Master thesis:
Expectations of Energy communities

Name: Kimberly Deppe (6157955)

Supervisor: Alexander Peine

Second reader: Nick Verkade

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Abstract

Energy communities are a vastly growing development in the Netherlands. They organize collective and citizen-led energy actions. They help to increase public acceptance and private investments for renewable energy projects. Simultaneously, they can provide citizens with benefits such as increased energy efficiency or decreased electricity bills. Furthermore, energy communities can contribute to the flexibility of the power grid through demand response and storage.

A common vision on the role of energie communities for the future is still missing. This thesis utilized literature on the sociology of expectations and the notion of transition pathways to fill this knowledge gap. The expectations of actors in the niche as well as the regime were gathered to identify the possible transition pathways for these energy communities. This research explicitly focused on both actors in the regime and niche since previous literature mainly focused on the dynamic within the niche themselves.

19 semi-structured interviews were held with actors sampled from the structure analysis. This analysis provided an overview of relevant actors in the energy transition. through these interviews the expectations of the interviewees were gathered. This resulted in the following eight key expectation: *decentralization/centralization, type of energy community, business parks, grid operator, laws and regulations, public support, professionalization, and the heat transition.* Subsequently, these key expectations were used to identify the following five possible transition pathways: *postcoderoos/SCE, (smart) energy sharing, off-grid, business parks and the heat transition.* These pathways should not be viewed as a forecast for the future, but rather as a tool to assist actors in critically thinking about the various pathways and where action is desired.

Based on these pathways a recurrent barrier was identified: legislations. Currently, the law does not allow energy communities to execute all of their plans, such as energy sharing. Additionally, there are bottlenecks in respect to the switch from the postcoderoos subsidy scheme to the SCE subsidy scheme that might hamper the development of energy communities.

Furthermore, the governance for business parks will be vastly different from citizen led energy communities and thus asks for further research. Moreover, this research has contributed to the topic of the democratization of the energy system on the subject of energy communities. Although, the democratization overlaps with the development of energy communities, it entails more than just this development. A system wide analysis on this development within the whole energy system to identify which factors are affected would therefore be relevant.

Table of Contents

Abstract 2

1 Introduction 4

2 Theory 6

2.1 Transition pathways 6

2.2 Expectations 7

2.3 The context 7

2.3.1 Role and organisation 8

2.3.2 Power 8

2.3.3 Niche/regime 8

2.4 Theoretical framework 9

3 Method 10

3.1 Research design 10

3.2 Data collection 11

3.2.1 Structure analysis 11

3.2.2 Interviews 11

3.3 Data analysis 12

4 Results 13

4.1 Structure analysis 13

4.2 Decentralization vs centralization 14

4.3 Types of citizen energy community 14

4.4 Business Parks 17

4.5 Grid operator 18

4.6 laws and regulations 20

4.7 Public support 21

4.8 Professionalization 22

4.9 Heat transition 23

5 Discussion 25

6 Conclusion 32

7 References 33

Appendix A 37

1 Introduction

The energy transition is one of the biggest transitions faced by the century. The entire energy system needs to change to make the transition from fossil fuels to renewable energy. And there is no time to waste, since the first goals are set by the Dutch government for 2030 (Rijksoverheid, 2019). This paper will provide an Innovation studies perspective on this transition. Geels (2002), describes a transition as a long-term change in socio-technical systems at the level of societal functions. The term "socio-technical system" refers to a transition that includes both technology as well as sociocultural changes. For example, changes in regulations, meaning, networks, or infrastructure etc. The energy transition will therefore drastically change the current energy system. One of the developments that is taking place that can contribute to these changes are energy communities. Energy communities are initiatives for the sustainable production and use of energy by a community (Hielscher et al., 2011). In comparison to the current centralized energy system, these communities operate decentralized (Hess & Lee, 2020). This means that the energy is generated locally and if possible, directly supplied to the community itself (Hess & Lee, 2020). The legal entity in which these initiatives are often organized are cooperatives. A cooperative enjoys the advantages of a collective: they purchase more cheaply and share earnings (KVK, n.d.). Members can leave or join without affecting the cooperative's viability (KVK, n.d.). Energy communities can take on multiple forms with different ambitions and motives (Van der Schoor & Scholtens, 2015). For example, the initiative can be a wind park in which the local community can invest. But there are also initiatives that have higher ambitions and want to supply their generated electricity directly to their community or regulate their own grid. Because of these different forms of energy communities there is currently a lot of confusion/conflict in the literature on the definition of an energy community, this will be further touched upon in the next chapter.

Energy communities can play an important role in the energy transition by addressing some of the current barriers. One of these barriers is grid overstimulation, which can be reduced by decentralizing the energy system. This is one of the major difficulties confronting the current energy transition (Dubbeld, 2021). There are cases in which a new wind or solar park cannot be built due to the grid's inability to support the electricity supply (Dubbeld, 2021).This is obstructing the energy transition significantly, as more and more energy is required to come from renewable energy sources. Energy communities can help to alleviate system overload by bringing energy generation closer to the point of usage (TKI Urban Energy, 2021).This goes hand in hand with the second point where energy communities can play an important role. Namely, renewable energy sources cause grid imbalances since they are highly dependent on weather conditions. In energy communities it is easier to balance these fluctuations locally trough demand-response and storage (European commission, 2020). Additionally, energy communities make it possible for more citizens to make use of renewable energy (Overbeek, 2019). Not everyone, for example, has a proper roof or the financial means to make a significant investment.

There are currently 676 energy communities active in the Netherlands. They generate enough energy to supply around 380.000 households (HierOpgewekt, 2020). There are in total 8.1 million households (CBS, 2022), thus roughly 4,7% percent of the households can be supplied with energy generated by energy communities. This shows that this development is still in an early stage. In transition terms, energy communities are active in a niche. This means that there are still multiple transition pathways that these energy communities can undergo. Transition pathways refers to possible ways a transition can come about (Geels & Schot, 2007). Through the alignment of actor’s visons and actions, a transition is coordinated (Geels & Schot, 2007). Thus far a common shared vision on what energy communities could mean for the future amongst actors is missing (Ruggiero et al., 2018; van der Schoor & Scholtens, 2015). Therefore, this research has the goal to inform actors on the different

visions and possible actions in the transition to help coordinate the transition process. This will be done by analyzing the most expected possible transition pathways. In this paper a vision is seen as an aspiration for a desirable and possible future. Transition pathways on the other hand will be defined as possible roads that the innovation in the niche can take to transition the regime towards a new socio-technical system. In this perspective, the vision is the future aspiration, and the transitional pathway is the journey leading there. Since there is not yet a consensus on the vision it is interesting to observe the transition pathways that are currently most expected. In this way, identifying transition pathways can help inform and coordinate actors to align their visions.

Expectations are explored to identify these possible transition pathways for energy communities. Expectations are real-time depictions of future technological conditions and capabilities (Borup et al., 2006). Such futures are made a reality by enacting them, and expectations may therefore be viewed as performative (Borup et al., 2006). Thus, identifying the current expectations can tell us something about the current possible transition pathways for energy communities. This paper thereby will show whether expectations are and appropriate instrument for such an analysis. Researching these expectations of a diverse set of actors is important since a transition is dependent on various actors and institutions, each with their own set of goals and interests (Gui & MacGill, 2018). The results of this study could for example help connect relevant actors, mobilize resources, or inform policy makers (Gui & MacGill, 2018). Previous innovation/transition literature has mainly focused on dynamics that were taking place within or between energy communities (de Vries et al., 2016; Hielscher et al., 2011; Ruggiero et al., 2018; Süsser et al., 2017; Verbong et al., 2013). Therefore, both the expectations of actors in the niche as well as the regime have been gathered. This study will answer the following research question:

What are the expectations regarding the transition pathways of energy communities for the future energy system, and how can these insights help in coordinating actors within this transition?

The expectations were gathered through the use of 19 semi-structured interviews. The participants for the interviews were selected based on a structure analysis. This analysis consisted of reviewing energy vision/roadmap documents of a diverse set of actors to gather an overview of all relevant actors to interview. Next, the interviews were coded to obtain the core categories. These categories have then been analyzed to find conflicts and synergies between the expectations. This showed which expectations are shared among multiple actors and which are opposing. Next to this, the drivers behind the expectations were identified from the context factors. These drivers provided clarifications on where the conflicts and synergies are derived from and can potentially solve coordination problems. This is followed by the identification of the possible transition pathways and a recommendation on how to coordinate actors within these pathways.

This chapter has introduced the problem and discussed the significance of the study followed by the research questions. Chapter 2 reviews the literature on transition pathways, expectations, and the links between the two. The methods used in the study are described in Chapter 3. Subsequently, in chapter 4 the core expectations from the interviews are presented. The discussion in chapter 5 identifies the possible transition pathways and their implications. Lastly, chapter 6 provides an overall conclusion of the thesis.

2 Theory

2.1 Transition pathways

Thus far energy communities have for a large part been researched with literature strands such as grassroot innovations (de Vries et al., 2016; Hielscher et al., 2011; Smith et al., 2016), community innovation (Ceglia et al., 2020; Hielscher et al., 2011; Süsser et al., 2017), or strategic niche management (Ruggiero et al., 2018; Verbong et al., 2013). These papers largely focused on the aspects taking place in or between the niche(s) or community(s) themself, and to a lesser extent the interaction with the regime. Besides, one major issue with the scaling up of energy community projects, according to Ruggiero et al. (2018) is the lack of a shared vision on what energy communities could mean for the future. This was demonstrated by the different aims for expansion among different projects and a limited national policy support. Van der Schoor & Scholtens, (2015) also identified that visions among local initiatives differed in scope and ambition. On the one hand there were lower ambitions such as stimulating energy efficiency measures and installing PV panels in the community. And on the other hand, there were higher ambition that focused on making the community energy neutral. This difference in ambition is where the definition of an energy community becomes conflicting in the literature and amongst actors. Namely, if the initiative is solely an energy investment for the local community is it then an energy community or should it be called an energy cooperative?

Thus, previous literature identified a lack of a shared vision and had a limited focus on actors outside of the niche/community. This lack of a shared vision is problematic since a shared vision is essential for niche development (Seyfang et al., 2014). This thesis therefore focuses on the different visions of energy communities in the energy transition and incorporates both the niche and regime in this analysis. This is done with the use of transition literature. The multi-level perspective (MLP) explains how a new local development or technology can make its breakthrough to the mainstream practices; this is called a transition. The MLP describes such transitions on three different levels: niche, regime, and landscape. The theory's primary concept is that new technologies start in the niche, which is a safe environment in which they can learn and thrive (Geels, 2002). Until, at some point, the niche breaks through to the regime and takes over. Because the niche and the landscape impose pressure on the regime, this breakthrough can occur. However, such a breakthrough does not happen automatic, there are processes occurring at numerous dimensions and levels at the same time which need to align and reinforce one another for a transition to occur (Geels & Schot, 2007). Thus, a breakthrough asks for favorable circumstances which is often difficult to achieve. In this paper the transitions that will be investigated takes place from local energy communities (niche) to the current energy system (regime). In these terms a radical transition would indicate that the old regime is completely taken over by new practices from the niche. While an incremental transition would be more of a reconfiguration of the regime where old practices will remain, but new niche innovation will be integrated in them (Geels, 2007). Such a transition from one socio-technical system to another can occur along different transition pathways (Geels & Schot, 2007). This paper will define these pathways as possible roads that the innovation in the niche can take to transition the regime towards a new socio-technical system. The goal of this research is to identify these possible transition pathways based on the input of both niche and regime actors. This will help actors to critically think about the future and their actions, which in turn could help steer towards a shared vision. For this research, the definition of an energy community is intentionally left vague because these possible transition pathways can be linked to the definition that is given to an energy community by an actor.

This is an important subject to research given the fact that the transition towards a clean energy future is dependent on multiple actors and institutions and their different aims and interests (Gui & MacGill, 2018). To successfully transition to such a future, it is thus important to understand the different social and infrastructural dimensions of different possible pathways. Since this understanding can help to make informed decisions, ensure financial support, and can result in beneficial policy developments (Gui & MacGill, 2018).

2.2 Expectations

For the identification of the possible transition pathways the literature on the sociology of expectations is explored. Expectations are an appropriate tool for this analysis since they aid in understanding the social and technical changes that occur (van Lente, 1993). Next to this, they are performative and thus affect the possible pathways by influencing the behavior of actors in the present day (van Lente, 1993). Expectations may be viewed as fundamental in coordinating various actor groups as well as different levels such as the niche and the regime (Borup et al., 2006). Indeed, it is difficult to imagine the emergence of technological breakthroughs and innovations without some type of common guiding expectations. Namely, if certain expectations are shared by a larger group, then these expectations will gain more legitimacy, and will thus have a larger impact (van Lente, 2012). This can for example be seen in the promise requirement cycle. This cycle suggest that expectations can turn promises into requirements. When multiple actors share the same expectations about a certain technology it can turn into a requirement set for the technology in the future (van Lente, 1993). For example, when energy communities are seen as a promising development to substitute the current energy system it is likely that this promise becomes part of research agendas of firms, government, and/or researchers. And thus subsequently, there is a higher chance that the initial promise becomes a reality. The impact of shared expectations can be observed in the socio-technical system through changes in regulations, but also through the pressure that these expectations impose on the current regime. When expectations are shared amongst a large group of actors, they can help destabilize the regime and open a window of opportunity for the niche to break through (Geels, 2002).

Thus, expectations of a diverse set of actors in both the niche and the regime are gathered. Subsequently, with the help of these expectations it is possible to identify synergies and conflicts between the expectations. In this study, the sharing of the same expectation is referred to as a synergy, whilst competing expectations are referred to as a conflict. This in turn makes it possible to identify possible transition pathways for the future. When a lot of synergies are found regarding an expectation, momentum can be created due to the performative nature of expectations. Thus, actors will start acting upon these shared expectations and thereby making the expectation a reality. The momentum of multiple actors acting upon a shared expectations can be seen as the start of a transition pathway. Since a transition pathway is concerned with the change from one socio-technical system to another, for which alignment of actors their expectations and actions is central. This alignment of expectations and actions creates direction and momentum to the transition and provides the opportunity for the destabilization of the regime.

2.3 The context

Different aspects can influence the expectation which will be referred to as the context. The context can help in identifying certain ***drivers*** behind the expectations. These drivers in turn can help in solving conflicts and explaining synergies amongst actors. For example, conflicting expectations could be associated with similar drivers. Coordination problems between these actors could be reduced by identifying and understanding these drivers. The following sections will discuss four aspects that are of importance.

2.3.1 Role and organisation

An actor's expectations might be influenced by their role and organizational structure (Brown & Michael, 2003). Which in turn are linked to their norms and values (Brown & Michael, 2003). For example, an entrepreneur likely exploits their understanding about a certain development to attract investments (Brown & Michael, 2003). To accomplish so, they must portray confidence and conviction in the expectation they express. A researcher, on the other hand, does not have the underlying purpose of luring investors and hence may more easily detect the uncertainties in their expectations (Brown & Michael, 2003). Thus, the expectations of an entrepreneur and a researcher may differ in terms of what they believe is likely to happen and achievable. As a result, it is essential to evaluate the role and organization of the actors who provide the expectations.

2.3.2 Power

It matters whether the actor who is presenting the expectation has a certain level of authority. Because an actor is more likely to perceive an expectation in a normative frame if they believe they have little influence over the outcome of the expectations. Thus, an actor with less authority could view their expectation is the following way: "*it is going to happen anyway, so my own expectation is less relevant, and therefore I will not act upon it*." (Borup et al., 2006)

2.3.3 Niche/regime

Whether an actor is primarily operating in the niche or regime can have an influence on their expectations. In essence regime actors are seen as more rigid in terms of changing direction and will therefore often have lower expectation of new developments then actors in the niche (Penna & Geels, 2015). However, there is also a turning point where regime actors do see the potential of the new development and therefore their change their expectations. Thus, when analyzing the expectations of regime actors, it is important to consider that these expectations can still change overtime. On the other hand, actors in the niche will likely have a higher level of trust in their expectations since they are closer to the knowledge that is being produced and are less rigid (Borup et al., 2006; Penna & Geels, 2015).

2.4 Theoretical framework

Figure 1 provides a schematic overview of the theoretical framework that will be used in this paper. Firstly, expectations of a diverse set of actors will be collected, which will result in the indentification of ***conflicts and synergies***. Additionally, the context aspects will be analysed to identify the ***drivers*** behind the expectations. The context aspects are derived from the expectation literature (role, power, organisation type) and the MLP (niche/regime). Next to this, an additional factor is added where the actors is asked to clarify their reasoning for the expectation they provide.

The identified conflicts, synergies, and drivers will be analysed on how much they are shared amongst actors and whether there are any patterns observed. An example of a pattern could for example be between certain conflicts in expectations of actors and their argumentations or place in the niche/regime. This analysis will lead to the identification of possible transition pathways and their potential barriers. The identification and possible barriers can in turn help to coordinate relevant actors and resources. These transition pathways can help actors to think about the future.

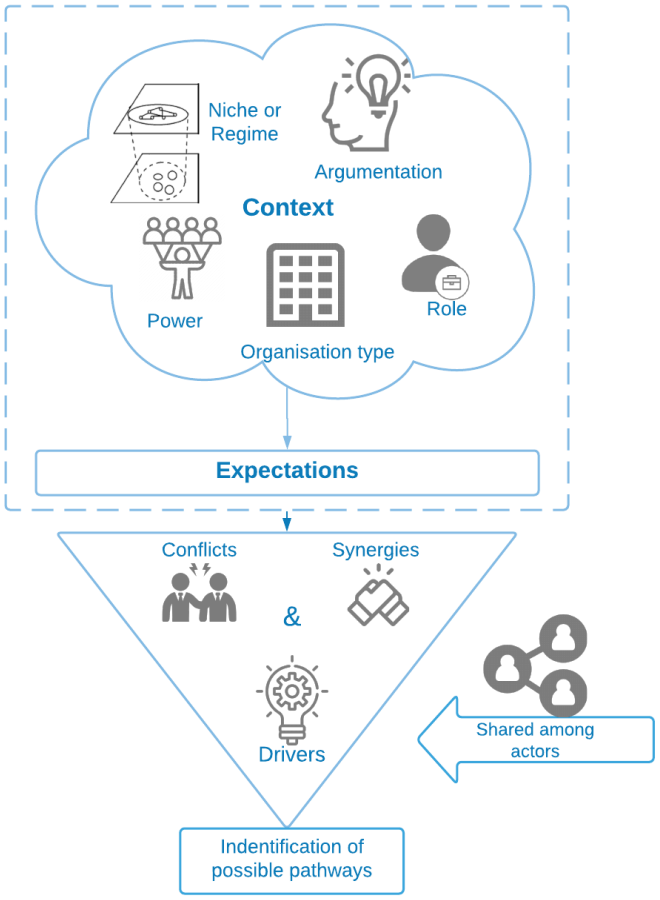

Figure 1: Theoretical framework

3 Method

3.1 Research design

For this research a qualitative approach has been selected since it fits the goal of identifying expectations of different actors. Namely, expectations are subjective to the actor and therefore require an interpretivist approach. Meaning that, the emphasis is on understanding the social environment through an investigation of how its participants view it (Bryman, 2012). To provide an in-depth analysis on the subject a single country case study is chosen. Such a case study is appropriate since the factors influencing the transition highly differ amongst countries. For example, each country has a different institutional setting but also different visions by stakeholders. For this paper the Netherlands has been chosen as an appropriate country. The Netherlands is a relevant case since there are already 676 energy communities established in the Netherlands, thus a big enough group to research (HierOpgewekt, 2020). However, these communities are still in their early stages, where 60% has a size of less than 100 citizens (HierOpgewekt, 2020). Specifically, the role (radical or incremental) that energy communities will have in the energy transitions is still unknown and therefore relevant to research. That energy communities will probably play a role in the energy transition in the Netherlands can be seen in the goals set by the government. The Dutch government has set the goal to make 50% of renewable energy projects in hands of local ownership and thereby stimulates the potential transition (Rijksoverheid, 2019). Additionally, the government has implemented the Cooperative Power Generation subsidy scheme to support energy communities (RVO, 2022) .

I have chosen to use interviews to research the expectations of a diverse set of actors. A purposive sampling approach was employed for the selection of the participants to interview. This means that respondents were chosen strategically rather than at random to ensure that those sampled are relevant to the study (Bryman, 2012). The main sampling criterium was based on the concept of regime and niche, which is derived from the MLP. I have used the notion of regimes to identify relevant actors in the current energy system. Furthermore, I have used the notion of niche to identify relevant actors associated with energy communities. This is especially an important selection criterium, because the influence of energy communities on the regime level has not received a lot of attentions. And since a lack of a common vision on energy communities in the transition is missing, it will be relevant to include both groups. Next to this, it was important that the interviewee had some knowledge about energy communities. Not all participants needed to be experts on the subject but some affiliation with the topic was required. The selection process of interviewees consisted of a structure analysis of the sector, which will be elaborated on in section 3.2. Figure 2 provides an overview of the different steps that will take place to answer the research question and provide recommendations. The sections 3.3 & 3.4 will go into detail on the data collection and data analysis.

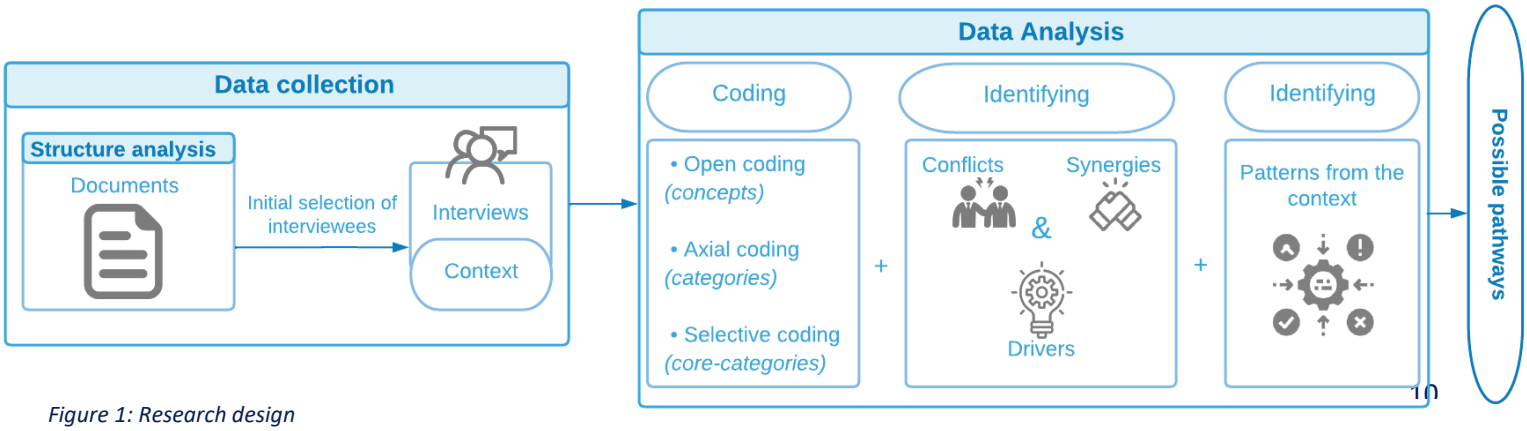

Figure 1: Research design

3.2 Data collection

3.2.1 Structure analysis

I have used a structure analysis to create an overview of relevant actors related to the transition of energy communities. This analysis is in turn used to identify and select relevant interview participants, which as aforementioned, was based on the concepts of regime, niche, and the actors' knowledge. This analysis has provided an initial overview of the relevant actors for the energy transition which can be seen in table 3 in chapter 4. The analysis consisted of a document review and browsing the actors' websites. The energy vision and roadmap documents of various actors have been consulted in order to determine who is working on which topic and with whom. Additionally, actors that are being mentioned in the documents have been used as a form of snowball sampling. This means that the websites and documents of these actors have been reviewed in the same way. This process has been repeated until saturation was achieved, at which point the same actors reappeared. I have contacted the actors that were selected as relevant interview participants through email, LinkedIn, or their company website. The study has been shortly explained to the actors, followed by the question on whether they wanted to participate in an interview. The following table 1 gives an initial overview of some documents that have be consulted and started the snowball sampling:

Table 1: Vision and roadmap documents

Document/actor	Clarification
Regional energy strategy (RES)	In these documents each region in the Netherlands has made a strategy to reach the climate goals as set by the government.
TNO	TNO is an independent research organization. They have created multiple roadmaps about the energy transition.
Climate accord	The government has set their climate goals for the coming 10 to 30 years.
Top sector energie	Top sector energie helps companies, knowledge institutions, governments, and civil society organizations to work together on the energy system of the future. (They work on behalf of the government)

3.2.2 Interviews

I have contacted 43 interview participants directly, additionally some interview participants have been contacted indirectly through interviewed actors. I have conducted 19 interviews with 12 regime actors and 7 niche actors to learn about the actor their various expectations, context, argumentations, and recommendations. I have then used this information to identify the drivers, synergies, and conflicts in the transition pathways of energy communities. As aforementioned, I have used the structure analysis to identify relevant interviewees and contact them. The data collection through interviews has stopped when saturation was reached. Which meant that performing another interview would not provide drastically new insights. The interviews were semi-structured, as this provided for more flexibility in the interview, which allowed for a better understanding of the interviewee's perspective (Bryman, 2012). This especially fits the goal of identifying expectations, since these are highly based on the interviewee's perspective. This means that I have used an interview guide, but there were opportunities for follow-up questions and deviations. The interview guide has been based on the four topics displayed in table 2 and can be found in Appendix A. These topics were derived from the theory section

and therefore enhanced the validity of the interview guide. The interview guide itself improves the research's reliability by allowing another researcher to replicate the study more easily.

Additionally, some interviewees provided supporting documents. These documents have been used as additional information to the expectations.

Table 2: Interview topics

Topic	Description
Context	Questions about the role, organization, and power of the actor (Not about whether they are a regime or niche actors since this will be used as a sampling criterium).
Expectations	Several broad questions will be asked initially to try to gauge the views of the interviewee as much as possible. Next, a series of predefined specific questions about the possible transition pathways will be asked.
Argumentation	For each expectation the interviewee will be asked to provide an argumentation for why the interviewee has that specific expectation.
Recommendations	Finally, the interviewee will be asked whether they have any recommendations for the transition based on their aforementioned expectations.

3.3 Data analysis

The initial step in the data analysis was to code the transcriptions of the interviews and the relevant document obtained from the interviews with NVivo. The interviewees names have been anonymized. The coding has been done to organize the data and create structure to analyze the data in a systemic way. This in turn has increased the validity of the results. The coding firstly consisted of open coding, this resulted in the identification of concepts (Bryman, 2012). This was followed by axial coding, where the identified concepts have been grouped into categories (Bryman, 2012). Lastly, selective coding took place. In this coding process the core-categories have been identified (Bryman, 2012). For example, the following concept has been coded in the first step “more guidance energy communities in recent years”. In the axial coding step, this concept (along similar concepts) has been grouped in the category “supporting energy communities”. Lastly, together with other identified categories such as “growth” and “knowledge exchange” these have been grouped together during the selective coding process under the core-category “professionalization”. After this last coding step there was focused on linking the identified categories to overarching synergies, conflicts, and drivers. When for example a core-category was identified which is based on a specific expectation that is shared among different actors it is seen as a synergy. Lastly, the context of the actors has been analyzed. This was done by searching for patterns within the identified core-categories, synergies, conflicts, and drivers.

The final step was to tie everything together and provide a narrative that includes the findings from the aforementioned steps and an interpretation of these findings. I have used quotes to support the narrative and firstly described the core expectations and their synergies and conflicts. Next, I have used the identified synergies and conflicts to demonstrate what is working effectively and where concerns may exist. This was supposed to be supported by the identified drivers as well as the context, but this turned out to be ineffective. Chapter 5 will further explain these limitations. Lastly, after the qualitative narrative of the core expectations, the possible transition pathways were identified. Based on these transition pathways recommendations are provided for future research or policy actions.

4 Results

4.1 Structure analysis

As input for the sampling strategy a structure analysis of the energy system has been performed. This analysis resulted in a long list of involved actors in the energy system. These actors have been grouped in categories, which is shown in table 3. Next, actors in each of these categories have been approached for an interview. Unfortunately, not all actor groups have been interviewed, but the data did reach a point of saturation.

Table 3: Structure analysis

Number	Categories	Niche/regime	Interviewed
4	Energy producer	Regime	1
43	Energy supplier	Regime	No reply
7	Energy producer/supplier	Regime	1
Undefined	Webber community	Niche	No reply
3	Branch organization	Regime	2
1	Coalition	Niche	No reply
Undefined	Government	Regime	2
12	Province	Regime	2
Undefined	Municipality	Regime	No reply
1	Topsector energy	Regime	1
6	Grid operator	Regime	1
676	Energy community	Niche	3
30	Regional energy strategies	Regime	1
24	Knowledge institute	Regime	No reply
1	Transmission System Operator	Regime	1
Undefined	Supporting organization for energy communities	Niche	3
1	Advocacy group	Niche	1
Total			19

4.2 Decentralization vs centralization

Whether the future energy system is structured decentralized or centralized will affect how big energy communities could be in the future. If there is the anticipation that the future energy system will be primarily centralized, then energy communities won't be able to play a significant role. This is because the current expectations of the future energy system influence the actions and decision in the present. Thus, if there is no expectation of a decentralized system, then actors will probably also not act accordingly. The interviews revealed that the majority of actors anticipates a mixed energy system where a part of the energy is produced centrally, and a part is produced decentralized:

> *"You just need the central parts since we don't have nearly enough renewable energy, especially if everything is electrified and we move away from fossil fuels. Then you need those large parks out at sea and on land." (Interview energy producer/supplier) & "Because it is no longer feasible to organize things centrally, that will also take place decentralized. And you'll need to put more effort into making sure that whatever you produce locally, you also utilize locally and that you don't need to transfer it across however many kilometers " (Interview province).*

This expectation of at least a partly decentralized energy system makes it possible for energy communities to play a role in the future energy system. However, decentralized electricity generation does not necessary mean this has to be done through the use of an energy community. There are however some advantages in using an energy community instead of citizens investing individually or a commercial organization. The biggest advantage of using an energy community is the public support it can create amongst citizens; this will be further elaborated on in section 4.7. Next to this, for the homeowners it can provide a financial incentive to acquire some form of renewable energy instead of buying their energy from an energy supplier. The energy transition as a whole benefits from this since it encourages more investment in renewable energy. Lastly, energy communities can help balancing the grid and solve grid congestion, this will be further touched upon in section 4.5. All interviewees expected some role for energy communities in the future energy system. However, the type of role still differed quite a bit. The expectations from the interviews of the energy communities ranged from incremental types to more radical types. The next section will delve deeper into this matter.

4.3 Types of citizen energy community

Three synergies in expectations on energy communities have become evident from the interviews. Firstly, the most incremental expectation of energy communities is the so called postcoderoos cooperation. These are energy communities where a citizen can invest in if they live in the zip code (postcoderoos) area. In exchange, they get a discount on their energy tax bill (the postcoderoos scheme has been replaced by the SCE scheme in 2021 which will be further elaborated on in section 4.6). Figure 3 provides a schematic overview of this construction. These types of energy communities are the ones that are currently most active in the Netherlands and are vastly growing. The shared expectation is that this growth will continue in the coming years. With this growth, professionalization is seen as the next step for these communities, this will be further elaborated on in section 4.8.

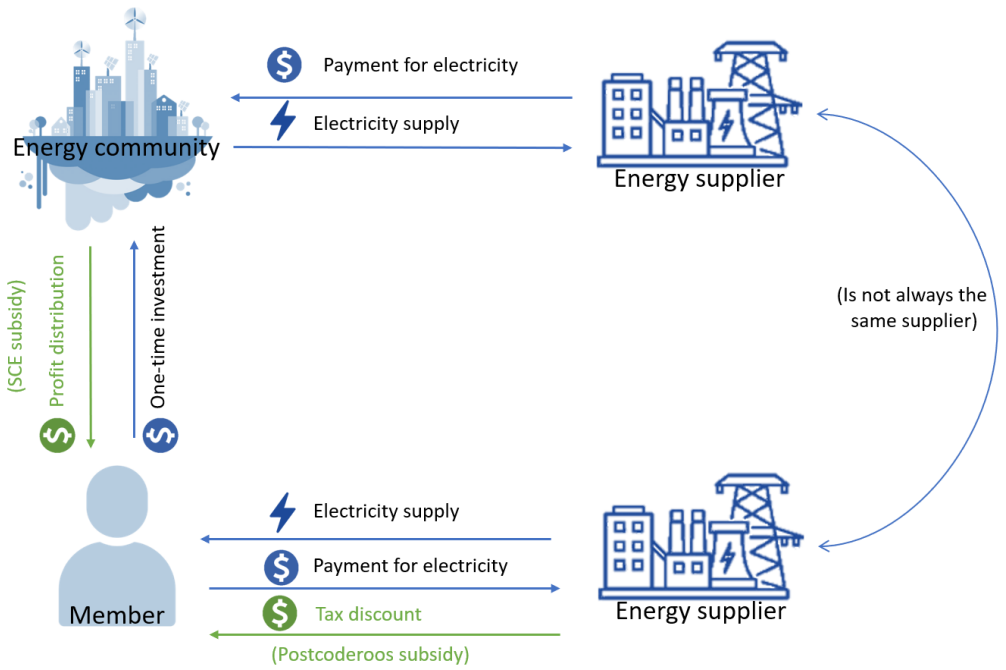

Figure 3: SCE/Postcoderoos energy community

Furthermore, most interviewees stated that they did not consider postcoderoos/SCE schemes to be an energy community. This is because a sense of community is missing for some (not all) of these initiatives. For instance, it is entirely possible that citizens that participate in such an initiative never meet the other citizens that are participating. However, the postcoderoos cooperation's do meet the criteria for an energy community under the European definition. From the interviews it has become evident that there is no clear consensus what an energy community precisely entails. But there is also the perception that it is not necessary a bad thing that the definition is left vague *"Indeed, there are several forms and types. You don't have a specific one, and that is precisely what gives the Energy Community its strength. It just depends on the initiatives they're working on and the residents that are interested."* (Interview province). This expectation is shared by relatively a lot of the interviewees, both regime and niche players.

Secondly, is the incremental/radical energy community expectation. These types of energy communities have a focus on sharing the electricity produced by the energy community directly with its members. The interviewed advocacy group for energy communities explains this clearly in their whitepaper*:*

> *"If energy communities collectively produce renewable energy locally, they would prefer to buy it locally: 'local 4 local'. However, the electricity system is not designed in that way. The electricity that the members of an energy community produce, for example, with a collective solar installation is fed into the public grid. According to the administration, the electricity is sold to an energy supplier. At another time, the members use electricity from the public grid, which they buy administratively from an energy supplier, which is not necessarily the same as the one to whom the electricity was sold."* (Energie samen, 2021)

Figure 4 provides a schematic overview of what this construction looks like. In this case there are two options for citizens to participate. Firstly, as member by making an investment and receiving profit from the energy community, next to buying energy from the energy community. The other option would then be only as costumer, thus only buying the electricity without investing into the energy community. These citizens would

then have now decision-making power in the energy community, only the members will have this. With the emergence of more renewable, energy communities can play an important role with these energy sharing systems:

> *"Traditionally the central energy system in the Netherlands was seen as a copper plate: it doesn't matter where the generation is and where the consumption is, through the electricity market it sorted itself out, but now with a lot more grid congestion and the electricity grids that are filling up, it is becoming more and more important to get supply and demand closer together"* (Interview government).

Especially if they implement "smart" energy sharing which is "*a form of energy sharing aimed at minimum electricity transmission, where the members of the energy community ensure that the electricity produced is immediately purchased, stored or converted locally.*" (Energie samen, 2021). By doing this energy communities can help the net congestion issues of the grid operators (section 4.5).

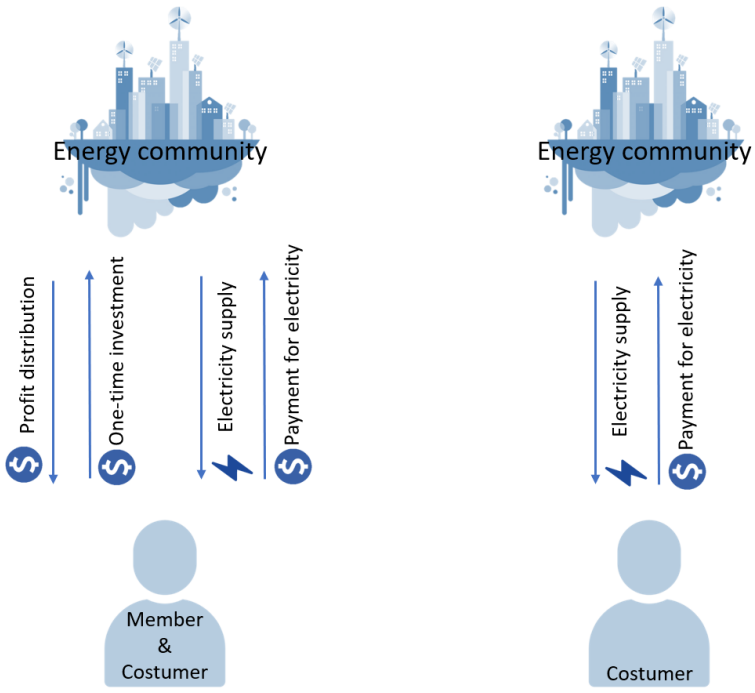

Figure 4: (Smart) energy sharing communities

Currently this construction is only allowed by law if the energy community has an electricity supply license, for which the application is expensive and complex. While the concept of sharing electricity is different from supplying electricity. Energy sharing is defined as the same as production behind the meter, which does not result in imbalances and thus in essence a supply license would not be needed. However, this definition is not yet included in the electricity law. Most communities therefore opt for the simpler construction of figure 3. In order for this type of smart sharing energy communities to play a bigger role in the future energy system, some changes in the law will need to be made. Section 4.6 will dive further into this. The (smart) energy sharing community is an expectation that is being actively lobbied for. Some regime players also acknowledge their potential but are unsure whether they will tap into their potential, partly because of the non-favorable laws and regulations for this type of energy community.

Lastly, going off-grid is the most radical expectation. Most interviewees did not see merit in energy communities going off grid since the advantages are limited due to the highly connected electricity network of the Netherlands: *"In the Netherlands, where everything is already so populous and linked, I would say no, not at all. Although I do believe there are off-grid options in many more remote regions."* (Interview TSO) Next to this, it is also not possible (yet) for energy communities to go off grid, and the question remains whether they will ever be allowed. Business Park energy communities however do have more opportunities in this regard which will be further touched upon in the next section 4.4.

These three expectations regarding the type of energy communities are not necessarily conflicting. Since they can exist along-side one another. However, for the second and third type, a larger shift in the regime needs to take place. This leads to another point; how big will the role of these energy communities actually become in the future system? The interviews did not show an exclusive answer to this, and most actors had no clear expectation yet. However, a synergy in expectations has been found in the fact that almost all interviewees did not expect energy community to be the only way of supplying energy to households:

> *"I don't believe that we will have exclusively local energy efforts; I believe that there will always be a combination of market parties and local initiatives delivering power. When you could previously only purchase electricity from Vattenfall, Nuon, Essent, or Eneco, you now have other options." (Interview Supporting organization for energy communities).*

This links back to the expectation of a partly centralized and partly decentralized system as discussed in section 4.2.

4.4 Business Parks

Currently energy communities are mainly established by citizens. However, business parks are now slowly gaining momentum by also establishing energy communities. This can for example be done the following way*: "one factory has a lot of daytime consumption, another factory has a big roof, well then you can use the solar power from the roof from that factory next door"* (Interview energy supplier/producer). Another example is the energy community of Schiphol, which is currently the biggest and best-known business energy community in the Netherlands. This energy community differs from the citizen energy communities, because Schiphol has only one cable connection to the grid of Tennet. They have their own grid network on which they exchange electricity with one another. This also implies that they are their own grid operator. One big advantage of such energy communities between businesses is that the grid is used more efficiently. Currently a lot of the grid is not used to its full potential*: "Many companies have predetermined contracts; for example, they have a supply of 10 megawatts but only use 1 or 2 of them since they don't need more. However, such quantity may increase to 10 megawatts at peak times. So, yeah, they do have a claim to the electrical infrastructure even though they don't utilize it"* (Interview province). Another large driver behind the development of energy communities in business parks is the fact that business can't always connect to the grid: *"You can see that local business areas require an alternate source of energy as a result of the strain that results from the grid operator's lack of connection capacity. They are therefore almost obliged to be independent."* (Interview energy producer)

One of the reasons that citizen formed energy communities don't take on this form is because they are not allowed with the current legislations. Also, for business parks it is not a given that it is allowed. Schiphol got an exemption from the law to set up this energy community project. It is also the question whether this would ever be allowed for citizen energy communities:

"Interviewer: But what Schiphol has done with its own grid, with a connection to Tennet, could a neighborhood do the same, or are there restrictions in place?

Government: No, that is not possible and that was done for certain reasons. We think it is very important that everyone has excess to a reliable electricity grid. And in order to guarantee that, you have to have an organization that takes care of that, and if you say that, well, I'm going to split it off, then you get all sorts of sub-organizations and how do you keep that reliable is the question.

Interviewer: Yes, that's a tricky one. And there are no changes in the new Energy Law to allow such activities?

Government: In that regard, no, not at all."

In the interviews mainly regime actors have mentioned the potential of business park energy communities. Some of these actors had a more active role in trying to support these business parks and others only knew of the development. There were no clear conflicts in expectations found. There can however be spoken of a synergy in the expectation that business park energy communities can be useful for the energy transition. Additionally, legislation is agreed upon as a main bottleneck at the moment for these initiatives, even though they are permitted more freedom than citizen energy communities.

4.5 Grid operator

Cooperation between grid operators and energy communities is close. Energy communities do not manage their grid themselves; instead, they rely on the grid operators to do so. It seems unlikely that communities that use citizen-owned energy will be allowed to manage their own grid, despite the fact that some communities do strive to achieve this, as described in section 4.3. As a result, energy communities are highly dependent on the grid operators. This in particular causes some tensions between these to actor groups since grid operators can't always meet the needs of the energy communities: *"Yeah, how frustrating is that? When you can save in your energy costs by generating electricity yourself, but you can't do it because you can't dispose of the electricity."* (Interview province). Grid operators' struggle with a significant grid congestion is the root of this issue. This implies that there are instances where energy communities can't connect to the grid or cannot supply back to the grid. Figure 5 shows how big the problem currently is in the Netherlands.

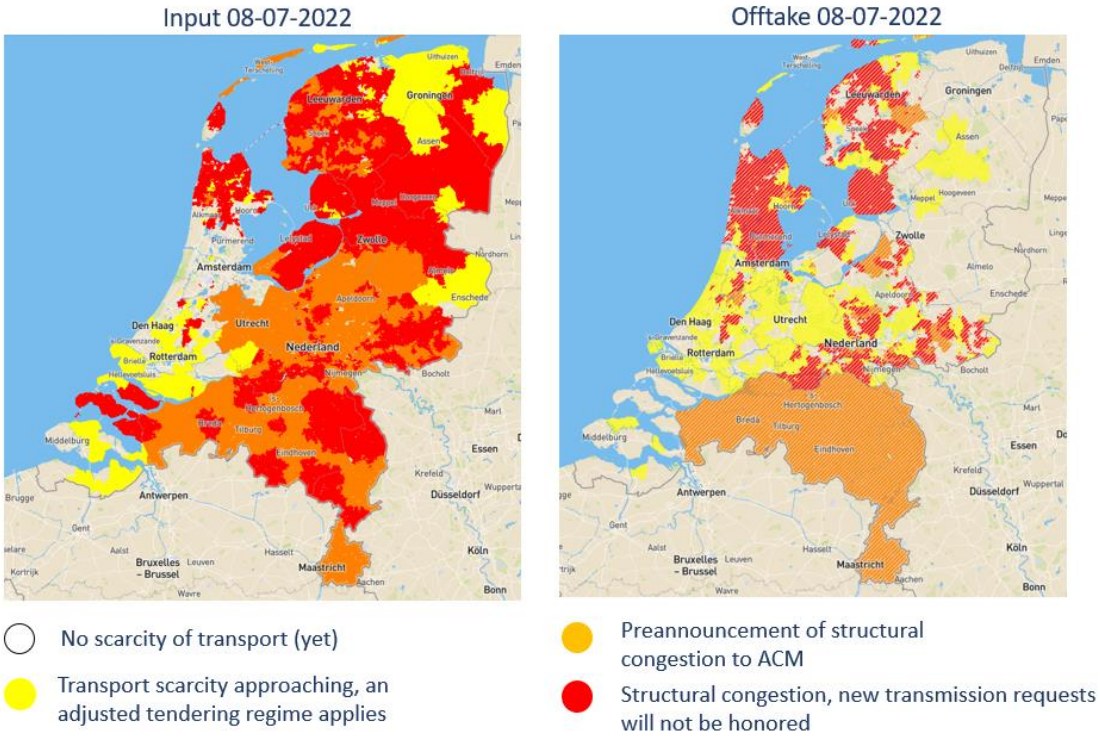

Figure 5: Capacity map (Netbeheer Nederland, 2022)

For renewable energy projects the left map (input) is most related to the grid problems they experience. On this map there can be seen that almost everywhere in the Netherlands there are some problems experienced with renewable energy projects supplying energy back to the grid.

Thus, the potential development and role of energy communities will depend on how grid operators handle the grid congestion issues in the next years. Therefore, it is interesting to discuss the expectations regarding this issue in the future. Grid operators are heavily focusing on grid reinforcements to solve this issue. This is something they are currently already executing, and they have lots of plans to further reinforce the grid in the future. For now, this is a task they must do on their own, however there is the possibility that there are other actors that will support them in the future: *"primarily the grid operators, though it is being investigated if a change in roles would be possible soon. Potentially, governments will have more influence over this."* (Interview province). Energy communities are also one of these actor groups that can play a role in this aspect by preventing grid reinforcements and helping with the day-to-day balancing. To maximize the potential of energy communities in solving net congestions, they can utilize smart energy sharing systems. This type of energy community has been previously explained in section 4.3. However, the relationship between the grid operator and the energy community will need to change for this to work optimally:

> *"The energy community becomes an integral organization at the center of the energy system that intelligently combines production and consumption, not only technical but also organizational and financial. Consequently, the energy community will also become a supplier of flexibility services. As a result, network operators will no longer regard energy communities as any other producer, but as a long-term partner in keeping the energy system affordable and reliable."* (Energie samen, 2021)

Next to this, there is the expectation that the future energy system will become a highly integrated system. Which means that everything in the system is dependent on each other and communicates with one another.

With this integrated energy system there is the expectation that grid operator's role in the system will likely change and will become more similar to the tasks of the system operator Tennet:

> *"so, what we traditionally do is manage grids so constructing, managing, maintaining, breakdowns prevention and or repair breakdowns. Making the network available, safe and reliably. That's what we do every day. But we also have to start becoming a system operator. This means that we have to facilitate the interaction that arises decentral. We have to facilitate that. It used to be very simple: you had a central coal plant and it cascaded down to the power outlet, and we were very good at that, and we remain very good at that. But the other way around, the rhythm of decentralized generation and consumption, and possibly storage. This requires a whole new discipline, and that is the system operator." (Interview grid operator).*

Thus, the main synergy in expectations regarding the net congestion is that energy communities can play a role in this matter. Another synergy is on the expectation that the future energy system will become a highly integrated system and the role of the system operator and grid operator will become more similar. The main conflict in expectations is on how big of a role energy communities will have in this matter. On the one hand, regime players see the potential of the energy communities and acknowledge the advantages they can provide, but they are not sure how much they will utilize them. One of the grid operators interviewed calls the energy communities a tool in their toolbox for net congestions but not necessarily their biggest tool. Especially, since the way in which energy communities can play the biggest role for the net congestion; energy sharing is not (yet) allowed by law. On the other hand, the advocacy group for energy communities is advocating that the role of energy communities can be much bigger and there is still a lot of untouched potential. This advocacy group is also actively lobbying for changes in the law to exploit this potential.

4.6 laws and regulations

Legislation is currently seen as the main bottleneck that prevents energy communities from scaling up and executing new innovative plans. Namely, most of the subsidy systems and other procedures are designed for larger corporations and not volunteering organizations such as energy communities:

> *"The biggest problem is that the whole system in the Netherlands supports the big project developers and disadvantages the corporations and small generation .... systems of environmental permits are all based on the larger companies, this means that if you want to build a small solar field behind your house in the rural area, then you have the same permit costs as if you build a park of 20 hectares." (Interview supporting organization energy community) & "Because this kind of experimentation, when companies do that, they can go to the RVO for subsidy for example. But if you do that as a volunteer organization, you can't bill your own hours and you have to do co-financing" (Interview energy community)*

Next to this, there is a problem with the newly introduced SCE regulations. This regulation is the replacement for the postcoderoos regulation. The participants of the old postcoderoos regulation can keep using this regulation for another 15 years, only new participants will need to use the SCE regulations. The SCE regulations provides a fixed rate per Kwh produced and disburses this to the energy community, who then in turn distribute the profit amongst their members (RVO, 2022) (see figure 3). The SCE regulation makes things in essence simpler for the energy communities which is a good thing. However, the implementation of this new subsidy does not go without a struggle. Firstly, there was an issue with the budget that was set too low. Within 3 months, the budget was emptied, which meant that energy communities needed to wait another year before they could re-apply (Solar magazine, 2021). Fortunately, the advocacy group lobbied for increasing this budget and succeeded.

A second issue is related to the fixed rate per Kwh that is used to calculate how much subsidy an energy community receives. With the current rates a lot of projects do not have a profitable business case. The advocacy group is still actively lobbying to increasing these rates (Energie samen, 2022). Lastly, the old postcoderoos communities receive a tax discount on their energy bill, but the energy tax is lower than promised. This results in a failure to live up to raised expectations and complicates new investments by members (Energie samen, 2022). Next to this, for some energy communities this creates financial problems (Energie samen, 2022).

Additionally, if a community would want to store some energy in a battery for later usage, they are faced with quite some costs and laws:

> " *The moment you start extracting Energy from a battery, then all of a sudden that battery is an energy supplier, then you have to deal with transportation costs and grid tax rates. Those are really legal circumstances that really need to change to so make that much more accessible.*" (Interview province).

And lastly, legislation is a bottleneck because a lot is not (yet) allowed for energy communities. For example, the energy sharing as previously mentioned, or the management of their own grid.

However, there is a new energy law in the making that replaces the current energy law from 1998 that might provide some clarity and more room for energy communities: *"There are possibilities for Energy Community in the new energy law. But how that will all work in practice is not yet entirely clear to me."* (Interview energy community). The law is supposed to be released at the start of 2023, but whether these previously mentioned issues will be fixed in this new law remains unclear. The current version of this new energy law prevents energy communities from smartly sharing energy, although there are still efforts being made to reform this. What will be allowed in the new energy law is not yet fully set in stone. Additionally, is not clear whether the government will be able to implement this new law at the start of 2023. Next to this, when this new law is released, it will also take some time for the law to be interpreted in the right way: "*I think the energy law 1.0 really does give possibilities, but the possibilities are not so on the surface of the new law if you haven't read into it. It's not that easy that the new law says from now on you can do anything and everything, no problem, no it's not that easy. So, I expect it will take time before the law is properly interpreted but also different variants of implementation are tested.*" (Interview grid operator).

Thus, there are quite some legislation bottlenecks found that hamper the development of energy communities, and in turn can affect the expectations actors have for the future. The new energy law could provide some extra freedom for energy communities, but how much remains unclear. Current initiatives do find it difficult to take action as a result. No clear synergy in the expectations around this new law have been found. There are however conflicting expectations on what will and will not be allowed in the law. It is clear that the energy communities and their advocators vision of this new energy law is currently not in line with the vision of the government.

4.7 Public support

From multiple interviews it has become evident that the energy transition in the built environment is seen more as a social than a technical problem. This relates to how the spatial planning in the Netherlands is organized:

> *"Because you can't build anything anywhere without having a permit to build. In the Netherlands we have organized it in such a way that every piece of land has a destination. So residential destination, agricultural destination, water destination et cetera. There has never been a plot of land set aside for wind or sun. Thus, if you want to build something in the Netherlands, you have to convince a local City Council as well." (Interview advocacy group energy community). & "Minister Jetten can impose all kinds*

of things from above or the councilor can impose things but that often creates resistance. If an Energy cooperative or local community comes up with something together and puts its shoulders to the wheel, I think that has much more chance of success than if it is imposed from above." (Interview branch organization).

It should however be noted that energy communities are not a universal remedy for increasing the public support. There are also instances where they achieve the opposite: "*There are also some examples of energy cooperatives that actually provoke resistance. Then there are some of those hyperactive locals who are too enthusiastic."* (Interview government)

Nearly all interviewees mentioned the role of public support in the interviews. Both regime and niche players have a positive expectation on the role energy communities can play for the public support in the energy transition. Thus, the shared expectation is that energy communities can actively contribute to increasing public support in the present and the future. This due to the fact that the energy transition is taking place for a big part in the spatial planning sector, which citizens can object to. A classic example wherein this can be seen is the Not I My BackYard (NIMBY) effect. This is the case when people object to the placement of for example wind turbines near the area where they live, while they often have no problem with the placement of these turbines in other areas. Energy communities can help counter this effect by actively involving the citizens in these projects. By doing so, a solution can be found that fits best for each specific community. This adaptability to different circumstances is agreed upon to be one of the strong points of an energy community. Additionally, the benefits of these projects are also kept more locally by involving citizens, and thus again raising the public support. *"People should receive also the benefits of having a solar park in their neighborhood, not just the drawback. Currently, there are large investors, often from abroad that build these solar parks and the local people only experience the disadvantages. I think that is crap."* (Interview supporting organization energy community). No conflicts in expectations have been found.

4.8 Professionalization

There are vast differences in the professionalism of current energy communities as well as in the expectations regarding their future professionalism. A supporting organization for energy communities describes what the current playing field looks like:

"There are real beginners who say, hey, can't we do something with a few neighbors? Then there's a very large middle group who have already done an energy saving project who then say, could we maybe put a solar installation on the roof of the town hall? And there's a leader group. This is a group of reasonably experienced communities that have already started to work in a more professional way and have therefore already grown from a volunteer organization to a more professional one." (Interview Supporting organization for energy communities).

In order to scale up energy communities some form of professionalization needs to take place. When a project is small it can be organized by a few volunteers. However, when the projects become bigger, larger investments will need to be made and thus professionalism becomes more critical: *"However, you are talking about millions of dollars if you want to create a wind farm. And then, you must make contracts with banks, insurers, and other parties, where you are required to present professional documents and other things."* (Interview supporting organization energy community). Additionally, with the scaling up of projects, more technical knowledge is also required. Which is something these volunteering organization are struggling with: *"Because well then if you want to start managing your own grid. How are you going to do that? And how to maintain it and so on. Yes, that*

really requires some knowledge, and you can't just do that in a few spare hours in the evening" (Interview branch organization).

There are a few expectations found on how these energy communities will deal with the professionalization. Firstly, energy communities can turn to project bureaus and other supporting organizations. These bureaus can help the energy communities in realizing their projects by offering their expertise. This would entail that the energy communities will stay in hands of the citizens, but that they will be supported by other more professionalized actors. This is a trajectory that has already been set in motion. Secondly, there is the expectation that energy communities will be taken over by already established big players in the energy market. And the third expectation is about the merging of energy communities with a resulting efficiency gain in the system: *"I think it's more beneficial if you optimize organizationally, that you're not going to have meetings with hundreds of people in 100 different cooperatives anymore"* (Interview TSO). A merger of this kind can take on different shapes and sizes, it could range from as big as a municipality to a whole region. The second and third expectation goes hand in hand with the presumption that citizens should not need/ do not want to think much about the energie they use: *"However, I predict that there will be a sizable number of people who are eager to be free of their responsibilities and don't care whether or not they should install batteries; they simply want energy."* (Interview government). In this view energy communities are a transitionary element for the energy transition, and it is thereby expected that when that transition is realized, citizens won't find energy that interesting anymore.

Thus, there are three synergies in expectation found in regard to the future professionalization of energy communities. Thus far the first synergy is already being implemented and is slowly growing. The other two synergies in expectations are further in the future. These three expectations are not seen as conflicting since they can emerge alongside each other, they are not mutually exclusive. This also goes hand in hand with the fact that the main strength of an energy community is adaptability to different local situations. Thus, for the one community is fits better to stay relatively independent and for the other an acquisition or merger is more appropriate in the future.

4.9 Heat transition

From the interviews a synergy in expectations emerged (shared by niche and regime players) stating that energy communities can not only play a big role in the energy transition but also in the heat transition. However, in the heat transition they are less developed yet: *" The heat transition has only been underway for about 3, 4, 5 years. So they are in a phase that the electricity transition already passed. With heat you are also now seeing a huge number of initiatives"* (Interview supporting organization energy community). Currently there are 78 projects for the heat transition, from which only 4 initiatives have started building (HierOpgewekt, 2020) . Compared to 927 solar and 296 wind projects, this is relatively little.

The capability of increasing public support by energy communities, as previously noted, is the reason that energy communities can play a significant role in the heat transition. This public support is even more vital during the heat transition:

> *"Well, the opportunity now lies in the heat transition, because there you can't build without the consent of residents. So, then the decision no longer lies with a municipal council, where smart project developers can sometimes fool an alderman into giving them a permit. But in the built environment you have a homeowner, so the citizen himself has the right to decide about his own home, so you have to include*

them. Energy cooperatives have a big opportunity to unite those homeowners and create their own localized networks in the community." (Interview advocacy group for energy communities).

In the heat transition, decentralization plays and ever bigger role. There is (currently) no technological national centralized system that can deliver heat to all households. Decentralized system for heat generation will need to be created. Just as in the energy transition this will consist of a variety of technologies such as heat pumps, geothermic, etc. These systems are more efficient and cheaper if they are set up for a district then for each household individually:

"Well, if you take an individual heat pump, it is usually an air water heat pump. However, a heat pump that uses groundwater is theoretically superior since it is more efficient and can operate at temperatures below zero. However, installing such a heat pump is quite costly. For one house, you wouldn't do that." (Interview energy community).

No conflicts in expectations have been found from the interviews.

5 Discussion

The aim of this research was to identify the possible transition pathways on the role of energy community in the future energy system using expectations. This study contributes to the existing transition literature by attempting an analysis of transition pathways by exploring expectations. Gathering these expectations is relevant because of the performative nature of expectations. Namely, the expectations for the future provide direction to the current developments, agreements, collaborations etc. These accumulated expectations in turn can provide insights in conflicts and synergies between different actors. This makes it possible to analyze the possible transition pathways for energy communities. This study focused primarily on the expectations of both niche and regime players, as this combination was underrepresented in the existing literature. Additionally, context factors (role, power, argumentation, organization type, and niche/regime) were researched to identify whether there are underlying drivers of the identified expectations. This information will be subsequently utilized to provide suggestions for coordinating actors.

From the interviews eight key expectation subjects have been identified and have been discussed in the result chapter. For each of these subjects, synergies and conflicts have been identified. A synergy is identified when multiple interviewees shared the same expectation. On the other hand, a conflict was identified when there were vastly different expectations. This is summarized in table 4. An X in the table means that there was either no conflict or synergy in expectations identified within the group of interviewed actors. This does not preclude that there are entirely no conflicts or synergies around these subjects, it merely states that the interviewed actors shared the expectations or had opposing expectations.

Table 4: Synergies and conflicts of expectations

	Synergy	Conflict
Centralized/decentralized	Mix between centralized and decentralized	X
Types energy community	The postcoderoos/ECS energy community, (smart) energy sharing community, and an off-grid energy community	X
Business parks	Large potential for business parks	X
Grid operator	Potential to help grid operators solve net congestions	How much energy communities will be actually used for solving net congestion
Laws and regulation	X	Different expectations and hopes for the new energy law
Public support	Energy communities can help to increase public support, partly due to their local adaptability	X

Professionalization	Supporting organization, acquisition by bigger firms or a merger of energy communities.	X
Heat transition	Large potential in heat transition	X

As described in the theoretical framework, from these expectations the possible pathways can be identified. This has been done by analyzing which expectations are shared the most and whether there are synergies or conflicts in these expectations. Additionally, context factors were used to identify whether certain drivers that explained the actors' expectations. However, this identification of drivers turned out to be rather difficult. This will be further touched upon later in the limitations at the end of this chapter. Before the possible pathways for the energy communities are discussed it is relevant to discuss the broader pathway of the energy system itself. It is expected that the future energy system will be a mix between centralized and decentralized energy generation. This means that there is a potential for the use of energy communities in the future. In essence there are five pathways that are expected for energy communities, some are already more developed than others. An overview of these pathways is displayed in figure 6.

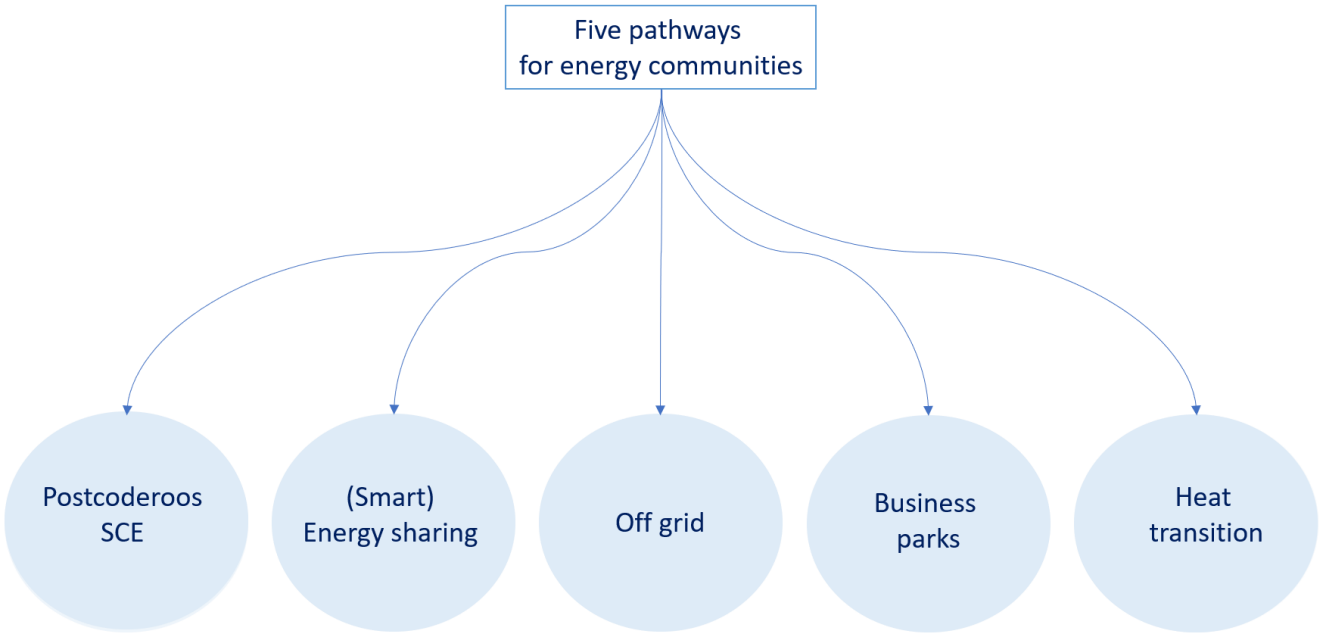

Figure 6: Five transition pathways

The following section will discuss the five identified pathways, their opportunities, barriers, and areas of future research. To start with, there are three identified pathways that are concerned with the type of citizen energy communities. These three pathways can be divided in incremental, radical/incremental and radical. The incremental pathway is based on the postcoderoos/SCE subsidy, these communities are solely focusing on production and are selling their electricity to energy suppliers. This form of energy community is expected to keep growing the next couple of years. Professionalization is a big factor that is starting to play a role for these communities. This is why there is currently a vast emergence of multiple supporting platforms and organizations

to help energy communities in this regard. Thus, the current expectation of needed professionalization for these energy communities has set actors into motion to set up these supporting networks and are thereby actively supporting this transition pathway. This pathway can help the energy transition by increasing the amount of renewable energy generation. Specifically with the new SCE subsidy it is financially interesting for individuals to invest. However, there are two important barriers with the new SCE subsidy since the fixed subsidy rates and savings on the energy tax are too low. The way the government handles this issue will have a big impact on this pathway. The advocacy group is actively lobbying for changes to this legislation. Their lobby efforts have had success in the past. These efforts are having a slowly destabilizing effect on the regime.

The radical/incremental pathway is concerned with (smart) energy sharing communities. Next to the production of renewable energy, these communities are also concerned with sharing their generated energy to their members or costumers. This is the part where they differ from the incremental energy community. Additionally, some communities want to take this a step further and focus on the "smart" energy sharing aspect. These types of communities have the opportunity of destabilizing the regime and changing the status quo. Especially actors in the niche see a lot of potential for these types of energy communities. Regime players, on the other hand, are starting to recognize their potential, such as grid operators who see possibilities in collaborating with these communities to tackle net congestion challenges. These energy communities are capable of more than increasing the amount of renewable energy generation and the public support. They can help to make the energy system more efficient and change the behaviors of participants in these communities. These types of energy communities have in the literature been analyzed among other things on their intrinsic motivations, dynamics inside the community, interactions with other communities, and their learning process (Gui & MacGill, 2018; McCabe et al., 2018; Seyfang et al., 2014; Süsser et al., 2017). The literature has also focused for a large part on describing the potential of these communities and how they can help in managing the electricity system with for example smart grids(Verbong et al., 2013). However, this literature has not yet focused on the legislation barriers that these communities run into. The results of this research suggest that in order for these communities to succeed in the Dutch energy system, significant modifications in present energy regulations will be required. The new energy legislation is scheduled to be implemented in 2023, and there are many conflicting expectations and aspirations about what will and will not be permitted. There are also niche actors actively lobbying for favorable revisions to this law for energy sharing. Thus, whether this pathway will gain traction is highly dependent on whether the government grants these communities more freedom. For now, it does seem that beneficial changes will be made in the energy law but not (yet) enough for energy communities to execute all of their plans. But this could still be a possibility in the future.

Next, there's the radical path, which involves energy communities moving off-grid. Not a lot of opportunities and developments were seen for this pathway. Most regime actors did not perceive the value in this alternative because the Dutch power system is strongly integrated, which provides several benefits. In more rural areas, they did recognize the advantages of this idea. There aren't many niche players who have cited going off grid as their ultimate objective, but they do admire the groups who do. Utilizing these communities as learning places for applications in more remote areas is one way these communities were thought to make a significant impact. The biggest barrier for this pathway is the fact that the government has no plans in allowing such initiatives in the present nor in the future. Given that electricity is seen as a basic necessity, they aim to ensure that the electrical infrastructure remains dependable. There are currently no active lobby efforts to change these rules. These results are in line with the current literature on off grid energy generation. The focus in this literature is mainly on application in remote rural areas and/or poor areas (Aberilla et al., 2020; Adkins et al., 2010; Hirmer & Guthrie, 2017). The main objective of these off-grid energy systems is to give people access to electricity that currently do not have electricity yet or where the electricity grid is unreliable.

Interestingly, the literature observed another type of energy community (de Vries et al., 2016; Seyfang et al., 2014; Verkade, 2020). Namely, where citizens collectively buy for example solar panels for their own roofs or share energy savings and monitoring practices. Within this research this type of energy community was not mentioned by the interviewees when asked about their expectations for energy communities in the future energy system. This can have a few explanations. For example, it can be that these activities were not seen as an energy community by the actors interviewed. Or another explanation could be related to the questions that have been asked to the interviewees. Namely, they were asked about their future expectations for energy communities. Thus, this result could mean that the interviewed actors did not see a (noteworthy) future for these type of energy communities. There could however be other reasons for this difference with the literature.

The other two pathways are concerned with the opportunity of setting up energy communities in business parks and the heat transition. Firstly, the pathway of business parks has several opportunities. Schiphol has demonstrated the feasibility of an energy community in a business park and has thereby set an example on how these communities could be managed. Furthermore, industries consume relatively more energy than households, thus there are several energy savings potentials along this road. The implementation of energy communities in business parks makes it possible to use electricity more efficiently. The fact that business parks are more likely to receive leniency under current and future legislation than citizen energy communities is another aspect that contributes to the relevance of this transition route. One factor that pushes this pathway is the net congestion problems of the grid operators. It is not always possible for companies to connect to the grid or to increase their electricity use. In this sense these companies are forced to become self-sustaining. As a result, this path shows a lot of development potential. However, there are a few barriers to consider. Namely, this pathway is still in its early development. Thus, there is currently limited knowledge and projects available. Thus far, the literature on energy communities has barely delved into the subject of business energy communities. There are two relevant papers. Firstly, the paper by Eslamizadeh et al., (2022) researched how the government could make these business park communities financially attractive. They did this by comparing a feed in tariff and a tax incentive to support these communities. Their results suggest that a tax incentive is more appropriate. Thus, if the government wants to incentivize these collaborations, they could do this with a tax incentive. The other paper by Eslamizadeh et al., 2020 researched whether industries could be participants in energy communities. Their main conclusion was that energy communities are a promising approach for industries to use. They highlighted that for the establishment of energy communities in the industry a higher level of community spirit and trust was required then for citizen energy communities. Another essential component is a solid legal framework for resolving disputes that may arise in industrial collaborations. These results thus suggest that energy communities between industries do operate differently from citizen energy communities, this is important to consider developing energy communities between industries. This also shows the importance to further research these types of communities as the knowledge from citizen energy communities cannot be one to one copied. Specifically in the area of governance of such business parks there is still a lot to learn, as this is vastly different from the citizen communities. This is mainly because of the differences in motives and interests between these two groups. Industries have higher electricity demand and more rigid demands on the availability and quality of the electricity service (Eslamizadeh et al., 2022). Besides there are also larger differences between the electricity use between companies then between households, this requires a higher level of governance, which needs to be further researched. Additionally, because of the early developmental stage of this pathway the first stages of a niche development are important to focus on. Specifically, this requires learning as much as possible from experimentation in the niche (deepening), repeating the experiments in other contexts (broadening), and applying the experiments at higher scales (scaling up) (Loorbach & van Raak, 2006).

Next, the pathway of energy communities in the heat transition has its opportunities in the public support it creates and local adaptability of energy communities These two factors are significantly more critical in the heat transition than they are in the energy transition. This is because in the heat transition adaptions are being made within the homes of households, requiring greater public support. Another opportunity for using an energy community is because it is not efficient to use a different technology for each individual household. Collective heat generation options are more efficient and affordable. Additionally, incorporating heat generation in an energy community fits well together. Namely, the energy generated in an energy community can be used to power for example (geothermal) heat pumps in the heat transition. The community can collectively install/invest in these heat pumps. There are a few initial projects that are exploring this pathway; however, this is still at a relatively early stage. The literature has thus far mentioned the potential of using heating systems in energy communities or performed a case study on an energy community with a heating technology (de Vries et al., 2016; Gui & MacGill, 2018; Hielscher et al., 2011). However, what these papers have not explicitly discussed is the difference between the energy and heat transition. This research has shown that the increased public support and local adaptability of energy communities can play an important role in the heat transition. This is because the heat transition takes place inside the house of households. Currently municipalities have the lead in the heat transition in the build environment. However, they experience great difficulty in keeping the heat transition going (Brand, 2021), which is why energy communities can play a crucial role in this field. However, the developments in the heat transition are still in its infancy when compared to the energy transition. Thus, similar to the business parks pathway it is advised to focus on deepening, broadening and scaling up experimentation projects and providing the legal space for these experiments (Loorbach & van Raak, 2006).. Next to this, this research did not find any legislation barriers, but that does not mean that they are not there. Similar to the energy transition, the system is designed for a central heating supply, and thus the legislation is also for a large part still designed for this system. There is a new heating law in the making, which is expected to be released in 2024 (Walle, 2022). It is therefore important to analyze the legislations in place to identify bottlenecks where these communities are currently but also in the future are running. As can be seen with current developments for the energy communities it is important to start lobbying and changing these legislations rather sooner than later before it becomes a barrier for further development.

Along with these five pathways, there are some expectations for potential future pathways that may emerge when the energy transition is accomplished. For energy communities, there are currently three anticipated pathways after the transition is completed. Firstly, the communities stay organized by citizens, with the help of supporting organization. Secondly, large firms in the energy sector acquire the energy communities. Lastly, energy communities will merge, which adds an efficiency to the system and unburdens the volunteers. This second and third pathway revolves around the expectation that these communities are merely a transitionary element to get to an end point. As described in the result section, in this view it is expected that most citizens do not want to think about their electricity. They simply want to turn on the lights and not have to bother about anything else. This is a view that is mostly shared by regime actors. On the other hand, there is the expectation that the electricity system will become more democratized, where citizens actually want to have a say in where their electricity comes from and how everything is organized. The democratizing of the energy system is the foundation on which the development of energy communities is based. Namely, the democratization of the energy system makes a case for the energy consumer, because in the end, it is primarily the citizen who pays for the transition, either as an energy consumer, or as a taxpayer (REScoop 20-20-20, n.d.). Energy communities empower the citizens in making decisions in a field that is affecting them greatly. If this trend continues, then there is likely more opportunities for energy communities in the future energy system. One area where this democratization is already being set in motion in the regime is with the establishment of the 30 RES regions.

Each region has its own responsibility and authority in regard to their strategy for the energy transition. They must, however, adhere to the government's stated national policy objectives. Although decision-making processes are closer to the citizens with the establishment of the RES regions, there is still a large group of citizens that are not able to participate in the process. But these kinds of developments do show potential for this trajectory to further develop in the future. It is important to recognize this democratization trend and gain more knowledge on how this affects the entire transition. This research has contributed to this topic specifically on the aspect of energy communities; however, the democratization is not solely about energy communities. For example, it is also about citizens getting a transparent and fair price. Future research can therefore focus on a system wide analysis on how the democratization of the energy system takes form and what the opportunities and barriers of this development are. This knowledge can help in anticipating future changes that will come to the system because of this development.

The observation of the absence of a common vision, as stated in the introduction of this study, is strongly supported by the finding of five distinct paths. There might be several pathways identified, each with its own vision, due to the lack of a shared vision. Additionally, each of these paths has begun some type of development; this can be attributed to the performative nature of the accumulated expectations. The actors are acting in accordance with their expectations, which reinforces these pathways. However, whether these pathways gain enough momentum to destabilize the regime and whether actors align their vision is dependent on various factors which have been extensively discussed in the previous paragraphs. Additionally, not every pathway is in competition with another. Namely, the business parks and heat transition pathways can coexist next to the pathways on the types of energy communities. This diversion into other domains can be beneficial in destabilizing the regime and opening a window of opportunity to breakthrough. On the other hand, since these pathways are all a part of how energy communities may exist in the future energy system, it also leads to a misalignment of visions. It is challenging to align visions due to the varied advantages and roles that energy communities might play in several domains of the future energy system. From the interviews it becomes clear that when spoken of an energy community all of these possibilities are seen as an energy community and not (yet) as for example as a heat community or an industrial energy community. Also, the different forms of citizen energy community make the alignment of a vision difficult since each of these communities operates differently but is often referred under the term of an energy community. Thus, when spoken about the role of energy communities in the future energy system a broad range of visions come about. This paper has tried to distinguish these visions into separate pathways and thereby informing actors on the distinct visions on which they can act. This in turn can help to better align the visions of actors in the sector.

There are some limitations to this study. Namely, the driver identification as part of the theoretical framework, was not unsuccessful. The context factors “role, power, argumentation, organization type, and niche/regime” were supposed to be used to identify certain drivers behind the expectations. The drivers are relevant because they can provide additional information on the identified pathways and can show which contextual factors have a large influence. However, the identification of the role, power, argumentation, and organization type context factor were not successful. Firstly, for the argumentation context factor, “why” questions were asked to the interviewees. Nonetheless, the “why” questions in the interview did not have the desired effect. When the interviewee was asked to explain why they had a certain expectation they repeated their expectations for a large part without further elaboration on why they thought this. In future research this could be minimized by separating the expectation questions better from the argumentation question, and thus not combining them. A follow up interview could also be a possibility that specifically asks the arguments behind the identified expectations. An important thing to consider is that actors might not always know what drives them and would therefore not be able to answer these questions directly. Additionally, the context factor role and organization

type were rather difficult to assign to one specific role or organization since a lot of interviewees were involved in multiple organizations or had volunteering positions next to their regular jobs. Because of this, it was rather difficult to identify from what position within which corporation they were speaking. This was especially the case with energy communities and branch organizations. For future research I would leave out this context factor because it cannot be prevented that actors represent multiple organizations, without compromising the sampling strategy. Next, the power context factor overlapped a lot with the regime/niche factor, where regime players naturally have more power than niche players. There were differences in the level of power observed between the niche players and regime players themselves. However, this did not have a noteworthy result on the expectations and pathways. The only context factor that was useful for the analysis was whether the interviewee was operational in the regime or in the niche. As this could be used to determine how much potential the given pathways already showed. However, this context factor alone was not enough to identify drivers behind certain expectations.

The sample of participants that were interviewed is another limitation. First of all, the sample is limited and thus generalization for the entire energy industry is not possible. Next to this, because snowball sampling was used there is the possibility to get stuck in a circle of likeminded participants. This has been minimized as much as possible by contacting participants directly. However, due time constraints this was not always possible. Secondly, there are a few actor groups missing that were identified in the structure analysis, such as municipalities. This is because these actors unfortunately did not respond. However, the data did approach a point of saturation, thus the outcomes will most likely be similar. But nonetheless a few actor groups their views have not been included.

A limitation of exploring expectations is that the results are highly dependent on the interview process. One important pitfall to consider is that the interview questions can have a large influence on the identified expectations. Namely, the gathered expectations and patterns of the previous interviews should not be used in the following interviews. This would result in an unfair allocation of importance of certain expectations. Previous interviewees would have shared the expectations on their own accord, while the later interviewees would have been influenced by the previously mentioned expectations. An additional research step to add to this research design is therefore to perform a second round of interviews to ask the interviewees all the gathered expectations of the first interview round. This would provide additional information on synergies and conflicts of expectations.

To conclude, this study analyzed five transition pathways that emerged from the expectation of both regime and niche actors in the energy system. With the discussion of these pathways a brief overview of the current developments, opportunities, and barriers has been shown. In doing so actors are shown where the current system is developing towards, and because of what actions it is moving in these directions. This research has also shown what actions are needed for the transition pathways to be followed. This study thereby has shown that exploring expectations can be a useful tool in analyzing transition pathways. It should however be considered that although expectations are performative, there is no guarantee that energy communities will develop along any of these pathways. These pathways should therefore not be seen as a forecast for the future, but it should help actors to critically think about the different pathways and where action is needed for the desired pathway and thereby help in the alignment of their visions.

6 Conclusion

This last chapter will conclude this thesis and summarize the key findings in relation to the research question and discuss the contributions of this thesis. This research had the following research question:

> *What are the expectations regarding the transition pathways of energy communities for the future energy system, and how can these insights help in coordinating actors within this transition?*

In order to answer this question, 19 interviews have been held with actors operational in the niche as well as in the regime. From these interviews eight key expectation topics have been identified and discussed in the result chapter: *decentralization/centralization, type of energy community, business parks, grid operator, laws and regulations, public support, professionalization, and the heat transition*. Within these expectation topics synergies and conflicts were identified. A synergy transpired when numerous participants shared the same expectation, but a conflict transpired when there were obvious competing expectations. Next, five possible pathways for energy communities have been identified in the discussion chapter with the help of the key expectations topics, synergies, and conflicts. Three of these pathways are concerned with the type of energy community; *postcoderoos/SCE, (smart) energy sharing, and off-grid*. And two of these pathways are concerned with upcoming fields in which energy communities are starting to be implemented: *business parks and the heat transition*.

Based on these pathways a recurrent theme has been identified as barrier for most of the pathways: legislation. Currently, the law is not yet set up for energy communities. There is a new energy law in the making which will provide more freedom but does not yet make all the plans of the energy communities possible. Niche actors are still actively lobbying for more beneficial changes in this new law. Furthermore, the new SCE subsidy provides insufficient subsidy rates and a too low discount for the old postcoderoos subsidy. This can hamper the future development of these energy communities. Therefore, action needs to be taken to increase the rate for the SCE subsidy and a solution needs to be found for the problems with the old postcoderoos subsidy. Additionally, for the development of energy communities in the heat transition it is important to analyze the current and potential legislation barriers to prevent a similar situation as in the application of energy communities in the energy transition. This study did not identify legislation barriers for heating, but this was also not the focus of this study. Finally, a tax incentive is preferable to a feed-in tariff if the government wants to actively support energy communities in business parks.

Next, there are two areas identified for further research. Firstly, the governance in business parks is vastly different from citizen led energy communities and is therefore a relevant subject to research further. Secondly, the democratization of the energy system is playing an important role in the energy transition. This research has contributed to this topic specifically on the subject of energy communities. However, the democratization entails more than energy communities and therefore it is important to research this development with a system wide view. In order to identify all relevant factors that are being affected or will be affected by this movement.

In conclusion, this research identified five possible transition pathways, which have been extensively discussed. By analysing these pathways, it can inspire actors to critically think about the future of these energy communities and learn something about their applications in different situations and field, in order to align the visions in the sector. This research has made a contribution to the existing knowledge base with the identified legislation shortcomings and areas of future research. Additionally, this research showed that exploring expectations for the identification of possible pathways to be effective.

7 References

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Appendix A

Context

1) Kunt u wat vertellen over de organisatie waar u voor werkt? (organisatie)
    i) Wat zijn de voornaamste taken?
    ii) Hoe zit de bedrijfs structuur in elkaar?
    iii) Grote onderneming of klein?

2) Wat voor projecten of onderzoeken participeert uw organisatie in omtrent de energie transitie?
    a) Samenwerkingen?

3) Wat is uw rol binnen de organisatie ? (rol)
    i) Wat zijn precies uw taken?
    ii) In hoeverre bent u betrokken bij beslisingen in het bedrijf?

4) Werkt uw organisatie veel samen met andere belangrijke actoren? (power)
    i) Zo ja, wie?
    ii) Zijn dit vooral regime of niche actoren?

Energie transitie

5) Hoe ziet u het toekomstige energie systeem voor u? – en waarom?
    a) Centraal/decentraal?
    b) Voorziet u problemen in de energie transitie? – en waarom?

Energie communities huidige ontwikkelingen

6) Hoe zou u zelf momenteel een energie communitie omschrijven? – en waarom?
    a) In hoeverrre denkt u dat deze omschrijving zal veranderen in de toekomst? – en waarom?
    b) Warmte ?

7) Heeft u het gevoel dat uw organisatie een actieve rol speelt in de beslissingen omtrent energie communities? (power)
    i) Zo nee, zouden ze een actievere rol kunnen spelen?

Verwachtingen toekomst

8) Hoe ziet u de rol van energie communities **in de toekomst** in de energie transitie voor u? – en waarom?
    i) Opschalling?
    ii) Incrementeel vs radicaal?
    iii) Ambiteus?
    iv) Ervaart u spanningen tussen actoren?
    v) Rol van energie suppliers
    vi) Lokalen energie opwekking

vii) profesionalisering

b) Hoe ziet u de rol van uw organisatie voor u in de toekomst omtrent energie communities?

c) Welke actoren zijn belangrijk om te betrekken bij de ontwikkeling van energie communities? – en waarom?

Recommendations

9) Waar liggen de huidige kansen voor energie communities volgens u ? – en waarom?

10) In hoeverre voorziet u momenteel nog problemen voor energie communities in de toekomst? – en waarom?
    i) Maatschappelijk?
    ii) Samenwerkingen?
    iii) Financiele?
    iv) Regelgeving?

11) In hoeverre doet uw organisatie of energie communitie iets om deze problemen te verhelpen? – en waarom?

Slot vragen

12) Heeft u nog laatste vragen of nog andere belangrijke punten die we nog niet besproken hebben?

13) Zou u mij nog door kunnen verwijzen naar andere participanten voor mijn interviews?