Motivating house buyers to energy renovate: A Practice Theory approach

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Abstract:

For Denmark to become independent on fossil fuels by 2050 there is a need to energy renovate the existing building stock. Private households represent 31 % of the total energy use, and 65 % of the building stock, which is erected prior to the introduction of the first requirements to building's energy-efficiency in 1980, are estimated to be suitable for energy renovation. The investment of these energy renovations is dependent on the owners; however, homeowners seem to lack motivation to do so.

This thesis strive to generate new knowledge about how to motivate house buyers to energy renovate, utilizing the approach of Practice Theory. Our data is based on a literature review, semi-structured interviews and a workshop consisting of two realtors, two energy renovation advisors and three homeowners.

We have mapped the practices of these actors and identified the professional actors that are appropriate as potential proponents of energy renovation. We have we identified important drivers and barriers of the house buyers' motivation for carrying out energy renovations. We found that no generic solution is available for motivating house buyers to energy renovate, as the house buyers' willingness to invest in energy renovation depends on the outcome being favorable according to their own preferences, and the outcome is dependent on the material conditions of the particular house. On top of that, both the house buyers' preferences and the material conditions of their houses vary considerably. Therefore, we suggest digitalization of the Energy Performance Certificate, as a means of personalizing the motivational incentives.

Indhold

1. Introduction

Striving for reducing CO_2 emissions, the Danish government has a vision where Denmark becomes independent on fossil fuels by the year of 2050 (Klima- og Energiministeriet, 2011). To fulfill that vision, the Danish government has implemented measures to lower the energy use in buildings, since 31.2 % of the annual heat- and water use stems from Danish households (Energistyrelsen, 2017 p. 35). One measure taken to ensure the energy use is reduced is the Building Regulations, which dictates that all newly erected buildings should comply with the existing standards.

However, not only newly erected houses hold the potential for lowering the overall energy use in Danish households, because prior to 1980, regulations were nonexistent. This means, that buildings predating the 1980s rarely can be considered energy effective, and since 65 % of the Danish building stock was erected prior to 1980 (Dansk Byggeri, 2017), a potential to lower the annual energy use lays within these houses. Today, detached houses represent most of the building stock with a total of 44 %, and a study by the Danish Building Research Institute categorized 52 % of all detached houses in Denmark as either suitable or very suitable for energy renovation. Thus, that study concludes that a potential for energy savings lays in energy renovation of the existing building stock in Denmark (Statens Byggeforskningsinstitut, 2016).

When it comes to the existing building stock, the Danish building regulations contain requirements to energy-efficiency regarding renovation of houses. An example is, that when renovating it is required to carry out energy saving measures if it is profitable according to the calculations specified in the Building Regulations (Trafik-, Bygge- og Boligstyrelsen, 2018). However, these regulations only succeed to some extent, as it ultimately depends on the homeowners' willingness to invest in renovation of their houses. Governmental incentives already aim to motivate the homeowners to renovate, with the aid of incentives such as the energy grant (energitilskud), which provides homeowners with financial grants for conducting energy renovations, such as switching to a new heat source. Another measure is the contractor deduction (håndværkerfradraget), which is a similar incentive that enables homeowners to receive a tax deduction for payment of contractors, with a maximum of 18,000 DKK per resident over the age of 18. Yet another incentive is the Energy Performance Certificate (EPC), which has been mandatory for house sellers to provide since 2010. The

EPC is a report based on the energy efficiency of a house, and the house is rated on a scale from G to A2020, with A2020 being the best possible rating. The EPC also includes suggestions about how to improve the energy efficiency of a house, with estimations of costs and benefits thereof. The purpose is to give the buyer an impression of the condition of a house and to encourage buyers to initiate the energy saving measures suggested in the report. A study from 2014 revealed that the EPC does not have the intended effect, as most homeowners do not find the information useful. The study pointed out that other suggestions, such as increased comfort, should be incorporated into the EPC (Christensen et al., 2014).

Despite the incentives taken by the Danish government, homeowners' interest in energy renovation seems to decrease, possibly because it is not required by law or that energy renovations demand large investments.

Several studies have been carried out to determine how to motivate homeowners to energy renovate, but seemingly there is no simple answer. A 2014 study by Judson and Maller, concluded that policies regarding energy renovation have limited effect and impact on homeowners, but it is the homeowners' private practices that affect their decision-making (Judson and Maller, 2014). This is supported by another study by Vlasova and Gram-Hanssen, who found that policies need to take the inhabitants' everyday practices into account, due to a significant connection between habits and technology (Vlasova and Gram-Hanssen, 2014). A review of a similar focus also found that, although design, technology and maintenance can be factors that influence homeowners in their energy renovation process in some cases, homeowner's own behavior must also be considered as a significant influence on their willingness to energy renovate (Visscher et al., 2016). Bartiaux et al. argue, that energy renovating should be considered a practice determined by social settings, and that homeowners should not be considered as actors choosing to energy renovate, but as carriers of norms that are socially accepted and acknowledged (Bartiaux et al., 2014). Bartiaux et al., demonstrated that human beings are too complex to fit into one single category - also in terms of energy renovation. Instead, the study suggests that homeowners should rather be acknowledged as individuals who all have different needs, ideas, hopes and desires when energy renovating their homes (Bartiaux et al., 2014).

An investigation carried out by Boligsiden.dk, based on a survey including 1,078 homeowners, found that 57 % of the respondents would invest up to 200,000 DKK in renovations when buying a house. 30 % of the respondents would invest more than 200,000

DKK and only 6 % would not invest in renovations at all (Boligsiden.dk, 2014). However, there are no studies that demonstrate the relation between what the homeowners express in terms of future energy renovations, and them actually carrying it out. A recent study of homeowners demonstrated that 34 % of the respondents were either not interested in, or did not care, about energy renovations. The study also revealed a decrease of interest in energy renovation since 2012 (Bolius, 2017). In addition, the study found that when buying their house, homeowners are likely to invest in renovations, thus making this an appropriate situation for engaging a motivational incentive (Bolius, 2017). This convinces us that there is an excellent opportunity to motivate house buyers to energy renovate, thus focusing on a specific time. Additional literature about homeowner's practices also made us realize, that we need to understand the actions of the groups intertwined in the practice of buying a house, in order to learn how and when to motivate house buyers to energy renovate. This leaves us with the following problem statement:

> *How can house buyers be motivated to energy renovate during the process of buying their house?*

1.1 Research questions

To answer the problem statement, we have divided it into two research questions, which eventually will enable us to answer our problem statement.

Who should motivate house buyers to energy renovate?

To answer this, we have mapped the practices of the main actors involved in the process of buying a house. We have located and investigated relevant actors' practices to find out how they are related to the house buyers and energy renovation, with the purpose of determining which of the actors holds a potential for positively influencing the homeowners to energy renovate. To do so, we have conducted semi-structured interviews with two homeowners, a realtor, a banker, a contractor, an energy advisor, and an advising engineer. These interviewees each represent a field of interest, thus the answers provided in the interviews are considered as generalizable. To process the data, we have utilized the approach of Practice Theory, which has helped us examine the different practices of the actors, by locating patterns and structures present in their practices. Locating the appropriate actor to be in charge of motivating the house buyer leads to the next research question:

How to motivate the house buyers to energy renovate?

To answer the second research question, we have located drivers and barriers regarding motivation of homeowners, in the perspective of energy renovating. This with the aid of findings from similar studies accumulated during our literature search, our interviews and a workshop conducted with homeowners, realtors, and energy advisors as participants. The purpose of the workshop was, to have the participants generate ideas of how to motivate house buyers to energy renovate. We have clarified how the technologies of energy renovation and governmental measures can motivate or hinder the practices of energy renovating.

1.2 Structure of the thesis

To ensure eligibility of the thesis, we have listed the following table to demonstrate how the thesis is structured.

Chapter	Purpose
Chapter one - Introduction - Research questions - Structure of the thesis - Terminology - Delimitation	The first chapter includes the description of the study, the limitations we have made and the aim.
Chapter two - Practice Theory approach - State of the art literature on energy renovating	We will enlighten the theoretical approach of Practice Theory, and how we have utilized the approach. This chapter will also demonstrate the extent of knowledge and previous studies, or state of the art, regarding energy renovating.
Chapter three - Phase one: Interview - Phase two: Workshop	The methodological approaches of interview and workshop will be described, in which we distinguish them as: phase one: interview, and phase two: workshop.

Chapter four - Analysis of external influencing factors in energy renovating	This chapter analyzes the external factors that influence energy renovating. The analysis is concluded with a part-conclusion.
Chapter five - Analysis of Practices involved in the sale of a house	This chapter analyzes the practices involved in a sale, with a part conclusion.
Chapter six - Conclusion - Reflection	The last chapter concludes and reflects on the study and findings.
Chapter seven - References	A list of references used in this thesis.

1.3 Terminology

For readers of this thesis, as well as ourselves, we have chosen to list the terminology that may require distinguishing. This will help us to create consistency in the thesis and allows for the readers to understand our choice of terminology.

In the problem statement and throughout the thesis, we distinguish between homeowners and house buyers, because our interest lays with people in the situation of purchasing a house, thus *buyers* and not *owners.*

The term *energy renovation* we define, as all renovations carried out that improves the house's energy-efficiency and/or causes a reduction in its use of energy. This includes, but is not limited to: the installing of solar cells, additional insulation, replacing outdated heat sources, replacing window-glass for further insulation, the installing of heat exchanger, etc. These have been further described in Analysis of external influencing factors in energy renovating.

We use the terms internal factors and external factors. By factors we mean elements, aspects, or things. We identify the internal factors as personal aspects, such as house buyers'

preferences, values, beliefs, and desires. The external factors are other influences, such as governmental measures, the technologies of energy renovation and geographical limitations.

Not all terms can be directly translated into English, thus we have translated some terms as closely related as possible, followed by the Danish term in parenthesis. This ensures, that the terms not directly translatable, are understood by readers of this thesis.

1.4 Delimitation

Moving from the introductions and terminology-clarifications, we will now describe the limitations we have made, in order to conduct this study. We acknowledge that there are factors that may be relevant to the problem statement, but due to the time limit of our project, these have been excluded.

We have not delved deep into the political system, as it is a highly complex matter, and we want to focus on studying the actors that have hands-on experience with energy renovation, or actors that can potentially motivate house buyers for such renovations. Since we are located in the municipality of Aalborg, we have primarily acquired informants resident in the Northern Jutland Region due to logistics. Conditions that are essential for this study, such as the housing markets, utility services, local municipal politics and local culture differ across the country. Therefore, this project is mainly representative of Northern Jutland and not the entire country of Denmark. Furthermore, we have excluded some actors that may be influential for the project: Public servants, family and friends of the house buyers, and other contractor professions are also related to the practices of buying a house and energy renovation. Those actors have also been excluded due to the time limit of the project. Based on our interviews, we have chosen to focus on those actors we found closest related to the house buying practices and energy renovation. Finally, we have only looked into research from other countries than Denmark to a limited extent, as our study focus on Denmark, and important factors such as climate, politics and culture may differ greatly from other countries. Lastly, we have not focused on the green aspect of energy renovating, and what/how Danish citizens' energy use affects the planet. This also due to time-limitations, though we recognize that this aspect may have been of relevance to the study as well.

2. Theoretical approach

To gain a better understanding of what drives the different actors in the process of buying a house we have utilized the approach of Practice Theory, due to its tools and insight into actors' practices. When utilizing the term practice, we perceive this as the actions that are carried out by human beings in particular situations: in this thesis, we focus on the practices of buying a house, as well as associated practices carried out by the some of the actors who are involved in the house buying process. Yet, we recognize that house buying practices are not necessarily the same, thus they can differ across time and space: other actors may carry out a practice differently, than we have found. The house buying process is not necessarily the same across the entire country, nor is the practice of selling a house and an apartment the same. Our focus is on the practice of buying a house, and the relating actors in that practice, thus we acknowledge that the actors take part in developing the practice.

2.1.1. Perspectives of Practice Theory

According to professor of geography and philosophy, Theodore Schatzki, Practice Theory can be defined not as a unified theory, but as a *"body of highly diverse writings by thinkers who adopt a loosely defined 'practice approach'"* (Bräuchler and Postill, 2010 p. 4). Schatzki has, simultaneously, argued that Practice Theory can be defined in four categories, namely philosophers, social theorists, cultural theorists and theorists of science and technology. In addition, the theorists Bourdieu (1977), Foucault (1979), Giddens (1979/1984) and de Certeau (1984) are considered part of the first wave of Practice Theory: the second wave consists of those that attempt to build on the foundations of Practice Theory, namely, Schatzki (1996), Reckwitz (2002), Warde (2005), etc. (Bräuchler and Postill, 2010 p. 4).

2.1.2. The first wave

The first wave of Practice Theorists attempted to locate a middle ground between methodological individualism and methodological holism. This means, that the theorists sought a middle ground between "*that social phenomena must be explained by showing how they result from individual actions*" and "*the explanation of phenomena by means of structures or social wholes*" (Bräuchler and Postill, 2010 p. 4). French sociologist, Pierre Bourdieu, approached this by creating the term habitus, and defines it as a human being's physical, mental, and verbal actions in any given situation. Bourdieu developed the term to

demonstrate the "*permanent internalization of the social order in the human body*" (Bräuchler and Postill, 2010 p. 4) as well as the practices of different agents, and their ability to improvisation and invention. Habitus is based on a person's individual actions and habits, as well as embodied experiences in social groups, which causes patterned actions. A person's habitus is controlled by the subconscious, thus actions are not necessarily deliberate. Bourdieu argues, that the fact that actions are subconscious, means, that we can decode a social setting very quickly when we are in it, and from thereon act accordingly to the specific setting. This helps us in acting accordingly to any social setting based on the habitus (Westerling et al., 2015). In addition to the habitus-term, Bourdieu also defined the term field, which later became another important element in Practice Theory. Fields are described as domains of practices, with individual logic, constituted by capital. This can, as an example, be financial, symbolic such as prestige, or social capital. A field can be exemplified with a game: players of a game with know-how and belief are willing to spend time and efforts on playing, thus long-time players with skills can develop a practical sense or *"feel for the game"* (Bräuchler and Postill, 2010 p. 4). This makes their actions embodied, and it seems almost effortless. According to Bourdieu, the seemingly effortless action is much more than just that, and demonstrates a good fit, between habitus and field (Bräuchler and Postill, 2010). We identify the terms habitus and field within the actors of relevance: these are considered skilled in their respective practices, e.g. realtors are skilled players in the field of house selling, contractors in renovations, energy advisors in advising as well as energy, and homeowners are skilled players within their own home and the purchase thereof.

Another element in the first wave of Practical Theory, is the term structuration, which was developed by British sociologist Anthony Giddens (1984). This constitutes, that social relations are structured across time and space, due to duality of structure: a notion, that illustrates how structure is both *"the medium and outcome it recursively organizes"* (Giddens, 1984 p. 374). We perceive the term structuration, as the structure of selling a house in which the social relations are structured across time and space: the structure of selling a house is, as Giddens described it, both the medium and outcome of the social situation. This, because without selling the house, the social situation would not occur, while selling a house would not be possible without some form of social situation. This is especially evident because homeowners would require contact with realtors to sell a house and most homeowners would also require contact with a banker, and due to the requirements of developing an EPC when selling a home, energy advisors are also a necessary contact.

This outline of original thinkers and philosophers of Practical Theory leads towards the newest generations of thinkers within the field, which can be defined as the *second wave*.

2.1.3. The second wave

The second wave of Practice Theory, as described by Schatzki, is the culmination of scientists that build on, or question, the initial proclamations of Practice Theory. These theorists also focus on the human body and practice, though focusing on culture and history, and the application of Practice Theory to new areas, such as consumption studies.

According to Schatzki, material arrangements, or materiality, are essential for social practices (Schatzki, 2010). Materiality are the elements that pertain practices, including physical things, nature, and organisms, thus also technology. It is not merely the physical surroundings wherein and amongst the practices take place, but materiality also plays an active role in shaping the practices that are carried out amongst them (Schatzki, 2010). An example is, that the physical surroundings in a house affects the residents' practices. our understanding is that houses are material arrangements that are constituted by floors, walls, a roof, windows, doors, insulation, a heat source, a ventilation system, electrical installations, and devices, etc. The house is the focal point of many daily-life practices of the residents, such as cooking and watching TV, as well as it is the material arrangement wherein the homeowners' practices of (energy) renovation takes place and revolves around. The material things that constitute the house - particularly the technologies - affect and shape the homeowners' practices. E.g. a ventilation system affects the residents' practices of maintaining a healthy indoor climate, as they no longer have to open windows several times a day to ventilate. Additionally, it may affect other practices, such as dishwashing and cooking, due to the automation of ventilation. Also, the house is a part of the material arrangements pertaining to the practices of the professional actors involved in energy renovation. Both the realtors', bankers', contractors', and energy advisors' practices related to energy renovation are dependent on the houses and, especially, the condition of the material things that constitute the house. An example is, how the construction of the house and its composition of technologies affects how the contractor carries out a renovation, while it affects how the realtor evaluates the house as well as how the energy advisor advises the homeowners.

Material arrangements can be related to practices in four ways; causality, prefiguration, constitution, and intelligibility. Causality relations is, when the characteristics of a material element causes the actors to behave in a certain way, and thereby affect their practices. In other words, are causality relations change the flow of action. An example of a causality

relation is that if a house's heat pump malfunctions it will cause the residents to react accordingly by putting on warm clothes and call for reparation. Prefiguration becomes visible when the appearance of a material element leads the actors to prefigure its characteristics. This is perceived as opposites, such as easy/difficult, comfortable/uncomfortable, etc. An example is, that the characteristics of a house lets house buyers prefigure that it is difficult to break and comfortable to live in. A relation of constitution is, when the practice cannot occur without the material, thus, when the material thing constitutes the practice: without a house, which is for sale, the practice of buying a house cannot occur, nor can an energy renovation.

Schatzki also argues, that the individual's actions are led by a practical immediacy: he/she acts in accordance with what makes sense to him/her in that specific moment, which is led by three different types of understandings of practices, namely practical understandings, rules and teleoaffective structures (Schatzki, 2010). Practical understandings are defined as the knowledge of how to identify elements and phenomena, how to handle them and how to react towards them. Practical understanding can be seen, according to Gram-Hanssen's perspective, in the bodily know-how of regulating heat and ventilation in a home, to maintain the indoor climate. The actual practicality lays in adjusting valves, as well as opening and closing doors and windows. We perceive practical understandings similarly: where Gram-Hanssen exemplifies practical understandings with regulating the indoor climate, we view it in the perspective of, if homeowners feel an indoor draft, they locate what causes such a draft, and repair/replace it.

Rules are present in nearly all social contexts and constitutes how the individual should act in a social setting. These are explicit rules, most often formed by authorities, and can be identified as an element that applies in certain buildings, as declared by building- or home associations. These can include which levels of heating are allowed as well as the levels of ventilation in a home. In the perspective of energy renovating houses, homeowners are especially affected by the building regulations which dictate how renovations should be carried out, to ensure the quality and energy-efficiency of the building. This is further investigated in chapter 4, Analysis of external influencing factors in energy renovating. Teleoaffective structures denote the actions towards a certain aim, which is defined by normative attitudes and perceptions. A normative attitude in Denmark that it is important to take care of the environment can also determine a practice. However, the individual may not be aware of teleoaffective structures: when a homeowner wants to reduce the energy costs he/she may, consciously, do it solely for financial purposes, but it may also originate in the

normative societal understandings of being environmental friendly. Gram-Hanssen exemplifies with, that when people wash their clothes, they do so based on normative rules about cleanliness, not individual actions: it is, most likely, based on the cultural understandings that contributes to the construction and reproduction of teleoaffective structures (Gram-Hanssen, 2014 pp. 202-203).

In Practice Theory, the individual is not the focus of an investigation or analysis, but rather the practices that are being carried out in social contexts. Though the individual affects the practices, he or she is not the creator thereof. The individual only participates in the practices that are socially constructed as a combination of practices that are developed over time, along with the material arrangements, which the practices evolves around. Even though a practice is carried out by an individual, it is led by collective norms and structures. In this sense, individuals are only carriers of practices who assist in maintaining and developing them (Schatzki et al., 2001). This is evident in how we have chosen actors, and defined them as relevant: an example is, that realtors are carriers the practice of selling a house, because only they are aware of what it entails. If a contractor was to develop deeds and purchase agreements, otherwise developed by the realtor, it is likely that the contractor would fail. According to Andreas Reckwitz (2002), this causes Practice Theory to neglect the individual, which is highly distinctive in the first wave of theorists. Reckwitz argues, that social practices are bodily and mental routines that entails a multitude of social practices: thus, the individual is the crossing point of practices (Reckwitz, 2002).

Returning now to the perspective of Schatzki who states that Practice Theory concerns studying social practices, as all social phenomena are perceived as the nexus of practices: a series of different practices that are interconnected and interdependent. Social phenomena are perceived as everything that relates to human coexistence, thus all aspects of the human life, including language, science, knowledge, power, institutions, meaning and other human activity. All practices are derived from, dependent on, and affect other related practices (Nicolini, 2017).

2.1.4. How do we operationalize Practice Theory?

With the perception that Practice Theory concerns itself with human action and the relationships that occur in correlation with a system of patterns, we perceive and utilize the approach by attempting to understand the practices of relevant actors in the house-buying process. The house-buying practice that we focus on, as well as that of energy renovating,

constitutes the human action: the system, is evident in the perspective of governmental measures, policies, and political incentives to lower the use of fossil fuels, thus lowering the negative impact our energy use has on the environment. This also means, that the approach of the study is to understand the practices of relevant actors, later to find out how to motivate house buyers to energy renovate. If social phenomena are indeed the nexuses of practices, the practices of each actor will, ultimately, help us determine a specific situation in the process of house buying, in which house buyers are most susceptible to encouragement and motivation. Each actor will represent a field, as Bourdieu calls it, though homeowners will be represented by more than one: the practices of owning and buying a home are highly individual, since the process can be conducted in several manners. This with the expectation, that the fields of realtors, bankers, energy advisors and contractors are somewhat similar within each respective field, as they are educated in their fields of profession, with each their associated norms and procedures.

2.2. State of the art literature on energy renovating

Prior to engaging in collecting data, we conducted a literature search to locate similar studies about energy renovating of houses, which helped us understand how to place ourselves in the data collection process: this ensures that we contribute with a new and alternate perspective of how to motivate for energy renovations, thus providing new knowledge to the field. The literature search resulted in 22 articles, in which the most similar to ours will be elaborated in the following section, thus enlightening the state of the art of research within the field of energy renovating.

2.2.1. Cause for action and/or inaction

Several studies, including that of Organ et al. have illustrated, that homeowner motivation stems from economic, social, and environmental factors, while influences are both of internal and external factors (Friege and Chappin, 2014; Organ et al., 2013). Another 2013 study based on a questionnaire with more than 800 Danish homeowners, demonstrated that homeowners could feel motivated to renovate, if grants and funds were accessible (Mortensen et al., 2014). However, since 2013 new initiatives have been made to implement such grants in an attempt to encourage energy renovations.

A case study by Risholt & Berker found through in-depth interviews, that deciding to renovate depends on the needs, desires, and capabilities of the homeowners (Risholt and Berker, 2013), which demonstrates that the motivation for energy renovating is very broad and depends on many factors. Because of these many factors, some studies are contradictory: as Organ et al. proved that environmental factors are considered when renovating (Organ et al., 2013), Abreu et al. and Tan both concluded, that their interview data pointed towards aesthetics being more important than energy consumption when renovating one's private home (Abreu et al., 2017; Mortensen et al., 2015; Tan, 2014). Studies by Gram-Hanssen and Gram-Hanssen et al. have, through interview data, found that despite the policies that have been developed, homeowners do not energy renovate, simply to energy renovate, but rather renovate over a long period of time or in relation to ongoing renovations (Gram-Hanssen et al., 2007; Gram-Hanssen, 2014).

While the motivating factors for energy renovation are many, as are the barriers that may cause inaction amongst homeowners. The Energy Performance Certificate has the purpose of being an information source, as well as an encouraging description of what homeowners and house buyers can do to renovate their home energy-efficiently. However, a 2014 study of 743 survey answers showed that the EPC is unsuccessful in encouraging homeowners, mainly because owners do not know how, and what, to do with the information (Christensen et al., 2014). This is supported by Bjørneboe et al., whose firstly listed barrier is information, while other barriers located by Bjørneboe et al., are described as finances, e.g. economics of renovations, and process, including physical and social contexts (Bjørneboe et al., 2017 pp. 23-24).

While Bjørneboe et al. found barriers that are dependent on the homeowners, Gram-Hanssen and Risholt & Berker found, that craftsmen and contractors are potential barriers for future renovations, while their professions have the opportunity to encourage and influence homeowners, by functioning as driving forces (Gram-Hanssen, 2014; Risholt and Berker, 2013). Another study, focusing on questionnaire answers from more than 400 German homeowners demonstrated, that a majority of the participating parties had high energy expenses, and that this would function as the main driving force to energy renovate their home (Achtnicht and Madlener, 2014). Other results in the same study indicate, that a need for general renovation of a home also has a major role in whether they energy renovate, whereas environmental and climate protection was the least driving force behind energy renovating. In 2015, Wilson et al. developed a list of drivers, barriers, attributes of efficiency

renovations, personal influences, and contextual influences, to inform policies to promote energy efficiency, by demolishing barriers (Wilson et al., 2015).

A 2014 study by Judson and Maller concluded, that policies regarding energy renovation have limited effect and impact on homeowners, because their private practices affect them (Judson and Maller, 2014). This is supported by another study by Vlasova and Gram-Hanssen, who conducted a three-part case study, and 12 interviews. They found that policies are required to take the inhabitants' everyday practices into account due to a significant connection between their everyday habits and technology (Vlasova and Gram-Hanssen, 2014). The same study found that in order to develop successful policies, a combination of which technologies are energy efficient and human behavior needs to be present. To accommodate this, the authors state that a dialogue between homeowners and energy advisors could be the solution (Vlasova and Gram-Hanssen, 2014 p. 523). A review of a similar focus also found that though design, technology and maintenance can be factors that influence homeowners in their energy renovation process, their behavior is also considered as a significant influence (Visscher et al., 2016). Bartiaux et al. argue that energy renovating should be considered as a practice determined by social settings, and that homeowners should not be considered as actors choosing to energy renovate, but as carriers of norms that are socially accepted and acknowledged (Bartiaux et al., 2014). With this it is simultaneously argued that household practices differ between Denmark and Portugal, which can be transferred onto a smaller scale as well: in Denmark, costs for heat, water and electricity varies depending on location, which may affect where and who chooses to energy renovate.

Based on the literature, it is clear that most studies have obtained data either through interviews or survey questionnaires without including the homeowners and house buyers in any development phase. This demonstrates one element in which our study is different: we have included homeowners, energy advisors and realtors in a workshop, to find out how to motivate house buyers to energy renovate. In addition, we found that most studies ask the question how homeowners are motivated to energy renovate, with the expectation that only homeowners, not house buyers, are relevant. However, we identify house buyers as relevant due to findings in the first part of the analysis, in which we have illustrated the interconnected practices with a timeline (see analysis). The timeline also demonstrated that realtors are the actors most often in contact with house buyers, thus they may hold the potential for motivating house buyers to energy renovate. This too, has not been investigated in the

accumulated literature, which leads us onwards in studying how to motivate house buyers to energy renovate.

2.3. How we combine Practice Theory and state of the art literature on energy renovating

To merge the literature we accumulated in the aforementioned section about state of the art literature on energy renovating and Practice Theory, the following will enlighten how we have operationalized these in the study.

In our process of collecting interview data, we ask the interviewees to describe their practices in relation to buying a house, namely in the perspective of: a bank which provides a buyer with a loan, an energy consultant who consults on energy renovations, a realtor who presents and sells houses, an advising engineer who develops EPC's, a contractor who works with house renovation, and finally the house buyers who buy a house and, possibly, initiate the energy renovations.

To describe how we operationalize Practice Theory, we have chosen to illustrate the timelines of each actor in the house-buying practice. The timelines visualize the practices of each actor and represent each field in which the actor is affiliated. These have been listed in the analysis as part of each actor-analysis in chapters 4 and 5. In addition, we decided to develop a timeline to illustrate the practices of all actors and house buyers. This helped us determining where to aim our focus when attempting to motivate homeowners to energy renovate. However, the process of developing the timeline proved to be more difficult than anticipated and as a result we have listed a set of rules for developing the timeline:

- All homeowners interviewed in the pilot interviews should be represented in the timeline. This base on, that homeowners are the actors that are required to choose to energy renovate.
- We need to compile the information we received into comprehensible steps that can be representative for house buying practices.
    - We need to illustrate that the steps may differ, because we are investigating human practices that are individually different.
- The steps are defined as: prior to house buy (step 0), house buying (step 1,2,3) and post house buy (step 4) and is illustrated in illustration 8.

Findings and analysis will be based on a combination of the results from similar literature as well as data accumulated throughout the study. Relating our data to relevant literature will

help us assess whether our findings could potentially be successful and/or new to the field of motivating homeowners to energy renovate. This due to, that a literature search proved the focus to be studied at length yet measures and recent findings have yet to be proven successful.

3. Method

Our method of collecting and analyzing empirical data can be seen in two phases. In phase one, the documentation and analysis of the current practices of five actors involved in a house sale is presented. Phase two focuses on input from the actors in relation to how house buyers can be motivated to conduct energy renovations.

The initial phase consists of interviews with representatives from the five fields, namely the fields of homeowners, realtors, bankers, contractor, and energy advisors. Later, these interviews were transcribed and condensed into tangible data, in the form of meaning condensations. This has helped analyzing the data and comparing it to the accumulated literature. Ultimately, this has guided us in locating an appropriate time in which homeowners are most receptive to motivation for energy renovation. With the knowledge regarding the current practices of the actors, we continued to the second part of the method, in which we investigated how to motivate homeowners. We did this by conducting a workshop in which two realtors, three homeowners, a contractor and an energy advisor participate. The following chapter will describe our methodological steps, leading up to the data analysis.

3.1. Phase one: Interview

According to Steinar Kvale (2009), professor of educational psychology, an interview investigation consists of six phases. In this chapter we describe the phases we find relevant in accordance with the study of how to motivate house buyers to energy renovate. We have defined the interviews as pilot interviews, due to their nature being explorative. This means, that we collected knowledge from relevant actors to understand their practices in the perspective of buying a house. The upcoming chapter will not distinguish between interview and pilot interview (Kvale, 2009).

3.1.1. Thematizing the interview

According to Kvale, the initial stage of an interview investigation is to determine the purpose of the investigation and what the topic is (Kvale, 2009). This is important for locating the proper methods that can lead the way to finding the answer of a problem statement.

Next, the researchers must gain insight into the subject by reaching an understanding of the phenomena and the terms being used in the field of the subject. This will enable the researcher to ask relevant questions. To produce new knowledge on a subject, Kvale argues

that it is necessary to present all existing knowledge on the field and other similar studies (Kvale, 2009). Literature studies and theory alone is not enough to get truly familiar with the field, therefore, it is recommended to experience the environment and the people that are a part of it. As the subject of this study is energy renovating of private dwellings and motivation of house buyers, a literature review was conducted on the topic. The literature search was conducted with search terms and keywords through the software program Publish or Perish and Ebscohost, Springer Link, IEEE Xplore and PRIMO. After going through the steps of the Flow Diagram, as per the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Moher et al., 2009), we identified 22 articles of relevance to the topic of motivating homeowners to energy renovate. The full extent of the literature search is placed in appendix 1.

The literature search enabled us to investigate phenomena and terms that were otherwise unfamiliar to us, with the intention of further delimiting our focus. Simultaneously, the search enabled us to determine where to place our study in the realm of knowledge, thus contributing with new knowledge and perspectives in the topic of energy renovation. Furthermore, as we focus on energy renovating when buying a house, the interviews conducted are defined as explorative due to the intention of uncovering problems or gaps in the interconnected practices. Simultaneously, the literature search enabled us to clarify the relevant actors, and thereby who the relevant interviewees are: a banker, a realtor, a contractor, homeowners, an advising engineer, an energy consultant, and an employee at a utility supplying company.

3.1.2 Designing the interview

Moving further in the interview process is the design phase, in which the design of the interview investigation is planned. The procedures and techniques that are going to be used throughout the study are determined in this phase, with the purpose of gaining an overview of all the phases: what needs to be done and which methods should be used (Kvale, 2009). It should be taken into consideration that the answers received in one interview, may affect the upcoming interviews. This became evident to us in an interview with a contractor, who explained the relevance of advising engineers, whom we later interviewed. Therefore, researchers should be prepared and willing to change the scope as a result of gaining more knowledge in the interviews. All phases are planned as detailed as possible and time and resources should be taken into consideration. This entails that we determined the date, time

and location for each interview, preparation of roles and what materials are required, such as paper and pen, audio-recording devices, and interview guides.

3.1.3 What an interview is - according to Steinar Kvale

An interview is a conversation between an interviewer and interviewee, in which the interviewer wants to learn something about the interviewee's view on a certain topic. There are different types of interviews with varying structure and rigorousness, depending on the purpose of the interview (Kvale, 2009). We used semi-structured interviews in this study, as we wanted to gain insight into the lifeworld of the actors involved in the practice of buying a house. The semi-structured interview is characterized by a less rigorous structure, and the power distribution between interviewer and interviewee is more balanced, compared to a completely structured interview, where the interviewer is in charge of the conversation and the interview guide is followed strictly (Kvale, 2009). Thus, the semi-structured interview was expected to provide us with insights into the lifeworld of relevant actors, based on their individual experiences otherwise unknown to us (Brinkmann and Tanggaard, 2010). This we perceive as one of the advantages of utilizing the semi-structured interview approach. It is an explorative way of studying a person or subject, it can shed light on unforeseen topics of relevance to a study and it since it resembles a friendly conversation the interviewee can be more comfortable.

To remain within a field of relevance we developed interview guides to follow when interviewing actors. The interview guides are placed in appendix 2. The interview guides ensure not only relevance, but also a natural flow of conversation because we stay aware of what we want to learn more about. This with the aid of research questions, which consists of scientific questions such as: what is the actor's practice? Put into perspective, research questions differ from interview questions because we asked the participants to describe the process of doing their job. This to ensure that the interviewees understand and are able to comprehend what we are asking, as well as what we want to know more about. Thus, interview questions are formulated in a language that is appropriate to the interviewee, without expectations or prejudices about their scientific knowledge. We cannot expect that everybody understands or can comprehend what we mean with the term practice, which is why we used more common terms. Despite attempting to accommodate for potential misunderstandings due to terminology, we experienced a problem during one interview: one interviewee perceived a question differently than intended, which required that we asked follow-up questions. When the interviewee did not answer the follow-up questions, we found

it difficult to continuously ask the interviewee to describe further, as it may seem patronizing or condescending.

Another disadvantage when utilizing semi-structured interviews is that the data obtained mostly consists of qualitative results, depending on the questions asked. Generalizable questions, such as age, gender, and occupation, are quantifiable, which data obtained through our interview questions are not. Thus, the generalizability of our study results may be jeopardized, because we investigated the lifeworld of actors interconnected in the practices of buying a house.

Lastly, before engaging in the interviews we informed the interviewees of formalities such as anonymity, informed consent, and audio-recording of the interview. Since audio recording may affect the behavior of the interviewee, we placed the recording device next to a cup or other material, to make it seem less intimidating. Being aware of the device may cause the interviewee to be less expressive or descriptive when answering questions, which we wanted to avoid.

After conducting the interviews, we moved towards processing the data, which transcribing enables us to do. To create a consistent and tangible overview of the accumulated data, we developed a set of rules to follow during the transcriptions. These have been listed in accordance with each interview in appendix 3. The rules differ depending on interview, mainly due to how we delegated the roles amongst ourselves, to ensure that all group members are equally included in the process of collecting data. Interviewer 1, as listed in the interviews, represents the main interviewer, which differs between the interviews.

3.1.4 Analysis of interview data

The next step is to analyze the accumulated interview data in which appropriate theories and methods for analyzing are applied. Which form of analysis and theory is applied, depends on the topic and purpose of the study, as well as the nature of the empirical data. Due to the interviews being conducted in Danish and contain a large amount of information, the interviews have been meaning condensed into shortened, coherent English texts. We have developed our own set of rules to follow during this condensation, namely:

(1) Read the interview transcription, to gain an understanding of the whole interview.

(2) Collect statements of relevance to the problem statement.

(3) Translate the statements of relevance into English, while ensuring that the meaning of the statement is not lost.

(4) Regularly go back and forth in the transcriptions and text, to ensure all relevant statements are included.

(5) Statements that cannot be written into the coherent text, are bullet listed.

Moving forward in the data-collection process entailed that we analyzed and attempted to comprehend the data acquired in the interviews.

3.2. Phase two: Workshop

After interviewing relevant actors, we conducted a workshop to obtain further data. We defined the interview data-collection process as explorative, because we expected the data would help us determine who would be relevant to participate in a workshop. In addition, we found that only a small amount of the literature accumulated during the literature search have attempted to collect data by conducting a workshop. This way, we not only contribute with new knowledge to the field of energy renovating, but also a new perspective regarding data collection. Ultimately, we expected that conducting a workshop would provide a new perspective to motivate homeowners to energy renovate, with an outset in the relevant actors and their collective impressions of how to motivate homeowners. We organized a workshop with seven actors, namely three homeowners, two realtors from different companies, one contractor and one energy advisor. The following chapter describes our process of selecting workshop participants, preparing for the workshop and our intended process, facilitating the workshop participants, and analyzing the data.

3.2.1 Workshop approach

Workshops are a means of obtaining information from one or more informants. What separates the workshop from other types of data collection method is that workshops require a defined goal, which can be more or less specific (Bertelsen and Kanstrup, 2016). Workshop activities generally aim to support the co-operation of participants, which enables the participants to develop ideas together, ultimately leading to findings that would not have occurred in other situations (Brown, 2009). This also defines our workshop in which seven actors were asked to develop ideas about how to motivate house buyers to energy renovate.

There are four key points that must be fulfilled when planning a workshop: definition, preparation, participants, and summarizing (Bertelsen and Kanstrup, 2016). The last point, summarizing, has not been utilized in this study, because of our choice of condensing the data

into coherent texts. First of these is the definition of goals, which in our study is to identify how the actors believe that house buyers could be motivated to energy renovate. The second point is the preparation of the workshop, which we approached after recruiting participants for the workshop. This entailed discussing what materials to bring, how the process should proceed and how to help the participants feel comfortable. To ensure that the participants feel comfortable is not only a matter of facilitation, but also about setting up a comfortable environment. To do so, the participants had coffee, cake, and water available. Another element we found relevant to prepare for was that some of our participants are new parents on maternity leave. To ensure a natural flow and constant focus on the topic, we asked them to participate in the workshop without their children, because it could potentially disrupt the workshop.

Preparing for the workshop also entailed that we considered how it should proceed in order to obtain relevant data. Since a total of eight participants were expected to be present, we decided to split the participants into two groups in which each actor was represented: one contractor/energy advisor, two homeowners and one realtor. This with the intention of allowing all participants to feel comfortable enough to address the topic, without being overlooked due to the number of participants. In addition, we decided to conduct the workshop in two phases: the initial phase, in which the participants work together to develop a timeline of the house selling practices, in the realtor's perspective. This had several intentions: to ensure that all participants understand the realtor-practice and to help them enter the disposition of the house buying practices. In other words, the first phase attempted to encourage the participants to enter the mindset of the house buying practices. The second phase was intended to modify a specific point in the realtors' practice of buying a house, with an outset in the results from phase one. This in an effort to assess how the motivation of homeowners could proceed, as well as facilitate a discussion. If the participants reached consensus, they were asked to place their thoughts on the timeline, with a post-it. If the discussion is not active, we were prepared to ask the participants questions that would add to their level of constructive discussions: When do you (homeowner) think that you would be most compelled to carry out energy renovation? When can your (contractor or energy consultant) competences best assist in motivating energy renovating?

The third point presented by Bertelsen and Kanstrup is to invite participants. Participants in our workshop represented the actors identified in, and during, the process of conducting pilot interviews. The actors of most interest to us proved to be realtors, based on their extensive involvement with the house buyers, while homeowners were asked to participate due to them

being the actors that choose to energy renovate and lastly the contractor/energy advisor based on their vast knowledge of energy renovating. However, the process of recruiting participants for both interviews and workshop proved more difficult than expected. Interviewees were located through social media and personal contacts, after which we visited several companies to find participants. After a long search we decided to reevaluate our requirements for the participants, which initially included: homeowners that have bought a house within the past year, so they remember the process of buying a house, and the house ought to be erected prior to 1980, because of findings that demonstrate, that these houses are in most need of energy renovation. After reevaluating our requirements, we contacted people we know on a personal- and professional level: three co-students and a personal friend agreed to participate in the workshop, as well as a contractor from our pilot interview. Thus, the workshop participants consisted of: one contractor, one energy consultant from a local utility supply company, four homeowners and two realtors. After conducting the workshop and analyzing the results we found that a banker would have been interesting to have partaken as well, due to the findings about how banks holds potential for encouraging house buyers to energy renovate. Yet, since we could not anticipate the answers provided during the workshop a banker did not partake.
Prior to engaging in the workshop, we anticipated that our co-students would be biased, due to education and knowledge about energy renovations, which we did not find to be an issue. However, one co-student brought her child to the workshop, which resulted in the recordings being compromised because of crying. This prolonged the transcription process but did not seemingly influence the data.

3.2.2. Additional workshop considerations

After determining how to utilize the workshop to obtain data, we will enlighten the considerations we had, before conducting our workshop. This includes how we intended to conduct and facilitate the workshop, as well as treatment of the data.

3.2.3. The workshop process

The workshop was to be held on April 17th at Rendsburggade 14, the AAU Create building. Upon arrival, the participants were asked if we could audio-record the workshop and take pictures of the process. In addition, they were asked to sign their names on a name tag. Following this, the workshop was planned to proceed as follows:

1. Introduction
    a. Who we are and the purpose of the study and workshop
    b. The participants are asked, if we can audio-record them
    c. Who they are
2. Participants are split into two groups, consisting of two homeowners, one realtor and one renovation consultant
        i. <u>First phase</u>
3. The realtors are asked to describe and sketch the process of a typical sale, from their perspective, on a timeline
            1. Short break for coffee and cake
        ii. <u>Second phase</u>
4. The participants are asked to imagine that introducing energy renovation to motivate the house buyers to conduct such renovations, is a part of the realtor's job, and describe how this task could be executed, along with when this would be appropriate.
    a. Open discussion in the groups
    b. The participants are asked to place post-its along the timeline to better illustrate how and where the motivation could be introduced.
5. If the discussion quiets, participants will be asked elaborating questions, such as: When do you (homeowner) think that you would be most compelled to carry out energy renovation? When can your (carpenter or energy consultant) competencies best assist in motivating energy renovating?
6. Closing remarks
    a. Thank you and good bye

In order to collect audio-recordings during the workshop, we rented a dictaphone from the local IT-department at Aalborg University. This device would supposedly provide us with clear audio-recordings, which we anticipated would be necessary, since the participants would be split into two groups. Thus, recording on our telephones may not provide us with clear audio. However, the flow of the workshop unfortunately made it so, that we did not notice that the device had stopped working halfway through, thus the data obtained only represents half of the workshop data from group one. As a result, all group members wrote extensive notes about what had proceeded, the participants' opinions and attitudes. Though notes and descriptions can be just as, if not more, usable as audio recordings, a risk of

forgetting important elements could occur. However, after writing extensive notes we do not believe that this is an issue.

The realtors were asked to illustrate their practices on a timeline in order to establish a common ground amongst them and the other participants. In other words, the realtors were asked to develop a timeline, so the other actors knew how the process is. This with the aim of enabling all participants to enter the mindset of selling a house, thus ensuring that they all are aware of, how selling a house proceeds. This with the intention of making the participants think about when house buyers might be inclined to receive motivation about energy renovation. However, the results proved to be different from what we expected: all participants were negative towards the idea of being motivated while viewing houses, and instead focused on the EPC. During these discussions, we attempted to facilitate the participants towards how the EPC could be implemented in the practice of buying a house, which we have analyzed in the workshop analysis.

The intended process, along with definition, preparation, and participants by Bertelsen and Kanstrup (2016), we will now move onwards by demonstrating how we facilitated the workshop and how we processed the data.

3.2.4. Facilitating the workshop

As part of the workshop considerations, we addressed the topic of role-delegation and how we, as facilitators, influence the outcome of the workshop. The most important thing for us was, to ensure that the conversation does not stray too far from the topic of motivating house buyers to energy renovate and that all participants are equally active in the discussions. Prior to engaging in the workshop, we gave the participants a description of the study, our previous steps of interviewing actors we found relevant and the technologies and governmental approaches we have investigated. We also addressed, that the participants could expect that we would intervene, if the discussions strayed too far from the workshop topic.

Due to the number of participants in the workshop, all three group-members were important facilitators: since the seven participants were split into two groups, one facilitator was present and partook in, or facilitated, each group. This is supported by Vidal who claims that it is favorable to have more than one facilitator during a workshop in order to obtain favorable data (Vidal, 2005). The third group member was also available to partake in the discussions throughout the process but had a more fluent role. In this way, two group-members functioned as main facilitators, whilst the last member was able to move between the two groups, while taking notes. Though our participation in the discussions may have influenced

the data, we anticipated a need for our facilitation: since the topic of energy renovation may be incomprehensible or perceived differently amongst the participants, there was a need to keep the participants on track.

3.2.5. Analysis of workshop data

Similar to the treatment of the interview data collected, we chose to conduct a meaning condensation of the workshop data as well. This both due to the workshop being conducted in Danish, as well as the large amount of data collected. In addition, treating all data similarly ensures a coherent and structured analysis. We also found that due to the extensive amount of data, we needed to highlight the data of most importance, without neglecting statements of relevance. This was ensured by transcribing the workshop recordings, thus enabling us to add statements we later found relevant, if such have been excluded in the beginning. Rules similar to those of the interview data were followed:

(1) Read the workshop transcription, to gain an understanding of the whole workshop.
(2) Collect statements of relevance to the problem statement.
(3) Translate the statements of relevance into English, while ensuring that the meaning of the statement is not lost.
(4) Regularly go back and forth in the transcriptions and text, to ensure all relevant statements are included.

Though this form of data treatment may have disadvantages, such as overlooking relevant statements, we have attempted to accommodate for such problematics by leaving the data treatment process open. In other words, one group member has written the meaning condensation, and another has gone through the transcriptions afterwards, to ensure that statements of relevance have been incorporated.

With the method being defined will we now follow to the analysis chapters, in which we will go through our data processing of both literature, interview and workshop data.

4. Analysis of external influencing factors in energy renovating

Prior to engaging in the interview and workshop analysis, we found a need to investigate the rules and teleoaffective structures that apply in energy renovating, as they are some of the key elements in what determines practices (Schatzki, 2010). Through the literature search we found that homeowners are not only motivated or discouraged by internal factors, such as their own values and desires, but also external factors such as the financial, technological, and governmental incentives. We identify these external factors as teleoaffective structures or rules, as they are elements based on a social- and cultural structures that contributes to establish a normative understanding that it is necessary to reduce CO_2 emissions, and that it is important to take action by energy renovating. Rules are represented in the form of governmental incentives and measures taken to ensure building- and renovation quality in Denmark. In addition, we distinguish between actors and factors, because we recognize actors as humans interconnected in the practice of buying a house. Factors we perceive as non-human influencing elements that motivates, drives, or functions as a barrier towards energy renovating.

In the following section, we engage in the technologies used when energy renovating to provide an overview of those most commonly used in energy renovation. Subsequently, we will clarify the governmental authorities, initiatives, and policies of energy renovating to enlighten the restrictions and requirements that homeowners who wish to energy renovate are subjects to.

4.1. The technologies of energy renovating

Material things, including technologies, are not merely neutral objects, as the nature of these things influence how the practices occur amongst them (Schatzki, 2010). The technologies of energy renovation also affect their associated practices as barriers and drivers/opportunities are embedded in them, thus affecting how they take part in social and material structures and, ultimately, affect the house buyers' decision-making when it comes to investing in energy renovations. Inherent in the different technologies are both technological, infrastructural, and

social drivers and/or barriers, which is important to keep in mind when deciding if and how to energy renovate a house.

The drivers and barriers vary depending on the structure of the individual house, its location and general condition. Though many technologies are available to energy renovating homeowners, we have chosen to enlighten a representation thereof: these will aid in comprehending the complexity of the technologies available and their advantages and disadvantages.

The technologies enlightened will focus on two forms of energy use in buildings, namely heating and electricity. Since heating represents 83 % of the total energy use of a building (Energistyrelsen, 2017), most energy renovations are aimed at reducing the buildings' use of heat. Therefore, we will not discuss energy savings by replacing electrical devices with new energy-efficient ones, though, we do acknowledge such replacements matter when reducing the energy use in households. In the perspective of heat reduction, two approaches are primarily used: switching to a more energy-efficient heat source and reducing heat loss by insulating.

4.1.1. Heat sources

The most common heat sources for houses in Denmark are district heating followed by heat pumps, solar panels, and biofuel furnaces. District heating represents 60 % of heat sources, in Danish households (Energitjenesten, 2018a). The heat is produced by waste heat from electricity production, biofuel plants, waste burning, etc. Depending on the municipality or utility supplier, the fee and expenditures vary, and some residential areas have mandatory connection to the district heating grid (Energitjenesten, 2018a).

Heat pumps are devices that transfer heat from one source to another. The sources that are most commonly used in Denmark are ground source, water, and air. Ground source pumps have pipes buried in the ground, which utilize the nearly constant temperature in the ground. The efficiency of a ground source heat pump is dependent on the house being well insulated, and the expenditures for installation are relatively large and the payback period is long. Therefore, it is mostly used in houses located outside the district heating grid as an alternative to a biofuel furnace, as central heating most often is a cheaper option if possible (Energitjenesten, 2018b). Devices for water- and air source heat pumps are placed outside the house and are not as efficient as ground source heat. The investment, however, is cheaper and the installation uses less space. Heat pumps can be used as a supplement to another heat

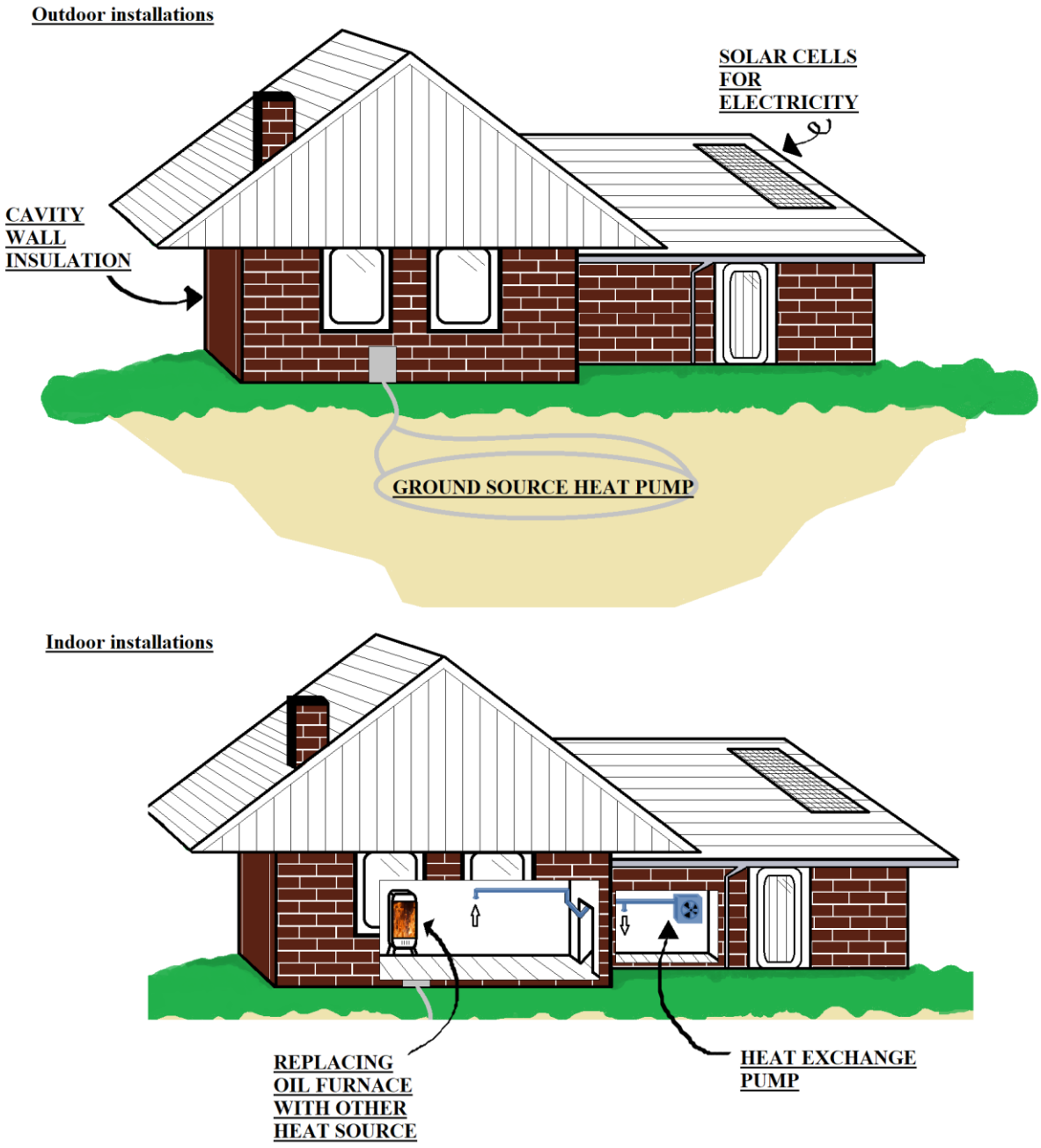
source or as the main source of heating (Energitjenesten, 2018b). Solar panels are only used as supplemental heat sources, since the efficiency of solar panels is dependent on the presence of sunlight. Therefore, they are not sufficient during the winter in Denmark. Normally, solar panels can cover approximately 30 % of a households heating and 60 % of the domestic hot water, but it also varies due to differences in energy use. Solar panels are only recommended if the house is well insulated and the consumption is low (Energitjenesten, 2018c). If a house is located outside the district heating grid, a biofuel furnace can be a solution to supplement the original heat source (Energitjenesten, 2018d). It is a furnace the produces heat by burning wood, straw, biogas, wood pellets, wood chips or other biodegradable products.

4.1.2. Insulation

Another form of ensuring the energy-efficiency of a house, is with insulation which is placed in the building envelope. The building envelope is the outer shell of the building, thus all surfaces that separate the indoor from the outdoor, including walls, roof, floor, doors, and windows of the building. To improve the building envelope, cavity walls, floors and attics can be insulated, and doors and windows can be replaced with new energy efficient ones (Energitjenesten, 2018e). If the cavity walls are of inadequate size or nonexistent, it is possible to place insulation on either the inside or outside of the outer walls. This has to be followed with some additional work in the form of facade changes, e.g. if insulating the inside, plaster walls, new wallpaper, and new paint, as well as possibly repositioning electrical installations, can be necessary. When insulating the outer walls, new plaster and possibly repositioning of windows are necessary. On a comfort-level insulation prevents unwanted air drafts inside, thereby enhancing the comfort of the indoor climate. The most common forms of insulation are glass wool, stone wool and expanded polystyrene, and more alternative materials of insulation are paper- and wood fiber, flax, and perlite (Energitjenesten, 2018). Depending on the structure of the house different types of insulation can be favorable to install: as an example, high pitched houses can have under-tile and ventilated roof insulation, whereas flat roofed houses can have green- or insulating panels as insulation (Dall'O', 2013 pp. 288-299). Insulation not only possess heat-resistant features but can also be used to maintain a healthy level of humidity in a house. Perlite, for instance, has a high percentage of air which makes it easy for humidity to transport through it. Besides the building envelope, other installations such as pipes with hot water can also be insulated to reduce heat loss.

4.1.3. Replacing outdated items

In addition to heat and insulation, replacing outdated or insufficient technologies in a house also has a high energy renovation purpose, which is visualized in illustration 1. The illustration only exemplifies potential energy solutions, because it is not restricted to oil- and gas furnaces, but also windows, doors and roofs etc. (Energitjenesten, 2018).



Examples of energy renovations, illustration 1

Windows can, in particular, be the source of heat losses and air drafts, which results in a poor indoor climate: by replacing windows, or simply the joints, heat loss can be reduced

significantly, and thereby reduce the costs for heating. When installing new windows to a building, considerations must be made in regard to its U-value, which is an expression of how much heat transfers through $1m^2$ of the construction, with one-degree difference on the inside and outside of the construction (Energitjenesten, 2018f). Doors can have the same effect as windows; rotten framework, poorly insulated frames, gaps, or air leakages can also cause excessive heat loss and drafts.

4.1.4. Ventilation systems

When a house is thoroughly insulated it is important to properly ventilate the house, as moist trapped indoor forms condensation, which causes an unfavorable indoor climate and eventually mold. The alternative to a mechanical ventilation system is, to manually ventilate by opening windows several times a day, but when it is cold outside there is a considerable heat loss. A mechanical ventilation system has sensors that measure the humidity and automatically regulates the air-flow for the optimal indoor climate. These ventilation systems also use heat recovery with up to 85 % of the heat, by transferring heat from the used air to fresh air. A mechanical ventilation system is, however, expensive and depends on electricity, thus it uses energy, to produce a favorable indoor climate. Such a ventilation system is, therefore, contradictory to lowering the electricity use in a building. Yet, the advances are better utilization of the heat, a better indoor climate and improved comfort.

4.1.5. Summary

The drivers and barriers of each technology cannot be determined with a simple general answer, as it greatly depends on the prerequisites of each individual house. First of all, the quality of a house's building envelope affects the efficiency of certain installations, such as heat pumps and ventilation systems, as well as how much can be saved in use of heat. Therefore, it is beneficial to invest in proper insulation and sealing of the building envelope in most cases.

Regarding heat sources, central heating is often the most profitable investment, depending on the expenditures for installation, which also depends on the conditions of each house. However, the savings also depend on the efficiency of the previous heat source, which ultimately affects the payback period. Depending on the house's location and general condition, many renovations are therefore not profitable. If a house is located outside the district heating grid, it is necessary to have its own heat source, e.g. a heat pump, a biofuel

furnace and/or solar panels. The expenses of these are relatively high, and their payback periods are long, which can be a barrier for many house buyers. Therefore, we identify economic drivers and barriers as aspects that are ungeneralizable, because economics have to be assessed in relation to each specific house.

Other drivers for energy renovation in a technological perspective includes increasing the indoor comfort: by insulating and sealing the building envelope air drafts and cold spots are eliminated and the house is easier to heat. By installing a ventilation system, fresh air is constantly provided, and chances of mold and allergens are reduced. Additionally, the ventilation system is automatic, which saves the residents' the inconvenience of opening windows several times a day. The aesthetics of some of the visible installations, e.g. solar panels, heat pumps and new windows can be either a driver or barrier, depending on the homeowners' preferences, as what fits the particular house, what looks good and what does not is a subjective matter. In addition, homeowner's individual preferences and beliefs of what is aesthetic also has an influence on whether they choose to install systems such as solar panels or heat pumps. Lastly, inconveniences can occur during the installation of some technologies. Nuisances of dust, noises and restriction of the residents' living space can occur during several weeks, which also can be a barrier for energy renovating to some homeowners.

Not only technologies affect homeowners' decision-making regarding energy renovation, but governmental authorities, municipal initiatives and policies of energy renovating also affect the practice of energy renovating. This will be elaborated in the following section.

4.2. Governmental authorities, initiatives and policies of energy renovating

To comprehend the vast concept of energy renovating, as well as influential aspects of homeowners' choice to energy renovate, the following chapter will enlighten the perspective of building regulations in Denmark, political incentives, and district heating. This is based on the literature accumulated in the literature search with the intent of uncovering the complexity of energy renovations, the motivations behind conducting such as well as governmental measures taken in an attempt to increase the numbers of energy renovations.

4.2.1. Ensuring building quality in Denmark

This section will illuminate some of the governmental measures taken to ensure energy-efficiency of Danish buildings. The chapter also illustrates how the measures have changed during the past four decades.

The first steps in Denmark towards the development of building regulations were made in 1876, in which the ministry of justice developed the law for providing building regulations for rural districts (Lov angaaende Tilvejebringelsen af Bygningsreglementer for Landdistrikter) (Byggeportal, 2010). The purpose of developing these laws was to ensure that buildings would be erected safely for future inhabitants, as well as ensuring that buildings being erected would not cause inconvenience for neighbors or pedestrians (Byggeportal, 2010). The building regulations today contain a much broader range of regulations, including sewage handling, electrical systems, fire safety and energy consumptions (BygningsReglementet, 2018).

The regulations regarding energy consumption were added in 1979, following the oil crisis of the 1970's, but the motivation for having these regulations has since shifted from being practical and economical, to a more environmental point-of-view. Current regulations are aimed at ensuring that future buildings are erected, build and maintained without unnecessary use of heat, domestic hot water, cooling, ventilation and lighting. This, while still considering the building's usage, as well as the size of the building project. Further regulations of the building envelopes ensure this (Bygningsreglementet, 2018).

To learn about the condition of a house, a house inspection can be conducted, which is known as the House Inspection Scheme (huseftersynsordningen) (HE) (Sikkerhedsstyrelsen, 2012). HE is a voluntary inspection that house sellers can choose to have carried out when selling their homes, and the intention is to view and assess the overall state of the house and the

electrical installations. By having such an inspection conducted, homeowners simultaneously ensure that future flaws and defects that are found by new homeowners can be accommodated for with an insurance policy.

4.2.2. Political motivation incentives

The past 25 years have offered a great increase in the Danish ambitions regarding the reduction of the carbon footprint of Denmark, by switching to sustainable energy sources or decreasing the energy use in general (Energistyrelsen, 2016). There are multiple reasons for doing so: firstly, reduced CO_2 emissions will lower the greenhouse effect (Energistyrelsen 2016). Secondly, a decrease in CO_2 emissions will result in a lower consumption of fossil fuels such as oil and gas, in a time where oil prices are dependent on political stability in the Middle East and gas prices are dependent on Russia (Vattenfall, 2017). Thirdly, Denmark offers a large industry of green energy solutions, an industry which the Danish government wish to support (Hald, 2017). Another point is that being green, thus environmentally considerate, is an important branding opportunity, and increasingly more corporations are taking steps to become more environmentally considerate and brand themselves as such. This can, for instance, be achieved by relocating corporation departments to Danish districts, where the electricity consumption can be considered green (Lodberg, 2007). The Danish government has developed multiple steps to achieve a green transition: one example is the transition from fossil fuels to wind energy and biofuels, another being the implementation of a smarter energy grid and the reformation of the public transportation sector (Helveg, 2015).
The steps towards lowering the national CO_2 emissions may seem far away, but other smaller efforts have also been made to encourage the Danes to reduce their energy use. One step towards this is to create a tax deduction for energy renovating homeowners, up to 18.000 DKK (Danish kroner) (Håndværkerfradrag.dk, 2018). Measures taken by the government also include the Energy Performance Certificate (EPC), which was introduced in Denmark in 1997, in which the Danish government made it mandatory for all house sellers to present an energy performance certificate to the buyer. This with the intention of making the energy use of a house transparent for future owners and to promote energy renovations. In the course of the past 20 years the EPC has undergone several changes, latest in 2010 where it was decided that all houses are required to have an EPC before setting a house for sale (Nenadovic et al., 2017).

The EPC grades the condition of a house on a scale from A2020 to G, A2020 being the most energy efficient houses and G being the worst. This system is also used when selling and buying home appliances, such as refrigerators and washing machines. The EPC is developed by a certified energy consultant who assesses the house based on the descriptions provided by the homeowner and former reports on the house (Nenadovic et al., 2017)**.** The report consists of two parts: first the rating of the house in its current state, along with a description of the overall condition and construction, along with information regarding the financial costs for heat and electricity use. The second part of the EPC is a set of recommendations based on the energy use of a house and the economical savings available, along how to improve the indoor climate. The typical prices for having the EPC created is around 5,000 DKK (Nenadovic et al., 2017). Though the Energy Performance Certificate has the purpose of being an information source, as well as a motivating factor, studies show that the EPC is unsuccessful in encouraging homeowners, mainly because owners do not know how, and what, to do with the information (Christensen et al., 2014).

Nonetheless it draws an interesting picture of that the EPC encouragement initiative was unsuccessful when first incorporated as well as now, because homeowners do not simply accept the information provided in the EPC (Gram-Hanssen et al., 2007). A means of addressing the problematics that recipients may encounter when viewing the EPC or similar documents is provided by Dall'O' in the book Definition of the Green Energy Plan. Dall'O' provides a list of guidelines about how to ensure positive reactions by remembering that the Green Energy Plan must be: *"Balanced between technical and economic aspects but also aimed at communicating well the results to the client/owner"* (Dall'O', 2013 p. 163). This is, amongst others, exemplified with statements that should, and should not, be incorporated in the documents.

Attempting to limit the carbon footprint is not limited to the encouragement and motivation of homeowners, but exceeds toward companies: in 2013, the Danish government and the grid- and distribution companies of power, natural gas, district heating and oil, made an agreement regarding the companies being obligated to lower the energy consumption of their customers. This agreement was accepted by the companies who in return had the Public Service Obligation-charge removed. The companies are resolving this task through funding and counseling (Energistyrelsen, 2018).

4.2.3. Districts and municipalities as an affecting factor for energy renovating

The Danish district heating differs from one municipality to another, as each municipality has different suppliers of heat and the prices thereof vary depending on which energy source is used by the, approximately 400, district heating companies servicing 1,7 million Danish households (Energitjenesten, 2018). The Danish district heating consist of 60 % green energy, in the form of solar- and biomass fuel, along with excess heat from industries. The goals is to become 100 % dependent on such energies by 2035 (Energitjenesten, 2018). The municipality of Aalborg has more than 17,000 heat production sites, with wood chips being the most used source for heat production. The production sites distribute the heat via highly insulated pipes that, despite the insulation, lose a total of 27 % during the distribution process (Jespersen, 2017). Not all areas in Denmark are eligible for district heating systems, due to high establishment costs, as well as long and comprehensive effect on the surrounding traffic and outdoor climate due to noise.

Several pilot interviewees expressed that Danish homeowners may be inclined to energy renovate if their homes reside in cities, where the costs for heat, electricity and water are high. Since the heating prices in Aalborg are the lowest in the country (Green, 2015), homeowners may not see the need or benefits of energy renovating their homes, given the cost of renovating would be far greater than the financial gain. Though we have not found any data to support this, there may be a difference in the energy renovations conducted within the municipalities of Denmark.

Several municipalities have attempted to increase the number of energy renovations carried out, while decreasing the level of non-environmental friendly energy sources. One example is the Energy City (Energibyen) in Frederikshavn, which commenced in 2007 and presents a 100 % sustainable model by producing green energy, as well as 300 new jobs (Gram-Hanssen et al., 2016 pp. 47-48). Another example is ESCO-light in Middelfart, which was based on the culmination of a variety of measures, including attempts to encourage homeowners to renovate by paying them 1 DKK for each kWh they saved (Gram-Hanssen et al., 2016 p. 46).

4.2.4. Summary

Governmental measures range wide, though not all approaches have been proven successful, due to their design and content. This is evident in the case of the EPC, which contains a large amount of information, though little affect is measured: homeowners do not know how to process the information, which leaves the EPC inadequate. Building qualities in Denmark is another attempt to ensure the quality and energy-efficiency of newly erected buildings and renovations that are carried out in the form of certificates. Companies, such as that of grid and power distribution have been incorporated in the attempt to lower CO_2 emissions and energy use, yet the number of energy renovations carried out are too low if we are to reach the governmental 2050 ambitions. Homeowners may be influenced by the costs of heat, if located in district heating areas of Denmark, thus their desire to energy renovate is not existent. This may be due to the fact, that energy renovation costs would not pay off, regardless of the lessened costs for energy. In addition, applying for the tax-deduction of 18,000 DKK is time-consuming and extensive, thus homeowners may not be positively affected by this measure.
After reaching an understanding of, what external factors may influence homeowners- and buyers in their decision to energy renovate, we move onwards to an analysis of the internal factors based on the data collected through interviews and a workshop.

5. Analysis of Practices involved in the sale of a house

In the following analysis, the practices of some of the actors involved in the practices of buying a house will be described with the purpose of locating barriers and opportunities for motivating house buyers to energy renovate their homes. Each of the professional actors involved in the practices of buying a house may hold a potential for encouraging and affecting the house buyer to conduct energy renovations. Therefore, we have conducted interviews with a banker, a contractor, a realtor and two energy consultants, with the purpose of revealing their practices regarding the house purchase, how they are involved and how they interact with the house buyers. Additionally, we have conducted interviews with two homeowners who recently bought a house erected prior to 1980, to investigate their practices of buying their house, as well as their perception of energy renovation (transcriptions are available in appendix 3). Each actor/profession will be elaborated in the following sections and, ultimately, their practices will be viewed in contrast to one another. The actors are interconnected due to their roles in the house buying practice, and each actor represents a field. All actors and their workplaces are anonymous.

5.1. Homeowners' practices

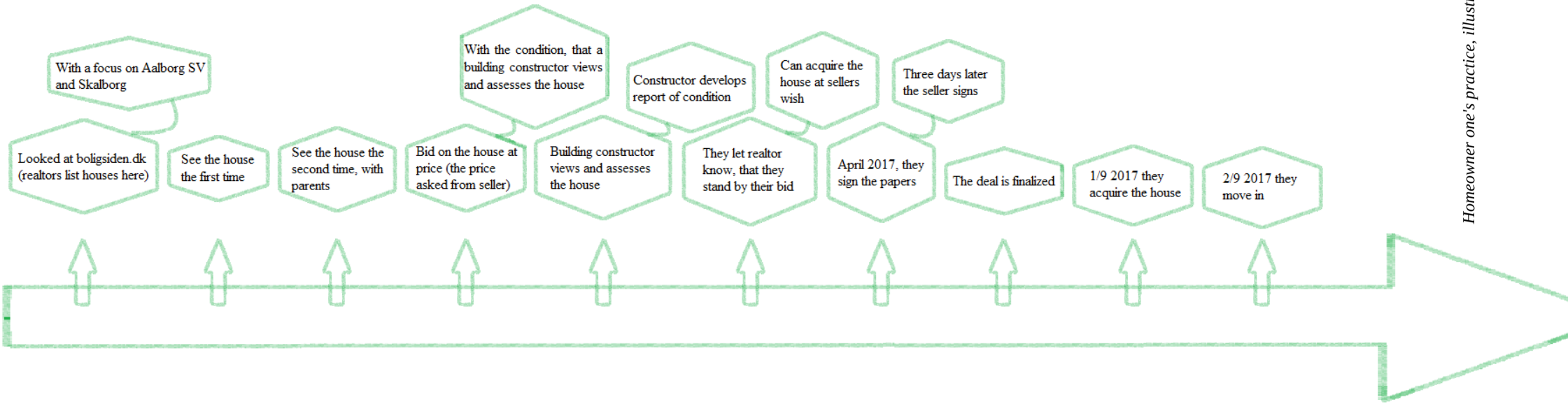
Conducting interviews with homeowners aid us in reaching an understanding of, how homeowner practices proceeds when buying a new home. While other actors involved in the house purchase primarily have information about their own practices, homeowners and house buyers provide a unique insight into the collective practices. This due to their constant contact with actors outside their own role as house buyer or homeowner. The following section will enlighten the practices of the homeowners interviewed in the preliminary, explorative process of the study. Each actor's practice has been illustrated with a timeline and each are listed in accordance with the actor (illustrations 2-7). In addition, the literature search provided us with a description of the drivers, barriers and motivators homeowners may experience when energy renovating their homes, based on former studies conducted on the topic. This is relevant to our analysis because neither of the two homeowners chose to energy renovate when they purchased their houses. With the literature results we will, therefore, understand why the homeowners may not have chosen to energy renovate, based on former findings. All descriptions of the actor's practices are based on their own statements and attitudes expressed during the interviews.

5.1.1. Homeowner one's house-buying practices

Homeowner one lives in a detached single-family house and did not renovate the newly purchased house, because previous owners had already renovated the house internally.

The homeowner perceives energy renovation as a reorganization of the energy source in the house: other sources of energy can be used, such as ground source and district heating, while some may follow the advice from the energy report and re-insulate a house. Though she and her husband have not done any renovations in their current home their house-viewing practice concerned only houses with an energy mark of at least C. This due to economic considerations regarding the costs of energy use each quarter. If the homeowner and husband had found a house with a lower energy mark than C, they might be inclined to energy renovate, because such an investment has a great potential for decrease of future costs.

The practices of purchasing their house has been illustrated in a timeline (2) and begins with, how the homeowner and her husband found their current house online, and shortly after viewed it for the first time with a realtor. Later followed by a second viewing accompanied by their parents and a realtor. The couple agreed to purchase the house with the condition of having an external structural engineer assess the house before signing the purchase agreement. The report from the engineer proved satisfying and the couple decided to complete the purchase. Following this, a lawyer assessed the sales papers and afterwards these were signed.



Homeowner one's practice, illustration 2

To ensure the quality of their newly purchased house, they hired a professional structural engineer to view and assess it: this way, they had professionals assessing it because they themselves have little knowledge of the EPC and the report of condition (tilstandsrapport). The report of condition is an assessment of the building, including the state of the damages visible during inspection. The structural engineer concluded that the house was in good condition.

When asked if the homeowner would be interested in energy renovating in the future, she expressed that she is not rejective of such renovations, as long as it is economically responsible. If such renovations were to be conducted, she expressed that it would have to be a necessity and not something their savings would be spent on.

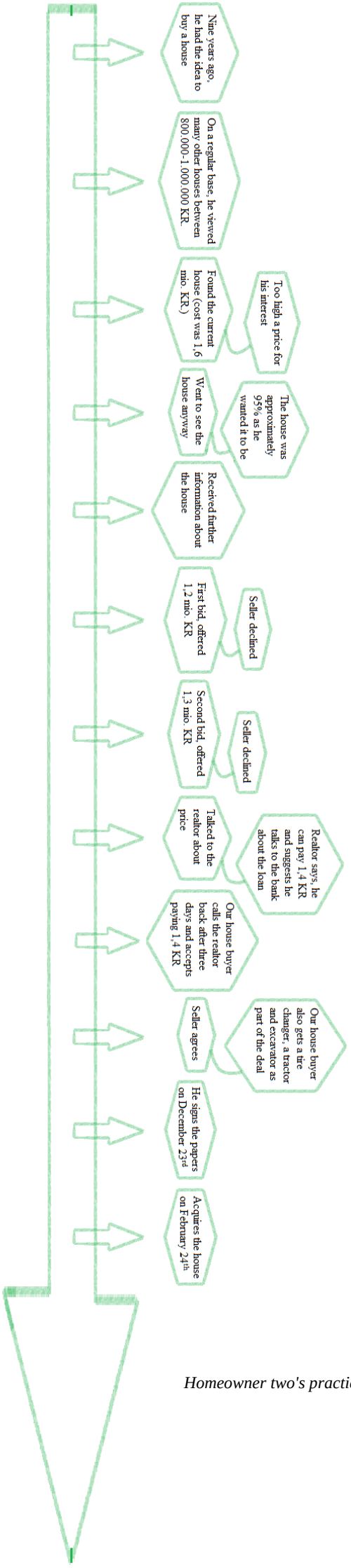
When she and her husband talked to the bank, they were offered a package for house-buying, in which elements such as energy and heat-sources, along with home optimizations are mentioned. According to their bank, this package is, however, most relevant to houses from the 1920's.

5.1.2. Homeowner two's house-buying practices

The second homeowner lives alone in his house and he has not yet done any renovations. Parts of his house have been renovated prior to the buy, through a longer period of time. After paying off some of the house loan the homeowner intends to begin renovating, first by creating a conservatory (udestue), then a porch upstairs. Later it is expected, that he will install a gate outside, replace radiators and add floor-heating and after paying off the entire loan, in approximately 20 years, he expects to replace the now 20-year-old kitchen. In addition, he may replace the existing pellet stove with ground source heating or solar heating sometime in the future.

When asked of his perception of energy renovation, he explains that he would use the term energy improvement instead, and describes his perception as replacing an item that still functions but could be cheaper. In his words, the term energy renovation implies that something is very wrong with a building and adds: supposedly it is the same as doing energy-reductions, such as investments for long term optimization, e.g. ground source heating and solar cells. Though his furnace is fine for now, he will eventually have to replace it at the cost of maybe 25,000 - 50,000 DKK, so it would be favorable to replace it with something modern, such as ground source heating.

The homeowner had the idea of buying a house nine years prior to the purchase, which means that his house buying practice began nine years ago: this is illustrated in timeline 3. Throughout the nine years, he regularly checked the marked and looked at available houses, and found his current house, which costed a lot more than he could afford. When viewing the house, he found, that the house was almost perfect for him, so he placed the first bid which was declined by seller. He later placed a second bid, which was also declined. Only after placing a third bid, the seller accepted. After settling on the price of the house, the paperwork was developed by the realtor and he acquired the house shortly after.



Homeowner two's practice, illustration 3

Homeowner two only takes little notice of the EPC, and only remembers that it was graded with a G. He believes, that if he had an oil furnace he would have viewed the energy report far more extensively, because it would be more expensive to heat his house. However, outside the house he has a solid fuel boiler which he uses during the summer to heat up his home.
Later he explains that the reason for not energy renovating by replacing the heat source, such as with solar cells or ground source heating, is because of the financial aspect. If he loans money for the replacement of heat source, it will not necessarily pay off, because of the interests on the loan.
He has lowered the heating expenses significantly (from 18,000 to 13,000 DKK per year) compared to the previous owners, which makes him even less compelled to carry out energy renovations. When viewing houses, he never experienced anyone who encouraged or motivated him to energy renovate and he does not believe that it would have motivated him anyway, given that it for him was the financial aspect which is the most important. He also thinks that solar panels are ugly. With this being said, he is not 100 % rejective of the idea of energy renovating, and he has considered insulating the cavity walls. During the interview the homeowner expresses that he is unsure of whether the cavity walls are insulated already.

5.1.3. Homeowner's motivation, barriers and drivers

Neither of the homeowners chose to energy renovate their homes, which can have several causes: homeowner one purchased a house that had undergone extensive renovations prior to the purchase, and had an energy mark C, which is the third highest grade a house can receive. Due to the high energy mark, the homeowner does not believe that there is cause for energy renovating. A house with an energy mark C may not have extensive energy costs, which a study by Achtnicht and Madlener found to be the biggest driving force for energy renovating in German homes (Achtnicht and Madlener, 2014). This is also evident in the interview with homeowner two, who experienced that his costs for heat will be much lower than the previous owner's: thus, a need for energy renovating may not be present. According to several studies, homeowners' lack of motivation for energy renovating may also be influenced by aesthetics (Abreu et al., 2017; Mortensen et al., 2015; Tan, 2014), which is clearly expressed by homeowner two, who finds solar cells ugly. This leads us to believe, that the aesthetics of his house are more important than energy consumption and costs. However, energy renovating is

perceived more attractively when planning to renovate, which corresponds with homeowner two's expression of, that he may insulate the cavity walls in the future.

Neither homeowner one or two expressed a desire to be environmentally considerate when renovating, yet this may not be a general perception: Organ et al. proved that environmental factors indeed are considered by homeowners when renovating (Organ et al., 2013). Wilson et al. also found that homeowners are driven to energy renovate with the prospect of environmental benefits (Wilson et al., 2015). Though neither homeowners in our interviews expressed a consideration of the environmental effects of energy renovating, homeowner one made it a priority to purchase a house with an energy mark of C, B or A, because lower graded houses have larger energy costs.

Both homeowners recall receiving an EPC when acquiring their homes, but neither recall its content. The purpose of such a certificate is to motivate homeowners and house buyers to energy renovate, yet this seems to be ineffective: Christensen et al. found, that the EPC is ineffective, possibly due to the fact that homeowners do not distinguish between renovating for comfort and aesthetics and renovating for energy efficiency (Christensen et al., 2014 p. 499). The results of the study express that a future improvement of the report could take the following into account:

> *"(...)improving the usability of the EPC recommendations, e.g. by including other kinds of information such as how to find qualified tradespersons or by taking into account that DIY is very common in relation to Danish home improvements"* (Christensen et al., 2014 p. 499).

This is also expressed in the pilot interview with an advising engineer, which is described further in a later chapter.

5.1.4. The homeowner's house buying practices summarized

The practice of buying a house differs greatly amongst the two homeowners, mainly because homeowner two bid several times, whereas homeowner one only bid once. This causes the practices to differ, because realtors are far more interconnected with the practice of homeowner two. In addition, homeowner one also had more contact with the seller, per seller's request. This also affects the practice of homeowner one, because the seller functions as another actor. However, since we are investigating practices of human beings within different fields, we cannot be certain of the statements: another homeowner may recall the process differently, thus, a different practice. Nonetheless, both homeowners express that

their main contacts are the realtors, whereas neither had contact with actors such as advising engineers or energy consultants.

5.2. Energy advisors' practices

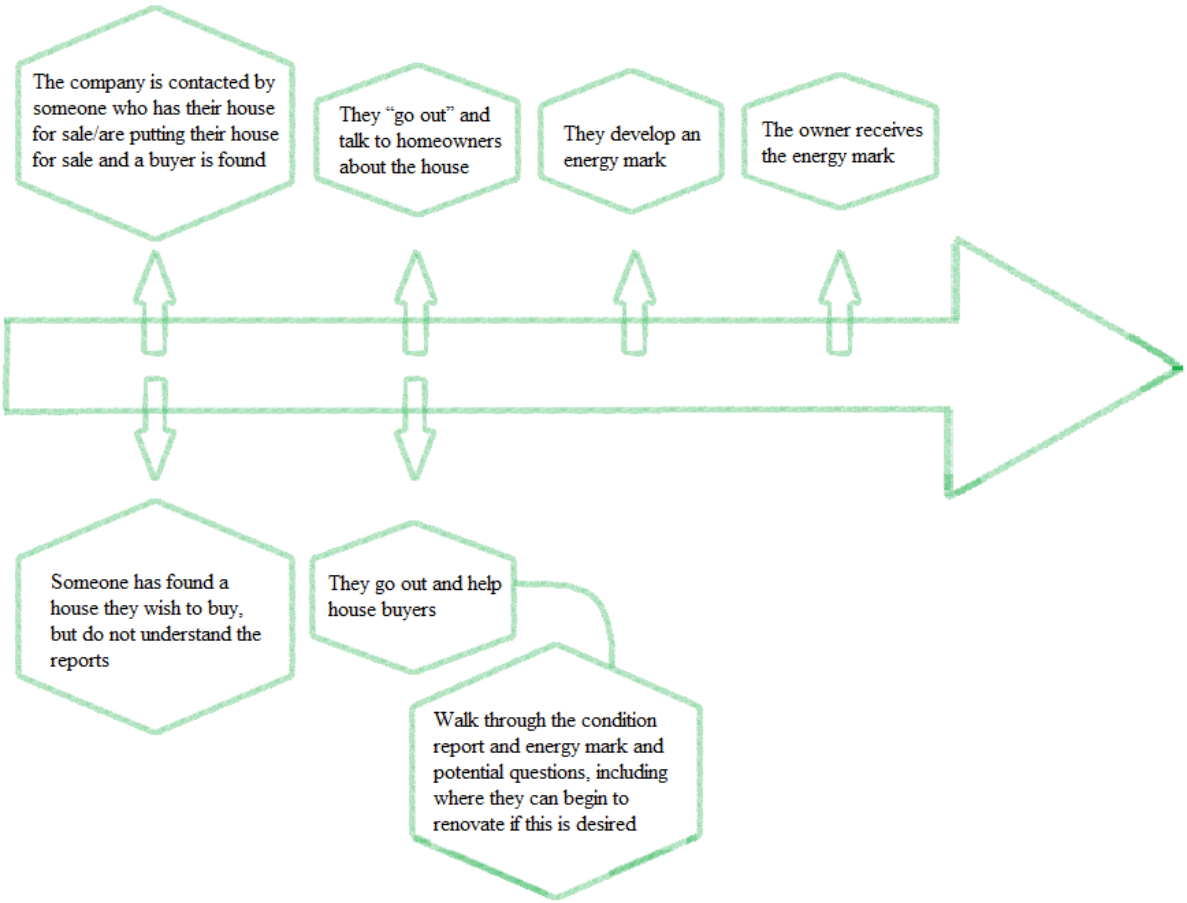
An advising engineer and energy consultant represents the energy advisors we have interviewed, and the following chapter will enlighten the practices of these actors. We will simultaneously draw on the literature accumulated in the literature search, to understand the practices of developing EPC's and the corresponding perception thereof.

5.2.1. Advising engineer practices

Our advising engineer is part of a three-person group who work with energy related issues, as well as private people. Additionally, condition reports, maintenance and operation, such as plans for maintenance, advising on renovations, overseeing renovations, and everything else that deals with the private homeowner, are part of the advising engineer's job. The company has a department in Aalborg and Hjørring, and the two departments work together on cases in all Northern Jutland.

The interviewee primarily works with the EPC and otherwise energy-related topics. Her perception of the term energy renovation is an older building with little insulation, where the goal is to reduce energy use. She only rarely advises homeowners on energy renovations.

The advising engineer describes her practice in the house buying process as follows: a house seller contacts her company, after which she visits the house and talks to the owners about the construction. Afterwards she returns to her office and develops the EPC, which the seller then receives. Mostly, she does not have further contact with the customer unless parts of the EPC need explanation, and if so, she visits the customer again. The practice has been visualized in illustration 4.



Advising engineer's practice, illustration 4

She and her coworkers are mostly contacted prior to the sale of a house, and if she advises a buyer, the focus is often regarding which energy renovations are cost-effective, such as insulation of horizontal ceilings. She also explains that if she advises a buyer, she asks herself the questions: what can be done? Is it possible to insulate the outside wall externally, though it may not be cost-effective, but the indoor climate may become better? This she also perceives as energy renovating, but with a focus on the indoor climate and not cost-effectiveness. To us, this indicates that the advising engineer mainly interprets the term of energy renovating as something related to cost-effectiveness, and not other aspects such as increased comfort and environmental consideration. The customers may cause her interpretation, who often focus on cost-effective renovations, instead of being environmentally considerate.

According to the advising engineer, only a few homeowners in Aalborg install alternative heat sources because the district heating is cheap already. Clients only discuss solar cells, if anything.

Though the customer's interests in installing alternative heat sources are slim, there is an increase in how many clients that contact the company. She explains, that clients think it is a

good idea to energy renovate, but that a few have the financial coverage to do so, or interest in spending the money if they do. Though it is an investment that can pay back over time, it is not prioritized. The money that could be used for an energy renovation is usually spent on elements that look pretty, such as paint, floors, or a new kitchen. She believes, that energy renovations are not conducted because it is not a visible renovation, and that Copenhagen and Zealand in general has a higher level of interest and energy renovations.

The advising engineer generally experiences that the people she has contact with are reluctant towards energy renovations, because they do not understand why it is necessary. Simultaneously, she experiences that the EPC has a bad reputation and is considered an extra expense, and an added number of papers to consider. Her impression is that the energy mark is perceived as nonsense and non-correctional, and an annoying element that buyers and sellers are required to have. Not long ago, she experienced a client that would not let her into a part of the house, because it was a business. The client expressed that it was nonsense, and that it is unusable and unnecessary to develop an energy mark and correlated EPC.

She is experiencing an increase in negative clients, possibly due to negative media-focus. If she goes to a client and does not have a blueprint of the building, she has to rely on her experiences of what is usually done on a house like that one. This, combined with the owner's statements that may be flawed or incorrect, makes it difficult to develop a good EPC.

Her job differs from that of a carpenter or contractor because she has a lot more communication with the homeowners and clients in general, so she has the opportunity to promote energy renovations, whereas a contractor should act neutral.

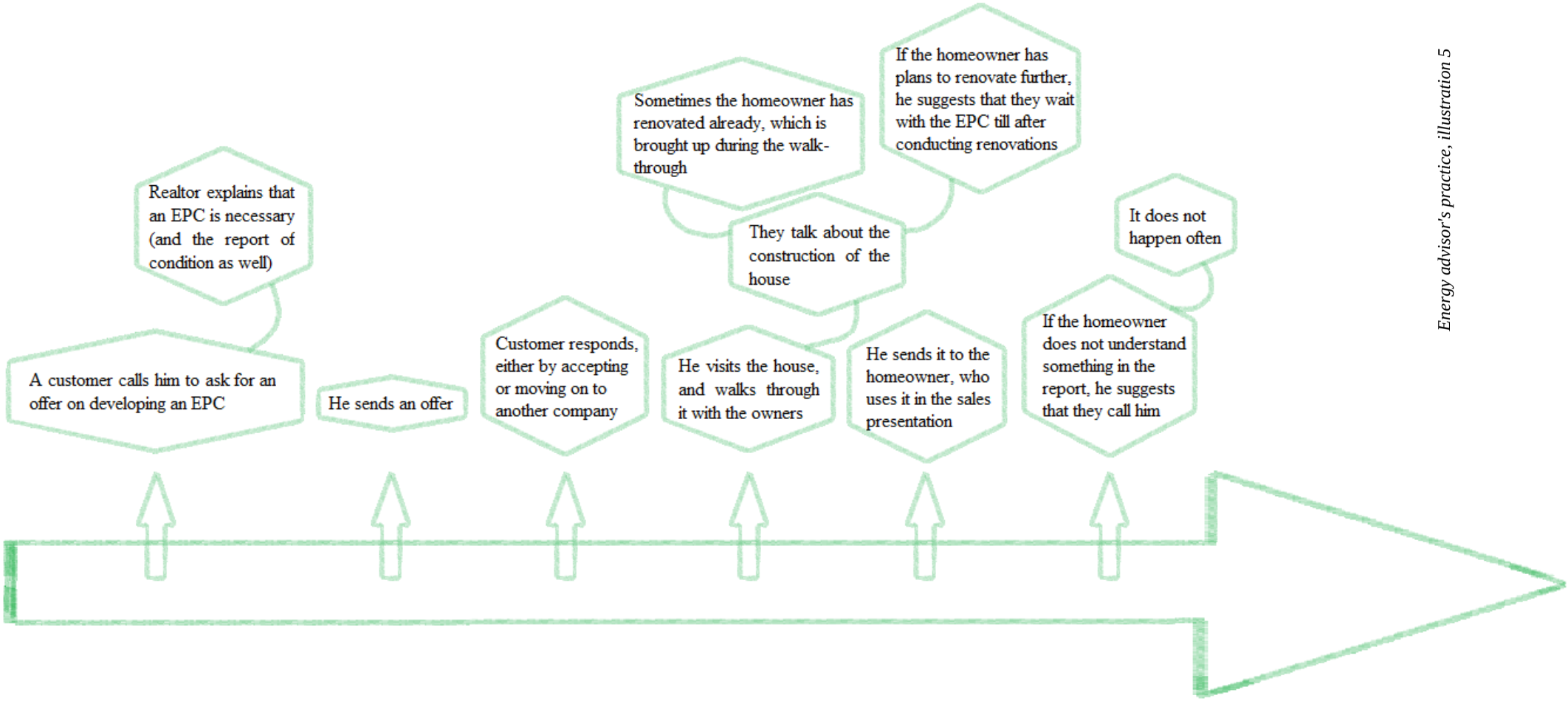
5.2.2. Energy consultant practices

The energy consultant is part of a major energy corporation in Southern Jutland, and functions as an advisor for both professionals and privates, though mainly focusing on private homeowners. His main job consists of developing EPC's and grants for energy renovations.

According to the energy consultant, three types of homeowners exist, and all contact him with questions: those that are new homeowners, homeowners, and house buyers. Usually when people have contacted our interviewee, they return and ask what else they can do and what he suggests.

Since his role in the house buying practices is to develop the EPC, he describes this as follows: a house seller contacts him due to the EPC being mandatory. Later he returns with a proposition on costs, and if it is accepted, he visits the customers and assesses their house.

This usually includes him and the seller walking through the house talking about the construction, previous and potential future renovations. If future renovations are scheduled, the customer is advised to contact him again after renovations, to develop the EPC. After visiting the house, he returns to his office to develop the EPC, which then is delivered to the homeowner for use in a sales presentation. If the homeowner needs explanation of the report he does so on the phone, however, this is not a common situation. This has been visualized in illustration 5.



Energy advisor's practice, illustration 5

He explains, that his workplace is a firm believer of that the EPC needs to be well developed and he exemplifies with: some EPC's mention roofs too simply, and do not include what the construction consists of, nor the extent of insulation in a building, thus the EPC's are poorly developed. He also explains, that it is necessary for the EPC to be easily understood by the recipients, which often is not the case. However, they do not follow up on renovations, to see if the customers energy renovate. As soon as the EPC is delivered, and possible questions are answered, he has no further contact with the customer. He believes, that customers that follow up and ask questions about the EPC do energy renovate, because they are interested in what the report entails.

According to the energy advisor, it is important for the recipients of the EPC to understand the content: thus, he previously handed out explanatory schedules to realtors, because the EPC contains measurements and descriptions that may seem difficult to comprehend.

According to the interviewee, the press has aided in developing a negative perception of the EPC, even though the developers of the EPC do not make the rules about what constitutes the grade of a house. An example is, that the government decided, that houses that are heated with electricity automatically receive an F- or G-mark.

The energy consultant does not encourage customers to go beyond the requirements, such as by installing windmills or the like; nor does he believe, that it makes sense to install such measures, because it most likely would not be cost-effective. Lastly, he expressed that the largest appeal for people to carry out energy renovations are the financial benefits.

5.2.3. The energy advising potential

Based on the interviews, the advising engineer and energy consultant have many similarities: neither experience many customers that are interested in energy renovating, except in the form of telephone consultations. Most of their energy related work consists of the development of EPC's, and otherwise generally assessing houses in the context of a sale or purchase. However, the advising engineer expressed her concern about, how the EPC is perceived. As part of an advising team, her main job is to develop EPC's for homeowners, both sellers and buyers, and is experiencing an increasingly negative perception of the report. This interviewee may be especially affected by the reception of the EPC, since her job is to develop the reports. Nonetheless, the perspective of the EPC being negatively received is relevant to consider, as the main focus of the EPC is to inform and encourage homeowners to energy renovate. If homeowners and buyers perceive the EPC negatively, the report seems

counterproductive to its cause. This is also found in a study by Christensen et al. who found that the EPC is ineffective in motivating homeowners to energy renovate (Christensen et al., 2014 p. 499). The advising engineer's perception of the attitudes towards the EPC is that it may stem from the EPC's that are poorly created and formulated. To this she argued that developing an EPC is difficult, because the circumstances need to be favorable: the homeowner should ideally have a drawing of the building and the correct information prepared for a visit by an engineer, which is not always the case. An example the interviewee provided is that a homeowner described the EPC as unnecessary and useless nonsense while the inspection was conducted. While the attitudes towards the EPC can leave the reports counterproductive, negative attitudes can also affect the choice to energy renovate, because recipients of the report may not have the desire to read and consider the content of the EPC.

The two energy advisors have many similarities that range from the development of the EPC and the perception thereof: also, neither reach out to customers to encourage or follow up on energy renovations, though both define themselves as advisors or consultants. Particularly the energy consultant says that he feels that reaching out to customers would have more negative effects than positive. This may also reside in that a very small number of customers have an interest in energy renovating. If more homeowners or house buyers had an interest to energy renovate, advising engineers and energy consultants might be more inclined to reach out. Contradictory to the small number of people interested in energy renovating is that both advisors experience a large number of phone calls regarding energy renovating. Particularly, the energy consultant believes that the phone calls lead to action, in the form of energy renovating.

5.2.4. Summary of the energy advisor's practices

Both energy advisors experience an increasingly negative reception of the EPC, which both argue is caused by poorly formed reports. Yet, neither reach out and contact customers to promote the cause of energy renovating, with the expectation that it would be negatively received. This demonstrates, that the practice of buying a house differs, depending on the actors involved. If the energy advisors have been present in the house buying practice with homeowner one and two, as described earlier, the practice would have looked different. This is particularly due to that the house buyers would have spent time with the energy advisors.

5.3. Contractors' practices

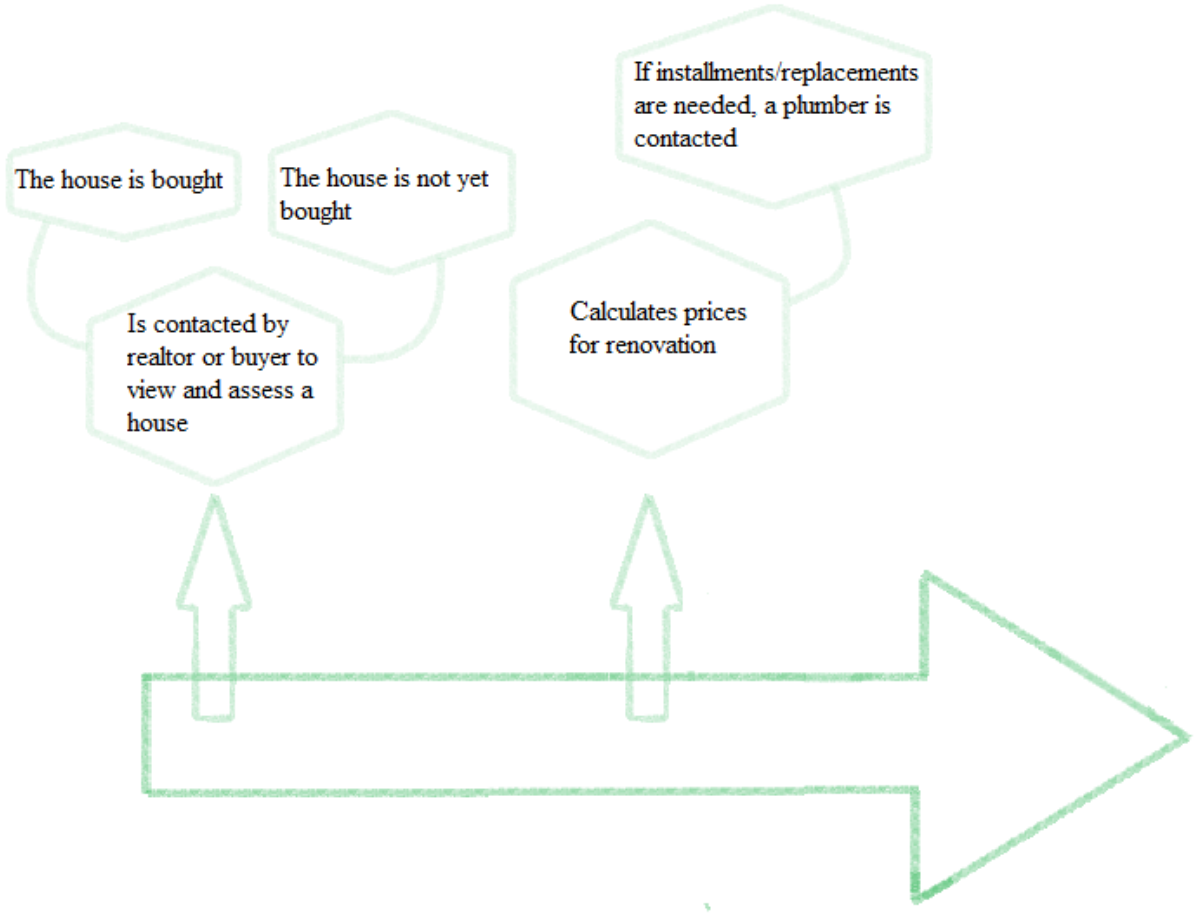
The following chapter will enlighten the interview conducted with the contractor and the practices of a contractor described regarding the process of house buying. The practices uncovered could potentially be of interest, since carpenters and contractors in general are key actors when performing renovations and energy renovations.

The contractor who participated in the pilot interview expressed, that the company conducts all forms of renovations, ranging from changing and repairing door locks, to building factories and houses. In addition, they have a mason and an energy consultant working at their company, and he, the CEO and owner, describes the business as an ordinary carpentry business. The company chose to have a worker educated to become an energy consultant, because of the measures taken in the municipality in an effort to make the municipality more energy considerate. When asking the contractor of his perception of energy renovation, his primary focus is insulation, because it is a low hanging fruit (lavt hængende frugt), meaning that the costs are low compared to the advantages and it is a commonly used form of renovation. The challenges of energy renovating is also a major element of his perception. Particularly regarding old houses, energy renovation can be difficult to conduct in a manner that is economically sensible.

Besides insulation, he describes how heat sources also can be replaced to reduce CO_2 emissions, these being exemplified with: circulation pumps, water pumps, produced via water-, air- or ground source. However, in the municipality of Frederikshavn, and many others alike in Denmark, it is mandatory to use suppliers of heat distribution, which is unnecessary if the house is zero-energy emissive. In addition, he states the he himself lives in a zero-energy house.

When involved in the house buying practice, the contractor is typically contacted by a realtor or buyer, who asks for his assessment of a house or property, which he describes as the first time in which he has a role in the house-buying process. This way, he acts as the buyer's advocate, because he assesses the house and the flaws and future necessary renovations therein. After viewing the house and assessing what is required, he calculates prices and presents his proposition to the potential customer. If installations are necessary, he contacts a plumber or other relevant professionals. Afterwards, given the buyer accepts his proposition, the buyer either negotiates the price or another company is hired. Prior to engaging with the renovations, the required permits and paperwork are developed. The last step is, to begin

renovations and delegate payment. The contractor's practice has been visualized in illustration 6.



Contractor's practice, illustration 6

When viewing the house, the main purpose is to evaluate the state of the house, often with a focus on the roof. Yet, if an oil furnace is installed in the house, the contractor would recommend a replacement, due to the costs of oil heating. If a replacement is agreed on, the carpentry business may contact an external plumbing business, if the client prefers this. Though such advising is almost mandatory according to the interviewee, he says that he must be careful when advising house buyers to renovate. If the house buyers feel pushed or ill advised, they may choose a different company to do the renovations, which would be a financial loss for his business.

When asked if contractors are sufficiently engaged in energy renovating and advising in such, he explains that the next step would be to advertise about which measures are available. However, such an attempt has already been implemented at the company with an expense of

50,000 DKK, though it gave no results. The main goal is to earn money, but not at the expense of giving customers bad advice, because that can result in a bad reputation: their role as carpenters is to provide house buyers with an evaluation of the house in accordance with their economy.

The contractor believes that the residents in the Copenhagen area would be more inclined to energy renovate, because people from the Northern Jutland are more considerate of what everyone else is doing. He only experiences homeowners that wish to energy renovate beyond the requirements every second year, and those usually have an architect advising their renovations. To increase the number of homeowners that choose to energy renovate, the contractor argues that the law must include such measures and exemplifies it with: if people have a home that is 120 m^2, they can only have a certain level of CO_2 emission.

5.3.1. The contractor as actor and potential barrier

According to a 2017 study, contractors are relevant actors that can promote and encourage energy renovations (Minter et al., 2017). Yet, despite of their potentials, carpenters and contractors simultaneously have the ability to create barriers that prevents homeowners and house buyers from energy renovating. This becomes evident in the interview with a contractor who acts cautiously when advising homeowners to energy renovate. This is supported by a 2013 study by Risholt & Berker who also state, that craftsmen and carpenters can act as barriers (Risholt and Berker, 2013). If contractors seem indifferent towards energy renovations, homeowners may be inclined to act accordingly: this possibly due to that contractors and carpenters are professionals whom homeowners would expect to have sufficient knowledge regarding renovations. According to the contractor interviewed in this study, his company follows the restrictions and requirements developed in the latest building regulations, though a study from the environmental think-tank CONCITO found that contractors, and homeowners alike, are ill-informed about governmental measures (Minter et al., 2017).

5.3.2. Summary of contractor's practice

The interview with the carpenter illustrates a versatile actor who simultaneously assesses and renovates houses, though his contact with homeowners vary. This could have the potential to alter or inspire contractors to promote the cause of energy renovations: however, according to the contractor, the potential of losing financially if the homeowners are pushed too far, makes

his efforts in advising for energy renovations less attractive for him. In general, we perceive the business of contractors to be highly focused on the financial aspects, as they are dependent on homeowners to select them. This leaves us with the belief, that contractors are too dependent on financials, to make a change and encourage homeowners to energy renovate.

5.4. Bankers' practices

Based on that most house buyers require a loan to purchase a house, a banker from a local bank was interviewed, with the intention of uncovering the practices of delegating a loan to house buyers. A 2017 study conducted by the Danish think-tank CONCITO also state that bankers have the opportunity to encourage energy renovations. This is due to their position and opportunity to promote loans that are specifically oriented towards energy renovation (Minter et al., 2017).

The banker described in the interview, that his function in the workplace is to give sensible financial advice to customers in what he describes as all stages of a person's life, and that each stage requires different advice.

The bank has a very clear guideline about what he can advise about, and the bank advisors must always view the individual customer's needs, wishes and desires rather than focusing on a sale. This is mainly due to the fact that the bank is accountable for the advice and have a responsibility to uphold the law from the government and Financial Supervisory Authority. As a result, the banker does not advise or pressure about what to do with a potential loan but evaluates whether it makes sense to provide a customer with a loan. Whether something makes sense is based on whether an improvement or renovation of a property adds value to a future sale: if it does not add value, a loan is not given.

The banker also describes, that they do not receive information or education about energy reports, and that energy renovations is not something they are required to learn about. As a banker, the main focus is to understand and evaluate whether an improvement on a property can increase the value, which is calculated by a coworker who is specialized in value-assessments. However, the banker states that if a customer wishes to buy a house and keep the oil furnace already installed, he will simply explain the heat expenses, not advising for- or against any heat source. If a customer choose to replace the oil furnace, they are advised to contact professionals for help in doing so.

The banker's description of his role in the house purchase practices is that customers first contact the bank if they have found a property to purchase or intend to build a house. The customers usually give a presentation or have prepared a proposition. Afterwards the bank collects information about the customer, such as their income and expenses. The banker then calculates whether it is realistic for the customers to purchase or build a house, and what they can afford to loan and pay. At this point, the customers usually look for a house, if they have not yet found it: if they find a house, the bank calculates the expenses of that house and the potential loan, after which the bank gives license to sign the papers. After the customer has contacted the realtor of the desired house, a purchase agreement is received, and the bank approves the purchase, giving both realtor and seller's bank notice of this. When the cancellation period has passed, the bank arranges for the realtor's payment, and the bank has a period to guarantee the buying sum. This period usually extends until the date of acquisition, typically three months later. The last parts of the process which the bank is involved in, concerns planning how to finance the loan, when to transfer payment to the previous owner, and a meeting about budget for the loan. Lastly, the banker describes that during the entire process there is an ongoing correspondence between the bank, the customer's lawyer, realtor and the seller's bank. This practice has been displayed in illustration 9.

Bankers practice, illustration 9

Though bankers do not advise about energy renovations, they have had a campaign about energy improvements of a home. However, this was before our interviewee was hired at the bank. In addition, the bank has loans specifically developed for energy improvements, though mostly in regard to solar cells, and this is rarely taken advantage of. As a result, the banker stated that energy renovation is not the first priority for the customers, but rather improvements of kitchens, bathrooms, windows and doors are prioritized. An example is that a client from Strandby, a small rural town in Northern Jutland, was attempting to sell their house, but had little buyer-interests, thus decided to replace the oil furnace. The client financed the replacement independently without having his bank conduct an evaluation of cost and added value to the estate. This means that the homeowner could potentially lose the 30,000 DKK it costs to replace the furnace if the house is sold, because the bank had not been a part of the process.

5.4.1. The bank's opportunities to encourage energy renovating

As found by Minter et al., banks have the opportunity to encourage energy renovations with the aid of specific loans that are aimed at such renovations. The interviewee also expresses that his bank indeed have such loans available, yet these are rarely used amongst customers. This convinces us that there are several levels of encouragement: specific loans for energy renovations that potentially have low interests functions as economic motivation, which can be construed as indirect. The contractor's encouragement of replacing old oil furnaces is more direct, though also focusing on an economic motivator. Yet, despite of the indirect encouragement from the bank, no large interest in energy renovations is visible.

5.4.2. Summary of banker's practice

According to the banker, he has a lot of contact with the house buyers, though over a short period of time. However, this is not generalizable, because of the 2017 study by CONCITO, which states that banks have an ongoing interaction with house buyers. This in addition with the bank's advisory responsibility, we do not believe that banks would be as efficient in energy renovation encouragement, as explained in the CONCITO study.

5.5. Realtors' Practices

The following section will enlighten the interview conducted with a realtor from a local business in Aalborg. After conducting an analysis of the other actors, as written prior to this section, we have concluded that realtors represent a potential factor when encouraging and motivating homeowners to energy renovate. The following section will enlighten how and why we have come to this conclusion.

Our female realtor functions as a driving realtor, meaning that she sells and advertises for the company in the municipality of Aalborg. She deals with selling single family houses, apartments, and abolished agricultural properties. According to her, the process of buying a property differs depending on the type: apartments tend to sell quicker than houses, because houses have reports of condition and other documents for buyers to consider. Apartments do not have as many reports, and the focus usually is on the state of the entire building, which is taken care of by the owner's association.

When asked how she perceives energy renovation, she explains that it is a decrease of the consumption in a household such as heat, water, and electricity as well as improving and maintaining a property. When describing the process of selling a house, she explains that the buyer often acquires a sales presentation either online or by calling the company, after which further information is provided, if the buyer is interested in the property. Additional information consists of the report of condition and the EPC. The next step is to provide the potential buyer with a walk-through of the estate, often followed by a second showing with parents or contractor accompanying. This is followed by the buyer deciding whether to buy the property. If the buyer is interested, the seller is contacted, in which the realtor attempts to find a price that both seller and buyer can accept. Next, the realtor ensures that both seller and buyer are aware of, and understand, the purchase agreement and other relevant documents. Afterwards, the information of the purchase is provided to buyer's bank and lawyer, after which potential problematics can be addressed, often from the bank. This concludes the purchase of the estate: the realtor develops the deed and on date of acquisition, the guarantee is cancelled, and the purchase is final. This practice has been visualized in illustration 7.

Realtor's practice, illustration 7

If a buyer expresses a desire to energy renovate a property, the role of the realtor is to evaluate the potential gain of value that a property can receive if energy renovated. However, according to the realtor, there is a clear difference between maintenance and energy renovating a house: if a buyer conducts a maintenance renovation of a property, e.g. replacing rotten window-frames and windows, this does not constitute as added value to a property. If a property has an abnormally high level of heat consumption and a large monthly cost, the realtor might advise to conduct a cavity wall insulation, but otherwise an energy advisor may be more beneficial for the buyer or seller to consult with. If a potential buyer questions the high costs of heat in the building, the seller may have to replace or install insulation prior to a sale, which the realtor advises to. If a seller does not replace or install as advised, the buyer may be inclined to ask for a reduction of purchase costs of the house. However, the realtor only interferes, if the heat costs and use are abnormally high.

Though the realtor expresses an increase in energy renovation awareness amongst buyers and sellers, she is yet to experience buyers who directly express a desire to energy renovate. Nonetheless, more and more buyers express or comment on the energy mark of a building and buyers that solely wish to purchase zero-emission houses also exist. These buyers may have two reasons for buying zero-emission houses: the economic benefits, and the environmental. According to the realtor, these environmental buyers believe that the future lays with a windmill in the backyard, whereas those that are economically inclined represent a larger group with other convictions.

Later in the interview, the realtor expresses that she experiences an increase in buyers that discreetly discuss future renovations, such as insulation and window replacements, but she views this as renovating maintenance, not energy renovation. She also expresses that if we were in a different municipality with higher heat costs, homeowners/buyers may be more inclined to energy renovate, because of high costs and bills. In addition, she expresses that if the buyer has a desire that the realtors cannot advise about, the buyer is recommended to contact energy consultants. This also correlates with her not having an opinion about whether realtors do enough in regard to energy renovating, but she believes that house buyer's increased focus on the topic can lead to changes in the future, thus more energy renovations may be conducted.

5.5.1. The realtors' perspective of energy renovating

When viewing the realtor's timeline in correlation with the timeline of the homeowners, it is evident that realtors are the actors that are most interconnected with the homeowners in the house buying process. Homeowner two explicitly describes the ongoing interaction with his realtor when bidding on his dream house, and homeowner one expresses a constant contact with her realtor as well. This convinces us that realtors have the biggest opportunity to encourage and motivate homeowners to energy renovate, due their ongoing contact and interaction. Due to the interview data we can also acknowledge that the same rules do not pressure realtors as e.g. bankers, who are responsible for their advice: simultaneously, realtors may not be as financially dependent as contractors, because if house buyers find the house of their dreams, they cannot simply hire a different realtor to sell them their dream house: contractors are highly dependent on whether house buyers choose to hire the company to conduct the renovations. Since energy consultants primarily work with energy renovations, and have no major success in motivating homeowners, these are not of focus: especially in the light of the many measures and approaches taken previously, as mentioned in the section districts and municipalities as an affecting factor for energy renovating. As a result, we believe that realtors, in comparison with the remaining actors, has the potential to encourage and motivate house buyers to energy renovate.

5.5.2. Summary of realtor's practice

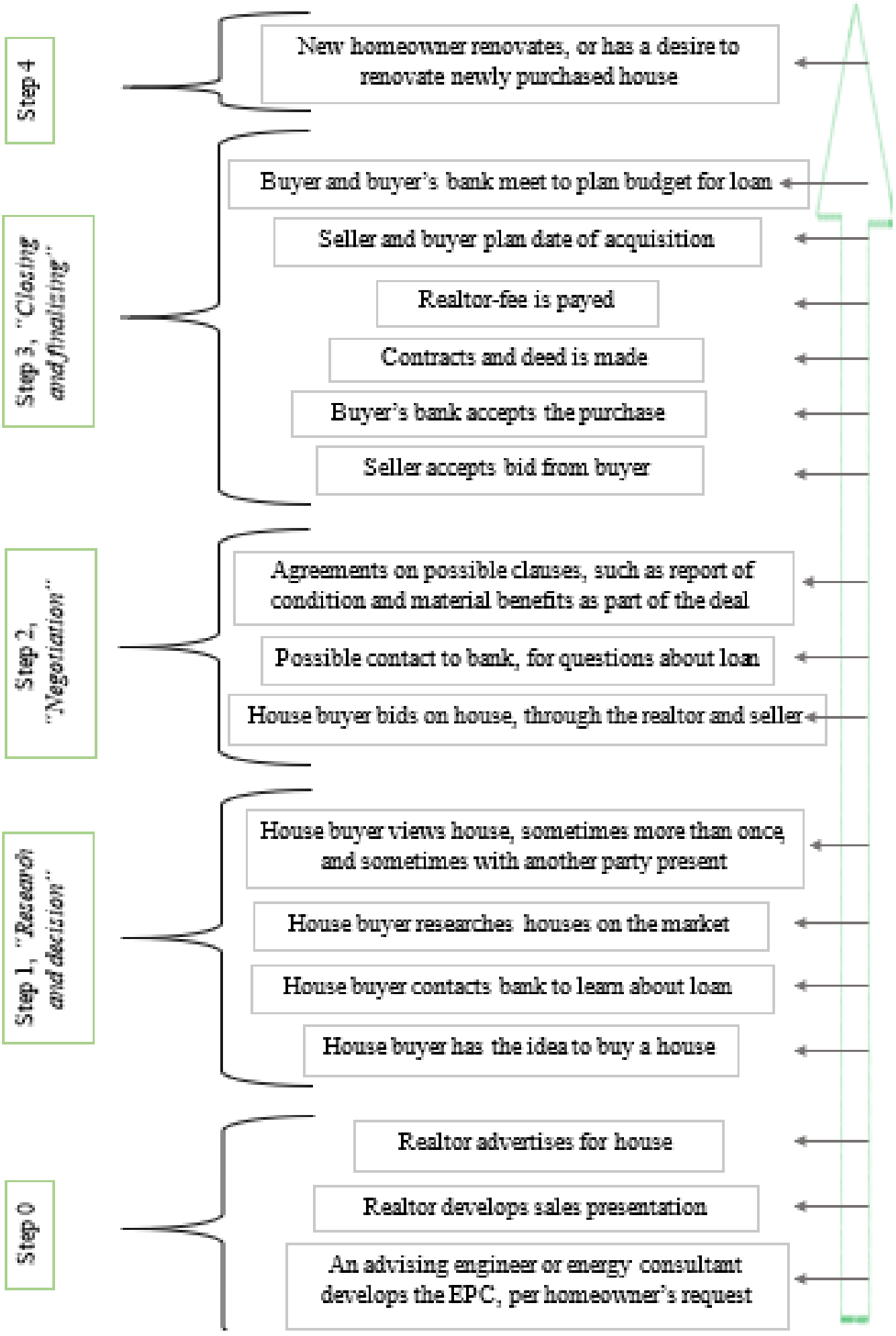
Due to the realtor and homeowner practices, we believe that realtors possess the opportunity to motivate homeowners to energy renovate in the house buying process. This particularly due to their practice seeming freer from rules, than that of the banker, whom other studies have found to be of relevance, as before mentioned. In addition, we found that realtors are the actors most in contact with house buyers. This is also evident in the process description provided by the homeowners.

5.6. Part-conclusion: phase one

In the following part-conclusion we have used the previous analysis of practices involved in the sale of a house to answer the research question: *who should motivate house buyers to energy renovate?*

To visualize the practices of buying a house, we developed a merged timeline including all actors we have investigated (illustration 8). The timeline mainly focus on the house buyers' practices, since they are the main actor who partakes in practices with the other actors. The other actors - the professionals - only participate in the practice of buying a house on occasion. The professional actors also have other practices related to the purchase that do not directly involve the house buyers, such as office practices, which are excluded from the merged timeline.

The timeline demonstrates five steps: step 0 includes all practices conducted prior to the engagement of house buyers, including but not exclusively: the development of the EPC and preparations for putting a house for sale, the evaluation of the property and advertising the sale of a house. Step 1, research and decision, represents the house buyer's idea of finding a house, moving towards contacting the bank for a loan and researching the market for houses. This step also entails viewing houses, sometimes with another party present such as a contractor, a family member or a friend. In step 2, negotiation, the house buyer has contact with the realtor and the seller of the house. They can go back and forth several times until they come to an agreement on a price. In other words, the house buyer bids on the house. This step can also include contact with the bank for questions about a loan and clauses for house buying, such as secondary assessments of the condition of the house and additional material benefits that may be included in a purchase. Step 3, closing and finalization, demonstrates when the seller of the house accepts a bid from a buyer. This is the one of the last steps of finalizing the purchase of the house, in which the buyer's bank accepts the purchase and contracts are developed and signed by both seller and buyer. Afterwards, the realtor is payed, and the date of acquisition is determined. As a last step, the house buyer's bank will call for a meeting to plan a budget for the loan. Step 4, post purchase of the house, is an ongoing step, which represents the process in which the homeowners desire and/or determine to renovate their new home. This process potentially includes actors such as carpenters and energy consultants. We have illustrated the steps in illustration 8. Pictures of the development of the timeline can be seen in appendix 4.



Merged timelines of actors and homeowners, illustration 8

The actual purchase of a house involves buyers, realtor and bankers. In some cases, energy advisors and contractors are involved too, especially if the house needs renovation. Depending on the particular house and the individual buyers, the practices vary as well as the degree of involvement of the professional actors. The condition of the particular house highly affects the practices. E.g. a house in a poor condition requires a more thorough renovation, which results in more work to the contractor, and causes the realtor to adapt their sales strategy. On the other hand, a house that only requires little renovations, results in less work, different sales arguments, and different suggestions from the energy advisor. Buyers have their individual preferences, needs, values and desires, which affects how the practices proceeds.

The energy advisors' practices related to house buyers and energy renovation mainly involves the development of EPC's and advising house buyers, which is often by telephone. We assume that the energy advisors' clients are already interested in energy renovation, as it is not mandatory for them to consult the energy advisor. Thus, clients that contact energy advisors are presumably interested in energy renovations, because they contact energy advisors on their own, and not due to mandatory requirements. Additionally, the energy advisors already strive to motivate house buyers by running campaigns to promote energy renovation. Therefore, we do not find a need to alter their practices, as they mainly are in contact with people who are already interested in energy renovation.

The contractors' practices related to house buyers and energy renovation involves meeting with the house buyers to assess their house and give a proposition on the renovation work, as requested by the house buyers. The contractors have to ensure that the renovation is in compliance with building regulations. Occasionally, the contractors assist house buyers when they are viewing a house. Otherwise they only interact with the buyers when they ask for a proposition. This situation could be an opportunity for the contractors to advocate for energy renovating, but it would be limited to a single time in the house purchase process where the house buyers have finalized the purchase, and most have already decided what to invest in.

The bankers' practices related to house buyers and energy renovation is determined by giving financial advice. They do not differentiate between energy renovation and ordinary renovation: bankers are only interested in increasing value in the house, regardless if it is a new kitchen or a heat pump. However, they are interacting with the buyers in a situation where they are planning to invest, which makes the situation ideal for the bankers to advocate

for energy renovation. Though, the bankers are legally bound to give financial advice, which does not fit as most energy renovations are not financially profitable investments.

The realtors' practices are connected to energy renovation in the sense, that they can provide encouragement to house buyers, when viewing houses. We have identified, that realtors currently do not have a direct connection between their practice and energy renovation, though they hold a potential for developing a connection. This is due to that realtors have most contact with house buyers and house buyers often talk about how a house could be renovated to fit the desires of the buyer. Thus, with the input from realtors, these discussions could be moved towards energy renovating.

That realtors are the actors most in contact with homeowners leads us to believe that they also have the biggest opportunity to encourage house buyers to energy renovate. Whereas other actors, namely contractors, bankers and energy consultants, are restricted by their practices or laws and rules, the realtor is not affected by such matters. E.g. the bank employees have advising responsibility. Additionally, we believe that realtors have an opportunity to encourage homeowners to energy renovate, because they are not professionals within the field of renovation: thus, realtors have the ability to address the topic at the same level as the average house buyer, who may not have extensive knowledge about the topic. This is supported in the accumulated literature, in which it was found that homeowners express that they do have some knowledge about energy renovation and environmental friendliness.

To find out how the realtors can adapt the motivation of house buyers to energy renovate into their own practices and how it will be received, we have conducted a workshop in which some of the actors involved in the house buying practices participated, with the purpose of facilitating a discussion, create ideas and to articulate the participants' ideas and opinions. We believe that realtors, homeowners, contractors and energy advisors would be appropriate as participants in the workshop. Realtors, since it is their practices we intend to alter, and homeowners because they are the subject to motivate. We decided to involve a contractor and an energy advisor too, as they possess knowledge about the possibilities of energy renovation, which would be beneficial for the dynamics of the discussions.

5.7. Workshop analysis

To better understand and comprehend the data accumulated during the workshop (which can be seen in appendix 6 and 7) we will look into the standpoints of each group, in order to understand their position regarding the topic of energy renovation. In addition, we will look into the common ideas of the groups as a result of the second phase of the workshop.

5.7.1. Realtors

The realtors participating in the workshop both state that house buyers' preferences are mostly guided by requirements such as size, condition and location, rather than electricity- and heat consumption. The means of approaching the buyers are, therefore, defined by which criteria are most important to them. The realtors also express that pushing ideas about energy renovating onto the buyer may jeopardize the sale. As a result, the realtors described that if they are expected to encourage house buyers to energy renovate it must be due to buyers' initiative. One realtor explained, that if buyers seem interested in increasing the energy performance of a house, he always informs them of what he believes can be done. In addition, both realtors specified that they are unsure whether it is a nationwide perception, that realtors can be too intrusive in their sales strategies. This tells us that the realtors may be reluctant to motivate house buyers to energy renovate, because it would entail a change of their practice. In addition, the realtors seem to be fearful of the perception of their field, and that attempting to motivate house buyers to energy renovate may add negative perceptions to their field.

Both the realtors speculated that the low heating prices in the Aalborg area can be a cause for the small interest in energy renovation. Both experience that the most common motivation for conducting energy renovations is financial advantages, whereas only a small group of homeowners carry out energy renovations based on ideological standpoints. Both realtors also explained that they believe bank loans aimed specifically at energy renovations holds the biggest potential for increasing the number of energy renovations carried out. If these banks provided loans for energy renovations, it would be necessary to incorporate political incentives to accomplish the success of these loans. This could be in the form of a financial pool for energy renovations or enabling homeowners to have their renovation costs paid by the state, which homeowners later would pay back in the house is sold to another party. If no financial approaches can be taken in the motivational process, the realtors express that comfort can be an appealing factor for some homeowners.

The realtors have negative perceptions of the EPC, since they believe that the calculations in the report often are too theoretic, while it lacks the ability to take personal positions into consideration. One of the realtors noted that he has a similar perception of the report of condition of a house. This realtor explained that he feels that homeowners and buyers rarely consider the EPC as important as the report of condition, but rather as a secondary source of information. In addition, he expressed that if the house buyers are to carry out renovations based on any of these two reports, it is typically based on the report of condition. He argues that this would be due to the urgency of the damages mentioned in the report of condition, while renovations that improve the grade of a building are significant and costly. Furthermore, the realtors express that some house buyers overlook the EPC, because they receive a large amount of information when viewing a house. This is also the reason why the realtors would never present their clients with the possibility of having financial aid from the energy companies when carrying out energy renovation, because it would only confuse them more, thus jeopardizing the sale.

5.7.2. Homeowners

Both homeowners in each group agree with the realtors when presenting the idea of political measures, like a financial pool. The homeowners express that it is the best way to motivate the house buyers and that there is a possibility of motivating more house buyers if it is possible to involve the banks, which corresponds with the statement of how finances represent the main obstacle for energy renovating.

Furthermore, one of the homeowners stated that she believes, that house buyers are most inclined to receive information about energy renovation when viewing a house for the first time. This due to, that it is often in that situation the house buyers generate ideas about altering the function and aesthetics of a house. Thereby, buyers are likely to be susceptible to motivation and encouragement. However, the homeowners also describe that house buyers may already have ideas about what and how to renovate the house they are viewing, thus leaving them less inclined to alter their ideas. As a result of this, it can be very difficult to engage a house buyer in energy renovations if he/she is already settled on renewing the kitchen or bathroom.

The homeowners all agree that the EPC is important, but it lacks the ability to be personalized and adjusted to one's personal habits and position. This became even more evident when one homeowner described the information in the EPC as confusing and another perceived the

EPC as a report, which only presents information already known. Furthermore, the EPC tends to be overlooked among all the other information involved in a sale, and two of the homeowners did not remember the EPC as an individual part of the sale papers.

When introduced to the possibility of having realtors delivering information regarding financial support from energy companies, the homeowners stated that the information would cause more confusion than motivation. One homeowner even stated that she would be skeptical towards advice about energy renovations from the realtor, because it is not the realtor's job to consult about such matters. She would fear that the realtor has a hidden agenda, and that she would be repelled from buying the house believing that the condition of the house is a worse than it is. However, she stated that her husband has a different impression of this, because his background as an electrician could render him more approachable for such advice. The same homeowner also stated that she would prefer to receive advice about energy renovations from the bank, instead of the realtor.

5.7.3. Contractor

The contractor generally understands the realtor, when he states that he has no interest in bringing energy renovation into the conversation if the buyers' focus and desires are elsewhere. This, along with the statement that the realtors' position in the house buying process is to sell the house, and nothing else. He also agrees with the others when they say, that the bankers have the best chance to motivate house buyers to energy renovate but is also aware of the appeal of the possibility of promoting comfort. He believes, that the comfort aspect is more important than the possibility of receiving financial aid from the energy companies, because the support from these is too low. Though, he stated that some sort of financial benefit might be the key to ensure the motivation of the homeowners.

5.7.4. Energy consultant

The energy consultant states that the EPC has a lot more value than the realtor thinks. The EPC is the best tool to compare the heat expenses in two different houses. But he believes, that the recommendations in the EPC do not matter before homeowners receive the first heat bill, because that is when they start to consider their heat use. Furthermore, he also believes that the EPC report should contain information regarding financial possibilities, as well as examples to compare.

In relation to the appeal for energy renovations he argues, that comfort is a selling point when it comes to energy renovation, whereas the financial aspect is not. However, like the realtor, he is also aware of the possibility of involving the banks to help with the financial issues, as well as the idea that banks can provide counseling as well as making contact to specialized contractors.

5.7.5. Collective thoughts from the workshop

The workshop enabled the participants to both represent their own field and to develop ideas and fictive situations in the quest of finding out how to motivate house buyers to energy renovate.

The first group acknowledged that the issue of receiving the EPC along with a large amount of other information causes, that the EPC is lost: thus, the report is not received with sufficient attention and focus. To avoid this, the participants expressed that it would be preferable to receive a reminder of the report within a year of purchasing their home, or to have the report reintroduced. According to the workshop participants, the homeowners are aware of the different issues, such as drafts or the actual heating expenses, after living in the house for a while: this could make the homeowner more approachable to the elements represented in the EPC. In addition, the participants stated, that if the EPC was presented by an energy consultant, the report may be received more favorably while avoiding any misunderstandings that may occur.

The second group argued that the EPC would be more approachable if it was made accessible online. By making the EPC digital it would be possible to include new information, which ensures a more accurate estimation of a specific situation. It should also be possible to make estimations regarding the energy performance of a house, and how this would change if minor renovations were conducted, such as switching to energy-saving light bulbs or replacing appliances. If this format of the EPC is created, one realtor believes that he would be able to actively include the EPC when selling a house, and possibly use it as a selling point. One of the homeowners also believe that she would engage herself with the EPC if it was developed as an interactive tool, instead of dismissing the report entirely.

The ideas generated in the workshop have been condensed onto a list of five points:

1. Involvement of the bank: the bank should be involved either through better loans or a counseling position.
2. Rethinking the EPC: the following points should be incorporated in the EPC, to better motivate house buyers:
    a. Personalization: the EPC should be related/adjustable to the specific home.
    b. Timing: the EPC tends to drown amongst the other information, reports, and papers.
    c. Humanization: to have the information in the EPC delivered by an expert may make the EPC usable for the house buyers.
    d. Digitalization: if the EPC is digital, you have the option to alter it as necessary.
3. Governmental financial support: such as the possibility of having a tax deduction or by having the government pay for the energy renovations, and then reimburse when house is sold again.
4. Energy renovation has to be introduced to the buyers as a relevant option prior to searching for houses.
5. Specific selling points: The participants were able to identify the following set of specific motivational points which could engage them in energy renovations:
    a. Financial gains.
    b. Comfort and indoor climate.
    c. Aesthetics.
    d. Climate friendliness.

These ideas give a tangible view of motivational points as defined by the workshop participants. In the following chapter, these ideas will be related to relevant literature to evaluate if they could be successful if they were to be utilized.

5.8. Part-conclusion: phase two

Based on the ideas generated during the workshop, the following section will answer the research question: *how to motivate the house buyers to energy renovate?*
To investigate this, we utilize a similar approach as that of the first analysis by relating the points to studies with similar findings. This includes looking into if any efforts have been made in relation to these ideas today and if there are any specific disadvantages.

The first idea from the workshop concerns the involvement of banks in cases of energy renovation. However, since mid-2017, it has been possible to obtain energy-loans in a variety of banks, which was initiated by the Energy City in Frederikshavn. The Energy City Frederikshavn actively began a dialogue with large national banks, as well as a range of local banks, and promoted the idea of providing customers with better loan-possibilities, given the loan would be used for energy renovations (Pedersen, 2017). In other words, this initiative is similar to the idea developed during the workshop. The impact of these loan possibilities is, however, limited: as described by the banker in the pilot interview, he was under the impression that such loans were rarely given and applied for. This tells us, that bankers can motivate homeowners to energy renovate, yet since loans for such renovations are not utilized, the bankers do not take advantage of this potential. However, despite the statement that energy renovation loans are hardly provided to customers, we believe that bankers do have an opportunity to encourage homeowners to energy renovate. This due to the banker's unique position and interaction with homeowners, regarding finances and loans. Some energy renovations may not be perceived as profitable in the bank's perspective, due to long payback periods, thus loans may not be given to customers. Nonetheless, homeowners who energy renovate can experience an increase in comfort and indoor climate, as well as lowered expenses of heat and water, which both have value. Comfort and indoor climate can increase the homeowner's quality in life, especially if drafts cause illness or unpleasantness. Lowered expenses of heat and water has financial values, which is the main concern in banks, according to the banker interviewee. In addition, a study based on 3058 interviews with homeowners concluded that the most significant barrier for homeowners to conduct energy renovation is the financial expense, as we also uncovered during the workshop (Bolius, 2017). The long payback period on most energy renovations also result in homeowners being reluctant towards such renovations. The analysis by Bolius also investigated how reluctant homeowners can be motivated: it was found that a public financial support would be the most

significant driving factor, which we also identified in the workshop. In relation to public financial possibilities, the analysis also found that a motivational tool could be to reduce the real estate taxes (Bolius, 2017). This arrangement is similar to the suggestion from the workshop participants who desired a solution with the possibility of having the expenses for energy renovations paid by the state, and then pay it back in the event of a sale. Yet, for this to become a possibility, the government would need to partake in the decision-making. This is because if the homeowners inhabit a house until they perish, the pay back of finances would be dependent on next of kin or the savings of a homeowner. Lastly, the analysis also found that there is an appeal to energy renovate if homeowners are ensured better comfort as a result. This is also connected directly to the inputs from the workshop, thus a potential lay here as well. A means of enlightening the aspect of comfort when energy renovating could be through advertising or marketing: yet again, the government or private investors would have to partake in this situation, because payment of such measures may depend on them.

To focus our study on the house buying process possibly caused the workshop participants to focus extensively on the EPC, since it is the most elaborated input from the participants. The main areas of focus regarding the EPC are digitalization, humanization, and personalization, which the participants argued would affect them positively. This need for change in the EPC is strongly supported in the study by Bartiaux et al. (2014), in which the informants state, that the EPC drowns in the large amount of paperwork and information (Bartiaux et al., 2014). In addition, the study found that the informants find the EPC to tends to describe what is obvious, which was also enlightened by some participants during the workshop, while others described parts of the EPC as too complicated. The need for personalization of the EPC is again being highlighted in the report by Christensen et al. who found that Danish homeowners like the idea of doing it yourself (DIY), and in these cases the estimates in the EPC's are incorrect, as they include wages for the contractors (Christensen et al., 2014). If homeowners conduct DIY-projects, their practices would differ from that of purchasing and renovating a home with the aid of contractors, because of materiality: as Schatzki explains it, materiality pertains the practice, and shapes how a practice can unfold. This we identify as relation of constitution, which Schatzki describes as a material element that is necessary for the practice to occur. If homeowners intend to conduct renovations themselves, certain material elements are necessary: tools such as hammers, nails, and handsaws, along with other tools that are necessary to conduct a renovation. In addition, the homeowners would have to possess sufficient know-how about how to conduct the renovations. Since DIY-projects are not necessarily conducted by professional contractors or carpenters, this cannot

be defined as a field. Homeowners outside relevant fields may also possess know-how from certain fields, which enables them to conduct renovations successfully.

The report by Christensen et al. (2014) also explains that another element to consider regarding the EPC, is timing: as our workshop participants stated, the EPC would be received more favorably if it was introduced at a later point in time, after they have moved into their house. This is because the homeowners then would be aware of the issues within their house, and it would not disappear amongst other information (Christensen et al., 2014).

Common for the suggestions of both workshop and literature is that additional resources from either the homeowners or the government are required for the suggestions to be carried out. If the EPC is to be made more descriptive and thorough, it will be more time consuming to develop, thus making it more expensive. Ultimately, this could affect the popularity of the EPC negatively.

If the EPC is to be digitalized, additional expenses may also be a reality, possibly for the government. It seems unlikely that the government would agree to finance this expense, based on the latest 2018 governmental measures on removing energy counseling and the establishment of smart energy systems in private homes from the services which it is possible to have a tax refund from via the contractor deduction (Buch, 2018).

Summarizing it must be said that the five points all may have the ability to motivate the house buyers to energy renovate, but if the suggestions are to be carried out, a range of complications both on a political, financial, and individual level may occur.

We found that influences of the house buyers' decisions of energy renovation are not only limited to non-physical elements, such as finance and comfort, but can also be represented in the technologies available for such renovations. Homeowners and house buyers alike may feel overwhelmed by the vast range of solutions and uninformed of which technologies are available to utilize, while the prerequisites of each individual house also have relevance. The technologies of energy renovation can be a barrier in itself, as the outcome of investing in energy renovations highly depend on the material conditions. Some energy renovations may result in a domino-effect, because it would not be sufficient to only conduct one alteration: for heat pumps to be effective, a house needs to be properly insulated to ensure that the heat does not escape the building. If homeowners or house buyers decide to use district heating - this being in areas without mandatory grid connection - also leads to multiple aspects to consider: not all parts of Denmark are ideal for district heating, and those that are suitable would have to endure a long period of burying pipes into the surrounding area. While the technologies for

energy renovations can be two-sided, as can the governmental approaches and measures: the EPC has, despite its purpose and efforts, negative connotations amongst its recipients, which causes the report to be received negatively by some house buyers. Both energy advisors experience that EPC's are not descriptive enough, e.g. lacks examples that the homeowners understand, and thereby cause the negative perceptions, while the contractor believes that the media and news also create negative perceptions of the EPC.

6. Conclusion

The following conclusion will answer our problem statement: *how can house buyers be motivated to energy renovate during the process of buying their house?*

A significant driver and barrier of energy renovation lies in the material arrangement, namely the houses and the energy renovation technologies, as the nature of these determines the outcome of a potential renovation. These vary depending on the particular house and its condition and location, therefore, there are no generic solutions. This is important to have in mind, as house buyers' willingness to invest in energy renovation is highly dependent on the outcome being favorable according to their own preferences. The most prevailing driver for motivating house buyers to energy renovate is economy, and since only few energy renovations are actually profitable investments, economy is also the main barrier. To accommodate this, our informants requested for increasing financial support, such as tax reduction and grants, thus an expansion of already existing incentives.

Our study indicates that the information in the EPC can be difficult to relate to for some house buyers, as the information regarding energy use is standardized. Therefore, we suggest that the EPC should be personalized, representing data that takes an outset in the individual buyers' household practices. This would be achievable if the EPC was to be digitalized. Digitalization of the EPC could also make it more accessible and making it interactive could enable the house buyers to explore the possibilities of energy renovation and how it would affect their actual energy use, which may be a motivational incentive for some people.

The realtors could be appropriate motivators, as they are in contact with the house buyers at several stages in the process, including during the first view of the house where the buyers' first ideas are generated. The realtors could adapt the digitalized EPC into their sales presentation and/or house viewing as well. However, this may require the realtors to qualify for communicating the EPC. Additionally, we see a tendency that house buyers give the EPC little to no attention, as they are overwhelmed by information in the process of buying their house. Therefore, we advocate that the EPC should be reintroduced at a later time after they have settled in their house.

6.1. Reflection

Through the process of locating relevant literature, we came to the conclusion that energy renovation is: any renovation of a building, which causes a reduction in use of heat, water and/or grid-supplied electricity, as well as the costs thereof. Throughout the pilot interviews it became evident that our interviewees perceive the term energy renovation differently. Since the participating interviewees distinguish between renovations and energy renovations, we believe that there may be a need to remove this differentiation. This is due to that if energy renovations are perceived as something other than, or larger than, regular renovations, such as replacing a kitchen, homeowners and house buyers may be intimidated. In other words, there is a need to make energy renovation into renovation, thus making energy renovations seem less intimidating.

Through the pilot interview we were able to identify three types of renovations: renovation carried out to reduce the expenses for, or use of, heat and electricity, which typically is the case of installing a heat pump or replacing the glass in windows. This type of renovation is, however, not the most common, as most energy renovations are conducted due to maintenance. We recognize this as the second type of renovation: if a homeowner carries out a renovation, which in some way affects the building envelope (such as replacing windows, or replacing the roof), the homeowner is obliged to upgrade the building envelope to fit the current standards, as long as it is considered profitable according to the specified building regulation calculations. Contrary to the first type of renovation, this type of renovation is not necessarily carried out with intentions of reducing the use of heat and electricity, but as additional maintenance. The third cause for doing renovations is aesthetics, or functional improvements of the house, which does not affect the heat or electricity use, e.g. installing a new bathroom or kitchen.

In other words, the first renovation is for the sake of the reduced electricity and heating consumption. Secondly, renovation with lowered electricity and heating consumptions as a side effect of home maintenance and thirdly, renovation without any consumption decrease, such as installing a new kitchen or interior maintenance.
We believe, that homeowners and house buyers alike, should not differentiate between renovation and energy renovation, but rather recognize the terms as one in the same. In other words, it should be a common practice to energy renovate as a part of the ordinary maintenance of a house. The workshop participants support this idea as well, in which one

homeowner stated that if she had been approached with the idea of energy renovating prior to searching for- and purchasing her home, she would consider energy renovations as a part of the renovating maintenance on the house. To unite the terms energy renovation and renovation we believe that companies, such as contractors, masons, and plumbers, should no longer describe the forms of renovations as separate types, but as one unified renovation-form. This may influence those having renovations conducted, thus altering the pattern of perceiving energy renovations and renovations differently.

7. References

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