A qualitative analysis of the internal organisation in Dutch thermal energy communities

MOT Master Thesis

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TU Delft

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by

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TU Delft

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Wouter Nijhuis
Delft, October 2024

Executive Summary

The purpose of this report is to investigate how Dutch thermal energy communities can successfully transition from grassroots initiatives to formal thermal energy organisations. The study explores the knowledge and values required by community boards to achieve this transformation, focussing on how they address internal knowledge gaps and collaborate with external stakeholders. Key areas of inquiry include the types of knowledge needed, how the board ensures community members understand the social, environmental, and economic impacts of thermal energy, and the role of partnerships in advancing these initiatives. The findings aim to provide insights that can support scalable implementations in the Netherlands and Europe.

The theoretical framework of this report is based on the 3C model, which builds on Amartya Sen's capability approach. This model emphasises three key capabilities: conscientiality, conciliation, and collaboration, which are necessary for the successful transition of thermal energy community initiatives into formal organisations. Conscientiousness involves raising critical awareness within communities about their energy needs and environmental impacts. Conciliation focusses on the building of consensus among stakeholders, while collaboration emphasises partnerships with external actors, such as municipalities and energy companies, to access resources and expertise.

The research methodology combines a qualitative approach with thematic analysis. Semi-structured interviews were conducted with key members of five energy cooperatives to gather insights into community dynamics, knowledge sharing and values. These interviews were supported by an analysis of existing literature and two additional interviews. The data collected was analysed using a systematic coding process, grouped into themes aligned with the research questions and the theoretical framework to identify patterns and insights related to the development of thermal energy communities. This methodology ensures both reliability and validity in capturing the challenges and successes of grassroots energy initiatives.

The key findings of the report highlight several important aspects of thermal energy initiatives in the Netherlands. First, these initiatives require diverse knowledge, including financial, technical, and organisational expertise, which can be sourced both locally and externally. Partnerships with professional entities are crucial to fill knowledge gaps, especially in the legal, technical, and financial areas. Community involvement is essential for the success of these initiatives. Trust and familiarity within the community are critical to convincing residents to adopt sustainable heating solutions, especially when costs are comparable to traditional heating options. Personal interactions, such as one-on-one conversations, were found to be the most effective way of sharing information and gaining community trust. Collaboration with external stakeholders, especially local governments, is also vital. The success of these initiatives often hinges on their relationship with the local government, which is involved in the funding, approvals, and overall support of the project. However, challenges such as differing work paces and ownership questions can slowly progress. These insights provide a clear understanding of the dynamics and hurdles faced by thermal energy communities in the Netherlands.

The study found that knowledge and trust are critical factors in the success of thermal energy communities transitioning to formal organisations. Boards rely on a mix of local expertise and external consulting for specialised knowledge, with local involvement fostering trust among residents. Personal involvement, such as door-to-door communication, is essential to gain support. In addition, collaboration with external partners, particularly local governments, plays a key role in the practical implementation of projects. Challenges such as ownership and the varied cooperation of municipalities have emerged as significant hurdles. The study suggests that the ability of the board to manage knowledge, build trust, and collaborate effectively determines the success of these initiatives.

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1

Introduction

In recent and coming years, the Netherlands needs to take significant steps in the energy transition, with the aim of reducing its dependence on natural gas in favour of more sustainable energy sources (*The Netherlands 2020: Energy Policy Review*, 2020). This chapter introduces the central issues of this energy transition, focussing in particular on the role of energy networks and community-based energy initiatives.

According to the national climate agreement, all Dutch buildings must be free of natural gas by 2050 (Rijksoverheid, 2019). In 2030 1.5 million houses and other buildings should be made more sustainable or natural gas-free, helping to reach the renewable energy targets set by the EU (European Commission, 2023). The government plans state that this should be done under the supervision of local authorities (Rijksoverheid, 2019). Thus, local authorities have an important role to play in the implementation of this energy transition. They decide which solution is best for each neighbourhood. They do this in cooperation with residents, cooperations and energy companies (NPLW, 2023). Crucial in this cooperation is working together to promote renewable energy and support local energy initiatives (Klimaatstichting HIER, 2023b). Heating networks initiatives offer the potential for neighbourhoods to collectively transition to more sustainable heating solutions. Community energy initiatives are particularly promising as they allow residents to take ownership of the energy transition, fostering a sense of involvement and responsibility (Rozite et al., 2023).

1.1. Heating Networks in the Netherlands

Heating networks have emerged as a prominent solution in the transition of the Netherlands away from natural gas. This section explores the concept of heating networks and their implementation.

One of the solutions described in the MJP (meerjarenprogrammaplan) (2023) of the NPLW (National Programma Lokale Warmtetransitie), to achieve this goal, is to work with community initiatives based on heating networks. These initiatives work to replace the connection to the natural gas grid, by connecting to a district heating network or using solutions including thermal insulation and heat pumps. These heating networks come with several solutions; some work with residual heat, others work with biomass, geothermal energy, or aqua/solar thermal energy. Figure 1.1 shows the most common types of heat sources listed.

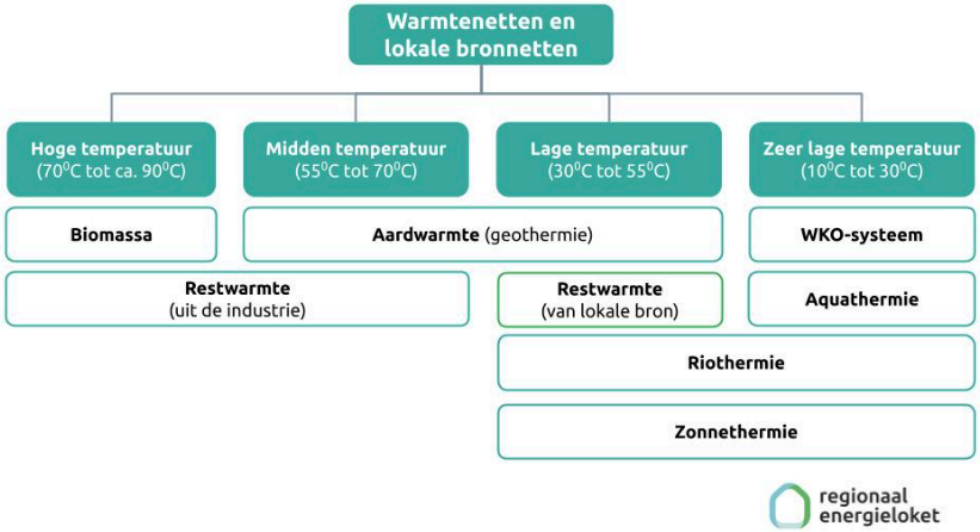


Figure 1.1: Most common types of heat sources (Theodoor, 2024)

One of the key reasons heating networks are considered a favourable solution is their ability to cater to large groups of homes, providing centralised systems that can be more efficient than individual home-based solutions (Vattenfall Heat UK, 2024). As shown in Figure 1.1, they can also take advantage of various heat sources, allowing flexibility in how energy is supplied. However, district heating solutions are highly dependent on local conditions, available infrastructure, and, most critically, the participation of local communities. To fully replace the natural gas grid with a district heating system, it is essential for these community initiatives to develop a feasible business plan. This involves collaborating with various stakeholders, securing funding, and more. To accomplish this effectively, these initiatives must become formal organisations. This is necessary because communities are formed around people who share a common speciality or interest and exist to help their members (Garfield, 2023). But communities are not the institutional setting that is good for realising projects such as a district heating network. Organisations, on the other hand, share some characteristics, are not self-forming and exist to get work done (Garfield, 2023). The latter is important in the implementation of projects and ultimately in achieving the sustainability goals set by the Dutch government.

1.1.1. Buurtwarmte

TNO looked at the drivers and barriers for residents to switch to a natural gas-free home. They recommended "*developing a neighbourhood approach that responds to the different steps of the customer's journey to natural gas-free homes*" (de Koning et al., 2020). The Dutch federation of energy communities *Energie Samen* has been developing such a approach called *Buurtwarmte*. *Buurtwarmte* helps local initiatives to start a thermal energy community. The *Buurtwarmte* approach follows a step-by-step path divided into four phases; an initiation, develop, build, and exploitation phase (1.2). This approach is based on the knowledge and previous experiences *Energie Samen* has about energy communities and is still in development at the time of writing this report.

Figure 1.2: Buurtwarmte Approach (EnergieSamen, 2024a)

Energie Samen has been implementing and testing this approach with seven replication sides across the Netherlands. These seven initiatives come from various places in the Netherlands such as; Den Haag, Utrecht and Groningen. They all have a different approach to how to provide their respective neighbourhood with heating. They have recently finished the initial phase, which was part of a Horizon 2020 EU funded research project entitled SCCALE20-30-50, which focusses on scaling community energy projects, practices and impact (SSCALE, 2021). Within this project, the focus has been on citizen participation and building a support base for collective thermal heating solutions within their neighbourhood. Currently, these replication sides are working on the development phase, hoping to progress to the building and exploitation phases soon.

1.1.2. Institutional Setting

These community initiatives in the Netherlands that work on sustainable energy solutions have a specific institutional setting. According to De Vries (2016), these local initiatives demonstrate a lot of diversity in how they are organised, each project is rooted within the community, and the articulation of goals and values that led these communities to the development of a sustainable energy solution. Although each initiative has its specific traits, De Vries (2016) found that there is a peculiar form that these communities share, "*they are open technical systems in which technical components, business cases, skills, and community goals and values are configured in multiple local systems* (de Vries et al., 2016). This makes them different from conventional communities, like sport- or religious-communities. Conventional communities might have a governance structure, separate groups, and financial resources originating from contributions. They do not have to provide a viable business case or run a technical system.

Bringing these components together is the task of the board. The board is a small group of people who are responsible for achieving the goals set by the community, and they also monitor the progress of these local systems. Van Der Windt (2021) found that this requires a considerable level of knowledge about your neighbourhood, technology / construction, revenue models, communication and participation with the members of the community. The support of third parties or paid professionals can compensate for a lack of expertise within the board. However, the board remains responsible for acquiring both internal and external expertise. Knowledge should be brought in; this means that people in the community need to build their own knowledge base. External knowledge can not be forgotten about; when the existing knowledge is not sufficient, this should be complemented by external knowledge, such as advisory reports from market professionals. In addition, the board must articulate the goals and values of the community that led to the development of a heating network.

This is where the community also differs from conventional business setups due to the participation and value sharing of the community. In traditional businesses, values are often created and controlled by a central entity (Deal and Kennedy, 1983). However, for thermal heating communities, the creation and sharing of values is more decentralised. Participants actively contribute to the development and success of the community, and in return they receive a share of the generated value. However, decentralisation of values means that there should also be a way of reconciling diverse opinions in a way which still allows members to drive towards a coherent aim. This differs from conventional communities, which are typically defined as social units with shared socially significant characteristics (Cambridge Dictionary, 2024). Although conventional communities are often bound by common interests, values, or geographic location, thermal heating communities are more dynamic and purpose-driven. The focus is on collaborative efforts and mutual benefit rather than merely shared characteristics. This results in a unique blend of business and community elements, where the board plays an important role in managing the balance between these two.

1.2. Problem statement

Despite various efforts to support the energy transition, there are still significant challenges facing the thermal energy communities. This section outlines the central problem that this research will address and the gaps that still exist between theory and practice.

In the Netherlands, there are already several initiatives that actively work to replace the connection of households with the natural gas grid, either by connecting to a district heating system or using solutions that include thermal insulation and heat pumps (PAW, 2023).

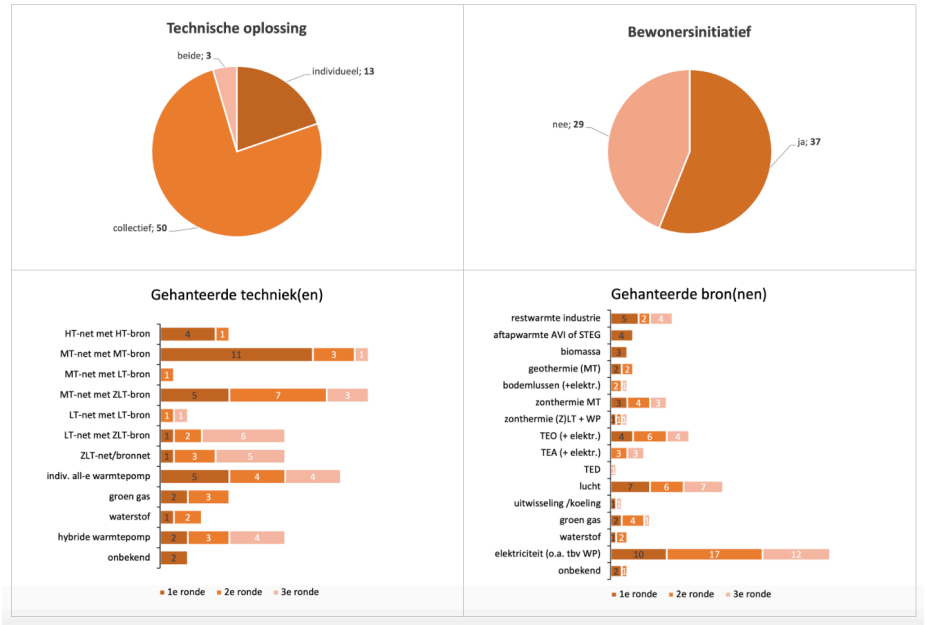


Figure 1.3: Composition of different ongoing heating solutions in the Netherlands (PAW, 2023)

To do this, local residents must be involved. This is often done by forming thermal energy communities, typically in the form of an energy cooperative. This has to do with challenges with regard to legislation, government support, and ownership. A new Dutch law titled *"Wet collectieve warmtevoorziening (WCW)"* should help tackle these challenges; however, this law is still waiting for approval (van Wolferen, 2024). So, despite the efforts of communities and organisations, like *Energie Samen*, numerous hurdles, such as financing and ownership, still persist to effectively establish thermal energy cooperatives.

Since their establishment in 2018 they have helped many cooperatives in setting up a collective energy solution. During this time they found that the literature shares a great deal of knowledge about citizen participation. However, *Energie Samen* found that there is a gap between science and practice when it comes to setting up new community initiatives in thermal energy as organisations (Energie Samen, n.d.). Although the external structure of an organisation will be described by the WCW law, *Energie Samen* assumes that if an initiative wants to progress, internally it should have clear organisational bases set up. The external structure divides the shares between stakeholders, such as the local government, private companies, or the cooperation itself. The internal organisation is meant to describe the structure and inner workings of the initiative. The assumption is that the latter requires clear values and a strong knowledge base within the organisation itself, which is not always present.

1.3. Research objectives and questions

Having identified the central problem, this section introduces the specific research objectives and questions that guide this study.

1.3.1. Research objectives

Following the problem statement, the purpose of this research is to investigate what makes a strong internal organisation. How do thermal energy communities deal with any lack of knowledge and how cooperate with other stakeholders who may have the knowledge they need. In addition, this study aims to find out how values play a role in the transition of an initiative into a thermal energy organisation. This research should investigate how the community itself can develop into a thermal energy organisation capable of developing and exploiting a natural gas-free solution. The objective is to paint a clear picture on how communities balance between in-house knowledge and knowledge available on the market, how they share this knowledge but also their values within the community.

1.3.2. Research questions

The main research question forms the basis for this research into Dutch thermal energy communities. The four sub-question each provide a different insight into the type of knowledge and values that are needed according to the theoretical framework that will be discussed in Section 2.4. In general, these questions should provide meaningful insight into understanding how community initiatives develop further.

Main research question

The main research question serves as the central focus of this research. It defines the purpose and scope of the study and encapsulates what this study tries to explore. The aim is to explore how community initiatives based on thermal heating solutions develop themselves. The research question is as follows:

"To what extent do knowledge and values within the board of Dutch thermal energy communities influence the transition of the community initiative into a thermal energy organisation?"

To help answer the research question and better understand the incentives within the thermal energy initiatives, the research question will be supported by subquestions. These sub-questions are based on the theoretical framework described in Sec 2.4. This 3C-model by Ibrahim (2017) demonstrates three capabilities that can be built within a community process; these three are linked to the sub-question.

Sub-questions

The first sub-questions aim is to create a basis from which to work. Knowing what is perceived to be the necessary knowledge needed for the transition into an organisation is vital to provide a starting point from which the theoretical framework can be built.

1. ***What knowledge does the board possess and what do they identify as necessary for the transition of community initiatives into a thermal energy organisation?***

After developing the concepts within the research question. The next three sub-questions delve deeper into the reasoning behind the need, or perhaps the non-essential need, for certain knowledge and values. These are based on the three capabilities of the 3c-model.

2. ***How does the board ensure that members are equipped with the necessary knowledge and information to understand the social, environmental, and economic impacts of a thermal energy initiative?***

The second question aims to gather a better understanding of critical awareness and empowerment among community members. Understanding how they participate in decision-making processes and how they can voice their concerns. In the 3c-model this is described as conscientisation.

3. ***What approaches does the board take to promote dialogue and understanding among stakeholders involved in thermal energy initiatives?***

The third question is based on conciliation; it helps to understand how energy communities build consensus around shared goals and values to reach a common goal.

4. ***How does the board employ collaboration and partnerships in their efforts to transition household initiatives into thermal energy organisations?***

The last question describes collaborative efforts and answers how partnerships are incorporated in energy communities to pool resources, expertise, and networks together.

These four subquestions, together with the main research question, are designed to provide an idea of how communities build their capabilities, and it is not irrelevant what capabilities they possess. This will provide insight in what capabilities are needed within the board to develop a community initiative into an organisation.

1.4. Structure

This section provides an overview of the thesis structure; the thesis is structured to guide the reader through the author process. Outlining the path taken in conducting this research that goes from a theoretical foundation to practical findings.

The literature review, chapter 2, will start with a general introduction to community energy solutions before delving deeper into the technicalities of one specific community energy solution, namely thermal energy communities. The chapter continues with the challenges of managing such an energy community, leading to a knowledge gap. After identifying the existing gap in academic knowledge, this chapter will introduce the theoretical framework that guides the research.

Chapter 3 describes the qualitative research methodology used in this research, which will include literature analysis, case selection, data collection & analysis and ethical considerations.

The next chapter 4 describes the findings of the data analysis. This chapter is divided into five sections; the first four sections are knowledge, citizen involvement, information sharing, and collaboration, following the structure provided by the theoretical framework. The final section discusses the main points that are derived from the data analysis.

The final chapter 5 discusses these findings and what these findings entail in both research / academic and real world / practical ways. In addition, discuss the research limitations and validity as well as further research recommendations which will allow us to tackle some of those research limitations. This will be followed by practical recommendations for thermal energy communities. Finally, combining the results and the discussion, the last section will answer the research questions. In addition, it will provide the link between this thesis topic and the MOT master programme.

The two appendices contain the materials that help in understanding the research methodology. This information should add to the reliability of the research, it includes the literature search [A] and the interview overview [A].

2

Literature Review

This chapter will describe the theoretical background of this research proposal. This was done through a deep dive into the existing literature related to energy communities, identifying a knowledge gap suitable for further research, and introducing a theoretical framework for this research.

2.1. Community Energy

Local energy communities or projects such as heating networks, as described in Chapter 1, are referred to as community energy (CE) initiatives. Community energy refers to a wide range of projects in which citizens play an active role, either through ownership, participation, or direct involvement in the production, distribution, and/or consumption of energy resources (ClientEarth, 2022). These initiatives promote more sustainable decentralised energy systems, often driven by grassroots efforts, and offer local solutions to broader environmental and energy challenges.

The first notable step toward CE in the Netherlands occurred in 1985, when a community cooperative was formed with a primarily focus on wind energy (Oteman et al., 2017). This marked a significant point in the development of community-based energy solutions, as it demonstrated a shift from government-controlled energy production to a more participatory model where citizens had greater autonomy over their energy choices. According to research conducted by Marieke Oteman (2017), the origins of this CE movement can be traced back to the anti-nuclear protests of the time. The early emergence of CE projects was driven by public dissatisfaction with government energy policy, particularly with its dependence on non-renewable sources and nuclear power. This grassroots resistance to conventional energy sources created the foundation upon which CE initiatives were built.

However, these early energy cooperatives faced several barriers, especially a lack of clear regulation. The energy market was tightly controlled, and private party energy generation was not yet legally allowed. As a result, these early initiatives struggled to gain momentum, as they were unable to connect their projects to the national grid. This regulatory gap meant that true collective energy solutions could not be realised until legislative changes were made (Oteman et al., 2017).

International examples further illustrate the importance of government support in enabling CE initiatives to flourish. For example, a Scottish case study by Elizabeth Bomberg (2012) highlighted the crucial role that government backing plays in mobilising citizens for community energy projects. Her research demonstrated that communities are more likely to engage and invest in energy projects when they receive tangible support from local or national authorities. Government incentives and guidance help reduce the risks and uncertainties faced by community groups embarking on such ventures. Similarly, the research conducted by Gill Seyfang (2014) on grassroots innovations in sustainable energy emphasised that policy makers must play an active role in fostering the growth of CE initiatives by providing the necessary regulatory and financial frameworks to stimulate change.

This insight helps explain why the CE movement in the Netherlands did not gain significant traction until the early 2000s. It was not until the liberalisation of the Dutch energy market in 2004 (Damme, 2005) that these initiatives were able to flourish. The removal of legal barriers and the opening of the energy market to new players resulted in a rapid increase in CE initiatives, growing from approximately 40 in the early 2000s to more than 360 by 2015 (Oteman et al., 2017). This surge was largely driven by local communities that sought to create more sustainable energy solutions while simultaneously reducing their reliance on fossil fuels.

The role of policymakers in facilitating this growth cannot be overstated. As Frank Pieter Boon (2014) has argued, local and national governments can stimulate the creation and expansion of CE initiatives by shaping public perception and demonstrating the success of similar projects elsewhere. This not only inspires local communities, but also allows the transfer of valuable knowledge and expertise, which can be critical to overcome the technical and regulatory challenges associated with the establishment of renewable energy systems. In addition, governmental support plays a crucial role in securing the necessary funding for these projects, helping them transition from small-scale initiatives to fully operational organisations capable of meeting the energy needs of their communities.

Having had a great deal of governmental support in recent years, community energy in the Netherlands has continued to expand. By 2023, the number of energy cooperatives had grown to 714, a clear indicator of the increasing public interest and governmental support for local renewable energy solutions. Among these cooperatives, 63 have focused specifically on thermal heating solutions, highlighting the growing importance of diversifying community energy sources beyond wind and solar (Klimaatstichting HIER, 2023a). This diversification is a response to both the changing energy landscape and the recognition that different communities require customised solutions to meet their specific energy needs. Thermal heating cooperatives are particularly well-suited for densely populated areas, where the collective distribution of heat can be more efficient than individual heating systems.

2.1.1. Thermal energy communities

Thermal energy communities are a subset of community energy (CE) initiatives that focus specifically on district heating through heating networks. These heating networks are made up of a system of insulated pipes that are connected to a centralised heat source, which is responsible for heating the water that circulates through the network. The heat source can vary depending on the location and available resources. Common options include residual heat from industrial processes, geothermal energy, and heat derived from natural sources such as rivers and lakes, or even biomass (Klimaatstichting HIER, 2023c). This flexibility in heat sources can make district heating a versatile solution that can be adapted to a wide variety of local energy contexts.

Once heated, the water flows through the network of pipes and into the connected homes or buildings within a neighbourhood. Transfer of heat is achieved through a heat exchanger located in each building, which allows hot water to warm the internal heating systems without directly mixing with the water used by residents. This method of heat distribution is not only efficient but can also be highly sustainable, especially when using renewable or waste heat sources. The process allows for the provision of consistent heating throughout an entire neighbourhood or district, reducing the reliance on fossil fuels for individual home heating systems.

A recent study by Berenschot, commissioned by Energie Beheer Nederland (EBN), sheds further light on the potential benefits and limitations of thermal energy communities using district heating networks (Hoetz et al., 2024). The findings are significant, as they show that while district heating networks may present fewer barriers compared to alternatives such as all-electric heat pumps (Figure 2.1), they are not without challenges. As the study indicates, there are no one-size-fits-all solutions when it comes to selecting a heating technology. Each neighbourhood and even each house may require a tailored approach based on its specific circumstances.

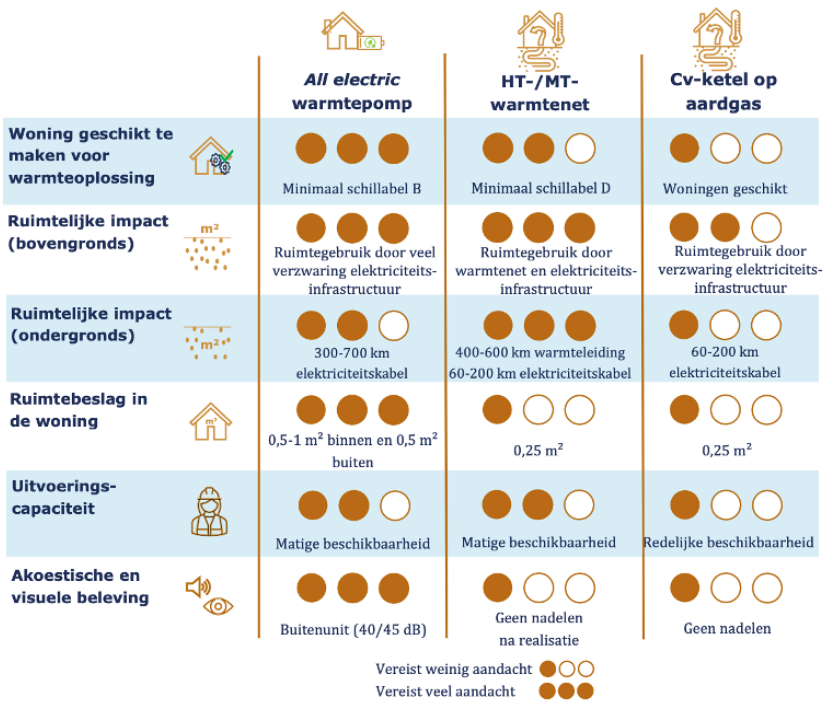
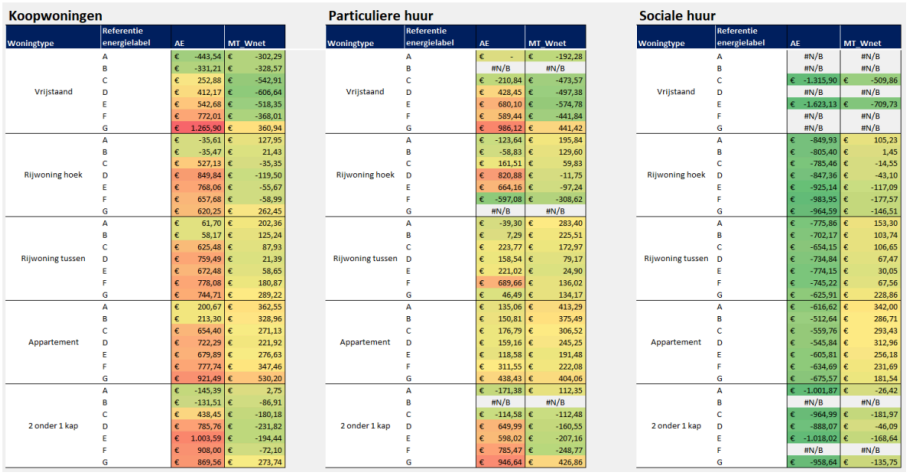


Figure 2.1: Advantages and limitations of heating solutions (Hoetz et al., 2024)

One of the key findings of the study is that the costs associated with district heating can vary significantly based on a number of factors. These include the ownership structure of the homes, the type of housing (whether apartments, detached houses, etc.), the energy efficiency rating or label of the buildings, and even the heating habits of the residents (Hoetz et al., 2024). For example, homes with a high energy efficiency rating and modern insulation will require less energy to heat and, therefore, may benefit more from a district heating system than older, less insulated buildings.

The type of heating network implemented also plays a role in the cost and necessary home adjustments. For example, high-temperature (HT) or medium-temperature (MT) heating networks typically require minimal changes to the house, apart from some minor insulation improvements. These systems can work efficiently with existing radiators and provide a seamless transition from gas-based heating. However, low-temperature (LT) and very low-temperature (ZLT) heating networks require more extensive modifications, such as full insulation, the installation of special low-temperature radiators, and an additional system for providing hot water (Nationaal Programma Lokale Warmtetransitie, 2024). These differences highlight the importance of choosing the right system for the specific needs of each neighbourhood.



Koopwoningen

Woningtype	Referentie energielabel	AE	MT Wnet
Vrijstaand	A	€ -443,54	€ -302,29
	B	€ -331,21	€ -328,57
	C	€ 252,88	€ -542,91
	D	€ 412,17	€ -606,64
	E	€ 542,68	€ -518,35
	F	€ 772,01	€ -368,01
	G	€ 1.265,90	€ 360,94
Rijwoning hoek	A	€ -35,61	€ 127,95
	B	€ -35,47	€ 21,43
	C	€ 527,13	€ -35,35
	D	€ 849,84	€ -119,50
	E	€ 768,06	€ -55,67
	F	€ 657,68	€ -58,99
	G	€ 620,25	€ 262,45
Rijwoning tussen	A	€ 61,70	€ 202,36
	B	€ 58,17	€ 125,24
	C	€ 625,48	€ 87,93
	D	€ 759,49	€ 21,39
	E	€ 672,48	€ 58,65
	F	€ 778,08	€ 180,87
	G	€ 744,71	€ 289,22
Appartement	A	€ 200,67	€ 362,55
	B	€ 213,30	€ 328,96
	C	€ 654,40	€ 271,13
	D	€ 722,29	€ 221,92
	E	€ 679,89	€ 276,63
	F	€ 777,74	€ 347,46
	G	€ 921,49	€ 530,20
2 onder 1 kap	A	€ -145,39	€ 2,75
	B	€ -131,51	€ -86,91
	C	€ 438,45	€ -180,18
	D	€ 785,76	€ -231,82
	E	€ 1.003,59	€ -194,44
	F	€ 908,00	€ -72,10
	G	€ 869,56	€ 273,74

Particuliere huur

Woningtype	Referentie energielabel	AE	MT Wnet
Vrijstaand	A	€ -	€ -192,28
	B	#N/B	#N/B
	C	€ -210,84	€ -473,57
	D	€ 428,45	€ -497,38
	E	€ 680,10	€ -574,78
	F	€ 589,44	€ -441,84
	G	€ 986,12	€ 441,42
Rijwoning hoek	A	€ -123,64	€ 195,84
	B	€ -58,83	€ 129,60
	C	€ 161,51	€ 59,83
	D	€ 820,88	€ -11,75
	E	€ 664,16	€ -97,24
	F	€ -597,08	€ -308,62
	G	#N/B	#N/B
Rijwoning tussen	A	€ -39,30	€ 283,40
	B	€ 7,29	€ 225,51
	C	€ 223,77	€ 172,97
	D	€ 158,54	€ 79,17
	E	€ 221,02	€ 24,90
	F	€ 689,66	€ 136,02
	G	€ 46,49	€ 134,17
Appartement	A	€ 135,06	€ 413,29
	B	€ 150,81	€ 375,49
	C	€ 176,79	€ 306,52
	D	€ 159,16	€ 245,25
	E	€ 118,58	€ 191,48
	F	€ 311,55	€ 222,08
	G	€ 438,43	€ 404,06
2 onder 1 kap	A	€ -171,38	€ 112,35
	B	#N/B	#N/B
	C	€ -114,58	€ -112,48
	D	€ 649,99	€ -160,55
	E	€ 598,02	€ -207,16
	F	€ 785,47	€ -248,77
	G	€ 946,64	€ 426,86

Sociale huur

Woningtype	Referentie energielabel	AE	MT Wnet
Vrijstaand	A	#N/B	#N/B
	B	#N/B	#N/B
	C	€ -1.315,90	€ -509,86
	D	#N/B	#N/B
	E	€ -1.623,13	€ -709,73
	F	#N/B	#N/B
	G	#N/B	#N/B
Rijwoning hoek	A	€ -849,93	€ 105,23
	B	€ -805,40	€ 1,45
	C	€ -785,46	€ -14,55
	D	€ -847,36	€ -43,10
	E	€ -925,14	€ -117,09
	F	€ -983,95	€ -177,57
	G	€ -964,59	€ -146,51
Rijwoning tussen	A	€ -775,86	€ 153,30
	B	€ -702,17	€ 103,74
	C	€ -654,15	€ 106,65
	D	€ -734,84	€ 67,47
	E	€ -774,15	€ 30,05
	F	€ -745,22	€ 67,56
	G	€ -625,91	€ 228,86
Appartement	A	€ -616,62	€ 342,00
	B	€ -512,64	€ 286,71
	C	€ -559,76	€ 293,43
	D	€ -545,84	€ 312,96
	E	€ -605,81	€ 256,18
	F	€ -634,69	€ 231,69
	G	€ -675,57	€ 181,54
2 onder 1 kap	A	€ -1.001,87	€ -26,42
	B	#N/B	#N/B
	C	€ -964,99	€ -181,97
	D	€ -888,07	€ -46,09
	E	€ -1.018,02	€ -168,64
	F	#N/B	#N/B
	G	€ -958,64	€ -135,75

Figure 2.2: The financial benefits of MT heating network (Hoetz et al., 2024)

Currently, in the Netherlands, around 6% of the homes are connected to thermal heating networks. This represents a relatively small proportion of the total number of houses, but the number is increasing as more communities recognise the benefits of thermal energy solutions. In 2023, there were 70 active heating network projects that involved a thermal energy initiative, reflecting the increasing interest in sustainable heating alternatives at the community level (Klimaatstichting HIER, 2023a). These projects are spread across the country and showcase a variety of approaches to integrating district heating into local energy systems.

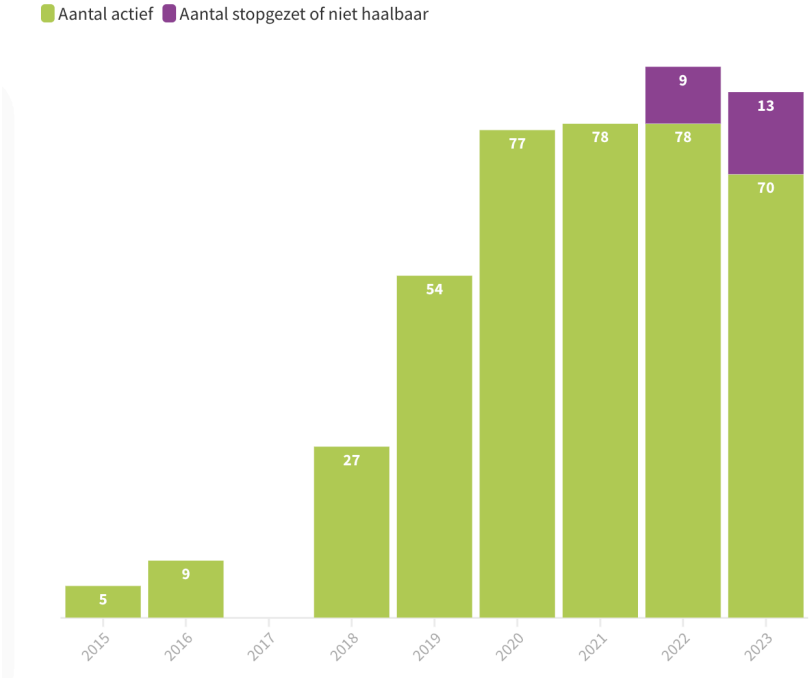


Figure 2.3: Heat projects that involve a heat initiative (Klimaatstichting HIER, 2023a)

Despite this growth, Figure 2.3 reveals that 13 of these projects were discontinued, although the exact reasons for their closure are not completely clear. Financial, technical, or regulatory challenges may have played a role in stopping these initiatives. Furthermore, as shown in Figure 2.4, there has been a noticeable stagnation in the growth of active projects since 2020. Many of the existing projects remain in the early planning and orientation phases, and only a few have reached the operational stage.

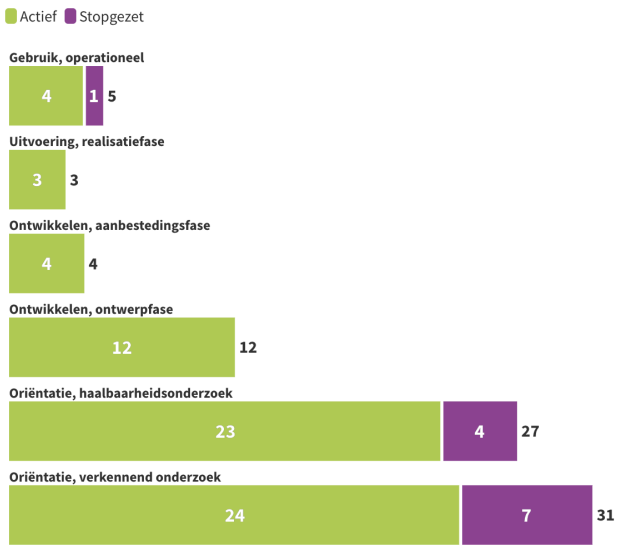


Figure 2.4: Heat projects that involve a heat initiative divided as per phase (Klimaatstichting HIER, 2023a)

These findings underscore the need for continued support and innovation in the development of thermal energy communities. Although the potential benefits of district heating are clear, implementation challenges must be addressed, particularly in terms of costs, infrastructure, and community engagement, to ensure the success of these initiatives.

2.1.2. Challenges

The stagnation in the development of new thermal energy initiatives can be attributed to several key challenges that hinder progress. One of the primary issues, as highlighted by the Dutch Climate Foundation *"HIER"* (2023a), is that most local energy cooperatives consist of volunteers with limited time, resources and expertise. Although the grassroots, community-driven nature of these projects can be a positive force in engaging local stakeholders, it also poses a vulnerability. As these cooperatives transition from conceptual plans into the complex development phases of establishing a heating network, they increasingly begin to resemble formal organisations, requiring not only higher financial investments but also greater time commitments. The amount and difficulty of the tasks involved often exceed the capabilities of the volunteer teams. Developing a heating network, for example, requires extensive planning, coordination, and management, as well as technical expertise that might be beyond the reach of volunteer groups. This dependency on volunteers leaves these initiatives vulnerable to delays and even failure.

In addition, thermal heating collectives are based on relatively new and evolving technologies, such as aquathermia, which extract heat from water sources such as rivers and lakes. The relative novelty of these technologies presents an additional layer of complexity when trying to align stakeholders. These projects often take longer to organise than more established renewable energy solutions, such as wind and solar energy (Klimaatstichting HIER, 2023a). The reason for this is multifaceted. Firstly, obtaining the necessary funding and investment for these projects can be challenging, particularly when there is less public awareness or trust in the newer technologies being proposed.

Secondly, gathering the required permits and adhering to regulations can be a time-consuming process, especially since policymakers and local governments are still adjusting to these innovations (Klimaatstichting HIER, 2023a). Compared to wind and solar projects, where regulatory frameworks are more established, thermal energy projects must navigate a more uncertain and evolving landscape. New legislative changes, such as the WCW law, are expected to create more opportunities for these types of initiatives. However, as of now, there remains a significant degree of uncertainty about how the implementation of this law will unfold and what the practical implications will be for new and existing projects (Energiesamen, 2020).

Another considerable challenge lies in securing widespread community support for the implementation of heating networks. Unlike wind and solar energy projects, which generally require less direct involvement of homeowners, heating networks depend heavily on the participation of individual households (Klimaatstichting HIER, 2023a). For a heating network to be viable, a significant portion of the neighbourhood must agree to insulate their homes and replace existing heating systems with those compatible with the new network. The installation of the pipe network itself also involves disruptions, such as digging the street, which can be a source of inconvenience and resistance for local residents. In addition, the changes affect the very way people interact with their homes, making the process more personal and, consequently, more difficult to secure buy-in. Each project typically requires a minimum number of participants to join in order to make the project financially feasible. As Van Poelgeest (2022) points out, approximately 50% of households in a given area need to participate for the project to succeed. This high threshold of participation poses a considerable risk, as convincing the majority of building owners to participate in such an initiative is no easy task, and this challenge can ultimately determine whether or not the project moves forward.

Despite widespread agreement that heating networks are a critical part of the transition from natural gas, the actual implementation of these systems remains a challenge. Although there are government subsidies and financial support mechanisms in place to help these initiatives, the heavy reliance on volunteers who lack the necessary manpower and financial stability to operate like traditional businesses continues to be a limitation. Furthermore, the diversity of approaches taken by community energy projects adds another layer of complexity. According to the literature, the success of these initiatives is heavily dependent on the social and spatial settings in which they operate. In other words, what works for one community may not necessarily work for another, making it difficult to standardise solutions across different regions and contexts (Warbroek et al., 2019). This absence of a one-size-fits-all model further underscores the challenges of scaling up community energy initiatives, as each project must be tailored to fit its unique circumstances. That is why local initiatives may be preferred. Thus, the development of thermal energy projects requires not only technological innovation, but also adaptive management, strong community engagement, and a flexible approach to address the varying challenges faced by different cooperatives.

2.2. Managing Heating Initiatives

As mentioned above, the management of these initiatives is mainly based on the voluntary work of local citizens and community members (Klimaatstichting HIER, 2023a). The volunteer nature of these initiatives brings both strengths and challenges. In order to formalise their activities and gain legal recognition, many of these initiatives adopt a cooperative structure, which provides them with a defined organisational framework. Within this structure, some volunteers assume more formal roles by forming a board that is responsible for managing the cooperative and overseeing the progress of the initiative. This board not only handles day-to-day management, but also plays a key role in decision-making processes, ensuring that the heating network is developed and maintained according to the goals and standards of the initiative.

One of the key advantages identified by *Energie Samen* in using this cooperative model is that it is aligned with the principles of the Dutch market. When citizens are directly involved in managing their own energy and heat supply, they tend to develop a stronger sense of ownership and responsibility. This increased sense of accountability leads to higher levels of support for the initiative and often results in faster implementation of the heating network (Energie samen, 2022). Another benefit of such management is that these cooperatives tend to prioritise local, sustainable heating solutions rather than motives that are profit driven. This means that cooperatives are more inclined to focus on using low-temperature or very low-temperature heat sources, such as residual heat from nearby industry or thermal energy from rivers and other bodies of water, rather than opting for more expensive or higher-profit solutions (Krabsen et al., 2022). In doing so, they create heating networks that are both environmentally sustainable and more affordable for the community.

2.2.1. Knowledge

However, despite these advantages, as found in Section 2.1.2 setting up and managing a cooperative heating network is not without challenges. Establishing a viable initiative requires a significant amount of knowledge and expertise in various fields. A multiyear study conducted by *Platform31* (2024) aimed to provide more insight into the working methods and experiences of community-driven energy initiatives throughout the Netherlands. This comprehensive study followed eight different initiatives over several years to better understand the learning processes and challenges they faced. One of the most notable findings of this study was that over time, the initiatives developed their own knowledge related to the energy transition. As these cooperatives gained experience, they became better equipped to navigate the complexities of establishing a heating network. They learnt which experts or organisations to consult when technical, legal, or financial difficulties arise, significantly improving their ability to solve problems efficiently (Platform31, 2024).

In addition, having a strong knowledge base within the cooperative appeared to relieve some of the challenges related to the financing of the project. With a deeper understanding of energy systems, regulations, and the economic landscape, cooperatives found it easier to secure the necessary funding for their projects than they had initially anticipated (Platform31, 2024). However, knowledge acquisition remains an ongoing process and many initiatives continue to rely on external expertise for specialised areas, such as legal support, technical design, and financial planning.

In addition to building technical knowledge, the people involved in the cooperative must work to foster participation within their community. This involves organising community meetings, providing information to residents, and actively engaging citizens in discussions about their heating network. In addition, the cooperative must develop a comprehensive business case for the heating network, which involves addressing a range of technical, legal, and financial challenges. The business case must be both financially viable and operationally feasible, ensuring that the network will provide affordable heat to the community in a sustainable way. This process requires a deep understanding of the different available heating solutions, their advantages and disadvantages, as well as a knowledge of local energy needs and potential funding mechanisms (Directorate-General for Energy, 2024)(Energy Communities Repository, 2023).

2.2.2. Values

In the same study *Platform31* also highlighted the importance of values within these cooperatives. It found that the core group of stakeholders, typically board members, must adopt a passionate and knowledge driven approach to managing the initiative. Enthusiasm for sustainability and the broader energy transition must be coupled with a strong commitment to the local community (Platform31, 2024). This intrinsic motivation to support both the environment and the neighbourhood is often the driving force behind the success of these initiatives. Without a core group of dedicated individuals, it would be difficult for the cooperative to maintain momentum and achieve its goals.

The success of these initiatives is heavily dependent on what is known in the literature as civic engagement. Civic engagement refers to the actions that people take to improve their community and encourage others to do the same. This level of involvement requires not only a shared understanding of community needs, but also a commitment to collaboration and mutual support (Ehrlich, 2000)(Pesch et al., 2018)(de Tocqueville, 2004). In the context of thermal energy initiatives, civic engagement manifests itself as a collective effort to address local energy challenges through innovative, sustainable solutions.

For this study, these values can be viewed as the underlying motivations of the core group, the board. The aim is to explore not only what motivates these individuals to take on leadership roles in managing the heating network, but also how they inspire and encourage other members of the community to get involved. Understanding these motivations can provide valuable insight into how thermal energy initiatives can be replicated and scaled in other regions, further supporting the transition to more sustainable heating solutions in the Netherlands.

2.3. Knowledge Gap

This section introduces the need for further research on the transition of thermal energy communities and their internal organisation, addressing a gap that exists in the current literature. Although there has been considerable focus on understanding the external drivers, settings, and regulatory frameworks within which energy communities operate, there remains a noticeable deficiency in the literature when it comes to examining the internal dynamics of how these cooperatives evolve over time. Specifically, a more in-depth analysis of internal organisational structures, the actors involved, and how knowledge and motivations play a crucial role in their development and success (Bauwens et al., 2016).

Although previous research has extensively explored factors such as the social and economic drivers behind energy communities, much less attention has been paid to the actual processes through which these cooperatives transition from initiatives into fully operational thermal energy cooperatives. Therefore, more research is required to gain a better detailed understanding of the internal functioning of these organisations. This includes examining how community-driven thermal energy cooperatives establish themselves, adapt to changing circumstances, and gain the necessary knowledge and skills to sustain their operations.

There are several potential pathways for further investigation into these processes. Upon reviewing the findings, three questions arise regarding how citizen initiatives can transition to fully functioning thermal energy cooperatives. The first focusses on the internal development of knowledge and values. It points out that in order for a citizen initiative to progress beyond its initial stages, it must build sufficient capacity within the organisation. This means that a deep understanding of both the technological and legal aspects is crucial and the development of these competencies, coupled with strong internal values, is essential for long-term success.

Secondly, the progression of a cooperative may depend not only on the knowledge and values it holds, but also on how effectively these elements are shared with the community. The idea is that knowledge sharing within the cooperative and with external stakeholders is just as important as the accumulation of knowledge itself. Effective communication strategies that ensure transparency, inclusion, and collaboration between all members of the community could play an important role in determining the success of the initiative.

Lastly, external support from third-party organisations could be a critical factor in acquiring the necessary knowledge and resources to facilitate the transition. According to *Fakton Energy* (2023), one possible solution involves the creation of a larger umbrella organisation that can provide guidance, support, and shared resources to local cooperatives. Such an organisation could help bridge the gap by offering expertise in technical, legal, and financial areas, thus keeping some of the pressure off the local cooperatives to develop these competencies entirely on their own.

The core members of these initiatives, typically represented by the board, are believed to play a pivotal role in addressing these challenges. These individuals invest substantial time and energy to ensure the success of the initiative and are often driven by a passion for a sustainable future and a strong commitment to their local community (Platform31, 2024). These board members are expected to be ”jacks of all trades,” possessing a diverse set of skills, including financial, technical, and organisational knowledge. They also need to be adept at communicating with both internal stakeholders (such as members of the community) and external entities (such as policy makers and administrators) (Platform31, 2024).

In addition to these technical skills, perseverance and adaptability are essential qualities for those working in this field. The lengthy processes involved in obtaining permits, gathering funds, and navigating complex regulations can cause frustration. In cases where progress is slow or obstructed by bureaucratic procedures, there is a risk that community members may lose faith in the initiative. If trust is eroded, residents can withdraw their support, which can lead to the failure of the initiative (Platform31, 2024).

The challenges faced by collective heating initiatives are numerous and multifaceted. However, many of these challenges can be overcome if board members possess the right combination of knowledge, skills, and values. These elements converge in their capabilities. Therefore, the real knowledge gap lies in identifying which specific capabilities are essential for a community initiative to successfully transition to a fully operational organisation. Addressing this gap through further research could provide valuable information on how these initiatives can be better supported and scaled in the future.

2.4. Framework

This section introduces the framework used to explore the capabilities required for community initiatives to transition to organisations, focussing on thermal energy communities. Through this framework, the aim is to better understand how energy communities evolve and what capabilities drive their success.

The capabilities needed for community initiatives to transition to an organisation can be investigated using the capability approach, first mentioned by Amartya Sen (1992)(1999). ”*The capability approach is a theoretical framework that entails two normative claims: first, the claim that the freedom to achieve well being is of primary moral importance and second, that well being should be understood in terms of people’s capabilities and functioning.*” (Byskov, 2015). Thus, the capability approach is about freedom and the development of an environment suitable for human flourishing. The focus is on developing people’s capabilities, rather than looking at the resources (Walker, 2005).

However, from the perspective of communities, the capability approach can be used to create a capability model shown in Figure 2.5. Rather than showing what each person is able to do, it shows us which capabilities a person, or a group of people, should have in order to complete each step within a desired process. This process can be seen as the development of a thermal energy community. Furthermore, it does not only consider the capabilities a person or group of people have, it also shows how partners can add to their capability model.

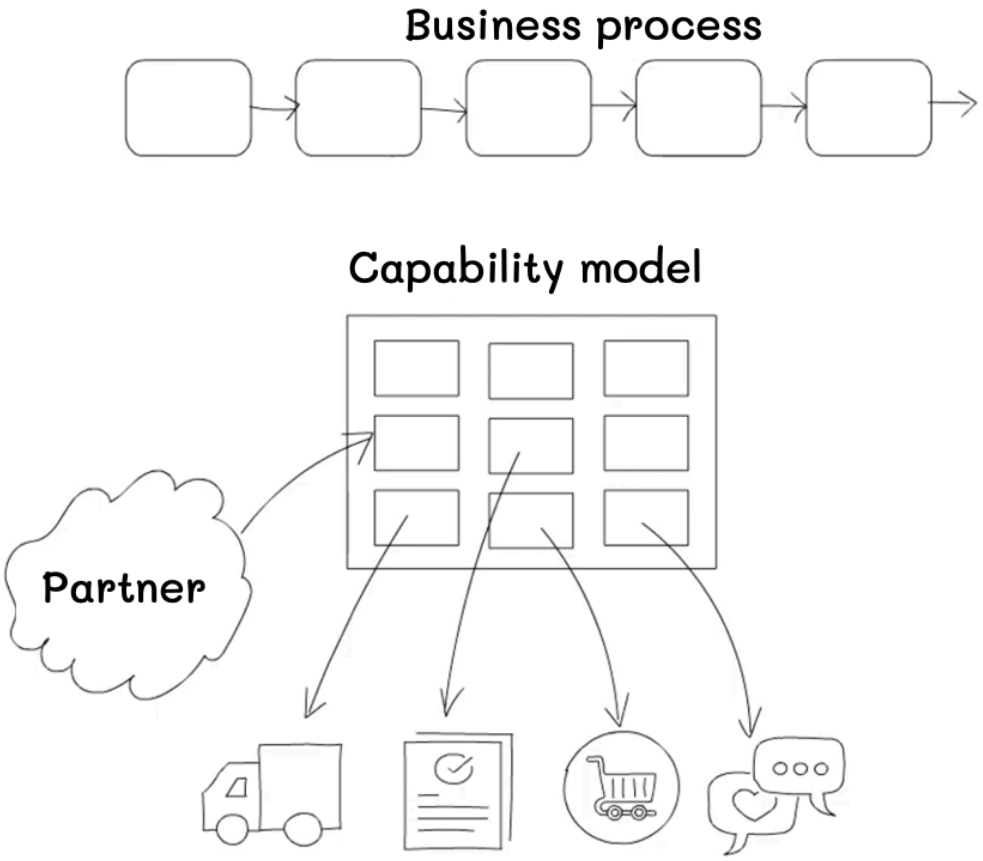


Figure 2.5: Basic capability model

The 3C model developed by Ibrahim (2017) builds on this concept and creates a foundation for capabilities that can be applied to community initiatives. "*The 3C model aims to demonstrate how individual and collective acts of agency can generate new collective capabilities at the grassroots.*" (Ibrahim, 2017) The 3C model demonstrates three capabilities that can be built within a community process. This can be a great way to start analysing the thermal energy communities. As a visualisation, this model should essentially provide three building blocks that together create new capabilities for community initiatives (Figure 2.6).

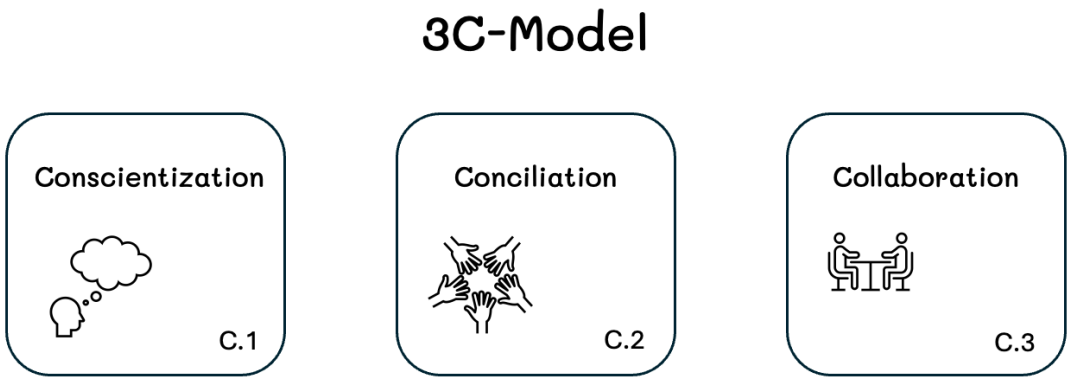


Figure 2.6: Visualisation of the 3C model

With this research, the aim is to find out which capabilities are or should be present within thermal energy communities and which knowledge or what kind of values help in shaping these capabilities. Therefore, we suggest a model as shown in figure 2.7. It investigates how collective capabilities needed for the community process are generated using the 3C model, but also shows the knowledge and the values that those capacities are based on.

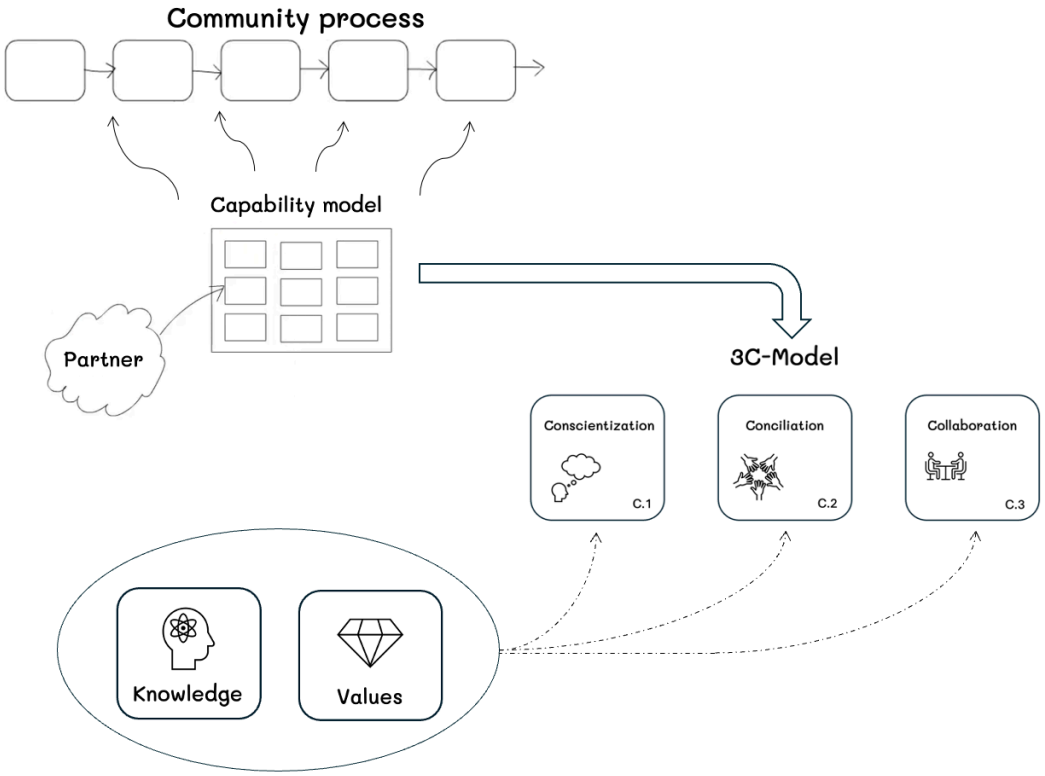


Figure 2.7: Visualisation of the models combined

Key Concepts of the 3C-model

Applying the capability approach to thermal energy communities through the lens of the 3C model involves the conceptualisation of three core components: conscientisation, conciliation, and collaboration. These concepts, as outlined by Ibrahim, serve as the basis for the building and maintenance of grassroots initiatives such as thermal energy communities (Ibrahim, 2017).

The first concept, conscientisation, refers to the process of enabling individuals to critically reflect on their circumstances, thereby empowering them to actively engage in problem-solving activities. In the context of thermal energy communities, this means that members become more aware of their energy needs, the environmental impact of their current energy consumption, and the potential benefits of switching to more sustainable heating solutions. This increased critical awareness is what allows them to meaningfully participate in discussions about energy alternatives and contribute to decision-making processes.

However, conscientiality alone is not sufficient to achieve the goals of a thermal energy community. Performing as an individual, most community members would likely face significant challenges in setting up a thermal heating network. The complexity of these systems, which involve technical, financial, and legal considerations, makes it nearly impossible for individuals to succeed in isolation. Therefore, conciliation, cooperation, and building consensus among members are essential. Conciliation involves fostering collective decision-making processes in which different perspectives can be discussed and aligned toward a common goal. The ability to resolve conflicts constructively and reach a consensus is critical for the functioning of the community, as it ensures that all members work toward a shared goal.

The third key concept, collaboration, emphasises the importance of engaging external actors in the initiative. Although conscientisation and conciliation empower the community internally, they are often not enough to sustain the initiative on their own. As Ibrahim notes, "*Collaboration is important for two main reasons. First, it is essential to promote local institutional reforms. Second, the exercise of individual and collective agency alone (through conscientisation and conciliation processes) is not enough to sustain social innovations at the grassroots*" (Ibrahim, 2017). In the case of thermal energy communities, collaboration often involves working with municipalities, private companies, or non-profit organisations that can provide the necessary resources, expertise, or financial backing to help the initiative succeed.

Key Concepts in Thermal Energy Communities

Section 2.4 outlined the theoretical framework of the 3C model. Applying these concepts specifically to thermal energy communities offers a more nuanced understanding of how these initiatives function. In the case of this research, conscientisation refers to empowering community members to critically assess their current energy usage, understand the environmental and social impact of relying on non-renewable energy sources, and explore sustainable alternatives like thermal heating solutions. This process often involves a shift in values, with members increasingly recognising the importance of environmental stewardship and the long term benefits of transitioning to renewable energy. Investigating how these values are embedded within the collective mindset of the community can provide valuable information on the degree to which conscientiality has been achieved.

Conciliation, as it applies to thermal energy communities, involves communication and cooperation between different stakeholders, including community members, businesses, and local government entities. Successful conciliation relies on values such as transparency, trust, and mutual respect, which facilitate open dialogue and consensus building. In many cases, this requires not only technical knowledge but also social knowledge: knowing how to manage relationships, resolve conflicts, and ensure that all stakeholders feel heard and valued. In addition, the way in which conflicts are managed and compromises are reached can reveal a great deal about the internal workings of these communities and the strategies they use to move forward despite differing opinions.

Finally, collaboration, while closely related to conciliation, is a distinct concept in the 3C model. In the context of thermal energy communities, collaboration refers specifically to partnerships formed with external stakeholders, such as government agencies, utility companies, or environmental organisations. These partnerships are often essential for accessing the resources, expertise, and networks necessary to build and maintain a thermal energy network. Values such as trust play a crucial role in ensuring the success of these collaborations. For example, partnerships can involve complex negotiations about funding, technical support, or regulatory approval, and all parties must trust that their counterparts will uphold their end of the agreement. Investigating how thermal energy communities establish and maintain these partnerships and what knowledge is required to navigate these collaborations effectively can provide critical insights into how these initiatives operate. This will be explored in more detail in the methodology chapter 3, where the specific tools and approaches to measuring these factors will be discussed.

3

Research Methodology

This chapter describes the proposed methodology that will be used to answer the research question. It will explain the research design, how the data are collected, and what could be a suitable way to analyse these data.

3.1. Research Design

This research will be carried out in cooperation with *Energie Samen*. *Energie Samen* has developed a platform and approach entitled ”Buurtwarmte” (n.d.)to encourage and support local citizen initiatives to start thermal energy communities. Currently, this ”Buurtwarmte” platform has seven replication sites, which serve as pilots for the programme and help in developing a step-by-step approach for future projects.

3.1.1. Analysing literature

Before starting any research approach, a thorough review of the literature should provide a basis for this research. The literature review will examine relevant topics and identify the challenges and knowledge gaps in the previous literature. The literature review for this report has been conducted using *”WebOfScience”* (2024). Keywords like; ”Community Energy”, ”Renewable Energy”, ”Grassroots” and ”Heating Networks” were used in finding literature. A detailed description of the search strategy used can be found in the Appendix A.

In addition to scientific reports, public knowledge bases have also been used in the Netherlands, such as *Energie Samen*, *HIER* and government databases. All of these have been found with the help of Google searches and have been essential to gather information about current Dutch collectives.

3.1.2. Research approach

A qualitative approach will help to understand the social dynamics and community participation processes involved in the establishment of thermal energy communities. This can be done through semi-structured interviews using the seven known replication sites as part of the ”Buurtwarmte” approach. Interviewing key members, such as board members, energy workers, and initiators, will provide in-depth insights into the experiences and motivations of the people involved in these energy communities.

3.2. Case selection

The cases for this research were selected with the help of prof. dr. Thomas Hoppe, professor of rural urban systems. He presented the subject of this thesis and the associated cases. He already collaborated with domestic energy initiatives and has established a partnership between *Energie Samen* and *TU Delft*. *Energie Samen* is one of two large cooperative energy organisations in the Netherlands, supporting and representing many different energy initiatives across the country. Its goal is to encourage and facilitate local, community-driven projects that promote the transition to sustainable energy solutions. *Energie Samen* proves to be a suitable source of cases for this research, since the focus is on energy cooperatives and *Energie Samen* has already established itself as one of the largest knowledge institutes for these types of programmes, with contacts in many sustainable energy initiatives.

For this research, the 'Buurtwarmte' programme, a pilot programme launched by *Energie Samen*, is specifically interesting. 'Buurtwarmte' focusses on developing sustainable community-led heating solutions, specifically 'warmtenetten' or district heating networks. The purpose of this programme is to help smaller communities transition from fossil fuels and instead rely on renewable, neighbourhood-based heating solutions. The 'Buurtwarmte' pilot represents multiple, smaller energy cooperatives.

After reaching out to *Energie Samen* about the 'Buurtwarmte' pilot programme and the energy cooperatives they support, the organisation presented the contact details of seven of the initiatives they support. Crucially, all of these projects are at the same stage in their development, which makes them more suitable for comparative analysis. This has been tested by evaluating their progress in terms of implementing a 'warmtenet' or district heating network through freely available information. These preliminary checks proved that all these small-scale energy cooperatives were at a point where they needed to implement or develop a business case, find a contractor, and realise the actual heating network. After reaching out to these cooperatives, five of them proved willing to participate in the research, while two did not respond to any contact request.

3.2.1. Selected cases

BENG! Bilthoven

BENG! is the first of the five cases represented by the 'Buurtwarmte' initiative and will feature in this thesis. BENG! collaborates with the local authorities in De Bilt, a small municipality on the outskirts of Utrecht, on creating a district heating network for the Brandenburg West neighbourhood in Bilthoven. In partnership with the SSW housing association and the HDSR water authority, BENG! aims to provide this part of De Bilt with sustainable heating.

Figure 3.1: Beng Bilthoven (2024)

BENG! wants to use surplus heat from a nearby wastewater treatment plant to create a district heating network. The heat released at this plant can, in theory, heat more than 1,100 homes. However, for this plan to work properly, the homes in Brandenburg West must be well-insulated, thus requiring the cooperation of the local residents. BENG! is actively involved in the management discussions about this project and encourages resident participation. Furthermore, BENG! provides technical knowledge to residents and assists them in applying for subsidies. After an initial subsidy application for a district heating network was rejected in 2020, the BENG! initiative was approved in the spring of 2022.

Buurtwarmte Enkhuizen

Another case in the Buurtwarmte pilot programme is Buurtwarmte Enkhuizen, or BWE. BWE aims to make the Gommerwijk-West neighbourhood more sustainable by connecting it to a district heating network. This project should, in theory, provide the residents of Gommerwijk-West with heat in the winter and cooling in the summer. In this case, the heat will come from a nearby bulb grower. For this particular project, BWE wants to manage the transition independently, ensuring that affected residents pay no more than they currently do for conventional gas heating while preparing them for a more sustainable future. BWE is currently in the process of gaining support within the community of Gommerwijk-West, before presenting the proposed plans for a district heating network to local authorities.

Figure 3.2: Buurtwarmte Enkhuizen (2024)

Warm in de wijk

Warm in de Wijk is another cooperation represented by the Buurtwarmte initiative. The project was pioneered by residents of Vruchtenbuurt, a neighbourhood in The Hague. Warm in de Wijk aims to provide the community with sustainable heating in the foreseeable future. With subsidies from the local government, this particular cooperation conducted its own research to create a more sustainable heating plan. A study revealed that there is no suitable heat source in the neighbourhood. However, there is a pipeline not far from Vruchtenbuurt that carries purified wastewater from the nearby Harnaschpolder. According to Warm in de Wijk, this pipeline should be able to provide 55.000 to 70.000 homes with heating through a district heating network.

Figure 3.3: Warm in de wijk (2024)

Warmtenet Zwolle

Project 'De Groene Renovatie' is an initiative of '50 Tinten Groen Assendorp', a local sustainability project for a neighbourhood in Zwolle and part of the Buurtwarmte programme. The project was launched in 2021. Residents of Assendorp, along with housing cooperations and stakeholders from SWZ and Deltawonen, sought to improve the sustainability of their neighbourhood through a heating transition. Approximately 120 homes would be affected by this preliminary planning. In 2022, with the support of the local government, residents were able to discuss these plans with the associated stakeholders. A collective heating solution has emerged, consisting of a district heating network, sourced from a thermal energy storage system (WKO) and a solar energy installation on the roof of the sports hall located in the project area. The next step of the 'De Groene Renovatie' is investigating the feasibility of these solutions.

Figure 3.4: Sallandsweide Assendorp (2024)

Lopster Energie Coöperatie

In Loppersum, a small village in the province of Groningen, Buurtwarmte supports LOPEC. LOPEC is a local cooperative that supports sustainable energy solutions. The municipality is planning to develop a district heating network for a small group of houses and LOPEC is directly involved. According to LOPEC data, about 86% qualified residents have responded positively to joining a district heating network. The project is subsidised by local government organisations (National Programma Groningen and Programma Aardgasvrije Wijken). Not only residential homes, but also several commercial and public buildings are eligible to connect to a district heating network.

Figure 3.5: Lopec (2024)

3.3. Data Collection

Data collection will be carried out using a semi-structured interview method. The data collected through these interviews will be complemented by alternative data found online.

3.3.1. Semi-structured interviews

The aim is to find the capabilities needed to transform a household initiative into a thermal energy organisation. Furthermore, the aim is to find out what knowledge and values these capabilities are built on. For now, this is still an unknown; therefore, the choice has been made to follow a semi-structured interview approach. This data collection method relies on asking questions within a predetermined framework. This provides comparable and reliable data while still giving the flexibility to ask other questions. Furthermore, it allows for input from the interviewee. This could be helpful in deciphering the capabilities needed within the organisation.

The sampling method used for selecting the interviewees will be purposive sampling; this method allows for selecting participants of the ”Buurtwarmte” approach or other stakeholder that, from the literature, turned out to be key people. A large part of the data used for this research will come from these interviews.

3.4. Data Analysis

A suited technique for analysing the date from these interviews is thematic analysis. Thematic analysis helps identify common themes, topics, ideas, and patterns. This analysis method requires six different steps (Caulfield, 2023):

- Step 1: Familiarisation; knowing the data is important before starting the analysis. This includes putting all data into written transcripts.
- Step 2: Coding; the second step is to encode the data. Coding data means extracting relevant pieces of text and coming up with codes to describe their content.
- Step 3: Generating themes; having a set of codes is not enough. After coding, it is important to identify patterns among the codes and come up with themes. These themes can be broader than codes, so several codes can combine into a single theme.
- Step 4: Reviewing the themes; coding and generating themes is an iterative process. After the first set of themes has been generated, these themes need to be reviewed to ensure their accurate representation of the data.
- Step 5: Defining and naming themes; after going back and forth between the data, codes, and themes, the final list of themes can be defined. Defining a theme means exactly formulating what a theme means and how it helps in understanding the data.

Familiarisation

Where possible all interviews will be conducted using MS teams, an online video meeting software. MS teams has a built-in feature that allows for an individually generated transcript from any conversation. However, all interviews will be conducted in Dutch, and therefore the transcripts are not always perfectly accurate. Therefore, each of the transcripts will be checked manually. After manually cleaning up, the transcripts can be imported into ATLAS.ti, still ensuring that each of the transcripts is formatted correctly and that the participant’s responses are clearly delineated, ensuring consistency throughout the coding of each transcript.

Coding

In this study, coding will be structured around the 3C-framework, which examines conscientisation, conciliation and collaboration within thermal energy communities. This framework provides a foundation for understanding how communities develop. In its turn, the subquestions [1.3.2] are based on this framework, sub-question 1 provides a basis to know what is perceived to be necessary knowledge and motivations in order to transition community initiatives into thermal energy organisations. The second sub-question explores how board members ensure that community members are aware of critical issues and participate in decision-making. This is based on the concept of conscientistation form the 3C-framework. The third sub-question fits the concept of conciliation. Examines how energy communities promote understanding and build shared values. The last sub-question investigates the role of partnerships in helping communities, for instance through pooling resources and expertise.

In order to organise the coding process and keep the process structured, containers will be created. Each container will reflect the respective sub-question based on the 3C-framework. A fifth container was added to ensure that codes not fitting to any of the sub-questions would not get lost. These containers serve as categories that help to group the codes related to a specific research question. For this study, five main containers were made:

- (SQ1) Types of Knowledge/Motivations, this container will hold codes related to knowledge and values identified by the board as necessary for transitioning into a thermal energy organisation. Some common codes in this container are Organisational expertise, Financial processes, Using local knowledge, Technical knowledge, and sustainability values.
- (SQ2) Knowledge helping to understand/move, this container will focus on how the board ensures members understand the social, environmental, and economic impacts of thermal energy and what motivates them to want to learn. Some common codes in this container are Citizen involvement, Costs for homeowners and Motivations.
- (SQ3) Approaches for sharing knowledge/motions, this container will store codes related to methods of promoting dialogue and building shared goals among stakeholders. Some common codes in this container are Information sharing, One-on-one, and Conversations.
- (SQ4) Knowledge partnerships/collaborations, this container will group codes related to the collaborative efforts and partnerships that energy communities engage in. Some common codes in this container are Structures, Partnerships and Agreements.
- Other findings, any insights or stories that do not directly fit into the subquestions but my offer valuable information will be stored here.

These five containers provide a simple framework for systematic coding. With this framework ready, each transcript will be reviewed, identifying phrases or sections of text that are relevant. Relevant information can be defined as any data that directly or indirectly contributes to the research objective. If a piece of relevant information is identified, it will be tagged with a code. These codes will summarise the concept in that piece of text in one word or sometimes a short phrase (2 to 5 words). Each of these codes will be put in any of the corresponding containers.

In addition to relevant information, some of the interviews contained stories or personal experiences. To not lose these stories or experiences in the data later on, ATLAS.ti provides the use of memos. Memos will be used as notes for any of the codes that included a nice story. These stories can then be implemented in the results section of this document.

Generating themes

For this study, thematic analysis will be used as the main analytical technique. This involves grouping the codes into overarching themes that represent key patterns in the data. This gives a more conceptual understanding of the data. For this research, the themes were directly related to the research questions. The creation of these themes can be done using the code grouping function in ATLAS.ti.

Reviewing and defining codes and themes

The coding process is an iterative process. If all transcripts are coded, the codes need to be refined and grouped together. Codes that are closely related can be grouped together. Furthermore, codes can be changed if, for example, at a second or third look the code does not summarise the concept correctly.

3.4.1. Validity and reliability

This research process requires validity and reliability. Validity will be ensured through using known theoretical frameworks (e.g. thematic analysis) to interpret the data, and making sure that the semi-structured interview questions adequately cover the research topic. These interview questions as well as the number of interviews can be found in the appendix B. Reliability can be achieved throughout this methodology chapter by thoroughly explaining how the data were collected and analysed. Furthermore, using standardised data collection procedures will ensure repeatability through detailed documentation of each step within the data collection and data analysis process.

4

Interview results

Using the research methodology described in Chapter 3 and based on the theoretical framework presented in Section 2.4 this chapter will explain the findings from the collected data.

Data were collected by interviewing 10 members of five different Dutch energy cooperations [Table B.1]. These interviews were carried out using a semi-structured method shown in the appendix B. Two of these interviews were conducted to validate the previous results. Furthermore, document analysis shows further validation of the data.

4.1. Knowledge and capabilities

Based on the interviews conducted and the first sub-question, *What knowledge does the board possess and what do they identify as necessary for the transition of community initiatives into a thermal energy organisation?*, this section will thoroughly explore the types of knowledge and skills that are identified as essential for creating, managing, and sustaining a thermal energy community.

4.1.1. Internal knowledge

Internal knowledge can be seen as knowledge available without external help, thus the knowledge or skills that are in the organisation itself. Members of the organisation have the knowledge or skills themselves. Organisational knowledge, according to the interviewees, is crucial to ensuring the successful management of thermal energy cooperatives. This type of knowledge includes project management and leadership skills, which are crucial to ensuring the operation of the project. One interviewee noted, "*at a certain point, that needs to be organised and that really requires different knowledge and different skills*". Most of the cooperatives studied in this research eventually hired a project leader, someone with the expertise to guide the project, assemble teams, maintain supervision, and solve emerging problems. Without this internal organisational knowledge, it becomes significantly harder to manage the complexity of setting up and running a thermal energy organisation.

When the board or community lacks the knowledge or skills needed, it can be brought in externally or it can be obtained from the neighbourhood itself. This can be referred to as local knowledge. Local knowledge is also critical to the successful establishment of a thermal energy organisation. As one board member explained, "*There are simply people in the neighbourhood who have, for example, experience with finances. These people simply exist in the neighbourhood, but you need to enlist them in your organisation*". Despite being a challenge to locate such individuals, they are highly valuable. These local experts not only provide knowledge, but also help build trust among community members. Familiarity plays a key role in gaining the trust of residents, as people are more likely to believe and follow advice from a neighbour than from an outsider (Stern, 2000). The social characteristic of the community, therefore, becomes intertwined with the technical and organ-

isational capacities needed to run the thermal energy network.

Another key area that has been frequently mentioned, but is often overlooked, is social knowledge. Social knowledge refers to understanding how to engage the community, foster participation, and build support for the initiative. This differs from local knowledge, as local knowledge refers to all knowledge and skills available in the neighbourhood. Social knowledge is particularly important for a collective heating solution because it requires broad participation from the neighbourhood. Residents must agree to the changes required in their own homes, such as updating their heating installations, and convincing them to do so requires a high degree of trust and effective communication. Social ambassadors or participation workers play a critical role in building this trust and ensuring that residents are on board with the initiative.

4.1.2. External knowledge

External knowledge are skills or knowledge that is not present in the organisation. The board often relies on external knowledge, particularly in areas such as technical, legal, and financial expertise. Consulting firms and public knowledge bases like *HIER* and *Energie Samen* provide the necessary technical and legal support. An interviewee stated, "*Yes, and in the end, you cannot avoid the fact that you also need to hire a lawyer*". This highlights that while internal knowledge is valuable, it is often necessary to rely on external knowledge to navigate complex technical, legal, and financial issues.

However, this external knowledge comes with its own challenges. For example, hiring consultants or legal advisors can be costly and time consuming. Finding the right partner, explaining the specific issues, and waiting for advisory reports can significantly slow down the process. In addition, it is not just about acquiring external knowledge; it is also about understanding and communicating with these external partners. For the board to engage effectively with these third parties and make use of their advice, a basic understanding of the technical and legal concepts involved is required. This is where having some internal knowledge proves advantageous.

Key takeaways

A summary of key points with respect to knowledge and capabilities:

- **External knowledge**: This includes specialised knowledge that can be sourced from outside the organisation, such as technical, legal, and financial expertise. Consultancy firms and public knowledge bases, like *HIER* or *Energie Samen*, provide much of the necessary external knowledge. However, while external expertise is crucial, it is often expensive and time-consuming, necessitating careful management.
- **Local knowledge**: This refers to the knowledge available within the community itself. Residents with professional expertise in areas such as finance, technology, or management are invaluable resources. Although finding and engaging these individuals can be challenging, their contribution is crucial to building a successful initiative, and their local connection helps to foster trust within the broader community.
- **Organisational knowledge**: This is identified as essential for the transition of community initiatives into formal thermal energy organisations. Organisational knowledge includes sets of management skills and the ability to effectively lead and coordinate the project. At a certain stage, having someone in the cooperative with project management skills becomes indispensable.
- **Social knowledge**: Social knowledge is crucial to building community support, as thermal energy networks are based on high levels of resident participation. To achieve this, the organisation must build trust and communicate effectively with the community. Social ambassadors or participation workers are key to this process, ensuring that the project has the support of the neighbourhood.

4.2. Citizen involvement and community engagement

Based on the second sub-question, *How does the board ensure that members are equipped with the necessary knowledge and information to understand the social, environmental, and economic impacts of a thermal energy initiative?*, this section explores the vital role that citizen involvement and community engagement plays in the success of community heating initiatives. Active involvement of residents is crucial, as a collective network heating system can only succeed when it meets the specific needs and preferences of the community it serves. It is not enough to implement a top-down solution; instead, the solution must be crafted with the input and participation of the people it affects. In this sense, citizen involvement is closely related to the concept of conscientiousness, as described in the theoretical framework, which involves raising awareness and encouraging active participation in decision-making processes.

4.2.1. Challenges in involvement

A major challenge is building trust within the community. The value of trust cannot be overstated when it comes to citizen involvement, particularly in thermal energy initiatives. Homeowners are far more likely to participate in and support an initiative if it is supported by someone they trust, usually a neighbour or someone with local credibility. As one of the interviewees stated, "*people often end up doing what their neighbour does, and maybe not what would be most beneficial*". This dynamic is both an advantage and a challenge for the board, as it reinforces the need to involve respected and influential local residents in the project. Through personal contacts, word of mouth, or advertising in local newspapers, the board can identify and recruit people who have the necessary knowledge and influence to drive the project forward. However, finding such individuals who are willing to volunteer their time and expertise can be difficult. In addition, they must possess strong intrinsic motivations to contribute to the energy transition and sustainability goals. According to one of the interviewees, ideal candidates are often "*people who are interested in change and sustainability*," which shows that these individuals are not only skilled but also passionate about the cause.

Another critical factor in securing citizen involvement is cost. Although some homeowners may be willing to pay a premium for sustainability, especially if their neighbours are doing the same, others are motivated primarily by financial considerations. The high upfront costs of connecting to a heating network can be a deal-breaker for many households, particularly if the immediate economic benefits are not clear. Although government subsidies can help reduce some of the financial burden, and rising gas prices make heating networks increasingly attractive, the board still faces challenges in conveying the long-term economic benefits of switching to a thermal energy system. An interviewee shared a particularly telling story: "*People didn't trust it. There was a man who was absolutely against it. He was not planning on signing, but then they calculated it for him using a tool that estimates gas consumption or something similar. And it turned out that he would save €2,000 compared to what he was currently paying. Then suddenly a light bulb went off for him. After that, he signed the letter of intent*." This example underscores the need for clear and transparent communication about the financial benefits of thermal energy systems to overcome scepticism and hesitation.

4.2.2. Methods of engagement

Thermal energy cooperatives depend not only on the recruitment of skilled individuals but also on the approval of a large portion of the community. Early adopters, those who are already enthusiastic about sustainability and environmental issues, are typically easy to convince. These individuals are often technically minded, already familiar with the concept of renewable energy, and eager to be part of the change. However, the challenge lies in reaching the larger and more hesitant segment of the population. For the heating network solution to be viable, it must connect a significant percentage of the community to the heating network. The board must eventually convince a larger base of residents to join the initiative.

To engage this wider audience, cooperatives typically organise public information sessions and campaigns. These efforts aim to educate residents about the benefits of a heating network and how the proposed heating network will improve the sustainability of their homes, reduce energy costs, and

contribute to environmental preservation. However, despite these efforts, most cooperatives have found that door-to-door conversations are the most effective way to reach homeowners. Energy workers and participation workers play a crucial role by visiting residents individually, explaining the project, and addressing specific concerns or misconceptions. This personalised approach not only provides answers to residents' questions, but also allows for a tailored conversation that directly addresses individual doubts or fears. According to a board member, while this approach is effective, it is also resource intensive. According to a member of the board, this approach is highly dependent on "*how much money is available, the most labour intensive aspect is that many people are, of course, often not at home. Well, there is some experience with favourable times, but those are often not the times when professionals are working. Saturday, right? During the day between 10 and 3*." This comment highlights the difficulties of running a door-to-door campaign.

Key takeaways

A summary of the findings regarding citizen involvement:

- **Familiarity**: Familiarity plays a critical role in citizen participation. Residents are more likely to trust and engage with the project when it is led by someone they know and trust. Ensuring that trusted members of the community are involved in the initiative is crucial to gaining widespread support.
- **Motivations**: Engaging residents with an interest in sustainability and environmental change is easier, as they are naturally more inclined to support such projects. However, for broader community involvement, the board must also appeal to the practical and financial motivations of residents who may not be as driven by environmental concerns.
- **Costs**: Cost remains a significant barrier to widespread participation. Although government subsidies and rising energy prices make heating networks more financially attractive, the board must still effectively communicate the long-term economic benefits of the switch. Clear and transparent financial information is essential to convince homeowners to join the initiative.

4.3. Information sharing and consensus building

This section discusses how boards promote dialogue and understanding among stakeholders to build consensus, and the various methods and strategies used to facilitate the exchange of information within thermal energy communities. This aligns with the concept of conciliation and directly addresses the third sub-question, *What approaches does the board take to promote dialogue and understanding among stakeholders involved in thermal energy initiatives?* The role of communication is a vital part of establishing consensus and understanding among various actors involved in the heating network initiative.

4.3.1. Communication strategies

Information sharing can be achieved through a variety of methods, each suited to different types of audience and the complexity of the information being shared (Figure 4.1). Community meetings are one of the more formal methods used to provide updates, share context, and explain the progress made by the thermal energy initiative. These meetings are useful in providing a broad overview of information, especially when major developments or changes need to be communicated to the community. In addition to meetings, newsletters, websites, and other digital tools are also used to keep the community informed. These platforms allow for ongoing communication, where updates on timelines, technical details, or frequently asked questions (FAQs) can be shared. Websites are particularly useful for residents to access detailed information whenever they need it, giving them the flexibility to engage at their own pace.

Figure 4.1: Different ways of sharing information

Technical information meetings offer a more in-depth look at the specifics of the heating network, but tend to attract a limited audience. As noted by one interviewee, "*you only get the technical guys coming to the information sessions. Then it is all about how the system works in technical details, like with the heat network, how it looks. You end up with only technical people who want to know the technical details and think they know better than the experts who have been working on it for months. They only focus on a few numbers that may not add up for now, so you get these strange public consultation meetings, so to speak*". This comment highlights a common issue in public consultations: they often attract a niche group, typically those with a technical background, which can alienate the broader community that may be more concerned with the overall benefits and impacts of the system than its technical details.

4.3.2. Building consensus

Building trust is central to the building of consensus. Individualised or one-on-one meetings allow the board to build stronger relationships with the community, addressing individual concerns, and creating a sense of transparency. Many of the initiatives interviewed found that door-to-door conversations, or "keukentafelgesprekken" (kitchen table discussions) in Dutch, are an effective strategy for information sharing and consensus building. This approach allows the board or participation workers to directly engage residents, offering them customised information that addresses their specific concerns or needs. As one of the board members explained, "*you can ask hundreds or thousands of questions about the development of a heat network, but that one person only has those two specific questions. So, in a conversation like that, you can really focus on addressing those questions or say I will look into it for you and get back to you. And that will also take the burden off people during the entire thought process*". This method makes it easier for residents to digest information and feel heard, without being overwhelmed by unnecessary technical details.

Additionally, external verification from third-party experts or consultants helps solidify trust in the project's technical feasibility. As discussed in Section 4.1, having external confirmation, such as a consulting firm or a government agency that verifies the technical details, can help alleviate residents' concerns and help residents feel more confident in the proposed solution. A board member pointed out the importance of this process by saying, "*you do not want to have to knock on your neighbour's door saying 'Hey, I am not getting any heat.' Having experts work out the technical details helps to create confidence in the proposed solution*".

Key takeaways

Summary of the key points about information sharing and consensus building:

- **General information sharing**: This aspect of communication is not particularly challenging, as it can be easily managed through public meetings, newsletters, or digital platforms such as websites. The key is to ensure that the information is communicated clearly and in a comprehensible way, often requiring the assistance of communication specialists who can simplify complex topics for broader audiences.
- **Specific information sharing**: Conveying detailed technical information is more of a challenge. In practice, many of the initiatives interviewed found that ”keukentafelgesprekken” or door-to-door conversations work best for sharing specific, personalised information. This approach allows for more targeted engagement, where residents can ask questions that directly affect them and receive personalised responses.
- **Trust**: Trust remains a crucial factor in information sharing. Residents are more likely to accept information as true and credible when it comes from trusted sources. This trust can be established through direct interactions, such as personal conversations, or through the verification of information by external experts or consultancy bureaus. Trust building is not just a by-product, but an integral part of effective communication in these initiatives.

4.4. Collaborations and partnerships

Thermal energy initiatives often engage in collaborative partnerships with a wide range of actors, as these collaborations are essential for the successful transition from a thermal energy initiative to fully operational thermal energy organisations. This section discusses the third element of the theoretical framework, collaboration, and addresses the fourth and final sub-question: *How does the board employ collaboration and partnerships in their efforts to transition household initiatives into thermal energy organisations?* These collaborations bring together various stakeholders who contribute their expertise, resources and support to ensure the success of thermal energy initiatives.

4.4.1. Partnerships

Collaborative partnerships in thermal energy initiatives typically involve a variety of actors, each playing a specific role in the development and management of the heating network. These collaborations can be organised with:

- **Municipality**: The local government is a crucial partner, as it plays a leading role in the heat transition, particularly in terms of regulatory approval and permit issuance. Municipalities often provide funding or support for heating networks.
- **Residents**: At the heart of the initiative, residents are both stakeholders and end users of the heating network. They must be involved in decision-making processes to ensure that the solution is tailored to their needs and that the project gains sufficient local support.
- **Building owners**: These include housing corporations, private landlords, schools, and businesses. Each requires sustainable heating solutions for their properties, making them critical stakeholders in ensuring the feasibility and scalability of the heating network.
- **Grid operator**: Depending on the new heat law, the grid operator may become an essential partner, particularly when it comes to integrating the new heating system with existing energy infrastructure, such as electricity generation and distribution networks.
- **Underground managers/users**: Responsible for managing the underground infrastructure that will house the heating network’s pipes, these stakeholders play a key role in maintaining and coordinating the technical aspects of the network.
- **Other governments**: Entities such as water authorities, provinces, and water companies also play vital roles, as they may be involved in providing water resources or regulatory oversight.
- **Contractors**: These are the companies responsible for the physical construction and instal-

lation of the heating network, including the installation of pipes and the installation of heat exchangers. They bring the practical skills necessary for the realisation of the project.

- **Consultancy agencies**: These agencies provide essential expertise in areas such as project management, planning, and technical advice. They often help the board overcome knowledge gaps and create viable business models.
- **Legal partners**: These partners assist in navigating the complex regulatory and legal landscape associated with thermal energy projects, ensuring that the initiative complies with all relevant laws and contracts.

By engaging with these partners, thermal energy initiatives can pool their resources and expertise to address the unique challenges they face in their respective communities. As highlighted in Section 4.1, consultancy agencies and academic institutions are key contributors to building the knowledge base required to develop a solid business plan. In addition, partnerships with third party companies provide missing technical skills, such as legal counselling, accounting, and construction expertise. These collaborations are important, as most initiatives lack the resources to develop all aspects of the project in-house. Instead, they rely on the collective strength of partnerships to fill the gaps and ensure the success of the project.

4.4.2. Challenges in collaboration

One of the most important collaborators identified in this study is the local government. The local municipality is a critical partner at every stage of the development of the heating network, from the initial planning phase to securing funding and obtaining the necessary permits. Some initiatives reported very positive working relationships with their local governments, particularly when the municipality itself was an active driver of the heat transition. These initiatives tend to progress more quickly and encounter fewer obstacles. In other cases, the relationship between the initiative and the local government was more strained, with differences in work pace and priorities slowing down the project. As one board member remarked, "*I find the collaboration more complex than I initially thought with those three other parties. They operate at such a different pace than us, we are more action-orientated*". This comment underscores the challenges that can arise from misaligned expectations between the initiative and governmental partners. Furthermore, frequent changes in government personnel can lead to disruptions in continuity, making it harder for initiatives to maintain momentum.

Another significant challenge that emerged during the interviews was the ownership issue. When developing a heating network, decisions must be made about who will own and operate the system once it is completed. In some cases, the initiatives expressed the desire to retain ownership within the community, keeping control in the hands of the residents. However, this presents its own set of challenges, as most initiatives lack the experience needed to run a utility company. On the other hand, some local governments have expressed interest in running the heating network themselves, but since the liberalisation of utility services in 2004 (Tweede kamer, 2004), many municipalities no longer have the experience to manage such a system effectively. An interviewee suggested that "*the hoogheemraadschap, which has much more experience with this kind of technical public service, and it would make much more sense to place it under their responsibility*". This illustrates the complexity of determining the appropriate ownership and governance structures for these initiatives, an issue that remains unresolved in many cases.

Key takeaways

A summary of the findings on collaborations and partnerships:

- **Knowledge transfer**: One of the primary motivators for engaging in collaborative partnerships is the ability to transfer knowledge. Thermal energy initiatives typically do not have all the experience or resources required to develop a heating network in-house. By partnering with third parties, they can access the necessary skills, experience, and technical knowledge to advance the project.
- **Local government**: The role of the local government has been identified as critical to the success of heating networks. The relationship between the initiative and the municipality can significantly influence the project's progress, with positive collaborations leading to faster implementation and more comprehensive support.
- **Ownership**: Although outside of the direct scope of this study, ownership emerged as a recurring theme in many interviews. Determining who will own and manage the heating network remains a key issue, with various stakeholders expressing different preferences and concerns.

4.5. Main Findings

The previous sections have presented the key findings derived from interviews with various members of energy initiatives involved in the development and management of thermal energy communities. These findings provide valuable information on the critical factors that contribute to the transition of community initiatives to fully functioning thermal energy organisations. This section provides an overview of the findings and highlights the most significant trends and patterns in the different sections. Providing a summary of the key takeaways found throughout each section.

The results reveal that thermal heating initiatives possess a diverse range of relevant knowledge and skills. This includes financial expertise in managing budgets and ensuring economic viability of the project, technical expertise in understanding the intricacies of heating systems, and organisational skills to manage the various stakeholders and processes involved. In addition to these, communication skills are essential for engaging with administrators, policymakers, professionals, and citizens. Many initiatives find this knowledge locally within their own neighbourhoods, especially in the form of residents who possess relevant professional experience. However, where knowledge gaps exist, partnerships with external professionals, such as consulting agencies, legal experts, and contractors, are critical to filling these gaps and ensuring the progression of the project.

As expected, a significant finding of this study is the importance that residents place on both costs and trust in the community. With cost, the financial aspect of the heating network is a major concern for residents, as the solution proposed by the thermal heating initiative must be competitive with traditional heating options. If costs significantly exceed those of traditional heating systems, it becomes difficult to get widespread support for the initiative.

Apart from costs, trust is a fundamental factor in the success of these initiatives. Trust refers to the confidence that residents have in the success of a cooperative. Residents are more likely to support and participate in the initiative if they feel a sense of trust in the board and in their neighbours who are involved. Familiarity with those leading the initiative helps to build trust, as does a shared passion for sustainability and a commitment to a sustainable future. The importance of local knowledge, as discussed earlier, further reinforces this trust, as residents tend to rely on familiar faces and local expertise when making decisions.

Information sharing is another area where trust plays a crucial role. The study highlights that sharing information through personal, one-on-one conversations is the most effective approach to building trust and ensuring that residents fully understand the benefits and implications of the thermal energy initiative. This personalised method allows residents to ask specific questions and receive tailored answers, creating an environment of openness and transparency. Public meetings, newsletters, and websites are useful tools for sharing general information, but it is through direct interaction, such as the ”keukentafelgesprekken” (kitchen table conversations), that the most meaningful exchanges occur. These personal conversations help address any doubts and build confidence in the initiative, ensuring that residents feel informed and supported.

Lastly, the results underscore the importance of collaboration with the local government, working together with local governments, for example, through regular check-ups and meetings. Thermal energy initiatives typically rely heavily on local authorities for support, be it through regulatory approval, funding, or technical assistance. The relationship between the initiative and the municipality plays a critical role in the overall success of the project. Although some initiatives report positive and productive collaborations with their local governments, leading to faster implementation and more comprehensive support, others face challenges. Differences in work pace, priorities, and lack of continuity within government bodies can slow the process and create obstacles to progress. Despite these challenges, collaboration with the local government remains essential and initiatives that navigate these relationships effectively appear more likely to succeed in implementing a functional and sustainable heating network.

5

Discussion & Conclusion

5.1. Addressing the subquestions

This section addresses the subquestions by integrating the interview results and linking them to the existing literature and the main research question. Describing both original findings and how they align or differ from previous research or knowledge that *Energie Samen* had.

Sub-question 1: What knowledge do the board possess and what do they identify as necessary for the transition of community initiatives into a thermal energy organisation?

Findings

The interviews show that the initiatives are turning into professional organisations, for example, by hiring paid employees. Each cooperative consists of at least multiple board members, a project lead, energy coaches, or participation workers. Most of these people are volunteers, but in some scenarios even paid workers. These people need to create a viable business plan which requires millions of euros of investment and will impact hundreds of households. This shows the scope of the organisation that started as an initiative. Transitioning towards such an organisation requires the development of knowledge. Board members possess a combination of basic technical, managerial and organisational knowledge, crucial for leading thermal energy projects. Although much of this knowledge comes from within the local community, external experts are often brought in to fill gaps, particularly in technical or legal areas. All initiatives were experiencing problems with the time that volunteers could dedicate to running the initiative. In all cases, this led to the hiring of paid employees. Sometimes in the form of energy coaches or participation staff, who take on time-intensive tasks. But also in crucial positions, such as project management, the hiring of paid staff has proven essential for the growth of the initiative.

The interviews highlighted the vast amount of knowledge available in these communities. Through years of building the cooperative, the board members learnt a lot about both the technical and organisation aspects of a thermal energy. Although they do not have specialist knowledge, their general knowledge suffices, and specialist knowledge can be brought in through consultancy firms. This internal knowledge is usually derived from the experience of local residents, while external knowledge is sourced through partnerships with contractors, legal advisors, and consultants. The board's ability to mobilise internal knowledge fosters trust within the community, while leveraging external knowledge ensures that specialised tasks are handled by experts. Last, social knowledge is knowledge about the neighbourhood and knowledge about how to approach people. This is an important aspect for the board and a piece of knowledge that they should therefore also possess.

Existing knowledge comparison

The Platform31 study (2024) highlighted how community initiatives develop knowledge over time, emphasising that local organisational knowledge is crucial. Similarly, this study shows that while external technical expertise is often necessary, building in-house capacity is essential for the long term success of thermal energy cooperatives. Like the Platform31 study, this study recognises that local participation, particularly in the acquisition of management and organisational skills, strengthens the initiative and improves its chances of success. However, a key difference lies in the emphasis this study places on the critical role of external partnerships. Unlike Platform31, which focusses primarily on internal development, this study emphasises the need for a balance between internal capabilities and the ability to strategically collaborate with external stakeholders to access specialised knowledge and resources. This shows an interaction between internal development and external expertise, expanding the understanding of capacity building in thermal energy organisations.

Figure 5.1: Types of knowledge needed for a thermal energy organisation (EnergieSamen, 2024b)

Figure 5.1 provides an overview of the various types of knowledge required to operate a thermal energy organisation found by *Energie Samen* (n.d.). These include knowledge in collaboration with external partners, such as local governments, knowledge in technical design and business cases, organisational and financial skills, and communication know how, particularly to encourage citizen participation. Each of these areas plays an important role for these thermal energy initiatives. These four types of knowledge are in line with the findings of this study. However, this study highlights the importance that knowledge is sourced locally.

Link to main research question

The knowledge that boards possess, both internally and externally, is vital to the transition from a community initiative to a thermal energy organisation. The ability to manage this knowledge effectively influences the progress and viability of these initiatives. The latter is associated with the Platform31 study, while the link between internal and external knowledge provides new findings from this study.

Sub-question 2: How does the board ensure that members are equipped with the necessary knowledge and information to understand the social, environmental, and economic impacts of a thermal energy initiative?

Findings

In addition to gaining knowledge through experience, the framework divides the building of capabilities into three main parts: conscientisation, conciliation, and collaboration. Conscientiousness was found in the interviews as a desire to contribute to the thermal heating initiative. This is where values and not only the knowledge of residents came to the forefront. Reliability and familiarity are values that are considered important. This can be validated by the literature: “Familiarity is valuable to individuals and communities as it promotes a sense of common identity, trust, and respect within a community” (Zhang et al., 2022). In addition to reliability and familiarity, people’s motivation to participate can be divided into two groups. The early adopters, often those very involved in the initiative, have an interest in sustainability; they are eager to adopt sustainable practices and are willing to invest both money and free time. Then there is the larger group of people, the majority, who, in addition to reliability and familiarity, are primarily concerned with cost. The cost of heating their home should not be higher than it is currently.

Existing knowledge comparison

This approach aligns with previous research on community engagement, where trust and personal attention are the key to fostering participation. The capability model, and in this case particularly the conscientisation part of the 3C framework by Ibrahim (2017) also highlights the importance of fostering critical awareness among community members. However, where this study differs is in its exploration of how conscientisation is influenced by external actors. Although the 3C model focusses primarily on internal community dynamics, this research shows and adds new knowledge, which are external pressures, such as government regulations and funding availability, shape how communities engage in conscientisation. In this way, the study extends the 3C model by integrating an extra dimension into these internal processes.

Link to main research question

Educating community members about the social, environmental, and economic impacts strengthens their participation, which is essential for the overall transition to a formal thermal energy organisation.

Sub-question 3: What approaches does the board take to promote dialogue and understanding among stakeholders involved in thermal energy initiatives?

Findings

From the interviews and the corresponding analysis, it emerged that conciliation can be found in the way the board shares information. There are countless methods for this, and their effectiveness has been extensively researched in the academic literature. But whether it is through newsletters, information on the website, or community meetings, the analysis showed that it primarily revolves around personal attention. There must be trust in the organisation. One-on-one or ’kitchen table’ conversations work best when it comes to gaining trust. An additional advantage is that this method is also the most effective in conveying information.

Existing knowledge comparison

The emphasis on personal involvement supports the existing literature on stakeholder participation. However, this research highlights the importance of validating information through third-party experts, adding another layer of trust building that has been less emphasised in previous studies. This is a new knowledge that was assumed important by *Energie Samen*, but now has been academically demonstrated with this study.

Link to main research question

Effective dialogue and understanding among stakeholders are critical to building consensus and moving towards a shared vision for the thermal energy project.

Sub-question 4: How does the board employ collaboration and partnerships in their efforts to transition household initiatives to thermal energy organisations?

Findings
Collaboration is the third building block of the 3C model. Collaboration involves working together with external parties. These are parties as described in 4.4.1. The interviews confirmed that collaborations are essential to realise a heating network. Specialised knowledge is needed for the legal, financial and technical aspects of the project. This is expertise that organisations do not necessarily need to have in-house, but is crucial for the realisation of a heating network. In addition, the local government plays an important role in the implementation of a heating network. They are often responsible for subsidy applications and zoning plans for certain neighbourhoods. Therefore, intensive collaboration with local governments is of great importance. Although the sample size is not large enough to draw clear conclusions, there appeared to be a correlation between the progress of certain initiatives and their collaboration with the local government. The better the collaboration, the faster the progress in the process of realising a heating network.

Existing knowledge comparison
Consistent with previous research, the need for external partnerships is well established. This study reinforces the idea that collaborations with local governments and contractors are crucial in navigating complex legal, financial, and technical hurdles. This aligns with the first step of the *Buurwarmte* approach *Energie Samen* already published. Were collaboration with the municipality the fifth step in a twelve-step initiation phase (EnergieSamen Academie, n.d.).

Link to main research question
Partnerships play a fundamental role in the success of transitioning community initiatives into formal thermal energy organisations by providing the necessary resources and expertise.

5.2. Comparison with Existing Literature
This section delves deeper into how the study's findings align or differ from the existing literature, including contributions to theoretical frameworks such as the 3C model.

5.2.1. Addition to the literature
A review of the literature on community energy, the management of heating initiatives and the building of capabilities provided a starting point for this research. The review of community energy and more specific thermal energy communities provided a historical background for community energy. Furthermore, it emphasises the challenges and the growing interest and need for community energy, more specifically thermal energy, because of the need to reduce the use of natural gas. The analysis then explores how these thermal energy communities are run. They often start as an initiative based on volunteers, who form a board in a cooperation structure. These volunteers are professionals in their own field of work, but are not always knowledgeable about managing thermal energy initiatives. This introduces the concepts of knowledge and values, where knowledge can be divided into. Internal knowledge, knowledge that is available within the community itself, and external knowledge, knowledge that is available outside the community. Managing this need for knowledge, as well as the values present within the community, is the start of the knowledge gap.

This is where the literature review presents a framework designed to assess the capabilities a person or a group of people should have to complete each step of the development process of thermal energy communities. This framework is called the capability approach (Sen, 1992) and has been adopted in the 3C model for use in the analysis of communities by Ibrahim (2017). However, this framework was created for general communities. In contrast to general communities, for thermal energy communities, the focus is on collaborative efforts and mutual benefit rather than merely shared characteristics. Such a community has not been analysed before, using the 3C-model. Therefore, the framework has been expanded with the notions of knowledge and values as they were found to be a gap in the literature. The end result is a framework based on a thorough analysis of the literature, which ensures academic relevance for the study of thermal energy communities.

This study highlights the balance between internal organisational knowledge and external specialised expertise, which further enhances the understanding of capacity building in thermal energy cooperatives. Boards utilise local expertise while supplementing their knowledge through external partnerships. The study also extends the literature on the role of external actors by showing how collaborations with government bodies and professional consultants are essential for overcoming regulatory and technical challenges.

5.2.2. Reflections on the 3C-Framework

Framework strengths

The 3C framework (conscientisation, conciliation, and collaboration) was useful in structuring the analysis of the dynamics of the community. It helped capture how knowledge and values are mobilised within the community and how decisions are made collaboratively. It proved to be an excellent framework around which to build research. Focusing on conscientisation within the community led to new insights regarding external pressures. Conciliation revealed that trust building is crucial for the success of initiatives. Collaborations, as described in section 4.4.1, proved essential for the initiatives to transition towards a thermal energy organisation.

Framework limitations

Although the introduction of knowledge and values as separate entities extended the framework to more accurately represent the case of thermal energy communities, it turned out that it did not fully represent the thermal energy communities. As explained in section 1.1.2, thermal energy communities are a unique type of community which has corporate characteristics. The framework used did not fully represent the corporate traits present in these cooperations. For these specific cases in addition to the 3Cs conscientisation, conciliation and collaboration, the addition of a fourth C in the form of cooperation could be explored as an option. The introduction of a fourth ”C” could help the theoretical framework better describe a thermal energy community.

Framework contributions

The framework provided a solid foundation for analysing the dynamics of the internal community. However, integrating external influences more explicitly would improve its relevance to thermal energy communities, which operate within a broader regulatory and economic context.

5.3. Research limitations and future research recommendations

This section presents a critical reflection on the limitations encountered during the research process and offers recommendations for future studies. Recognising the limitations of current research is essential by assessing its validity, reliability, and generalisability. By discussing the limitations, the aim is to provide transparency about potential biases or gaps that may have influenced the findings. In addition, on the basis of these limitations, several recommendations are proposed to guide future research efforts.

5.3.1. Research limitations

In this section, the limitations of the study and its validity are discussed. It is crucial to identify and address these aspects to provide a complete understanding of the findings.

Case selection

This research has been limited to cases only in the Netherlands. For a more complete picture, it could have been useful to also look at other cases within the EU, as the Dutch energy approach is driven by subsidies and guidelines from the EU. Furthermore, the selection of cases is limited to cases affiliated with *Energie Samen*, which introduces a certain bias that could have been avoided by involving cases in the research that have no affiliation with *Energie Samen*. Lastly, the limited time and resources of the author have resulted in a restriction on the number of cases, as well as the number of interviews. This study used five very different cases, but provided very similar results regarding the issues they encountered. A broader data set and more interviews could better represent trends and further support the reliability of these trends, which could indicate whether the issues are truly the same or if it was a coincidence in this case.

Data collection & analysis

The data was collected from the literature, but primarily through semi-structured interviews. Although semi-structured interviews are a comparable and reliable data collection method, the use of only one data collection method is somewhat limited, and multiple data collection methods could strengthen research. Furthermore, all data were obtained in Dutch and to include this data in the report, it was translated. This was done very carefully to maintain the integrity of the content, but it is still possible that differences in terminology arose due to the translation.

Data coding was also performed by a single researcher, which is a known form of bias. During the coding process, an effort was made to remain as objective as possible, but bias can never be fully excluded. Another critique of coding is the risk of overlooking codes that do not fit the predefined categories or themes (Medium, 2024). During the coding process, buckets were created beforehand to prevent the preestablished categories from potentially leading to the exclusion of unique or unexpected findings. In fact, the most valuable information can come from outliers that were not predicted in advance. Moreover, it is important to maintain the context of the data. During coding, the context could potentially be lost, and to prevent this, extra buckets and memos were created to ensure that the context, as well as outliers, were not lost.

5.3.2. Recommendations for future research

In this section, several recommendations for future research are presented to address the limitations identified in the current study. These suggestions are intended to provide guidance for future investigations and improve overall understanding of the topic.

The various forms of bias mentioned in Section 5.3.1 can be avoided by expanding the research with more researchers and a larger data set. Expanding the research with more cases would provide a better picture of the trends that can be found. Furthermore, more interviews could be conducted not only with board members, but also with financial contributors, representatives of local governments, and partnering companies. This could offer a broader perspective on opinions and potentially lead to new insights or verify existing ones. This is the first recommendation for further research.

Moreover, it could be useful to verify the recommendations by following the initiatives, for example, over a longer period, and expanding the research with a form of participatory research. In this way, the recommendations and findings of this study can be verified.

The limitations mentioned related to data collection and analysis can also be addressed in further research. A well-known and rigorous research method is the mixed methods approach, which integrates quantitative data with the qualitative data that are already there. This mix is an excellent way of reducing subjective biases. However, as with the larger dataset and participatory research, all these recommendations would require a longer research period. This would undoubtedly make the study more robust.

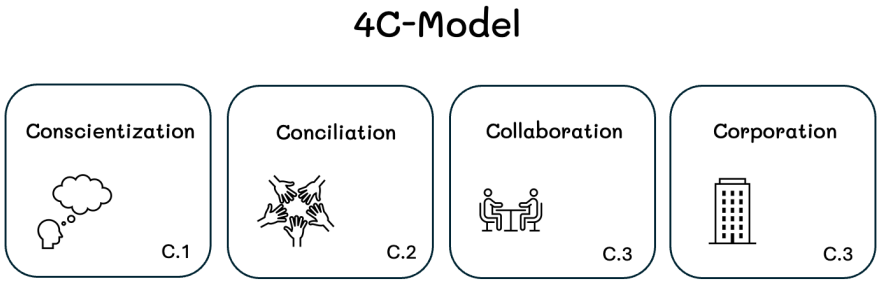


Figure 5.2: Proposed 4C model

Furthermore, it would be useful to explore an expansion of the 3C model, an expansion that fits the thermal energy communities. A suggestion would be to explore the possibility of a fourth C, creating a 4C model (Figure 5.2) that also focusses on the corporate characteristics of the thermal energy community. Such an expansion of this theory could be very helpful in analysing success factors in initiatives. These success factors could help establish a scalable implementation for thermal energy communities in the Netherlands and Europe in the future.

Finally, it would be valuable to investigate the effects of the new WCW law. The literature has shown that in recent years, the growth of thermal energy cooperatives has stagnated. Uncertainty about the governance structure could be a significant reason for this. The new WCW law is made to provide more clarity on this issue and should, in the future, ensure that community-led heating networks are established more frequently.

5.4. Practical recommendations for thermal energy communities

Based on the findings, this section presents some recommendations for thermal energy communities in the Netherlands. These recommendations are based on the interviews and literature research conducted for this report. This means that there are limitations to the validity of the recommendations; these limitations were discussed in Section 5.3.1.

Build trust with the community

Trust is essential to ensure the participation of residents, and personalised engagement fosters the relationships necessary to build this trust. A community initiative often starts from the bottom up, driven by people in the neighbourhood who believe in helping the community move forward in an effort to become more sustainable or free of natural gas. These initial motivations, rooted in the desire for collective improvement, must be effectively transferred to the majority of the neighbourhood to gain widespread support. Convincing the majority and conveying these motivations requires trust from the community because trust forms the foundation for genuine collaboration and support.

Building this trust is not only crucial, but must be done thoughtfully and authentically. An important way to achieve this is to ensure that the initiative is deeply embedded within the community itself. When an initiative reflects the values, needs, and goals of the community, it demonstrates a commitment that resonates with residents, making them more likely to engage. A top-down approach, such as newsletters or informational talks, often lacks the personal connection necessary to inspire action. In contrast, a personal approach, such as going door-to-door to address individual concerns and answer questions directly, creates meaningful interactions. This form of participation fosters a sense of accountability and mutual understanding, which in turn builds a stronger bond between residents and the initiative.

This bond is essential to the long-term success of community projects such as a district heating network. Without trust and personal connection, residents may be reluctant to commit to changes that impact their homes and lives. Personal involvement not only reassures them, but also empowers them to actively participate, turning abstract goals into shared aspirations. Therefore, investing in personal relationships that build trust is key to achieving the full potential of any community-led initiative.

Source knowledge locally

Using local knowledge fosters trust and reduces the reliance on expensive external consultants, promoting long-term sustainability. Building trust is closely related to using local knowledge, as these two aspects go hand in hand. The neighbourhood possesses a wealth of knowledge, with residents who have affinity and expertise due to their professions. This local expertise often includes critical skills such as project management, organisational development, and financial or legal know-how. Involving residents who have these talents not only adds valuable capacity to the initiative but also deepens the trust between the community and the project.

Trust is built when local residents feel ownership and involvement in the process. By incorporating your expertise, the project gains credibility and becomes more reflective of the values and needs of the community. Residents are more likely to trust the outcome when they see that their peers contribute to the decision-making process and technical aspects of the project. Furthermore, no one who contributes to the district heating network and is connected to it themselves wants it to function poorly. Their vested interest in the success of the initiative drives a higher level of commitment and accountability, which in turn enhances the project's chances of success.

However, while local knowledge plays a critical role, it's important to acknowledge that not everything can be sourced locally. Some specialised areas of expertise, such as advanced technical solutions or complex engineering requirements, may require partnering with external professionals or renowned experts. These partnerships are essential to ensure that the project is technically sound and operates efficiently in the long term.

In addition, in the operation and maintenance of the district heating network, the community must consider the necessity of involving an independent professional organisation. As a board member of an energy cooperative noted, "*no one wants to knock on the door of their neighbour if the heating system is not working.*" A professional company is essential for managing technical problems, maintenance and repairs, providing a reliable and responsive support system. This balance between leveraging local knowledge and securing professional expertise ensures both community trust and operational excellence, creating a sustainable and effective heating network.

Build a good relationship with the local government

These partnerships are crucial to ensure that thermal energy projects can navigate the legal, financial, and technical hurdles effectively. The local government plays an essential role in the establishment of a district heating network. It has authority over the neighbourhood zoning plan and is responsible for issuing the permits required to install and operate such a network. Without local government cooperation, these administrative hurdles could significantly delay or even prevent the project implementation.

Furthermore, many national government subsidies and funding opportunities, which are essential for the financial viability of district heating networks, can only be accessed through the local government. Therefore, a strong, collaborative relationship between the initiative and the local government is indispensable. This relationship can facilitate smoother access to permits, ensure compliance with zoning regulations, and unlock crucial financial support, making the entire project more feasible.

Although it is important to engage with higher-level figures, such as the alderman or council members, the continuity of these relationships is not guaranteed due to potential changes in leadership following elections. Political shifts could disrupt established agreements or delay decision-making processes. As a result, relying solely on these figures for long-term cooperation may introduce instability into the project. To mitigate this risk, obtaining a letter of intent or appointing a dedicated project manager from the municipality would provide a more stable and structured approach to collaboration. A project manager, in particular, could serve as a consistent point of contact, ensuring that the project's progress remains on track regardless of political changes.

Such formal agreements and designated roles would provide the district heating network with the continuity and reliability necessary to successfully navigate the complex legal, financial, and regulatory landscape. This, in turn, helps ensure the long-term sustainability and operational success of the initiative, reinforcing the importance of these governmental partnerships.

5.5. Conclusion

This chapter presents the conclusions drawn from the study by answering the research questions. It also provides a link to the academic programme, for which this research represents the final assignment.

5.5.1. Answering the research questions

The research objective of this study was to understand what makes a strong internal organisation, how thermal energy communities handle knowledge gaps, and how they collaborate with stakeholders who have the necessary knowledge. By investigating the community board and through four subquestions, the main research question addresses these objectives, illustrating how communities balance internal knowledge, market expertise, and share both knowledge and values within the community.

Subquestions

This section answers the four subquestions that were formulated to achieve the research objective and address the main research question. Addressing each sub-question sheds light on the factors that enable or hinder this transition, providing a clearer picture of how knowledge, collaboration, and community engagement contribute to the transition of community initiatives into formal thermal energy organisations.

Sub-question 1

The first sub-question focusses on the division between knowledge that must be present within the organisation versus knowledge that can be sourced externally through the market.

What knowledge does the board possess and what do they identify as necessary for the transition of community initiatives into a thermal energy organisation?

Although the answer may seem straightforward, it varies significantly depending on the specific needs and circumstances of the community. Each initiative involves the development of a unique heating network, and the knowledge required to establish and maintain this network can differ depending on local conditions or heating solution. However, a general consensus exists across all initiatives: specialised knowledge, such as technical expertise or legal know-how, does not necessarily need to be in-house. Instead, it can be acquired externally through partnerships with contractors, consultants, and legal advisors. This allows cooperatives to tap into the expertise available on the market without the burden of developing all the necessary skills internally.

However, the board must possess organisational and management skills. Ideally, these skills come from individuals within the local community. Local knowledge, especially from residents who understand the specific context of the neighbourhood, is highly valuable. Engaging these individuals and bringing them on board is often a challenge, but the results are worth the effort. Locally sourced knowledge fosters trust and community members are more likely to support initiatives led by their neighbours. The challenge lies in identifying and engaging these individuals, yet they are crucial for the board's success.

Sub-question 2
The second sub-question explores the methods used by board members to ensure that the cooperative understands the complexities involved in managing a district heating network.

How does the board ensure that members are equipped with the necessary knowledge and information to understand the social, environmental, and economic impacts of a thermal energy initiative?

Boards employ several strategies to ensure that their members and the wider community understand the various impacts of thermal energy projects. One of the most effective methods is to maintain close contact with the community through personalised one-on-one conversations. This approach allows board members to directly address concerns, answer questions, and provide relevant information to individuals at their level of understanding. These interactions can be supplemented by communication specialists, who help convey complex information in a more digestible manner.

All interviewed communities agreed that door-to-door conversations are particularly effective. By bringing information directly to residents, board members can simplify the decision-making process for community members. This method also allows for more personalised responses to specific concerns, whether they are of social, environmental, or economic nature. In cases where technical questions arise, follow-up meetings with specialists can be arranged. This personal approach ensures that community members are better equipped to understand the benefits and implications of the heating network, promoting greater support and participation.

Sub-question 3
The third sub-question addresses how the board facilitates dialogue and promotes understanding between the various stakeholders involved in thermal energy initiatives.

What approaches does the board take to promote dialogue and understanding among stakeholders involved in thermal energy initiatives?

The cooperative employs a variety of communication channels to share information and engage stakeholders. These include newsletters, websites, local newspaper articles, word-of-mouth campaigns, and public information sessions. However, one of the main challenges is to ensure that the information provided is perceived as credible and trustworthy. To overcome this, boards often rely on two key strategies: one-on-one conversations and the verification of information through reputable third parties.

One-on-one conversations, as discussed in the second sub-question, are a vital tool for building trust and ensuring that community members feel heard and understood. In addition, having a third party, such as a trusted expert or organisation, validate the information being shared can further reinforce its credibility. This approach not only fosters better communication, but also links back to the concepts of conscientisation and conciliation, helping to build consensus among stakeholders. Through these strategies, the board promotes dialogue, ensuring that all voices are heard and that the community remains aligned with the goals of the thermal energy initiative.

Sub-question 4

The fourth sub-question addresses the importance of partnerships and collaborations in the success of thermal energy cooperatives, particularly in the context of the capability model.

How does the board employ collaboration and partnerships in their efforts to transition household initiatives to thermal energy organisations?

Partnerships play a fundamental role in the success of any thermal energy cooperative. Collaborations not only bring essential knowledge and skills to the table, but also help manage practical matters such as securing funding, obtaining permits, and operating the heating network. In particular, collaborations with local governments are crucial, as they provide access to subsidies, regulatory approval, and support for long-term sustainability.

By working closely with these external partners, cooperatives can ensure that the needs of the neighbourhood remain a priority. In addition, these partnerships enable the cooperative to navigate complex regulatory environments and implement effective heating solutions that are tailored to the needs of the community. The ability to build strong relationships with external stakeholders is a key factor in the cooperative's ability to transition from a grassroots initiative to a fully operational thermal energy organisation.

Main research question

The thesis investigated knowledge and values in Dutch thermal energy communities. This section answers the main research question of the study:

To what extent do knowledge and values within the board of Dutch thermal energy communities influence the transition of the community initiative into a thermal energy organisation?

Based on the findings presented, the knowledge and values within the board of Dutch thermal energy communities have a significant impact on the transition of community initiatives to fully functional thermal energy organisations. Several key factors contribute to this influence:

Knowledge: Knowledge of the board plays a critical role in driving the initiative forward. This knowledge should contain basic technical expertise, some legal and financial experience, and management skills. The findings of this study indicate that boards often rely on external consultants for specialised knowledge, but internal organisational knowledge, especially in project management and local expertise, is crucial to making informed decisions. The ability to mobilise local knowledge, such as that from residents with relevant expertise, is essential to reduce costs, build trust, and ensure the survival of the organisation.

Social Values and Trust: Trust within the community is an essential value that the board must cultivate to ensure resident participation and participation. The board members recognise that familiarity and local involvement foster greater acceptance among residents. People are more likely to support initiatives proposed by familiar and trusted neighbours, and this trust helps to overcome resistance to change, particularly in terms of cost concerns and technical challenges. The ability to build trust through personal relationships and effective communication is a vital asset for the board in transitioning the community initiative.

Citizen Involvement: The board's efforts to involve citizens in the decision-making and transition process reflect the broader values of inclusivity and sustainability. The board members recognise the importance of not only informing the residents, but also empowering them to understand the social, environmental, and economic benefits of the thermal energy initiatives. The focus on door-to-door conversations and personal engagement underscores the board's commitment to fostering an inclusive and participatory approach, which is essential for long-term success.

Collaboration and Partnerships: Collaborations with external stakeholders, particularly the local government, play a key role in the transition. The involvement of the local government in permits, funding, and regulatory matters is a given. However, the way of collaboration varies, with some boards experiencing challenges related to differing work ethics and continuity within the municipality. Effective collaboration with various partners including legal advisors, contractors, and utility companies enhances the board's ability to navigate technical and logistical hurdles. The values of cooperation and shared expertise are clearly essential for the transition process.

Challenges of Ownership: A recurring theme among boards is the issue of ownership and control over the heating network. Although this topic lies outside the immediate scope of the study and will be clarified in an upcoming law, the WCW (Energiesamen, 2020), it reflects the underlying values related to governance and community empowerment.

Knowledge and values within the board of Dutch thermal energy communities play a critical role in the transition from community initiatives to thermal energy organisations. The extent of this influence is considerable, as the ability of the board to mobilise local knowledge, build trust within the community, involve residents, and collaborate with external stakeholders, such as the local government, directly shapes the success of the initiative. The values of sustainability, inclusivity, and community ownership, combined with practical knowledge in areas such as project management and social management, are key to overcoming the challenges of transitioning to a fully functional thermal energy organisation. The ability of the board to integrate these aspects determines the pace and effectiveness of the transition.

5.5.2. Research Relevance

This section discusses the relevance of the study both academically and managerially, focussing on its importance within the context of Management of Technology (MOT).

Link to MOT

This research is closely related to the MSc in Management of Technology (MOT) programme, which focusses on leveraging technology to improve organisational productivity, profitability, and competitiveness. In the case of thermal energy communities, the study explores how technological innovation and collaboration are managed to address sustainability goals and community-driven energy solutions. The transition of these initiatives into formal organisations requires managing not only the technological aspects but also the organisational challenges related to stakeholder management, funding, and regulatory alignment.

From a managerial perspective, the study highlights the importance of balancing in-house knowledge with external expertise. This resonates with the MOT programme's focus on managing technology efficiently by building partnerships and leveraging external resources. The study also demonstrates how local knowledge and community involvement, elements in MOT, can lead to competitive advantages for cooperatives adopting renewable heating solutions. The study addresses the gaps in understanding how cooperatives manage the transition from small scale initiatives to fully operational organisations. It is incorporated into MOT courses like *Technology Dynamics*, which examine how technological change influences social systems, and *Social and Scientific Values*, which emphasise ethical management of technology for societal well-being. By focussing on sustainability and renewable energy, this study broadens understanding of technology management in a sector critical for future energy transitions.

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A

Literature Search

To achieve the research objectives of this report, a systematic review of the literature was carried out using multiple search engines, with a primary focus on *Web of Science*. The theoretical framework guiding this research is the capability approach, which was identified with the guidance of my supervisor. This framework helps to understand how energy communities can enhance their abilities and opportunities to manage knowledge and values effectively.

A.0.1. Search Strategy

A search strategy was employed to ensure a thorough investigation of the relevant literature. The strategy involved the following steps:

Identification of Key Search Terms

Key search terms were identified based on research objectives and the theoretical framework. These terms included:

- Grassroots initiatives
- Energy initiatives
- Energy transitions
- Renewable energy
- Local renewable energy organisation
- Sustainable
- Community
- Energy community
- Community energy
- Cooperatives
- Heating networks

Database Selection

The primary database used for the literature search was *Web of Science*, known for its extensive coverage of high-quality academic publications. Furthermore, Dutch knowledge institutes such as *HIER*, *Energie Samen* and *NPLW* were consulted for relevant information about Dutch heating collectives.

Search Execution

The search was executed in a structured way, starting with broad terms and progressively narrowing down to more specific terms. This funnelling approach ensured a comprehensive yet focused collection of literature.

Search Level	Search Terms	Objective
Broad	Grassroots initiatives, Energy initiatives, Energy transitions, Renewable energy	Identify general literature on community initiatives and renewable energy
Intermediate	Local renewable energy organisation, Sustainable, Community, Energy community, Community energy, Cooperatives	Focus on sustainable practices and community-based energy solutions
Specific	Heating networks	Narrow down to thermal energy networks and their management

Table A.1: Search Funnel Structure

A.0.2. Inclusion and Exclusion Criteria

To ensure the relevance and quality of the literature, specific inclusion and exclusion criteria were applied:

Inclusion Criteria

- Peer-reviewed articles
- Publications from 2010 onwards to ensure relevance
- Studies focusing on community-based energy initiatives
- Literature addressing knowledge management

Exclusion Criteria

- Articles not available in English or Dutch
- Publications unrelated to community initiatives
- Studies focusing solely on technological aspects without community involvement

B

Interview Overview

For this research, I have interviewed multiple people from the five contributing energy communities. All of these people play an important role in the development of community initiatives. Table B.1 shows the people I have interviewed, their position in the energy communities and the date the interview took place.

Interviewee	Position	Date
1	Member of the board	2024-07-15
2	Member of the board	2024-07-17
3	Project lead	2024-07-22
4	Member of the board	2024-07-29
5	Energy coach	2024-07-30
6	Member of the board	2024-08-13
7	Member of the board	2024-08-14
8	Energy coach	2024-08-21
9	Project Manager	2024-09-03
10	Energy coach	2024-09-04

Table B.1: Interview Candidates

As a researcher and graduate student, it is important to maintain the highest ethical standards during this research. This means that all information used is in line with the guidelines of the Human Research Ethics Committee (HREC). Therefore, the information that can be shared about the interviewees is limited. All interviews have been conducted in Dutch; the informed consent form sent to each interviewee can be found on the next page.

Informed consent form / opening statement in Dutch

Onderwerp: Uitnodiging voor Interview over Warmtenet Initiatieven

Geachte,

Mijn naam is Wouter Nijhuis en ik ben een masterstudent in Management of Technology aan de TU Delft. In het kader van mijn onderzoek naar de ontwikkeling van warmtenet initiatieven, zou ik u graag willen uitnodigen voor een interview. Het doel van dit interview is om waardevolle inzichten en ervaringen te verzamelen die kunnen bijdragen aan een beter begrip van dit onderwerp. Uw input is hierbij van groot belang en wordt zeer gewaardeerd.

Dit interview zal plaatsvinden in een semigestructureerd format, wat u voldoende vrijheid geeft om uw ideeën openlijk te uiten in een omgeving zonder oordeel. Uw antwoorden zullen met discretie worden behandeld, waarbij anonimiteit en vertrouwelijkheid worden gewaarborgd. De opname, transscriptie en ander notities van het interview zullen opgeslagen worden op een TUDelft server en alleen zichtbaar zijn voor het onderzoeksteam.

Alle informatie die u verstrekt zal worden samengevoegd met de input van andere interviews, tezamen zal dit geanalyseerd worden. De resultaten van deze analyse zullen publiekelijk beschikbaar worden gesteld als onderdeel van mijn MSc thesis. Alle persoonlijke data worden 1 maand na afronding van het project (verwacht september 2024) verwijderd.

Mocht u zich op enig moment tijdens ons gesprek ongemakkelijk voelen of besluiten dat u het interview wilt beëindigen, voel u dan vrij om dit aan te geven. U heeft de volledige vrijheid om het interview op elk moment te onderbreken of te beëindigen.

Mag ik uw toestemming vragen om dit interview op te nemen? Dit is puur voor mijn onderzoek. Met uw toestemming zal ik direct met de opname beginnen.

Alvast hartelijk dank voor uw medewerking en ik kijk uit naar uw reactie.

Met vriendelijke groet,

Informed consent form / opening statement in English

Subject: Invitation for Interview on District Heating Initiatives

Dear Sir/Madam,

My name is Wouter Nijhuis, and I am a master's student in Management of Technology at TU Delft. As part of my research into the development of district heating initiatives, I would like to invite you to participate in an interview. The aim of this interview is to gather valuable insights and experiences that can contribute to a better understanding of this subject. Your input is of great importance and is highly appreciated.

This interview will follow a semi-structured format, allowing you the freedom to express your ideas openly in a non-judgemental environment. Your responses will be treated with discretion, ensuring anonymity and confidentiality. The recording, transcription, and other notes from the interview will be stored on a TU Delft server and will only be accessible to the research team.

All information you provide will be combined with input from other interviews and analysed as a whole. The results of this analysis will be made publicly available as part of my MSc thesis. All personal data will be deleted one month after the completion of the project (expected September 2024).

Should you feel uncomfortable at any point during our conversation or decide to end the interview, please feel free to indicate this. You have complete freedom to pause or stop the interview at any time.

May I ask for your consent to record this interview? This is solely for my research. With your permission, I will begin the recording immediately.

Thank you very much in advance for your cooperation, and I look forward to your response.

Kind regards,

B.0.1. Interview Structure

The interview themselves were structured in a semi-structured format. This requires an interview script with a broad overview of the questions asked. These questions follow from the literature research and the theoretical framework. However, in a semi-structured interview, the questions serve as a guide. The interview questions can be adjusted to accommodate the interviewee. This allows for more interactions and allows open-ended responses from participants, leading to more in-depth information. The structure used for these interviews can be found below:

Interview Script voor Onderzoek naar Warmtenet Initiatieven

Algemene Informatie over de Geïnterviewde:

- Kunt u iets vertellen over uzelf en uw rol binnen het warmte collectief?
  - Hoe lang bent u al betrokken bij dit collectief?
  - Wat zijn uw belangrijkste verantwoordelijkheden binnen het collectief?
- Hoe bent u in aanraking gekomen met warmtenet initiatieven en wat motiveerde u om betrokken te raken?

Algemene Informatie over het warmte collectief:

- Kunt u vertellen hoe de gemeenschap eruit ziet?
  - Hoeveel leden zijn er aangesloten, en hoeveel bereikt? Wat was het oorspronkelijke doel
  - Welk type warmtenet willen jullie aansluiten?
- Hoe ver zijn jullie in de ontwikkeling van het warmtenet?

Subvragen

- Welke kennis en motivatie kunt u identificeren als noodzakelijk voor de transitie van het initiatief naar een organisatie?
  - Kunt u specifieke voorbeelden geven van kennis die belangrijk is voor deze transitie?
  - Welke motivatie beschouwt u als essentieel binnen het bestuur tijdens deze transitie?
- Hoe zorgt het bestuur ervoor dat leden over de benodigde kennis en informatie beschikken om de sociale, milieu- en economische impact van een warmtenet initiatief te begrijpen?
  - Welke methoden worden gebruikt om deze kennis over te dragen?
  - Hoe wordt ervoor gezorgd dat alle leden deze informatie begrijpen?
- Welke benaderingen hanteert het bestuur om dialoog, begrip en samenwerking te bevorderen onder de belanghebbenden die betrokken zijn bij warmtenet initiatieven?
  - Kunt u voorbeelden geven van succesvolle samenwerkingen of dialogen?
  - Hoe worden verschillende standpunten en zorgen binnen de gemeenschap behandeld?
- Hoe gebruikt het bestuur samenwerking en partnerschappen in hun inspanningen om initiatieven om te zetten in warmtenet organisaties?
  - Welke soorten partnerschappen zijn het meest waardevol gebleken?
  - Hoe draagt samenwerking bij aan het bereiken van gemeenschappelijke doelen?
  - Wat is de motivatie om opzoek te gaan naar partners?

Afsluiting

- Zijn er nog andere punten of ervaringen die u zou willen delen die we nog niet hebben besproken?