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System-Smart Energy Use: Does it require smart users?

A case study on housing cooperatives in
Kristiansand and Oslo

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Abstract

Housing cooperatives are a crucial component of Norway's housing stock, accounting for approximately 20% of total housing units. As a result, decision-making processes in housing cooperatives significantly impact the country's energy consumption patterns. This thesis explores contextual and internal factors, including perspectives on economy, complexity and environmental norms and values, which may influence the adoption of "system-smart energy" solutions. System-smart energy refers to various technologies and practices that enable efficient energy use and reduce environmental impacts, such as renewable energy sources, energy-efficient appliances, and smart grid systems.

The study applied theoretical underpinnings related to behaviour from institutional economics. It used the Environmental Governance System framework (EGS) to map the institutions and actors with which housing cooperatives interacted. The research objectives included clarifying the concept of system-smart energy solutions, investigating the impact of relationships between actors, structures, and institutions on housing cooperative success, identifying enablers and barriers to investing in system-smart energy solutions, understanding decision-makers motivation for collaboration and partnership, and investigating factors shaping housing cooperative decision-making regarding smart energy systems.

Overall, this study aims to understand better the role of system-smart energy solutions in housing cooperatives and the factors influencing their adoption and success. The research highlights the challenges decision-makers face in housing cooperatives navigating the complex landscape of smart energy solutions. Through shedding light on decision-makers perspectives in housing cooperatives, as framed within the formal and informal institutions external and internal to the housing cooperatives, this study provides valuable insights that may inform policymakers, energy service providers, and housing cooperatives in achieving energy goals and a successful energy transition. Specifically, the research underscores the importance of taking a comprehensive approach that considers the interaction of different energy systems and the critical role of actors, structures, and institutions in implementing smart energy solutions.

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List of illustrations

Figure 1: Internal Structure of a Norwegian housing cooperative.....	7
Figure 2: The EGS Framework. Source: Vatn, 2015, p. 154.....	16
Figure 3: Green Valley Cooperative EGS framework based on Vatn’s EGS framework.....	35
Figure 4: Sunshine Cooperative EGS framework based on Vatn’s EGS framework.....	36
Figure 5: Riverfront Cooperative EGS framework based on Vatn’s EGS framework.....	37
Figure 6: Forest Hills Cooperative EGS framework based on Vatn’s EGS framework.....	38
Figure 7: Pinegrove Cooperative EGS framework based on Vatn’s EGS framework.....	39
Table 1: ZERO's System-Smart Energy Use Framework (ZERO, n.d.).....	10
Table 2: Blumstein et al. (1980) Barrier taxonomy.....	17
Table 3. Vatn’s (2015) policy instruments.....	18
Table 4. Information about interview participants.....	22
Table 5: Overview of the five housing cooperatives.....	30
Table 6: Common barriers affecting the implementation of energy upgrades	41
Table 7: Common enablers affecting the implementation of energy upgrades	47

Abbreviations

AMS	Advanced Measurement Systems
CICERO	Center for International Climate and Environmental Research
CO ₂	Carbon dioxide
EGS	Environmental Governance System
ENGOS	Environmental Non-governmental Organizations
ENØK	Effektiv energibruk/Energy Efficiency
kWh	Kilowatt-hour
MWh	Megawatt-hour
NBBL	Norske Boligbyggelags Landsforbund/The Co-operative Housing Federation of Norway
NOK	Norsk krone/Norwegian krone
NOU	Norges Offentlige Utredninger/ Norwegian Official Commissions
NSD	Norsk senter for Forskningsdata/Norwegian Centre for Research Data
NVE	Norges Vassdrags- og Energidirektorat/The Norwegian Water Resources and Energy Directorate
OBOS	Oslo Bolig- og Sparelag/Oslo Housing and Savings Cooperative
SINTEF	Stiftelsen for industriell og Teknisk Forskning ved Norges Tekniske Høgskole/The Foundation for Industrial and Technical Research
SOBO	Sørlandet Boligbyggelag/South-Norway Housing Developers
TWh	Terawatt-hour
ZERO	Zero Emission Resource Organisation

Table of contents

1. Introduction	1
2. Background	4
2.1 The Norwegian energy sector	4
2.2 The Norwegian residential energy sector	5
2.3 Housing Developers	5
2.4 Housing Cooperatives	6
2.4.1 The General Assembly	7
2.4.2 The Board	8
2.4.3 Maintenance	8
2.4.4 Rebuilding, extensions and other changes	9
2.4.5 Joint costs	9
2.5 System-Smart Energy Use	10
3. Theoretical background	12
3.1 Institutions: The individual and the society	12
3.1.1 Rational choice theory	13
3.1.2 Bounded rationality	14
3.1.3 Social constructivist theory	14
3.2 The Environmental Governance System Framework	15
3.3 The Nature of Barriers and Instruments in an energy context	16
3.3.1 Blumstein et al.s barrier taxonomy	17
3.4 Policy instruments	18
3.5 Application of Theory	19
4. Methods	21
4.1 Purposive sampling	21
4.2 In-depth interview	22
4.3 Interview guide	23
4.4 Conducting the interviews	24
4.5 Data analysis	25
4.6 Trustworthiness	26
4.7 Ethical Considerations	26
4.8 Positionality	27
4.9 Research Challenges	28
5. Analysis	29
5.1 Description of the housing cooperatives	29
5.1.1 Oslo's energy sector	29
5.1.2 Kristiansand's energy sector	30
5.1.3 Green Valley Cooperative	31
5.1.4 Sunshine Cooperative	31

5.1.5 Riverfront Cooperative.....	32
5.1.6 Forest Hills Cooperative.....	33
5.1.7 Pinegrove Cooperative.....	34
5.2 External Relationships of Housing Cooperatives.....	35
5.2.1 Green Valley Cooperative.....	35
5.2.2 Sunshine Cooperative.....	36
5.2.3 Riverfront Cooperative.....	37
5.2.4 Forest Hills Cooperative.....	38
5.2.5 Pinegrove Cooperative.....	39
5.2.6 Similarities between the cooperatives.....	39
5.3 Barriers and Enablers.....	40
5.3.1 Barriers.....	41
5.3.2 Enablers.....	47
5.4 Motivation.....	50
5.4.1 Gary - Green Valley Cooperative.....	50
5.4.2 Simon - Sunshine Cooperative.....	52
5.4.3 Rachel - Riverfront Cooperative.....	54
5.4.4 Frederick - Forest Hills Cooperative.....	55
5.4.5 Peter - Pinegrove Cooperative.....	56
5.5 Navigating the Institutional Landscape.....	58
5.5.1 Economic, legal, and technological complexity.....	58
5.5.1.1 Economic Complexity.....	58
5.5.1.2 Legal Complexity.....	61
5.5.1.3 Technological Complexity.....	63
5.5.2 Informal Institutions.....	65
6. Discussion.....	72
6.1 System-smart energy solutions.....	72
6.2 Relationship between actors, structures, and institutions.....	74
6.3 Barriers and enablers for investing in system-smart energy solutions.....	75
6.4 Institutional economics Theory and decision-making motivation.....	76
6.5 Decision-making process and navigating complexity.....	78
7. Conclusion.....	81
8. References.....	83

1. Introduction

Climate change is one of the most pressing global challenges of our time, and it is widely recognised that urgent action is needed to mitigate its effects (IPCC, 2023). In addition, to be able to reach the Paris Agreements' goal of limiting global warming to 1.5 C, it is essential to implement drastic changes in the energy sector, such as phasing out fossil fuel usage, reducing energy consumption, and utilising energy we already have (IRENA, 2019). In Europe, renewable energy will be the primary driver for phasing out fossil energy. This also applies to Norway (Klima- og miljødepartementet, 2020). Even though Norway has, and still will in the future, have hydropower as a reliable and primary energy source, little less than half of the total energy consumption is based on fossil energy (Hovland, 2018).

Electrification and new green industries will result in large consumption, as comprehensive plans for growth in new industries need power (Bråten, 2022). However, electrification and an enormous increase in renewable power production, especially wind and solar power, along with existing hydropower, make energy systems more reliable for variable power generation. Transitioning from flexible fossil power generation to a large proportion of weather-dependent power generation creates a need for new flexibility (Bråten, 2022). One area with significant potential for achieving these goals is the residential sector, particularly in the context of housing cooperatives in Norway. The residential sector in Norway contributed the most to the increase in total electricity consumption (SSB, n.d.). With the high energy consumption of households, and the growing number of housing cooperatives in the country, implementing climate-friendly solutions at this level can significantly impact reducing carbon emissions and promoting sustainability. If you can use existing building stock rather than building new, it will often be a more sustainable alternative. Renovation is good for the economy, the environment and the people who live in the homes. (NBBL, 2021a)

In the past few years, sustainable energy systems have been developed through initiatives such as "Net Zero Energy Buildings" and "smart grids". However, these systems often only focus on single-sector approaches, forming sub-infrastructures. A new concept called "Smart Energy Systems" or "Smart Energy" has been introduced in response. This approach aims to provide an integrated and holistic understanding of the energy system (Lund et al., 2017). Although relatively new, the terms have gained significant traction in recent years. There are

two different understandings of Smart Energy Systems. The first group focuses on "smart" and highlights the potential for more control management, often associated with "smart grids" (Acha et al., 2019). The second group emphasises the word "system". It aims to include all sub-sectors of the energy sector in one integrated system, promoting cross-sectoral integration and even non-energy sectors into the system (Lund et al., 2017). The "System-Smart Energy Use" project, which is managed by the environmental foundation Zero Emission Resource Organization (ZERO), aims to provide an integrated and holistic approach to energy management by exploring options beyond electricity and adopting a more efficient approach towards utilising energy resources (ZERO, n.d.).

Despite the considerable efforts made to address climate change and promote the development of more sustainable energy systems, a significant research gap still needs to be filled, particularly in decision-making processes within residential housing communities. Housing cooperatives in Norway, which account for approximately 20% of the total housing stock, play a vital role in energy consumption. Their decision-making processes are critical to the success of any energy transition (Bjørkan & Gjelsvik, 2018). With the increasing focus on climate change and the transition towards a sustainable energy system, housing cooperatives are expected to play a crucial role in achieving the country's energy and climate goals. Housing cooperatives and their decision-makers may face numerous barriers when it comes to implementing system-smart energy solutions (NBBL, 2021b).

Various perspectives exist on how to overcome these barriers. Some suggest that only economic instruments and direct regulations are needed, while others propose other relevant perspectives to contribute to the transformation process, such as institutional economic theory. This theory recognises that social norms and institutions, including social expectations and cultural values, can influence behaviour and decision-making. Based on this observation, the main research question to be addressed in this thesis is: *How do decision-makers in housing cooperatives relate to the complexity of system-smart energy solutions?* The following sub-research questions were developed to answer the main research question:

SRQ1: What do system-smart energy solutions implicate?

SRQ2: What is the nature of the relationship between actors, structures, and institutions in the context of housing cooperatives, and how does this relationship impact their success?

SRQ3: What are the common barriers and enablers for housing cooperatives investing in system-smart energy solutions?

SRQ4: How may institutional economics theory explain decision-makers motivation in housing cooperatives to collaborate and partner in different contexts?

SRQ5: How do housing cooperative decision-makers navigate the complex landscape of system-smart energy systems, and what factors shape their decision-making?

The thesis will draw on various sources, including existing research on energy systems, housing cooperatives, and system-smart energy solutions. Additionally, empirical research will be conducted through interviews with actors involved in decision-making processes within housing cooperatives in Norway. ZERO's "system-smart energy use"-concept is the primary basis for analysing and discussing energy technologies and solutions.

This thesis consists of seven chapters. The first chapter introduces and outlines the problem statement and research questions. The second chapter provides an overview of the Norwegian energy sector, system-smart energy solutions, and the cooperative housing system in Norway. Chapter 3 presents the study's theoretical background, while Chapter 4 discusses the methods chosen for conducting the research. Chapters 5 and 6 analyse and relate the data material to the background and theory presented earlier. Finally, Chapter 7 draws conclusions based on the results.

2. Background

2.1 The Norwegian energy sector

In 2018, mainland Norway consumed 235 TWh of energy, with over half of the total energy consumption being electricity. Electricity usage is high in households, commercial buildings, and industries. Electricity consumption is expected to continue to rise, particularly in the transportation sector, industries, the petroleum sector, and data centres (NVE, 2019c).

Norway produces around 156 TWh of electricity in a typical year, with the high development of power and renewable power of over 19 TWh provided by the electricity certificate scheme (NVE, 2019a). The Norwegian power supply comprises hydroelectricity, wind, and thermal power. Hydroelectricity accounts for 89 per cent of Norway's power supply, and the resource base depends on the annual precipitation levels (Energifaktanorge, n.d.a).

There are various actors to consider when analysing this topic. First, the Norwegian Parliament sets the political framework for the Norwegian Directorate of Water Resources and Energy (NVE). The government has executive authority and sets it into action with help from various ministries. The Ministry of Petroleum and Energy is responsible for managing energy and water resources in Norway, which means its primary task is to ensure the administration is working according to the guidelines set by the government. They also have ownership responsibility for the state enterprises - Enova and Statnett. NVE manages domestic energy resources and is the national regulatory authority for the electricity sector (Energifaktanorge, n.d.b). Enova is a state enterprise that manages the funds in the Energy Fund. They aim to promote the environmentally friendly restructuring of energy use and production and the development of energy and climate technology (Enova, n.d.)

Statnett, a state enterprise, is responsible for building and operating the electricity grid. It owns more than 90 per cent of the central grid. Therefore, they are responsible for ensuring the right power balance and delivery in all parts of the country (Energifaktanorge, n.d.b). Due to its geographic conditions and extensive settlements, Norway faces certain challenges. The country has numerous areas far from the closest power producer, making providing electricity to those regions difficult. (Grinstad & Mosvold, 2022). Connection to the transmission network must be clarified with Statnett. Local or regional network companies must handle most cases of connection. A central duty of the network companies is to provide new

customers with connections and facilitate production and consumption increases for existing customers. Network companies cannot, therefore, choose their customers or how much effect the customers will have. It is this transfer that power grid companies are responsible for (OED, 2022)

2.2 The Norwegian residential energy sector

In Norway, 90 per cent of all households own their own houses. Individual private homeowners are, therefore, important decision-makers. In energy use, the housing sector can be divided into new and existing housing (Enova, 2012, p. 29). The residential energy sector is one of the primary consumers of energy usage in almost every country. In addition, the sector is the most energy-consuming, just after the industrial sector, and it has almost doubled during the last decade (IEA, n.d.). The vast majority of buildings in Norway utilise electricity as the primary heating source, accounting for approximately 80% of household heating. (Bråten, 2022). Furthermore, many households in Norway are linked to district heating systems, while only a small proportion rely on oil or gas-fired heating systems (NVE, 2019b).

Regarding energy saving, the government has set a goal of saving 10 TWh per year in existing buildings by 2030 (Granavolden, 2019). Nevertheless, this has not been happening; actually, quite the opposite. As a result, the national electricity consumption is expected to increase from around 140 TWh in 2022 to 190 TWh in 2040 (Statnett, 2020). In addition, electricity consumption in Norwegian households is increasing. Despite record-high electricity prices, household electricity consumption increased by 4.2 per cent from 2020 to 2021, making up 39.8 TWh. Cold weather, prosperity development, and population growth can contribute to this trend (SSB, n.d.).

2.3 Housing Developers

Housing Developers can be traced back to the early 20th century when Norway faced a severe housing crisis. At the time, housing in Norway was mainly provided by private landlords, who charged high rents for often substandard housing. The Norwegian Cooperative Union recognised the need for alternative forms of housing that would be more affordable and better suited to the needs of the working class. The first housing developers were established in Oslo in 1929, and over the following decades, the cooperative model became increasingly popular across Norway. The government provided loans and grants to

construct cooperative housing, and many housing cooperatives were formed during this period (NBBL, n.d.). Housing Developers is an entity that constructs, sells, and administers residences for its members. The residences are usually organised as housing cooperatives or occasionally as co-ownership. In addition, housing developers offer services such as management and consultancy to housing companies. They arrange courses for board members and assist in formulating maintenance plans for the housing company (TOBB, n.d.).

2.4 Housing Cooperatives

Housing cooperatives are buildings, land, houses, and outdoor areas. They are high-rise buildings, low-rise buildings, terraced houses and semi-detached houses. Nevertheless, it is primarily a way of organising housing (Eek, 2009c). The rules on housing cooperatives are stated in "The Housing Cooperative Act" (Burettslagslova, 2003). It regulates the rights and obligations of housing cooperatives and their residents. It is a comprehensive law that defines a housing cooperative, how it is founded, capital ratios, who can be unit owners, what rights the owners have to dispose of the home, and rules on how the housing cooperative is to be managed (Eek, 2009c).

In addition, it is common for housing cooperatives to draw up their own rules of order. A housing cooperative is, by definition, a company that unit owners own. This can be compared to how shareholders relate to joint-stock companies. The purpose of a housing cooperative is to give the unit owners the right to use their own homes on the cooperative's property. The right of use is a housing right and expresses the user ownership principle in the housing cooperative. This means that whoever is the owner must also be a user. Housing cooperatives can also carry out other activities, provided that this activity has a sufficient connection with the unit owners' right of residence. Examples of such measures could be establishing a children's park, tennis court or the operation of a nursery. Housing cooperatives have also been responsible for joint electricity purchases in recent years (Eek, 2009c).

A distinction is made between two types of housing cooperatives- the independent and the associated housing cooperative. In an associated housing cooperative, it follows from the articles of association that the unit owners in the housing cooperative must also be unit members of a specific housing developer. In an independent housing cooperative, there is no requirement for this. The associated housing developers comprise 90 per cent of all housing

cooperatives. Being a member of a housing developer gives them the right to acquire a share and become a share owner in a housing cooperative (Eek, 2009c).

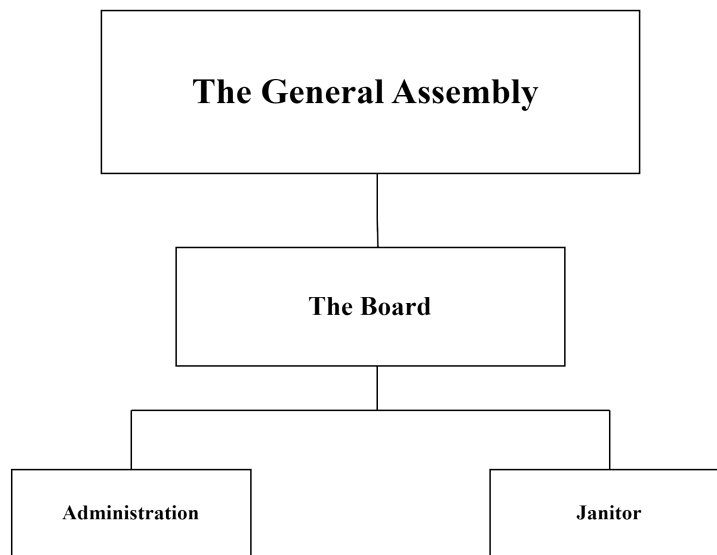


Figure 1. Internal Structure of a Norwegian housing cooperative

The figure displayed depicts a standard internal structure, drawing inspiration from an information handbook for residents of Vestlia Borettslag, a housing cooperative (Vestlia Borettslag, n.d.). The chart begins with the general assembly, the cooperative's supreme decision-making body. The board, the next level in the hierarchy, is elected by the general assembly. Typically, the administration and janitorial staff fall under the board.

2.4.1 The General Assembly

The general assembly is the housing cooperative's highest authority. All unit owners in the housing cooperative have the right to attend. Any case relating to the housing cooperatives relationship can be considered; there is no requirement that the case is of great importance, practically or financially. Three people are obliged to attend the general assembly. It is the board leader, the managing director and the auditor. Several tasks must always be dealt with and decided by general assemblies: distribution of funds to unit owners, approval of annual accounts and annual report, the election of the board, merger and division of housing cooperatives, dissolution of a housing cooperative, and decisions of a possible investigation (Eek, 2009b).

2.4.2 The Board

The executive body of a housing cooperative is the board, which is responsible for making decisions made by the general assembly and managing the cooperative's daily operations in the best interest of its unit owners and residents (Eek, 2009d). The housing cooperative possesses substantial assets, which the board must manage on behalf of the unit owners. Board members are elected by the general assembly, with the board leader elected separately, and the other members elected collectively. Although it is not a requirement for board members to be unit owners, many are, and they often reside within the cooperative. Every housing cooperative must have at least three board members, with no maximum specified by law. Board members are elected for two-year terms, with no limit on re-elections, subject to approval by the general assembly. The board is responsible for ensuring that matters are handled within set deadlines and that the housing cooperative adheres to the annual cycle, including budgeting, determination of joint costs, submission of accounts and annual reports (Eek, 2009d).

2.4.3 Maintenance

The main rule of the Housing Cooperative Act is that the unit owner is responsible for the maintenance of the home. In addition to the housing unit itself, the owner's responsibility includes the associated rooms and other areas exclusively disposed of by the owner. Typical examples are basement and attic storage rooms that belong to the home (Lauridsen, 2009). The same is the case where a unit owner rents out or, in some other way, entrusts the use of the home to others. The unit owner must maintain such things as windows, pipes, cables, fixtures, equipment, appliances and interior surfaces in the home. The unit owners' maintenance obligation is also limited to common ducts and other standard installations that run through the home. The housing cooperative must therefore maintain shared ventilation systems. According to the law, the housing cooperative must keep buildings and the property otherwise in good condition, provided that the duty does not lie with the unit owner. This means that the housing cooperative is responsible for carrying out all maintenance in the housing cooperative unless it follows or can be derived from law, statute or agreement that the unit owner must carry it out (Lauridsen, 2009).

2.4.4 Rebuilding, extensions and other changes

Without the general assembly having given its consent with at least a two-thirds majority, the board cannot make decisions about rebuilding, additions or other changes to buildings or land according to the conditions in the team and go beyond day-to-day management. It is the board that leads the housing cooperative and makes decisions that are not assigned to other bodies by law or bylaws. Therefore, when it comes to rebuilding, additions or other changes to buildings or land that may, depending on the conditions in the team, go beyond regular management and maintenance, as mentioned, the board can only decide with the consent of the general assembly. However, what in a large housing cooperative must be considered regular management in a smaller housing cooperative could be considered to go beyond regular management and will therefore require a general assembly resolution.

It is the board that must assess whether a matter falls within the scope of the general assembly or not. Putting the matter before the general assembly may make sense if the board is in doubt (Stormfelt, 2009).

The housing cooperative must finance all measures that the housing cooperative carries out under joint auspices. This can happen by using saved funds or taking out a loan. The housing cooperative must refrain from demanding that the unit owners pay more cash to finance an extension. Regardless, the housing cooperative can increase the joint costs to build up funds or cover interest and instalments on loans that must be taken out. All unit owners must help pay, even if they benefit little from the measure. Specific measures that only benefit some unit owners are exempt from this. An example is that verandas are built, but those living on the first floor cannot get them; they do not need to pay for them (Stormfelt, 2009).

2.4.5 Joint costs

For the housing cooperative to cover the running costs of day-to-day operations and pay interest and instalments on the joint debt, they need income. The housing cooperative's activities aim to manage the buildings and property for the benefit of the unit owners. The team can only run other activities as long as these are related to the unit owners' housing interests. Therefore, the cooperatives do not have the opportunity to run ordinary business activities to obtain a profit to cover the housing cooperatives' expenses (Eek, 2009a). The housing cooperative's typical only source of income is payments from the unit owners. The joint costs in the housing cooperative consist of two main elements, operating costs and capital costs. Operating costs are necessary to run the housing cooperative from day to day.

The capital costs are interest and instalments on the housing cooperative’s joint debt. The board must determine what the unit owners must pay monthly to cover the common costs. The amounts must be so high that they are sufficient to cover the common costs the housing cooperative will receive. Collecting an amount that covers more than the current common costs for the housing cooperative is also permitted. The board would be well within its rights to establish monthly amounts that cover ongoing expenses and provide for future welfare and rehabilitation projects. The board has the right to change the size of the amount as often as it deems appropriate. Typically, the amount is increased or decreased once or twice a year (Eek, 2009a).

2.5 System-Smart Energy Use

A project managed by the environmental foundation ZERO - *System-Smart Energy Use* - has been trying to explore and shed light on alternative energy solutions to open space in the Norwegian power grid. Moreover, as quoted by the project, “We must use alternatives to electricity where we can - and think smarter about how we use the energy resources we have.” (ZERO, n.d.). The project categorises five solutions that should be included more in the debate to achieve an integrated and sustainable energy system. For example, 1) smart and flexible management of the power; 2) local energy production; 3) energy efficiency measures; 4) utilisation of other heat sources, and 5) energy storage.

Table 1. ZERO's System-Smart Energy Use Framework (ZERO, n.d.)

Solutions/alternatives	Description
1. Smart management	Smart and flexible power management means more control over power usage until everyone has room. Such flexible solutions can reduce the pressure on the power grid during “peak hours” and make the price cheaper. A typical example is a smart hot water tank that can be regulated when it is the best time to heat the water according to the best access to electricity during the day.
2. Local energy production	To avoid transporting energy over long distances, such as what has to be done in Norway, it can be possible to produce more electricity where it is used—for example, installing solar cells on outer roofs and walls or solar parks in the area.
3. Energy efficiency	There are many solutions to reduce the need for energy to achieve heat. Such as, for example, better insulation of walls,

newer windows and heat pumps. By re-insulating a house, there is less heat leakage, which means more energy for other purposes.

4. Other heat sources

It is possible to reuse more energy already produced. Instead of, for example, letting the energy produced in factories go to waste, it can be recycled as heat for many. Using district heating as a heat source for a city can relieve both the power system and the power grid.

5. Energy storage

Renewable energy is weather-dependent and a variable energy source. Norway's climate has significant contrasts depending on the season, which means that the energy we need is not always produced when we use it. Energy storage or seasonal storage can therefore be a helpful tool. For example, a technology called "geo-thermos" where solar production is stored in the ground to be brought up for winter.

3. Theoretical background

Housing cooperatives may be influenced by various institutional and structural factors outside their direct control. By looking at housing cooperatives as a single actor related to the institutions and structures around them, institutional economics could help to identify which policy instruments may be more effective in promoting environmentally sustainable technologies. A housing cooperative can also be seen as an institution with specific roles and responsibilities assigned to its members. These roles may include the board of directors, the management team, and the individual members who own or rent properties within the cooperative (Foster & Burrows, 2019). This chapter explores the theoretical foundations of institutional economics and its potential application to studying housing cooperatives. Additionally, it aims to present the Environmental Governance System framework (EGS), which could help map the institutions and actors that housing cooperatives interact with (Vatn, 2015). Lastly, two frameworks will be presented to understand the obstacles and solutions to implementing system-smart energy solutions: Blumstein et al.'s barrier taxonomy (Blumstein et al., 1980) and Vatn's policy instruments (Vatn, 2005).

3.1 Institutions: The individual and the society

Institutions are commonly defined as the "rules of the game" that structure human interactions, encompassing formal and informal norms and conventions (North, 1991, p. 3). Formal institutions are legal or regulatory frameworks created by governments or other governing bodies enforced through legal mechanisms (Vatn, 2005). Formal institutions such as laws and regulations in environmental governance can shape behaviour by providing incentives or disincentives for specific activities. On the other hand, informal institutions are unwritten rules, norms, and conventions that govern social behaviour, which can be seen as being culturally or socially constructed. This can also influence behaviour by shaping attitudes and values (Vatn, 2005).

Conventions are shared understandings about how social interactions should take place. They are similar to norms but are more specific and often relate to how things are done in particular contexts or industries, such as through language conventions, measurement scales, and directions. Conventions can help to facilitate coordination and reduce transaction costs in social interactions but can also create barriers to change or innovation (Vatn, 2015). Norms are unwritten rules of conduct widely accepted within a society or group. They prescribe how

individuals should behave in various social situations and are enforced through social sanctions such as ostracism or disapproval. Norms can be informal and arise spontaneously within a group or formalised through laws or regulations (Vatn, 2015).

The social theory offers two main perspectives on the relationship between individuals and institutions. The individualist perspective, neoclassical economics, posits that individuals possess predetermined capabilities and exist independently of institutional constraints that do not influence their goals. Conversely, the social constructivist perspective, institutionalist economics, contends that institutions shape external society and influence individuals' abilities, ideals, and needs (Vatn, 2005). The institutionalist approach has a long history, with the first contributions dating back to around 1900. It emerged as a reaction to the "view of humans" in neoclassical economics. Key contributions came from Norwegian-American economist Thorstein Veblen, researchers like John R. Commons - with several publications in the interwar period - and later Karl W. Kapp, who made essential contributions from the 1950s onwards (Vatn, 2021). The institutionalist perspective suggests that society becomes imprinted on individuals. It is concerned with the social and political factors influencing human action and interaction, making it helpful in understanding human contributions to climate change (Vatn, 2021). Vatn proposes three different theories for human action and behaviour: "rational choice theory," bounded rationality", and "social rationality theory" (Vatn, 2021, p. 81).

3.1.1 Rational choice theory

The concept of rationality is central among methodological individualist epistemology and serves as the foundation for neoclassical or mainstream economics (Vatn, 2005). The rational choice theory assumes that individuals are rational and self-interested. This theory assumes that individuals make decisions based on a careful analysis of the costs and benefits of each option. Accordingly, individuals seek to maximise their utility or well-being, subject to constraints such as time and resources. An individual must be able to rank and evaluate options to decide what offers the highest utility for his or her own (Vatn, 2015). Rationality is the reason for our decisions, and this exact rationality will prevent a person from making a choice that will harm their interests for the sake of others. Anything that is not selfish is irrational. No external factors - societal or cultural - can influence them - since preferences are seen as stable. Interactions between rational actors are done by exchanging goods and services; however, this exchange will eventually stop when there is no more to gain from it

(Vatn, 2015). The theory has been influential in economics and used to explain a wide range of human behaviour, from consumer choice to labour supply. Nevertheless, critics argue that this model oversimplifies human behaviour and fails to account for factors such as emotion, social norms, and bounded rationality (Kebede, 2014).

3.1.2 Bounded rationality

Bounded rationality theory, developed by Herbert A. Simon (1955) is based on the assumption that individuals are rational but face cognitive limitations that prevent them from fully processing all available information. According to this model, individuals make decisions based on simplified heuristics or rules of thumb rather than a complete analysis of all available information (Vatn, 2021). Bounded rationality recognises that people have restricted capacities to obtain the information necessary to make the absolute best decision. People are instead satisficers - they make sufficiently good choices based on their tools and knowledge. The limited man model has been influential in psychology and used to explain a wide range of human behaviour, from judgment and decision-making to memory and learning. However, critics argue that this model fails to account for factors such as emotion, culture, and social norms (Vatn, 2015).

3.1.3 Social constructivist theory

The theory has been influential in sociology and used to explain a wide range of human behaviour (see, for example, Berger and Luckmann, 1976; Giddens, 1984). The social constructivist theory assumes that individuals are social creatures influenced by the norms and expectations of their social environment. Conversely, social constructivist theory also suggests that individuals have agency and can influence the norms and expectations of their social environment. This means that actors are not just passive recipients of social structures but actively shape and negotiate them through their actions and interactions. According to this model, individuals make decisions based on the values and beliefs of their social group, as well as their culture's social norms and expectations. It emphasises the importance of non-market factors in influencing economic behaviour and argues that social constructions shape rationality. Therefore, there is no individual rationality without social influence (Vatn, 2015). Social processes will then influence who we are and our relations with others. Consequently, maximising individual rationality will not be possible. Instead, social rationality can be divided into we-rationality and they-rationality - what is best for the individual's group (solidarity) and what is best for others (altruistic) (Vatn, 2005).

The socially rational is not easy for an individual to define for a community, so it is established through institutionalised conventions and norms. Institutional economists base their analyses on the social human being and examine how institutions, such as markets, companies, households, and local communities, affect our behaviour. Humans are not only concerned with pleasure but also with what is meaningful and correct. While markets have benefits, institutionalists argue that they are only sometimes the best solution and need other criteria beyond efficiency to determine appropriate (Vatn, 2021).

In addition, just as social norms can influence people's behaviour, environmental norms can also significantly shape individual and collective actions related to environmental issues. For instance, a norm of environmental responsibility may emerge within the housing cooperative, whereby members must invest in sustainable technologies to reduce their environmental impact. Alternatively, social pressure from external actors such as regulators or neighbouring communities may influence the housing cooperative, shaping the normative environment and decision-making (Cattaneo, 2019).

3.2 The Environmental Governance System Framework

Vatn (2015) defines a framework as a set of interrelated variables that can draw upon various theories and enhance interdisciplinary communication. One such framework is the EGS framework, designed to assess the effectiveness of environmental resource governance, as depicted in Figure 2. The EGS framework encompasses a governance structure involving political, economic, and civil society actors, each with objectives, incentives, entitlements, and obligations. Additionally, the institutions governing political and economic processes, the resource regimes, and the normative foundations of civil society are integral components of the governance structure.

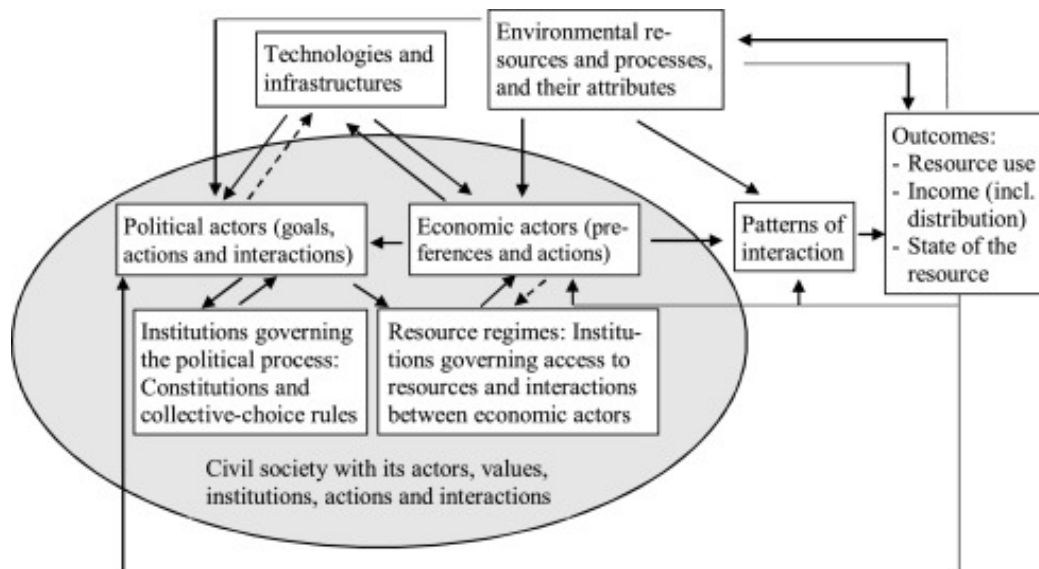


Figure 2. The EGS Framework. Source: Vatn, 2015, p.154.

In addition to the governance structure, the EGS framework considers environmental resources, processes, attributes, technologies and infrastructures, patterns of interaction among economic actors, and resource outcomes. Economic actors' patterns of interaction are a separate variable, as the attributes and outcomes of the resources influence them. Political actors shape the regulations that control economic activity, while economic actors drive technological change that affects resource extraction and waste production. The condition of the natural environment influences all of these actors, and researchers and media play essential roles in interpreting and reporting on these dynamics. The framework helps understand these different actors' complex interactions and potential conflicts (Vatn, 2021).

3.3 The Nature of Barriers and Instruments in an energy context

Research on barriers in the energy context can be related to the "energy paradox" or the energy efficiency gap. Even though economically viable and mature technologies exist to improve energy efficiency, they are frequently disregarded (Weber, 1997). The question is, why? If someone is conscious of energy consumption and possesses environmentally friendly knowledge, why isn't this reflected in their energy-efficient and environmentally friendly behaviour and action? First, the term "barrier" must be defined in an energy context.

Thollander and colleagues define barriers as explaining the resistance to adopting energy- and cost-efficient measures (Thollander et al., 2010). The dominant categorisation of barriers has been from a technological and economic perspective. Vine and colleagues define barriers as

factors that limit the promotion of energy efficiency in a society (Vine et al., 2003, p. 412). This means that barriers are any factors that restrict the ability for energy efficiency in a society. Moreover, which factors can prevent the implementation of system-smart energy measures can be examined. Factors like habits, knowledge, culture, social norms, technical standards, regulations, and economic incentives can hinder actors such as consumers, households, companies, workers, political parties, and environmental organisations (Weber, 1997). Therefore, several environmental and physiological factors must be considered in barrier analysis to study household energy measures.

3.3.1 Blumstein et al.s barrier taxonomy

Blumstein and associates developed one of the earliest structural barriers. An empirical study identified six categories of barriers that can prevent energy-saving measures from being implemented in buildings. The study is based on informants that have roles as tenants, homeowners, managers of buildings, and construction companies. The barriers identified are 1) misplaced incentives, 2) lack of information, 3) regulations, 4) marked structure, 5) financing, and 6) custom (Blumstein et al., 1980).

Table 2. Blumstein et al. (1980) Barrier taxonomy

Barriers	Description
1. Misplaced Incentives	When the economic benefits of saving energy do not accrue to the person trying to take such measures, for example, in a landlord-tenant relationship where the tenant pays the electricity bill, the landlord might need more incentive to make energy-saving improvements in the house.
2. Lack of information or Misinformation	If a consumer does not know of an energy-efficient measure or is unaware of its cost-effectiveness, it is unlikely that the person will implement it. Alternatively, if the architect does not know the principles of energy-efficient design, it is unlikely that an energy-efficient building will be built.
3. Regulations	In cases where cost-effective measures contradict existing laws and regulations. Regulatory barriers can often be evidence of conflict against social goals.
4. Marked structure	In those cases where mature technologies still need to be added to the market or are prevented by competitive companies with better marketing opportunities.

5. Financing

Energy-efficient measures often require an initial investment. Therefore, it is often necessary to have the availability of capital. It is also possible that the risk associated with the investment is overestimated and benefits are underestimated. Capital markets are not perfect.

6. Custom

In those cases where energy and cost-effective measures require a habit change or seem contrary to accepted values. It can also be related to lifestyle preferences.

3.4 Policy instruments

Policy instruments can be defined as the “(re)formulations of the resource regime” (Vatn, 2015, p. 287). Most importantly, it implies a change in rights. This can happen on two levels. Firstly it concerns the “establishment of and changes in basic structures of property rights and types of interaction rules”. Secondly, it concerns “various regulations, given these structures, like the introduction of prohibitions, taxes, and so on.”. Policy instruments can, in other words, contribute to institutional change. In addition, policy instruments can have distributional effects depending on who gets the right and can influence people’s motivations, values, and preferences. It is essential to differentiate between policy measures and policy instruments. Policy measures refer to the desired changes, such as encouraging individuals to use public transportation instead of personal vehicles in a city. Policy instruments are the tools used to implement these changes by influencing behaviour. Implementing policy instruments is critical in promoting environmentally friendly behaviour by affecting rights, duties, and norms (Vatn, 2015). Four distinctive policy instruments will be looked at: 1) legal instruments, 2) economic instruments, 3) Informational instruments, and 4) Infrastructure instruments (Vatn, 2015).

Table 3. Vatn’s (2015) policy instruments

Instrument

Description

1. Legal

Includes publicly sanctioned rights, prohibitions or prescriptions.

- 2. Economic** Consists of changing external incentives by changing relative prices. The main economic instruments include taxes, subsidies, and tradable quotas/permits.
- 3. Informational** Informational mechanisms can make information gathering easier, evoking norms of good conduct or learning new habits. Informational instruments can be labels, certifications, and information campaigns. These instruments are essential in establishing values and preferences at both an individual and social level.
- 4. Infrastructure** Physical infrastructures can be vital to facilitating environmentally friendly action. This can be illustrated by the system-smart technology discussed in this thesis. It depends on the availability of the technology and how it can be physically implemented.

3.5 Application of Theory

The theoretical frameworks presented can help understand the behaviour and motivations of decision-makers in the context of housing cooperatives and their efforts towards adopting sustainable energy practices. However, to gain insight into how these factors shape the decision-making processes of housing cooperatives, it may be beneficial to consider alternative theoretical frameworks that extend beyond neoclassical economics, which tends to assume that actors are primarily motivated by market forces and utility maximisation (North, 1990). Instead, institutional economics can offer a more detailed view of decision-making by examining the role of norms, values, and institutions in shaping behaviour (Williamson, 1991).

The EGS framework provides a theoretical background for empirical studies of housing cooperatives and their decision-making processes, identifying key actors, institutions, and policy instruments. While initially designed for analysing environmental resource governance systems, it can offer valuable insights and resources for housing cooperatives and policymakers seeking to promote sustainable energy practices. Given housing cooperatives' distinct features, some aspects of the EGS framework, such as governance structures and institutional arrangements, may be applicable but require adaptation and modification to ensure their appropriateness. Therefore, resource regimes were replaced by policy instruments. Moreover, the barrier taxonomy and policy instruments frameworks

systematically analyse the factors hindering or facilitating energy upgrades in housing cooperatives.

This thesis uses the term "actors" to refer to the individuals involved in the cooperative and the combined entity. "Structures" encompass the cooperative's physical and organisational aspects, including buildings, governance structures, and decision-making processes.

4. Methods

This chapter describes and explains the methodological approach used in the study. To address the research questions, in-depth interviews were used. Quantitative methods were not employed in this thesis, and the statistics obtained from previous studies fell under the qualitative document analysis method (Bryman, 2016, p. 387). The study design focuses on qualitative research to understand human practices and how meaning is created in the world. This often involves the researcher immersing themselves in the topic or people being studied (Leseth & Tellmann, 2018, p.12). The research design involves several actors, institutions, and policy instruments, requiring an in-depth understanding of complex social conditions that cannot be solely addressed with numerical data and statistics. Qualitative methods were chosen because they reveal actors' experiences, knowledge, and practices, which are critical in understanding the determining factors, including psychological and structural determinants of behaviours and actions, barriers, and facilitators of energy measures. Each interview was recorded and transcribed verbatim. The Norwegian Institute of Social Sciences data service (NSD) approved the research project.

4.1 Purposive sampling

Purposive sampling was chosen for the investigation. This non-probability sampling technique involves selecting individuals or cases based on specific characteristics or criteria. The researcher purposefully selects participants most relevant to the research question or objectives rather than randomly selecting participants from the population (Bryman, 2016, p. 408). Purposive sampling has benefited my research because I had specific research questions requiring in-depth knowledge and perspectives. Therefore, it was natural to interview a board leader or a general manager to map out different housing cooperatives. They will have an overall view and knowledge of the management of the housing cooperative.

Through my contacts in ZERO, I got in touch with the “Co-operative Housing Federation of Norway” (NBBL), which further got me in contact with the “South-Norway Housing Developers” (Sørlandet boligbyggelag, SOBO). From these two, I suddenly had many possible housing cooperatives in Oslo and the South of Norway region that had done or thought about doing energy measures. This method is called snowball sampling (Bryman, 2016, p. 188). The two cities were chosen because they represent different geographic regions in Norway. A series of five housing cooperatives were selected, where I interviewed three

board leaders, one previous board leader and one general manager. However, I encountered a problem with my potential informants; they were all men. I, therefore, had to ask my contacts if they knew of women board leaders or members and received just one they knew of. It was a coincidence that all the informants represented different age groups. Following is some more general information about the five informants.

Table 4. Information about interview participants

	Position	Duration of position	Gender	Age group	Interview date	Alias name
Informant 1	Board leader	2019 - Present	Male	30s	06.02.2023	Gary
Informant 2	General manager	2011 - Present	Male	50s	10.02.2023	Simon
Informant 3	Board leader	2019 - Present	Female	20s	13.02.2023	Rachel
Informant 4	Previous board leader	2016-2022	Male	60s	14.02.2023	Frederick
Informant 5	Board leader	2022 - Present	Male	40s	17.02.2023	Peter

It is important to note that conducting purposive sampling does not enable the generalisation of a population. Even though it is not a random sample, it is not a convenience sample (Bryman, 2016, p. 408). However, qualitative data can achieve "transferability" provided researchers produce a "thick description" - providing a detailed, rich, and contextualised description of social phenomena (Bryman, 2016, p. 384). Aiming to develop an in-depth understanding of a phenomenon can make it transferable to similar contexts. Other housing cooperatives in Norway might recognise some of the descriptions provided in this thesis.

4.2 In-depth interview

In-depth interviewing is a prevalent technique for collecting data within the qualitative method. It refers to semi-structured and unstructured interviews (Bryman, 2016, p. 201). Qualitative interviewing is often used when wanting to investigate a phenomenon that has yet to be researched much before or when you want to understand a phenomenon extra

thoroughly. It is important to get the interviewee's point of view; therefore, following the interview guide strictly is not required (Bryman, 2016, p.466). By conducting in-depth interviews with key stakeholders such as board leaders and general managers, I intended to gain insights into their experiences, motivations, and practices. As qualitative interviewing allows for flexibility and adaptability in the research process, I discovered new insights or areas of interest that require further exploration (Bryman, 2016, pp. 466-467).

4.3 Interview guide

In preparation for the interviews, I created a semi-structured interview guide to categorise themes with sub-questions. The interview guide used in the study is provided in Appendix A. A semi-structured interview is often a conversation about topics the interviewer wants to learn more about. The researcher has a list of questions or topics to review (Johannsen et al., 2010, p. 135). I have used this in the interviews, where the guide was primarily used to guide the conversation but not determine the structure and order. Even though the interview guide was important, it was essential for the informants to speak freely, so I could follow the informant's flow in the conversation while getting the information I wanted. It was also important to, as much as possible, avoid being a "moral supervisor" who pushed my own beliefs about the topics being presented (Grimen, 2007, p. 248).

The interview guide was developed based on prior research and the theoretical framework to explore the topic of system-smart energy solutions for housing cooperatives in Norway. The guide comprised open-ended questions and sub-themes to delve into the subject matter. The interview process commenced with specific and straightforward opening questions to put the interviewees at ease, such as describing their housing cooperatives, energy measures implemented, and previous experiences. Next, the guide was structured into sub-themes aligned with the research questions and objectives, starting with technical aspects like energy solutions and their understanding of system-smart energy use. The following sub-theme addressed barriers and enablers, while the last sub-theme focused on management within the board and with residents. Finally, the interviews concluded with questions about the interviewees' key takeaways and whether they had any more thoughts. This approach aimed to avoid being prescriptive and obtain honest responses, acknowledging that the researchers' presence could impact the data and demonstrating self-reflection and transparency in the later stages of the writing process.

4.4 Conducting the interviews

The method used to collect data for this study was semi-structured interviews. The interviews were conducted in both Oslo and Kristiansand, with all the housing cooperatives agreeing to show me their buildings and energy solutions before commencing the interviews. This familiarised me with their facilities and might have helped create a more relaxed atmosphere. The interviews were conducted in a quiet and private setting to ensure the participants' privacy and confidentiality. The timing of interviews was arranged in advance with the participants, and they were conducted at a convenient time for both parties. The duration of the interviews ranged from 30 to 60 minutes. All interviews were recorded on an audio recorder to ensure accuracy during transcription, and participants were informed about the recording beforehand. The recordings were transcribed verbatim, ensuring the data accurately reflects the participants' opinions and perspectives.

Ensuring that my expectations or biases did not influence the participants' responses was essential during the research process. To minimise the potential for reactivity, I took a backseat during the interviews and encouraged the interviewees to speak freely and openly. This approach ensured the informants' answers were authentic and reflected their perspectives and experiences rather than what they thought the researcher wanted to hear. Reactivity refers to the behaviour of research participants who are aware they are being studied, which can result in atypical behaviour. It is, therefore, crucial to identify and minimise factors that may lead to reactivity during the research process (Bryman, 2016, p. 695). To achieve this, I used a structured research design to focus clearly on the research questions and avoid personal biases. I had already standardised a set of questions and followed a structured interview guide to ensure that each informant was asked the same questions in the same way. This approach aimed to minimise the potential for interviewer bias and ensure that the research results were reliable and valid. While a structured research design can help minimise the potential for reactivity, obtaining data entirely unaffected by the researcher is impossible. Therefore, I ensured transparency and rigour in my research process by documenting all decisions and actions taken throughout the study. This approach aimed to increase the study's transparency and enable other researchers to evaluate the research process and findings.

In addition to minimising reactivity, it is also important for researchers to be aware of their biases and assumptions that may influence the research outcomes. Reflexivity refers to the

researcher's self-awareness of assumptions and biases that may influence the research outcomes (Bryman, 2016, p. 695). I reflected on my biases and assumptions to minimise reflexivity and documented them in a research journal. This approach aimed to increase the study's rigour and transparency and ensure the research findings were as objective as possible.

4.5 Data analysis

I conducted a thematic analysis of the five interview transcriptions. Thematic analysis is a commonly used method in qualitative research for identifying themes within data (Bryman, 2016, p. 697). I began by immediately coding the data. Next, I printed out the transcriptions on paper and highlighted them manually. This allowed me to organise and categorise the data as I read it. A detailed summary was written for each interview, and all relevant points were concluded. The summaries included relevant quotes to describe the opinions in the person's own words. Next, I read the data repeatedly to identify patterns and develop codes specific to my research questions. The five research questions that guided my study were used as a framework for constructing the themes. I began by analysing the data for themes related to the first research question, then moved on to the second, and so on. This allowed me to focus clearly on each research question and ensured I got all relevant data.

In addition to operationalising the data analysis process, I also operationalised relevant theoretical frameworks to make sense of the data. The Institutional Economics theory by Vatn (2005) was used. Furthermore, the EGS framework by Vatn (2010) was used to map out the external structures of the five housing cooperatives. I thoroughly reviewed the relevant literature to operationalise these theoretical frameworks, which helped me identify key concepts and variables to guide my analysis. I then used these concepts and variables to guide the coding and analysis of my data, ensuring that my findings were grounded in the relevant theoretical frameworks.

The quotations highlighted in their own paragraphs in Chapter 5 are not really quotations. In this particular case, the interviews were conducted in Norwegian, but the thesis was written in English. To ensure that the interview information was accurately represented in the thesis, the quotes were translated from Norwegian and treated as quotes, even though they were not direct. This decision was made because it was important to preserve the interviewee's original responses and perspectives as much as possible.

4.6 Trustworthiness

Ensuring trustworthiness was a top priority in my qualitative research for my master's thesis. Trustworthiness pertains to the credibility, reliability, and validity of research findings. In qualitative research, trustworthiness is typically evaluated using various methods, including credibility, transferability, dependability, and confirmability (Krefting, 1991).

To guarantee credibility, I used triangulation, which involved using multiple data sources and theoretical perspectives to validate the data (Lysack et al., 1994). This approach allowed me to ensure comprehensive data analysis and strengthen the findings' validity (Bryman, 2016). Conversely, transferability refers to the extent to which the research findings can be applied to other settings or contexts. Krefting suggests that researchers should provide detailed descriptions of the research context, participants, and procedures to enhance the transferability of their findings (Krefting, 1991). To address transferability, I utilised thick descriptions that provided rich and detailed information about the study's context. This enabled me to identify similarities and differences between the study's context and other contexts (Bryman, 2016, p. 384). Dependability refers to the consistency and stability of the research findings over time. Krefting recommends that researchers maintain detailed records of the research process and establish precise data collection and analysis protocols to enhance dependability (Krefting, 1991). To ensure dependability, I documented all phases of the research process and made it accessible to peers. This auditing approach allowed for evaluating the procedures during and at the end of the research. Lastly, confirmability refers to the degree to which the research findings are grounded in the data rather than the biases or preconceptions of the researcher. Krefting suggests that researchers should maintain an audit trail of their research process and engage in peer debriefing to enhance confirmability (Krefting, 1991). I acknowledged that my values did not influence the research findings. I made it clear in my writing and explicitly stated that there was no influence of personal values in conducting the research and its findings.

4.7 Ethical Considerations

Ethical principles are crucial in social research and should be considered throughout the research process. When conducting research, there are four main areas to consider when discussing ethical principles: harm to participants, lack of informed consent, invasion of privacy, and deception (Bryman, 2016, p. 125). These considerations are important to ensure

that participants' rights are respected and protected.

Before starting the study, I reviewed the ethical guidelines from NSD and received approval from the NSD ethics committee. One of the most critical ethical considerations in social research is informed consent. Participants must be informed about the research's purpose, potential risks and benefits, and their right to withdraw at any time (Bryman, 2016, p. 130). I obtained verbal and written consent from all participants. An informed consent (Appendix B) was presented before the interview. They were fully informed about the study's purpose, potential risks and benefits, and their right to withdraw at any time.

Another essential ethical consideration is the preservation of anonymity and confidentiality. Participants must be assured that their personal information will be kept confidential, and their identity will not be disclosed in any publication or presentation of the research (Bryman, 2016, p. 136). To protect anonymity and confidentiality, I used pseudonyms or codes to refer to participants in my work, and their personal information was kept confidential. While the study may not have been perceived as very sensitive, I made sure to be sensitive to the possibility that participants may experience discomfort or emotional distress during the research process. I balanced obtaining good data with respecting participants' limits and clarified my role in the project to ensure that participants felt safe and secure.

Lastly, researchers must be sensitive to participants' limits and ensure they feel safe and secure during the research process. By considering these ethical principles, researchers can ensure that their research is conducted with integrity and respect for participants' rights (Bryman, 2016). Therefore, I established clear boundaries and supported participants if needed, emphasising their right to withdraw from the study at any time.

4.8 Positionality

As the researcher conducting the interviews, my personal biases, opinions, and expectations may have influenced the data collected from the participants. To minimise this risk, I have ensured that I am aware of my biases and strive to remain neutral and objective during the interview process. My position is shaped by my affiliation with ZERO, an environmental organisation promoting concrete solutions for sustainable development. As a previous intern at ZERO, I have been involved in various projects, including the "System-Smart Energy Use", -a project that inspired my thesis. However, I consciously tried to distance myself from

ZERO's primary working method and focus on other potential barriers and aspects related to energy efficiency and flexibility. In doing so, I aimed to provide a more comprehensive understanding of the topic and contribute to the broader discourse on sustainable development.

4.9 Research Challenges

Conducting qualitative research with a small sample size was challenging for my study. The five informants I interviewed may differ from the larger population, limiting the findings' generalizability. While qualitative data is not meant to be representative, it is essential to acknowledge this limitation. Despite this challenge, the small sample size allowed for a more in-depth analysis of each participant's experiences and perspectives.

Furthermore, I encountered another challenge while translating the data from Norwegian to English. As the researcher, I had to take precautions to ensure the translation process's accuracy and preserve the data's meaning, as translation can introduce biases and inaccuracies that affect the trustworthiness of the findings. Moreover, even if the translation is done competently, there is still a possibility of a problem with insensitivity towards particular cultural and national contexts (Bryman, 2016, p. 65). Nevertheless, conducting interviews in Norwegian helped to create a more comfortable environment for the participants, as they could freely express themselves in their mother language.

5. Analysis

This chapter provides an in-depth analysis of the collected data. It presents the key findings of the research. The theoretical framework outlined in Chapter 3 provides a lens through which to analyse the empirical data gathered in this study. Using thematic analysis, this method facilitated the identification of central themes. The analysis is divided into five parts. Section 5.1 presents a case study of the five housing cooperatives. Section 5.2 maps out how a housing cooperative, as an independent actor, relates to external actors and institutions, drawing inspiration from the EGS framework. Section 5.3 offers insights into the most common barriers and enablers that affect the implementation of energy upgrades in the five housing cooperatives, structured into five categories inspired by Blumstein et al.'s barrier taxonomy and Vatn's policy instruments. Section 5.4 investigates the motivators that individual housing cooperative actors put forth for achieving system-smart energy solutions. Lastly, section 5.5 presents the legal, economic, and technical requirements and suggestions that housing cooperatives have to relate to. Furthermore, it employs concepts such as norms, conventions, values, and habits to scrutinise the underlying social and cultural factors that can influence the behaviour and decision-making of housing cooperative members.

5.1 Description of the housing cooperatives

5.1.1 Oslo's energy sector

Oslo, the capital of Norway, is home to a growing residential energy sector. The city has set ambitious targets to become carbon neutral by 2030 (Oslo Kommune, 2020). Oslo's energy supply is diverse and includes various sources such as electricity, petroleum products, district heating, biomass, and biofuel. In 2009, total energy consumption in Oslo was 14.3 TWh, which increased to 14.9 TWh in 2018 despite population growth of almost 100.000 people. However, energy consumption per inhabitant has decreased by 11%, from approximately 24.800 kWh per inhabitant in 2009 to 22.100 kWh in 2018, which may be attributed to better-insulated buildings, more energy-efficient heating systems, and the shift from oil heating to various heat pump solutions. Renewable energy sources accounted for 76% of energy consumption in Oslo in 2018, while the remaining 24% was from fossil fuels, primarily used in the transport sector (Oslo Kommune, 2020). Oslo relies heavily on imports from large hydropower plants to cover the approximately 4400 MW of power consumption during peak hours. In contrast, local power production accounts for only about 2% of

consumption during peak hours (Elvia, n.d.). District heating is essential to Oslo's energy system, producing just under 2 TWh of heat annually. The heating network primarily relies on waste incineration, which covers approximately 60% of the production (Norsk Fjernvarme, n.d.-c).

5.1.2 Kristiansand's energy sector

Kristiansand is a city in southern Norway with a population of around 115.000 people (Kristiansand Kommune, n.d.). The city's energy mix is primarily based on electricity and district heating. Electricity is the largest source of energy in Kristiansand, with the city receiving most of its electricity from renewable sources such as hydropower and wind power (Lindland & Østby, 2017). The use of electricity in the residential sector in Kristiansand is high, with most homes relying on electricity for lighting, cooking, and other household appliances. District heating is also an important part of Kristiansand's energy mix. In 2022, "Å Energi Varme" supplied Kristiansand with district heating primarily derived from recycled heat generated within the city, totalling 130 GW (Norsk Fjernvarme, n.d.-b). Moreover, the district heating system in Sørlandsparken, situated outside Kristiansand, with biobased fuels as the primary source, produces 19 GW (Norsk Fjernvarme, n.d.-a). The city aims to become a society with an 80% reduction in greenhouse gas emissions by 2030 (Kristiansand Kommune, 2023).

Table 5. Overview of the five housing cooperatives

Housing cooperative	Location	Nr. of housing units	Average price per sq.m	Size of board	Technologies in place/energy upgrades
Green Valley Cooperative	Oslo	60	NOK 104 134	5	District heating, energy-efficient radiators
Sunshine Cooperative	Oslo	819	NOK 62 610	5	Post-insulation, energy-efficient radiators, CO ₂ -heat pump, heat-recycling system
Riverfront Cooperative	Kristiansand	60	NOK 41 020	5	District heating, post-insulation, heat-recycling system
Forest Hills Cooperative	Kristiansand	60	NOK 41 020	5	District heating, heat-recycling system

Pinegrove Cooperative	Oslo	777	NOK 62 610	5	Rock heating system (energy well), post-insulation, solar panels
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The table briefly overviews the critical characteristics of the five housing cooperatives selected for this study. The names of the cooperatives have been replaced with aliases to protect their anonymity. These basic details help contextualise the study's findings and provide a starting point for analysing the data collected.

5.1.3 Green Valley Cooperative

Green Valley Cooperative was built in 1956 and comprises 60 housing units. It is located outside the centre of Oslo and is managed by Oslo Housing and Saving Cooperative (OBOS). The housing cooperative has a board of five members, including a board leader, a deputy board leader, and two deputies. The executive board comprises three men and two women. The board members' age range spans from 30 to 85 years old.

Regarding energy solutions, the cooperative primarily measures energy efficiency with district heating but has yet to find other viable options. While they have yet to undertake significant energy upgrades, they are gradually replacing their radiators with more energy-efficient models. Furthermore, the cooperative is exploring the possibility of installing solar cells on the roof as another potential solution. To support their radiator project, the cooperative hired a project manager from OPAK and contacted contractors, including OPAK and Soltech, to identify possible energy-efficiency measures.

5.1.4 Sunshine Cooperative

Sunshine Cooperative is a large complex with 819 flats spread over three blocks, each with 13 floors, located east of Oslo. The complex was completed in 1969, and the first move-ins occurred in 1967. The administration of the housing cooperative is managed by a board and its own operations office, which has five employees. The board is responsible for all decisions, and the operations office handles the day-to-day operations.

Energy solutions have been a significant focus for the housing cooperative recently. The buildings had not been maintained adequately until 1992 when they began with facade rehabilitation, which was largely unsuccessful. After that, no major maintenance work was

done until 2008, when they started to change their energy system. They have post-insulated the facades, replaced 10 000 windows and 2000 lamps, and replaced old radiators with more efficient convectors. They have also invested in CO₂-heat pumps and a recycling plant for heat from the ventilation. These measures have significantly reduced purchased energy, from 13 million kWh a year to less than 6 million, or approximately a 43-60% reduction.

Their next project is to connect their 39 cold rooms to the recycling plant system, which only requires adding two pipes. They are also considering installing solar cells on the roof and seeking financial support because they have significant ceilings and good solar conditions. They received NOK 7.5 million in support from Enova and Oslo municipality for their energy measures and have invested 40 million themselves.

The cooperative housing board comprises four women and three men, while the operations office has a general manager, a project secretary, and three technical personnel. The housing cooperative has faced challenges with some of the systems they implemented, but they are continuing to work on improving their energy efficiency.

5.1.5 Riverfront Cooperative

Riverfront Cooperative in Kristiansand was completed in 1964 and contains 60 apartments. The building houses around 80 people, mostly single or roommates, and 4-5 children. Two people have lived in the building since it was new. The board of the housing cooperative consists of two women and three men, all of whom work full-time jobs.

District heating serves as the primary heating source for the building, and each apartment is equipped with a single radiator. The building was constructed using concrete modules, and its long sides were covered with facade panels and 5 cm insulation. Despite this, residents found the building uncomfortably cold, prompting two upgrades to be carried out. First, facade boards were insulated and installed on the gables, and then insulation was added. New facade boards were laid over the old ones, and the insulation on the long sides about 20 years ago. The building also has a common ventilation system with a fan exhaust on the roof.

In 2020, further upgrades were adopted, including installing balconies with glazing, replacing the facade panels, and re-insulating the gables.

The housing cooperative also underwent pipe renewal of the drainage pipes, which revealed two pipe collapses and numerous holes in the pipes. The same year, they entered an energy-saving agreement with "Enøk Total" and received NOK 100.000 in Enova support for energy mapping. In addition, they installed a heat recycling system on the roof and backyard, sensors that switch off the radiator when the balcony door is opened, and automatic temperature control on radiators. As a result, they have reduced their district heating usage by 40%.

Enøk Total determined that solar collectors and solar cells were not appropriate for the building and that the radiators were not being used optimally, so they knocked off the radiators in November 2022, which immediately raised the surface temperature by about 10 degrees. The housing cooperative will also replace all windows on the foundation wall/basement floor and seal all available thermal bridges in the facade during the work. They have received support from SOBO to find suitable solutions for these upgrades.

5.1.6 Forest Hills Cooperative

Forest Hills Cooperative is a residential complex in Kristiansand constructed in 1965, featuring 60 apartments distributed across ten floors. During the 60s and 70s, families often lived in the complex's 4-room apartments, with some renting out a bedroom to make ends meet. However, the number of residents has since decreased to about ninety people, and the 2-room apartments have become more popular among first-time investors and frequently change ownership. The current board of the housing cooperative comprises one woman and four men.

In 2014, the cooperative underwent a rehabilitation project to reduce energy consumption. As a result, the typical flow to the housing cooperative increased due to installing a balanced ventilation system. The building's walls, floors, and ceilings underwent additional insulation, while the facade panels were cleaned of asbestos and replaced with new ones. New windows and doors were also installed, along with glazed balconies constructed independently of the building's concrete structure. Given the area's climate challenge of strong winds, the project prioritised using tight solutions and maintenance-friendly materials. In addition, the district heating used for tap water and water for radiators in the apartments was significantly reduced. As a result, the project was estimated to have reduced the block's energy demand by 70%, and the annual climate footprint was reduced by 55% to 25.2 kg CO₂ equivalents.

Recent high electricity prices have made it relevant for the board to consider additional measures to reduce energy costs. Therefore, the board is currently working on alternative solutions from various actors and is expected to present proposals at the General Assembly in spring 2023.

In 2014, the housing cooperative was approved as a pilot project in “Framtidens bygg”, initiated by SOBO. The cooperative received NOK 2 million in support from Enova and was fully funded by Husbanken. The research projects "BESLUTT" and "BEVISST", supported by the NBBL, provided valuable support throughout the project. In addition, a supervisor was made available to assist other housing cooperatives embarking on similar upgrades.

5.1.7 Pinegrove Cooperative

Pinegrove Cooperative is situated east of Oslo, covering an area of 100 acres with 15 blocks and 94 floors. It was built in 1965 and house 777 three-room apartments with approximately 1200 residents. The standard size of the apartments often leads to frequent relocations when families expand. While some residents have lived in the cooperative since its establishment, this has resulted in a higher number of older people within the community.

The board consists of three men and two women with an average age of 40, and deputies comprise four men and one woman. In addition, there is a dedicated operations office with a general manager and a janitor.

The cooperative has implemented various energy-saving solutions. Initially, the water heaters were moved to a common water heater room, resulting in a new water and drainage system. Hot water is now heated using a rock heating system located 300 meters into the ground, saving around 50% of the energy costs for all the apartments. In addition, the facades have been re-insulated, windows and lamps replaced, and solar panels installed on the roofs to provide electricity for hot water, laundry and lighting in the blocks. There are plans for expanding the solar cells, but this has been put on hold due to financial constraints. They are also exploring the possibility of storing energy as hydrogen.

The housing cooperative ordered a maintenance plan from OBOS Prosjekt in 2016 and received NOK 750.000 in support from the Climate and Energy Fund in 2018 for drilling

geothermal energy. They have also received NOK 500.000 from Enova, while Oslo municipality provided NOK 50.000 for consultancy and NOK 190.000 for installing solar cells. In addition, the "OBOS gives back" scheme supported the project with NOK 300.000.

5.2 External Relationships of Housing Cooperatives

This section presents five figures that map how the five housing cooperative interacts with external actors. The figures provide a visual presentation of the relationships between different actors. By analysing this, we can better understand how it operates concerning other structures and institutions. It shows the complex interplay between the cooperative and various external actors, including political, economic, and institutional. The cooperative interacts with various external actors, such as local authorities, financial institutions, contractors, and suppliers. These actors significantly impact the housing cooperative's operations and its ability to achieve its objectives. Furthermore, the figures illustrate the role of policy instruments in shaping the relationship between the housing cooperative and external actors. These instruments include regulations, subsidies, and incentives provided by the government, as well as voluntary agreements and codes of conduct adopted by the housing cooperative and its partners.

5.2.1 Green Valley Cooperative

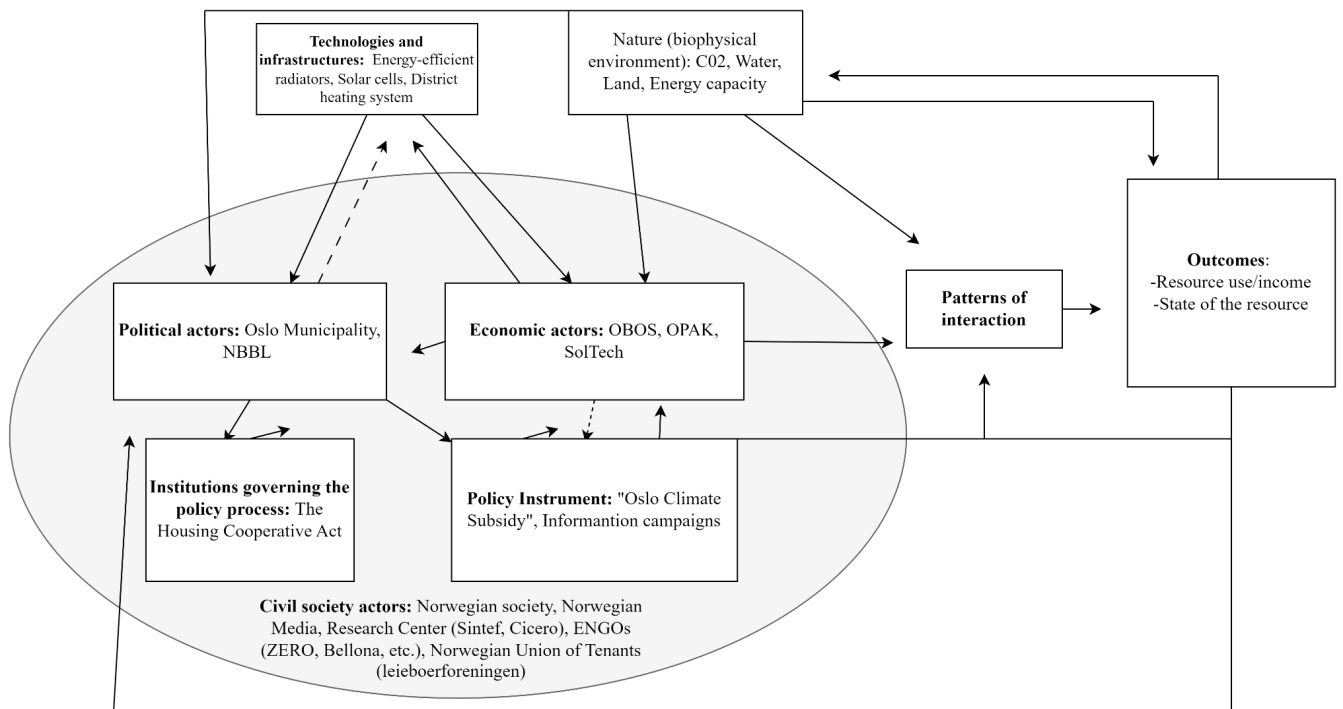


Figure 3. Green Valley Cooperative EGS framework based on Vatn's EGS framework.

The Green Valley Cooperative has established links with the Oslo Municipality and NBBL. In pursuing its objectives, the cooperative interacts with various economic actors, including OBOS, SolTech company, and OPAK, an entrepreneurial firm. These relationships involve financial transactions, knowledge sharing, technological collaborations, and other forms of social interactions that can influence the success of sustainability initiatives. The Green Valley Cooperative has also secured financial support from the "Oslo Climate Subsidy", a policy instrument promoting sustainable practices. In addition to financial incentives, the housing cooperative has discovered information campaigns on social media.

5.2.2 Sunshine Cooperative

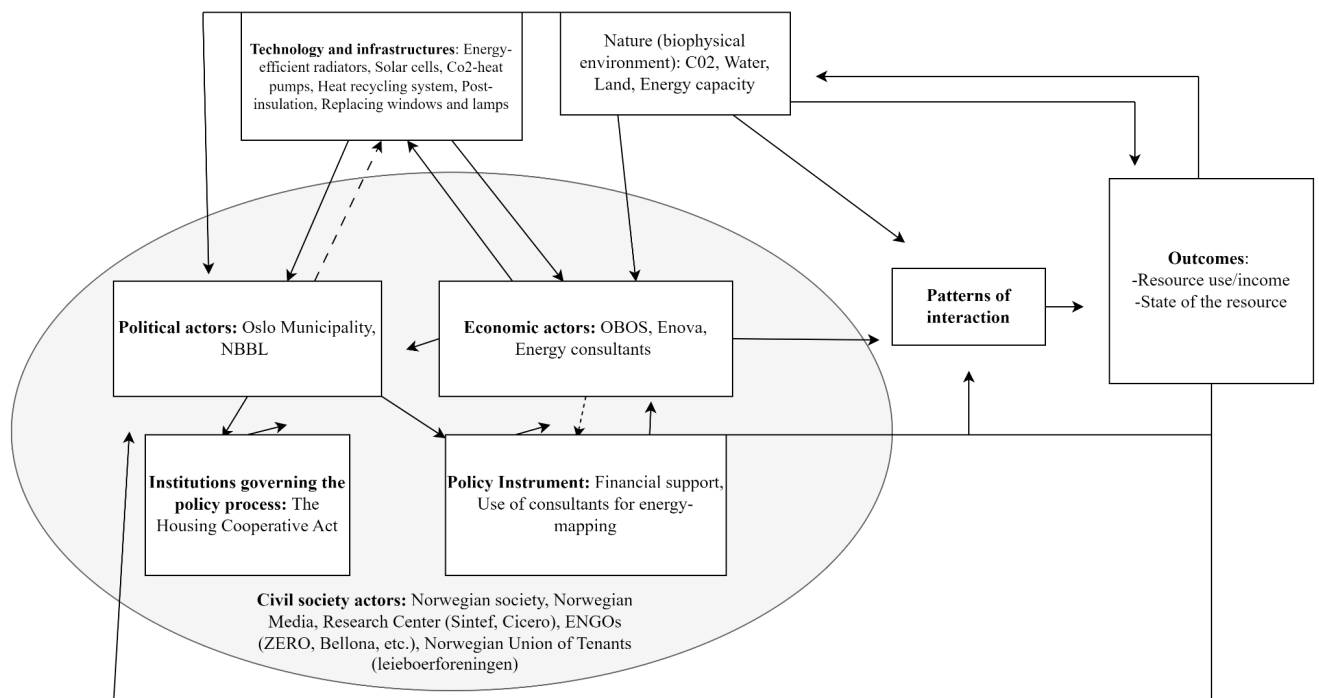


Figure 4. Sunshine Cooperative EGS framework based on Vatn’s EGS framework.

The Sunshine Cooperative has established relationships with the Oslo Municipality and NBBL, similar to the Green Valley Cooperative. In its pursuit of sustainability objectives, the Sunshine Cooperative engages with OBOS and Enova, among other economic actors. Additionally, the cooperative works with energy consultants to implement energy-saving measures, highlighting the importance of knowledge-sharing in sustainability initiatives. The Sunshine Cooperative has benefited from financial support and the use of consultants for energy mapping, which facilitates identifying opportunities for energy-saving initiatives.

5.2.3 Riverfront Cooperative

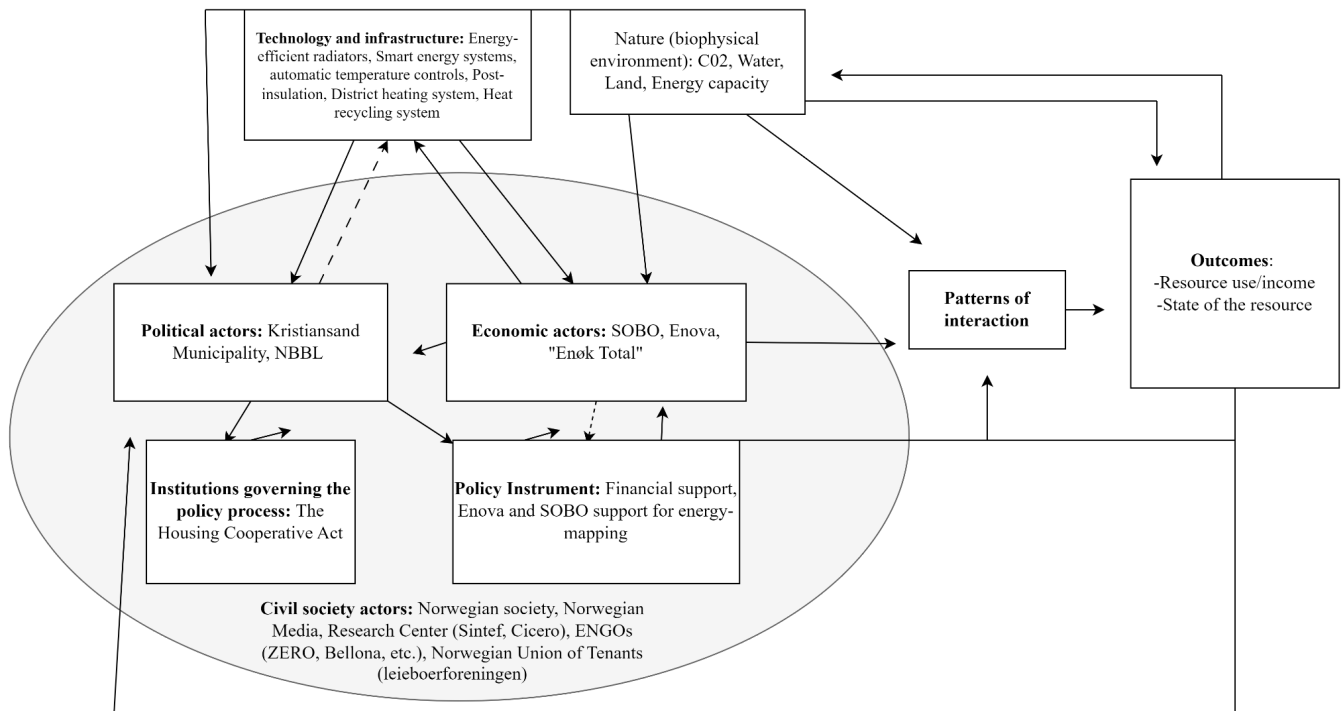


Figure 5. Riverfront Cooperative EGS framework based on Vatn’s EGS framework.

The Riverfront Cooperative has established links to the Kristiansand Municipality and NBBL. In addition, to achieve sustainability objectives, the housing cooperative engages with various economic actors, including SOBO, Enova, and Enøk Total, which provides energy-saving solutions. Enova and SOBO's financial support and energy mapping assistance benefits the housing cooperative.

5.2.4 Forest Hills Cooperative

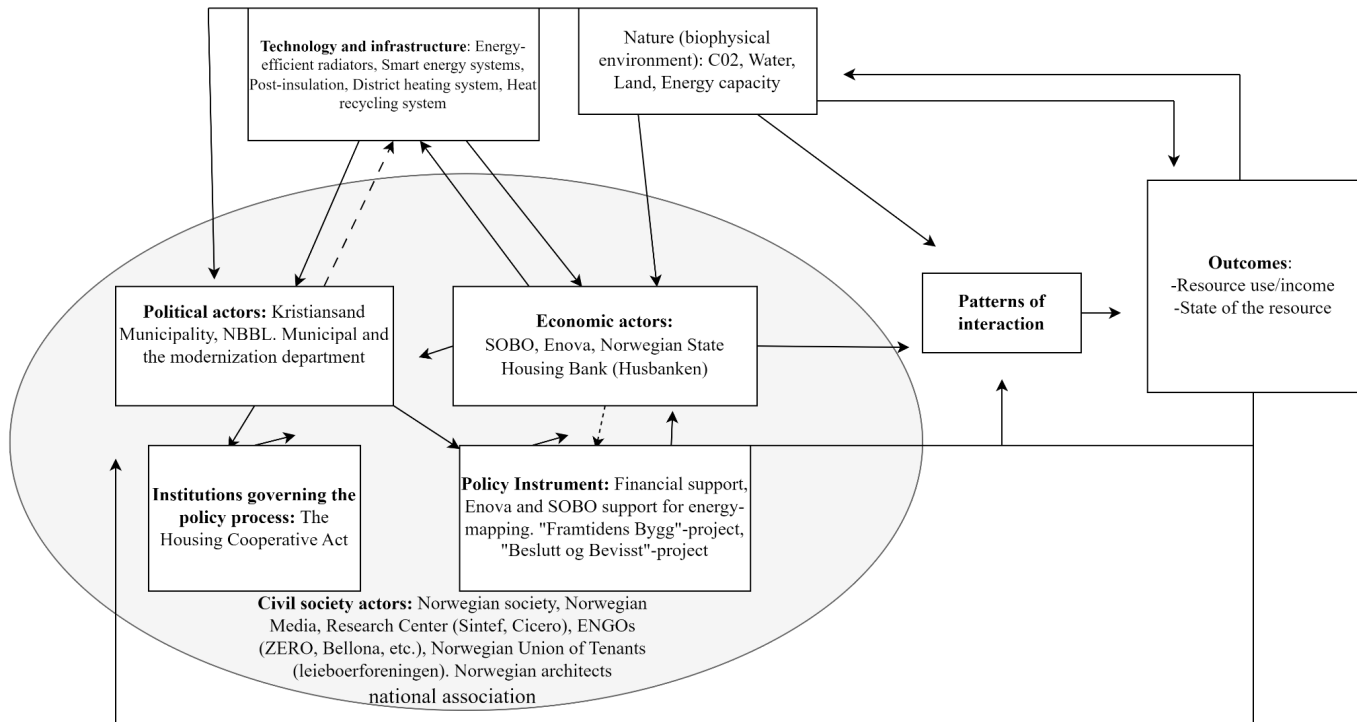


Figure 6. Forest Hills Cooperative EGS framework based on Vatn's EGS framework.

Like Riverfront Cooperative, the Forest Hills Cooperative has established relationships with the Kristiansand Municipality and the NBBL. The cooperative collaborates with the Municipal Modernization Department to improve governance practices. The Forest Hills Cooperative works with various economic actors, including SOBO, Enova, and the Norwegian State Housing Bank (Husbanken), to achieve sustainability objectives. Enova and SOBO's financial support and energy mapping assistance benefits the housing cooperative. Additionally, the cooperative has participated in various research projects.

5.2.5 Pinegrove Cooperative

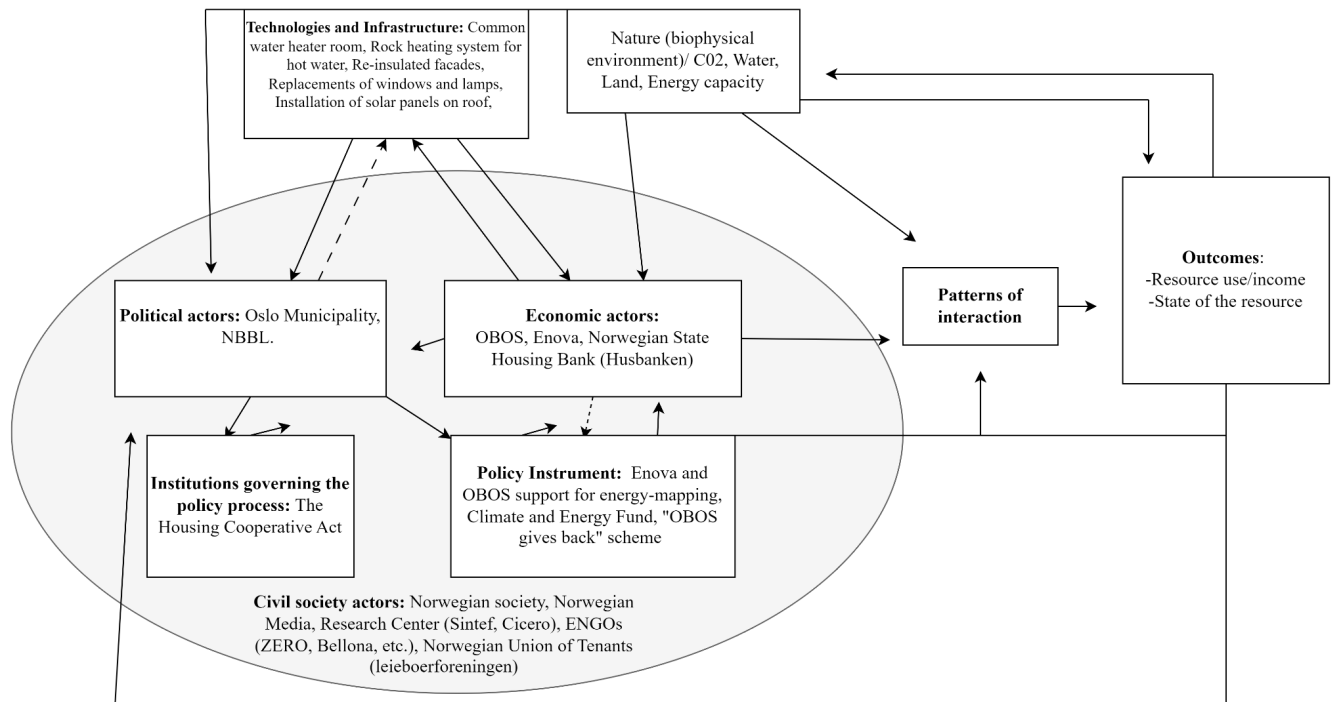


Figure 6. Pinegrove Cooperative EGS framework based on Vatn's EGS framework.

The Pinegrove Cooperative involves several political actors, including the Oslo Municipality and NBBL. Economic actors include OBOS, Enova, and the Norwegian State Housing Bank (Husbanken). Several policy instruments have been implemented to support Pinegrove Cooperative's efforts, including Enova and OBOS support for energy mapping, the Climate and Energy Fund, and the "OBOS gives back" scheme

5.2.6 Similarities between the cooperatives

All of the cooperatives share several similarities in their external structures. Firstly, they operate under the institution governing the policy process outlined in the Housing Cooperative Act, which governs the formation and operation of housing cooperatives in Norway. Secondly, all the cooperatives work with housing developers, municipalities, and various economic actors such as OBOS, Enova, and the Norwegian State Housing Bank. Thirdly, they have implemented technologies and infrastructure, such as solar cells, energy-efficient radiators, district heating systems, and post-insulation, to reduce their environmental impact and improve their resource use in terms of CO2 emissions, water

usage, land usage, and energy capacity. Fourthly, the Oslo Municipality and NBBL are typical political actors involved in the policies and initiatives of all cooperatives. Fifthly, the cooperatives have utilised policy instruments such as financial support, information campaigns, and energy mapping to achieve their sustainability goals. Sixthly, civil society actors such as Norwegian society, Norwegian media, research centres such as the Foundation for Industrial and Technical Research (SINTEF) and the Center for International Climate and Environmental Research (Cicero), Environmental Non-governmental Organizations (ENGOS) such as ZERO and Bellona, and the Norwegian Union of Tenants are involved in the cooperatives' initiatives.

5.3 Barriers and Enablers

This section presents findings about the most common barriers and enablers that affect the implementation of energy upgrades in the five Norwegian housing cooperatives. In neoclassical economics, institutions are viewed as constraining factors that limit economic activity and restrict market efficiency. However, institutional economics takes a more nuanced view of institutions and recognises they can also enable economic activity. While institutions can be constraining, they can also have an enabling effect on economic activity. The institutional economy also recognises the role of informal institutions in shaping behaviour. By identifying these factors, we can better understand housing cooperatives' challenges when adopting energy-efficient technologies and strategies. Below is a table of findings from the interview subjects. The purpose of the tables is to give an overall understanding of what the various informants identify as barriers or enablers and whether this is a consistent theme for several housing cooperatives. It has been quantified the number of times a finding was mentioned.

The data results can reveal insights into the factors that hinder or facilitate the implementation of energy upgrades in housing cooperatives in Norway. Identifying, however, how and why the informant means it is a barrier or enabler is relevant to highlight the qualitative dimension of this study. Thus, some of the most common barriers and enablers will be examined in more detail. Attached are all the quotations from the findings, structured between barriers (Appendix C) and enablers (Appendix D). The names of the informants have been replaced with aliases to protect their anonymity.

5.3.1 Barriers

Various barriers can influence the successful implementation of system-smart energy measures. These can be classified into different categories such as legal, economic, informational, infrastructure and custom barriers. Some of the barriers can overlap. For example, challenges such as high electricity/district heating prices and difficulties finding solutions on your own were mentioned by only one informant. However, they were also mentioned under other categories, indicating that they may be more complex or multifaceted.

Table 6. Common barriers affecting the implementation of energy upgrades

	Quotation number	Number of informants
Legal		
Measuring energy use at individual points	25,26	1
Mandatory electric charging stations	29	1
Financial support disappears when it is adapted	30	1
Too strict requirements	33	1
Municipality not willing to cooperate	38	1
Legislation not accessible	45	1
Difficult to produce own energy and sell it	68,39	2
Economy		
High electricity/district heating prices	10	1
Managing resident's money	11	1
Excessive borrowing/interest rate rising	14,20,24,36	2
Increase in joint rent	14,55, 11, 36	3
Paid but no results achieved	15	1
Excessive focus on saving	18,31,62,65,78	2
Energy solution not profitable	23,39,52,66	2
Cost increase for sustainable solutions	34,78	2
Inadequate financial support	39,40,52	2
Frequent relocations	55,61	2
Renters	59	1
Information		
External actors with limited skills/knowledge	1,5,7,12,15	2
Challenges in finding solutions	3,40,41,46,58	3
Little information available	3,45,46	2

External actors informing based on self-interest	48	2
Infrastructure		
Challenges in implementing energy solutions for district heating systems	2,48	3
Challenges in comprehending energy systems/solutions	6	1
Poor maintenance	17,20,21,24,65	2
Operational/technological problems	22	1
Shortage of skilled artisans	27	1
Negative experiences with artisans	28,74	2
Poor foundation for expanding/building energy solutions	37,38,49,67	3
Old infrastructure	49, 79	5
Custom		
Time-consuming	4,8,35,42	3
External actors resistant to change	9	1
Excessive resident dialogue	13	1
Self-interested choices	18,73	2
Low board member turnover	19	2
Bad habits	16,57	2
Board-employee conflicts	32	2
Overly complicated	39,1,2,77	3
Engaging available board members	43	2
Challenges collaborating with housing cooperatives	44,50	2
Gender discrimination	47	1
Decision-making difficulties within the board	53	1
Lengthy negotiation process	54	1
Diverse values and perspectives	55,60,64	2
Lack of board diversity	63	1
Limited transparency between board and residents	69	1
Inexperienced board members	70	1
Catering to a single generation	71	1
Little delegation	76	1

The most common legal barrier was the difficulty (legally) of producing own energy and selling it:

“In the past, it was in the legislation-that the municipality at the time and the power plants were only allowed to earn from electricity. And I think that the electricity companies themselves - this should almost be a non-profit piece - you produce to create the best possible supply for your residents, and then you can sell again - because then you are in storage again - you can sell out to Europe - but this is a policy that has existed since the 70s. So it is not just about changing that.” (Peter, Pinegrove Cooperative)

“(...) Sell the power if necessary. There is no question that it will not pay off. And it gets way too complicated.” (Rachel, Riverfront Cooperative)

The first quote, stated by Peter, mentions that profit-making motives should not primarily drive electricity production but instead focus on providing residents with a reliable and efficient energy supply. Peter notes that electricity can be sold to other regions or countries, but there should be other goals for electricity production. Overall, it suggests that electricity production and distribution should be oriented towards serving the needs of local communities rather than maximising profits for private companies or other entities.

On the other hand, Rachel sees selling power as a possible solution but might want to avoid dealing with the potential complications that could arise. This could be due to various factors, such as legal or logistical challenges.

The most prominent economic barrier for the housing cooperatives was the increase in joint rent for the residents:

“Also, what is always recurring is the economy in it, so it is the money. Some will fight hard against the rent going up; they do not want a few extra hundred pounds a month they have to pay. They may not see the community, the block as a whole, and the surrounding area as much. (...)” (Frederick, Forest Hills Cooperative)

“But now we have already increased the joint costs. And we have to finance with loans. For us to be able to save up several million to start, something like that means a substantial increase. That is where the challenge lies. Because with interest rates rising, we cannot afford it. Interest exceeds savings.” (Rachel, Riverfront Cooperative)

Frederick emphasises the importance of money in community projects and notes that some people may resist rent increases. He suggests that these individuals may not see the bigger picture of the community project and may need to appreciate its impact on the surrounding

area. It can imply that the cost of community projects can be a contentious issue and that some individuals may prioritise their financial interests over the greater good of the community.

Rachel mentions that joint costs have increased significantly, and financing the project with loans will be necessary. However, the challenge lies in saving up several million for the project's start, which would require a significant increase in funding. This can also be connected to another barrier identified in the table; excessive borrowing/interest rate rising. She notes that rising interest rates pose a challenge, as the cooperative needs to pay higher interest rates. She also suggests that the interest rates they would have to pay on loans would exceed their potential savings, making it difficult for them to accumulate the necessary funds.

An informational barrier that was brought up often was difficulties finding solutions, often when they are alone:

“So then the one saving is worse. Connecting it to the district heating system that we spend much money on could be exciting, but where do you start? Initially, I searched for something like this: Enova-energy efficiency-district heating, but I did not really come up with anything. So I do not know if there is any possibility. I have been on the Enova pages, not directly aimed at this, but for my job. It should be easier to find if there are any possibilities.” (Gary, Green Valley Cooperative)

“But finding out what to get and how to apply is complicated. For me, who is sitting here alone, if I have someone with me, it helps. However, it also costs money. I cannot just go to a business and ask if they can help me with something and expect them to do it for free.” (Rachel, Riverfront Cooperative)

Gary discusses connecting a saving to a district heating system to save money. He has been looking for information or resources on energy efficiency and district heating but has not found anything useful yet. Rachel states that figuring out what resources are available and how to apply them is complicated. She also mentions that having someone to help would be beneficial but acknowledges that it would cost money. It may highlight the barriers individuals may face when accessing resources and support for various needs.

Several infrastructure barriers were identified as common among the housing cooperatives. The most prominent one was that all of the housing cooperatives have old infrastructure, meaning the buildings were built in the time range from the 1950s to 1960s:

“What is typical for this housing cooperative is that there is much old infrastructure, we do not have measurements, and we do not have management options. Or minimal control options. We are connected to district heating.” (Frederick, Forest Hills Cooperative)

“But these old windows were installed in 1988 and had no standard; there was no requirement, it leaked air. Back then, you had the option because wooden frames could be bent. This means that our crooked building is almost impossible to seal.” (Peter, Pinegrove Cooperative)

Frederick mentions the lack of measurements and management options that can suggest that the housing cooperative may need more information or tools to manage their energy use effectively. His comment about limited control options suggests they may need more control over their energy use or the district heating system. Peter describes how the building's old windows were installed without a standard or requirement and leaked air. The mention of wooden frames that could be bent suggests that the building may have a non-standard construction, making it difficult to retrofit with modern energy-saving measures. As a result, the building may be less energy-efficient and have higher heating and cooling costs due to air leaks.

There were several custom barriers identified. First, many of the housing cooperatives have experienced that the projects and management of housing cooperatives were too time-consuming:

“The question is also how much more difficult it is to get the process done, the more you drop it, because in a housing cooperative with a board, it is time-consuming, and to get it done; you need energy and time that goes far beyond what we are supposed to do. So it had to be a simple process.” (Gary, Green Valley Cooperative)

“I could have set up a meeting with Enova myself, but then you come back to how much time I will actually spend on this.” (Gary, Green Valley Cooperative)

“It is much work. You get paid a little, but not what it is worth.” (Rachel, Riverfront Cooperative)

This can emphasise the board members' constraints, who need more time and energy to dedicate to complex processes. Time constraints are a significant factor in carrying out tasks, and allocating the necessary time for them might be challenging. It can also indicate that the rewards, in terms of pay or other benefits, may not be worth it.

Another noteworthy custom barrier reported was the perception that everything was excessively complex:

“Finding out if there were any possibilities for district heating and radiators was difficult. It was something that ended up on the agenda when we set the projects. Still, I understood that we had to put it aside because the contractors and project managers we used did not even know. It complicated the process, which can be destructive for our residents. We must have as smooth a process as possible.” (Gary, Green Valley Cooperative)

“For example, one of our challenges with the old board leader was that he was very technical about things. Extremely technical on electricity and that kind of things, and could talk about kWh and prices, and I need help understanding something. And we must dumb it down so that people understand that our solar panels can produce the same as a Ford Mustang every hour.” (Peter, Pinegrove Cooperative)

Housing cooperative faces challenges in financing and implementing sustainable energy solutions. There are challenges in finding possibilities for district heating and radiators in a housing cooperative. Consequently, complexity can result in putting aside projects to ensure a smoother process for the residents. Housing cooperatives must often prioritise simplicity and efficiency in their projects to ensure they can be executed without disrupting the residents' daily lives. In addition, there are challenges in communicating technical information to residents since it might provide that the residents need to have a technical background. Additionally, technical information can be challenging to communicate effectively to residents, especially those without a technical background. To ensure that everyone understands the message, technical jargon must be simplified, and technical concepts must be presented in a way that is easy to understand.

5.3.2 Enablers

Various enablers can facilitate the implementation of system-smart energy measures in housing cooperatives. These enablers are broadly categorised into five groups: legal, economy, information, infrastructure, and custom.

Table 7. Common enablers affecting the implementation of energy upgrades

	Quotation number	Number of informants
Legal		
Board authorised to do much more than they believe	7	1
Help from external actors	11,13,17,18,24,27	5
Economy		
District heating cheaper than electricity	3,12	2
Collaboration between housing cooperatives	9,14,20	3
Financial support	26	5
Economic benefits for residents	31	5
Information		
Municipality information campaigns and subsidy schemes advertisements	1	1
Training for board members	19	1
Infrastructure		
External project manager	2	1
In-house employees	8,29	2
Good accessibility to skilled artisans and companies	10,11,15,22	3
Custom		
District heating cheaper and more environmentally conscious.	4	1
Transparency and easy feedback process	5	1
Meetings and info sessions for residents	6,16,28	3
Engaged individuals	18,21,23	1
Younger board	30	1
More delegation	30	1
Clear communication to residents	32	1

The most common legal enabler mentioned by all of the housing cooperatives was the help from external actors, this can also be considered as an economic enabler, as many of these actors provide financial support:

“But then you get to know many people in the industry. We are associated with electricians and lift constructors and one with the other. So I am just asking. There are solutions. We also get help from the housing developers to find good solutions. And then they tell us about what others have done, and we start searching.” (Rachel, Riverfront Cooperative)

“With SOBO, we have much legal expertise. Housing cooperatives know they can get help and advice from them if needed.” (Frederick, Forest Hills Cooperative)

“We could not do anything without our partners in the OBOS projects. And the suppliers.” (Peter, Pinegrove Cooperative)

These legal enablers, such as technical experts from housing developers, partners, and suppliers, play a significant role in potential success. They enable individuals and organisations to collaborate and work together to achieve their goals and solve problems. Technical experts from housing developers offer their expertise and advice to housing cooperatives, allowing them to make better decisions and improve their operations. Partners and suppliers contribute to the success of projects by providing necessary resources, services, and support.

Two economic enablers standing out were 1) financial support and 2) economic benefits for residents:

“We received support for a total of around NOK 500.000 from Enova. The project itself cost NOK 1.4 million. Also, we received support for project management.” (Peter, Pinegrove Cooperative)

“But it is the economy that has to be defended against the residents. That is what you can defend with; as long as you can defend things to the residents, things will work out. (...)” (Peter, Pinegrove Cooperative)

Overall, this can demonstrate the importance of financial support and the need to effectively communicate the economic benefits of a project to its stakeholders.

There was not much mention of information enablers from the housing cooperatives. Still, two things were brought up 1) information campaigns from Oslo Municipality and 2) training for board members:

“The good thing about Oslo is if you want to highlight something positive, the municipality and subsidy schemes come up very often on social media. They probably pay a lot on Facebook for advertising, so solar cells on the roof, bicycle sheds and that type of thing - good things for the housing cooperative.” (Gary, Green Valley Cooperative)

“As a board representative, I was at a lecture or a sales meeting; I think it was SOBO who had called in some actors and explained and taught us stuff.” (Frederick, Forest Hills Cooperative)

Overall, this can exemplify the positive impact of subsidy schemes and the importance of seeking advice and assistance from organisations like housing developers to improve the facilities and operations of housing cooperatives.

An infrastructure enabler essential for the housing cooperatives was especially good accessibility to skilled artisans and companies:

“After all, we have our partners that we use. And then, for example, with the plumbers, we use someone from Jessheim, who is very good. It is no-nonsense.” (Simon, Sunshine Cooperative)

“Yes, we have built up a good base with good people. And also some we have yet to be satisfied with and know we will not choose again.” (Rachel, Riverfront Cooperative)

Having reliable and skilled partners and artisans and the importance of building good relationships with housing cooperatives can be beneficial. The housing cooperatives recognise the value of using reliable professionals who can deliver quality work and are committed to maintaining solid partnerships with them.

A custom enabler most prominent was meetings and information sessions for residents:

“We had six meetings for residents, three during the day and three in the evening, where we talked about the project, why it is important, and how it will be carried out.” (Simon, Sunshine Cooperative)

“(…) We have always been cautious to inform residents about what will happen and what they can expect, which has helped a lot.” (Rachel, Riverfront Cooperative)

“The new board has informed much more and received many more inquiries since they shared more. However, you also have to share it smartly.” (Peter, Pinegrove Cooperative)

Overall, arranging meetings and providing information to residents about new projects can be an effective custom enabler that helps build trust and confidence among residents, which is essential for the project's success. The housing cooperatives recognise the importance of communicating effectively with residents and sharing relevant information to create a positive relationship between residents and the project.

5.4 Motivation

This chapter will explore the motivations that drive individuals to take action. The success of energy upgrading initiatives often depends on the willingness and motivation of building owners, managers, and occupants to implement these measures. This is also relevant for housing cooperatives, where individuals take on a role of responsibility for a more prominent part. The five informants selected for this thesis can provide information or insights on how individual motivations for achieving energy upgrades can result in a knock-on effect.

5.4.1 Gary - Green Valley Cooperative

Gary is a young male who is the current board leader of Green Valley Cooperative and has a background in environmental work. Gary's motivation to pursue energy efficiency measures is based on his concern for the environment, an example of how values and norms can influence economic decisions:

“(…) I wanted to check if we could do some energy efficiency measures because society and we all have to go in that direction. We must have energy efficiency measures everywhere we can. Moreover, because it is exciting and interesting, I think it could also benefit the housing cooperative.”

However, he has faced challenges in implementing these measures, including the time-consuming process of getting approval from the board and the need to balance environmental concerns with economic considerations. This highlights the importance of balancing economic and environmental considerations in decision-making:

“If there had been something I could have applied for, I would, of course, have just done it myself. If I knew where to find an Enova initiative that I could apply for. However, I would, of course, have to get approval for it from the board. The question is also how much more difficult it is to get the process done the more you drop it because in a housing cooperative with a board, it is time-consuming, and to get it done; you need energy and time that goes far beyond what we should do. So it has to be a simple process that is classic for many professional areas when choosing energy efficiency measures or making the right choices.”

Gary shows that implementing energy efficiency measures in a housing cooperative can be challenging. The formal institution - in this case, the board - can approve or reject proposed energy efficiency measures. He would be willing to pursue these measures independently if they could find an enova initiative to apply for. Nevertheless, he recognises that getting approval from the board can be time-consuming and require significant effort. Gary emphasises the importance of having a straightforward process for implementing energy efficiency measures to facilitate progress.

Despite his enthusiasm for energy efficiency measures, Gary recognises that not all residents may share their concerns or knowledge about energy efficiency. Additionally, his role as the board leader requires them to manage residents' money responsibly and make choices in the resident's best interest. He also recognises that economic considerations can influence decision-making, which can reflect the norms and values of the cooperative's residents:

“What is a challenge is that we manage the residents' money. So, the choices must be based a little on economics because it is easy to say that I want to make green choices, but I have to get everyone on board. I cannot just do what I want on behalf of all the residents. I would, of course, fight for solutions that cut emissions anyway, but in the end, it is the residents' money that I am managing and the residents that we have to think about.”

As a young board leader, Gary has also faced challenges managing the cooperative and balancing their responsibilities and personal commitments. He took over as board leader at a young age and did not fully comprehend what he was getting himself into:

“Because it is me, at least I am on the board as a young guy who took over as board leader immediately, so I did not really know what I was getting myself into. Because there are many little things that you have to fix and arrange all the time, we also have X, who is about 85 years old and well into his years, so you can even imagine that there is not much energy efficiency in his head. However, he is very concerned about light bulbs and that people should turn off the lights. So, of course, there is something, but I cannot commit myself so much to the light bulbs that have gone out and that people should be better at turning off the light. However, it is, in a way, an energy efficiency measure, of course.”

Gary’s experience shows that institutional barriers can exist at both individual and organisational levels. Informal institutions such as residents’ age and level of knowledge about energy efficiency can create challenges for implementing measures. In contrast, formal institutions such as the board approval process can be time-consuming and require significant effort, adding to the institutional barriers.

5.4.2 Simon - Sunshine Cooperative

Simon is a male general manager of Sunshine Cooperative with a bachelor’s degree in economics. He is a previous artisan. Nevertheless, the motivations of a general manager and a board leader in a housing cooperative may differ. A general manager is responsible for the day-to-day operations of the housing cooperative. It is his full-time job, and he must focus on maintaining the physical property, overseeing staff, managing budgets, and ensuring that residents are satisfied with the services provided. However, what a general manager prioritises can differ based on motivation:

Simon’s emphasis on future-oriented investments may stem from his background in economics, which may have taught him the importance of long-term planning and investment strategies. As a general manager, he must balance the day-to-day operations of the housing cooperative with the need to plan for the future. This may be why he is critical of the previous board's decision to buy the cheapest calling system, as it did not consider the system's future scalability:

“A few years ago, the previous board wanted to invest in a new calling system in every block. I then brought in 12 different offers. It is wild. Usually, you bring in 2 or 3. Then the board leader and deputy board leader went behind my back and bought

the cheapest. It was a huge mistake. This means the system cannot be expanded and is closed and finished. They did not think ahead. They just wanted to save money. I do not think like that. When we do something now, it must be future-oriented, and then it must last longer.”

Furthermore, Simon seems to prioritise the collective interests of the tenants over the individual interests of board members. This may be due to his background as an artisan, which may have instilled a sense of community and shared responsibility. He questions the rationale behind the wet room project, which he sees benefiting only a few tenants, including the board leader:

“Then the board started a wet room project and renovated ten bathrooms yearly. With 819 apartments, it will take 82 years to complete. How many people have renovated their bathrooms in the meantime? And who do you think was the first to get it? The board leader, yes.”

Formal rules guide the board’s decisions. Simon’s adherence to these formal institutions is evident when he questions the rationale behind the wet room project, which he believes does not align with the cooperative’s overall mission and values. He also emphasises this in another example:

“There are different interests in the board. One is super hung up on bike parking because she has bought a new electric bike and does not want to park in our current bike parking. We have parking for approx. Ninety bicycles to every block. So it is pretty good, but not good enough for her. She wants a room that only a few can access. But it cannot be like that. If we build something, everyone must have access, at least in the block.”

In addition, Simon's comments about environmental concerns and economic viability reflect his understanding of the practical realities of managing a housing cooperative. As a general manager, he must make decisions based on the available budget and ensure that any investments made are economically sustainable in the long term:

“I can be quite sure that not many people in Norway have started with heat pumps, energy efficiency-measures and all this here if the costs are not a factor. Very few people probably think, “No, we are doing this because of environmental concerns.”

Simon believes that only some people would prioritise environmental concerns over financial considerations. Hence, any measures taken to improve energy efficiency or reduce

environmental impact must be economically viable. Overall, Simon's background as an artisan and his education in economics may have influenced his perspective on managing a housing cooperative. His emphasis on future-oriented investments, collective interests of tenants, and practical considerations reflects a balanced approach to general management.

5.4.3 Rachel - Riverfront Cooperative

Rachel is a female board leader of Riverfront Cooperative. She is currently a full-time student in economics and administration, which means she has a flexible schedule and can stay at home often. However, after finishing her studies, she plans to leave her role. One of the main issues that she faces is the lack of adequate compensation for her work. While she understands the importance of collaboration and working together, she is also aware that this may come at a cost, which could be a barrier to her motivation in the long term:

“Yes, for now, I think. But now I am studying economics and administration, so I will sit until I finish it. It is much work. You get paid a little, but not what it is worth.”

The issue of inadequate compensation for her work highlights the role of informal institutions, such as values and norms that can influence decision-making. Rachel is committed to her work, but the lack of adequate pay could affect her motivation to continue in the long term. The challenges of navigating complicated bureaucracies can also affect motivation:

“But finding out what you get and how to apply is complicated. For me, who is sitting here alone, if I have someone with me, it helps. However, it also costs money. I can't just go to a business and ask if they can help me with something and expect them to do it for free.”

Rachel's comments on collaboration and the associated costs reflect the influence of conventions in institutional economics. She recognises the importance of collaboration and working together but also understands that this may come at a cost, which should be considered while making decisions. When asked about her motivation for starting the projects, she answered:

“For me, it is about the total package in that it is important to keep up with the times, we have to be forward-leaning, and we have to prepare for things that can happen and most likely will happen.”

This implies she wants to ensure that the housing cooperative stays relevant and current with changing times. She is driven by a sense of responsibility to ensure the cooperative's success and prepare for future challenges, which reflects the value of proactive planning and preparation. She is also driven by thoroughness:

“But that is the theme of everything - this will be an extra job for people, which eventually gets annoying. However, someone has to take it. And I do not work like that; I have to do things properly when I first have to do something. We are people with different backgrounds forced to work together or relate to each other.”

Rachel is also aware of the cooperative's financial pressures and the difficult decisions that must be taken to maintain stability. She believes that she has made the right choice but is aware of the ongoing challenges it faces:

“Our rent has gone up 67% with all this here. 28% are construction costs; the rest is interest. So it has become costly for people, but at the same time, it leaked from the windows and seeped straight through, so we had to do it. And I think it is the right choice because we have a good and safe home, which we must pay for. But with the energy crisis and things becoming even more expensive, we have at least done what we can.”

Based on her background as a full-time student in economics and administration, she may have a strong understanding of financial and administrative processes, which may have influenced her decision to take on a leadership role in the housing cooperative.

5.4.4 Frederick - Forest Hills Cooperative

Frederick is a former male board leader in Forest Hills Cooperative. He is happy to be finished in the role but has good experiences, too:

“Nevertheless, it was also very good to be a board leader. You meet the block's residents, get to know each other better, and get a good feeling. That is the thing about people who live in blocks; you like your housing cooperative. After all, even if you retire or take a break as board leader, it does not mean that the commitment is not still there. However, It is nice not always to step out when there is something.”

Frederick believes that the most influential leaders for a housing cooperative board are those passionate about the community's well-being and who have specific projects they want to

accomplish. The success of these projects depends on the leader's ability to generate interest and involvement from the residents. However, the issue of money and rent increases can sometimes create tension and differing priorities among community members, with some prioritising individual financial concerns over the community as a whole.

Frederick also emphasises that it is essential to have passionate individuals willing to come up with sensible ideas to improve the well-being of their housing cooperative. While money is a recurring issue, individuals who can get the residents involved and see the community as a whole can make a significant difference. While the cooperative board sets formal rules and regulations, individual members may prioritise their financial concerns over the community's well-being, indicating a clash of values and norms:

“They may not see the community, the block as a whole, and the surrounding area as much. So again, first-time owners will come and live in that apartment for a few years and hope to earn money from it. It does not always coincide with an expensive rehabilitation project. You will not automatically get the money back again.”

Frederick also points out the generational divide regarding attitudes towards energy-saving measures. Younger generations may be more open to technological solutions, while older generations may prefer more traditional approaches. Personal beliefs do not solely determine attitudes towards energy-saving measures but can also be influenced by an individual's life stage. This suggests that informal institutions such as generational values and norms can be crucial in shaping individuals' attitudes towards sustainability and energy conservation.

5.4.5 Peter - Pinegrove Cooperative

Peter is a male board leader in Pinegrove Cooperative, with a degree in social economy and has taken courses in renewable energy. He plans to continue as a board leader for a few more years. Peter recognises the need for project expertise and has hired a general manager to work closely with him. He acknowledges the importance of focusing on his mental health and recognises his limitations while also emphasising the importance of delegating realistic expectations and cooperation within the board:

“I am fully committed to my full-time job; I also have my mental health to focus on. Some have more to do than others, and I may be the one who has more to do. But now I feel things have improved slightly because we have brought in a slightly younger board that might see that part.”

He often points out how a change to a younger board has brought fresh perspectives and helped improve the situation. He also clarifies that delegating realistic expectations and cooperation within the board is essential. The board leader cannot always be present but must be willing to help when needed:

“The challenge is that if one person takes everything, that knowledge will also erode as that person disappears. Moreover, that happened because the previous board leader and I argued. When he left, I could not use his knowledge anymore.”

When asked about his motivation for starting up energy upgrading projects in the housing cooperative, he points out the importance of balancing economic considerations and environmental concerns in decision-making, particularly in the context of community leadership. While economics may be the bottom line, it is important to consider environmental factors. However, ultimately, the economy must be defended against residents, meaning that economic considerations often take priority over other concerns in decision-making. Peter also emphasised the importance of being prepared and mapping out potential scenarios in advance, as failing can leave one vulnerable to being caught off-guard and unprepared. As someone who has taken courses in renewable energy, he knows the importance of sustainable energy solutions. He also recognises that economic considerations often take priority over other concerns in decision-making. This reflects his understanding of the social economy, emphasising the importance of balancing economic and social goals.

Finally, Peter’s focus on the energy shortage in Norway reflects his knowledge of the country's energy situation, which was likely informed by his academic background in renewable energy. His call for support in project management and incentives for private individuals and housing cooperatives to invest in renewable energy reflects his understanding of the potential benefits of these projects for both the environment and the economy:

“Still, I think that if there is something I would like from the state of Norway, it would be to use the extra billions not only to provide electricity support but to provide incentives to both private individuals and companies and housing cooperatives, to simply provide support in project management, to provide support in the project itself, to get a holistic view. If you then see that here you can produce so much electricity that the housing cooperatives can almost be self-sufficient, not among the residents, but in the housing cooperatives themselves. And that one is developing, for example, hydrogen.”

Finally, Peter's call for support in project management and incentives for private individuals and housing cooperatives to invest in renewable energy reflects the role of formal institutions in shaping the community's priorities and decision-making processes. He is advocating for the state of Norway to provide support and incentives to promote sustainable energy solutions, reflecting the importance of formal institutions in shaping the community's goals and priorities.

5.5 Navigating the Institutional Landscape

As previously demonstrated, decision-makers and actors may hold varying interests, priorities, and values that pose difficulties in the decision-making process. Within a housing cooperative, navigating the intricate landscape of contemporary society and institutions can also present challenges. As a result, decision-makers and actors within institutions must navigate a complex web of factors, relationships, and processes that affect their ability to achieve their goals and objectives. This complexity can be categorised into different thematic areas, such as legal, economic, and technological contexts. In addition, there is the social context, where decision-makers must navigate through a complex web of cultural norms, values, and beliefs.

5.5.1 Economic, legal, and technological complexity

As mentioned previously, housing cooperatives have experienced various economic, legal, and technological aspects of implementing or considering system-smart energy solutions in their housing cooperatives. As new legal requirements, financial subsidies, and technical solutions arrive at a fast speed, is it possible for them to keep up?

5.5.1.1 Economic Complexity

Housing cooperative actors must relate to economic demands, financings, and market price changes. Simon from the Sunshine Cooperative mentioned the requirements to measure energy use at each point of consumption, starting with tap water. In 2010, NVE prohibited housing cooperatives from using shared electricity metering after implementing Advanced Measurement Systems (AMS)¹. Shared metering is only allowed in cases where the

¹ Advanced Measurement Systems (AMS) are digital systems that are used to measure, monitor, and control various types of equipment, such as power plants, industrial processes, or building systems. AMS typically includes a network of sensors, controllers, and software that can provide real-time data, analysis, and automated control of various parameters, such as temperature, pressure, flow rate, and energy consumption (NVE, 2015).

additional cost of installing separate meters is unreasonably high (Lie, 2015). For Sunshine Cooperative, this is likely to result in a significant increase in expenses for housing cooperatives. Housing cooperatives must invest in technology and infrastructure to measure energy use at each point, which can be costly. This can be a challenge for smaller cooperatives, as they may not have the necessary resources to invest in such technology and infrastructure:

“There are now proposals to measure the energy use in each individual point. Now, in the first instance, tap water, which I do not quite understand why should be the most important thing. But it is clear that it has a big impact on us. It will be a huge expense.” (Simon, Sunshine Cooperative)

Simon also mentions that support tends to disappear once a decision is made to adopt smart energy solutions. This can make it difficult for housing cooperatives to implement smart energy solutions effectively. Cooperatives must ensure they have the necessary support before adopting smart energy solutions. Otherwise, they may invest in obsolete technology, wasting resources:

“When it is decided to be carried out, the support also disappears. One should make sure that things are done before it is adopted. Now I read that when new homes are to be built, it says that all homes must have a heat pump. But it is also idiocy that in 2020 you set up ordinary panel ovens. I do not understand why that is happening today.” (Simon, Sunshine Cooperative)

At the Riverfront Cooperative, financing system-smart energy solutions is challenging. Housing cooperatives may receive some support from organisations like Enova, but this is not always enough to cover the costs of installing solar cells and battery banks. As a result, cooperatives may need to take out loans to finance these investments. The high costs associated with battery banks can also make it difficult for cooperatives to see a return on their investment:

“We have received NOK 100 000 from Enova, but that is all we have received in support. We could also get solar cells, and then there was talk of a subsidy of NOK 300 000, but more is needed. We had to have battery banks for that investment to be worthwhile, but they are expensive and last a short time, and if there is no more help in the future, we have to take out a loan for this here. Sell the power if necessary. There is no question that it will not pay off. And it gets way too complicated.” (Rachel, Riverfront Cooperative)

The cooperative has also experienced joint costs that have already increased significantly. Financing with loans may not be feasible. Rising interest rates can also make it difficult for cooperatives to afford the necessary investments in system-smart energy solutions. The cost of borrowing is likely to increase as interest rates rise, making it even more challenging for cooperatives to invest in system-smart energy solutions:

Pinegrove Cooperative was re-insulated in 2006, but they only added 5 cm because they wanted to avoid the municipality's fee of NOK 130 000. This can lead to insufficient insulation, resulting in drafts and cold air, impacting energy consumption and increasing expenses:

“It was also re-insulated in 2006. But at that time, they added 5 cm because it is not compulsory to apply for the municipality, so this was a saving because then you avoided the municipality's fee of NOK 130 000. But we still have much heat loss, and it is cold.” (Peter, Pinegrove Cooperative)

Solar cells on the roof may not always be lucrative. As Frederick from Forest Hills Cooperative mentions, the repayment period can be too long, and support schemes may come and go, making it difficult for housing cooperatives to invest in these solutions. It is also essential to do the necessary research before investing in system-smart energy solutions to ensure that the investment will pay off in the long run:

“I think X also said something about solar cells on the roof there. It was not a lucrative business, or at least they did not feel like it; the repayment period was too long. Then there are, for example, different support schemes that come and go. And Enova. If you want to start counting on it, and if the board will sell it in towards the general assembly, you must have done your homework. But it is not always so very lucrative.” (Frederick, Forest Hills Cooperative)

As in Sunshine Cooperative, supplier pricing can be challenging. They had previously bought bio-oil but returned to regular diesel after increasing prices. Suppliers may increase prices when required to use a specific product, increasing cooperatives' expenses. This highlights the need for cooperatives to find cost-effective solutions and work with reliable suppliers:

“We bought bio-oil, which was good; we bought quite a lot. And then they changed their pricing system, which was twice as expensive, plus more. Because now it is

required to use it. Then we no longer use it. So it is a bit silly that the supplier realises that this is something they can exploit. The price is a factor because they now sell less than they should have. We buy regular diesel.” (Simon, Sunshine Cooperative)

Implementing system-smart energy solutions requires a significant upfront investment, which can be a major obstacle for housing cooperatives with limited financial resources. Moreover, the benefits of system-smart energy solutions, such as energy savings and reduced carbon emissions, are only sometimes visible, making it difficult to justify the initial investment. Furthermore, the complexity of financing mechanisms and lack of financial incentives for housing cooperatives further exacerbate the economic challenges.

5.5.5.2 Legal Complexity

The legal complexity of system-smart energy solutions presents significant challenges for housing cooperative actors.

In the Sunshine Cooperative, legislation has significantly affected their housing cooperative regarding electric car charging infrastructure. The requirement for housing cooperatives and condominiums to make arrangements for electric car charging infrastructure has led to significant costs and infrastructure changes. This highlights the importance of considering the legal implications of policies and legislation before implementation to avoid unintended consequences:

“ It has then been decided that all housing cooperatives and condominiums will be required to make arrangements for electric car charging. This means that the infrastructure must be in place. Then we had to do it. We have a garage with space for 500 cars. And they all had to have access to an electric car space. So we established the possibility of electric chargers for 500 cars two years ago. Cost us a lot. So that is the consequence of such a decision. It had major ripple effects. We had to replace substations.” (Simon, Sunshine Cooperative)

The cooperative also highlights housing cooperative actors' challenges in meeting legal requirements for energy-efficient windows. The requirement for a U-value ² of 0.8 on windows can be difficult to achieve, and failing to meet this requirement can result in

² U-value (or U-factor) is a measure of the rate of heat transfer through a building material or assembly, such as a wall, roof, or window. It represents the amount of heat that passes through one square meter of the material or assembly per hour, for every degree Celsius difference in temperature between the indoor and outdoor environments. The U-value is expressed in units of watts per square meter per degree Celsius (W/m²K) and is used to assess the thermal performance of a building element. The lower the U-value, the better the insulation properties of the building element, as it indicates that less heat is being lost through it (Lymath, 2015).

financial losses. This raises questions about the effectiveness of setting strict legal requirements without considering the practicality and cost implications. Simon suggests looking at how much reduction is achieved instead:

“Now we have applied for support from Enova for the windows, but then they have set a U-value of 0.8 on the windows. It's extremely low. We ended up on 08.6. You have to have 0.8 to be paid, but then we will not be paid 330,000 because of that. The whole thing is silly from Oslo municipality. Shouldn't one look at how much the reduction is instead? Only counter to set a requirement for 08. Then you have to install wooden windows, which require much more maintenance than aluminium, which is maintenance-free. Slightly higher U-value, but not much.” (Simon, Sunshine Cooperative)

Accessing legal information is a significant challenge for housing cooperative actors, as highlighted by Riverfront Cooperative. The complexity of legal language and the lack of accessibility to legal information can create significant barriers for actors who must comply with legal requirements. This raises the importance of providing accessible legal information and support for housing cooperative actors to ensure compliance with legal requirements:

“Yes, it is very problematic that the legislation is not as accessible to us as it should have been. I noticed when we upgraded the balconies that I could not access them. Because the law is supposed to be public, but it just is not. So that's really what has been difficult. We sit here as normal people who do not know the law and must study and find out the legislation ourselves. I have requested that the housing developers make a legal introduction because we face many legal challenges. But I haven't got it yet.” (Rachel, Riverfront Cooperative)

Finally, Pinegrove Cooperative highlights the cost implications of the different block sizes in their housing cooperative. The varying block sizes can reduce costs for smaller blocks, meaning smaller blocks may receive less electricity than larger ones. Additionally, the inability to sell electricity to residents can create financial barriers for housing cooperative actors. These challenges demonstrate the need for flexible and adaptive legal frameworks that accommodate varying sizes and structures of housing cooperatives:

“Also, you can say that it is because the blocks are different sizes. The block here has three risers, and the block next to it has six. So there will be reduced costs to do it on the smaller blocks, but it will also mean you get less. We cannot sell electricity to the residents but only use our electricity.” (Peter, Pinegrove Cooperative)

Implementing system-smart energy solutions also involves legal complexities. For instance, housing cooperatives must comply with regulations related to building codes, energy efficiency, and environmental standards. These regulations can be complex and difficult to navigate, requiring the expertise of legal professionals to ensure compliance. Moreover, implementing system-smart energy solutions may require changes to existing contracts with energy providers and other stakeholders, adding legal complexity to the process.

5.5.5.3 Technological Complexity

One of the main challenges housing cooperative actors face when implementing system-smart energy solutions is the technical complexity of these systems. Green Valley Cooperative was interested in solar cells as part of their energy upgrade but found the system they had in place to be too complicated for this solution. Similarly, Sunshine Cooperative needs a system to handle settling and invoicing related to the installation of radiators and the reduction of rent to pay for energy. Installing 2700 radiators would require much work, and a system would need to be in place to handle these changes.

“So the Oslo municipality's aids have popped up and seemed fine to apply for. Solar cells on the roof have been mentioned regarding the energy upgrade. But it seems quite complicated for the system we have.” (Gary, Green Valley Cooperative)

Housing cooperative actors might face technical challenges due to their lack of expertise in these systems. Gary from Green Valley Cooperative states that there is a skills gap between contractors and project managers. While external actors may be interested in eco-friendly measures, they may not fully understand the energy efficiency measures that could be taken. Additionally, he mentions that they need help understanding how the district heating system and radiators work in general:

“There also needed to be more competence in this regard on the part of the contractor and project manager.” (Gary, Green Valley Cooperative)

“Energy management is something I have also tried to find out and talked to the contractors about. Still, I need help understanding how the district heating system - i.e. the radiators- works.” (Gary, Green Valley Cooperative)

Operational problems can arise when implementing system-smart energy solutions. In the Sunshine Cooperative, operational problems can occur with heat pumps and other systems that need fixing:

“We have had some operational problems with the heat pumps and systems we bought, which need to be fixed.” (Simon, Sunshine Cooperative)

Additionally, they need to bring in contractors from outside the cooperative due to the complexity of large projects, such as replacing radiators:

“But with these big projects, such as replacing the radiators, we would not have had a chance with our regular plumber. Then we had to find people from the west coast of Norway. We also chose a bunch of Lithuanians who worked here. Concerning the fact that we are so big, not everyone can take it.” (Simon, Sunshine Cooperative)

The lack of management options can also challenge housing cooperative actors. Some cooperatives may not have measurements or management options. This lack of control can make monitoring energy usage and costs difficult:

“What is typical for this housing cooperative is that there is much old infrastructure, we do not have measurements, and we do not have management options. Or minimal control options. We are connected to district heating.” (Frederick, Forest Hills Cooperative)

Housing cooperative actors face another challenge: finding the best solution for their energy needs. At Forest Hills Cooperative, the board's challenge is to determine the best technical solution. This requires research and effective communication among actors involved in the project. In addition, effective communication is essential for successfully implementing system-smart energy solutions. Contractors, heat pump suppliers, and district energy suppliers may all have different solutions they want to provide:

“The board's challenge is also to find out what might be the best solution.” (Frederick, Forest Hills Cooperative)

“Because if you talk to a plumber, he has his solutions; if you talk to a heat pump supplier, it is heat pumps that he wants to supply. If you talk to Agder Energi, they have the things they can do.” (Frederick, Forest Hills Cooperative)

The implementation of system-smart energy solutions also involves technological complexities. Housing cooperatives must identify and select appropriate technologies and solutions that align with their energy goals, building characteristics, and budget. Moreover, implementing these solutions requires specialised technical knowledge, which may need to be more readily available within the housing cooperative. Additionally, integrating different technologies and ensuring compatibility can also be a challenge.

5.5.2 Informal Institutions

As mentioned in section 3.1, institutional economics views the economy as a complex social system with interacting and evolving institutions. This can also be connected to housing cooperatives where external complexity meets internal complexity.

Decision-making processes can be time-consuming. This can be due to the different opinions and interests of the members. However, an “enthusiast” who is passionate about a particular issue taking the lead might be more likely to drive change:

“But it is a classic that every board meeting where you have at least half an hour where I have to sit and try to get ahead on the agenda” (Gary, Green Valley Cooperative)

“It is not just energy saving, but deciding which colour should be on the plates on the outside. As you saw, they disagreed, so three different types were chosen. Yes, they took a lot of time. But then again, it was especially the “enthusiast” who burned for this that pulled it through.”(Frederick, Forest Hills Cooperative)

Sunshine and Pinegrove Cooperative have a general manager, which might help processes go faster. Without someone with the appropriate knowledge and experience in charge, it could lead to mismanagement and financial difficulties:

“So, the board itself does not use much time because I have planned things. After all, I present these plans, and they only answer yes or no. I have not had anything rejected yet, as I do not put forward a case that I have not spent much time on and am sure of.” (Simon, Sunshine Cooperative)

“We brought in X because he has financial expertise that perhaps the board does not have, specialist expertise. Before this, the housing cooperative was run on a hobby

basis, and when you run such a large housing cooperative on a hobby basis, it usually fails.” (Peter, Pinegrove Cooperative)

The importance of balancing economic decisions with environmental considerations is emphasised at Riverfront Cooperative. Cutting emissions is essential, but ultimately, they must consider the residents’ best interests since they are managing their money. The norm highlighted is the need for preparedness and forward-thinking. Rachel acknowledges that the power grid in Kristiansand is not adequately built to meet the increasing demand for electric vehicles. To prepare for the future, she believes it is crucial to be proactive and invest in infrastructure and energy efficiency.

“But then we are entering a time where we have to. And where the power grid in Kristiansand has not been developed well enough. People want electric car chargers, so we must consider those things. I do not know people’s motivation, but generally, people want to save money. It is about the total package in that it is important to keep up with the times; we must be forward-looking and prepare for things that can happen and most likely will happen. And I think it is the right choice because we have a good and safe home, which we must pay for.” (Rachel, Riverfront Cooperative)

The housing cooperatives have also often experienced a tendency of “bad” habits. Such as at Sunshine Cooperative:

“Because we had a lot of bad habits with residents. With the old radiators, there was no thermostat, so it was usual to ventilate with windows. Then you cool down by opening the windows, thus regulating like this. However, do we want that? No. After all, we heated the whole neighbourhood.” (Simon, Sunshine Cooperative)

This can highlight the bad habit of leaving windows open to regulate temperature instead of using thermostats, resulting in wasted energy and discomfort for others in the neighbourhood. The norm of regulating temperature with windows instead of thermostats is so ingrained that residents do it without thinking about the consequences.

At Pinegrove Cooperative, it was stated that an unequal distribution of power and behaviour between the board and the residents:

“The knowledge lies in the housing cooperative. It does not lie with the board, i.e. the expert competence lies with the board, we know what is happening here and now, what things cost and about the one hole in the asphalt, but we do not know how a housing cooperative should be run, because the general assembly knows that and they

are the residents. The last board leader then told me: 'We do not do it like that' (Peter, Pinegrove Cooperative)

"No matter how many board leaders before me that have shouted at people. I will never do that, I am the last person to lecture anyone." (Peter, Pinegrove Cooperative)

On the one hand, board members are usually selected for their expertise in a particular field or industry, and their knowledge and experience can be valuable in making decisions. The board is responsible for setting the strategic direction of an organisation and ensuring that it operates within legal and ethical boundaries. Their expertise can ensure that the organisation is well-managed and successful. However, relying solely on the board's expertise can also be a bad habit. Board members may have limited knowledge of certain aspects of the organisation or the community it serves. The board may overlook important perspectives and ideas by not seeking input from a broader range of stakeholders, leading to missed opportunities or poor decision-making. Additionally, suppose the board does not reflect the diversity of the community it serves. In that case, it may make decisions that do not adequately consider the needs and interests of all members. Using aggression and negativity to communicate with others, particularly in a position of power like a board member, can also be a bad habit. It is a norm that board members have a certain level of authority and can use that authority to speak down to others.

The same housing cooperative also stressed a lack of change in the leadership role:

"The board leader before me sat as a board leader for 32 years. It is not good; you really should not have that. At least not him, who did not do his job. No maintenance was done, nothing was planned, and he had not set aside any money." (Peter, Pinegrove Cooperative)

This quote highlights the negative consequences of having a board member who remains in their position for too long without making significant changes or improvements. In this case, the former board leader served for 32 years without presumably fulfilling their duties, which resulted in a lack of maintenance, planning, and financial allocation. This emphasises the importance of having fresh perspectives and new ideas brought in by board members who can contribute to the overall improvement and success of the organisation.

In addition, the housing cooperative has experienced a tendency to save money over spending it, which led to the deterioration of the building:

“A previous board leader- three board leaders ago - sat in the office 24/7. And many things are left behind by him. He was an economist and a very thrifty guy. Spending money wisely, because then you save money. Not spending money is not smart, and our building is in disrepair. And that is what has happened here in the housing cooperative.” (Peter, Pinegrove Cooperative)

The need for collective action and cooperation among its members and other external actors was also addressed. Sunshine and Pinegrove cooperatives emphasised the need for closer collaboration between cooperatives in the area. However, they have faced challenges implementing it because a larger group of actors complicated it:

“I tried to think a bit like that, that you should have a closer collaboration than what we have here at several points. The cooperation here should have been much better. We could have pushed prices down quite a bit. So I have been on it a bit. I will try to get at least the board leaders and general managers to let us get closer, maybe have a monthly meeting.” (Simon, Sunshine Cooperative)

“They wanted then to look at a joint purchasing agreement. But there were so many residents and things then, it would be difficult to follow up because then you need a solid administration” (Peter, Pinegrove Cooperative)

The Forest Hills Cooperative have also tried collaborating with other housing cooperatives but has experienced both good and bad cooperation between individuals, which can affect collective action:

“There has been cooperation over the years, but sometimes the chemistry has not been right between the people. And sometimes there has been good cooperation. You can see much is common by talking to the other cooperatives. So it would certainly have made sense for us to ask suppliers for offers.” (Frederick, Forest Hills Cooperative)

The Riverfront Cooperative also points out the difficulty of finding suitable candidates to serve on the board. In addition, people with different backgrounds and skill sets are often required to work together. The group's internal dynamics, including social norms, customs, and shared beliefs, can impact their ability to cooperate effectively. :

“They all have full-time jobs, except for one, a deputy member, so she does not do much. Getting people who want to stand up and have the knowledge to do so is challenging. After all, we manage a budget of approx. 5 million. It is a multimillion-dollar business that must be taken seriously. So I think it is almost a little irresponsible to bring in anyone who will sit as a board leader.” (Rachel, Riverfront Cooperative)

“We are different people with different backgrounds who are forced to work together or relate to each other.” (Rachel, Riverfront Cooperative)

Forest Hills also experiences different levels of dedication. Some residents may view their residency purely as an investment, while others may have a more profound sense of connection and investment in the community. The presence or absence of engagement may also vary among residents, with some unaware of the community's leadership structure. In contrast, others remain invested in the community even after leaving leadership roles:

“It's sort of the perspective around whether you will continue living here or have only done it for an investment. But again, commitment is very variable. I think you can find residents who hardly know that there is a board in the block. You will also find someone who has lived here for many years and has himself been on the board. Who are very interested in what is happening, even if they no longer hold board positions.” (Frederick, Forest Hills Cooperative)

Age, such as at Green Valley Cooperative, can also be a factor. Prejudices against elderly people may, however, exist At Green Valley Cooperative. Some older board members complain about everything, which can cause tension and division within the board and affect the effectiveness of the building's management.

“So there are two “oldies” on the board who complain about most things. Everything is painful and difficult. The washroom, people do not clean up after themselves, do not turn off the lights.” (Gary, Green Valley Cooperative)

At Pinegrove Cooperative, however, the age composition of the board has changed from being dominated by elderly people to mostly younger members.

“So we are a relatively young board, and being a board with an average age of close to 40 or rather a little under; I see this as positive, but also demanding. You are on the move more; you have a different approach to the world than those who have established themselves and are settled.” (Peter, Pinegrove Cooperative)

Having a relatively young board can be positive but challenging. This perception may reflect the belief that younger members may bring fresh perspectives and innovative ideas to the board but may also lack the experience and knowledge of older members. The same cooperative also highlights the importance of involving residents in their projects, as it is necessary for them to have ownership of the process more profoundly. Everyone has the same level of understanding. It might be necessary to convey information in a way that is understandable to everyone:

“I want more involvement of the residents because if the residents do not have ownership of their projects, you might as well quit. Because you cannot deliver a glass half-full to us and say you are now going to investigate that part here as a team”(Peter, Pinegrove Cooperative)

“You have to come out with information and defend it, then you have to get it down to such a human level that an idiot like me can understand it. I can compare myself well to the rest of the group.” (Peter, Pinegrove Cooperative)

Another observation made in the study is related to the gender dimension. At the Riverfront Cooperative, it has been a previous issue of gender discrimination. The habit of gender discrimination might have become infused in some people's minds, which influences their beliefs and behaviour:

“However, there have been challenges, such as discrimination against women. They underestimate me. We had one in particular; he quit, and he ended up moving. He was very concerned that women could not do this and that, especially when it came to working with practical things in general. Nevertheless, I know a lot of that too. But it was a bit like that - the men were right. There are few, but there are some.” (Rachel, Riverfront Cooperative)

At Forest Hills Cooperative, it is indicated that women have played an essential role in the cooperative's success. However, it also highlights the lack of female representation on the board, both present and in the past:

“No, in the history of the cooperative, there have been enterprising women who managed skillfully and with a good hand. Now there is just one woman on the board, and you can probably go back quite a few years to find more than one woman on the board.” (Frederick, Forest Hills Cooperative)

While exploring the challenges faced by women in the male-dominated building and energy sector would be interesting, it falls outside the scope of this thesis. However, this study suggests that further research would be valuable.

6. Discussion

This chapter delves into the empirical evidence presented in Chapter 5 and discusses the challenges housing cooperatives face in achieving system-smart energy usage. Housing cooperatives have to explore and consider various technologies and practices that can be used, such as solar panels, energy-efficiency measures, and smart meters. They also have to interact both within their internal structures of actors and with external actors and institutions. In addition, there may be barriers and enablers when investing in system-smart energy solutions for housing cooperatives. It is important to have a dynamic perspective acknowledging that barriers and enablers are context-dependent, perspective-dependent, and constantly changing. Housing cooperatives need to interact with both their internal structures of actors and external actors and institutions. Applying institutional economics theory can help understand decision-makers motivation and how individuals can drive action. Lastly, as illustrated above, navigating the complex landscape of cooperative governance and management for decision-makers in housing cooperatives can be challenging. Decision-makers must navigate the complex landscape of cooperative governance and management, including new technical, legal, and economic requirements, suggestions, and the complex web of norms, values, and beliefs.

The discussion in this chapter deals with the thesis' five research questions, which together should answer the thesis' problem. The research objectives included clarifying the concept of system-smart energy solutions, investigating the impact of relationships between actors, structures, and institutions on housing cooperative success, identifying enablers and barriers to investing in system-smart energy solutions, understanding decision-makers motivation for collaboration and partnership, and investigating factors shaping housing cooperative decision-making regarding system-smart energy systems.

6.1 System-smart energy solutions

Regarding energy solutions for housing cooperatives, numerous options are available. According to ZERO's System-Smart Energy Use framework (Table 1), system-smart energy solutions can be achieved through various alternatives, such as smart management, local energy production, energy efficiency, other heat sources, and energy storage (Systemsmartenergibruk, n.d.). These solutions aim to provide more control over power

usage, reduce pressure on the power grid, and make energy prices cheaper, among other benefits. In addition, this approach is expected to benefit both individual consumers and society as a whole, as it avoids overinvestment in the grid and production capacity that would be paid for by the community (Systemsmartenergibruk, n.d.).

Smart management, which includes AMS sensors that regulate radiators and automatic temperature controls, has been implemented by both cooperatives in Kristiansand. The cooperatives have also considered local energy production, such as solar panels, but only Pinegrove Cooperative has implemented it. However, this cooperative has only managed to install it on one roof due to financial difficulties. Nevertheless, new regulations implemented in February 2023 now allow housing cooperatives to invest in solar energy on their roofs and share it among the housing units without paying for the electricity grid fee and electricity tax for self-produced electricity up to 1000 kW (OED, 2023).

All the housing cooperatives studied have implemented energy efficiency measures such as after-insulation and changing windows or balconies, which the Energy Commission suggests are the cheapest and easiest measures for most actors (NOU, 2023, p. 84). Furthermore, the SINTEF report "The most sustainable buildings already exist" also shows that from a climate perspective, it is more beneficial to renovate and upgrade existing buildings rather than constructing new ones (Fufa et al., 2020).

Three of the five housing cooperatives studied already implement district heating, categorised within other heat sources. The Norwegian Energy Commission suggests that increasing district heating by 2-4 TWh by 2030 and doubling this potential by 2040 is a realistic goal (NOU, 2023, p. 14). However, as pointed out in the analysis, it can be challenging to diversify a district heating system with other system-smart energy solutions, such as solar panels and smart management. Nevertheless, the Energy Commission suggests that district heating systems can be flexible and utilise various energy carriers, including surplus heating and heat pumps that utilise the energy of seawater, soil or sewage, bioenergy, and energy storage (NOU, 2023, p. 125).

In addition, Pinegrove Cooperative has constructed an energy well providing geothermal power to the units and installed heat pumps to reduce the need for electric heating of hot water, which aligns with the system-smart energy solution of energy storage. For older

housing cooperatives with hydronic heating, installing an air/liquid-water heat pump can be profitable, according to the Norwegian Ministry of Petroleum and Energy (Prop. 1 S (2022-2023), p. 190).

System-smart energy solutions refer to a comprehensive approach to planning and implementing energy measures considering various energy systems' interplay. This can align with other relevant reports and incentives from organisations such as Enova, which promotes smart and renewable energy solutions (Enova, n.d.) In addition, it aligns with the "more of everything - faster" report by the Norwegian Energy Commission, which aims to increase energy production while maintaining surplus production of power and abundant access to renewable energy (NOU, 2023).

6.2 Relationship between actors, structures, and institutions

The analysis utilised the EGS framework to map the external structures surrounding the five housing cooperatives. However, it should be noted that the figures generated from the analysis may provide an incomplete basis for assessment, as they are based on the information from a limited sample and the number of interviews which were conducted with the cooperatives. In addition, other actors, institutions, and policy instruments may have yet to be considered. The actors in a housing cooperative include residents, board members, managers and any external partners. These actors interact through various structures, such as the general assembly and the board. The formal institutions in this context may include laws, such as the Housing Cooperative Act, and regulations that regulate the operation of the housing cooperative. The municipality was the most significant political actor for each housing cooperative, while the local housing developer and Enova were identified as the most significant economic actors. However, the municipalities also offer financial support, which can categorise them as an economic actor. The most commonly mentioned policy instrument was financial support, which was provided for energy technologies, energy mapping, administration, and research projects. The relationship between actors, structures, and institutions can be complex and interdependent.

The EGS framework highlights the importance of comprehending the diverse and often competing interests of various stakeholders involved in decision-making, including residents, managers, government agencies, and external partners. Successful sustainability initiatives require effective collaboration, communication, and trust-building across multiple levels of

governance. A study conducted by Ganapati (2010) explores the policy frameworks and practices that have enabled the success of housing cooperatives in Sweden, India, and the United States. In Sweden, housing cooperatives are supported by a comprehensive legal and policy framework that provides access to low-cost financing, tax incentives, and government subsidies. This support has enabled the creation of high-quality, affordable, and sustainable housing owned and managed by the residents. The article concludes that the success of housing cooperatives depends on a supportive policy framework that provides access to financing, subsidies, and other forms of government support. The five housing cooperatives have all received this - some more than others - but is this enough? As outlined in the analysis, certain housing cooperatives face challenges in determining the optimal technical solutions, adhering to legal requirements, identifying sources of assistance, and navigating differences in values, habits, and uneven distribution of work within the housing cooperative.

6.3 Barriers and enablers for investing in system-smart energy solutions

As presented in the analysis, the five housing cooperatives mention various barriers and enablers when discussing implementing system-smart energy solutions. Overall, the findings from the analysis chapters suggest that while there are barriers to investment in system-smart energy solutions for housing cooperatives, there are opportunities to overcome these barriers through targeted policy interventions and support. Several informants pointed out that strong political support and commitment to sustainability would make it easier for housing cooperatives to invest in energy-efficient solutions. In terms of Vatn's policy instruments (Table 7), several of the enablers mentioned by the informants can be seen as policy instruments to promote investment in system-smart energy solutions. Financial support from external actors is an example of an economic policy instrument that can incentivise housing cooperatives to invest in energy-efficient solutions. In addition, a collaboration between housing cooperatives in the area is an example of a regulatory policy instrument that can help overcome regulatory barriers and create a more supportive environment for investment in system-smart energy solutions.

The report "Potential and barrier study Energy Efficiency in Norwegian Buildings" (2012), conducted by Enova, examines various aspects of energy efficiency in buildings, including technology, finance, organisation, and regulation. The analysis in this thesis has covered many of these topics. However, the report mainly focuses on profitability calculations without considering other factors. They suggest that other private financial benefits resulting

from energy efficiency measures should encompass energy behaviour modifications, including reducing exposure to fluctuating energy prices and increasing the home's value (Enova, 2012). Even though this is important, focusing more on informal institutional factors is also beneficial. For instance, while financial incentives such as subsidies and loans are essential for energy efficiency measures, informal institutions such as lack of knowledge and skills, resistance to change, and lack of motivation can also act as barriers.

After looking at other research on housing cooperatives in Norway, most studies (see, for example, Enova 2012; SINTEF 2015) have focused primarily on the economic aspects of housing cooperatives. Many of these studies have concluded that the most significant barrier to establishing successful housing cooperatives in Norway is the issue of financing and economic viability. Nevertheless, it is essential to note that other factors may be at play in the difficulties facing housing cooperatives in Norway. For instance, social or cultural barriers may make it more challenging to establish and maintain cooperative housing projects. Additionally, governance, decision-making, and member participation issues may impact the success of housing cooperatives in Norway. Further research is needed to fully understand the complexities of establishing and maintaining successful housing cooperatives in Norway and identify potential solutions to the challenges facing these projects. By exploring the various factors that impact the success of housing cooperatives, policymakers, academics, and other stakeholders can work to develop policies and strategies that promote the growth and sustainability of cooperative housing in Norway.

6.4 Institutional economics theory and decision-making motivation

According to the Enova study (2012), households may need help implementing energy-efficient measures, such as a lack of motivation and a preference for comfort over energy efficiency. Institutional economics theory suggests that decision-makers motivations in housing cooperatives are shaped by the institutional context in which they operate. This includes formal institutions such as regulations and laws and informal institutions such as social norms and values. The informants' perspectives in this case study illustrate the complex interplay between these different institutional factors in shaping decision-making within housing cooperatives.

Gary, for instance, is motivated by his concern for the environment and the potential benefits of energy efficiency. He recognises that implementing these measures can be challenging,

particularly in the context of a formal institution such as a board. However, he emphasises the importance of having a straightforward process for implementing energy-efficient measures to facilitate progress. On the other hand, Simon is driven by the need for future-oriented investments in the cooperative. His background in economics has taught him the importance of long-term planning and investment strategies. He recognises that energy efficiency measures can provide significant long-term benefits to the cooperative but needs help convincing the board and residents to invest in these measures. According to the study "Conscious Strategies for upgrading housing cooperatives conducted by SINTEF, one of the main challenges in upgrading housing cooperatives is engaging residents. It takes a long time to make residents understand the seriousness and necessity of an upgrade. Having an enthusiastic board leader or hiring someone who can create support for a project (from a housing cooperative or contractor) is important in getting things done (SINTEF, 2015).

Rachel's comments demonstrate her awareness of the challenges and opportunities of leading a housing cooperative. She recognises the importance of collaboration and forward planning but is also aware of the financial pressures that can affect motivation. Frederick's perspective on the importance of passionate leadership and community involvement highlights the role of institutions, such as social norms and values, in influencing decision-making within housing cooperatives. He believes that individual members' priorities can sometimes clash with the community's interests, creating challenges for leaders to generate interest and involvement from residents. He emphasises that the success of housing cooperative projects depends on the leader's ability to see the community as a whole and get individuals involved. According to SINTEF's study, there are examples from other pilot cases where enthusiasm declines quickly. If the upgrade is voted down, board members quickly lose motivation and are replaced. It takes time for board members to regain their enthusiasm. The pilot cases also show examples of active resistance to upgrading. Opponents gather supporters and often mobilise more engagement than those favouring the upgrade. Opponents are more engaged than those favouring upgrading when the decision is nearing. Frederick also recognises the generational divide in attitudes towards sustainability and energy conservation. He highlights that younger generations may be more open to technological solutions, while older generations may prefer more traditional approaches. This suggests that informal institutions, such as generational values and norms, can influence individuals' attitudes towards sustainability and energy conservation.

Finally, Peter recognises the need for project expertise and has hired a general manager to work closely with him. He acknowledges the importance of focusing on his mental health and recognises his limitations while emphasising the importance of delegating realistic expectations and cooperation within the board. Peter understands that economics often takes priority over other concerns in decision-making, but he emphasises the importance of balancing economic and social goals. Peter's call for support in project management and incentives for private individuals and housing cooperatives to invest in renewable energy reflects the role of formal institutions in shaping the community's priorities and decision-making processes. He is advocating for the state of Norway to provide support and incentives to promote sustainable energy solutions, reflecting the importance of formal institutions in shaping the community's goals and priorities.

Overall, the informants' perspectives highlight the importance of formal and informal institutions in shaping decision-making within housing cooperatives. These institutions can influence individual attitudes towards sustainability and energy conservation, as well as the priorities and goals of the community as a whole. Institutional economics theory provides a valuable framework for understanding the complex interplay between these different institutional factors and how they shape decision-making within housing cooperatives.

6.5 Decision-making process and navigating complexity

Examples from the analysis chapters support the idea that decision-makers in housing cooperatives must navigate complex factors when considering system-smart energy solutions. In this analysis, findings show that financial considerations played a significant role in decision-making, with many cooperatives citing the high cost of implementation as a barrier. However, other factors, such as regulatory compliance and environmental responsibility, also influenced decision-making. Housing cooperatives face numerous challenges when implementing system-smart energy solutions, including economic, legal, and technological complexities. These factors can make decision-making processes time-consuming and difficult for key decision-makers in top management and board members, who are often volunteers and have other jobs.

One potential solution, highlighted in other reports, is the need for more collaboration and partnership between housing cooperatives and energy service providers. Energy service companies can provide technical expertise and support in designing and implementing

system-smart energy solutions, while housing cooperatives can access their infrastructure and data (Grini & Oksvold, 2018). However, in both political and economic circles, housing cooperatives are often viewed as rational actors, making decisions based on maximising their utility or self-interest. This view can be limiting and needs to capture the complexity of decision-making processes in housing cooperatives fully. First, the assumption of rationality overlooks that many housing cooperative decision-makers are volunteers who may need a background in economics or business management. As a result, they may make decisions based on their values or beliefs rather than on economic considerations. Second, housing cooperatives often have a social and community-oriented mission beyond maximising utility. This mission may include providing affordable housing, creating a sense of community, or promoting sustainable and environmentally friendly practices. These goals may conflict with maximising utility, leading to decisions not solely based on economic considerations. Third, the assumption of rationality needs to fully capture the impact of social and political factors on decision-making in housing cooperatives. Decisions may be influenced by power dynamics within the cooperative or broader political and regulatory environments. Decision-makers may also be influenced by social norms and expectations, such as the desire to conform to the values of the cooperative or the broader community.

It is worth noting that the two cooperatives with general managers employed to work full-time on the management of the cooperative have been able to complete more energy upgrades. These cooperatives are also larger and have more residents. A full-time manager may have helped these cooperatives navigate the complex web of technologies and actors involved in implementing system-smart energy solutions more effectively. In addition, these cooperatives are located in Oslo, Norway's capital. Oslo municipality may provide more support and resources to housing cooperatives in the city, as it is a larger and more significant urban area. This support may include financial incentives, technical support, and legal advice, among other things. Additionally, the municipality may be more prepared to address the challenges of implementing system-smart energy solutions. It has more experience with these issues due to its size and the number of housing cooperatives within its borders.

The case study "Living environment and inclusion - A case study of three housing cooperatives and a residential area" (Unstad, 2001) showed that the typical challenge for today's boards is facilitating groups with different values and norms. Based on the study, a board that works well in modern times must focus on value management, emphasising

specific values to underpin residents' actions. Equality should mean equality in conditions for choosing one's way of life. Reciprocity and mutual acceptance were deemed necessary by Unstad (2001). The assumption of rationality often overlooks that decision-making in housing cooperatives is often a collective process involving multiple actors with different interests and preferences. This can make decision-making complex and may result in decisions not solely based on economic considerations. Given these complexities, decision-makers in housing cooperatives should consider various factors. They need to invest time, knowledge, and motivation into their work and seek advice and support from experts in the field. These may include community values, social and environmental goals, power dynamics, and the interests and preferences of different actors. By taking a more holistic approach to decision-making, housing cooperatives can better align their decisions with their broader mission and goal.

7. Conclusion

The thesis findings highlight several important aspects of implementing system-smart energy solutions in housing cooperatives. The thesis addressed five research questions to answer the problem statement.

Firstly, the thesis clearly defined system-smart energy solutions, emphasising the need for a comprehensive approach considering different energy systems' interactions. The study identified various technologies and practices that enable efficient energy use and reduce environmental impacts, such as renewable energy sources, energy-efficient appliances, and smart grid systems. Secondly, the thesis highlighted the critical role of actors, structures, and institutions in the success of system-smart energy implementation in housing cooperatives. The study revealed that cooperation and collaboration among actors, including cooperative members, energy service providers, and local authorities, are essential for achieving energy goals. Additionally, the study emphasised the importance of supportive structures and institutions that facilitate energy initiatives, such as legal frameworks, funding opportunities, and policy incentives. Thirdly, the thesis identified common barriers and enablers for housing cooperatives when investing in system-smart energy solutions. The study revealed that financial constraints, lack of technical expertise, and limited awareness among cooperative members are significant obstacles to energy implementation.

Additionally, the identification of multiple custom barriers suggests the need to consider not only formal institutions but also informal ones. The study also identified several enablers, support from external stakeholders, the willingness of cooperative members to participate in energy-saving initiatives and effective communication and coordination mechanisms. Fourthly, the thesis applied institutional economics theory to explain decision-makers motivation in housing cooperatives to engage in collaboration and partnership activities. The study showed that various factors influence decision-makers' motivations, including economic incentives, social norms, and institutional frameworks. The findings indicated that decision-makers' motivations vary across contexts, emphasising the importance of context-specific solutions for system-smart energy implementation. Finally, the thesis explored how cooperative housing decision-makers navigate the complex landscape of system-smart energy solutions. The study revealed that decision-makers face various challenges related to technical, economic, and legal requirements, laws, and suggestions. In

addition, cultural norms, values, and beliefs within the social context can be challenging. It is a demanding task to understand the complexity of system-smart energy solutions, which in turn requires that decision-makers in housing associations possess deep insight into this topic in order to make optimal decisions. Housing cooperatives operate as democracies within democracies, ideally making decisions for and with the community. Therefore, decision-makers must collectively understand the barriers and enablers to implement system-smart energy solutions at the micro and meso levels. In addition, decision-makers within these collectives must contribute their time and understand the structures. Decision-makers must consider the actors involved in the decision-making process, such as board members, residents, energy service providers, and local authorities. Although decision-makers may face limitations due to economic constraints and regulatory frameworks, they must still consider the possible actions of the actors involved.

In conclusion, decision-making in housing cooperatives requires a nuanced understanding of the complex interplay between actors, structures, and institutions. Decision-makers must operate from a collective perspective, considering the values and perspectives of cooperative members. Institutional economics can provide a framework for understanding the institutional arrangements that impact decision-making. By considering the diverse actors involved and understanding the institutional context, decision-makers can make informed decisions that lead to a successful implementation of system-smart energy solutions.

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Appendix A

Interview guide

Opening questions

1. Can you provide an overview of the housing cooperative and its history?
2. How would you describe the diversity among the residents in terms of demographics and backgrounds?
3. Have any board members worked in the energy sector/climate industry before? Can you tell me about the backgrounds of the different board members?
4. Can you describe the turnover rate of residents in the housing cooperative?
5. What is the gender balance on the board?

System smart energy solutions

6. What energy upgrade measures, if any, have been implemented in the housing cooperative?
7. Are there any plans for future upgrades?
8. Has the board considered any energy upgrade measures that were ultimately not pursued?
9. How do you understand the concept of system smart energy measures?
10. Has the board recently received input from consultants or experts on potential energy upgrades?
11. If smart energy solutions have not been implemented, has there been a discussion about the possibilities of implementing them? If yes, what were the reasons for not pursuing them?
12. Is there a particular type of energy technology the board is more confident in, less confident in, or uncertain about regarding effectiveness?

Barriers and enablers

13. In what ways are regulatory measures important for the board when implementing smart energy solutions?
14. How do economic factors come into play when considering smart energy solutions?
15. In what ways is access to information about potential solutions important for the board?
16. Have access to infrastructure and resources been important for the board when implementing smart energy solutions?
17. How important are good communication and openness within the board when implementing smart energy solutions?

Management process in the board

18. What are the biggest drivers for implementing system-smart energy solutions?
19. What are the biggest challenges for implementing system-smart energy solutions?
20. What motivates the board to manage the housing cooperative?
21. What do you believe are the biggest challenges for managing the housing cooperative?
22. As a representative of the housing cooperative, what do you believe is the main challenge associated with obtaining a majority for extensive upgrades?
23. Who initiated the energy upgrade projects?
24. How has the board communicated with the other residents about the upgrades?
25. What do you think is necessary to motivate more housing cooperatives and homeowners to carry out system-smart energy measures?

Appendix B

Informed Consent

Vil du delta i forskningsprosjektet

” Hvordan er systemsmarte energiløsninger forstått fra en sluttbrukers perspektiv”?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å forstå hvordan systemsmarte energiløsninger er forstått fra en sluttbruker og hva kan være mulige barrierer eller virkemidler. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med dette intervjuet er å få en bedre forståelse av hva slags forhold sluttbrukere, det vil si de aktørene som faktisk skal gjennomføre smarte energiløsninger i deres boliger, har til disse løsningene. Jeg ønsker å få ett innblikk i hva slags løsninger som har blitt vurdert eller iverksatt i borettslag, og om hvordan prosessen i styret har vært.

Informasjonen vil bli brukt til en masteroppgave.

Hvem er ansvarlig for forskningsprosjektet?

Emma Rennan ved Norges Miljø- og biovitenskapelige universitet (NMBU) er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?

Utvalget er trukket ved hjelp av et strategisk utvalg basert på borrettslag som enten har gjennomført ulike energiltak eller har vurdert det. Det har vært ønsket å komme i kontakt med styreleder eller ett styremedlem som har vært en aktiv deltaker i prosessene. Utvalget vil basere seg på fire informanter fra fire ulike borettslag. Kontaktopplysninger har blitt gitt fra Sørlandet Boligbyggelag/proff.no.

Hva innebærer det for deg å delta?

Hvis du velger å delta i prosjektet, innebærer det at du deltar på ett til to intervjuer. Det vil ta deg ca. 60 minutter hver gang. Intervjuet inneholder generelle spørsmål rettet mot bakgrunnsinformasjon om deg (alder, utdanning, jobb) og om forvaltningsprosessene i borettslaget i forhold til energiltak. Jeg tar lydopptak og notater fra intervjuet.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Det er kun Emma Rennan og veileder Lars Kåre Grimsby som vil være behandlingsansvarlig.
- Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrig data.
- Datamaterialet vil bli lagret på en innelåst forskningsserver.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Prosjektet vil etter planen avsluttes 15 mai 2023. Etter prosjektslutt vil datamaterialet med dine personopplysninger anonymiseres. Lyddopptak vil bli slettet.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke. På oppdrag fra NMBU har Personverntjenester vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- Prosjektansvarlig Emma Rennan ved institutt for internasjonale miljø- og utviklingsstudier, NMBU på telefonnummer +4745210009, e-postadresse: emma.rennan@gmail.com
- Veileder Lars Kåre Grimsby ved institutt for internasjonale miljø- og utviklingsstudier, NMBU på telefonnummer: +47672312077, e-postadresse: lars.grimsby@nmbu.no
- Vårt personvernombud: Hanne Pernille Gulbrandsen, telefonnummer: +4740281558, e-postadresse: personvernombud@nmbu.no

Hvis du har spørsmål knyttet til Personverntjenester sin vurdering av prosjektet, kan du ta kontakt med:

- Personverntjenester på epost (personverntjenester@sikt.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Emma Rennan

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet «Hvordan er systemsmarte energiløsninger forstått fra en sluttbrukers perspektiv» og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i intervju

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

(Signert av prosjektdeltaker, dato)

Appendix C

Barriers

Informant 1	
Quot. nr.	Quotation
1	Finding out if there were any possibilities for district heating and radiators was difficult. It was something that ended up on the agenda when we set the projects. Still, I understood that we had to put it aside because the contractors and project managers we used did not even know. It complicated the process, which can be destructive for our residents. We must have as smooth a process as possible.
2	So the Oslo municipality's aids have popped up and seemed fine to apply for, but solar cells on the roof have been mentioned regarding the energy upgrade. But it seems quite complicated for the system we have.
3	So then the one saving is worse. Connecting it to the district heating system that we spend much money on could be exciting, but where do you start? Initially, I searched for something like this: Enova-energy efficiency-district heating, but I did not really come up with anything. So I do not really know if there is any possibility. I have been on the enova pages, not directly aimed at this, but for my job. It should be easier to find if there are any possibilities.
4	The question is also how much more difficult it is to get the process done the more you drop it because in a housing association with a board, it is time-consuming, and to get it done; you need energy and time that goes far beyond what we are supposed to do. So it had to be a simple process.
5	So we started by contacting them, and I was quite early on the ball with the contractors to find out what eco-friendly measures we could do here. But they did not know about the possibilities for enøk measures in relation to district heating. Skills gap there.
6	Energy management is something I have also tried to find out and talked to the contractors about. Still, I need help understanding how the district heating system - i.e. the radiators- works.
7	There also needed to be more competence in this regard on the part of the contractor and project manager.
8	I could have set up a meeting with Enova myself, but then you come back to how much time I will actually spend on this.
9	You can tell from the contractors that they have done things their way and have done so for many years. It has worked, and it seems they don't pay much attention to how to achieve enøk-measures there (district heating).
10	Electricity prices have been low, but district heating prices have been relatively high. I haven't looked at the invoices lately, but the expenses for district heating probably went up two times, three times almost. Plus, we spent a hell of a lot of money every month.
11	But then you get to know many people in the industry. We are associated with electricians and lift constructors and one with the other. So I am just asking. There are solutions. We also get help from the housing developers to find good solutions. And then they tell us about what others have done, and we start searching
12	One of the big barriers is also that there are big processes that you have to set aside time for. When starting

	with contractors or something else, I wish they knew which energy-efficiency- measures were best. That it is like that - here are the enøk-measures you can take. On that side, those who offer things were much more aware that they had information about it readily available.
13	Yes, there is far too much dialogue. It takes so long. It is almost a barrier that they are so damn chatty on the board that you almost want to get through and not bring up any new issues.
Informant 2	
14	So it is clear that a lot of money will have to be borrowed, and the financing of that is the rent. It is only there that you can finance at least the largest amounts. We financed something, of course, with the nursery school and the business premises, but it is practically nothing.
15	After all, money was thrown out to a consultant who earned a couple of million a year. I arrived on 1 February, and in March, I fired him. I realised that he had no idea what he was doing. He had big ideas but no ability to follow through. Failed to read the context in the system.
16	Because We had a lot of bad habits (with residents) because there was no thermostat with the old radiators, so it was usual to ventilate with windows. Then you cool it down, but then you come back to how much time I will teach the neighbourhood.
17	What was a bit of a problem here, and which has been a bit of the background for everything, is that since the buildings were completed in 1969, no maintenance was done until 1992, so to speak.
18	There were 30-40 water damages in apartments every year. And then, the board decided that they should start a wet room project and should then renovate ten bathrooms a year. With 819 apartments, it will take 82 years to complete. How many people have renovated their bathrooms in the meantime? And who do you think was the first to get it? Chairman, yes.
19	The chairman who sat there then actually sat as chairman for 32 years. It's not good; you really shouldn't have that. At least not him, who didn't do his job.
20	No maintenance was done, nothing was planned, and he had not set aside any money. He had 16 million in an account when he started with the maintenance. 16 million, and then we rehabilitate for 450 million in total. They had 16 million; the rest was loan-financed. And then everything came when nothing was planned.
21	When everything builds up and has to be taken, you also push forward simple enøk-measures because you have to save money.
22	We have had operational problems with the heat pumps and systems we bought, which need fixing.
23	Then we went through everything and looked at all the things we could do, and among other things, we thought about solar collectors on the roof. But we couldn't get it profitable because we had a CO2 heat pump, and it was so efficient. It was too expensive to buy.
24	Still, if we had done the work earlier, we would have avoided borrowing NOK 400 million. That's quite a lot of money. Consider the huge interest costs. We now see when the interest rate will rise; we will pay almost NOK 15-16 million a year in interest. It is very, very much.
25	There are now proposals to measure energy use at each individual point. Now, in the first instance, tap water, which I don't quite understand why should be the most important thing. But it is clear that it has a big impact on us. It will be a huge expense.
26	Also, with these radiators. Then we have to come in with a meter for 2,700 radiators. And last but not least, there must be a system behind it to handle settling and invoicing again. And how much the rent must be

	reduced to pay for energy in that way. It is not that easy. So we keep a close eye on this because it becomes much more difficult for us. I'm not saying it's impossible, but it will be difficult.
27	But with these big projects, such as replacing the radiators, we wouldn't have had a chance with him (the plumber). Then we had to go to Vestlandet and pick up someone from there. MT vest is their name. We also picked up a bunch of Lithuanians who worked here. Concerning the fact that we are so big, not everyone can take it.
28	But we have also had some bad experiences. For example, with the company Thorendal that operated here, those who have rehabilitated the blocks were a big project, 200 million. And then we have some slightly smaller jobs to do now, but they will not come. 2 weeks ago, the collaboration ends. Now it's finished. Then they will not be called in next time. Then they miss out on a few million.
29	We carried out a major case - here you can also see the consequences of the legislation - i.e. this with electric car charging. It has then been decided that all housing associations and condominiums will be required to make arrangements. This means that the infrastructure must be in place. Then we had to do it. We have a garage with space for 500 cars. And they all had to have access to an electric car space. So we established the possibility of electric chargers for 500 cars two years ago. Cost us a lot. So that is the consequence of such a decision. It had major ripple effects. We had to replace substations.
30	When it is decided to be carried out, the support disappears. One should make sure that things are done before it is adopted. Now I read that new homes are to be built, and it says that all homes must have a heat pump. But it is also idiocy that in 2020 you set up ordinary panel ovens. I do not understand why that is happening today.
31	When we had to rehabilitate the verandas, everything was put on a membrane, but the slope was not changed, so it was kept as it was. Then, there is a pool of water in the corner. It would have cost us 10 million more if we had done everything again, but we would have finished. Now we have to start doing something about it again.
32	This board I discussed was thrown out of confidence the following year. They did many strange things. Started an investigation of me, too—embezzlement and theft, which I have not done. Cost us half a million kroner, and nothing came of it. That was enough for the general meeting. If you are going to conduct an investigation, it must be decided at the general meeting; the board cannot do that alone.
33	We have applied for support (enova) for the windows, but then they have set a u-value of 0.8 on the windows. It is extremely low. We ended up on 08.6. You have to have 0.8 to be paid, but then we will not be paid 330,000 because of that. The whole thing is silly from Oslo municipality. Shouldn't one look at how much the reduction is instead? Only counter to set a requirement for 08. Then you have to install wooden windows, which require much more maintenance than aluminium, which is maintenance-free. Slightly higher u-value, but not much.
34	We bought bio-oil, which was good; we bought quite a lot. And then they changed their pricing system, which was twice as expensive, plus more. Because now it is required to use it. Then we no longer use it. So it is a bit silly that the supplier realises that this is something they can exploit. The price is a factor because they now sell less than they should have. We buy regular diesel.
Informant 3	
35	It is much work. You get paid a little, but not what it is worth.
36	But now we have already increased the joint costs. And we have to finance with loans. For us to be able to

	save up several million to start, something like that means a very large increase. That is where the challenge lies. Because with interest rates rising, we cannot afford it. Interest exceeds savings.
37	But the challenge is that we are built so high and not wide. Because we have such a small roof area, it looks big but is not. But it is a shame because we have optimal solar access here.
38	We don't have room. These housing associations here only own the block. It runs like a circle around the outer walls. Then the municipality owns everything else and is unwilling to cooperate with us. Not to any great extent.
39	We had received NOK 100.000 from Enova, but that is all we have received in support. We could also get solar cells, and then there was talk of a subsidy of NOK 300.000, but more is needed. We had to have battery banks for that investment to be worthwhile, but they are expensive and last a short time, and if there is no more help in the future, we have to take out a loan for this here. Sell the power if necessary. There is no question that it will not pay off. And it gets way too complicated.
40	But finding out what to get and how to apply is complicated. For me, who is sitting here alone, if I have someone with me, it helps. However, it also costs money. I cannot just go to a business and ask if they can help me with something and expect them to do it for free.
41	The biggest barrier is the economy. And to find out opportunities. But economics sets limits on everything
42	It has been almost a full-time position since we started here. And I get paid 40,000 a year. These (artisans) start work at seven in the morning, and then there are calls steadily throughout the day from someone who needs help with something or questions. Things must be fixed quickly, also on weekends. Fortunately, I'm flexible (a student), so I can be at home often, but it takes a lot of time.
43	They all have full-time jobs, except for one, a deputy member, so she does not take very much. Getting people who want to stand up and have the knowledge to do so is challenging. After all, we manage, we have a budget of approx. 5 million. It is a multimillion-dollar business that must be taken seriously. So it is almost irresponsible to bring in anyone who will sit as board chairman.
44	We are individual housing associations, so we don't share accounts or anything if the others don't want to. And I think it is difficult to get them involved. But that's the theme of everything - this will be an extra job for people who just get annoyed. But someone has to take it. And I don't work like that; I have to do things properly when I first have to do something. We are people with different backgrounds forced to work together or relate to each other.
45	Yes, it is very stupid that the legislation is not as accessible to us as it should have been. I noticed when we took the balconies that I could not access them. Because the law is supposed to be public, but it just is not. So that is really what has been difficult. We sit here as normal people who do not know the law and must study and find out the legislation ourselves. I have requested that the housing association make such a legal introduction because we face many legal challenges. But I have not got it yet.
46	So I really want to know a lot but do not know where to start. Because there is no such collection portal. Various elements are left behind.
47	But there have been challenges, such as discrimination against women. They really underestimate me. We had one in particular; now he is out, he ended up moving, and he was very concerned that women could not do this and that, especially when it came to working, practical things, in general. But I know a lot of that too. But it was a bit like that - the men were right. Fortunately, there are few, but there are some.

Informant 4

48	Because if you talk to a plumber, he has his solutions; if you talk to a heat pump supplier, it is heat pumps that he wants to supply. If you talk to Agder Energi, they have the things they can do.
49	What is typical for this housing cooperative is that there is much old infrastructure, we do not have measurements, and we do not have management options. Or minimal control options. We are connected to district heating.
50	There has been cooperation over the years (between the cooperations), but sometimes the chemistry has not been right between the people, and there has been poor cooperation. And sometimes there has been good cooperation.
51	You could also say that something that is a problem is that, in general, money is really bad in these housing associations. We can adjust the rent and save money and also run some projects. But money is bad. So if you need money, you collect it from the residents.
52	X also said something about solar cells on the roof there. It was not a lucrative business, or at least they did not feel like it; the repayment period was too long. Then there are, for example, different support schemes that come and go. And enova. If you want to start counting on it, and if the board will sell it in towards the general meeting, you must have done your homework. However, it is not always so very lucrative.
53	Then it was not just energy saving, but deciding which colour should be on the plates on the outside. As you saw, they disagreed, so three different types were chosen. Yes, they took time.
54	You cannot come to a general meeting and sell in a big rehabilitation project without doing your homework because that is where all the critical questions appear. And it was downvoted; it was several times. Moreover, the board was asked to go back and investigate more, but again all credit to those who went ahead for this and got it through. And then, it was presented at the general meeting, and I do not remember the number of votes, but in any case, it was more than enough for it to be carried out. But strong forces were also working against it, precisely because it was a large investment. 38 million. That was a lot. X works with quite a few more million, but it is a few years later. So it meant that solutions were discussed even more deeply, and in the end, it was all right to spend some time on it. But it was tiring for those who could not sell it after the first and second proposals.
55	Also, what is always recurring is the economy in it, so it is the money. Some will fight hard against the rent going up; they do not want a few extra hundred pounds a month they have to pay. They may not see the community, the block as a whole, and the surrounding area as much. So again, first-time owners will come and live in that apartment for a few years and hope to earn money from it. It does not always coincide with an expensive rehabilitation project. You will not automatically get the money back again.
56	There is a company here in Kristiansand that can supply five gw hours - they can supply 8 GWh to Agder district heating - supply energy them. Agder energy Varme only receives 2-3 GWh; the rest of that heat goes straight to cooling. And it is a shame because then there is something about that pricing policy: they put themselves right below the price of normal electricity.
57	After all, some say they fire up with panel stoves; it is not hot enough with ordinary radiators. So there are a lot of opinions around.
58	The board's challenge is also to find out what might be the best solution.
59	The current chairman has some rental apartments for students. And when it is at its coldest in winter, and he walks around the flats, it hurts him terribly when he sees all the windows open. They have electricity included in the rent. There is no incentive for those who rent to save. We have a water meter common to the block, and I followed it quite a bit about how much water was used. And it varies, and there is no incentive if you do not have individual meters to save on hot water.

60	You can also explain that depending on where you are in life, you can have different views on energy saving and young people like you have no problem with a trinket that is supposed to control something, but older generations may not want to use it.
Informant 5	
61	We only have three-room apartments, which means that many people have one child and would very much like to have another child very quickly, and then they move.
62	There has been too little focus on thinking holistically. That is the challenge today.
63	We have ended up with perhaps too young aboard. And it should have a slightly older board.
64	Our deputy leader chooses not to apply for re-election because she has become pregnant and will have a child; the same applies to several of these. You are on the move more; you move more often and have a different approach to the world than those who have established themselves and are done.
65	It was also re-insulated in 2006. But at that time, they added 5 cm because it is not compulsory to apply for the municipality, so this was saving because then you avoided the municipality's fee of 130,000. But we still have many drafts, and it is cold.
66	But now that we are in a slightly difficult financial situation that we are in, which means that we have to stop it for the time being.
67	Also, you can say that it is because the blocks are different sizes. The block here has three risers, and the block next to it has 6. So there will be reduced costs to do it on the smaller blocks, but it will also mean you get less. We cannot sell electricity to the residents but only use our electricity.
68	In the past, it was in the legislation (I don't know if it still is) that the municipality at the time and the power plants were only allowed to earn from electricity. And I think that the electricity companies themselves - this should really almost be a non-profit piece - you produce to create the best possible supply for your residents, and then you can sell again - because then you are in storage again - you can sell out to Europe - but this is a policy that has existed since the 70s. So it is not just about changing that.
69	And it is often what I often experience as something challenging here is that the previous boards have been very much on "the less information, the fewer questions we get".
70	For example, we have the lawyer over here who was supposed to put me in my place at the last general meeting - I understand that he wants to put me in my place and that he can do it without any problems because he has an education that I don't have in the legal field. We cannot sit and discuss with 400 people present because we will get nowhere because I cannot answer.
71	We also have her 93-year-old grandmother, who comes to complain about the curtains she bought; she believes that the housing association should pay for her installing the curtains. But the problem is that they have adapted to 93-year-old Olga and not the housing association itself. That is the challenge.
72	Before this, the housing association was run on a hobby basis, and when you run such a large one on a hobby basis, you screw it up.
73	The challenge, for example, with X is that the previous chairman worked at X. It is an unfortunate combination because you cannot separate several hats simultaneously. You are making a mess of it and have a management position there. I would say things have been tidy, but it still doesn't seem to be tidy out there because people don't know.

74	Those who drilled the wells were delayed all the way—many problems. I do not know why it was like that. The only thing I remember before that was the people who changed the windows in 1988; they took some courses during the project, then there was goodwill and people who solved things, but they did many strange things. They removed the glasses but did not remove them and used reused frames.
75	They then wanted to look at a joint purchasing agreement, e.g. a joint agreement like this on one and the other. But there were so many residents and things then that it would be difficult to follow up because you need a solid administration. If you combine X and X, there are more than 1,500 units.
76	The challenge is that if you take everything at once, that knowledge will also erode as that person disappears. And that is also what has happened because the old chairman and I got into an argument, which meant he had just left. Then I cannot use him. So yesterday was my first time speaking to him in six months. It goes without saying that if you cannot, call your neighbour and ask. Then I had to sit down and read all the reports from his time to know what has happened in the condominiums over time.
77	For example, one of our challenges with the old board leader was that he was very technical about things. Extremely technical on electricity and that kind of things, and could talk about Kwh and prices, and I need to help understanding something. And we must dumb it down so that people understand that our solar panels can produce the same as a Ford Mustang every hour.
78	So the borrowing has been approx. 170-180 million during the ten years. And interest rates have fallen, and municipal agreements have been put on hold. What is happening now is that everything is becoming more expensive, interest rates are going up, and we have higher borrowing costs, which also means that borrowing costs have exploded in addition to interest rates have exploded, and in addition to electricity going up. So that means that suddenly everything costs a lot more. And in 2018, it was not set up (solar panels) because the interest rate was zero. The same was not done in 2019, 2020 and 2021. In 2022, 3%, 5%, and 30% were taken first. Because it had become nothing, it was a standstill; it became a habit.
79	But these old windows were installed in 1988 and had no standard; there was no requirement, it leaked air. Back then, you had the option because wooden frames could be bent. This means that our crooked building is almost impossible to seal.

Appendix D

Enablers

Informant 1	
Quot. nr.	Quotation
1	The good thing about Oslo is if you want to highlight something positive, the municipality and subsidy schemes come up very often on social media. They probably pay a lot on Facebook for advertising, so solar cells on the roof, bicycle sheds and that type of thing - are good things for the housing cooperative.
2	Someone with professional expertise who can be a point of contact for the contractors is also necessary for us now because there will be a lot of work during the day anyway.
3	But it is clear that there were increased costs, and since we are going to replace radiators, we have had to increase the rent by 20 per cent, which is quite a lot. It will cover these radiators, which is 20 per cent, but considering that we don't have high electricity bills, it's ok. And those are the joint expenses.
4	People were understanding and probably think that they almost felt that way on their conscience that we have gotten away with the electricity prices. It is not the housing association residents who pay these district heating prices, so they do not see the bill. That joint bill of ours. If they read the annual report, they see it, but it's not that often you sit and read it. At least, not everyone does.
5	But, of course, it is important that such things are reviewed by a board and approved. That people agree that we should go for it. That you have a board that you can raise issues with. We always have an opportunity for any issues at the end of meetings. The same issues, parking in the backyard, are always brought up there, etc. We also have a Facebook group - and people are good at complaining if there is anything. And emails.
Informant 2	
6	We had six meetings for residents, three during the day and three in the evening, where we talked about the project, why it is important, and how it will be carried out.
7	With things like this, we wouldn't have needed to go to the general meeting with them. The board can do that alone. They are authorised to do so. It is actually in the law. The board can only sell shares; they cannot create new shares, remove shares, or buy or sell the property. Everything besides that they can do. So they are sovereign and are completely sovereign.
8	So, the board does not take much time because I have planned things in advance. After all, I present these plans, and then they really decide yes or no. I haven't had anything rejected yet, as I don't put forward a case that I haven't spent much time on and am sure of.
9	I think that you should collaborate more closely than what we have here. On several points, actually. We have X, which only has 100-150 apartments less than us, and then we have the red blocks over there with 400-500. The cooperation here should have been much better. We could have pushed prices down quite a bit. So I've been on it. I will get at least the chairmen and day-to-day managers to let us get closer, maybe have a monthly meeting.
10	After all, we have our partners that we use. And then, for example, with the plumbers, we use someone from

	Jessheim, who is very good. It is no-nonsense.
Informant 3	
11	But then you get to know many people in the industry. We are associated with electricians and lift constructors and one with the other. So I'm just asking. There are solutions. We also get help from the boligbyggelaget to find good solutions. And then they tell us about what others have done, and we start searching.
12	Electricity prices are not the worst; it is quite stable now. We have negotiated a new agreement with a power company, which is stable at 60-80,000. And we have replaced all the lamps with LED lamps, sensors, and all this here. So it's just the lifts, laundry, and lamps that take electricity and heating cables outside
13	It was a collaboration with Enøk Total. So they contacted us and asked if we were interested in power saving or energy saving. And of course, we said yes, we can save much money on that. So they started the process, but we are the responsible applicant for that. So I wasn't very involved in that application process.
14	But I collaborated well with him; all four chairmen also sit in the association. And there we meet a few times a year and discuss.
15	Yes, we have built up a good base with good people. And also some we have yet to be satisfied with and know we will not choose again.
16	The workers have been good at staying within their working hours. We have always been cautious about informing residents about what will happen and what they can expect, which has helped greatly.
Informant 4	
17	Energihuset was in and did a survey, and where we then asked them for advice - what should we do? We want an independent actor who can handle things and give us the best advice.
18	But it was crucial with help from Sørlandet Boligbyggelag and the board that was in place with people passionate about that rehabilitation. You need someone with the stamina and the willpower to push through with a project like this. After all, it was a general meeting. It was voted down. It was adjusted and resubmitted. And in the end, people agreed that we must do this.
19	As a board representative, I was at a lecture or a sales meeting; SOBO called in some actors and explained and taught us stuff.
20	Yes, so X has been very open about what they have done, and I think X also thinks it has been very good and talked about how the rest of us do it. You can see by talking to the other blocks that it is very similar. So it would make sense for us to go out together and to suppliers and ask for offers, e.g.
21	But then again, it was especially one person who burned for this that pulled it through.
22	There will always be complaints or reclamations, so it is a process. But on the whole, it was carried out well. (artisans)
23	No, that is, individuals who are passionate about it. They have great opportunities to get what they want, but it depends on them coming up with sensible things. Then they actually have a good opportunity to get the people or the residents involved.
24	With SOBO, we have much technical expertise. Housing cooperatives know they can get help and advice from them if needed.

Informant 5

25	Yes, Obos was here. We ordered a collaboration with obos, now I'm not sure what it's called - but we ordered a survey from obos. Based on that, they went for the joint facility, wet room, etc., because we wanted to use that project for a holistic idea.
26	We received support for a total of around NOK 500.000 from Enova. The project itself cost NOK 1.4 million. Also, we received support for project management.
27	We could not do anything without our partners in the OBOS projects. And the suppliers.
28	The new board has informed much more and received more inquiries since they shared more. However, you also have to share it smartly.
29	Yes, the general manager is, after all, at the top of the business world. He has worked with several smart systems himself. He is a 65-year-old man, so he is an adult. We brought in X because he has financial expertise that perhaps the board does not have, the specialist expertise.
30	But now I feel things have improved slightly because we have brought in a slightly younger board that might see that part.
31	But the economy has to be defended against the residents. That is what you can defend with; as long as you can defend things to the residents, things will work out. The most important thing to tell people who are going to sit on boards is that they have to map what-ifs; if you still need to map them, you will come unprepared.
32	Thinking again, yes, smart then, you have to come out with information and defend it; then you have to get it down to such a human level that an idiot like me can understand it.



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