkt at vi skal have en varmepumpe som kan tage over. Den har været på tale i flere år, men jeg ved at en varmepumpe har en levetid på 10-15 år, så havde vi købt den fra start skulle den have været skiftet nu. Jeg trækker den så langt som vi kan - indtil vi virkelig har behovet"*	*H24-05*	
Initial idea	*Overvejelser om solcelle scenarie: "Samtidig synes jeg også at hvis man skal have sat solceller op, så skal det være på et nyt tag. Man skal ikke begynde at sætte dem på et gammelt tag, for hvis man så stå 10 år efter og taget skal skiftes, så bliver det noget rod."*	*H24-06*	
Before renovation	*Erfaringer fra netværk er barriere: "Vi har nogle venner som går meget op i varmepumper. Når hans har siddet der i seks år så køber han en ny, for så er der sket noget teknologisk udvikling. Det er derfor jeg har holdt lidt igen."*	*H24-07*	
Before renovation	*Barrierer der har gjort at de ikke har energirenoveret: "Da jeg var på arbejdsmarkedet havde jeg ikke tid (til at energirenovere)."*	*H24-08*	
Initial idea	*"Vi har et gammelt etanittag og det er dem som holder i mange år, så jeg tror ikke at vi skifter det før at pladerne begynder at knække. Isoleringen nedenunder har vi isoleret, så der er ikke noget der skal forbedres det. Der er isoleret så meget vi kunne - altså man kunne godt have sat mere på men så ville rummet blive alt for lille."*	*H24-09*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Business through energy renovation	*"Vi kæmper hovedsageligt for kundens behov. Vi skal have lavet den laveste varmeregning muligt, og vi skal samtidig også have det bedste produkt. Og vi tilbyder ikke en halv løsning."*	*E01-03*	
Business through energy renovation	*"Det der oftest gør at folk er motiverede til at energirenovere er at de kan spare noget på deres varmeregning, eller kan få et bedre indeklima pågrund af energiforbedringer i huset."*	*E01-04*	
Initial idea	*"Vi vil gerne have nye vinduer. Det handler ikke om indeklima. Dem der er der holder nok ikke vores liv ud, så de skal nok skiftes."*	*H24-10*	
Thermal comfort & indoor climate	*Fortæller at det er vigtigt med indeklimaet: "Mange har det for tæt. Vi har det sådan at man skal også kunne få luft.". Fortæller at en i netværket fik nye vinduer og han blev efterfølgende nødt til at bore hul i vinduerne for at for ordentligt luft ind. "Hvis man får isoleret det hele meget, så kræver det at man har noget genveksling som skaber cirkulation i huset, men det kan kun laves i nye huse."*	*H24-11*	
Business through energy renovation	*"Langt de fleste energirenoverer jo i forbindelse med at de vil opdatere deres hus, og bygge noget nyt, laver en tilbygning osv. - det er de færreste der gør det i forbindelse med energiforbrug."*	*E02-03*	
Thermal comfort & indoor climate	*Fortæller at det kunne være en motivation at skifte fra kun brændeovn til også at have en varmepumpe ift. komfort: "så er der varme når vi kommer hjem og vi slipper for at fyre hele tiden."*	*H24-12*	
Environmental Sustainability	*Vi fik solceller i håb om at få en besparelse, og så samtidig være mere miljøvenlige. Der var en god ordning dengang for solceller, som vi kom med på, som de aller sidste. Vi får samme pris for det vi køber og det vi sælger. Nu er det blev forurenet, ved at de regner det i nogle intervaller. Så alt det vi bruger, mens solen skinner, det er gratis.*	*H27-03*	
Initial idea	*Vi er glade for soltaget, men det er som sagt ikke pågrund af økonomien, det er mere sådan 'idealisme'. Hvis jeg skulle gøre noget nu, skulle jeg have nogle nye paneler som ikke er utætte, og så ville jeg nok også få sat batteri på.*	*H27-06*	
Financing energy renovations	*Prisen på boligen handler også om det geografiske ift. hvor meget man kan tage for en bolig. Der er for forskellige området et loft for hvor dyrt man kan sælge en bolig, så man kan ikke blive ved med at renovere og så vil boligens pris blive ved med at stige. Sådan fungerer det ikke. Der er derved forskel på muligheden for at tage et lån afhængig af hvor man bor i landet, for hvis banken vurderer at boligen ikke vil stige nok i pris, så kan man ikke få et realkriditlån og så skal man ud i et lån som gør det en del dyre at tilbagebetale.*	*B01-02*	
Financing energy renovations	*"Vi har lavet forskellige tiltag ift. energirenovering gennem tiden, men uden det store helt. Det vi oplever er at folk vil hellere bruge penge på det der kan ses."*	*B01-03*	
Financing energy renovations	*"Forbrugerne er generelt dårlige til at efterspørge energirenovering"*	*B01-04*	
Financing energy renovations	*Jyske bank er i øjeblikket igang med at indgå et samarbejde med Energistyrelsen - noget der hedder 'Byg om så det kan mærkes'. "Det går ud på at vi skal hjælpe med at skubbe på og henvise folk til nogle hjemmesider hvor de kan regne på det og sådan noget. Det er ikke helt kommet igang endnu. Vi har prøvet noget ligenende før, men vi fik ikke så meget ud af det. Det er svært at få folk til at bruge de ekstra penge."*	*B01-05*	
Financing energy renovations	*For mange år siden havde de et projekt med energi nord hvor alle der havde kontakt til kunder med egen bolig skulle vise side og hjælpe med at regne og få et overslag og få et overslag på hvad der kunne være relevant for den enkelte at skifte. De har også haft samarbejde med BetterHome hvor energi vejledere kan komme ud og se på boligerne. Det var der dog heller ikke den store succes med."*	*B01-06*	
Financing energy renovations	*Motivationen for banken er at låne penge ud "Det er det vi lever af, så jo flere behov vi kan være med til at tænde, desto bedre for os - det er vores primære interesse i det. "Hvis vi kan vække et behov for at energirenovere, så vil vi gerne det."*	*B01-07*	
Financing energy renovations	*Ved en mere energirigtig bolig har kunderne et større rådighedsbeløb om måneden (da de betaler mindre i energiforbrug). De kan derfor købe et dyrere hus, da de har flere penge til at betale af på lånet. Dette tager banken med i beregninger når de låner penge til folk der vil købe et hus.*	*B01-08*	

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Topic	Source	ID	Actor
Financing energy renovations	*Deres rådgivere gør sådan at de kigger i energivurderingen ved køb af nyt hus og så spørg de ind til om køberne vil låne lidt flere penge for at indfri de muligheder der er præsenteret i energi tilstandsrapporten (energimærket). De trænede rådgivere i at kigge i energimærkerapporer og sprøge ind til om køberne skal have et ekstra lån for at optimere huset.*	*B01-10*	
National socio-economic optimal level of energy renovations	*15:02 Bygnignsreglemanger er bygget op til at man har analyseret sig frem til at der er et samfundsøkonomiskt optimalt potentiale ved at renovere eksisterende boligmasse og dermed spare 30% af det nuværende energiforbrug i boliger. Dette har man så taget med over i bygningsreglemanget og strammet det op så man kan nå op på de 30% energibesparelse.*	*K01-01*	*Danish Energy Agency Expert*
Knowledge for the house owners	*"Vi har jo som videncenter en interesse i at ting omkring boligen der er aktuelle og vigtige det skal vi sørge for at formidle og bidrage med viden omkring, så det er forståeligt for alle og enhver."*	*K02-01*	*Building expert from Bolius*
Local green growth	*Fortæller at de har prøvet mange tiltag hvor man skal få ejendomsmæglere og banker til at større agendaen, men det får ikke folk til at energirenovere.*	*M01-02*	
Local green growth	*Energimærkerapporter har haft et ry for at være af svingende kvailitet og det har været i forbindelse med at man skal sælge hus at de udarbejdet. Det prøver Energistyrelsen nu at ændre. Det skal være et system der gælder på tværs af kommuner.*	*M01-03*	
Local green growth	*Kommunen betaler energitjenesten for at være tilgængelige for deres borgere, så de kan yde energirådgivning. De er uvildige og dygtige.*	*M01-04*	
Local green growth	*Selvom borgere har med friværdi bliver rådgivet om energirenovering er det kun et fåtal der vælger at energirenovere.*	*M01-05*	
Local green growth	*Oplever at folk ikke forstår energien i sit hus. Hun siger at det derfor kan give rigtig god mening at få en rådgiver ud og gennemgå huset sammen med husejeren. Samt at husejeren bagefter får noget papir på hvad der kan gøres.*	*M01-06*	
Local green growth	*De arbejdet meget ud fra at fange folk der har et window of opportunity/hotspot. De gør det ved at udbyde energitjek (100-150 energitjek om året). De sender mails ud i e-boks.*	*M01-07*	
Local green growth through energy renovation	*Kommunen er meldt til som klimakommune.*	*M01-08*	
Local green growth	*Motivation: Klima og lokale jobs*	*M01-01*	*Development consultat from a Municipality 1*
Local green growth through energy renovation	*De har lavet flyers som de giver med når husejere henvender sig hos kommunen*	*M02-02*	
Local green growth through energy renovation	*Kommunen skal være upartisk og må ikke være konkurrenceforvridende. Derfor må de ikke give specifikke henvisninger. Via projectZero kan de dog give mere specifikke henvendelser. Der er lavet uddannelse til håndværkere, så de kan fungere som energirådgivere. Kommunne kan ikke henvise til specifikke håndværkere, men de kan henvise til projectzero som derfra kan henvise til håndværkere.*	*M02-03*	
Local green growth through energy renovation	*Kommunen har en quick-cafe hvor borgerne kan komme ind fra gaden og trække et nummer og komme til at tale med en byggesagsrådgiver. Her oplever vi at borgerne kommer med forspørgsler omkring energirenovering. Vi kan i den sammenhæng give råd omkring lovgivning og hvad der teknisk kan være smart.*	*M02-04*	
Local green growth through energy renovation	*Kommunen er drevet af den dagsorden som byrådet har. De skifter hvert 4. år. Sønderborg vil gerne kunne bryste sig af at være en grøn kommune.*	*M02-05*	

APPENDIX 4 - INITIAL EMPIRICAL FINDINGS

Topic	Source	ID	Actor
Local green growth through energy renovation	*Samarbejder med andre kommuner (også ud over det energimæssige), hvor man drøfter hvad det er for nogle erfaringer man har.*	*M02-06*	
Local green growth through energy renovation	*Kommunens byråd har sat et mål om at være CO2 neurtal - ProjectZero*	*M02-01*	*Development consultat from a Municipality 1*
National socio-economic optimal level of energy renovations	*15:45 Energstyrelsen har sagt at vi skal helst have over 30 % energireduktion i den eksisterende boliger, og hvordan gør man så det? Så tilpasser boligstyrelsen bygningsreglemanger med så skrappe krav at man kan opnå detr.*	*K01-02*	
National socio-economic optimal level of energy renovations	*16:14 Man har vudreret at omkring 30% er det mest samfundsøkonomiske ift. hvad det koster at renovere ift. hvad det koster at udbygge vedevarende energi. På et eller andet tidspunkt bliver det så dyrt at mindske energiforbruget yderligere, at det er billigere at bygge ny vedevarende energi. Det er omkring dette punkt som det er mest optimalt, men ikke mere end det*	*K01-03*	

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H05	*Dorte the Drifter*	*1920*	*39 år*	*1 voksen (børn flyttet hjemmefra)*	*1992*	*Har lidt erfaringer med gør-det-selv, men kun små projekter*	*Har lidt viden fra tidligere renoverings-projekter*	*- Slitage - Ville gerne have nogle væresler, og ville isolere i den forbindelse*	*- Finansiering - Overskud (pensionist)*	*"Nu hvor jeg er blevet pensionist er overskuddet ikke det store og der er ikke lige så mange penge til rådighed." (5)*
H16	*Dorte the Drifter*	*1957*	*51 år*	*2 voksne (pernsionister)*	*1980'erne*	*Har lidt erfaringer med gør-det-selv, men kun små projekter*	*Har lidt viden fra tidligere renoverings-projekter*	*- Kan mærke at det trækker*	*"- Financiering (pensionist) - Tid tilbage i huset - Begrænset tillid til håndværkere"*	*"Når man når vores alder, så er energirenovering en lille smule for sent. Det vi har gjort undervejs har været godt, men når man taler om store ting, så nej, for det vil koste os mindst 100.000-150.000 kr. Det er en stor udgift når man ikke er på arbejdsmarkedet og når man ikke har en kæmpe pension, så tænker man på en anden måde end hvis man bare har."*
H18	*Dorte the Drifter*	*1970'erne*	*20 år*	*1 voksen (pensionist)*	*-*	*Har nogle kompetencer på området*	*Har begrænset viden på området (kun fra egen research)*	*- Magelighed (pillefyr er besværligt, piller er tunge)*	*"- Financiering - Tid tilbage i huset"*	

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H03	*Inspector Gadget*	*1987*	*33 år*	*2 voksne og 2 børn (flyttet hjemmefra)*	*-*	*Han er VVS installatør*	*Har over middel viden på området*	*"- Øget effektivitet på varmekidle - Ny teknologi"*	*"- Travl hverdag - Ikke nødvendigt"*	*"Den nye teknologi var den kondenserende teknik, så der valgte jeg at skifte kedel - at få fra ikke kondenserende til kondencerende. Det var for at spare på energien. Den er mere effektiv."*
H17	*Inspector Gadget*	*2011*	*1,5 år*	*Bor alene (roomies)*	*-*	*Har læst til bygningsingeniør og læser nu til elektroingeniør*	*Har meget tekisk viden og ved en del om energirenovering*	*"- Synes det kunne være spædende - Ny teknologi"*	*"-Financiering - Ikke nødvendigt"*	*"Men det kunne være interessant at undersøge om det kunne gøre en forskel at lægge noget ekstra isolering op på loftet. Jeg har tænkt mig at sidde og regne lidt på det."*
H15	*Idealist Irene*	*1970'erne*	*12 år*	*2 voksne, 2 børn der bor hjemme*	*2010*	*Tidligere elektriker*	*Har meget viden indenfor solceller*	*- Ideologi (ideen om at producere sin egen energi og det bæredygtige aspekt)*	*- Frustreret over ændrede regulativer for solpaneler*	
H27	*Idealist Irene*	*2002*	*12 år*	*2 voksne, 2 børn*	*2013*	*Ikke decideret kompetencer til at energirenovere*	*Lidt viden omkring solceller og deres potentiale*	*- Miljø og bæredygtighed*	*- De nuværende solpaneler virker stadig lidt - de vil først handle når det er gået helt i stykker*	*"Vi er glade for soltaget, men det er som sagt ikke pågrund af økonomien, det er mere sådan 'idealisme'."*

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H22	*Idealist Irene*	*2004*	*13 år*	*2 voksne, 2 børn*	*Har ikke energi-renoveret*	*Lektor på design ingeniøruddannelse. Har haft projekter om 'energi-selvstændige' boligområder*	*Har ikke viden om energirenovering, men teknisk basisviden*	*- Miljø og bæredygtighed (ideen om at være off-grid)*	*"- Mangel på tillid til håndværkere - Financiering - Tidskrævende proces - Besvær med at finde optimal løsning"*	*"For mig er det meget den der afkobling. Jeg føler at det er meget sådan green-washing ift. at strømmen på nettet er grøn - jeg køber den ikke helt. Jeg kan godt lide tanken om at hvis man vil gøre noget så er man helt afkoblet."*
H07	*Iceman*	*Starten af 1900-tallet*	*15 år*	*2 voksne, 3 hjemmeboende børn*	*2013*	*Har få kompetencer på området*	*Har næsten igen viden indenfor området*	*Indeklima*	*"- Financiering - Prioriterer det ikke"*	*"Vi kan mærke at vi ikke har det samme kuldenedfald som der kunne være tendens til før. Det har i hvert fald hjulpet."*
H11	*Iceman*	*1934*	*18 år*	*2 voksne og 1 voksent barn*	*-*	*Ingen (hyrede en totalentreprise til at tage sig af alt)*	*Ingen viden på området*	*Indeklima*	*"- Økonomi -uoverskuelighed - besværligt at planlægge"*	*"Vi var meget tilfredse med resultatet. Det var et smukt tag, vi var meget tilfredse med kvaliteten, og helhedsindtrykket. Vi kunne mærke forandringen med det samme. Vi har ikke tændt op i brændeovnen siden, det har ikke været nødvendigt."*

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H02	*Bob the Builder*	*1968*	*11 år*	*2 voksne, 2 børn (børn flyttet hjemmefra)*	*2019*	*Hustruen har forståelse for faget, og ønsker at lede projektet selv. De har før bygget et hus selv, og omtalte renoveringen som 'let'.*	*Har viden fra tidligere renoverings-projekt*	*"- Fodkoldt om vinteren - Lavede det som en del af nogle andre renoveringer"*	*- Hunden skulle først gå bort. Der skulle lægges nyt gulv i forbindelse med energi-renoveringen, og de ønskede ikke at det blev ødelagt igen.*	*"Jeg har bare undersøgt selv på nettet undersøgt hvad der er praktisk. Jeg har ikke rådført mig med nogle specielt. Vi gjorde det selv, så vi har bare i familien snakket om at det skulle laves."*
H04	*Bob the Builder*	*1963*	*24 år*	*2 voksne og 2 voksne børn*	*2004*	*Gjorde det hele selv, men havde dog en arkitekt inde over, for at få byggetilladelse. Manden er tømrer.*	*Har basis håndværker-viden*	*- Slitage (overtog huset da det var i en dårlig stand)*	*"- Slitage (det skal være i stykker før det skal skiftes) - Upraktisk ift. at få hverdagen til at fungre samtidig med selv at renovere"*	*"Lars er tømrer så han lavede stort set det hele selv på nær VVS'er og elektrikere. Han bliver også inspireret i sit arbejde når han selv er ude og renovere hos andre. Så han havde helt styr på hvad der skulle til."*
H06	*Bob the Builder*	*1958*	*29 år*	*2 voksne (børn flyttet hjemmefra)*		*Har selv lagt loft-isolering, men har også fået rådgivning og håndværker på resten*	*Har ikke selv viden på området og søgte råd hos håndværkere*	*- Henvisninger til renovering*	*- Rentabilitet*	

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H09	*Bob the Builder*	*1934/1972*	*2 år*	*2 voksne og 2 børn*	*2018*	*Hun er uddannet energikonsulent*	*Er uddannet energikonsulent og har der igennem bred viden på området*	*"- Slitage - Skulle leve op til de nutidige energikrav"*	*- Financiering (ikke nok penge)*	
H10	*Bob the Builder*	*1968*	*4 år*	*2 voksne*	*2016*	*Manden er håndværker, lavede selv de ting der skulle laves, har tænkt fremad i forhold til det praktiske*	*Har ikke særlig viden indenfor energirenovering, men generel håndværker-viden*	*Tilstandsrapport, nyt hus, råd fra arkitekter og andre fagfolk, indeklima og slitage betød også noget*	*"- Financiering (havde de haft flere penge ville de have lavet mere) - Tidskrævende selv at udføre arbejdet"*	
H12	*Iceman*	*1969*	*1 år*	*2 voksne*	*-*	*Har ingen særlige kompetencer indenfor energirenovering*	*Har begrænset viden på området (kun fra egen research)*	*"- Lovgivning - Tilstandsrapport - Indeklima"*	*- Dårlig oplevelse med tidlgiere renovering (dårlig teknologi og dårlig service)*	
H14	*Bob the Builder*	*1955*	*23 år*	*2 voksne og 2 børn*		*Han er tømrer, lavede det hele selv*	*Har ikke selv viden indenfor energirenovering men kunne bruge netværk til at finde optimal løsning*	*Slitage - huset var et håndværkertilbud*	*- Skal gerne laves i forbindelse med anden renoering.*	

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H01	*Dime-Lovin-Diana*	*1886/ 1970/ 1998*		*2 voksne, 2 børn (børn flyttet hjemmefra)*	*-*	*Har ikke kompetencer indenfor energirenovering*	*Har en smule viden på området*	*"- Lovgivning - Lavede beregning på sigt - pillefyr ville betale sig selv hjem på 5 år i forhold til oliefyr"*	*- Ikke nødvendigt (fyr virkede fint)*	*"I alt investerede vi 158.000 i hele løsningen, og det tjente vi ind gennem besparelse på varmeregningen på 5 år."*
H13	*Dime-Lovin-Diana*	*1956*	*24 år*	*2 voksne, 2 børn (flyttet hjemmefra)*	*-*	*Har ikke kompetencer indenfor energirenovering*	*Har begrænset viden på området (kun fra egen research)*	*"- Fradrag fra staten - Slitage"*	*"- Skal gerne laves i forbindelse med anden renoering. Gør projektet stort og uoverskueligt. Ikke 'need-to-have' - Finder det besværligt - Ikke nødvendigt"*	*"Grunden til at det var den rigtige timing, med renoveringen (fyret), var fordi at der var håndværkerfradrag. Derfor ville vi gerne have gjort det i 2019, så vi fik fradraget med det samme. Støtteordningen var det der gjorde at vi fik det gjort det på det tidspunkt i stedet for at vente."*
H23	*Dime-Lovin-Diana*	*1852*	*30 år*	*2 voksne, 2 børn (børn flyttet hjemmefra)*	*1989*	*Har brug for professionel hjælp*	*Har begrænset viden på området (kun fra egen research)*	*"- At kunne tjene investeringt tilbage på energibesparelser el. selv producere energi - Slitage"*	*"- Har en lav varmeregning - Venter på det rigtige tilbud. Det er ikke nødvendigt, så de tager sig god tid"*	

APPENDIX 5 - PERSONA FINDINGS

Husejer nr.	Persona type	Husets alder	Boet der i	Familetype	Renovering år	Kompetencer	Viden	Motivation	Barriere	Citat
H24	*Dime-Lovin-Diana*	*1950'erne*	*40 år*	*2 voksne (snart pensioneret)*		*Han har været tømrer*	*Har basis håndværkerviden*	*- Slitage - At spare på energiregningen*	*"-For travlt, vil gøre det selv - Der har ikke været mange penge at spare ved at energirenovere"*	
H08	*Peter Practical*	*1919*	*12 år*	*2 voksne, 1 barn*	*-*	*Har ikke kompetencer indenfor energirenovering*	*Har begrænset viden på området (kun fra egen research)*	*- Skulle alligevel renovere og inkluderede energitiltag, da de havde købt nyt hus*	*"- Financiering - Besværligt - Lever med det (blvier ikke prioriteret)"*	
H19	*Peter Practical*	*1954*	*22 år*	*2 voksne, 3 børn (2 er flyttet hjemmefra)*	*2000*	*Han håndværksmæssige kompetencer*	*Har begrænset viden på området (kun fra egen research)*	*- Slitage - Energi renovering i forbindelse med anden renovering*	*"- Oplever det ikke som nødvendigt - Ved ikke hvor de skal finde information"*	
H20	*Peter Practical*	*1967*	*9 år*	*2 voksne, 3 hjemmeboende børn*	*-*	*Har ikke kompetencer indenfor energirenovering*	*Har begrænset viden på området (kun fra egen research)*	*- Energi renovering forbindelse med anden renovering/tilbygning*	*"- Oplever ikke at det er økonomisk rentabelt at gøre i sig selv - Finder det besværligt at finde ud af hvad man egentlig får ud af at energirenovere"*	*"Hvis man alligevel står og skal renovere et eller andet, ville det nok blive tænkt ind (energi renovering)."*
H21	*Peter Practical*	*1959*	*6 år*	*2 voksne, 1 barn*	*-*	*Har ikke kompetencer indenfor energirenovering*	*Har begrænset viden på området (kun fra egen research)*	*"- Høj regning grundet lav energiklasse - Vil gerne lave nye tilbygninge og energirenovere samtidig med det"*	*- Financiering (skal sparre op, skal låne hos banken)*	*"Da vi var lige ved at gøre det (energirenovere), var barrieren at vi ikke vidste hvonår vi skulle bygge til - så gav det ikke mening."*

APPENDIX 6 - ARENA FINDINGS

Topic	Source	ID	Actor
Guide	*"Ville det være en hjælp for jer at der kom sådan en guide til hvad man skulle overveje ift. valg af løsning og hvorfor ville det være en hjælp og er der nogle barrier i kunne forestille jer dette ville hjælpe jer med at overkomme når I skal igennem en sådan beslutningsprocess? "Jeg synes det er super at man får presenteret relevante informationer på den måde. Det gør det meget nemmere at komme igang med processen".*	*H01-05*	*House owner 1*
Concept potential	*"Hvad synes I om at få tips til energirenovering? Det er super. Hele platformen er jo et stort tip, er det ikke det de er?"*	*H01-06*	
Concept potential	*Kunne det gøre at I vil tilføje energioptimering når I vil renovere? "Ja, et klart ja".*	*H01-07*	
Solutions	*I føler der er fint med information - I drukner ikke i information? "Nej slet ikke og jeg følger med.*	*H01-10*	
Concept potential	*Hvilke dele vil skabe mest værdi for jer? "Der hvor man kan vælge tagkonstruktion. Kan godt lide at man blive ført igennem hvor man tager nogle beviste valg i stedet for at man sidder og rodder rundt. Det er godt at det er samlet på et sted."*	*H01-12*	
Financing	*"Jeg synes det er så fedt at I har skrevet prisen dér. Det kommer på det helt rigtige tidspunkt. Der er mennesker der sidder i to dage og regner på det og konkluderer at de ikke har råd til det. I starter med at sige, det koster dét her."*	*H01-13*	
Financing	*"Når man går op under der hvor prisen står, kunne men fremme det ved at illustrere en return on investement, man skal ikke bruge de ord, men måske skrive hvis man bruger de rigtige energiløsninger får man en besparelse hvert år og så lave en besparelse per år hvis du er miljørigtigt. Fx også co2 reduktion og return on investment".*	*H01-14*	
Community	*Hvilke information er god kontra unødvændige? "Billede for/efter er gode. Og jeg tænker også at hvis vi støder på noget uventet under vejs og billeder af det og så skrive noget om det. Under erfaringer. Erfaringer kan jeg godt lide."*	*H01-21*	
My Project	*"Når man er igang med denne her så ville det være 'den her løsning jeg går med' så regner jeg ud med nøgletal hvis jeg går med solceller og har så meget kvadratmeter tal, hvor noterer jeg disse ting?"*	*H01-23*	
Renovating	*Ide med opsummeret proces - "Det er rigtigt godt! Vi vil føle os klar til en renovering."*	*H01-24*	
My Project	*Tips fra andre fane - "Det er fandeme stjerne det der. Det er home-run det der. Skynd jer med at blive færdige så vi kan begynde at bruge det!."*	*H01-27*	
Community	*"Jeg kunne godt finde på at dele, men ikke kommentere på andres. Man kan jo selv bestemme man vil lægge op. Det ville være vigtigt at det var anomymt og strengt fagligt.*	*H01-28*	
Prototype conclusions	*Er det en platform I vil bruge næste gang I skal renovere? "Ja, fordi den er god til at understøtte processen og man kan sammenligne information et sted. Det er en inspirationskilde i en travl hverdag. Jeg synes det er godt produkt".*	*H01-32*	
Concept potential	*Hvordan samler I info på nuværende tidspunkt? "Det er arkitekten vi kontakter og så er Charlotte meget dokumenthåndteringsstærk. Så er vi ude og se på teglsten og så tager vi brochurer med hjem så sidder vi og søger på hjemmesider, så tager vi nogle ting. Så holder vi møde med entreprenurer og så har vi en mappe og brochurer og så kommer vi kørende hen ad vejen og så holder vi og så tager far et billeder. Vi har mapper. En virtuel mappe ville være god".*	*H01-33*	
Concept potential	*"Den er så god fordi den tager dem i hånden, der ikke er så god til det og ryster dem. Vi kan også blive trængt til at blive rystet, fordi jeg ved faktiskt ikke en skid om tagrenovering. Men jeg har tillid til nu har vi en arkitekt på der ved alt om det."*	*H01-34*	
Concept potential	*Hvis nu jeg skulle finde ud af det, så ville det være godt at det var trin for trin som tager en igennem hvad man skal overveje, hvad man har af muligheder og hvad man skal gøre.*	*H19-12*	*House owner 19*
Solutions	*Jeg synes det er meget godt at det står der (energioptimerende tiltag). Umiddelbart vil jeg synes at det er god information. Når der står sådan noget med at man taber 30 % af varmen gennem tager så bliver man jo interesseret.*	*H19-13*	
Concept potential	*Fortæller at det er fint at de energioptimerende tiltag passer til den løsning man er ved at kigge på: "Isolering er fint at have med. Det gør at man få det hele med."*	*H19-14*	

APPENDIX 6 - ARENA FINDINGS

Topic	Source	ID	Actor
Renovating	*Hvis alternativet er at man ikke har det, så bliver man helt klart mere klar via den. Hvis det var mig der på ingen måde ved noget vil jeg være rigtig godt hjulpet. Og siger ja til at det ville bringe dem tættere på at de vælger at renovere.*	*H19-15*	
Solutions	*Det er meget information. Kan godt virke lidt uoverskueligt - bare sådan ift. hvis man sammenligner med hvis man bare ringer til en der kommer ud at kigge på det. Der er mange ting man skal tage stilling til her - fordi man er sin egen projektchef. Men det er også godt med et overblik over hvad det er for en proces man kaster sig ud i. Den guider en til hvad man skal tage stilling til og det er fint. Han siger opsummerende: "Det virker lidt uoverskueligt fordi der er så meget man skal tage stilling til, men samtidig er det også fedt, fordi ellers ville man jo bare have en masse noter liggende. Umiddelbart er det fedt at alt sammen står sammen. Så man ikke har det i 14 mapper og 4 excelark. Det er bare i starten at det virker lidt overvælgende når man kommer ind på siden." Han fortæller dog at de ikke umiddelbart selv ville bruge det.*	*H19-17*	
Concept Potential	*"Step-by-step guide vil have mest værdi. Jeg kan godt lide hvis jeg skal lave et eller andet at bruge sådan nogle trin for trin guides og sådan noget. Det er meget sjovt. Hvis vi selv skulle igang med at renovere ville jeg nok bruge sådan noget her først (platformen) og så kunne det være en del af at vurdere om det er noget jeg selv ville kunne lave eller om der skulle andre på."*	*H19-18*	
Financing	*Beregneren er god. Det giver meget god mening.*	*H19-19*	
Financing	*Det er også godt at vide hvor længe det tager før det har betalt sig tilbage. Man tænker grønt, men man har altid rentabilitet med i sine overvejelser*	*H19-20*	
Financing	*Det er smart med tilskud. At der står hvad man skal er super. Det kunne være endnu smartere hvis der var en knap så man direkte kunne komme over på skats hjemmeside. Det er godt, fordi det er ikke altid man lige tænker over det er der.*	*H19-21*	
Financing	*Jeg ville nok ikke bruge det (om guide ift. bank), men det er også fordi så ville vi bare kontakte vores bankrådgiver. Vi ville heller ikke have brug for en låneberegner. De fleste der har et hus har skulle optage et lån og derigennem en bankrådgiver.*	*H19-22*	
Financing	*Banken er fint at have på tjeklisten, men behøver ikke at være en del af financieringssiden med låneberegner og alt sådan noget.*	*H19-23*	
My Project	*Det synes jeg er rigtig fint - man bliver da virkelig hjulpet her. Ja, man bliver hjulpet godt igennem.*	*H19-27*	
Project planning	*Det er rigtig godt med sådan en tjekliste hvor man lige kan krydse af. Det synes jeg er genialt. Det er sådan noget man jo faktisk selv ville lave på et stykke papir.*	*H19-28*	
Community	*Vi kunne ikke finde på at dele erfaringer på nettet og lægge noget op.*	*H19-30*	
Community	*Det er lidt det samme som hvis man skal købe en ny bil - så kan man gå ind og kigge på andres anbefalinger. Det ville vi godt kunne finde på at bruge.*	*H19-31*	
Community	*Der er nok også nogle erfaringer som man kan drage nytte af hvor man tænker 'hov, der skal man lige være opmærksom'. Det er rigtig fedt at få sådan nogle oplysninger om ting man ikke lige går og tænker over.*	*H19-32*	
Solutions	*Jeg kan godt lide det her med forskellige løsninger - det fint at det står sådan overskueligt. Også der står hvad det nogenlunde koster.*	*H19-33*	
Planning	*Umiddelbart når man ikke har så meget forstand på det, så hjælper så meget guidence som overhoved muligt. Det vil man jo få her når det er sådan trin for ting.*	*H19-35*	
Step-by-step	*Man vil nok altid være lidt i tvivl fordi det er så stor en omkostning. Men alligevel tror jeg at man får alt med her. Vi overvejer det altid meget og er forsigtige.*	*H19-36*	
Business model	*"Den tanke jeg sidder tilbage med efterhånden er bare hvorfor man ikke skal betale for noget af det her. Er der noget forretning i det her?" Forklarer lidt om tanken, og han svarer: "Det giver rigtig god mening hvis man betragter det som en opgave stillet af energistyrelsen."*	*H21-15*	*House owner 21*
Concept potential	*"Jeg ved ikke om det vil øge sandsynligheden, men det ville i hvert fald speede processen op. Så der er flere som der går med overvejelsen som går og venter. De ville speede det op så i stedet for at overveje det i 7 år, så ville de gøre det efter 1/2 år. Det vil nok også få nogle til at gøre det som ellers ville være sprunget fra."*	*H21-16*	*House owner 21*

APPENDIX 6 - ARENA FINDINGS

Topic	Source	ID	Actor
Planning	*"Det er overskueligt og giver mening. Man bliver holdt lidt i hånden og så kører det."*	*H21-17*	
Renovating	*"Vi kunne bestemt finde på at bruge det. Det kunne vi fordi det giver noget overblik og indsigt i nogle processer som vi ikke har prøvet før - skabe fokus på elementer der er værd at overveje. Det ville vi sætte stor pris på."*	*H21-18*	
Financing	*"Det er en kæmpe hjælp, for det er altid noget hvor man sidder og tænker. De der virksomheder gider typisk aldrig at lave en vejledende pris, fordi så er der nogle forbehold. Men det er rigtig rart at have sådan en som kan fortælle at det koster mellem 200.000 - 400.000. Det er altid godt at have et slag på tasken"*	*H21-19*	
Financing	*"Jeg kan godt lide at den viser potentiel besparelse."*	*H21-21*	
Planning	*"Det giver fin mening at man kan indtaste postnummer så man kan finde kontakter."*	*H21-22*	
Solutions	*Men det begynder også at blive så mange information at man ikke kan have det her i en oversigt. Man kunne have en 'læs mere' sådan så man kunne trykke ind på de forskellige muligheder - det ville være godt."*	*H21-23*	
My Project	*Projektinfo, overblik og tips fra andre* *"Det hele giver rigtig god mening. Jeg er meget imponeret. Der er ikke rigtig noget jeg mangler - det er meget gennemarbejdet."*	*H21-28*	
Community	*"Vi bruger rigtig rigtig meget at læse om andres erfaringer på nettet."*	*H21-30*	
Community	*"Vi ville nok ikke selv dele vores erfaringer, men vi ville være meget glade for at læse om andre der gider dele."*	*H21-31*	
Planning	*"Jeg kan rigtigt god lide at se hvilke steps det er man skal igennem for hvordan man skal lave de forskellige ting. Det giver rigtigt god mening."*	*H21-35*	
Solutions	*"Jeg sad sjovt nok for et par aftener siden og kiggede på nyt tag og isolering. Og der er en del her som jeg ikke kunne finde derude (på internettet). Så jeg havde været glad hvis jeg var faldet over den her platform."*	*H21-37*	
Community	*"Vi ville nok tænke 'gider folk læse om vores projekt. De måtte godt se det. Så hvis det var noget man blev opfordret til ville vi godt dele det."*	*H21-38*	
Concept potential	*"Jeg tror at det er rigtig klogt, for der er ingen der renoverer for at energirenovere. Man renoverer af andre årsager og så vil man gerne gøre det energivenligt når man er i gang. Det tror jeg er godt set."*	*H25-01*	*House owner 25*
Solutions	*"Det ville også være godt hvis der stod 'ud fra et energimæssigt synspunkt, så ville bør et tegltag laves sådan og sådan'. Så ville man være bedre klædt på til at vælge en god løsning."*	*H25-02*	
Concept potential	*Fortæller at det ville være en god ide at skrive på forsiden at det giver inspiration til energioptimeringer. "Det skjulte potentiale"*	*H25-06*	
Solutions	*"Hvis man hele tiden får at vide hvilke muligheder der er. Junglen er at man ikke ved ret meget om hvad der er af muligheder og hvad det koster. Det med at sætte penge på er en god ide." Pointerer at det er pengene der gør om man eks. vælger ekstra isolering. Derfor skal det også være muligt at se hvad det vil koste.*	*H25-08*	
Financing	*Ikke så begrejstet for delen med banken - de hører ikke ind der "Der kan ikke være ekspertise i det hele. Dem der har styr på renoveringer er det man bliver overbevist om her. Så skal de ikke agere bankrådgivere - det kan sænke troværdigheden. Det har man ikke brug for, for man har allerede en relation til sin bank."*	*H25-09*	
Financing	*"De faktuelle oplysninger om man kan få tilskud og sådan noget, fordi det overblik har man ikke nødvendigvis som husejere."'*	*H25-10*	
Planning	*"Det vi godt kunne bruge var en liste med ting man skulle spørge sin håndværker om. Sådan en liste ville være god. Jeg ville gerne have været klædt bedre på når jeg skulle snakke med håndværkeren. Det er sådan at man næsten ikke selv ved hvad man spørg om og de kan sælge en hvad som helst, så hvis der er nogle andre der kunne have lavet listen for dig med 'når du skal have et solcelletag, så er det vigtigt at din håndværker får denne info og tjekker dette m.v. Også når man vælger nyt tag generelt, så oplevede vi at de spurgte 'vil du have fast undertag eller membran?' og det aner vi jo ikke."*	*H25-15*	

APPENDIX 6 - ARENA FINDINGS

Topic	Source	ID	Actor
Renovating	*"Jeg kunne se mig selv bruge det. Det skal være sådan at man får et overblik over hvad mulighederne og får fortalt på en letforståelig måde. Det er godt tænkt at det er inde på hustyper. Jeg har prøvet at søge på det men nu er det random løsninger der kommer frem. Det vil være noget jeg kan bruge til beslutningstagen."*	*H25-17*	
Prototype conclusion	*"Der er så vanvittigt meget man skal tage stilling til gennem sådan en step-by-step guide, så er folk jo tørret ind inden de er nået halvvejs. Så at gøre det overskueligt at finde netop den information man skal bruge er bedre. Det skal være sådan overordnet med mulighed for at dykke ned. Men det skal ikke være et krav at man dykker ned. Det skal være sådan at man føler at man kommer rimelig hurtig igennem, så man føler at det er overskueligt."*	*H25-19*	
Community	*"Men jeg vil rigtig gerne læse om andres erfaringer. Det er ikke fordi vi ikke ville dele tingene, men det kræver noget viden. Men på den anden side hvis det var et sted man havde været inde og skrive med nogle som havde gjort det samme, så kan det sagtens være at man ville dele ens eget projekt."*	*H25-21*	
My Project	*"Man kommer til at køre rundt i det her, sådan fungerer det jo ikke. Sådan nogle progress barer kommer man ikke til at sidde og fylde ud. Man kan godt blive lidt træt hvis man kun ser 45 % færdig - det hjælper ikke til at man føler at energirenoveringen er overskueligt. Man kommer til at tænke 'shit vi bliver aldrig færdige'"*	*H25-22*	
Functions	*"Det vigtigste punkt er 'find løsning.'. Man vil gerne fortælle folk om alt muligt, men hvad er kernen egentlig. Det er relevant hvis der er tilskud og sådan noget, men sådan noget med banken er ikke relevant på dette site. Det man har brug"*	*H25-31*	
Information	*Pointerer at det er en godt at inspirationen til energioptimerede løsninger som passer til det man har klikket ind på: "Det er en balance mellem at man gerne vil vide noget om det man har klikket ind på men selvfølgelig også gerne ikke vil overse noget.*	*H25-31*	
Functions	*Skal være nemt: "Jeg kunne godt bruge et site hvor man kunne indtaste sin data og så sidde og lege med nogle tal uden at det linkes op på kommuner osv. Så man kan se nogle løsninger ift. hinanden og lege med hvilke muligheder der er. Der kunne man også blive introduceret til nogle nye løsninger som man ikke kendte til. Det skal ikke være sådan at man skal oprette en profil og sådan."*	*H25-44*	
Solutions	*At man er blevet taget i hånden ift. at finde en god løsning og at man ikke har bundet sig til et tilbud undervejs synes jeg er fornuftigt.*	*H26-01*	*House owner 26*
Renovating	*Jeg tror at det vil øge sandsynligheden for at vi vil få foretaget en renovering, men jeg tror også at for at klikke ind på sådan en side, så skal man have tankerne om renovering til at starte med.*	*H26-02*	
Financing	*Jeg tænker at det er en ret relevant info at få - hvornår har man fået betalt sit tag tilbage (return on investment. Og så ligger der også noget i at få folk til at forstå at når der står 10 eller 15 år ift. return on investment, så er det ikke langt tid, fordi taget holder i så mange år. Når jeg snakker med venner og bekendte så siger de at de skal bruge 70.000 kr på nye vinduer og det har først betalt sig hjem på 8-10 år. De synes de er langt tid. Men man kan sige at de jo skal tage i betagtning at de skal bo i huset i rigtig mange år. Også at de så har fået ekstra komfort.*	*H26-10*	
Financing	*Det ville skabe mest værdi at have det økonomiske overblik - hvad koster det og hvor hurtigt får vi vores penge igen. Jeg ville kigge på hvad der bedst kan svare sig.*	*H26-12*	
Functions	*Man kunne også tilføje der hvor man vælger håndværkere om man skal have en byggerådgiver på. Det kan også være en mulighed, for der er nogle der er mere trygge ved at have en der tjekker op på at håndværkerne har styr på det. Platformen kan gøre alt arbejdet op til de står med en byggesag og når de så står og skal igang kan det være godt at have en der står og tjekker om det hele passer. Der er super at man kan få nogle tilbud fra håndværkere men det ville også være fint hvis man kunne vælge bare at tage kontakt til en byggerådgiver*	*H26-13*	
Planning	*Det er meget relevant at man får en tjekliste over hvad man skal fortælle håndværkere med 'husk at du vil have det her undertag' husk at sådan og sådan' eks. også sådan noget med om stillas er med i prisen, for ellers skal man ud og selv finde nogle der kan gøre det. Sådan nogle ting tænker man ikke normalt over men det er meget relevant. Så man næsten kan stå med det papir og gå det igennem med håndværkeren. Det giver en sikkerhed for at det er i orden det som håndværkeren siger. Sådan en 'tjekliste når håndværken kommer' vil være super relevant.*	*H26-14*	

APPENDIX 6 - ARENA FINDINGS

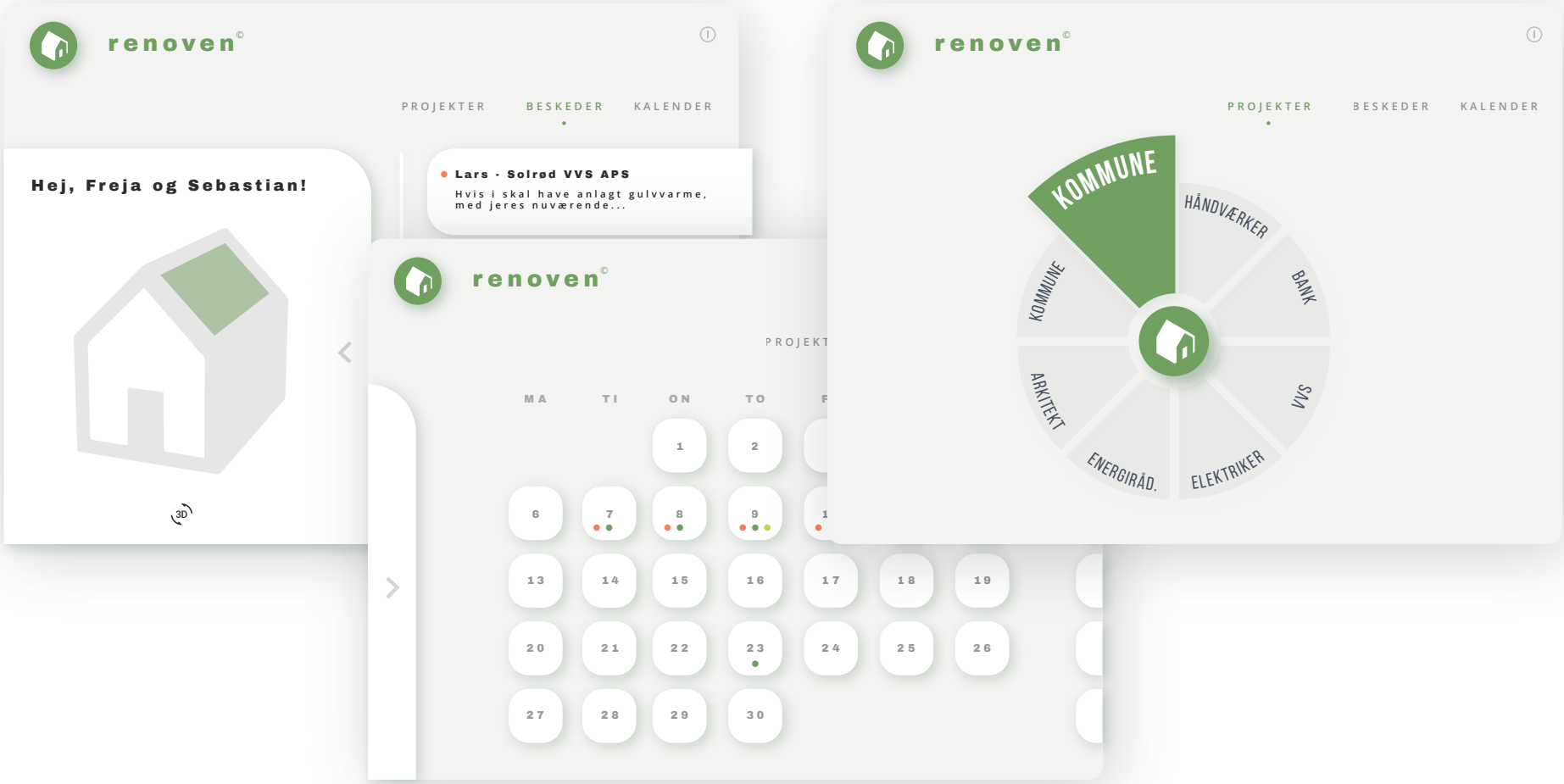
Topic	Source	ID	Actor
Community	*Netop den der hedder erfaringer (på platformen) synes jer er ret fin. Der jo de helt åbenlyse med eks. varmere hus og pænere. Men det er også ret relevant det her med at vi gjorde de i vintermånederne og det var faktisk rigtig koldt og vi havde slet ikke tænkt over at vi skulle opbevare ting. Når man læser det kan man jo sige selvfølgelig skal man have ting væk fra loftet når man skal have nyt tag, men man tænker bare ikke rigtig over det. Og det samme med tagrender. Han fortæller at han tidligere har arbejdet som murer og når de lavede tag kunne de tit påpege at de skulle have lavet deres skorsten. Det ville jo være logisk at gøre det i samme omgang som når taget blev lavet, men det var ikke noget folk tænkte over.*	*H26-17*	
Community	*Fortæller at de godt kunne forestille sig at dele et projekt "Det kunne vi godt ja"*	*H26-18*	
Project planning	*Potentielle besparelser ville jeg gerne have blæst i hovedet meget tidligere. Så man ved hvor mange år der går før man har tjent det ind, bare sådan at der helt tydeligt står 'tilbagebatalingstid 6 år'*	*H26-20*	
Community	*Jeg synes at det er meget simpelt og informative. Især den med tips fra andre er en rigtig god ide. Vi leder jo alle efter gode anbefalinger og hvis ikke man har nogle venner der har fået lavet tag inden for de seneste 2-3 år så sidder man jo på 'trustpilot' og 'anmeld hånværker' og hvad der ellers er. Men det her bliver her mere troværdigt - der er nogle levende menesker som har lagt deres huse op og sagt se her hvordan det er gået.*	*H26-22*	
Step-by-step	*Det ville være relavant med energitiltag, så man bliver opmærksom på det.*	*H26-26*	
Planning	*Vi kunne godt bruge den (også selvom han selv er bygningskonstruktør) fordi det ville være enkelt og let. At blive taget i hånden hele vejen er godt - for vi kan godt lide når tingene er nemme*	*H26-28*	
Knowledge for the house owners	*"Vores mål er at omdanne faglig tung og kompliceret viden til at den almindelige danske kan forstå hvorfor det er vigtigt at gøre og i nogle tilfælde også hvordan man gør det."*	*K02-02*	*Building expert from Bolius*
Staging a negotiation space	*"I efteråret 2018 kørte vi en større kampagne som hed 'komforten i hus' som var en kampagne som var mere målrettet at få folk til at energioptimere deres huse. Hvor der tidligere har været forsøg med andre kampagner hos energistyrelsen, sparenergi, hvor vores erfaringer er at det ikke vundet så stort indpas - det er ikke noget folk har taget til sig. Med de kampagner har fokus været omkring hvad man kan spare af kroner og ører. Det har vist sig at det er ikke noget der lokker boligejerne så meget (at man kan spare på varmeregningen ved at energioptimere). Derfor lavede vi en kampagne hvor vi greb den an med en anden vinkel - agendaen var den samme - at udbrede viden om energioptimering, men vi prøvede at gribe det an ift. at køre på komfort" Han fortæller at der er svært at sige om det er en success.*	*K02-03*	
Staging a negotiation space	*"bæredygtighed er et tema som vi kommer til at have meget fokus på efter sommerferien." De er ved at planlægge et flerårigt projekt hvor bæredygtighed er omdrejningspunktet. "Bæredygtighed er meget bredt og kan favne i mange retninger, men vi kan ikke komme udenom at energioptimering kommer med ind under det (...) Jeg håber at bæredygtighedsdagsordenen kan være som man oplever, selvom man synes er lidt irriterende, så er det noget man tager til sig og tænker over. Jeg håber at man via en bæredygtighedsvinkel kan gøre nogle indsatser ift. energioptimering - at man den vej rundt kan få boligerne til at se at man bliver nødt til at gøre noget - så det ikke er fordi man skal spare lidt penge eller undgå at have tykke sokker, men at det er det mere større perspektiv ift. at sikre en fremtid for ens børn på kloden"*	*K02-04*	
Staging a negotiation space	*Det kunne det sagtens i et omfang. Det er faktisk noget som vi også har gang i i nogle indlede faser ift. en app eller noget i den stil og det er noget der er i de spæde skridt - nemlig ift. at kunne give en mere målrettet vidensoplevelse ift. dig som bruger. Så man kan kigge på de specifikke behov. Netop så man kan sige 'går du med nogle tanker om nogle større renoveringsprojekter eller sådan noget' at man så aktivt skal indtaste bl.a. hvad man har behov for og så kan vi på den anden side sikre at du kun får den viden som interesserer dig. Vi har så meget viden, og hvis du gerne vil vide et eller andet mere målrettet så vil vi sådan set gerne give dig det, men vi skal bare vide det - vi kan ikke vide hvordan alle tænker. Så hvis du aktivt vil gøre noget (eks. indtaste noget data på en app), så vil vi gerne give dig noget tilbage. Det kan så være gennem sådan en brugeroplevelse hvor man sikrer at man får mere specifik viden om brugerne og deres behov. Der er noget der er på tale i forskellige projekter i Bolius.*	*K02-06*	
	"Vores vision bygger på at skabe godt design, støtte husejernes økonomi og bidrage til bæredygtigt omstilling".	*T01-01*	*Technology provider*

Energirenovering inspirationscenter

Kom og besøg vores fysiske center, for at få en snak om energirenovering af hjemmet. Uvildige fagfolk står klar til at svare på dine spørgsmål, og klæde dig godt på til at påbegynde dit næste skridt mod et grønnere, behageligere og mere værdifuldt hjem! Se de nyeste solpaneler, mærk indeklima-forskel med de nyeste vinduer og hør de nye lydløse varmepumper!

RenoVen

Log ind på RenoVen og du kan klare alt omkring din renovering online. Indtast dine oplysninger og du er klar til at få tilbudt løsninger. Få bud online, hjælp til at planlægge renoverings-forløbet inklusiv det lovgivningsmæssige og undervejs kan du følge forløbet online. Du kommer på denne måde igennem energirenoveringen med alt samlet et sted og uden bøvl med at finde den rette løsning.



RenoMy

Del tips og erfaringer fra renoverings-projekter og få selv inspirationer fra andres projekter via RenoMy. På dette sociale medie kan du gennem historier, billeder og videoer får du en indsigt i andres erfaringer og oplevelser. Det gør det nemmere at finde frem til den rette løsning og sikre en god proces.

Energi Vognen

Energivognen kan findes tæt hvor du bor. Den kører rundt i Danmark i sommerperioden og gør husejere opmærksom på fordelene ved energirenovering. Lokale borgere kan komme forbi og få råd fra en energivejleder. Gennem plakater viser energivognen generel information om energirenovering og giver råd til hvordan man kan tjekke og optimere husets energi-ydeevne.

APPENDIX 8 - FINDINGS FINAL PROTOTYPE

Topic	Source	ID	Actor
Concept 1 - Inspirationhouse	*Ville helt sikkert bruge: "Det er simpelthen så godt det der. Jeg tænkte simpelthen at jeg ville køre ud sådan et sted i eftermiddag."*	*H01-33*	*House owner 1*
Concept 1 - Inspirationhouse	*Vigtig med upartisk viden: "At det ikke er en forhandler er vigtigt"*	*H01-37*	
Concept 1 - Inspirationhouse	*Det er vigtigt at det er nogle der har noget god faglig viden på området: "Jeg tror nok at den praktiske tilgang er den vigtigste."*	*H01-38*	
Concept 2 - RenoVen	*Fordel at man får den rigtige hjælp undervejs og til at planlægge: "Det er vigtigt at guide husejere uden erfaringer til de rigtige rådgivere, så man får det meste ud af sine penge. Planlæsningsprocessen er vigtig at man kommer. Det ville være godt at have sådan en 'hvordan griber du din energirenovering an' gudie - det er lige før man kunne lave det i et excelark." Fortæller at den guidance ville de have sat pris på: "Da Charlotte og jeg startede med den første ombygning, der brændte vi så mange penge af. Vi spurgte byens tømrer om vi skulle have en arkitekt på. Det sagde han nej nej til, men det var faktisk et helt forkert råd, for det gør at vi idag skal ud og lave en ommer."*	*H01-44*	
Concept 3 - Share experience online forum	*Begrestret over at kunne få viden om andres erfaringer: "Det der det skal jeg - det er fantastisk. Den ville jeg gå på. Den vidensdeling med priser, problemer m.v. Det skal ikke være en trustpilot, men det måtte godt være derhen ad.". "Du ville tale med en bruger lige nu - jeg ville helt sikkert bruge det." "Findes det ikke? Det er da så sole klart at det skal laves"*	*H01-45*	
Concept 4 - Energirenoveringsvognen	*Det er for simplet ift. hvor stor en investering en energirenovering er: "Den tror jeg ikke på. Det er spild af tid. Man går ikke hen med et investeringsprojekt hvor man skal bruge mange 100.000 kr. til en pølsevogns-lignende-ting."*	*H01-46*	
Concept 1 - Inspirationhouse	*Fint hvis det er gennemsigtigt hvem det er der udstiller: "Det ville vi søge viden fra. Dem der skal stå og fortælle i sådan et inspirationscenter vil typisk være leverandører. Det virker som et udstillingsvindue. Man skal sørge for at der er et kritere for hvem der må stå og reklamere der ellers bliver det bare et kommercielt vindue."*	*H11-09*	*House owner 11*
Concept 1 - Inspirationhouse	*Fysisk inspiration betyder noget: "Det vi gjorde var faktisk at vi nogle søndag formiddage kørte rundt og så på tage for at søge inspiration."*	*H11-10*	
Concept 2 - RenoVen	*Ville bruge det som en tjekliste: "Det smarte ved det her kunne være at have en form for tjekliste."*	*H11-12*	
Concept 2 - RenoVen	*Det ville være godt at den minder en om gode ideer at gøre i forbindelse med energirenovering:"Jeg kunne godt finde på, hvis nu jeg skal have lavet en renovering, jeg vil gerne have tag med den og den rejsning, så kan systmet svare tilbage og sige 'husk du skal have 300 mm isolering'. Det kunne være en logik som jeg godt kunne bruge."*	*H11-13*	
Concept 3 - Share experience online forum	*Hvis det var overskueligt ville de gerne bruge det: "Hvis det skal være et funktionelt online medie, så skal der være nogle temaer som man kan søge inden under 'nyt køkken', 'ny tag' osv.. Så kunne der være noget chat. Det skal ikke være en stor rodebutik."*	*H11-15*	
Concept 3 - Share experience online forum	*Ville meget gerne bruge sådan en platform: Da de bliver spurgt om de vil bruge den: "Svaret er ja til den der løsning. Det er et rungende ja herfra."*	*H11-16*	
Concept 4 - Energirenoveringsvognen	*Ville ikke bruge løsningen: "Jeg kan svare på det samme nej (til om de vil bruge løsningen)."*	*H11-17*	
Concept 1 - Inspirationhouse	*Godt med konkret inspiration da de ikke har meget viden på området: "Det tænker jeg ville være en rigtig god ide. For sådan nogen som os der ikke ved ret meget om det - hverken har sat sig ind i det eller tænker over det i dagligdagen. "*	*H20-03*	*House owner 20*
Concept 1 - Inspirationhouse	*Upartisk viden ville være vigtigt: "Netop det der med at de er upartiske - at snakke med nogle der ved noget, men som ikke bare er ude på at sælge noget."*	*H20-04*	
Concept 2 - RenoVen	*Bruge det som hjælp til at vide hvad man skal gøre: "At have overblik over et renoveringsprojekt har vi ingen forstand på. Den der hjælp til at få styr på om man har kontakt de rigtige steder hen og hvad skal man egentlig have styr på - det ville være en stor hjælp."*	*H20-06*	

APPENDIX 8 - FINDINGS FINAL PROTOTYPE

Topic	Source	ID	Actor
Concept 2 - RenoVen	*Platform er godt format da man kan fordybe sig uden at det bliver for uoverskueligt: "Umiddelbart ville jeg tænke at app formatet ville være fint. Det ville man kunne sidde med i fred og ro. Selve renoveringsdelen har vi ingen forstand på. Hvis man nemt kunne sætte sig ind i det - og at det ville kunne hjælpe en på vej - det ville være godt. Det ville være en god hjælpende hånd"*	*H20-07*	
Concept 2 - RenoVen	*Ville bruge koncept 2 som en tjekliste som hjælp: Fortæller at han ville kontakte håndværker med tilføje "ved Renoven (koncept 2) der ville jeg godt gå ind og kigge på det og sætte mig ind i hvad det egentlig er den siger jeg skal gøre. Det ville jeg så holde op imod det som håndværkeren siger man skal gøre. Enten for at underbygge tilliden eller for at kunne spørge ind til hans valg. Jeg ville ikke bruge koncept 2 til selv at styre processen. Det skulle være en form for tjekliste til at se om man gør det rigtigt. Der kunne det være rigtig brugbart."*	*H20-09*	
Concept 3 - Share experience online forum	*Ville bruge løsningen som inspiration: "Det ville mere være et sted hvor man søgte inspiration. Fordi vi ikke har nogen viden om det bliver det svært at blande sig i en debat. Vi ville ikke gå ind og diskutere, men det kunne sagtens være et sted at hente inspiration." "Vi ville i første omgang se om der var noget der ser smart ud eller lyder smart."*	*H20-10*	
Concept 4 - Energirenoveringsvognen	*Skulle gøres opmærksom på dens formål for at bruge den: " Jeg tænker at hvis jeg stod og skulle lave noget energirenovering, så skulle jeg vide at vognen var der. Men hvis jeg bare sådan kom gående, så ville jeg nok ikke gå hen. Det handler nok om at jeg ikke rigtig ville vide hvad det var - kendskaben til den ville skulle udbredes. Jeg ville bruge den hvis jeg havde mere information om den på forhånd"*	*H20-15*	
Concept 4 - Energirenoveringsvognen	*Forbinder det med facere: "Jeg kunne godt føle mig lidt overfaldet - ligesom facere inde på strøget. Jeg ville tro at det var forbundet med salg. Det skulle gøre tydeligt at det ikke er det for at jeg ville bruge det."*	*H20-17*	
Concept 1 - Inspirationhouse	*Finder det interessant hvis det havde info om deres behov: "Hvis nu det havde været specifikt og ramt vores behov - eks. inspirationcenter for renovering af kælder, så ville det være relevant. For vi var totalt på bar bund. Så hvis man kunne få inspiration og viden for nogle der var upartisk."*	*H25-31*	*House owner 25*
Concept 1 - Inspirationhouse	*Det skal være tydeligt at det er neutral rådgivning: "Hvis jeg skal hen sådan et sted vil jeg gerne vide hvem der er afsender og hvilken interesse har de. Jeg vil egentlig hellere betale for et par timer og så vide at det er det de lever af. Man skal vide hvem der betaler."*	*H25-32*	
Concept 1 - Inspirationhouse	*Udfordring er at rådgivningen ikke bliver så specifik: "For at give noget god rådgivning har man brug for at de forholder sig til huset eller et specifikt projekt.". "Måske skulle man bestille tid, eller sende noget på forhånd, så de havde sat sig ind i sin case. Sådan en service ville jeg gerne være villige til at betale for." "Det handler om at man bliver klædt lidt på, for vi var jo fuldstændig blanke på det."*	*H25-34*	
Concept 1 - Inspirationhouse	*Vil gerne køre for at se på løsninger: "Vi kørte da til Hørsholm (bor i vanløse) for at se på vinduer da de lavede første sal".*	*H25-35*	
Concept 2 - RenoVen	*Vi betalte en arkitekt/fagmand til at stå for noget af kontakten til kommunen. Kontakten med kommunen var en langtsom og smertefuld død. Så det ville være smart hvis man kunne gøre den del nemmere for folk. Hvis man kan hjælpe folk med at vide hvor de skal søge hen og hvad de forskellige ting betyder.*	*H25-38*	
Concept 2 - RenoVen	*Step-by-step guide ville være en hjælp: "Man kunne lave nogle projektforløb - renovering af betongulv, renovering af tag m.v. Man kunne godt lave en simpel step-by-step, med sådan "sådan starter du", "sådan undersøger du", "her får du hjælp" m.v."*	*H25-39*	
Concept 2 - RenoVen	*Upartisk viden er at foretrække: "Det er svært at skille sælger fra rådgiver og det er et problem. På den måde ville det være fint at kunne få noget rådgivning fra nogle der ikke var interesseret i ens penge."*	*H25-41*	
Concept 2 - RenoVen	*Ville være godt hvis det ikke kun er henvendt energirenovering: "Vi har ikke lavet noget energirenovering som primært projekt - det er sådan noget der er kommet som følge af andre ønsker. Derfor ville det være godt hvis det ikke kun er henvendt energirenovering."*	*H25-42*	
Concept 3 - Share experience online forum	*Positiv overfor det, da hun bruger det allerede - at søge efter erfaringer og inspiration: "Sådan noget som pinterest det søger jeg da noget inspiration på. Og jeg googler også bare for at få andres erfaringer. Der kommer så bare en masse lidt random op, så hvis man rent faktisk kunne søge på et renoveringsmedie og så få nogle ting frem ville det være meget fint."*	*H25-47*	

APPENDIX 8 - FINDINGS FINAL PROTOTYPE

Topic	Source	ID	Actor
Concept 4 - Energirenoveringsvognen	*Jeg har det sådan at jeg ikke rigtig gider sådan nogle vogne fordi man ikke kommer i dybden. Altså hvis jeg virkelig skal have et renoveringsprojekt skal jeg have en vejleder der går i dybden. Hvis det stod noget med medbring dit projekt og få 1/2 times personlig sparring" eller sådan noget ville jeg synes at det er spændende. Det skal være så personligt som muligt."*	*H25-49*	
Concept 4 - Energirenoveringsvognen	*Det skal være tydeligt at de er neutrale*	*H25-50*	
Concept 1 - Inspirationhouse	*"Nu står der lydløse varmepumper og sådan noget. Det er sådan noget min mand gerne vil have, hvis det var. Jeg tror at et sted hvor man kan gå ned og se - det synes jeg lyder positivt. Det ville vi gøre hvis det var tilgængeligt. Sådan at man fysisk kunne se på det."*	*H28-01*	*House owner 28*
Concept 3 - Share experience online forum	*"Det synes jeg lyder som en god ide - vi har f.eks. brugt det meget i forbindelse med at vi er medlem af en gruppe i Sverige (har et hus i sverige). Her har vi ikke så meget forstand på de gamle huse i Sverige. Der går vi ind og kigger på hvad man kan gøre."*	*H28-07*	
Concept 3 - Share experience online forum	*Ærlige erfaringer er vigtigt: "Du får den ærlige mening fra folk på en måde - der er ikke en eller anden der prøver at sælge noget."*	*H28-10*	
Concept 4 - Energirenoveringsvognen	*"Ellers umiddelbart tror jeg at jeg ville gå videre. Jeg ville tænke at det var salg - at det var folk der skulle tjene penge. Sådan ville jeg tænker - at jeg vil blive snøret af en sælger."*	*H28-11*	
Concept 1 - Inspirationhouse	*"Jeg hælder mere til at have det mere tilgængeligt på en app eller sådan noget. Jeg ville mere noget nettet til at søge end sådan fysisk at komme hen til et sted."*	*H29-01*	*House owner 29*
Concept 2 - RenoVen	*"Alt afhængig af hvad man skal bruge i den specifikke situation kunne både adgang til forskellige typer løsninger men også rådgivning være relevant."*	*H29-03*	
Concept 3 - Share experience online forum	*"Det synes jeg er ret smart. Det synes jeg helt sikkert er en god ide."*	*H29-04*	
Concept 1 - Inspirationhouse	*Positiv ift. at bruge det hvis de stod og skulle renovere: "Det kunne jeg godt finde på at bruge. Hvis jeg lige stod og skulle lave noget. Vi ville kun bruge det fordi vi skulle igang med noget renovering. Så ville det være super, for jeg er sådan en der vil ud og kigge."*	*H30-01*	*House owner 30*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Bob the Builder (H28)	*At det er fysisk tilgængeligt er positivt: "Nu står der lydløse varmepumper og sådan noget. Det er sådan noget min mand gerne vil have, hvis det var. Jeg tror at et sted hvor man kan gå ned og se - det synes jeg lyder positivt. Det ville vi gøre hvis det var tilgængeligt. Sådan at man fysisk kunne se på det.".*	*Stort betydning om man har DIY kompetencer: Det ville være en rigtig god ide hvis man ikke havde en håndværkermand. Jeg tror at der er mange der ville have god gavn af det. Men der er vi lidt udenfor, fordi han er vant til at renovere Jeg tror at det er godt med sådan et forum - det tror jeg virkelig at vi ville gøre brug af. Støtter*	*"Meget positiv overfor at se andres erfaringer: ""Det synes jeg lyder som en god ide - vi har f.eks. brugt det meget i forbindelse med at vi er medlem af en gruppe i Sverige (har et hus i sverige). Her har vi ikke så meget forstand på de gamle huse i Sverige. Der går vi ind og kigger på hvad man kan gøre."" ""Hvis jeg købte et nyt hus og ikke havde særlig meget forstand på det, så ville det være genialt."""*	*Associerer det med sælgere: "Ellers umiddelbart tror jeg at jeg ville gå videre. Jeg ville tænke at det var salg - at det var folk der skulle tjene penge. Sådan ville jeg tænker - at jeg vil blive snøret af en sælger."*
Bob the Builder (H28)	*Vil godt transportere sig et stykke for at se det: "Vi kunne godt køre noget efter det hvis vi tænkter tilbage og skulle starte forfra - hvis vi stod foran et stort projekt så ville vi gerne tage en dags udflugt for at finde ud af et eller andet"*	*hvis man ikke har kompetencer indenfor området: Jeg har mange venner og veninder der står og ikke ved hvad de skal gøre.*		
God overvejelse af selvom det koster noget at have en profil og få rådgivning gennem hele projektet, så kan det være at man sparer noget ved at man netop får de gode råd og indhenter gode tilbud m.v.	*Selv håndværkeren vil bruge det: "Jeg tror også at min mand ville drage erfaring af det idag, hvis der var noget nyt han skulle gøre, som han ikke."*	.		
Bob the Builder (H28)	*Kontakt med fagfolk positivt: "Ser det som en god idea at kunne tale med fagfolk"*	.	*Ærlige erfaringer er vigtigt: "Du får den ærlige mening fra folk på en måde - der er ikke en eller anden der prøver at sælge noget."*	.
Rating	**2**	**3**	**1**	**4**

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Erik the Iceman (H29)	*Vil ikke bruge konceptet da det kræver for meget at skulle tage et sted hen: "Jeg hælder mere til at have det mere tilgængeligt på en app eller sådan noget. Jeg ville mere noget nettet til at søge end sådan fysisk at komme hen til et sted." "Det handler nok også om at vi har en masse fagpersoner i familien som vi kan hælde os op ad." Har ikke selv kompetencer, men har bl.a. en far der er tømrer. De har tidligere fået information via netværk og så har de været inde og læse på de steder de har fået vinduer fra. "Så har vi været inde og læse om hvad der er energirigtigt og hvad der ikke er."*	*Kunne godt se sig selv bruge sådan en platform til nemt at få svar på spørgsmål: Alt afhængig af hvad man skal bruge i den specifikke situation kunne både adgang til forskellige typer løsninger men også rådgivning være relevant.*	*Fortæller at andres erfaringer vil være meget brugbart: "Det synes jeg er ret smart. Det synes jeg helt sikkert er en god ide."*	*Kræver at man bliver opmærksom på det: "Det er en meget god ide, men så skal man på en eller anden måde vide at det er der." Snakker lidt videre om hvordan det kan finde sted. "I e-boks, der burde man få en melding. Så det ville være fint."*
Erik the Iceman (H29)	*.*	*.*	*Selv ville hun også bruge den til at dele erfaringer: "Selv ville jeg også poste en masse ting. Det ville jeg ikke have noget imod. Da vi lavede nyt badeværelse lagde jeg billeder før og efter op på sociale medier, men ikke decideret fremgangsmåde."*	*Fordel at det kommer tæt på en som bruger: "At løsningen er mobil giver nogle andre muligheder for brugeren. At det kommer tættere på."*
Rating	**4**	**2**	**1**	**3**
Erik the Iceman (H25)	*Finder det interessant hvis det havde info om deres behov: "Hvis nu det havde været specifikt og ramt vores behov - eks. inspirationcenter for renovering af kælder, så ville det være relevant. For vi var totalt på bar bund. Så hvis man kunne få inspiration og viden for nogle der var upartisk."*	*Ser det som urealistisk at den kan 'alt': Det ville være fedt hvis det kunne lade sig gøre, men det kommer nok aldrig til at ske. Den portal vil være så dyr at lave og drive. Hvem skal betale for det her?*	*Udfordring at få folk til at bruge det: "Kan være svært at få folk til at lægge noget op. Når man laver profil, så er bygger man en identitet op. Renovering er typisk ikke noget man gør så meget, så det kan være svært at fastholde folk"*	*Ikke så interessant, da det ikke skal være for overfladisk vejledning: "Jeg har det sådan at jeg ikke rigtig gider sådan nogle vogne fordi man ikke kommer i dybden. Altså hvis jeg virkelig skal have et renoveringsprojekt skal jeg have en vejleder der går i dybden. Hvis det stod noget med "medbring dit projekt og få 1/2 times personlig sparring" eller sådan noget ville jeg synes at det er spændende. Det skal være så personligt som muligt."*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Erik the Iceman (H25)	*Det skal være tydeligt at det er neutral rådgivning: "Hvis jeg skal hen sådan et sted vil jeg gerne vide hvem der er afsender og hvilken interesse har de. Jeg vil egentlig hellere betale for et par timer og så vide at det er det de lever af. Man skal vide hvem der betaler."*	*Hjælp til kontakt med kommune ville være stor hjælp: Vi betalte en arkitekt/fagmand til at stå for noget af kontakten til kommunen. Kontakten med kommunen var en langtsom og smertefuld død. Så det ville være smart hvis man kunne gøre den del nemmere for folk. Hvis man kan hjælpe folk med at vide hvor de skal søge hen og hvad de forskellige ting betyder.*	*Det kunne være en del af et større platform: "Det kunne være noget med indretning også. Jeg vil sige enten så er det håndværkerfif eller også så er det indretning."*	*"Det skal være tydeligt at de er neutrale"*
Erik the Iceman (H25)	*Det skulle give et overblik over muligheder: "Det skulle være muligt at få en helhedvurdering af projekt og ikke kun eks. varmepumpe. Det ville være vigtigt at man bliver præsenteret for de forskellige løsninger man kan vælge - både jordvarme, varmepumpe, fjernvarme osv. "De skal have en bred indgang til det, sådan at når sådan nogle som os der er på bar bund kan få en overordnet forståelse, men så også dykke ned i de elementer der virker interessante."*	*"Step-by-step guide ville være en hjælp: Man kunne lave nogle projektforløb - renovering af betongulv, renovering af tag m.v. Man kunne godt lave en simpel step-by-step, med sådan sådan starter du, sådan undersøger du, her får du hjælp m.v.* *Vi brugt https://henttilbud.dk/ til gulvet. Så kunne man kort formulere hvad ens projekt af. Fortæller at de her godt kunne se at der kunne være en step-guide."*	*Positiv overfor det, da hun bruger det allerede - at søge efter erfaringer og inspiration: "Sådan noget som pinterest det søger jeg da noget inspiration på. Og jeg googler også bare for at få andres erfaringer. Der kommer så bare en masse lidt random op, så hvis man rent faktisk kunne søge på et renoveringsmedie og så få nogle ting frem ville det være meget fint."*	*"Det svarer lidt til en facer nede ved stationer - der går man en stor bue udenom."*
Erik the Iceman (H25)	*Udfordring er at rådgivningen ikke bliver så specifik: "For at give noget god rådgivning har man brug for at de forholder sig til huset eller et specifikt projekt.". "Måske skulle man bestille tid, eller sende noget på forhånd, så de havde sat sig ind i sin case. Sådan en service ville jeg gerne være villige til at betale for." "Det handler om at man bliver klædt lidt på, for vi var jo fuldstændig blanke på det.*	*Upartisk viden er at foretrække: Det er svært at skille sælger fra rådgiver og det er et problem. På den måde ville det være fint at kunne få noget rådgivning fra nogle der ikke var interesseret i ens penge.*	*Oplever at det er noget der mangler som de godt kunne have brugt: "Det er i hvert fald ikke nemt at finde fif og erfaringer når man googler det - renoveringserfaringer."*	*Ville hellere have rådgivning gennem koncept 1 sammenlignet med dette koncept. "Energiprojekter er en stor beslutning og der skal man føle at man få rådgivning i dybden"*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Erik the Iceman (H25)	*Vil gerne køre for at se på løsninger: "Vi kørte da til Hørsholm (bor i vanløse) for at se på vinduer da de lavede første sal".*	*Ville være godt hvis det ikke kun er henvendt energirenovering: Vi har ikke lavet noget energirenovering som primært projekt - det er sådan noget der er kommet som følge af andre ønsker. Derfor ville det være godt hvis det ikke kun er henvendt energirenovering.*	.	.
Erik the Iceman (H25)	.	*Ser det som to forskellige værktøjer 1) op til at man finder ud af hvad der er man gerne vil og 2) projektmanagement tool under udførelsen: I skal droppe udførelen, for det mudret billedet. Man skal have hjælp frem til at få det udført. Det andet (udførsel) er også relevant, men det er udenfor scope her.*	.	.
Erik the Iceman (H25)	.	*Skal være nemt: Jeg kunne godt bruge et site hvor man kunne indtaste sin data og så sidde og lege med nogle tal uden at det linkes op på kommuner osv. Så man kan se nogle løsninger ift. hinanden og lege med hvilke muligheder der er. Der kunne man også blive introduceret til nogle nye løsninger som man ikke kendte til. Det skal ikke være sådan at man skal oprette en profil og sådan.*	.	.
Rating	**3**	**1**	**2**	**4**
Bob the Builder (H30)	*Positiv ift. at bruge det hvis de stod og skulle renovere: "Det kunne jeg godt finde på at bruge. Hvis jeg lige stod og skulle lave noget. Vi ville kun bruge det fordi vi skulle igang med noget renovering. Så ville det være super, for jeg er sådan en der vil ud og kigge."*	*Ville bruge det til indledende rådgivning/inspiration: Hvis det andet (inspirationscenter) lå meget langt væk, så ville jeg gøre det her (platform). Eller det ville nok være min mand der ville gøre det. Det er heller ikke udelukket at vi ville gøre begge dele.*	*Ville ikke være den store hjælp/ prioritering at få andres erfaringer: "Hvis vi stod og skulle lave noget, så ville vi også kunne bruge det. Men den er ikke lige så højt rated som de andre. Det ville fylde meget lidt. Vi ville nærmere undersøge det fagligt - hos fagfolk"*	*Til overordnet kan kunne få rådgivning ville de måske bruge det: "Hvis der er nogle der reklamerer med det på sociale medier eller sådan noget, så ville vi tager derhen, hvis vi stod og skulle igang med renovering."*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Bob the Builder (H30)	*Skal blive opmærksom på det: "Det skulle være noget jeg havde hørt et sted fra. Eller hvis jeg lige stod og skulle gøre noget, så ville jeg google det."*	*Ville ikke have det sådan at der er en anden der skal styre processen og rådgive. Det ville nærmere være at tage fat i de forskellige fagligheder. Vi ville selv undersøge det mere.*	.	.
Bob the Builder (H30)	*Er villigt til at transportere sig: "En halv time til tre kvarter ville være ok".*	.	.	.
Rating	**1**	**2**	**4**	**3**
Peter Practical (H20)	*Godt med konkret inspiration da de ikke har meget viden på området: "Det tænker jeg ville være en rigtig god ide. For sådan nogen som os der ikke ved ret meget om det - hverken har sat sig ind i det eller tænker over det i dagligdagen. "*	*Bruge det som hjælp til at vide hvad man skal gøre: At have overblik over et renoveringsprojekt har vi ingen forstand på. Den der hjælp til at få styr på om man har kontakt de rigtige steder hen og hvad skal man egentlig have styr på - det ville være en stor hjælp.*	*Ville bruge løsningen som inspiration: "Det ville mere være et sted hvor man søgte inspiration. Fordi vi ikke har nogen viden om det bliver det svært at blande sig i en debat. Vi ville ikke gå ind og diskutere, men det kunne sagtens være et sted at hente inspiration." "Vi ville i første omgang se om der var noget der ser smart ud eller lyder smart."*	*Skulle gøres opmærksom på dens formål for at bruge den: " Jeg tænker at hvis jeg stod og skulle lave noget energirenovering, så skulle jeg vide at vognen var der. Men hvis jeg bare sådan kom gående, så ville jeg nok ikke gå hen. Det handler nok om at jeg ikke rigtig ville vide hvad det var - kendskaben til den ville skulle udbredes. Jeg ville bruge den hvis jeg havde mere information om den på forhånd"*
Peter Practical (H20)	*Upartisk viden ville være vigtigt: "Netop det der med at de er upartiske - at snakke med nogle der ved noget, men som ikke bare er ude på at sælge noget."*	*Platform er godt format da man kan fordybe sig uden at det bliver for uoverskueligt: Umiddelbart ville jeg tænke at app formatet ville være fint. Det ville man kunne sidde med i fred og ro. Selve renoveringsdelen har vi ingen forstand på. Hvis man nemt kunne sætte sig ind i det - og at det ville kunne hjælpe en på vej - det ville være godt. Det ville være en god hjælpende hånd*	*Det skal være på et lavt teknisk niveau at information er præsenteret: "Det skal ikke blive ret fagteknisk før vi ville stå af. Fordi vi ikke har indsigten."*	*Godt at den kommer tættere på husejerne: "Ideen med at man har et rådgivningscenter som kan komme tættere på mig. Hvis jeg så ville se løsningerne eller vide mere, så kunne jeg køre til energihuset (koncept 1). Den tanke synes jeg er rigtig rigtig god."*
Peter Practical (H20)	*Ville være sagtens køre for det. Ville gerne køre 45 min for at se det.*	*Kunne supplere deres tillid til fagpersoners råd: Det ville gøre at de ikke skulle overgive sig til tillid til håndværkere. Men at de selv nemt ville kunne sætte sig ind i hvad den gode løsning ville være.*	*Ville ikke bruge det til at stille spørgsmål. Der vil vi hellere bruge håndværkere. "Det ville ikke være en samtaleplatform."*	*Forbinder det med facere: "Jeg kunne godt føle mig lidt overfaldet - ligesom facere inde på strøget. Jeg ville tro at det var forbundet med salg. Det skulle gøre tydeligt at det ikke er det for at jeg ville bruge det."*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Peter Practical (H20)	*.*	*Ville bruge koncept 2 som en tjekliste som hjælp: Fortæller at han ville kontakte håndværker med tilføje ved Renoven (koncept 2) der ville jeg godt gå ind og kigge på det og sætte mig ind i hvad det egentlig er den siger jeg skal gøre. Det ville jeg så holde op imod det som håndværkeren siger man skal gøre. Enten for at underbygge tilliden eller for at kunne spørge ind til hans valg. Jeg ville ikke bruge koncept 2 til selv at styre processen. Det skulle være en form for tjekliste til at se om man gør det rigtigt. Der kunne det være rigtig brugbart.*	*Ville foretrække at erfaringer kommer fra bekendte: Bruger normalt netværk til at finde gode løsninger. Bruger både venner og familie. Kunne også finde på at kontakte håndværkere de har haft til at lave noget før. "Her tør man spørge lidt dumt - det vil jeg nok ikke gøre inde på sådan et forum. Så er det nemmere at gå til nogle man kender."*	*Koncept 1 og 2 er fælles en god løsning: "Hvis nu jeg vidste hvad vognen var for noget, så kan det godt være at det ville være den første jeg ville gå til og hvis den så kunne fortælle mig noget interessant, så kunne jeg sagtens køre til energihuset (koncept 1)."*
Peter Practical (H20)	*.*	*.*	*Ville bruge koncept til inspiration: "Som inspiration ville det sociale medie, hvor man kan se andres projekter og skrive med andre, være godt. Men det ville formentligt kun blive som inspiration. Jeg ville nok gå en mere gammeldages vej efterfølgende og finde en håndværker."*	*.*
Rating	**2**	**1**	**3**	**4**
Dime-Loving-Diana (H01)	*Ville helt sikkert bruge: "Det er simpelthen så godt det der. Jeg tænkte simpelthen at jeg ville køre ud sådan et sted i eftermiddag."*	*Geografis har betydning: Jeg tror at det er meget geografisk afhængigt hvordan man bygger om. fortæller at det skal være forskellig rådgivning.*	*Begrestret over at kunne få viden om andres erfaringer: "Det der det skal jeg - det er fantastisk. Den ville jeg gå på. Den vidensdeling med priser, problemer m.v. Det skal ikke være en trustpilot, men det måtte godt være derhen ad.". "Du ville tale med en bruger lige nu - jeg ville helt sikkert bruge det." "Findes det ikke? Det er da så sole klart at det skal laves"*	*Det er for simplet ift. hvor stor en investering en energirenovering er: "Den tror jeg ikke på. Det er spild af tid. Man går ikke hen med et investeringsprojekt hvor man skal bruge mange 100.000 kr. til en pølsevogns-lignende-ting."*

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Dime-Loving-Diana (H01)	*"Lige sådan noget det er lige mig - At kunne se det og snakke med en sagkyndig. Det er nok det der virker aller bedst."*	*Er mere snakke end google-søge type, og derfor ikke oplagt målgruppe: Jeg kan godt se den virke. Jeg synes den er god. Jeg ville nok selv gerne bruge den hvis jeg var et andet sted i mit liv. Jeg er meget afhængig af at der kommer en mand ud - vi skal snakke. Fortæller at det mere er til typerne der laver research på nettet frem for typerne der tager en snak med en håndværker.*	.	*Kan bruges som opmærksomhedsskabende: "Så skulle det være hvis man vil lave noget politisk signalgivende - Hvis man vil lave en opmærksomhed. Så skulle det være budskaber man skal trumfe igennem med 'er du klar over at det kun koset 81.000 at få den nyeste varmepumpe' eller sådan noget."*
Dime-Loving-Diana (H01)	*Rammer hans behov: "Det er tæt på min generation - du rammer 40+ alderen."*	*Overvejelse: Med denne type løsning rammer man de yngre segment. Det er nok dem vi gerne vil ramme - dem der skal til at energirenovere.*	.	.
Dime-Loving-Diana (H01)	*Ville ikke have noget imod at køre: "Hvis man endeligt skal til at give penge på energirenovering. Så vil jeg helt sikkert gerne køre 45 minutter."*	*Fordel at man får den rigtige hjælp undervejs og til at planlægge: Det er vigtigt at guide husejere uden erfaringer til de rigtige rådgivere, så man får det meste ud af sine penge. Planlæsningsprocessen er vigtig at man kommer. Det ville være godt at have sådan en 'hvordan griber du din energirenovering an' gudie - det er lige før man kunne lave det i et excelark. Fortæller at den guidance ville de have sat pris på: Da Charlotte og jeg startede med den første ombygning, der brændte vi så mange penge af. Vi spurgte byens tømrer om vi skulle have en arkitekt på. Det sagde han nej nej til, men det var faktisk et helt forkert råd, for det gør at vi idag skal ud og lave en ommer.*	.	.
Dime-Loving-Diana (H01)	*Vigtig med upartisk viden: "At det ikke er en forhandler er vigtigt"*	.	.	.
Dime-Loving-Diana (H01)	*Det er vigtigt at det er nogle der har noget god faglig viden på området: "Jeg tror nok at den praktiske tilgang er den vigtigste."*	.	.	.

APPENDIX 9 - HOUSE OWNERS CONCEPT EVALUATION

Actor	Koncept 1 - Inspirationshus	Koncept 2 - Get started platform	Koncept 3 - Share experience online forum	Koncept 4 - Energirenoveringsvognen
Dime-Loving-Diana (H01)	*"Der skal være forskellige typer af energirenovering og gerne også renovering generelt. Fortæller at det er godt med præsentation vinduer, varmepumper, tagkonstruktioner m.m. Udfordring at man ikke kan få rådgivning det specifikke hus: ""Det bedste er jo at de kommer hjem til en."*	.	.	.
Rating	**1**	**3**	**2**	**4**
Erik the Iceman (H11)	*Fint hvis det er gennemsigtigt hvem det er der udstiller: "Det ville vi søge viden fra. Dem der skal stå og fortælle i sådan et inspirationscenter vil typisk være leverandører. Det virker som et udstillingsvindue. Man skal sørge for at der er et kritere for hvem der må stå og reklamere der ellers bliver det bare et kommercielt vindue.*	*Ville bruge det som en tjekliste: Det smarte ved det her kunne være at have en form for tjekliste.*	*Har interesse i at bruge andres erfaringer: "Sådan noget som vi har lavet, som eks. vores tagprojekt, der taler man med flere. Der får man erfaring."*	*Ville ikke bruge løsningen: "Jeg kan svare på det samme nej (til om de vil bruge løsningen)."*
Erik the Iceman (H11)	*Fysisk inspiration betyder noget: "Det vi gjorde var faktisk at vi nogle søndag formiddage kørte rundt og så på tage for at søge inspiration.*	*Det ville være godt at den minder en om gode ideer at gøre i forbindelse med energirenovering:Jeg kunne godt finde på, hvis nu jeg skal have lavet en renovering, jeg vil gerne have tag med den og den rejsning, så kan systmet svare tilbage og sige 'husk du skal have 300 mm isolering'. Det kunne være en logik som jeg godt kunne bruge.*	*Hvis det var overskueligt ville de gerne bruge det: "Hvis det skal være et funktionelt online medie, så skal der være nogle temaer som man kan søge inden under 'nyt køkken', 'ny tag' osv.. Så kunne der være noget chat. Det skal ikke være en stor rodebutik."*	*Det er en måde at skabe opmærksomhed: "Her kører man med spredehagl. Men det er en måde man kan få folk til at få øjnene op for energirenovering. Men vi har ikke brug for viden, for vi har viden på området."*
Erik the Iceman (H11)	*Ville foretrække at snakke med en specifik håndværker: "Som privatpersoner og med så store investeringer har man nogle rådgivere på. Vi ville nærmere læne os op af nogle dygtige håndværkere som ville vide det som vi ellers ville kunne få ud af at tage sådan et sted hen."*	.	*Ville meget gerne bruge sådan en platform: Da de bliver spurgt om de vil bruge den: "Svaret er ja til den der løsning. Det er et rungende ja herfra."*	.
Rating	**3**	**1**	**2**	**4**

APPENDIX 10 - UPDATED PERFORMANCE SPECIFICATION

Category	Demand	Wish
Platform		
	The platform must be digital	
	The platform must work as a website	*Should work on mobile devices*
	The platform must be about renovations in general	
	The platform must be in Danish	*The platform should also be in English*
		It should be possible to navigate in the different functions of the platform through maximum 3 clicks
Guide		
	It must provide a general step-by-step guide on what to do before an energy renovation	
	When relevant for the specific renovation, energy renovation tips should be a part of the guide	*Energy renovation suggestions should be adressed in all renovation guides*
		The platform should always display an overview of what part of the process the user is reading about
		It should be possible to navigate in a non-linear flow between different guide categories
		It should provide information directed to the specific type of house
		It should provide unbiased knowledge
		It should provide a check-list with relevant aspects to consider when conducting a renovation
		It should provide a simple overview with the possability of reading more about different aspects of renovations
Finance guide		
		It should provide information about the financial considerations of a renovation project
	It must provide information about financial benefits of energy renovation	*It should provides a return on investment estimate for the renovation*
	It must provide price estimate of the different solutions	
		It should provide info about grants for the specific type of renovation
Solution guide		
		It should provide information about indoor climate benefits of energy renovation
	It must suggest different types of renovation solutions	*It should make it possible to compare different solutions*
		It should indicate which solution is the most energy optimising (reduce energy or green energy)
		The renovation solutions should be presented visually to the home owner
		It should provide information about what regulation to consider when energy renovating

APPENDIX 10 - UPDATED PERFORMANCE SPECIFICATION

Category	Demand	Wish
Process guide		
		The solution should offer a list of relevant questions to ask the craftsmen/contractor about the renovation
	It must provide information about who to contact before the renovation	*The solution should explain differences in actors, and supply contact to different types*
		Should direct the user to a place where they can retrieve offers on solutions
My project		
		It should be possible to collect relevant info about the house owners own specific renovation project
		Tips from community should be visible in the house owners own project
		It should encourage sharing of renovation experiences
Community		
	It must be possible to share experiences about positives and negatives from process	
	It must be possible to share experiences about positives and negatives for the specific solution	
	Experiences must be possible to be share anonymously	
		The renovation should be presented visually before and after
		It should be possible to share experiences about professional actors involved during the renovation

Velkommen til RenoVen!
Dit personlige værktøj og inspirationscenter til dine renoveringsprojekter.
Se andre husejeres renoveringsprojekter, og lad dig inspirere
Få et overblik over hvilke trin der er i din renovering
Bliv guidet til hvordan du energioptimerer din bolig
Opret dine egne projekter, og hold overblik
Kom i gang

renoven
Dashboard
Community projekter
Renoveringsguides
Mine projekter
Om RenoVen
Log in
Hjælp
Indstillinger
Velkommen til RenoVen, gå på opdagelse!
Vidste du?
Et nyt tag kan forbedre din indeklima og samtidig sænke din elregning. Se vores step-by-step guides for at finde ud af hvordan!
Bliv inspireret af de seneste community projekter
Carsten, Espergærde
Hulmursisolering
Hulmursisolering i murermestervilla.
Se projekt
82
#Isolering
Ulla, Glostrup
Nyt tegltag
Nyt tegltag på parcelhus
Se projekt
82
#Tagrenovering
Bo, Herning
Nyt gulv
Nyt gulv med varme hos landejendom
Se projekt
82
#Gulv
Se flere projekter her
Step-by-step guides
Tagrenovering
Kælder
Gulv
Vinduer & døre
Køkken
Badeværelse
Isolering
Trapper
Vægge & lofter
VVS
El- & varmesystem
Grøn energi

APPENDIX 11 - WEBSITE PROTOTYPE

Interactive version can be found here: https://xd.adobe.com/view/985163ee-59f6-4366-718a-5edb1ad3f197-ee60/?fullscreen

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renoven

- Dashboard
- Community projekter
- Renoveringsguides
- Mine projekter
- Om RenoVen
- Log ind
- Hjælp
- Indstillinger

Tilbage til community

Nye tegl på parcelhus

Carsten, Espergærde

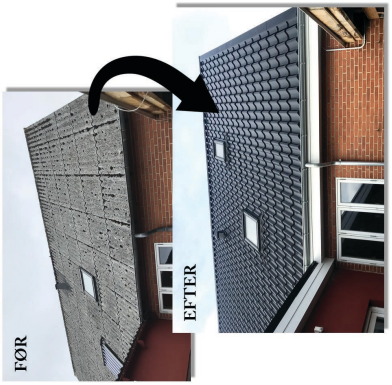
Parcelhus - 1972

132 kvm

4 beboer

LIKE 82

#isolering #loftvinduer #tagrenovation



Flere billeder

Erfaringer

- Meget varmere hus grundet bedre isolerede vinduer
- Flot æstetisk udtryk
- Bedre sikring mod nedbør

- Det var koldt at renovere i vintermåneder
- Vi glemte at finde opbevaring til ting på loftrum
- Vi vidste ikke at vi skulle lave tagrender i samme omgang - blev stressede

Process

1. Gammelt tag skulle skiftes
2. Fik energivejleder til at gennemgå huset
3. Valgte at udskifte loftvinduer sammen med renovering af tag
4. Indhentede tre tilbud
5. Kontaktede totalentrepreneur
6. Valgte endelige løsninger
7. Renoveringen
8. Færdig renovering efter 2 uger

Kontakter brugt til dette projekt

Energirådgiver

Benyttede bedrebolig-rådgiver til energitjek af boligen. Den lokale rådgiver blev fundet via: https://sparenergi.dk/forbruger/naerktoejer/bedrebolig/find-en-raadgiver

Totalentreprenør

Benyttede totalentreprenør Tømrerne A/S til at håndtere renoveringsprocessen.

"Totalentreprenøren sørgede for det hele og vi skulle ikke bøvle med håndværkere der ikke kom til tiden. Projektet blev udført på den aftalte tid og resultatet er meget tilfredsstillende. Vi er glade for at vi fik skiftet både tag og vinduer på en gang.", Carsten

Gem community-projektet som inspiration til dit eget projekt

Tilbage til community

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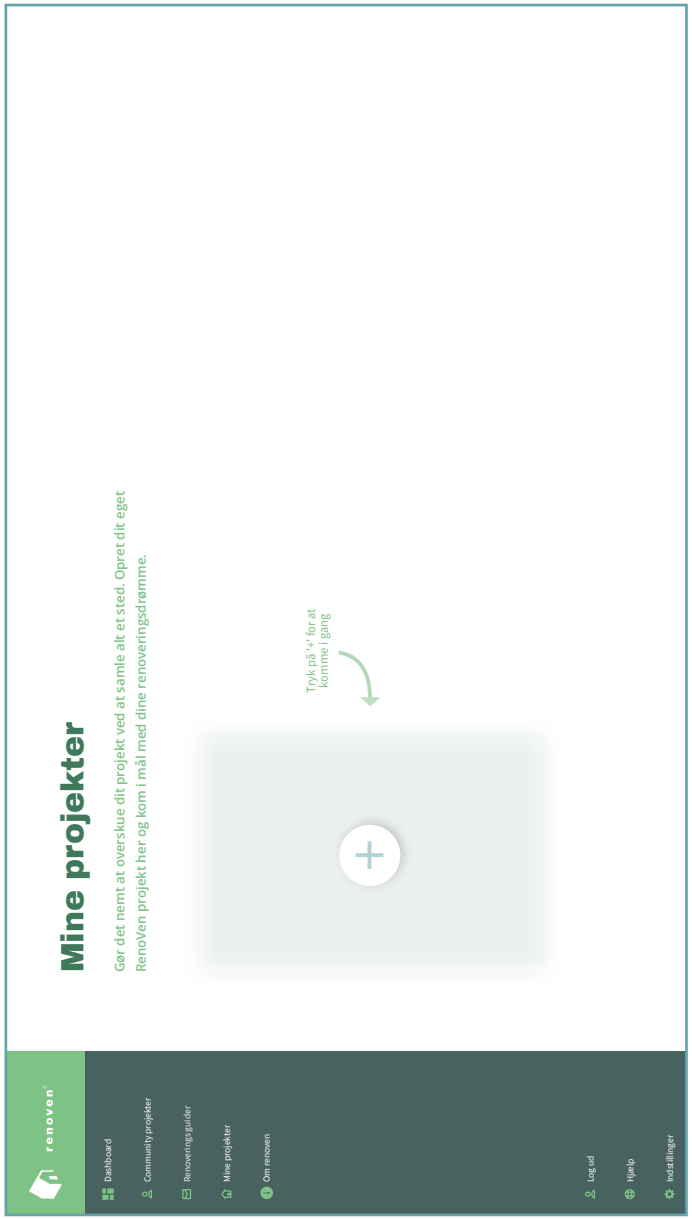

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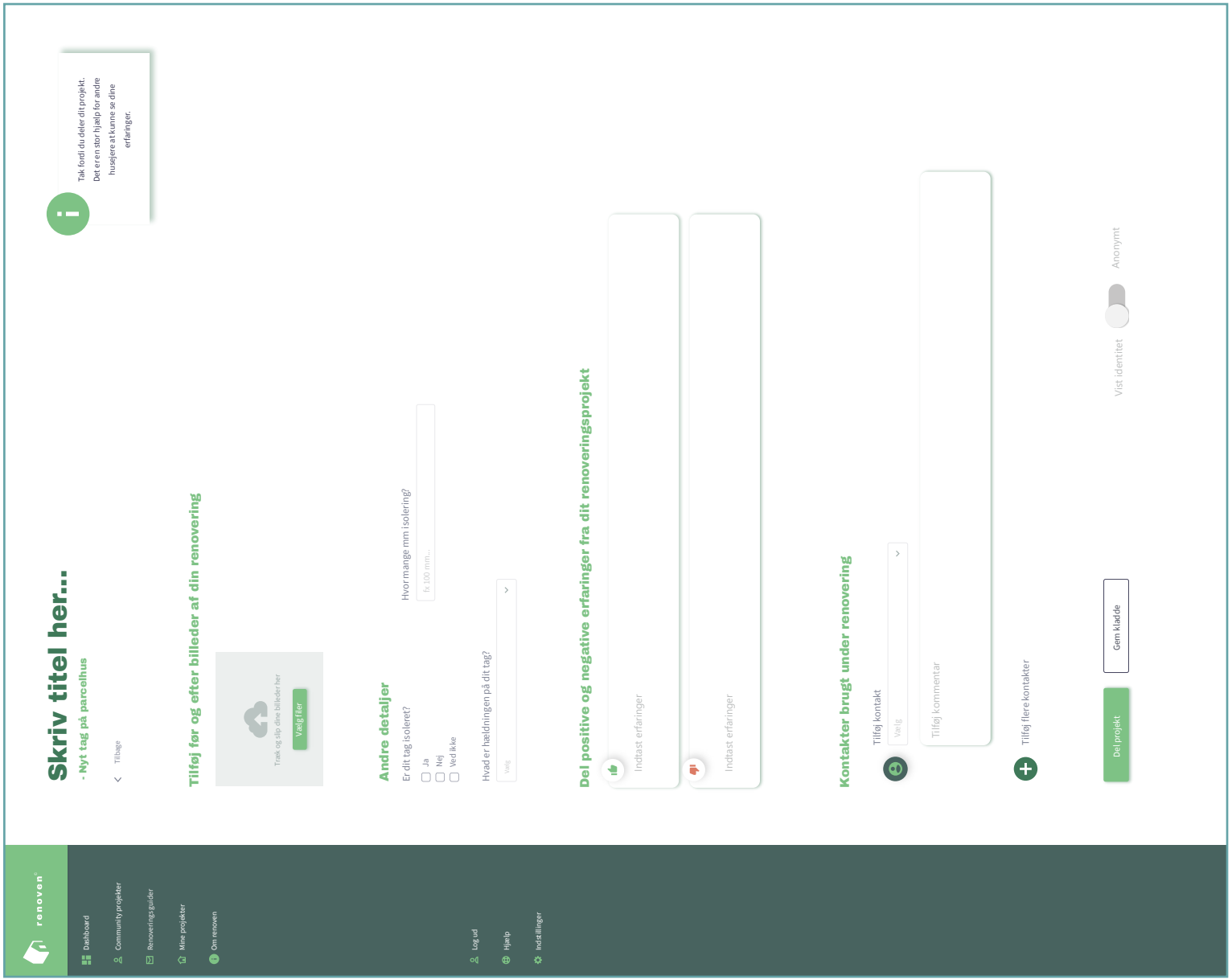

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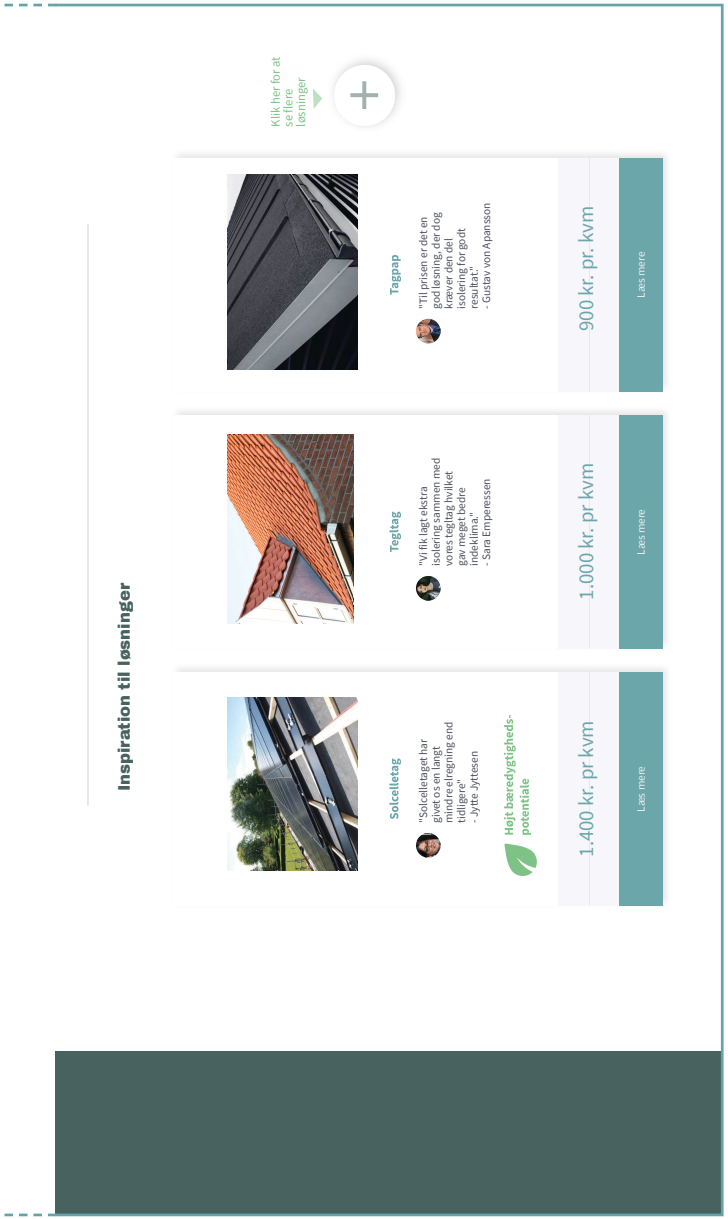

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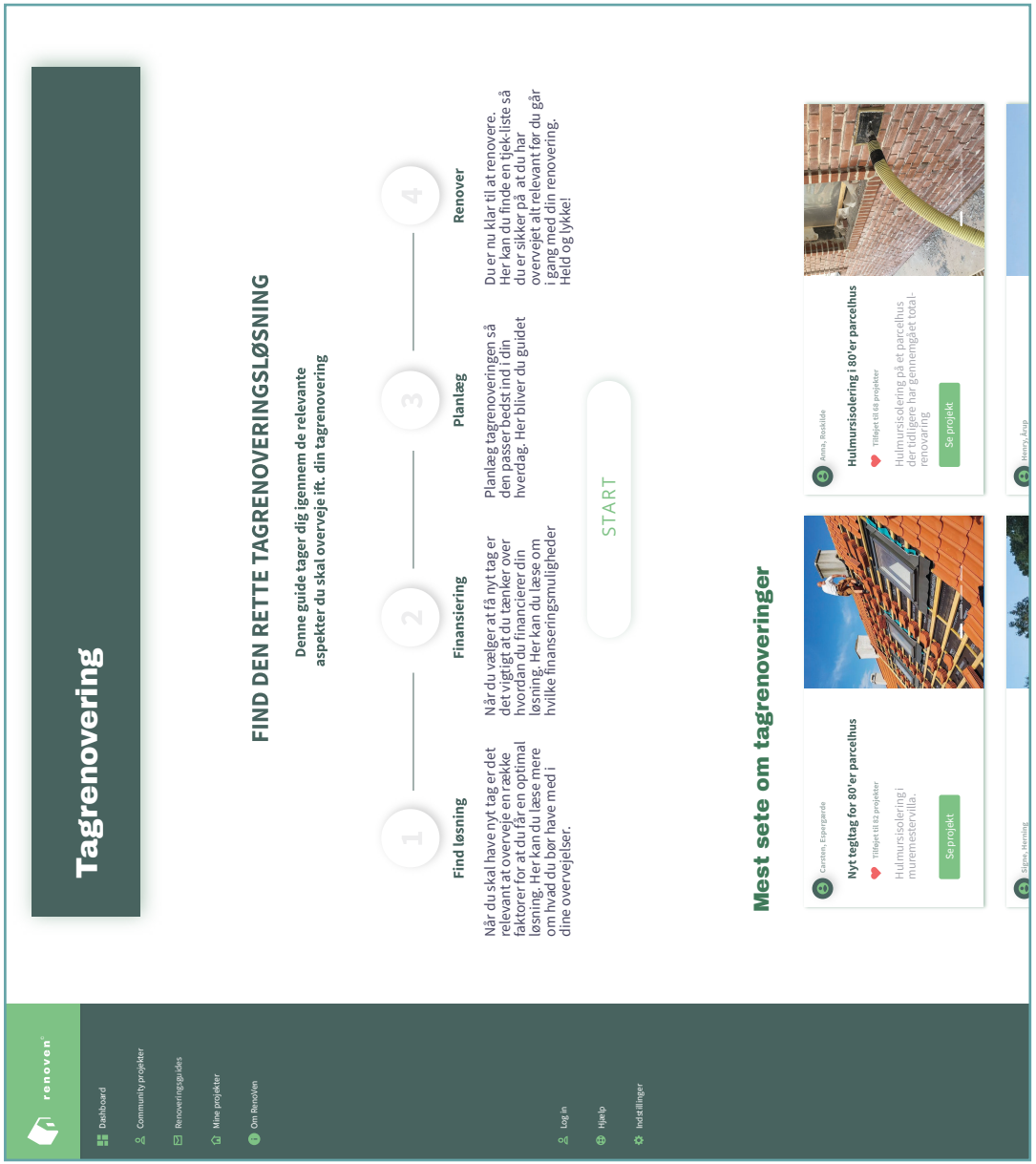

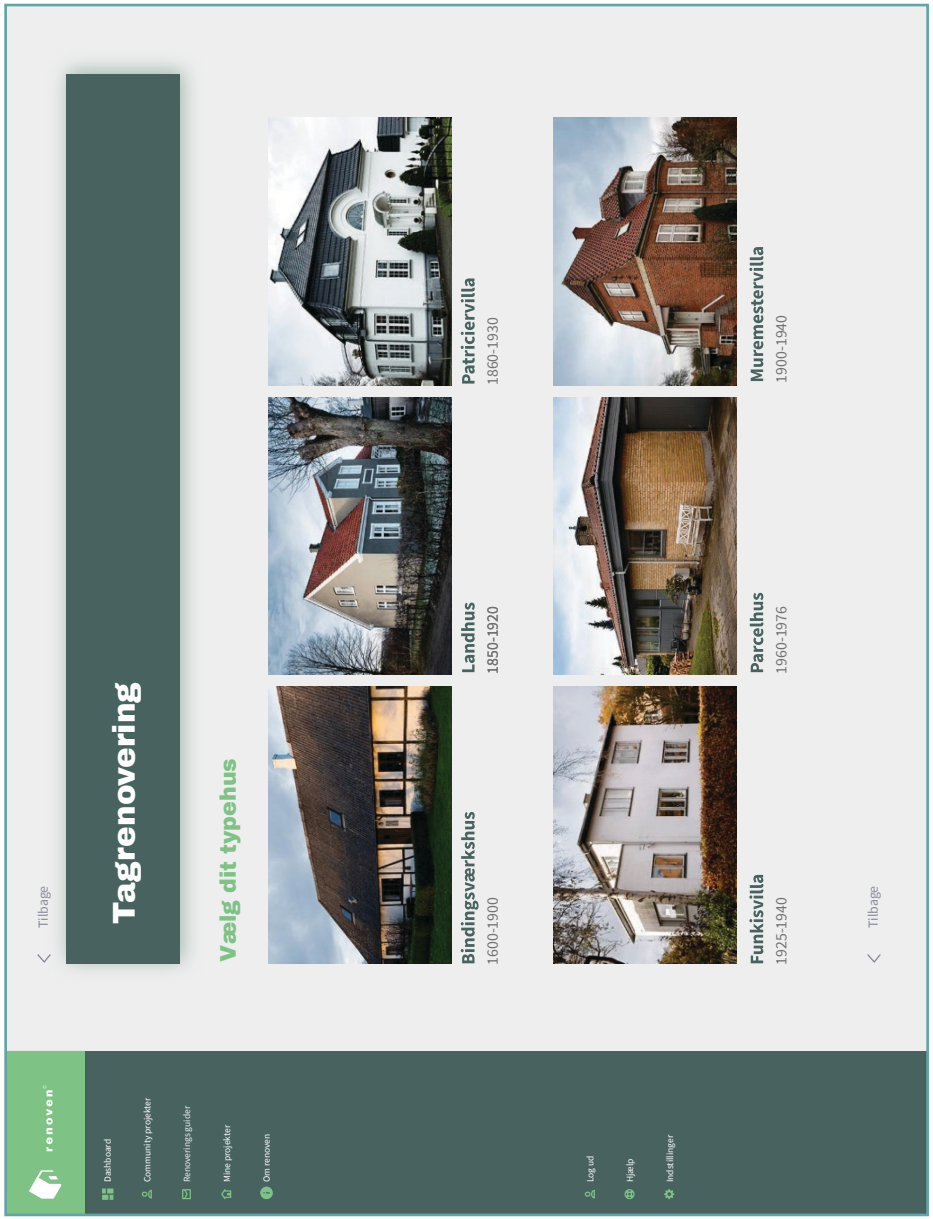

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1.400 kr. pr kvm	1.000 kr. pr kvm	900 kr. pr kvm	1.000 kr. pr kvm
Tilføj til projekt	Tilføj til projekt	Tilføj til projekt	Tilføj til projekt

1.2 Isolering

Vidste du at op imod 30 procent af dit varmetab sker igennem tager. Det kan derfor være en god idé at isolere dit loft og tag ekstra for at sikre et godt indendørs klima og en mindre varmeregning.

Når du skal have nyt tag er det en god ide i samme omfang at vurdere isolering på loft og tag. Hvis loftet er isoleret med mindre end 250 mm, er det en god idé at efterisolere det. Det mindsker varmtabet gennem loftet, så du sparer penge på varmeregningen, og giver dig et mere behageligt indeklima.

Lavere energiregning

Når du energioptimerer din bolig kan det ses på regningen for dit energiforbrug. Du sparer både energi og på penge. Det kan være med til at give dig en sundere økonomi.

Øget værdi af bolig

Energioptimering er forbedringer af din bolig som kan føre til at din ejendomes værdi bliver vurderet højere end før. Dette kan skyldes at du forbedre boligen i en sådan grad at den kan få en bedre energimærkning.

Bedre komfort og indeklima

Når du energioptimerer din bolig forbedre du dit indeklima. Du vil opleve en øget komfort. Det bliver nemmere at holde den rette temperatur og du oplever mindre træk og kulde.

Læs mere om energimærkning her

Overvej om din bolig kan blive yderligere energioptimeret når du er i gang med at renovere. Du kan kontakte en energivejleder som kan gennemgå huset sammen med dig og komme med ideer til hvordan din bolig bliver endnu mere optimeret. Find din rådgiver her: https://sparenergi.dk/forbruger/vaerktoejer/bedrebolig/find-en-raadgiver

Klik her for at komme videre til

Finansiering

< Tilbage

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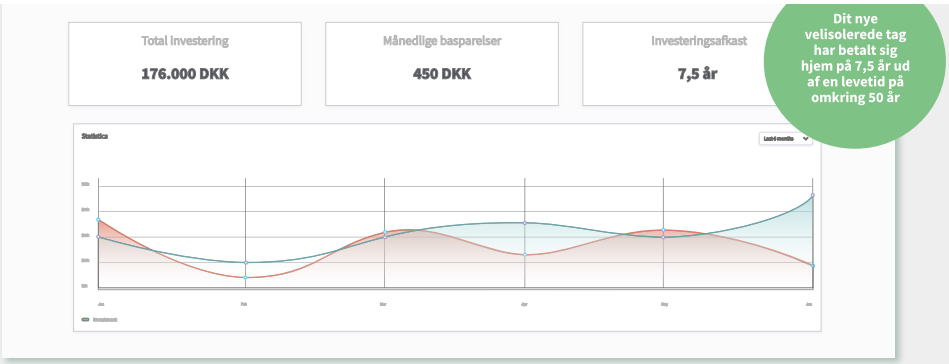

2.2 Tilskud

Håndværkerfradrag

Når du får lagt nyt tag kan du drage fordel af håndværkerfradraget. Med håndværkerfradraget kan du trække arbejdsløn til energirenoveringen af din bolig fra i skat. Du kan få et fradrag på helt op til 12.000 kr om året pr. person.

Håndværkerfradraget får du ved at lave en indberetning til SKAT ved at følge disse steps:

1) Log in på SKAT.dk og vælg TastSelv.

2) Find rubrikken 'fradrag' og klik på denne.

3) Du kommer nu ind på en side hvor en række forskellige rubrikker fremgår. Du skal finde den der hedder håndværkerfradrag og klikke på denne.

4) Nu kommer du ind på siden for håndværkerfradrag. I feltet nederst på siden kan du indberette håndværkerfradraget ved at følge step 5.

5) Ud fra feltet er der et lommeregner-ikon. Du trykker på denne (som fremgår til højre lige ud fra feltet.)

6) Et vindue åbner og her skal du angive data for at få dit fradrag. Til at starte med skal du angive typen af bolig og om det er en bolig i Danmark eller udlandet. Herefter trykker du 'næste'.

7) I næste trin skal du angive hvilke ydelser der er blevet udført i forbindelse med renoveringen. Her fremgår eksempler som du kan vælge ud fra. Tryk herefter 'næste'.

8) I sidste trin skal du skrive oplysningerne på den virksomhed der har udført arbejdet. Det vil sige cvr.nr. på virksomheden.

9) Du trykker herefter 'gem'. Du har nu angivet oplysningerne som gør at du får håndværkerfradrag for din renovering.

Klik her for at komme videre til

Planlægning

< Tilbage

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renoven

Dashboard
Community projekter
Renoveringsguides
Mine projekter
Om RenoVen

Log in
Hjælp
Indstillinger

Tagrenovering

1 Find løsning — 2 Finansiering — 3 Planlæg — 4 Renover

PLANLÆGNING

Her finder du tips til hvordan du planlægger dit tagrenoveringsprojekt

3.1 Vælg løsning

Du er nu klar til at vælge en løsning. Vælg den løsning du er kommet frem til passer bedst til dit hus.

3.2 Proces

Det er relevant at overveje hvornår i ønsker at få foretaget renoveringen. Her får du en oversigt over renoveringsprocessen.

3.3 Kontakt

Find den relevante aktør til at udføre din renovering. Her finder du en oversigt over de anbefalede teknologiudbydere og håndværkere.

Renover

Der er nu ikke andet at gøre end at gå i gang med din renovering. Tjek listen og vær sikker på at du har alle overvejelser med.

Du har valgt solcelletag

- Kombinerer tag og energiproduktion
- Holder 40-50 år
- Højt bæredygtighedspotentiale

1.400 kr. pr kvm

3.2 Process

Når du skal have lagt et nyt tag i form af et solpanelstag tager det typisk 1-2 uger før du har dit nye tag. Det anbefales at få skiftet tag i vintermånederne da det regner mindst i disse måneder, men skiftning af tag kan også sagtens foretages i de andre måneder af året. Når du skal have installeret et solpaneltag er processen den følgende.

Process

1) Der opstilles stillads på den ene side af huset.
2) Det gamle tag pilles ned og køres til genbrug.
3) Isolering af loft og tag foretages. Her er det vigtigt at loftet er ryttet og klar til at håndværkerne kan komme til under taget.
4) Det nye solpanelstag implementeres af tømrer.
5) Når taget er lagt tilsluttes elforsyningnen ved besøg af en elektriker.
6) Taget er nu renoveret og klar til at producere strøm til husstanden.

3.3 Kontakt

Hvem skal du kontakte

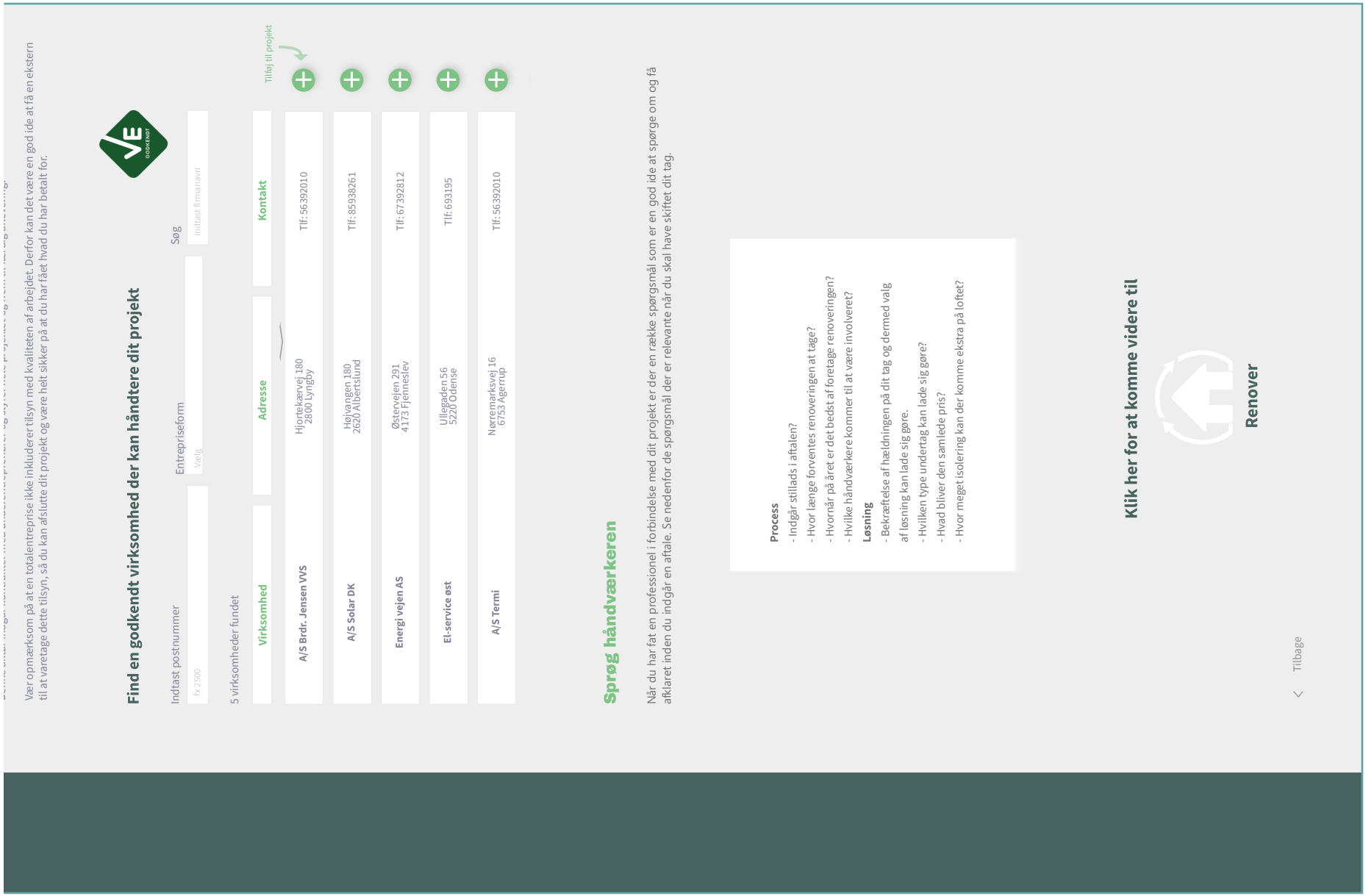
Hvem du skal kontakte afhænger af hvilken entrepriseformen du ønsker for din renovering. Entrepriseformen har betydning for hvem der har de forskellige ansvarsområder der følger med et renoveringsprojekt, eks. økonomi, jura, byggestyring. Det har derfor betydning for hvilke konsekvenser du som bygherre tager ansvar for. Det er vigtigt at vælge den rette entrepriseform til din renovering så du er sikker på et godt resultat.

Entrepriseformer, som er relevante for private boligejere er følgende:

- Fagentreprise
Her er det dig, der styrer projektet evt. sammen med en rådgiver. Dette involverer at du står for projektering (tegninger, beskrivelser m.v.), indhentning af byggetilladelse, indhentning af tilbud fra håndværkere samt det er dit ansvar at syre processen undervejs. Hvis der opstår konflikt med eks. håndværkere er det også dit eget ansvar at håndtere dette. Afhængig af projektets størrelse kan dette være en god løsning, som er knap så dyr som de andre entrepriseformer.

APPENDIX 11 - WEBSITE PROTOTYPE

Interactive version can be found here: https://xd.adobe.com/view/985163ee-59f6-4366-718a-5edb1ad3f197-ee60/?fullscreen



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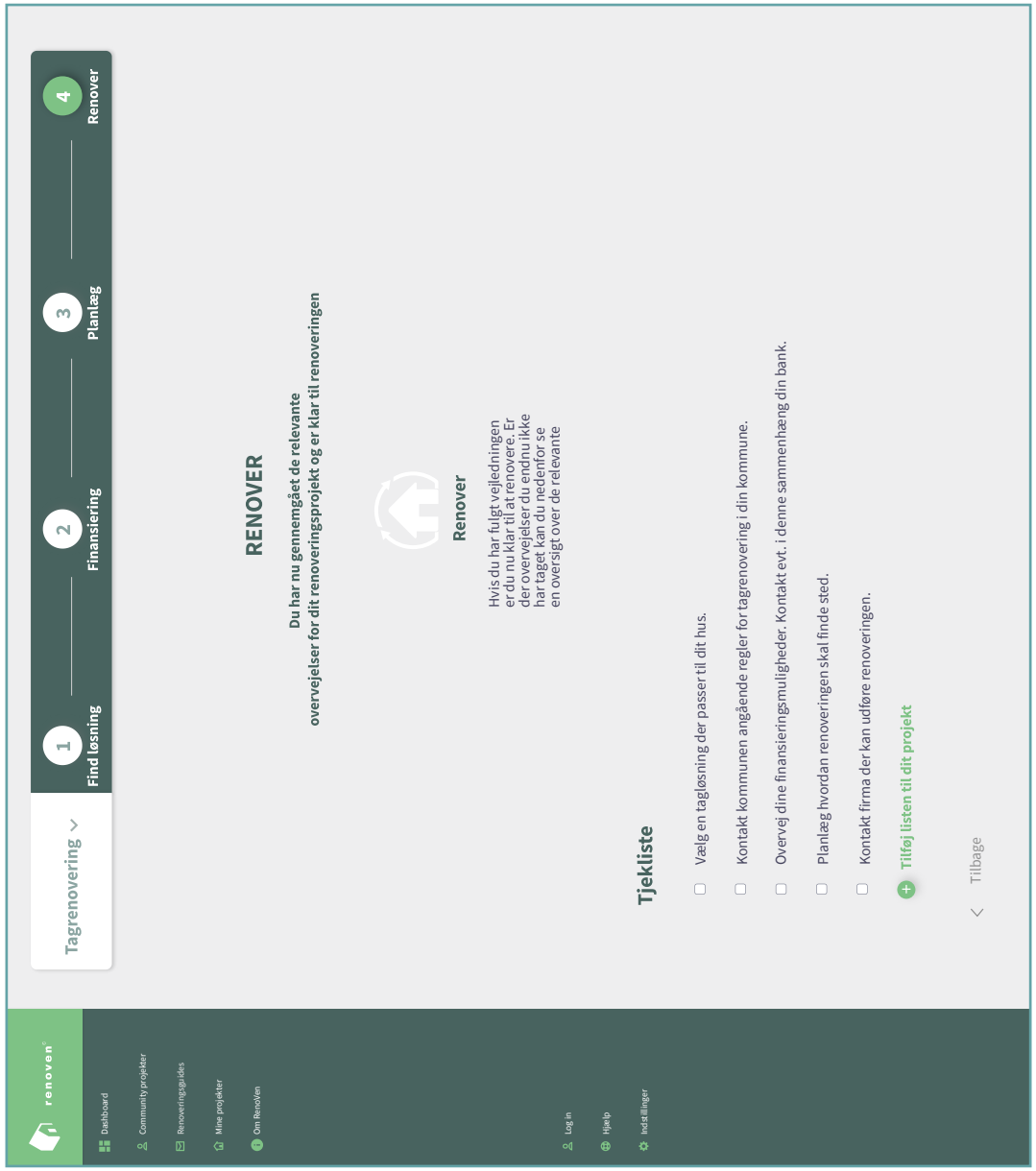

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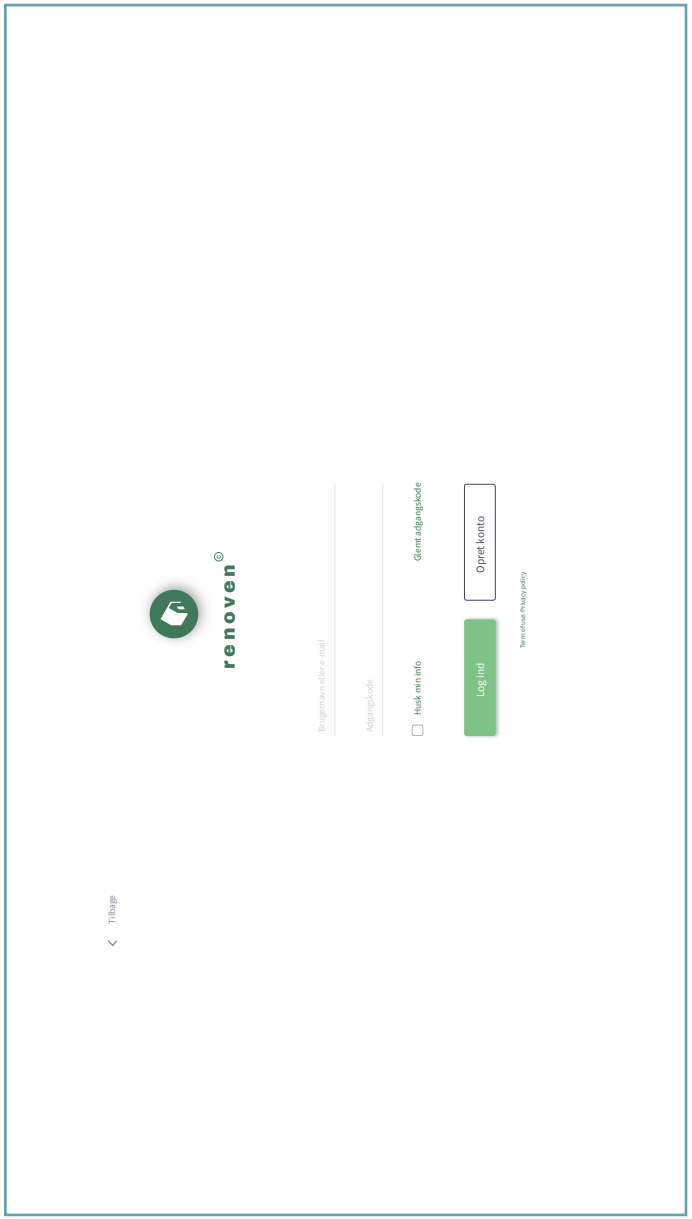

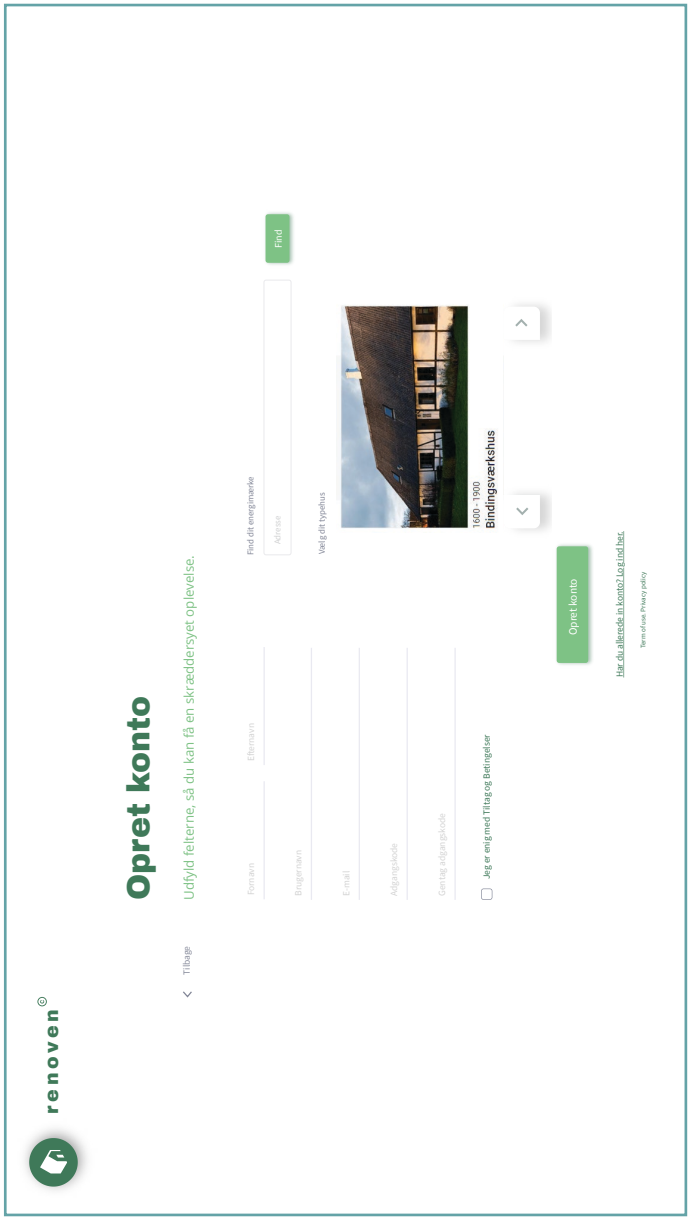

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