Renewable energy communities
A comprehensive study of local energy initiatives in the Netherlands and Germany

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Executive summary

The thesis is based on the idea that transition to a sustainable energy regime required to avoid the dramatic consequences of climate change involves not only changes in technology and production patterns, but it also necessitates the introduction of new actors, who could invest in renewable energy production. Without a massive expansion of renewable energy producers the chance for the transformation of the mostly fossil based energy regime into a sustainable one is very limited. Hence, besides strengthening the current stakeholders of this change, it is also inevitable to explore new groups of actors, who could become the future investors of renewable energy. This thesis focuses on such a group, namely the renewable energy communities (REC) and examines their transition potential.

RECs are residential groups, who decide to change their passive consumer role into the role of energy producer, generating the electricity and/or the heating they need. Acquiring knowledge on them helps to better understand how this new type of renewable investors could be strengthened and to what extent they can contribute to the energy transition. Therefore the aim of this research was to study renewable energy communities from different aspects and at different levels in order to answer the main research question, which was: How can the spread and scaling-up of renewable energy communities be supported?

To answer the research question a comparative cases study analysis was conducted involving Dutch and German communities that are different in terms of their size (ranging from small communities with a few members to large communities of 3000 members), locations (islands, villages, city neighborhoods, districts in small towns, or just small communities in apartment buildings), institutional background (German and Dutch regulations), renewable energy technology used (solar photovoltaic, water pumps, wind mills, biomass power plants) and organizational structure (wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy not only for their
members but also to other customers). The investigation was executed at four different levels through the use of different theoretical lenses:

At individual level, the research investigated personal motivations for joining a renewable energy community and investing in joint renewable energy projects by using Lindenberg’s goal-framing theory. The results show that regardless of size, location and applied technology, the members of all investigated communities were driven mainly by gain and normative motivations and hedonic considerations played minor role. Furthermore, there was no difference between frontrunners (members who participated in the organization of the project) and average members (financially supported the project) either in terms of the dominant motivations, however, the motives behind the altruistic behavior of participating in a working group and deliver the tasks on a voluntary basis were mostly hedonistic and normative. Thus, joining a REC is primarily defined by gain and/or normative considerations, while the decision to participate in the project organization (i.e. to become a frontrunner) is mainly driven by hedonic and partly normative reasons.

At group level, the research explored group formation and project organization methods of RECs through the lenses of the teamwork, collective action and grassroots theories. It found that contrary to Olson’s (1965) expectation about voluntary collective action, renewable energy communities can realize a project of a certain complexity counting on only a limited number of volunteers who develop the project without receiving any additional reward and who are also willing to accept free-riding. However, the larger the size of the community and the higher the complexity of the project (varied technology portfolio or technologies that generate both heat and electricity), the more likely is it that the community needs to take a formally organized structure or count on external help (expert, manager). Therefore, the investigation concluded these two factors, size of the community and complexity of the project, influence the composition and structure of RECs.

At institutional level, based on Dinica’s risk assessment framework the research assessed the effectiveness of national support instruments in decreasing investors’ risks from the perspective of RECs’. The analysis re-
revealed differences between the German and the Dutch institutional contexts. The German system provides an optimal investment context (the support system ensures high profitability potential with low risk) that largely decreases or eliminates all the investors’ risks, while the Dutch support instruments are less supportive in this regard or they benefit only small-scale energy producers (below 10MW/h). This negatively affected the ambition of RECs to scale up their projects. Furthermore, the lack of sufficient risk assessment in the Netherlands resulted in fewer and simpler projects in terms of portfolio of technologies compared to Germany.

At system level, the transition potential of RECs as social niches was examined with the help of the multi-level perspective. The investigation concluded that RECs learn from each other, establish networks and use similar practices and production patterns thereby forming a global level niche. At the same time they enjoy the support of powerful regime actors such as energy companies, banks, local governments, etc. and they establish links to sub-regimes (e.g. financial, policy, energy). Finally, RECs are heterogeneous in terms of their actors, the technologies they use and the conditions they are operating under. This heterogeneity increases the likelihood that this niche can expand and become an influential part of the regime. The interrelation among these three elements (global level niche, support of powerful regime actors, heterogeneity) can result in positive feedback loops, thus increasing the RECs’ transition potential.

This research made several theoretical and methodological contributions. It introduced proxies and accompanying indicators, extending earlier theoretical work on socio-technical transitions, to study the transition potential of social innovations and thereby social niches. It also reinterpreted the notion of niches and the way how transition occurs, paying special attention to social innovations developing besides technological innovations. Further, it also made a distinction between internally and externally oriented niches based on their orientation and application focus, claiming that RECs are internally oriented social niches that develop innovations for internal purposes and not for later regime use.

Contributions to Dinica’s (2006) investor-oriented risk assessment framework were the introduction of new indicators and testing this theoretical
evaluation method in practice. In addition, the research approached the investors as not one homogenous group, but made a distinction between different types of investors (individual, community, firm). It was argued that the level of initial capital, the level of ambition regarding the type and complexity of their projects, or the extent to which they are risk averse can vary among the three investor categories. As a methodological contribution, the research used interviews to gain a better understanding on the perception of investors to see whether the policy makers’ intentions with certain instruments could succeed in their objective.

Finally, the social relevance of the research has to be highlighted, since the adequate and tailor-made support of renewable energy communities would benefit not only their members, but it could also strengthen their links to actors in sub-regimes and thereby contribute to energy transitions. The significant increase of the share of renewables in the energy market is impossible without a massive involvement of new investors, and in case a new potential group emerges and is ready to take part in the change process supporting it is essential. Adequate support can come only from a thorough understanding of this group’s motivations, expectations, capacities and needs. This research has hopefully contributed to further the understanding of such emerging groups.
Chapter 1 - Introduction

1.1 Problem definition

The planet is increasingly energy-hungry. At the same time, it has become clear that the very source of most energy, fossil fuels, is the main driver of climate change. According to climate scientists going beyond the maximum of 2°C increase of the global average temperature above the pre-industrial levels is unacceptable if humankind wants to avoid too catastrophic consequences of global warming (including heat waves, sea level rise, extreme weather events, floods, decreasing availability of water resources, etc.) (Azar et al., 1997; Hansen, 2005; Rockström et al., 2009).

Without dramatically reducing CO₂ emissions, more precisely cutting it back to close to zero or – if that is not done fast enough – even moving towards ‘negative emissions’, the control over climate change slips out of hand leading to an unpredictable scenario with negative outcomes (Grübler, 2007; van Vuuren et al., 2007).

Transition to a sustainable energy future is therefore needed and increasingly advocated. Such a transition is based on the transformation of today’s global energy system from the current centralized mainly fossil and nuclear based power generation to a decentralized interconnected network that enables a massive use of renewable resources, which also involves radical change in production patterns, consumer behavior, policy approach and in the general way of thinking regarding energy (Loorbach and Verbong, 2012; Markard et al., 2012). Because the global economic development is so much entwined with energy consumption, this massive change requires fundamental adjustments in multiple sectors (e.g. energy, building, food, transport) at different scales – from individual to societal. To facilitate and support these adjustments, new institutional arrangements and governance structures and the involvement of a variety of stakeholders are necessary (Loorbach and Verbong, 2012; Verbong and Geels, 2007).
This latter aspect is focus of this thesis. More precisely, among several questions that remain open in the transition literature this thesis concerns the actors that should generate the substantial amount of renewable energy needed to satisfy both the increasing global energy demand and the required reductions in greenhouse gas emissions. However, the change in behavior, production patterns and ways of thinking is difficult to achieve if the structure of the energy system stays top-down led, steered by their present stakeholders. Actors who are active at the small-scale and local level could play an important role in the energy transition and they can potentially contribute to renewables’ deployment besides big companies and governments (Burton and Hubacek, 2007; Hiremath et al., 2009).

One group of the small-scale actors are the individual investors, who are already responsible for a substantial part of the overall energy production from renewable resources (e.g. in 2013 private producers were responsible for more than 35% of the total renewable energy generated in Germany (Trend:research & Leuphana Universität, 2013)). However the scale of personal energy production is limited and in most of the cases it is confined to the use of simple and cheap technologies such as solar PVs. A more efficient way of producing renewable energy could be achieved through the scaling up of individual projects to a community level through the establishment of energy communities, which are groups of citizens who jointly generate energy.

However, if only rational market considerations play a role in taking the decision to jointly generate energy, the relatively high costs of the investment could hinder the realization of this option. How can the formation of such groups be catalyzed then? What can motivate people to join and form a local investor group? Why is it worth starting a local energy initiative and doing it jointly, not individually? Well, on the one hand, probably transaction costs and investment risks would decline, as these would be shared among partners, thus providing incentives for collective action in terms of market rationality.¹ On the other hand, value-based considerations (e.g. environmental protection, support of the local economy) can al-

¹ Collective action here means, following Olson’s Logic of collective action, the production of collective goods either individually or in groups (Olson, 1965).
so play an important role in the individuals’ decision to invest in renewables and to produce energy locally. The coupled effect of these two advantages may result in such a market behavior that could lead to a solution for the aforementioned problem.

Secondly, even if we assume that people have sufficient motivation to start a local energy initiative jointly, the question remains: how can these groups deal with problems occurring from collective action? With other words, how can group members organize an energy project on a voluntary basis and cope with free-riders? Hence, it is also necessary to identify behavior patterns or group formation methods that can help investor groups overcome the obstacles and successfully implement these projects.

Thirdly, not only internal difficulties can hinder community energy projects, but there are also several risks that investors face during the implementation and the operation of the technologies. So even though such groups have the intention to invest in renewable energy, there are contextual barriers, which hinder them from finding the most appropriate solution. These problems range from having difficulties with obtaining a bank loan, finding sufficient demand for the energy produced, ensuring long term contracts with fixed purchase price or negotiating the conditions of grid connection and balancing. Therefore, besides exploring individual motivations and community organizing methods, it is also necessary to learn more about the institutional context that group investors operate under, more precisely about which support instruments could provide the best help for them.

Finally, it is also important to see the broader picture, thus the potential of these joint investor groups for scaling up and the extent to which they can contribute to the energy transition. In case they remain only a small number of people who have special needs and values, who define themselves against mainstream society and look for alternative solutions, their potential to deploy and become responsible for a substantial share of renewable energy production, is probably very limited. In case, however, renewable energy production at a community level is an option for many people with heterogeneous backgrounds, the likelihood that they can become im-
Important players of the radical changes required by sustainable transitions increases.

1.2 Renewable energy communities

The focus of the current research, following the logic of these arguments, is on residential groups who decide to change their passive consumer role into the role of energy producer, generating the electricity and/or the heating they need. Acquiring knowledge on them helps to better understand how this new type of renewable investors could be strengthened and to what extent they can contribute to the energy transition.

Before introducing the research questions, it is important to define what kind of group is being dealt with. Can it indeed be called a community? According to the sociological definition of a community (Fulcher, Scott, 1999), the group has to have the further characteristics:

- **Common situation:** those who live in a community share common features which connect them. We can distinguish residential and non-residential communities;

- **Common activity:** the members of a community are connected through various relationships which are not confined only to work, hobby, sport etc. but also cover most other areas of life;

- **Collective action:** the members of the community engage in collective action in order to realize their common interest;

- **Common identity:** group members have a common identity and it makes them feel good that they belong to a greater unit.

Certainly, there are groups which do not have all the characteristics, but only two or three of them and these are still seen as communities. Accordingly, the group of people co-operating for the realization of an energy project can be considered as a community, since they are doing a collective action or at least they intend to do so. Furthermore, as it is a group of people living in the same neighborhood, they can be defined as a residen-
Finally, assuming that these people have at least partially normative motivations for participating in an environment friendly activity then the common identity, which connects people, is also present. To which extent they participate in versatile joint activities is not clear, but probably it is not even relevant.

Henceforth these investor groups are called renewable energy communities (REC), which are residential communities that started and have been managing energy projects; they thus initiated the project, made the investment and have been operating the technology/ies.

1.3 Literature review

Local community based energy projects (such as RECs) started to gain interest among scholars especially in the last decade, which lead to an increasing number of studies investigating and positioning them within the grassroots (Seyfang and Smith, 2007; Smith and Ely, 2015; Smith et al., 2014; Hilscher et al., 2012), transition (Johnson and Hall, 2014;) and niche literature (Seyfang et al, 2014; Hargreaves et al., 2013; Smith et al., 2016), claiming that such community initiatives are grassroots innovations for sustainability that act as socio-technical niches developing both technical and social innovations and thereby contributing to energy transitions. Smith et al. (2016) define them as

“network of activists and organizations generating novel bottom-up solutions for sustainable development; solutions that respond to the local situation and interests and values of the communities involved. In contrast to mainstream business greening, grassroots initiatives operate in civil society arenas and involve committed activists experimenting with social innovations as well as using greener technologies (Smith et al., 2016, p.408).”

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2 A distinction has to be made between the residential community that includes all the people living in the same neighborhood and the renewable energy community, which is an investment community formed by (some, but not necessarily all of the) members of the residential community.
Even though the scientific attention is increasing around such community projects, there is no commonly accepted definition or name capturing the phenomenon of community based renewable energy initiatives. After taking a closer look at the literature, one can find several forms and activities described, such as energy efficiency measures, awareness raising or energy production (Hilscher et al., 2011; Seyfang et al., 2013) including all or some of them under the terms of community energy (Park, 2012), community renewable energy (Walker et al., 2010), renewable energy initiatives (Denis and Parker, 2009), renewable energy cooperatives (Yildiz, 2015), etc. Walker and Devine-Wright (2008) identified two dimensions according to which they defined “community renewable energy”. The process dimension refers to who the project is done by, who was involved in it and worked in its realization. The outcome dimension refers to the beneficiaries of the project partaking in its social and economic benefits. In their definition, in community renewable energy, the community carries out a project and the same people receive its benefits.

Similarly to Rogers et al. (2008) this thesis focuses only on communities that invested in renewable energy technologies that either benefited the community directly or indirectly by selling the produced energy to the grid. Thus energy efficiency measures or awareness raising are out of the thesis’ scope. Furthermore, it concentrates only on groups in which members actively participated in the project and all of them are shareholders of all or at least one of the technologies. Active participation refers to the involvement of citizens in, for example, planning, developing, decision-making or operation of a renewable energy project. Shareholding refers to a financial investment made by community members in a renewable energy project. In most cases, community participation and investment are regulated by specific patterns of ownership. These can be, for example, cooperatives, community charities, private limited companies with community ownership, community associations or informal community groups (Hielscher et al., 2011). This thesis concentrates only on these groups in the energy sector.

Restricting the scope conditions of renewable energy communities and differentiating them from other community based energy projects help conduct a comprehensive scientific analysis, which is still missing from the
literature, since partly related activities such as awareness raising or efficiency measures might require a different level of individual commitment, different way of community and project organization, or account for a different level of policy impact and dependence, which would distort the results and it would make it difficult to come to specifically RECs related conclusions. Therefore the current thesis concentrates exclusively on renewable energy communities and studies them at four different levels of analysis.

1.3 The structure of the investigation

The aim of this research is to study renewable energy communities for different aspects and at different levels in order to answer the main research question, which is: How can the spread and scaling-up of renewable energy communities be supported?

To answer this research question we divide it up into four sub-questions, according to which the investigations aim at four different levels with the help of associated theories:

1. At the individual level we explore the driving forces that motivate people to join RECs. Thus our research question at this level is the following: What are the individual motivations for investing in renewables and generating energy jointly by participating in a local investment community? In answering this question we make use of Lindenberg’s goal-framing theory, which provides a framework for the categorization of diverse motivations. Our aim is to explore the dominant goal-frame in the individual decision making for joining an REC and to study how people can be best motivated to invest in renewables jointly.

2. At the community level we are interested in ways people form a REC and organize a renewable energy project. Although several social theories deal with group formation and collective action, none of them can fully explain how
voluntary groups (with members receiving no reward for their work) that are formed in already existing strong communities can organize collective action, which benefit all members of the community. Therefore, we invoke three dominant theories: grassroots theory\(^3\), teamwork theory and collective action theory that help gain basic insights and which we complement with our findings to give an answer to the question: *What factors influence the formation and organization of renewable energy communities?*

3. At the institutional level we use Dinica’s investor-oriented risk assessment framework to explore the risks that community investors face and the governmental support instruments that could best address them. More precisely, our goal is to evaluate support instruments from the perspective of renewable energy communities in eliminating or decreasing risks of the set up and operation of renewable technologies. In addition, we are also interested in the perception of community members to see whether the support that these instruments intend to provide is indeed effective in practice. The research question which belongs to this level is: *How effectively can renewable energy support systems mitigate risk from the perspective of renewable energy communities?*

4. At the system level we place RECs in a larger context and investigate their role from the sustainability transition perspective. In this case one of the transition theories, namely the Multi-Level Perspective, yields the framework for the analysis. We study RECs as social niches that provide a seabed for not only technological but also for social innovations. The question that we raise at this level is: *To what extent do renewable energy communities, as social*

\(^3\) We refer here to David Horton Smith’s (1997) tentative theory of grassroots associations in society, which provided the basis to a broader analysis of grassroots movement in the last couple of decades.
niches, have the potential to scale up and contribute to energy transitions?

1.4 Research methodology

The research is conducted at different levels of investigation based on a comparative case study analysis between different renewable energy communities in the Netherlands (Amsterdam Zuid, Eva-Lanxmeer, Leeuwarden, Texel) and Germany (Jühnde, Freiamt).

As a research method semi-structured interviews were chosen, since it is a very flexible technique for small-scale research, especially for case studies. In this method the detailed structure is left to be worked out during the interview, and the person being interviewed has a fair degree of freedom in what to talk about, how much to say, and how to express it, which freedom is essential for a qualitative research that is investigating motivations, preferences and attitude or revealing processes, past events of a project development. 45 semi-structured interviews\(^4\) were done with members of RECs, representatives of local governments, REC consultants and researchers. Besides the interviews, the thesis also leans on desk based literature and document studies.

The scope conditions for the research population, as they were already discussed above, were: 1) the community that invested in renewable energy is located in the Netherlands or in Germany; 2) the investment is a citizen initiative; 3) the members of the initial investment community (people who bought the technology) live in the same location/region; and 4) all the members of the investment community are shareholders in all or at least one of the technologies.

Renewable energy communities in the Netherlands and Germany differ with respect to their size (ranging from small communities with a few members to large communities of 3000 members), location (islands, vil-

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\(^4\) The scientific analysis of each chapter is based on the comparison of the cases in different distribution.
lages, city neighborhoods, districts in small towns, or just small communities in apartment buildings), and the technology they use (solar PVs, water pumps, wind mills, biomass power plants). These projects also encompass different organizational forms, such as wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy not only for their members but also to other customers (Schwencke, 2012). Therefore, we used the diverse case method for case selection, as diverse cases of the population are likely to be representative of the full variety of cases (Seawright and Gerring, 2008). Consequently, we chose cases from different locations (village, small town, city), with different sizes and with different technologies and resources (wind, solar, biogas, thermal water). See the appendix for the detailed description of the cases.

The research rational for selecting communities from Germany and the Netherlands was based on the idea that they are two western-European societies with more or less similar institutional backgrounds, but with different results in terms of their renewable energy deployment, which make them interesting and comparable for an analytical research.

Although both countries have an increasing number of renewable energy communities and similar renewable energy support schemes, they represent opposite ends of the scale of RES installation rates in the European Union. With a 25.3% renewable energy share in gross electricity consumption in 2013, compared to only 3.1% in 1990, Germany is one of the most progressive countries worldwide in terms of RES market deployment (AGEE, 2013). In 2012, around half of the total installed renewable energy capacity was owned by private citizens and farmers (Trend:research & Leuphana Universität, 2013). By 2014, citizens had set up more than 800 renewable energy cooperatives (DGRV, 2014), but they also set up close-end funds and other legal forms to realize renewable energy projects and large

5 The advantage of this method is that a full range of variation increases the representativeness of the results that the researcher finds based on the analysis of the selected cases. Its disadvantage is that in case the distribution of different cases is not equal within the population, but the researcher selects cases from every type of cases equally, it can distort the results. Still, the diverse case method is regarded the most representative method from all small-N sample methods (Seawright and Gerring, 2008).
parts of the installed wind energy capacity are (co-) owned by the so-called Bürgerwindparks\(^6\) (citizen wind farms) (Yildiz, 2014). Thus, RECs have contributed substantially to the ongoing transition to an energy system based on renewables. In comparison, the Netherlands is lagging behind regarding its renewable energy share. With less than 5% of electricity consumed from renewables in 2014, the Dutch energy sector is at the tail-end in terms of performance in the European Union.\(^7\) With an estimated 150-300 renewable energy communities (Schwenke, 2012), the sector is developing but still lags far behind Germany.\(^8\)

**First generation of RECs**

Citizen initiatives dealing with renewable energy are rooted back to the 80s in both countries. In the Netherlands the first energy cooperatives were strongly linked to the Organization of Renewable Energy (ODE), an anti-nuclear movement that wanted to promote wind and solar energy among local and environmental groups and to create a balance against the monopoly of big electricity companies.\(^9\) As a result several local groups decided to establish wind-cooperatives, mainly because of ideological reasons and they were less interested in financial benefits. The consequence of that was the inability to cope with economic and regulative problems (Agterbosch et al., 2004).

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\(^6\) Typically Bürgerwindparks are legally organized as limited liability companies or close-end funds. The dominant business model is the feed-in of electricity from renewable energy sources while the organizational models vary with regards to legal forms.


\(^8\) Because the data that the paper analyzes was collected in 2013-2014, the latest changes in the German regulations could not provide a source for analysis of the current paper. Even though these changes might radically affect RECs in the future, it does not influence our general question concerning the most supportive combination of instruments that can best facilitate RECs. It remains to be seen how these changes in the regulations will affect renewable energy communities in the long term.

\(^9\) http://www.duurzameenergie.org/83
Similarly, the first RECs in Germany grew out of anti-nuclear movements. During the 70s and 80s Germany was home to massive protests against the construction of new nuclear power plants and nuclear waste treatment, culminating in 1986 after the fall-out in Chernobyl. While the government had already begun the search for alternative technologies to conventional power generation based on fossil fuels first citizen groups started to experiment with renewable energy technologies during the 1980s by putting up wind turbines to demonstrate the practicability of RES technologies (Schreuer, 2013).\textsuperscript{10} At the same time, the government introduced first policies to support the development of RES (see section 3). As a reaction to improved framework conditions, like an early Feed-in tariff (FIT) enacted in 1991, citizens and farmers started to form communities and those groups developed the first ‘Bürgerwindparks’ (citizen wind farms)\textsuperscript{11} in the early 1990s (Schreuer 2013). Thus, there was some modest growth of RECs during the 90s mainly in the area of community based energy projects.

\textit{Second generation of RECs}

After the liberalization of the energy market in the late 90s and early years of 2000 a second generation of energy cooperatives emerged in the Netherlands (Schreuer & Weismeier-Sammer, 2010). This generation was more organized and diverse in terms of their members and motivations than the early initiatives. Although the Dutch energy policy has never considered renewable energy as a top priority, there were several legislations introduced in the recent years that created better conditions for renewable investments (see section 3). Besides that, due to the social movements and the danger of climate change environmental protection became a general value, which is shared by not only some radical activists any more (van der Heijden, 2007).

\textsuperscript{10} Nuclear energy was positioned as an alternative and clean source of energy by the German government

\textsuperscript{11} In Germany wind farms initiated, (co-)owned or operated by collective citizen communities are named ‘Bürgerwindparks’ (citizen wind farms). See Schreuer, 2012.
Therefore, communities of citizens engaging as renewable energy investors are rather heterogeneous today including people with diverse motivations (financial, environmental, local added value, independence from big companies and the hedonic motivation of working together with fellow citizens on a joint project), different social backgrounds and people using all kinds of renewable technologies (mainly solar PV, but also hydro-, wind- and biomass energy) (Doci et al., 2013). The number of communities dealing with renewable energy in the Netherlands is somewhere between 150-300 today encompassing different organization forms, such as wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy to not only its members, but also to other customers (Schwenke, 2012).

In Germany, the activities and number of RECs also rose considerably during the 1990s and after the year 2000. While there were only 144 RECs in 2008 this number increased to 650 by the end of 2012 (DGRV 2013). More than 1300.000 people have participated in joint renewable energy projects investing approximately 1,2 billion € in renewable energy technologies until 2012 (Ibid.). Similarly to the Netherlands, RECs, especially in the area of wind energy, have not only been motivated by ideological reasons, but also by profitability expectations due to financial incentives and large parts of installed wind energy capacity owned by citizen wind farms (Schreuer & Weismeier-Sammer, 2010; Enzensberger et al. 2003; Bolinger, 2005). 90% of the cooperatives produce electricity from solar photovoltaic (PV), because it is cheaper and simpler to procure compared to other RE applications. However, one can find also other technologies, including electricity production from wind, biogas and hydropower as well as heat production from biomass, biogas and solar thermal power. Some cooperatives are also active in the area of energy supply and distribution. Finally, less formalized RECs have emerged in the form of joint solar procurement projects similar to the initiatives in the Netherlands (Dewald, 2012).

In conclusion, the history of German and Dutch RECs are similar. The development of RECs first started with ideologically motivated communities experimenting with RES in the 70s, 80s and early 90s in both countries and later RECs became more heterogeneous in their motivations and activities. The second generation of renewable energy communities show a large-
scale variety in both countries in terms of the technology they use (all types of renewable technologies) and the motivations of people to invest in renewable energy jointly (profit, supporting the local economy and the community, autonomy and system critique). In this sense they are comparable to other Western countries (e.g. UK) where similar processes started in the past decade (Walker, 2008). Except for citizen wind farms in Germany, which are rather unique, ownership structures are also similar in both countries, as one can find cooperatives and less formal initiatives too. However, there are also a major difference between these two countries, which is the development and spread of RECs in Germany after 2000. Germany has certainly become a leader in community driven renewable energy development, while the Netherlands is a bit behind in this regard. Therefore the aim of this thesis is to analyze and compare national policy instruments to see to what extent they influence the spread of renewable energy communities and weather different or better designed instruments are the key of the higher number of RECs in Germany.

1.5 Structure and outline of the thesis

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<td>What factors influence RECs? How can be the...</td>
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<td>Ch. 3 Group level of analysis</td>
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12 The majority of citizen wind farms take on the legal form of a GmbH & Co. KG consisting of a limited liability company (GmbH) with a private limited partnership (Kommanditgesellschaft / KG) (Enzensberger et al. 2003)
<table>
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<th>Analysis (Grassroots theory, Teamwork theory, Collective action theory)</th>
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Chapter 2 – “Let’s do it ourselves”: Individual motivations for investing in renewables at community level\textsuperscript{13}

Gabriella Dóci, Eleftheria Vasileiadou

Abstract

Renewable energy communities have multiplied the last years in many countries, even in contexts that the structural conditions are not favorable. The paper analyses individual motivations for partaking in local renewable projects and generating energy jointly in an investment community, in order to inform policy debates on how to support such communities. To do so, we applied a socio-psychological approach for studying renewable energy communities in Germany and the Netherlands. Our results show that mainly gain (such as decreasing energy costs) and normative (such as addressing climate change) considerations played a role in the decision, but in the background hedonic motivations were also present, such as having fun and integrating in a community. Each of the groups examined emerged in already existing strong communities, where trust was relatively high, which seems to be an important condition for the realization of local energy projects. Consequently, we argue that tailor-made incentives addressing the different types of motivations can be more effective for the support and spread of renewable energy communities.

Keywords: renewable energy communities, motivations, goal-framing theory, joint investment

\textsuperscript{13} This chapter was published as an article in Renewable and Sustainable Energy Reviews 49 (2015), 41-50


2.1 Introduction

If we want to transform the current centralized and fossil-based energy system to a sustainable one, the support and therefore a better understanding of renewable energy investors and generators is indispensable, including actors such as the state, companies or individual investors. In this regard, renewable energy production at the community level is very promising. It involves people in a neighborhood, who invest in renewable energy technologies jointly and generate the energy they consume, forming what we call renewable energy communities (REC). The growing importance of community-based energy production is well illustrated by the fact that, for example in Germany, citizens have set up more than 650 renewable energy cooperatives (TOKE et al., 2008), while in the Netherlands there are an estimated 150-300 such communities¹⁴ (Schwencke, 2012)(until 2012). Gaining a better insight on the motivations of renewable investors at the community level can help policy makers to develop more effective supporting mechanisms to address these communities.

Scholars have been studying motivations for investing in renewables for more than a decade (Claudy et al., 2010; Mahapatra and Gustavsson, 2008; Marques et al., 2010; Paladino and Pandit, 2012; Palm and Tengvard, 2011; Zahedi, 2011). These articles focus on motivations and barriers for adopting or installing renewable energy technologies at the individual level. Even though these studies are useful starting points, they don’t help us understand motivations for contributing to joint investment projects. We expect motivations to participate in renewable energy communities to be more related to group projects. At the group level, there have been also a few studies, which explore the reasons communities engage in renewable energy projects (Bomberg and McEwen, 2012; Rogers et al., 2008; Walker, 2008). Although, these articles provide a good starting point for understanding motivations for such collective action, they do

¹⁴ The large variation of numbers is due to the different interpretations of this phenomenon in the literature depending on the degree of the ownership or the participation of the local residents (Boon and Dieperink, 2014)
not present the individual citizen’s perspective (for example (Walker, 2008)).

When the individual participant is the starting point, the motivations are provided in a descriptive way in the literature, for instance by simply listing the answers of the respondents (for example (Rogers et al., 2008)), without an understanding of the underlying psychological mechanisms and rationales. As a result, our understanding of the participant’s point of view is limited, and cannot be easily compared with other cases. Therefore, the aim of this article is to answer the following research question: What are the individual motivations for investing in renewables and generating energy jointly by participating in a local investment community?

In order to explore this topic, we start from a social psychology approach, since we expect that some motivations would be related to motivations for joint action. Such a theoretical starting point is generally lacking in relevant literature on individual motivations (for example (Balcombe et al., 2013)), but can be very useful to help us compare across different cases.

The research contributes to a better understanding of community based energy projects, and provides relevant information for the government and all the support institutions including governmental associations, NGOs, knowledge platforms\(^\text{15}\) and companies that help the establishment and operation of renewable energy communities. Supporting such communities with specific policy instruments can help increase community self-reliance as well as the market share of renewables.

### 2.2 Theoretical framework

The literature on individual motivations for investing in renewable energy is diverse. A recent paper surveying the relevant literature analyzed and categorized the results of 18 articles on different types of motivations as follows (Balcombe et al., 2013):

\[^{15}\text{Knowledge platforms are either self-organized networks or co-operations between different stakeholders to support and educate RECs (Schwencke, 2012).}\]
Motivation

| Financial       | - Save or earn money from lower fuel bills and government incentives  
|                 | - Increase the value of my home  
| Environmental   | - Help improve the environment  
| Security of supply | - Protect against future higher energy costs  
|                 | - Make the household more self sufficient/less dependent on the utility companies  
|                 | - Protect the household against power cuts  
| Uncertainty and trust | - Use an innovative/high-tech system  
| Impact on residence | - Improve the feeling or atmosphere within my home  
|                 | - Show my environmental commitment to others  

| Table 1 Summary of motivations associated with adopting microgeneration (based on table of Balcombe et al. (2013) p. 658) |

We expect some of these motivations to be similar in our cases of community investments; for instance, environmentally-related motivations are probably relevant whether one conducts the investment alone or in groups. However, motivations for joint investments may also be expected to be different. For instance, being a member of a group, and the social acceptance that this brings may play a role in participating in RECs, but not for individual investments. We may miss similar motivations if we assume that the reasons people invest individually are the same that drive people to invest jointly.

Various motivations can be found behind a decision to invest in renewable energy and doing it jointly with others. Lindenberg and Steg (Lindenberg
and Steg, 2007) studied environmental behavior and coupled motivations behind such individual behavior with goal-frames, arguing that in every situation people want to achieve a goal that combines certain types of motivations. Hence, motivations can be divided into three groups depending on what fundamental desires and needs they fulfill. They argue that people perceive every situation from a different point of view, a perception that is influenced by the goal they want to achieve. They distinguish among three goal-frames: the hedonic goal “to feel better, feel comfortable”, the gain goal “to guard and improve one’s resources”, and the normative goal “to act appropriately” [(Lindenberg and Steg, 2007), p.119].

1. Within the *hedonic goal-frame* people want to improve the way they feel at the moment. This goal-frame has a short-term time horizon (focusing on the moment at hand) and motivates people to increase their pleasure (seeking excitement, happiness or direct improvement in self-regard) and avoid situations, which negatively affect their well-being (avoiding effort, negative thoughts or uncertainty). People are more likely to behave environmentally responsible, if this behavior also provides them with satisfaction and pleasure. However, in case an action is relatively difficult or complicated, then the hedonic goal-frame discourages people from acting.

2. The *gain goal-frame* determines one’s motivation to increase or protect resources. It has a middle- or long-term time horizon, which means the goals to be achieved are in the near or far future. In case this goal-frame is dominant, people are open to all kinds of incentives or opportunities which promise benefit. So people are more likely to act environmentally conscious, if they can also expect some profit.

3. Within the *normative goal-frame* people act appropriately, and behave ethically or morally. Their main goal is to meet norms expected by themselves or the community. It is more likely that people act according to normative goal-frames, if they are aware of environmental problems. However, the dominance of this goal-frame is reduced, if costs increase or the act becomes too
complicated or time-consuming. In this situation the gain or hedonic goal-frames take over.

According to this theory, motivations in all three goal-frames are present at all types of environmental behavior; however, motivations belonging to the dominant goal-frame condition the way people interpret the situation and also the way of action. Motivations belonging to the other two goal-frames remain in the background and they either strengthen or weaken the dominant one. In case the goal changes, the interpretation of the situation and the action itself change as well.

Besides investigating individual motivations from the perspective of the goal-frames there are also some other theories that help us understand why people want to invest in energy technologies jointly. First of all, people are social beings and their basic need is to belong to a group (Cartwright and Zander, n.d.; LOWIE, n.d.), not only for the group’s sake, but also since they can gain benefits through the group (Festinger, 1953).

Based on these arguments, Olson (OLSON, 2009) comes to the conclusion that every group or organization is seeking to ensure some kind of collective good. The acquisition of this collective good is beneficial for all members of the group. Thus, if a group decides to start an energy project and to produce the energy they need, then the group has initiated collective action. The members of the group become shareholders of the collective good, which is the community energy system including both the technological and social aspects.

Further, Olson argues that collective action is not necessary, if the person can achieve his or her goal also alone. Therefore groups are formed only when:

1) people have a common interest and unorganized, individual action is not able to realize this interest, or

2) realizing an (individual) interest alone involves greater sacrifice and effort than doing it with others. Following this line of reasoning, people would aim at procuring technologies jointly, because with collective action
they would have advantages that they would not gain, if they invested in renewables alone.

How can we understand this sacrifice and effort in the case of investment on renewable energy technologies? One of the reasons people may decide to invest in a technology jointly is that this way they can divide, and thereby reduce, transaction costs. Transaction cost is a cost incurred in trading goods or services (Hirshleifer et al., 2005). It includes not only monetary, but also other costs, such as time, energy etc, which, for example, incur during searching for suppliers, or specific technologies. Bargaining costs are also part of transaction costs: these are the costs of establishing a contract, which may comprise of applying for permits, consulting a lawyer or cooperating with the municipality. Secondly, it is a general belief that community-based projects can obtain permissions and local acceptance – which can be very important in case of the NIMBY phenomenon – easier than others and it is twice more likely that they get accepted by the local residents than external projects (Walker, 2008). Thirdly, costs of monitoring and implementing the contract are considered as transaction costs as well, which can arise if the supplier does not comply with the contract. Finally, costs may incur relating to the estimation of the locally available resources, which fundamentally means what each area can provide in terms of nature and resources as natural endowment (for example availability of geothermal resources, or locations with strong winds).

Apart from dividing transaction costs, sharing the risks (such as the failure of the technology; changes in regulations or on the market that can lead to financial loss) with others can also attract individuals to procure a technology jointly. In the course of collective action, the risk and also its consequences are distributed among all the group members, which renders major investment possible and allows for taking higher risks than in case of individual action (Samuelson, P., Nordhaus, 1998). If a person decides to invest in renewable energy together with others, then he or she can, presumably, afford a greater and more expensive technology for smaller input, since joint investment reduces the costs and risks (Kogut, 1988).

In addition, people can also have other motivations for taking part in a collective action. While the former motivations (reducing transaction costs
and risks) have mainly a gaining element, other motivations may be based on norms and values (Seyfang, 2009). Lindenberg and Foss (Lindenberg and Foss, 2011) suggest that partaking in a joint production requires different motivations than in case of independent action, which they call joint production motivation. Motivations aiming for “the realization of joint goals or meeting joint appropriateness standards” within the normative goal-frame are “the all-important preconditions for joint production motivation” [(Lindenberg and Foss, 2011), p. 506]. Especially in the case of renewable energy communities, it has been suggested that ideological reasons, such as improving the neighborhood’s conditions, serving as good example for others and supporting and strengthening the local community are among the most important reasons for participation (Rogers et al., 2008; Walker and Cass, 2007). Moreover, people might join community energy projects after their successful establishment because of direct or indirect social pressure (as they do not want to be left out) (Hoffman and High-Pippert, 2010). Joining to an already proven, successful project has lower risk but higher benefit promises than starting projects. It may also be the case that joint investment increases the person’s short-term pleasure: collective action can be exciting, it creates a good spirit and it may increase the people’s self-esteem (Rogers et al., 2008). Furthermore, doing something good and useful in a group provides immediate feedback and reinforcement from the other members of the community, which are important normative considerations and at the same time they strengthen the relationship between members, which is a hedonic aspect.

There is some speculation in the literature with respect to the role of strong local and municipal leadership in motivating individuals to participate in RECs. Even though one would expect that this factor is important, there is not enough evidence for this. “The origins of the groups are very strongly rooted in civil society: well over half (59%) were set up by individuals, and a further third (34%) by pre-existing community groups. This indicates that the community energy sector is predominantly citizen led and community-based from the outset (as opposed to projects being set up by businesses or local authorities and later involving community groups)” (Seyfang et al., 2013). Another study also conducting interviews in the Netherlands on civil society-based renewable energy organizations sug-
gested that sufficient evidence is lacking to validate the hypothesis that authorities play a role in the individual motivations (Boon and Dieperink, 2014).

In conclusion, we expect that what drives individuals to invest in micro-generation is partly similar to what drives people to participate in RECs. Even though the literature emphasizes gain and normative motivations in this decision, we also expect hedonic motivations to play a role.

2.3 Methodology

Based on the goal-frame theory, we examined the motivations of people in two Dutch (Amsterdam Zuid, Eva-Lanxmeer) and two German communities (Jühnde and Freiamt) that realized joint renewable investments to identify which goal-frame was the dominant for the joint investment decision. We conducted 41 semi-structured interviews both with the front-runners that initiated and invested more time and effort in these projects, and with average members, whose contribution was smaller. In addition to the community members, we also interviewed companies, municipalities and researchers (in the case of Jühnde) that helped the communities. The scope conditions for our research population were: 1) communities in the Netherlands or Germany that invested in renewable energy, 2) the investment is a citizen initiative, 3) the members of the initial investment community (people who bought the technology) live in the same location/region, 4) all the members of the investment community are shareholders in all or at least one of the technologies.

<table>
<thead>
<tr>
<th>Frontrunner</th>
<th>Average member</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (male)</td>
<td>5 (male)</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>1 (female)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- city councilor Göttingen (female),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- the LEADER (EU program)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Interviewees per case

<table>
<thead>
<tr>
<th>Case</th>
<th>Interviewees</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (male)</td>
<td>4 (male)</td>
<td>2 (- CEO of the Oekostromgruppe, the company that helped the organization of the project (male), - mayor (female))</td>
</tr>
<tr>
<td>2 (male)</td>
<td>3 (male)</td>
<td>-</td>
</tr>
<tr>
<td>2 (female)</td>
<td>1 (female)</td>
<td>-</td>
</tr>
<tr>
<td>5 (male)</td>
<td>4 (male)</td>
<td>2 (- founder of Eva-Lanxmeer (female), - formal director of Vitens (male))</td>
</tr>
</tbody>
</table>

Renewable energy communities in the Netherlands and Germany differ with respect to their size (ranging from small communities with a few members to large communities of 3,000 members), location (islands, villages, city neighborhoods, districts in small towns, or just small communities in apartment buildings), and the technology they use (solar PVs, water pumps, wind mills, biomass power plant). These projects also encompass different organizational forms, such as wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy not only for their members, but also to other customers (Schwencke, 2012). Therefore, we used the diverse case method for case selection, since diverse cases of the population are likely to be representative for the full variety of cases (Seawright and Gerring, 2008). Consequently, we chose four cases from different locations (village, small town, city), with different sizes and with different technologies and resources (wind, solar, biogas, thermal water).
In each case we had a contact person, who helped us to get in touch with other community members, so we could do face-to-face interviews usually by visiting people at their home. The interview guide covered, among other things, the personal motivations for participating in a joint investment project. All the interviews were recorded and transcribed, and our interviewees are anonymized for the purpose of this article.

All the interviews were taken in 2013, years after the realization of the projects. We are aware that our interviewees might have had different motivations when making the decisions than the ones they communicate in retrospect. In addition, there may be a recall bias, as in all other interview-based studies (Yin, 2011). Nevertheless, we are here interested in the perceptions of the participants themselves and their interpretations.

We conducted a qualitative analysis on the interview transcripts, using the theoretical constructs of the goal-framing theory. We coded the motivations using the three goal-frames discussed earlier (hedonic, normative and gain), and tried to answer: What is the main goal-frame influencing the decision to invest jointly? How is this goal-frame framed by the respondent? We considered the goal-frame with the most mentioned motivations as the dominant one. However the analysis also allowed us to pay attention to motivations that do not fit in any of the goal-frame categories, or motivations that belong to more than one goal-frames.

In addition, we sought to identify the characteristics, which may influence variation in these goal-frames. More specifically we looked into whether there were differences between project frontrunners, that initiated and invested more time and effort in these projects, and average members, that simply invested in the projects. Previous literature has shown that this distinction is relevant for sustainability transitions (Kern and Smith, 2008), and that often the focus is on involving frontrunners (R Raven, 2012). In addition, prior research shows that citizens prefer different degrees of participation, making thus the distinction between frontrunners and average members of these projects relevant (Rogers et al., 2012) even though this has not been systematically explored. We also looked into gender differences in the cases: previous research has suggested that in energy project planning there seems to be unequal gender distribution.
with men having a more prominent role than women (Skutsch, 1998), whereas another study found a predominance of women in organizing local sustainability projects (Merritt and Stubbs, 2012).

2.4 Results

2.4.1 Jühnde

The first case that we analyze is Jühnde, an agricultural village in Lower-Saxony, Germany, with a population of 780 residents. They produce both heat and electricity 100% from renewable energy resources and cover all the energy needs of the investment community. The core of the energy production comes from a combined biogas power plant that uses methane, which is complemented in winter by wooden chips. The heat is distributed via a local grid to the households. The total heat production of the village is 6500 MWh/year, while 5000 MWh electricity is produced annually (about double the amount of the local consumption). The project cost 5,3 million Euros, one third of which was paid with governmental and regional funds and the rest by the residents and some business investors.

The idea of a self-sufficient bio-energy village was developed in the University of Göttingen in 2001 as an experiment for a complete shift from fossil energy production to renewables. The university contacted several villages, to choose the village that can participate in the experiment. In each village, the researchers gave a presentation of the danger of climate change and the depleting fossil-fuel resources and of the financial and environmental benefits of a bio-energy project. The community in Jühnde showed such a big interest that the mayor together with other members and local farmers organized a field trip to a wood chip heating system and to a biogas plant to learn more about these installations.

On the same day of the field trip, the villagers founded an initiative named “Initiative Bioenergiedorf Jühnde”. Its mission was to create knowledge on bio-energy in the community, to find a position towards bio-energy and later to actively support the campaign to get selected by the university.
Several working groups were organized within this initiative according to the different professions and interests of the community members.

Finally, Jühnde was selected across 54 villages on the basis of local support (more than two thirds of the people supported the project) and agriculture, since the farmers were able and willing to produce crops for the biogas power plant. At the beginning of the project, the university actively participated in the organization of the work of the groups. However, after some time, the researchers retained more and more an observing position. In the following years, the villagers became more and more independent until the whole system started operating in 2005. During the whole process, the community was involved in every decision making.

After 2005, the project was led by a project manager from Eco-Institute, a private company who supported the foundation of the local cooperative. Today 70% of the local residents are members of the cooperative, which organized the whole process within four years. At present, 12 other villages in the region want to become the next bio-energy village.

Motivations

The idea of the project attracted the attention of the villagers from the very beginning on, which according to our interviewees, was always supported by most of the people. We can find motivations belonging to all three goal-frames behind the investment decisions; however, the gain motivations are unequivocally the dominant ones, followed by normative and finally by hedonic considerations. Being independent from big oil companies and thereby from increasing fossil prices. – was the most cited gain motivation, and – Protecting the climate or environment. – was the second most cited motivation, which belongs to the normative goal-frame. In this case, the influence of the university presentation at the beginning of the project is very visible on the motivations or at least on their articulation: our respondents here gave more elaborate answers than the members of other cases and they could better categorize and specify, which factors played a role in their decision making.
“Well, first of all we wanted to be independent. We used to have a gas storage tank in our garden because we had no central energy provision. Each person had his own storage tank for heating (gas or oil). In my opinion, this was nonsense because it’s expensive. Secondly, even if you fill up your tank it is sometimes not enough to get you through the winter and filling it up in the middle of the winter meant waiting for a couple of weeks and buying the resource for high prices.” (Interviewee 2.1, male, average member)

The answer of a farmer also mirrors the main points of the university presentation. — “Independence from oil, because you don’t need any oil. Secondly, [I] liked the fact that the added economic value would stay in the village once the plant was up and running. The people from Jühnde deliver the resources and we earn what we feed in. So everything is localized in contrast to a big electricity supplier.... I was also interested in environmental protection.” (Interviewee 3.1, male, average member)

The second most mentioned gain motivation is also related to the prices and saving money on the heating costs in the long run. It is important to add that, according to most respondents, the financial support from the regional and national government was crucial in the investment decision, although it rather reinforced the already existing gain motivations. In addition, due to the German feed-in tariff, EEG (Erneuerbare Energien Gesetz – Energy Sources Act) the prospect of a stable, guaranteed income also played an important role in the individual decision making.

Participating in a joint production was the best way for the villagers to benefit from the university’s support and also from the support of the local and regional government. It reduced transaction costs and risks, since professionals helped them for free and they experienced no difficulties with the permits. As one of our interviewees explained it — “Jühnde received a lot of support. The University initiated the project and the University itself received funding from the FNR [Fachagentur Nachwachsende Rohstoffe - the central coordinating institution for research, development and demonstration projects in the field of renewable resources] for their

16 The notation indicates that the interviewee is the second interviewee, of case 1.
research. The FNR also funded a big portion of the planning costs during the project so that the people from Jühnde had to invest money only in a quite late phase of the project. This put us in the comfortable situation that we could wait until the end of the planning phase, because up to that point we had not invested much money. Given this background the FNR supported us strongly during the planning phase. In addition we were supported by the input of expert knowledge from the University. Further we received ideological support from all the political parties and all the political levels like the municipality council, the regional government, the government of Lower-Saxony and finally also the national government.” (Interviewee 5.1, male, frontrunner). According to another interviewee they received not only ideological support: “Juhnde and the regional government helped us in lobbying at the state and national level. In addition the national government gave a guarantee to the ministry that in case the pilot project fails they pay back the money to the ministry” (Interviewee 8.1, male, frontrunner). In addition, through the researchers they could receive additional funds from the government, which were essential for the construction of the heating grid.

In terms of the normative goal-frame, addressing climate-change and protecting the environment were most often mentioned. Moreover, educative and patriotic motivations were in many cases present, as well as contribution to the next generation. As one of the interviews said – “And I was told that once we did the project, other villages would follow our example and in the end it has really happened now, so that more people do something for the environment and for our children.” (Interviewee 6.1, male, average member)

With respect to the hedonic goal-frame, we found different motivations for participation. One of the university researchers (a psychologist), who worked together with the villagers in the project summarized them as follows: “Most of the people in the working groups weren’t born in Jühnde, but moved there later. Since this is a very strong and closed community, this [participating in the working groups] was a possible way for them to integrate into the local society. Others liked the attention of the media and the honor and the appreciation of the locals for their work. At the same time it was good for them to increase the living standards in the communi-
ty and work together with other villagers.” (Interviewee 12.1, female, researcher)

The answer of a villager also confirmed the psychologist’s insights: “I think you don’t have many chances in life to participate in such a relatively big thing and we did not want to let this chance go. We wanted to participate in it. Well, it was a lot of fun. We had just moved here so we did not know many people and hardly any people knew us. And suddenly there was a group of people who met regularly and friendships developed. So having fun just getting to know others through the work was a motivation in itself” (interviewee 5.1, male, frontrunner).

All in all, we can conclude that motivations from all three goal-frames were present in the answers of almost all interviewees, however mainly gain and secondly normative motivations played crucial role in the investment decisions.

2.4.2 Freiamt

Freiamt has 4,300 residents and is located in the south-west of Germany, near Freiburg. Since 2007 the village produces 14 million kWh of electricity from renewable energy sources annually; exceeding the village’s electricity demand by 2 million kWh. The electricity is produced from multiple renewable energy sources: five windmills, 240 roof-mounted PV panels on private houses, two small hydro power plants and two biogas plants constructed in 2002 and 2007. In addition, 150 private houses have installed solar thermal collectors for water heating. All the generated electricity is fed into the national grid. Heating demands are met with heat produced by the biogas plant and several wood-chip and wood-pellet heating systems.

The community project started in 1996, when an external investor approached the villagers to buy land in Freiamt in order to construct wind farms. The population reacted in a skeptical way and nobody sold their land. Instead, some community members got curious about this option and wanted to investigate, whether there was a potential to gain money with wind energy. Hence, seven community members founded an associa-
tion for the promotion of wind power (Verein zur Förderung der Windenergie in Freiamt) in 1997, with the aim to set up two windmills. As a first test, the association put up a wooden pole in 1997 to make measurements and get data on wind speeds. The results were very promising, so the association concluded in 1999 that it is economically viable to construct a windmill there. The same year, the association started the project to construct two windmills and asked the relevant authorities for the necessary permissions. Two private companies joined the project as partners.

In 2000 a private company (Freiamt Windmühlen GmbH & Co. Beteiligungs KG) was set up in order to execute the project. The company initially had 150 (now +200) private shareholders, more than 50 of them being community members in Freiamt. Until today five windmills have been constructed and operated by Freiamt Windmühlen GmbH & Co. Beteiligungs KG. All electricity from wind energy in Freiamt is fed into the national grid\textsuperscript{17}. The association for wind power is still active today (2014) and according to the village’s mayor, it has established itself as an influential body for all community members. Today, the company has 350 active shareholders with a third of them being community members, while the rest of the shareholders live in neighboring villages.

In addition, Freiamt has more than 240 PV systems installed on private homes. The association for wind energy tried to construct several PV systems jointly with community members. However, there was not much interest from the citizens who rather preferred to install their solar systems individually, without collective action (“If my neighbor puts a PV system on his roof, I will too”). As they said, installation was much easier and cheaper than the wind project, so there was no sense for them to do it collectively. Also, there is a small biogas plant operated by a local farmer. Nineteen private homes and one school are connected to it.

\textbf{Motivations}

\textsuperscript{17} The wind energy they produce cannot be used directly, but the villagers can buy it back for the same price.
In contrast to Jühnde, gain and normative motivations were equally present, while there was limited evidence of hedonic considerations. Another difference between the two communities is that the answers about the motivations were less elaborate in Freiamt, while in Jühnde the presentation of the university summarized the possible reasons for investing and provided a framework in which people could think, and justify their actions.

The main gain motivation in this case was clearly the profit that the villagers expected to earn with the project. As one of our interviewees said “When I first started earning money, I had some money left to invest. I thought about what to do with this money. For me it was not very attractive to put the money in a bank account, because the interest-rates were declining. With the wind project it was obvious that there would be profit if you invested money” (Interviewee 1.2, male, average member). Another interviewee said: “First and foremost the attractive possibility to invest my money. The positive forecasts about the energy yield and the return on investment were decisive for me to invest” (Interviewee 2.2, male, average member).

Besides the profit, the stability of the project was also important for many respondents that helped to decrease the (psychological) risk of the investment. “It is more important to the people to invest in things that are stable in value; things they can see, they can touch and where they can say, “I own a part of this” instead of virtual investments. I think this is the main motivation. People don’t want to invest in a share, but they want to invest in a wind turbine, which they can see and they know that they own a certain part of it.” (Interviewee 5.2, male, frontrunner). The stability was an important factor that was also reinforced by the EEG: “The project would not had been realized without the Renewable Energy Sources Act (EEG) because with this, you already know in advance how much money you will receive for the electricity you produce. Without this Act we also would not have received any loans from the banks. And also the parts of this Act, which oblige energy suppliers to buy the electricity and to connect us to the grid, were crucial.” (Interviewee 6.2, male, frontrunner).
Reducing transaction costs as a gain motivation is present also in this case. This is most visible in the individually applied solar PVs. Olson’s reasoning on the participation of collective action is valid in this situation too. Hence, procuring the wind mills jointly was reasonable to reduce transaction costs, but the investment in PVs was simple enough to realize it on their own. “I think the support from the government was big and it was easy to buy such a PV system, because there was a lot of supply. I think most PV systems were installed for economic reasons. You don’t need to cooperate if you install a PV system, because you can go to the bank and get a loan. With the windmill it is more difficult I think.” (Interviewee 7.2, male, front-runner)

The main normative motivations in this case were also environment protection: “… we all, especially the next generation, want to live in an environment, which is “healthy”. We have to start acting now because later it will not be possible any more. And we have to do it with small steps; we can’t just change the whole energy system over night and turn off all nuclear power plants and use renewables only. In my opinion it won’t work this way.” (Interviewee 1.2, male, average member) and supporting the development of renewable energy technologies: “Also the motivation to support the wind power development. I believe that there are some “real” Freiämter, who want to genuinely support wind power development.” (Interviewee 4.2, male, average member). In several cases we also found patriotic considerations, thus the protection or improvement of the local community. “What fascinated me was that we could try such a project here in the region and also the ecological background I mentioned in the beginning.”; “The motivation to do it on our own was simple that we didn’t want anyone else to come here and construct his windmill in our town.” (Interviewee 3.2, male, average member). This sense of independence is emphasized also in the first case, and could also be related to hedonic goal-frame: a sense of good feeling created by being able to control one’s own resources.

It should be noted that sometimes, the categorization of motivations in the hedonic or normative goal-frame is not very self-evident, as some excerpts contain both normative and hedonic elements: “Apart from the economic motivations maybe also the feeling of being part of the group
that produces electricity here in Freiamt. I think this aspect/motivation connects the people within the community. (Interviewee 6.2, male, front-runner)

In conclusion, the Freiamt case indicates the coexistence of gain and normative goal-frames behind the decision to invest jointly in wind energy, as well as individually in solar PVs. Hedonic goal-frames are less relevant.

2.4.3 Amsterdam Zuid

The community is located in the south of Amsterdam: a houseboat area including 80 boats. The residents regard it as a village in a city, because the people know each other very well and they form a strong community. The neighborhood used to be divided between the old and new residents. The first generation of houseboat owners moved there in the 60’-70’s, because they couldn’t afford to live in a house and they could not “find their place in the mainstream society”. Later, living on a houseboat became expensive and only wealthier people could afford it\(^\text{18}\). While the first generation houseboat owners were low-educated, newcomers were rather high-educated. The awareness of environmental problems is high, since there are several initiatives related to environment protection. An overwhelming majority of the residents (95%) are members of the local association (Vereniging van Eigenaren), which exists for 50 years and once a year they have a general assembly. That was the connecting point and the forum where people met each other.

Four local people started the project in 2008, when they wanted to buy solar PVs on their own, because that year the local government launched a solar program for subsidizing individual application of solar PVs. However, when the technology supplier offered them 20-30% price discount in case they bought PVs in large quantities, the initiators decided to involve other people from the neighborhood. They organized a meeting in the local association, but not enough people came. So they cooperated with a few

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\(^{18}\) It was a form of suburbanization, when the wealthier residents of Amsterdam moved out from the city center to the green outskirts areas, thereby increasing the house prices in these neighborhoods.
other enthusiastic residents to organize a communication campaign to attract as many people as possible. They put advertisements in the local newspaper, distributed leaflets and they also went to each boat personally. Visiting all the residents one by one proved to be the most effective way of involving people in the project. In the end, 35-40 people joined the project.

Finally, one of the initiators ordered all the solar panels, and helped people apply for subsidies. When the solar panels arrived, the people got together and helped each other to put them on the roofs of the boats. After the first year, the initiators repeated the whole project twice. The last time, even though they didn’t go to each people’s house, there were already people who came to them to join. The municipality’s solar program continued in the following years, so they could apply for subsidies again.

Motivations

As in the German cases, the motivations belonging to the gain goal-frame were dominant also in the houseboat-neighborhood of Amsterdam Zuid. However, normative considerations had almost the same importance in the decision, while hedonic motivations played only a minor role.

Saving money in the long run was the most prominent gain motivation, followed by the opportunity of reducing transaction costs by participating in the project: “We know that the price of the fossil energy will increase so it is a good investment to buy solar PVs now.” (Interviewee 3.3, male, frontrunner); “Because there was this subsidy and it was well organized.” (Interviewee 2.3, male, average member). Similarly to Jühnde, regulations, such as saldering (a tax exemption that guarantees that up to 5000 kWh/year the behind-the-meter produced electricity is exempt from VAT and energy tax) and subsidies played an important role in the investment decision and reinforced the gain motivations of the people. – “Saldering was really essential, without it we wouldn’t have invested in this project.” (Interviewee 7.3, male, frontrunner); “We got subsidy from the local government, called Zon op je dak. The national government gave us also sub-
The most common normative motivation was related to the environment, similarly to the previous cases: “I was very positive about it, because I wanted to do something for the environment.” (Interviewee 1.3, female, average member), or doing something good for the next generations: “And it is also good to have some energy left for the next generation.” (Interviewee 2.3, male, average member). “People have strong principals and worldviews and they are a bit more pro-environmentalist than the average.” (Interviewee 1.3, female, average member) In addition, the complexity of the project was also much lower than in the previous cases, which meant less cooperation and joint action for the common goal. Nevertheless, also in this neighborhood the main hedonic motivation was the collaboration: “It was also fun to do it together and help each other.” (Interviewee 4.3, male, average member).

2.4.4 Eva-Lanxmeer

Thermo Bello is a district heating company owned by residents in the district EVA Lanxmeer. Eight hundred people (300 households) live in the neighborhood, which is located in Culemborg, a small town near Utrecht, the Netherlands. This district is different from the other parts of the town, and it also has a different history, since it was a planned ecological project of the local municipality. The eco-houses are built around common gardens, which people can cultivate together, producing seasonal fruits and vegetables; no cars are allowed. Besides that, EVA Lanxmeer can boast a very strong community with an intensive social life. People know each other and every hof (courtyard) has its own projects and parties that the residents organize.

The story of Thermo Bello started in 2006, when Vitens, a public water company wanted to sell its subsidiary, a local heating system. The company distributed heat emitted in the process of cooling down drinking water. Since there was no big company interested in this system at that time, even though Vitens offered it much under market price, the company also
asked the local municipality and the association of house owners whether they wanted to buy it. Although the municipality didn't show any interest, there were four residents who saw the potential in it and decided to investigate the option of setting up a local company and taking over the heating system.

At the beginning of the following year a business development association was set up (Vereninging Ontwikkeling Expertatie Warmtenet – VOEW) and the local inhabitants could become members of this association. In the end, 68 people joined the association. They set up 4 working groups (financial, organizational, communication and technology) with 5-6 people in each group led by the board members of the association. Everybody worked voluntarily. They put together all the information in a feasibility study and wrote a business plan.

In 2008 they presented it in the next assembly of the Bell (local association - vereniging van eigenaren), which would decide whether to realize this project. The large majority of the people was positive. So they could establish a limited liability company with shares. Finally the company started its operation in 2009 and took over the heating system from Vitens.

Motivations

In contrast to the previous cases, motivations belonging to all three goal-frames were equally present in the decision on participating in the takeover of Thermo Bello. Such as in Jühnede, the fear of increasing oil prices and the wish for independence were the dominant gain motivations. “Costs. There was a fear that the heating prices would go up, so a lot of people wanted to avoid that, so did I.” (Interviewee 6.4, male, frontrunner); “We were afraid if a big company bought the system, then we would lose all the control on it and we wouldn’t have any kind of influence on the tariffs.” (Interviewee 1.4, male, frontrunner). The financial support of the local government was essential also in this case, which reinforced the gain motivations and made it possible to realize the investment. – “We had a very
good relationship with the municipality, because it initiated this district. They gave a financial guarantee to the bank after the loan (70 000€). It meant two percent lower interest rate from the bank. The alderman helped us to lobby at the province level. The Province of Gelderland also gave us 150 000€ for the expansion (since the pipeline didn’t reach all the buildings we had to expand it). Without the guarantee we couldn’t have done this project.” (interviewee 5.4, male, frontrunner)

The wish for independence can be also found among the normative motivations, which was more prominent than environmental considerations. “Let’s do it ourselves. We can do it better on our own.” (Interviewee 6.4, male, frontrunner); “It was ideal for all of us. It was small-scale, people could get involved in it. It is more the feeling, that we do everything ourselves, independently.” (Interviewee 4.4, male, average member). Here again the sense of independence, as in Freiamt and Jühnde, is mentioned.

These considerations were also present among the motivations belonging to the hedonic goal-frame – “It’s fun to take a challenge and being an innovator.” (Interviewee 6.4, male, frontrunner) – while practicing a person’s creativity and work together with others were also important factors according to our interviewees – “I am interested in sustainability and technology. I like to create something together with others.” (Interviewee 1.4, male, frontrunner); “I am also a social type and like to work together with others which I had a chance for here.” (Interviewee 3.4, male, average member)

In Figure 1 we summarize the types of motivations identified per case. We show how many times gain, normative and hedonic motivations were mentioned per case. A word of caution here: since the research is based on qualitative analysis of non-representative interviews per case, the percentages should not be interpreted as generalisable results, but rather as indications of which were the more and less prominent motivations per case. In addition, the figure also indicates motivations which transgressed the framework we used, and can be understood in terms of multiple goal-frames. This is further discussed in the last section.
In Table 3, below we also show the distribution of dominant and background goal-frames with respect to the type of participant: frontrunner or average member. We also discuss this table in the next section.

**Figure 1.** Distribution of the pure and mixed categories of goal-frames in the cases
<table>
<thead>
<tr>
<th>Case</th>
<th>Dominant goal-frame</th>
<th>Background goal-frames</th>
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<tbody>
<tr>
<td>Juhnde</td>
<td><em>Frontrunner</em></td>
<td>Gain</td>
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<td>Freiamt</td>
<td><em>Frontrunner</em></td>
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<td><em>Average member</em></td>
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<tr>
<td>Amsterdam-Zuid</td>
<td><em>Frontrunner</em></td>
<td>Gain</td>
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<td><em>Average member</em></td>
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<tr>
<td>Eva-Lanxmeer</td>
<td><em>Frontrunner</em></td>
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*Table 3.* Distribution of dominant and background goal-frames in respect to the role of the respondents
2.5 Discussion and conclusions

Based on our empirical data gained in all four cases, we can conclude that mostly gain, but also normative motivations were the key drivers for joint energy production, and hedonic considerations were less important. However, while in the case of Jühnde and Amsterdam Zuid there is a clear dominance of gain motivations, followed by normative ones, in the case of Freiamt and Eva-Lanxmeer gain and normative motivations were equally present (Figure 1). Hedonic motivations were evident in Juhnde, Amsterdam Zuid, and Eva-Lanxmeer, but somewhat absent in Freiamt.

The most frequent gain motivation in all cases was cutting energy costs. Specifically, the respondents expected lower energy prices after the projects and thereby saving some money in the long run. It was in several cases related to the independence from big energy companies and from increasing fossil prices. Besides the cost reduction, in Jühnde and Freiamt people also hoped for some profit from the investment, which is indeed more probable in Germany than in the Netherlands due to the German feed-in tariff (EEG), the most established feed-in policies worldwide that guarantees a fixed price for the sold renewable energy, above the market price (Mosher and Corscadden, 2012). The Dutch feed-in system is less favorable in this sense (Doci et al., n.d.). Therefore, it is not surprising that the influence of this policy on the motivations was visible, although it rather reinforced the already existing gain motivations. We also found an influential regulation in the Netherlands, namely the saldering law that also strengthened gain motivations in the Amsterdam Zuid case. Finally, reducing transaction costs and risks was also an important factor in the decision making, which also belongs to the gain goal-frame.

Regarding the normative goal-frame, the protection of the environment was the most dominant motivation. Supporting the development of renewable energy technologies can be also linked to this motivation. In addition, protecting the rights of next generation was also often mentioned. Local patriotic considerations such as strengthening the community or the local economy were only present in the German cases. It is important to mention here that these latter motivations are specifically group motivations or, how Lindenberg and Foss (Lindenberg and Foss, 2011) call them,
joint production motivations, since within the normative goal-frame they tend towards a common interest, while all the other considerations are important only from the individual’s point of view.

Motivations belonging to the hedonic goal-frame were mainly focusing on the opportunity to get to know each other and to gain new friendships. However, the options of having fun and being creative were also attractive for many people. In the case of Jühnde the project provided also a good chance for the newcomers to get accepted by the community, which they had difficulties with before. Even though the goal-frame framework proved to be very useful for this analysis, the clear categorization of all motivations as well as the identification of the dominance of a certain goal-frame in each case was not always clear-cut. Firstly, we had difficulties to fit some of the answers in only one of the categories; becoming independent from big oil companies, could be gain (gaining back the control on prices) or normative (preferring local production over mass production) motivation. In such cases we either used the context of the transcript to assign the explanation to a goal-frame, or used a mixed category (see Figure 1). This suggests that the goal-frames have to be applied with a certain degree of flexibility. Especially with respect to the motivation for independence, it has to be noted that it was mentioned by participants in all three rural cases, and missing in the urban case (Amsterdam Zuid). In rural environments self-reliance is very important, whereas in urban environments interdependence and not self-reliance are the norm.

Secondly, we could also observe the interplay between the dominant and the background goal-frames and other factors that also influenced the motivations, thereby changing the possibilities and the motivations at the same time. On the one hand, we cannot neglect the importance of contingency in all of the cases. Without the initiative of the university in Jühnde the project may never have been realized. In Frieamt, the investors that wanted to buy the lands turned the villagers’ attention to the possibility of wind power. In Amsterdam Zuid, the supplier offered a reduced price for joint procurement, which triggered the collective action. In the case of Eva-Lanxmeer, the project started because of the plans of the water company.
On the other hand, the support of the local governments and national policy instruments (subsidies, feed-in tariffs) or the initiative and help of the university in Jühnde strengthened the gain motivations. In this respect, our cases provide some evidence for the role of the local (and national) authorities in motivating the participants, in contrast to previous cases (Boon and Dieperink, 2014). Further ethnographic research in such projects needs to clarify how the interplay of the goal-frames develops over time, and which factors trigger change in the dominant goal-frames.

With respect to the difference between frontrunners and average members of these communities, we observed no remarkable differences in any of the cases (see Table 2 previous section). This is quite intriguing: our data do not support a differentiation between frontrunners and average members on the basis of motivations. In other words, frontrunners do not necessarily become frontrunners because they have different types of motivations than average members (see Table 1.). Personal characteristics, such as style of leadership, or even contingent factors, such as free time available, may play a big role here. Further research is needed to clarify what makes a community member a frontrunner, since a lot of schemes, such as transition management or strategic niche management are relying on attracting and engaging these frontrunners (LOORBACH, 2010; R Raven, 2012).

It is important to note here that more than 90% of our interviewees (except in Amsterdam Zuid, where it was more balanced) were male, mirroring the male predominance of the participants in these projects. As one of our interviewees in Freiamt said: “...and mainly men conducted the project. At the shareholder meetings there were 90% men.” (interviewee 2.2, male, average member). This is the first time, to our knowledge, that gender inequality in such projects comes to the fore. Further research can illuminate whether this is related to gender inequalities in energy project.

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19 The only small exception was in the case of Amsterdam Zuid, where average members had only normative motivations in the dominant goal-frame in contrast to the frontrunners that were equally led by normative and gain motivations, and hedonic motivations remain in the background.
planning (Skutsch, 1998), or to more general unequal gender distribution of technology use (Grint and Gill, 1995).

In relation to the previous studies on motivations for micro-generation, and renewable investments, our results are somewhat different. There are a number of motivations identified in previous cases but not in own results, which can indicate that they relate more to individual investment. Examples of such individual-investment motivations are: increase of value of the house, protection from power cuts, show environmental commitment to others (Balcombe et al., 2013). Other motivations were similar to the ones identified before in the literature, such as improving local conditions and strengthening community (Rogers et al., 2008; Walker and Cass, 2007), and participating in an exciting project, contributing to self-esteem (Rogers et al., 2008). Other motivations we identified were new, like educating and helping the next generation, being independent from big companies, being accepted by the community, using unused resources.

All in all, our results suggest that incentives addressing mainly the gain and normative motivations could be the most effective triggers, if we want to support the spread of renewable energy communities. Governmental policies could provide long term and calculable financial incentives, such as the German feed-in tariff (EEG) or local subsidies addressing joint investments, which seem to be very important factors in terms of gain motivations. At the same time, the support of non-governmental organizations for populating the idea of community based clean energy production could provide normative triggers. Hedonic motivations can be emphasized by local organizations and connecting networks.

It is also important to recognize that all the four investment groups were formed in already existing and strong communities, where people knew each other and had some experience on collective work before. We hypothesize that in absence of supportive regulatory framework, which can guarantee financial gains, such projects would tend to emerge in rather closely-knit communities, where trust is relatively high. Hence, only the introduction of incentives addressing gain and normative motivations is probably not sufficient for accelerating local energy production, but they have to be tailor-made to the already existing strong communities, since
they have most likely the potential to become renewable energy communities in the near future. It could be the case that in communities that are not so closely-knit, other types of motivations play a role, which necessitate different incentives, probably to realize low complexity projects, such as solar panel installation. Further research is necessary to establish whether RECs can be established in such communities, for instance in urban areas.

Chapter 3 – Joint procurement: How does collective action work for investing in renewable energy at community level?

Gabriella Dóci

Abstract:

Background

Transition to a sustainable future requires not only technical, but also societal changes, including changes in behavioral patterns and consumer roles. Renewable energy communities embody such changes: they are residential communities that produce the energy they need from renewable energy resources, thereby changing their passive consumer role and becoming active ‘prosumers’. Although the number of these communities has increased remarkably in the last decade in many Western countries, as has the academic attention paid to them, we still know little about their formation and operation. It is unclear how they get their members to work collectively on a voluntary basis for a common goal, that is, energy production at the local level. This article seeks to contribute to a better understanding of the institutional and social context in which these communities operate, and of the way they are created and function. Therefore, the research question addressed is: What factors influence the formation
and organization of renewable energy communities? In particular, the interest is in strategies for group formation, task distribution, collective action, communication, decision making and problem solving.

**Method.**

To answer the research question, a comparative case study analysis is provided for Germany and the Netherlands, where communities were studied that were different in their location, size and the technology they use. The commonalities between these communities and their general practices that led to the successful implementation of their projects are analyzed.

**Results**

Contrary to Olson’s expectation about voluntary collective action, renewable energy communities can realize a project based on the work of only a few volunteers who develop the project without receiving any additional reward and who also accept free-riding. However, the larger the size of the community and the complexity of the project the more likely it is that they need to formally organize the procedure or count on external help.

**Conclusions**

Familiarity with the formation and operation of renewable energy communities can help both market actors and policy makers to provide tailor made support to this emerging and important sector from the sustainability transition’s point of view.

**Keywords:** renewable energy communities, group formation, collective action, grassroots, teamwork, social innovation

**3.1 Introduction**

The number of local energy initiatives has increased remarkably in the last decade in many Western countries (Hoppe et al., 2015), such as the Netherlands (Schwencke, 2012) and Germany (DGRV, 2014). According to Seyfang and Smith (2007), these grassroots innovations not only provide local
solutions to the needs and interest of the communities involved, but they are the seabed of social innovations, the development of new practices, patterns and social actor networks that also spur the upscaling of technological innovations and thereby contribute to the energy transition. In addition, local energy initiatives also play an important role in changing consumer behaviors and they empower citizens to replace existing social structures and thereby dissolve carbon lock-in (Arentsen and Bellekom, 2014; Hielscher et al., 2011; Hoppe et al., 2015). Although the importance of local energy initiatives in the sustainability transition is increasingly acknowledged, we still know relatively little about their formation and operation. In particular, it is unclear how they get their members to work collectively on a voluntary basis towards a common goal.

The literature uses several terms and definitions for capturing the phenomenon of local energy initiatives, from which I chose the term “renewable energy communities” (RECs), my understanding of which is the following: communities\(^\text{20}\) that invest in renewable energy technologies and generate electricity or heating in order to cover their energy needs\(^\text{21}\). Consequently the research question in this study is: What factors influence the formation and organization of renewable energy communities? To answer

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\(^{20}\) According to the sociological definition of a community (Fulcher and Scott, 1999), the group has to have the following characteristics: 1) Common situation: those who live in a community share common features which connect them. We can distinguish residential and non-residential communities. 2) Common activity: the members of a community are connected through various relationships, which are not confined only to work, hobby, sport etc. but cover the most areas of life. 3) Collective action: the members of the community do collective action in order to realize their common interest. 4) Common identity: group members have a common identity and it makes them feel good that they belong to a greater unit. Certainly, there are groups which do not have all the characteristics, but only two or three of them, but still are seen as a community. In this article I focus on those renewable energy communities that feature collective action (or at least the intention for it) in a residential community, with a common identity to the extent that the people involved have at least partially normative motivations for participating in an environment friendly activity (Dóci and Vasileiadou, 2015). Other studies (e.g. Heiskanen et al. 2010) have explored for instance other ‘low-carbon communities’ than geographical communities, such as sector-based, interest-based and sector mob communities.

\(^{21}\) More specifically I study residential communities that started and have been managing energy projects; they thus initiated the project, made the investment and have been operating the technology/ies. This does not exclude other partners neither from the investment nor from the project development, but the main initiator has to be the community. These scope conditions are discussed in more detail in the methodology section.
this question, firstly, I formulate sub-questions on the basis of a discussion of relevant theories offered by the literature on collective action, teamwork and grassroots initiatives. Secondly, I provide a comparative case study analysis, where I studied different communities regarding their location, institutional background (two communities in Germany and two communities in the Netherlands), size and the technology they use, in order to identify the commonalities between these communities and the general practices they applied that led to the successful implementation of their projects.

The article is organized as follows: In the second section I discuss the theoretical background from which research sub-questions are elaborated on research gaps that the current paper aims to investigate. The third section introduces the four cases that I investigated and the methods that I used for the analyses. This is followed by the analytical section that concentrates on the specific aspects of community creation and organization identified in the theoretical section; this section includes a discussion of the results. The conclusions that can be drawn from this study are discussed in the last section. In particular, I show that and how, contrary to Olson’s expectation about voluntary collective action, renewable energy communities can realize a project based on the work of only a few volunteers who develop the project without receiving any additional reward and who also accept free-riding.

3.2 Theoretical background

Grassroots initiatives are such value driven, bottom-up, community based, small-sized projects that position themselves against mainstream society and create their own solutions for local problems or for meeting social needs (Seyfang and Smith, 2006). Due to their local knowledge and social capital they are able to bring about behavioral change and, in the context of the sustainability transition, deliver energy savings or develop niche projects that regime actors cannot. Additionally, they experiment with innovative technologies and new consumption and production practices that challenge main-stream growth-based conceptions (Hielscher et al., 2011; Seyfang and Smith, 2007). However, despite their strength of using
the local and alternative conditions to their advantage, grassroots initiatives face several challenges, such as having to rely on volunteers, lacking professional workers and institutional support or long-term funding (Hoppe et al., 2015; van der Schoor and Scholtens, 2015).

Renewable energy communities constitute grassroots initiatives that are led by gain and normative motivations: to make some profit / avoid increasing energy prices and to protect the environment. RECs are usually formed in already existing strong residential communities (Dóci and Vasileiadou, 2015) and their main purpose is to generate energy at the local level, primarily to meet local needs. Even though there are several articles that studied this type of grassroots communities, either positioning them within the transition literature (Seyfang and Haxeltine, 2012), assessing the communities’ potential as a social niche to scale up (Dóci et al., 2015), studying the motivations behind such activities (Marques et al., 2010), or addressing the political context that affects them (Oteman et al., 2014), according to our knowledge no research has been done on the collective action that these communities realize. Although there are some observations that one can find in the literature on the way how people cooperate and work together in order to create a collective good – which is in this case renewable energy that benefits all the members of the community – an elaborated study on the formation and operation of renewable energy communities is still lacking.

The same conclusion is arrived at if we survey the broad literature on teamwork (Cohen and Levesque, 1991; Hoegl and Gemuenden, 2001; Jones and George, 1998), which primarily deals with the formation, the dynamics and the effectiveness of work teams. This literature can give insights into teams that work on a collective good either in an organization or in newly formed voluntary groups. While in the latter case it is assumed that the formation of a brand new team is mainly a struggle to create a structure that sets its goal, distributes the tasks and regulates the inter-

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22 A distinction has to be made between the residential community that includes all the people living in the same neighborhood and the renewable energy community, which is an investment community formed by (some, but not necessarily all of the) members of the residential community.
personal interactions (Tuckman, 1965), the studies of work teams within an organization (Kozolowski and Bell, 2013) already assume some kind of history of structures and interpersonal relationships, which the members take into the new situation and which strongly affects the classic model of group development (forming, storming, norming and performing) described by Tuckman (1965). These studies, again, are important to better understand the formation and dynamics of team work, but they still do not provide enough insight in the way how grassroots communities work that are formed on a voluntary basis, but in already existing strong communities, where people know each other, the level of trust is high and normative rules exist that regulate interpersonal relationships.

The third theory that could help us to gain more insight in the formation and project realization of energy initiatives is collective action theory (Olson, 1965). Olson (1965) assumes that in case a community creates a collective good that benefits all the members of the community, people who are rational actors will not participate in the collective action unless everybody participates equally. In other words, in case all community members benefit from the collective good regardless of whether they contributed to its production or not, make people free-ride. However, this way of thinking also prevents the others from participating and the collective action does not take place. Consequently, if the members of a large group – acting rationally – strive to maximize their personal interests, they will not try to realize their common goal. More precisely, they will attempt to do that only if they are forced to do so or selective incentives are envisaged for them, which are not identical with the group’s interest or the collective good (in this case the selective incentives cannot be identical with the share in energy, which is the collective good, but they should be different inducements) – on condition that they are contributing to the costs and to the collective action.

These findings on collective action are held to be valid for small groups (formed by a few people knowing each other) as well. In that case negative incentives such as social pressure and the exclusion of free-riders motivate people to participate in the collective action. There are certain small groups, however, that realize collective action even without resorting to selective incentives. These small groups are usually characterized by mas-
sive inequality, since there must be group members for whom it is worth-while to produce the collective good, even if they are doing it alone and paying all costs. For these people the benefits of the collective good are still higher than the losses resulting from the production. Usually, these small groups are able to stock up on the optimal amount of collective good.

Although collective action theory was criticized by several scholars for, among other things, not taking altruism into account (Isaac et al., 1994; Ostrom, 2014; Udehn, 1993), it has not yet been studied how collective action is realized if there is a small group of altruists that are willing to produce the collective good for everybody even without extra benefit or reward. In this case, sanctioning the free-riders is not even necessary, which leads to a different dynamic of group formation and operation than what we find in the theory.

The aim of this paper is to investigate this special type of grassroots communities that 1) are organized around a rather gain-oriented goal, but led also by normative motives (Dóci and Vasileiadou, 2015); 2) are formed in already existing strong communities, for which reason the level of trust between the members is high and the relationships are based on already existing normative rules; and 3) have some of their members willing to produce the collective good even without the participation of all members, and without the possibility of sanctioning at all if they quit or their contribution is not sufficient. However, I have to note here that in the renewable energy communities studied here all the members of the community funded the investment, but not all of them participated in its realization.

On the basis of outstanding questions pertaining to the three bodies of literature outlined here, I here identify five sub-questions that guide the analysis of the results:

1. **Group formation** – According to Hoffman & High-Pippert (Hoffman & High-Pippert, 2010) the successful involvement of community members into local energy projects massively depends on the social network of the initiators and on their
personal relationships with fellow citizens. In most of the cases the initiators of the renewable project are well-known and respected members of the community (Wüste and Schmuck, 2012). However, there is much less information on how they involve other members into the project development or how they get the permission from all the members for the investment?

2. *Project development and collective action* – The usual form of cooperation is the setup of voluntary working groups that are responsible for writing different parts of the business plan, the most crucial part of a renewable energy project development (Wüste and Schmuck, 2012). However, it is still not clear how the members distribute the tasks between each other and what are the phases of the project development.

3. *Decision making* – Participation in voluntary grassroots projects does not necessarily involve participatory decision making in all instances. Initiators who actively participate in the project development might have stronger willingness for an intense engagement in the decision making than average members who wish for only limited personal involvement (Hoffman & High-Pippert, 2005). Thus I investigate the following aspects: *Who makes the decisions and how? Do they use participatory or non-participatory decision making strategies?*

4. *Communication* – According to Walker et al. (2010) transparency in the communication is the basis of trust, which is eligible for the successful realization of a community renewable project. In case it is further enhanced by the possibility to provide feedback on the generated energy it further improves the local acceptance and support (Boon and Dieperink, 2014). Based on these key notions of successful communication I will study the following aspects: *How do the members of the project group communicate between each other, with other members of the community and with external bodies?*
5. **Problem solving** – Local energy initiatives can face several challenges, such as finding sufficient funding for the project, being able to recruit enough members, problems with the organization and leadership of the project, receiving sufficient governmental support and getting permits (van der Schoor and Scholtens, 2015). In addition they have to cope with local opposition or internal conflicts arising from uncertainty, irrational thoughts or interpersonal problems (Boon & Dieperink, 2014; Toke et al., 2008; Wüste & Schmuck, 2012; Wüstehagen & Menichetti, 2012). Thus the question here is: *How do the project members deal with problems within the project groups and within the community?*

### 3.3 Methodology

To gain a better understanding on the factors that influence the formation and organization of renewable energy communities I studied four communities. Since my main goal was to find the commonalities between the communities concerning the practices they use for developing renewable energy projects, I decided to do a comparative case study analysis by choosing cases with different institutional backgrounds from two countries (two communities in the Netherlands and two communities in Germany), with different technologies (solar PVs, water pumps, wind mills, biomass power plant) and in different sizes (ranging from small communities with a few members to large communities of thousands of members). These projects also encompass different organizational forms, such as wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy not only for their members, but also deliver it to other customers.

The scope conditions for my research population were: 1) communities in the Netherlands or Germany that invested in renewable energy; 2) the investment is a citizen initiative; 3) the members of the initial investment community (people who bought the technology) live in the same location/region; and 4) all of the members of the investment community are shareholders in all or at least one of the technologies. I used a diverse case
method in my case selection, since diverse cases taken from the population of cases are more likely to be representative for the full variety of cases (Seawright and Gerring, 2008).²³

I conducted 41 semi-structured interviews with community members by following an interview guide that consisted of questions about the group formation, the project development, the task distribution, the decision making, the communication and the problem/conflict solving methods. In addition to the community members, I also interviewed companies, municipalities and researchers (in one of the German cases) that helped the communities. In each case I had a contact person, who helped me to get in touch with other community members, so I could do face-to-face interviews, usually by visiting people at their home. All the interviews were recorded and transcribed; the interviewees are anonymized for the purpose of this study.

The communities that I studied are the following:

*Jühnde (Germany)*

Jühnde is an agricultural village in Lower-Saxony, Germany, with a population of 780 residents. They produce both heat and electricity for 100% from renewable energy resources and cover all the energy needs of the investment community. The core of the energy production comes from a combined biogas power plant that uses methane, which is complemented in winter by wooden chips. The heat is distributed via a local grid to the households. The residents form a very strong and closed community, which makes it difficult for new comers to get accepted. High percentage of the volunteers participated in the project development were residents who were not born there, but moved to the village later. Helping in the project provided them the opportunity to get accepted by the villagers.

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²³ The advantage of this method is that a full range of variation increases the representativeness of the results that the researcher finds based on the analysis of the selected cases. Its disadvantage is that in case the distribution of different cases is not equal within the population, but the researcher selects cases from every type of cases equally, it can distort the results. Still, the diverse case method is regarded the most representative method from all small-N sample methods (Seawright and Gerring, 2008).
(Dóci and Vasileiadou, 2015, p. 44-45). (for the story of the project development see Appendix 2)

**Freiamt (Germany)**

Freiamt has 4,300 residents and is located in the south-west of Germany, near Freiburg. Since 2007 the village produces 14 million kWh of electricity from renewable energy sources annually, exceeding the village’s electricity demand by 2 million kWh. The electricity is produced from multiple renewable energy sources: five windmills, 240 roof-mounted PV panels on private houses, two small hydro power plants and two biogas plants constructed in 2002 and 2007. In addition, 150 private houses have installed solar thermal collectors for water heating. All the generated electricity is fed into the national grid. The villagers deem their community a strong and independent one, which can develop projects on its own. Voluntary work and local projects had already a history in Freiamt that provided a good basis for the new challenge. (Dóci and Vasileiadou, 2015, p. 46) . (for the story of the project development see Appendix 2)

**Amsterdam Zuid (Netherlands)**

The community is located in the south of Amsterdam: a houseboat area that includes 80 boats. The residents regard it as a village in a city, because the people know each other very well and they form a strong community. The renewable project was developed in three sequential years when people collectively purchased solar PVs that could cover some part of their electricity need, depending on the household. However, the PVs were set up and operated individually. (Dóci and Vasileiadou, 2015, p. 47). (for the story of the project development see Appendix 2)

**Eva-Lanxmeer (Netherlands)**

Thermo Bello is a local heating company owned by residents in the district EVA Lanxmeer. 800 people live in the neighborhood, which is located in Culemborg, a small town near Utrecht, the Netherlands. This district is different from the other parts of the town, and it also has a different history, since it was a planned ecological project of the local municipality. The eco-
houses are built around common gardens, which people can cultivate together, producing seasonal fruits and vegetables; no cars are allowed. Besides that, Eva-Lanxmeer can boast a very strong community with an intensive social life. People know each other and every hof (courtyard) has its own projects and parties that the residents organize. In this case the residents of the district took over the heating system from a drinking water company that generates heat by cooling down drinking water; thereby they could cover not only all the heating needs of the residents but they also deliver heating to other neighborhoods (Dóci and Vasileiadou, 2015, p. 47-48). (for the story of the project development see Appendix 2)

3.4 Results and discussion

I conducted a qualitative analysis on the interview transcripts by following the sub-questions listed in section 2. For each sub-question I compared the answers for the different communities in order to see whether I can outline a general practice that communities usually apply.

3.4.1 Group formation

In all four cases the projects were realized in already existing strong communities that had a history of cooperative work and voluntary projects. However, while the Dutch communities consisted of rather environmentally concerned members with high social awareness, the citizens of the German villages were not particularly special in this sense. The commonality in all cases was the strong social network that bound the people and initiators who were respected and popular members of the community.

Nevertheless, in all four cases the occurrence of an external event created a window of opportunity to start a renewable energy project. In Freiamt some investors approached the village and brought the option of windmills into the residents’ attention, in Jühnde the University of Göttingen announced the competition to become the first bio-energy village of Germany, in Eva-Lanxmeer without the intent of the drinking water company to sell the heating grid the project would not have even started and finally
in Amsterdam Zuid the offer of a PV supplier gave the first boost to start a collective procurement.

However, the possibility to start a renewable energy project is not enough: there must be also some enthusiastic people who see the potential in it and initiate the project. The second step is convincing and involving fellow citizens into the project, for which the communities applied different strategies. “We wrote an email to the people and we also wrote about it in the local newspaper. We also have every year a general assembly, where we talked about the project, but it was still not enough. So some people went to each boat personally and asked the residents whether they wanted to participate in the solar project. This was the most effective way of involving people into the project.” – as interviewee 4.1 explained it to me in Amsterdam Zuid.

In Jühnde the University of Göttingen approached the mayor to involve them into the project. The mayor saw the potential in it and initiated the project. “The University came up with this idea. They contacted me and I liked what they told me. So I started to work on this topic and organized some trips to existing bio-energy plants. I chartered a bus and took some people with me. When we arrived back the people did not go home but they went together to the local pub to discuss the issue. … at a certain point I asked everyone present if we want to know more about this project.” – explained the mayor (interviewee 2.1) how the renewable project started.

In the case of Eva-Lanxmeer the initiators had to face some difficulties already at the beginning. When the drinking water company approached the local association with its offer about purchasing of the heating system the members of the Energy and Installations working group found it an interesting opportunity, so they decided to investigate this option a bit better. When they finally presented their findings to the community, it divided the people, only half of the citizens found it interesting while the other half was rather scared and negative about it. However, the time pressure was growing to make the decision, thus this leading group repeated the meeting in every four weeks until they could receive sufficient support for the purchase of the heating company. According to one of the initiators
the key to success was the enthusiasm of the leading group, which was convincing and that they were very transparent even about the probable difficulties.

The initiators in Freiamt also applied all the strategies that we saw in the first three cases. They started the public relations work before the construction of the measurement mast and continued it during the whole process. While they were doing wind measurements they already sent around an invitation to all villagers through the local municipality newsletter to come and visit them up on the hill and get the newest information on wind power. A lot of people came to see what was going on. So they handed out lists where all people who were interested could sign up. Some people also called them and asked if they could participate. This is how more and more people joined the project. Besides that they published little articles in the weekly municipality newsletter and they also made a brochure, in which they portrayed the chances and risks of the investment. But mainly they had a lot of conversations with the people, a lot of informal talks on different occasions, where the project was discussed.

3.4.2 Stages of project development and collective action

The project development of all cases followed very similar phases (see Appendix 2). After the occurrence of an investment opportunity a small group of initiators decided to investigate the option of a renewable project. The second phase was the informing and involvement of the other residents and thereby the formation of the investment community. In three cases (Freiamt, Jühnde, Eva-Lanxmeer), after receiving positive results in the investigation phase, the core group of initiators organized general assemblies for all residents of the wide community to get their approval for the project and create the investment community with the residents who wanted to join. Only in Amsterdam Zuid there was no need for general assemblies and the approval of the community to start the project. The residents could only decide to join or not join the collective procurement.
In the third phase the communities either hired a professional manager who could organize the project instead of them, or they organized working groups with some local voluntaries and developed the business plan together. The former solution was chosen in Freiamt, where all the necessary transactions were delegated to a manager who knew which turbines are the best and how much they cost, and had the contacts with the suppliers. He took care of the project management; but he did everything in close agreement with the citizens of Freiamt.

In Jühnde working groups were established already at the initial investigation phase. The core group of initiators took the lead, they helped when the work got stuck and kept the project running. There were 7-9 working groups (electricity, agriculture, field of the later power plant, district-heating grid, PR, etc.), in which members worked on a voluntary basis. Some people worked in more working groups at the same time and there was a coordinator (usually one of the researchers) in every group who coordinated the group’s work. Every Wednesday all the groups met and reported how far they had proceeded with their work.

Like in Jühnde, working groups were established for the development of the business plan in Eva-Lanxmeer too. First, the four initiators did an investigation and then they involved the community. They set up four working groups (financing, organization, communication, technology) for developing the business plan. There were 4-5 people in each working group and all of them had its own leader; however, only the main leader received some salary for his job from the drinking water company, which was so eager to sell the heating system that they even paid him to accelerate the process. The other members of the working groups worked on a voluntary basis.

In Amsterdam Zuid the complexity of the project did not require the setting up of working groups. The core group of initiators organized everything and distributed the tasks among each other. Similarly to the other cases they worked on a voluntary basis.

After or in some cases even during the business plan development the communities had to set up some kind of legal entity that represented the
project towards external institutions to receive funds and permits. At the same time, indirectly it also helped in the formalization of the investment community and the working groups (who are the members, who is responsible for which tasks, code of conduct)

The only exception was again Amsterdam Zuid where was no formal agreement on who was responsible for which tasks within the core group of initiators. This situation led to some conflicts. Sometimes it happened that the people did the same task without informing each other, or started to negotiate with suppliers without the permission of the other members and thereby losing some other even better offers. These conflicts later made some people to decide to not participate in the organization of the PV procurement in the following years.

Also within this phase the cooperation with local authorities was proven to be essential for the successful development of the projects. “Like I told you before we had personal meetings with politicians and decision makers from the authorities and during those meetings the former mayor and the municipality council members were present too and always supported us.” – interviewee 1.3 told me in Freiamt.

In Jühnde the mayor had contacts to the local government in Dransfeld, to the regional government in Göttingen and through deputies in the state he had contacts to the government of Lower-Saxony and finally also to the national government. They also went to Hanover, to the seat of the state’s government, and also to the national government. The cooperation with the local authorities and government was simpler in Eva-Lanxmeer. They received mainly financial support from the local municipality and they also got a guarantee for 150,000€ for the bank loan. There was also a legal adviser who helped them during the process. In Amsterdam Zuid the community did not cooperate with the municipality, because they were afraid of losing their independence in the project development. However, one of the core group members worked at the local government and had some insider information on what are the available subsidies and how to apply for them.
The last two phases of the projects are the construction of the technologies and their operation afterwards. For the more complex projects it was necessary in all cases to hire somebody who could coordinate the works. Even though the community in Jühnde did not hire a manager who could organize the project development they still cooperated with experts. The researchers at the university helped them to calculate how much heating the village would need and which power plant type and size would meet this need the best. They also hired a district-heating expert. In Freiamt the manager was responsible for the constructions. The case of Eva-Lanxmeer was special in this sense, since they took over an already existing technology, however, the administration of the heating company was very chaotic: it was not clear who were the customers exactly and how the tariffs were calculated. The working groups tried to make some kind of order in it, but they also received professional help from the drinking water company. In all three cases the operating companies (either association or cooperation) took over the maintenance of the technologies, work for which employees are paid now. Only in Amsterdam Zuid there was no need for professional help for the construction and neither for the operation of the technologies. As soon as the PVs arrived the residents helped each other to install the solar panels, which became the personal responsibility of each owner afterwards.

3.4.3 Decision making

I have already discussed that the active involvement of the residents into all phases of the project development is essential for the acceptance and the success of the project. The same principle is valid for the decision making too. What I saw in my cases is that communities used both participatory and non-participatory decision making strategies depending on the issue that emerged during the procurement and the implementation of the technologies. On the one hand, all the big decisions that had to be made on the finances or on the final versions of the business plans were made by the whole community, including all the members equally. On the other hand, for a practical and faster project development, small questions were usually decided by the voluntary working teams or the leading group
without discussing them with the wide public. Certainly, there were minor variations between the cases.

In Freiamt the founding members were always involved in the core decision making, which consisted 5-7 people. In most of the cases they just simply informed the other members about the process through information events. However, every time before the core group had to take important steps, they involved all the members in the decision making. After starting the cooperation with the professional management team most decisions were delegated to them, but still with the active involvement of the founding members. In order to keep control over the process and be able to participate in the decision making an advisory board was set up that included members of the initiators. Later, when the operating company started to function the structure of decision making changed as well. The managing director/ CEO is responsible for the current business of the company. The advisory board members can communicate important things to the shareholders, but most importantly they get involved if there are any problems. Then they can discuss the problem with the management and propose a solution.

The decision making process was similar in Jühnde too. First the mayor invited all the resident for a public meeting to decide on the participation in the competition organized by the university. “During this meeting we presented the project again and gave time and space for questions, remarks and so on. In the end I asked the people who were in favor of the project to raise their hands. There was not a single person of all the 120 present who voted with “no”. There is no way to make it more democratic.” – he remembers (interviewee 2.1). The decision making was very organized and democratic also within the working groups: each of them had a speaker, who represented the will of the certain group. These people met once a month to discuss the developments that they were working on that far and they were also allowed to make decisions in the name of the whole investment community. But also in this case the core group of initiators and especially the mayor himself made the less important decisions alone and the people were rather involved only when big decisions had to be made. After the setup of the operating company, its supervisory board is in charge of the decision making, but all the important questions are still dis-
cussed with the general assembly including all the members of the community.

The initiators in Eva-Lanxmeer followed also a similar procedure during the planning and development phases of the project. The citizens were asked after the investigation phase whether the project team should go further and develop a business plan. During the business plan development the decisions made by the working groups were more like advises and the project team (the four initiators) had the final word on all the steps that had to be taken. The internal decision making within the project team and the working groups was also regulated. In the project team everybody had to agree with all the decisions. While in the working groups and also in the board of the working groups the majority of the votes decided. After the establishment of the operating company, the board of the three directors got in charge of the decisions.

The only exception of the shared participatory and non-participatory decision making processes was Amsterdam Zuid, where, because of the simplicity of the project, neither the initial acceptance of the project or writing a business plan were necessary. In this case the two main initiators made all the decisions on the technology, the finances, etc. Moreover, they bought all the solar PVs in advance and took the risk if anybody, who has promised to participate, quit without paying for the panels. However, this was the only way to do the transaction, since the purchase of the solar PVs did not require the set-up of a company and the PVs had to be bought at once to receive the price reduction. Fortunately, at the end nobody stepped back.

3.4.4 Communication

All the four cases were similar in the sense that the group of initiators used different communications strategies at different phases of the projects. We can make a distinction between indirect, rather informative communication strategies and direct communication strategies that provided the possibility of two sided conversations. In the first case the purpose was to inform the residents about the current developments and it
included newsletters, leaflets, email, articles and advertisements in local newspapers. In the second case the main goal was to provide the possibility to the members to give feedback or raise questions. Usually it took the form of information events or face-to-face conversations, which gave also a great opportunity for the initiators to convince skeptics and opponents. What I found that in any case transparency about all the details including the difficulties and weaknesses of the project was perceived to be essential to gain the trust of the residents. It ensured that they felt involved and taken seriously even if they raised critical questions.

In Freiamt the communication of the initiators took different forms depending on the stage of the project and the people they communicated with. The first decisions about measuring the local wind-potential and refusing the offers they got from companies were based on informal communication between a few residents who were also friends at the same time. During this pilot project they already decided to inform the people about the recent developments. In the third phase they continued the active communication with the residents to keep them updated about the recent developments, so they organized village meetings and set up information stands at local cultural events. But mainly there were many conversations with the people and a lot of informal talks on different occasions, where the project was discussed. Besides internal communication the initiators also decided to get some publicity for the project at both regional and national levels and the suddenly gained media attention was not only helpful for lobbying at different governmental levels for some financial help, but it also made people proud of the project and willing to participate in it.

The communication and awareness raising about the energy project in Jühnde was to a large extent influenced by the presentation and moderation of the University of Göttingen at the beginning. Even the way how the interviewees shared their opinion about the project was very much shaped by the professional information they had received. Besides giving the presentation, the researchers also helped in the organization and communication of the working groups. Transparency was a key communication strategy. However, even in this case, except for the professional help, the initiators were responsible for the successful internal and exter-
nal communication, for which they set up a public relations working group. At the beginning, providing sufficient information on everything and having personal conversations proved to be the most effective way to convince people to participate. The initiators in Jühnde also used the media to get more support and attention from the government. After an unfriendly welcome at the national level they decided to call the media and tell their story. “We told the media what we had experienced and it was in the newspapers on the next days. ... After some time we suddenly received the information that they will fund our project with 1.3 Million €.” – interviewee 2.2 told me.

Similarly to Jühnde, there was a PR working group also in Eva-Lanxmeer, which was responsible for both the internal and external communication. At the recruitment phase of the project the organization of meetings, the distribution of leaflets and brochures were the main communication strategies applied. “At the end we published the business plan in the Bell news. We also set up a website, where people could find all the information they needed.” – a member of the communication working group told me (interviewee 3.4). Still many residents were skeptical about the feasibility of the project. In order to convince them the initiators organized small information events in different hofs and visited people in their home. After the most important decision was made, people were informed occasionally about how the project was developing. Transparency and providing space for criticism and skeptical questions were the most important communication policies also in this project.

Even though the scale of the project in Amsterdam Zuid is smaller compared to the previous cases, still both the external and internal communication followed similar strategies that I saw in the other three projects. The initiators approached the people through leaflets, advertisements, articles in the local newspaper, presenting the project at the general assembly of the local association, but the personal communication with each residents led to the real success also in this case. At later phases the active communication about the steps was a very important factor. “I wrote a procedure how to do this project, I planned the communication – keeping the people happy with certain successes in order to keep the enthusiasm go.” – shared the main initiator (interviewee 4.1) his tactic with me. Get-
ting the media attention for the project helped the initiators in the negotiations with the supplier. Finally, they found one who did not even charged them for anything above their purchase price for the PVs in exchange for the media attention.

3.4.5 Problem solving

In most of the cases the initiators had to face both external and internal problems. While the external problems, such as local opposition towards the projects for reasons that they could harm the environment, endanger local tourism etc., were easy to deal with in all the cases by acknowledging that these were irrational fears, the internal conflicts provided some obstacles in the project development. In Freiamt, for example, the fear of failure within the investment community provided the main difficulty for the core organizer group of the project, which is why they tried to create more security by doing wind measurements and collecting data about the wind quality. However, the more progress they made with the project the less skepticism there was. The core members were never really skeptical. Of course there were some doubts, but they always tried to find a solution to that.

In Jühnde, in contrast to Freiamt, the community members did not doubt the capability of the core group to realize the project, but there were several other problems that the initiators had to deal with. First, even in this case there were some opponents within the village who tried to hinder the project by negatively influencing the other residents. To compensate this negative campaign the mayor talked to these people personally. Second, there were some skepticism and impatience also within the investment community. Some people were concerned that it would be too expensive, or the biogas power plant would be noisy or smell bad. In order to convince the hesitant residents they organized a field trip to a similar, but already operating power plant to see its operation in practice. Furthermore they also asked the opinion of an independent consultant to prove the fears were irrational. Third, some people within the working groups had some disagreement regarding the development of the project. To solve the internal conflicts the researchers helped with the work of the
working groups by acting as mediators. “The university structured the meetings, established points that had to be discussed and defined results that had to be reached. If there were no results, we did not continue the discussion for ages, but everyone had to think about the problem again in his working group and we discussed it again when we met the next time. The structured approach was the most important aspect.” – one of the initiators (interviewee 2.3) explained to me. Finally, the core group of initiators also had to deal with the difficulties to receive a construction permit and financial support from the government both regional and national levels, which could be solved by contacting the media, as it was already mentioned in the previous sub-section.

The initiators at Eva-Lanxmeer had to face similar problems. Like in the first two cases they had to deal with the skepticism of the community about the feasibility of the project. Almost half of the members found it unthinkable that a small group of people could take over such a complex system without having the professional knowledge and expertise. Some others said that it would be too expensive and there would be technical problems too. One way to convince the skeptics was showing the business plan to external experts and another one was involving the skeptics in the working groups, to raise the most difficult questions and find answers for them together. There were some difficulties within the working groups too, when people quit or did not do their job, but taking over their tasks provided a good solution for this problem, and luckily most of the working group members were enthusiastic enough to continue their work until the end.

In Amsterdam Zuid, besides some fears of the community members about the technical feasibility of the project, such as the fear that the roofs of the houseboats were not strong enough for heavy solar PVs, conflicts mostly occurred within the core group of organizers. The source of the conflicts was mainly the lack of clarity regarding the rights and mandates of the members. As they did not write an official business plan and did not have an agreement on the different tasks and rights of the members, it could happen that some members started to negotiate with suppliers on behalf of the community, while others did not know about it. “There were some problems with the way we coped with the prices and agreements
we made with each other. We had a few different offers and some others took other offers a bit later, which were cheaper. We had some conflicts about which offer we should choose, what matters more the deadline or the price. But at the end it turned out that the PVs were already ordered, so we couldn’t get the cheap PVs anyway. We didn’t really solve these conflicts, we just stepped further.” – one of the organizers told me (interviewee 4.4). Other conflicts occurred when one of the main organizers decided to purchase the PVs through his own company and take all the discount only for himself, without letting the other members know about it. “I had some difficulties with him, I didn’t like that he earned money with this project through his company and he didn’t even tell this to us. He got a big advantage as a person and not the people in the neighborhood. That is why in the second year I did it alone and I quit in the third year when he came back again.” – said one of the disappointed organizers (interviewee 4.2). Even though these conflicts were not resolved in any of the cases the simplicity of the project and its short-term commitment for the organizers made it possible to realize the project in the end.

3.5 Conclusions

The purpose of this paper was to study the factors that influence the formation and organization of renewable energy communities. To learn more about these I studied four Dutch and German communities which are different in size, location and technologies applied, in order to find commonalities that could be valid for RECs in general.

I found that the location of the community did not matter in terms of group formation and organization, even though many scholars observed the influence of the local aspects and situative governance structures on local initiatives (Devine-Wright and Wiersma, 2013; Fuchs and Hinderer, 2014). Surprisingly, in my sample I found no substantial difference between the two countries, which have different regulations and institutional backgrounds. Even the type of the settlement where the community is located (village, district of a town) was not an influencing factor – although, I have to note here, that in all cases the investment community was formed in already existing strong communities, where people know
each other personally and the level of trust is high among the residents. However, the size of the community and the intricacy of the project (in terms of the ambition level, the price, combination and complexity of the technologies) seem to be important factors that strongly influence all aspects of its development.

In both German cases and also in Eva-Lanxmeer the community invested in expensive and very complex projects, where the technologies (windmills, bio-energy power plant, heating system – by cooling down drinking water) were installed in a separate location, had to be connected to the grid (or in one case, Jühnde, even the heating grid had to be constructed), or supplied energy not only to the shareholders but also to other customers, and where, because of their high price, special governmental funds and bank loans were required. That is why in all three cases the development of a business plan and the setup of a legal entity, and later an operating company, were necessary. Therefore the community members had to work together, both in the decision-making and the organization of the project development, or hire an external expert to manage the project.

However, in Amsterdam Zuid the simplicity of the project – where only solar PVs had to be set up on the private properties of the residents, providing electricity only to its user – did neither require a strong cooperation of the community members nor their active involvement in the decision making. They did not have to lobby the government for financial support or establish a legal entity representing them towards external institutions such as local authorities or banks. Still the core members of this community worked together actively to organize the project, but in contrast to Jühnde and Eva-Lanxmeer they did not have a formal agreement on the task distribution, the rights and mandates of the members or the phases of the project development, which situation led to the highest number of conflicts compared to the other two cases. Furthermore this project was organized in the least transparent way, but because of the simple and individual solutions and low investment risks, it did not impact the success of the project. Probably, in more complex cases this could have undermined the trust among members, which is the most essential factor in high-risk investments.
Furthermore, my results help us to better understand 1) grassroots initiatives; 2) voluntary working teams that are formed in already existing communities, where the members already know and trust each other and the relationships are based on already existing normative rules; 3) and community based collective actions built on the work of some altruistic members, who can accept freeriding.

Firstly, as I said, the core group of initiators starts to investigate the options for the investment and sets the goal. Secondly, they involve other community members into the working teams and distribute the tasks that they have to work on. Based on the already existing norms and rules of interaction within the community, a more formalized way of interpersonal cooperation is also set. However, unlike working groups formed in organizations where the members are paid for their job and they can be sanctioned for insufficient performance, this is not the case for renewable energy communities. If a volunteer of a working group decides to quit, the other members have to accept it and take over his/her tasks. However, in order to avoid the complete disintegration of the working group, the motivation of the members has to be continuously high. In my cases this was achieved by the constant involvement and continuous flow of information during the whole project, and by the regular small achievements that showed that the project was developing.

This paper has also addressed how a renewable energy community realizes a collective action when every member benefits from the collective good (the energy that is produced or the profit they receive after the energy is sold) equally, even though not everybody participates in its production. How can the community still carry out the collective action and cope with the problem of freeriding? The answer is that they don’t cope with it, they accept it. On the one hand, in all cases there was a small group of altruistic people that initiated the project and decided to work on it without any specific reward. On the other hand, besides this small group of initiators, large groups hired a manager (an expert), who was able to coordinate the whole process. However, the manager had to be rewarded for his work as well. In small groups the establishment of formal or informal organizations could provide another possible solution. Thus, in order to cope with the difficulties related to collective action, it was indispensable to
have a certain form of self-organization and rules of procedure or agreement on the code of conduct to some extent, to have set a goal and to identify members who are entitled to share the collective goods, even if there were altruistic individuals ready to take the responsibility of organizing activities without aiming at any personal benefit.

I make a distinction between small and large groups here according to the capacity of the members to maintain personal relationship with each other. As one of the university researchers who studied Jühnde pointed out, approximately 1,000 people is the threshold for working group based cooperation of community members; above that number people do not know each other that well enough and the level of trust decreases. This insight is also proven by my cases, since in the biggest community with more than 4,000 members (Freiamt) the community hired a manager who was responsible for all parts of the project development, while in Jünde, Eva-Lanxmeer and also in Amsterdam Zuid the project was carried out by a small group/groups of altruists who accepted free-riding without receiving any additional benefits. However, the reward of volunteers can take different forms, which might clarify the motivations behind altruistic behavior. According to the same researcher, most of the people in the working groups in Jühnde were not born in the village, but later moved there. Since this is a very strong and closed community, this was a possible way for them to integrate into the local society. Others liked the attention of the media and the honor and the appreciation of the locals for their work. At the same time it was good for them to increase the living standards in the community and work together with other villagers.

In my study, I could distinguish three types of projects: 1) small groups with simple technologies are most likely to be able to manage the whole procedure alone without external help or formal internal rules and working methods; 2) small groups with complex projects need some kind of formal agreement on who are the members of the group, their responsibilities, a code of conduct for the operation of the working groups and coping with interpersonal conflicts – at the same time they also need some legal advices for setting up operating companies and lobby for external funds; 3) big groups with complex projects are more likely not able to organize the project alone, since the people do not know each other
that well and the level of trust is also lower than in smaller groups. In the latter case the best solution is to hire an external expert, a manager who could organize the project for them. However, the manager has to be paid for his/her work.

In summary, I can conclude that contrary to Olson’s expectation about voluntary collective action, renewable energy communities can realize a project based on the work of only a few volunteers who develop the project without receiving any additional reward and who also accept free-riding. However, the larger the size of the community and the complexity of the project the more likely it is that they need to formally organize the procedure or count on external help. In that way the formation and organization of renewable energy communities thus depends on the size of the community and the complexity of the technology they want to apply. Consequently, RECs can very much benefit from the support of non-governmental organizations and also renewable market actors who could collect and provide the best practices and additional services to these communities or if it is necessary to take over the lead in the project development.
Chapter 4 – When energy policy meets community: Rethinking risk perceptions of renewable energy in Germany and the Netherlands

Gabriella Dóci and Boris Gotchev

Abstract

Although in academic literature several analyses can be found concerning energy policy instruments and their effectiveness in supporting renewables, usually no distinction is made between different investor groups that these instruments address. The present article focuses on an emerging group of investors, namely renewable energy communities, and on policy instruments fostering their operation and spread. The aim of the article is to assess and compare national support systems in Germany and in the Netherlands, respectively to identify which instruments are perceived as the ones most effectively supporting community-based renewable energy projects. To do so, first we adopt an investors’ risk framework to evaluate the effectiveness of support systems according to their ability to decrease investors’ risks, and we operationalize this framework by introducing indicators for a theory led analysis. Second, we also explore the investors’ perceptions of the policy instruments by conducting interviews with community members to see which instruments are perceived supportive in practice and which ones are less popular among community investors. Our results show that in both countries instruments designed and expected to reduce specific types of risk do not always achieve that goal practice, and this is reflected in the perception of the aforementioned investor groups.

Keywords: renewable energy communities, renewable energy policy, investors’ risk, perception

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4.1 Introduction

Although the goal of creating a low-carbon economy has become a priority for the European Union in recent decades, the overall share of renewables in the energy supply shows large differences between member states. Many scholars have stressed the importance of putting the right policy frameworks in place to initiate and maintain a sustainable level of renewable energy deployment (Bechberger and Reiche, 2006, 2004; Goldthau, 2014; Hess and Mai, 2014; Jacobsson and Lauber, 2006; Lauber and Mez, 2004; Mitchell and Connor, 2004; Schmidt et al., 2012; Verbruggen and Lauber, 2012; Walker et al., 2007). In their studies, they usually measure the effectiveness of support instruments according to their contribution to the deployment of renewable energy (Breukers and Wolsink, 2007; Butler and Neuhoff, 2008; Haas et al., 2004; Jacobsson and Lauber, 2006; Lipp, 2007). Although these studies help understand the advantages and disadvantages of certain policies from a governmental perspective, scholars tell much less about their effectiveness perceived by their primary target group, the ‘investors’.25 To date the perspective of investors, potential beneficiaries of support policies, has only drawn marginal attention in the literature.

The group of renewable energy investors is very heterogeneous including private individuals, collectives, local renewable energy companies, utilities, sole traders, publicly-owned non-energy companies and units, social enterprises, local governments, associations, farmers/agricultural holdings, independent power producers, plant producers, project developers and diversified companies, etc. (Bergek et al., 2013; Oteman et al., 2014; Seyfang et al., 2014; Yildiz, 2014). Since no single systematic change can bring about the effects that are necessary to combat climate change and efforts are required at many fronts, both top down and bottom up, the importance of all types of actors, including both individual and community investors that can actively contribute to a sustainable energy transition, is

25 We use the term ‘investors’ in a broad sense in this paper: everyone who invests in renewable energy – the term is thus not limited to ‘investor-oriented firms’ (cf. Yildiz et al., 2015).
unquestionable. The value of these investors is further enhanced by the fact that besides their direct contribution to renewable deployment, they also provide a test bed for both technical and social innovations, increase the acceptance of renewable technologies and change the discourse in energy (Mulugetta et al., 2010).

Renewable energy communities (RECs) are probably among the most interesting types of investors. These communities typically involve people living in the same neighborhood, who invest in renewable energy technologies jointly and who aim at generating the energy they consume. RECs form a special group in the energy market between individuals and firms (Seyfang et al., 2014). On the one hand, similar to individual investors, they have a wide range of motivations for investing (including financial, environmental and even hedonic reasons while realizing an energy project) (Dóci and Vasileiadou, 2015) and they usually lack business experience and total initial capital. On the other hand, they are able to organize more complex and expensive projects (Forrest and Wiek, 2014), in the same way that companies do. In general, compared to traditional commercial actors in the electricity market, RECs tend to be more risk averse, have lower expectations for profit and require more initial support (Couture and Gagnon, 2010; Dinica, 2006; Mitchell et al., 2006). However, these specific needs are not necessarily met by the general support instruments that are in force in a certain country, which can weaken the market position of this investor group.

Our aim in this paper is to assess the effectiveness of national support instruments in facilitating renewable energy communities. In other words, our research question is the following: *How effectively can renewable energy support systems mitigate risk from the perspective of renewable energy communities?* To do so, we first introduce indicators based on an

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26 Although many RECs set up a company (cooperatives, close-end funds, etc.) for the management of their project – a legal entity is even necessary for acquiring permits or for engaging in commercial activities, such as purchasing energy surplus they do not use – community members usually lack relevant business experience that existing companies already have. They learn it by doing it.

27 Due to their lack of entrepreneurial experience and inability to mitigate risks by dividing investment across more projects (Enzenberger et al., 2003).
analytical framework taken from Dinica (2006) and analyze the support instruments according to them. Second, we also explore the investors’ perceptions of the policy instruments by conducting interviews with renewable energy communities in order to see which instruments are perceived to be supportive in practice and which ones are less popular among community investors. “We live in a world of bounded rationality, and therefore, perceptions matter, and policy needs to take such perceptions into account.” (Wüsthangen and Menichetti, 2012, p.6). Addressing these challenges, we do a comparative case study analysis of Germany and the Netherlands — two countries with similar support policy portfolios, but with different results in terms of their renewable energy deployment.

Although both countries have an increasing number of renewable energy communities and similar renewable energy support schemes, they represent opposite ends of the scale of RES installation rates in the European Union. With a 25.3% renewable energy share in gross electricity consumption in 2013, compared to only 3.1% in 1990, Germany is one of the most progressive countries worldwide in terms of RES market deployment (AGEE, 2013). In 2012, around half of the total installed renewable energy capacity was owned by private citizens and farmers (Trend:research & Leuphana Universität, 2013). By 2014, citizens had set up more than 800 renewable energy cooperatives (DGRV, 2014), but they also set up close-end funds and other legal forms to realize renewable energy projects and large parts of the installed wind energy capacity are (co-) owned by the so-called Bürgerwindparks28 (citizen wind farms) (Yildiz, 2014). Thus, RECs have contributed substantially to the ongoing transition to an energy system based on renewables. In comparison, the Netherlands is lagging behind regarding its renewable energy share. With less than 5% of electricity consumed from renewables in 2014, the Dutch energy sector is at the tail-end in terms of performance in the European Union.29

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28 Typically Bürgerwindparks are legally organized as limited liability companies or close-end funds. The dominant business model is the feed-in of electricity from renewable energy sources while the organizational models vary with regards to legal forms.

150-300 renewable energy communities (Schwenke, 2012), the sector is developing but still lags far behind Germany.  

The structure of the paper is as follows. In the second section, we introduce indicators for our analysis based on our analytical framework. Using this framework, we carry out a literature-based evaluation in the third section, which will be compared to the results of our case studies conducted in the Netherlands and Germany in the fourth section. In the final section, we discuss our results and conclude with implications for policy-makers and suggestions for future research.

4.2 Analytical framework

While renewable energy communities primarily invest in renewables in order to meet their own consumption needs and environmental goals, and are often unwittingly conducive to the spread of renewables (Dóci et al., 2015), we argue that their decision-making can usefully be analyzed in an investors’ risk framework. We take our analytical framework from Dinica (2006), who defines a support system as a collection of governmental support instruments that help eliminate the financial and economic barriers to the market introduction and deployment of renewable energy technologies. It includes investment incentives, feed-in systems, soft loans and

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30 Because the data that the paper analyzes was collected in 2013-2014, the latest changes in the German regulations could not provide a source for analysis of the current paper. Even though these changes might radically affect RECs in the future, it does not influence our general question concerning the most supportive combination of instruments that can best facilitate RECs. It remains to be seen how these changes in the regulations will affect renewable energy communities in the long term.

31 Based on Gatti’s (2013) classification of risks, our understanding of investors’ risks include pre-completion phase risks and post-completion phase risks, however in our analysis we focus only on risks that support instruments can address (according to Dinica they are the trade components and the strategic-instruments components of the support systems’ risk, see explanation below) and risks such as not well planned activities (failure of the business plan) or failure of the technology are not in the scope of the current article. We remain agnostic here on whether these risks can be specified as likelihoods – the risks may actually be uncertain as described by Knight (2002). Risk is regarded in a general sense as an opportunity of loss.
tax incentives\textsuperscript{32} that are relevant for RECs. These support instruments should result in the attainment of the desired level of electricity being deployed at the lowest social and financial costs according to the policymakers’ perspective. That is why most of the studies focus on installed capacity as the dependent variable (Bürer and Wüstenhagen, 2009; Jacobsson and Lauber, 2006; Lipp, 2007; Wüstenhagen and Menichetti, 2012) in measuring the effectiveness of certain instruments.

Thus far, however, much less attention has been given to the effectiveness of policy instruments in support of energy investments. Although a recent stream of the literature started to analyze renewable energy policies according to their effectiveness in reducing risks for investors, which indirectly influences the renewable deployment too (Bürer and Wüstenhagen, 2008; Dinica, 2006; Gross et al., 2010; Lüthi and Wüstenhagen, 2012; Mitchell et al., 2006), the specific needs and perceptions of this particular group of investors (namely the renewable energy communities) have not been studied so far\textsuperscript{33}.

Different types of investors have different risk thresholds, which can make them to different extent risk averse (Cohn et al., 1975). If they are treated as a homogenous group, very important aspects of the investment are overlooked that can result in a sub-optimal level of renewable deployment. Individual investors, for example, might have low profit expectations, but they are much more sensitive to price risk than a company with

\textsuperscript{32} The selection of the abovementioned instruments was based on the categorization of promotion strategies by Haas et al. (2011). They make a distinction between direct (that directly support RES) and indirect (that create better conditions in long term) RES incentive schemes and policy instruments. Within direct policy instruments there are price driven or quantity driven ones and investment focused or generation based promotion strategies. Within the framework of this article we focus only on the price driven regulatory instruments, since they are the only instruments that address also individual or community based investors and directly help either the investment or the generation of renewable energy.

\textsuperscript{33} Neither Dinica (2006), Gross et al. (2010) or Mitchell et al. (2006) make a distinction between different types of investors, but they treat them as one homogenous group. Bürer and Wüstenhagen (2008) study cleantech venture investors, but it is also a broad category including companies, funds, wealthy individuals. Lüthi and Wüstenhagen (2012) investigate PV project developers, but still they do not discuss different types of investors (individuals, companies, cooperatives etc.) in PV projects.
a broad technology portfolio. Renewable energy communities are special in this sense, because they are, similarly to individual investors, more risk averse, but very often use not only one but more types of technologies and usually work with experts that provide professional help for them (Dóci and Vasileiadou, 2015).

A basic model to support investment in policy is “to make the risk-return equation more favorable for renewable energy investors”, for example, by increasing the returns for renewable energy investment (e.g., through feed-in systems) or by reducing the risk (e.g., through loan guarantees) (Wüstenhagen & Menichetti, 2012, p.4). Based on this idea, Dinica (2006) developed a classification of investment contexts. She defines four types of investment contexts according to the aggregated risks related to the support system and the profitability of the project that the support system can ensure. They are the following: the optimal (the support system ensures high profitability potential with low risk), entrepreneurial (ensures high profitability potential with high risk), political (provides safer conditions, but with the promise of lower income) and minimal investment contexts (high risk and low profit potential). Because different types of investors have different expectations regarding profit and risk, their preference for an investment context will also vary.

Describing this analytical framework, Dinica (2006) makes a distinction between the trade component and the strategic-instruments component of the support system’s risk. The elements of the first component are related to trade arrangements. The types of risk that belong here are the following:

- **Demand risk:** The purchase of electricity produced, thus the risk whether generators find demand at all for the electricity they produce. In a liberalized power market, they have to find and negotiate trade arrangements with energy distributors. Communities that have less experience and smaller networks in this field can have difficulties selling the electricity they generate.
- **Contract risk:** The contract arrangements and conditions. According to Dinica (2006) the most important contract characteristics are the duration, the quantity and whether it includes the option
for extension. The fixed purchase price is also an important aspect, but this could also belong to the output price risk. Because the application of renewable energy technologies typically requires high upfront investments, it is important to secure a long-term fixed-price contract for the electricity purchase in advance. Short-term or vague legal frameworks increase contract risk.

- **Output price risk**: The stability and predictability of the price a generator receives for every unit of electricity produced. The extent of this risk is related to the following aspects: what are the components for the calculation of the purchase price, how often and by whom is the price reviewed (Dinica, 2006).

We complement this list with two other types of risk that are very important from the RECs’ perspective.

- **Volume risk**: The total amount of electricity that can be sold and will be purchased. Thus after finding the sufficient demand, the question is whether the generators can sell all the electricity they produce or only part of it. In liberalized power markets, this can be limited by the design of the power market influencing the relation between buyers and sellers of power or the physical capacity of the grid (Kitzing and Mitchell, 2014; Klessmann et al., 2008).

- **Balancing risk**: The question of whether renewable energy generators have to supply load profiles to the party responsible for grid stability (Transmission System Operator – TSO) before power is actually fed into the grid. In the event that actual production deviates from the load profile—for example, where a wind turbine produces more or less electricity than forecasted—TSOs have to provide upward regulation and reduce power to the grid (Mauritzen, 2013). If generators are balance responsible, the TSO passes on the costs for such balancing to the generator.

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34 Certainly there are overlaps between the different types of risks; the categories listed here, however, help consider all the aspects that can hinder or endanger renewable investments at the community level.

35 Constant reconstructing or extending short-term contracts increase transaction costs and undefined contractual rights can lead to opportunistic behavior in case large amounts of surplus have to be divided ex post (Grossman and Hart, 1985).
Dinica defines “strategic instruments” as all of the other schemes that help in the elimination of economic or financial barriers. The biggest risks in terms of RECs are whether they have the initial investment capital for the realization of the project or whether they can obtain a bank loan for that. That is why we introduce the following type of risk:

- **Capital risk**: The risk of receiving a bank loan for a reasonable price or at all. The risk perceptions of banks become an important variable because citizen-led initiatives have to “borrow” large parts of their capital from those actors. If banks perceive investments in renewable energy under a certain policy scheme as risky, they might raise the interest rate, making investments for borrowers more costly and reducing borrowers’ revenues (Arnold and Yildiz, 2015); or they do not provide loans at all. This can potentially create a barrier to market entry.

In the following, we will analyze the Dutch and German support systems to see which combination and design of instruments provides the most favorable investment context for RECs. Hence, the indicators that we use are the types of risk that the support instruments address. According to our understanding, policy instruments can contribute to profitability directly in the form of subsidies and indirectly by decreasing risks and costs related to risks of the investments. For example, support instruments can increase profitability of a renewable investment, if they provide guarantee on the price after every kWh generated, thereby decreasing output price risk. But the same applies to other risks as well, since the more support instruments can reduce initial and operation costs, the sooner the investment pays off and becomes profitable. More specifically, based on Dinica’s framework, complemented by the three new indicators that we introduced, we will use the following components and analyze the support instruments that are supposed to address them (Table 1.)

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that obliges the distributors to buy all or a certain volume of electricity from the producers. Thereby, generators do not have to find a trading partner and negotiate trade conditions (Dinica, 2006).

| **Contract risk** | Support instruments can oblige distributors to buy generated renewable electricity and can also regulate the contract conditions. |
| **Output price risk** | Where a support instrument guarantees a fixed price, the output price risk is close to zero and investment security is high. |
| **Volume risk**<sup>36</sup> | Support instruments can oblige distributors to purchase all of the renewable energy produced, thereby eliminating volume risk. |
| **Balance risk**<sup>37</sup> | Support instruments can remove this burden when public institutions or grid operators take over the financial responsibility for balancing. |

| **Strategic-instruments components** | **Capital risk**<sup>38</sup> | Support instruments can either provide soft loans against a reduced interest rate and ensure loans, or provide support in the form of subsidies, thus reducing the amount that needs to be “borrowed”. |

**Table 1.** RE investors’ risks and the requirements on support instruments how to address them

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<sup>11, 37</sup> These are risks that the authors identified.

<sup>38</sup> Within the broad category of strategic-instruments components this risk was identified by the authors, which is relevant for RECs.
In the following we analyze the support systems of the two countries by concentrating on the support instruments that help the elimination of financial and economic barriers, such as feed-in systems, investment incentives, tax incentives and soft loans (Dinica, 2006). First, we study the support instruments separately to see which risks they address. Based on this insight we are able to answer our research question about the effectiveness of support systems (including all support instruments) to decrease investors’ risks. Thus the appropriate combination of instruments can ensure the best investment conditions for RECs, which we discuss more detailed in the conclusion section.

4.2.1 Germany

The issue of renewable energy has been placed high on the political agenda in Germany for more than two decades. Energy production from RES has been a central strategy of the German government to abate greenhouse-gas emissions since the early 1990s.

*Feed-in system (EEG)*

The introduction of the Renewable Energy Sources Act (Erneuerbare Energien Gesetz, EEG) can be regarded as the single most important regulatory policy for the establishment of RECs in Germany, hence it addresses, on its own, all trade and strategic-instrument risks hindering community investment. Although the EEG was not deliberately created to spur the development of RECs, it certainly created favorable conditions, especially for individual private investors and community-based RES electricity production.39

An initial structural element of the EEG, which addresses *output price risk*, is the guarantee of a fixed payment for renewable electricity generators under this scheme. The rate is paid for every kilowatt-hour (kWh) produced by eligible technologies over a period of 20 years, and the amount

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39 Our analysis focuses on the EEG regulations between 2000 and 2014, as these are the regulations that affected our case studies. The recent regulations introduced by the federal government in August 2014 created a completely new situation for renewable investors, including RECs, which we discuss in the last section.
of the payment depends on the technology, size and location of the energy project.\textsuperscript{40} In order to incentivize and respond to technological innovation, the rate is reduced yearly (degression) for new installations. While many other countries, such as the Netherlands, have used caps on the budget or yearly installed capacities, Germany has done so only for photovoltaic cells (PV) in the early years of the EEG. As a consequence, yearly installation rates were not limited to a certain amount.

A second structural element of the EEG for the elimination of demand risk and contract risk is the obligation of grid operators to connect renewable energy installations to their grids and to purchase the electricity produced from renewable energy generators (“Das Erneuerbare-Energien-Gesetz,” 2000). Equally important is the principle of priority transmission and distribution of electricity from RES over all other sources. In short, once connected to the grid, RE generators are guaranteed the purchase of every kWh they produce. This regulation is crucial for small energy producers, such as RECs, entering the electricity market, because it not only creates secured demand and contract conditions, but also reduces volume risk to zero. Small generators do not have to negotiate contracts with utilities about the connection and purchase of their electricity and, in addition, their tariff is guaranteed. Further, balancing risk does not exist for producers either, because they do not act on the balancing market and have no responsibility for balancing under EEG (Mitchell et al., 2006).

Finally, with a market-independent fixed tariff rate and a purchase obligation, renewable energy producers do not have to market their electricity on the spot market, and banks are more likely to grant loans for investments, because of the low risks, which also reduces the capital risk that RECs might have to face. These clear regulations reduce transaction costs and make electricity sales fairly easy and very favorable for RECs (Couture and Gagnon, 2010). In sum, the EEG has created a market for renewable energy, which is characterized by investment security, longevity and transparency.

\textsuperscript{40} Electricity produced from hydro energy, pit gas, biomass, wind and solar radiation sources is eligible for FiT (EEG 2000).
Investment incentives

Investment incentives belong to the strategic-instrument component by contributing to the reduction of capital risk. They aim at stimulating renewable investment and they can take the form of different subsidies. In Germany, direct subsidies in the form of grants were available through the 100/250 MW wind program, the 100 000 Roofs Program in the 1990s, and other programs in a scattered manner until the early 2000s. However, most subsidy programs expired after the introduction of the EEG. Still, subsidies have been available for individual projects. For example, Germany’s first “bio-energy village” Jühnde received 1.3 million euros in direct funding from the German state for the construction of a district heating grid to connect citizens to a biogas plant (“Bioenergiedorf Jühnde,” 2013).

Soft loans

Soft loans also address capital risk by providing loans with more favorable conditions than the market conditions for “green” projects. In Germany, low interest loans for RES technologies are available from the state-owned German Kreditanstalt für Wiederaufbau (KfW). 41 Preferential loans are issued by the KfW or through local banks as contract partners. The two important financial support programs coordinated by the KfW are the Environment and Energy Conservation Program (EECP) and the Environment Program (EP). EECP was introduced in 1990 and provides low-interest loans to renewable energy projects. Those targeted are, above all, SMEs, freelancers, local/municipal companies and public–private partnerships. Normally, financial support is given in the form of soft loans with interest rates 1–2% below market levels for up to 50% of investment costs. The credit payback time is set between ten and twenty years, with a two- to five-year redemption free period (International Energy Agency, 2004). Soft loans for renewable energy projects are also available at similar conditions from the EP. While the maximum support amounts to 1 million euros in the case of the EECP, the maximum amount of the EP is 10 million euros. If the two programs are combined, 75% of investment costs could be cov-

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41 Until 2003, loans were also available from Deutsche Ausgleichsbank (DtA; merged with KfW in 2003).
ered (Staiß, 2007). In 2009, the KfW consolidated their support programs for renewable energy investments. A single program superseded the aforementioned programs.\footnote{An overview of the most recent financial support programs from KfW is available here: \url{http://www.kfw.de/kfw/en/Domestic_Promotion/Our_offers/Renewable_energy.jsp}}

### 4.2.2 The Netherlands

The relatively low share of renewable electricity (10%) in the overall electricity portfolio indicates that “green” electricity has not been a top priority for the Dutch government\footnote{According to Verbong and Geels (2007), it is due to the liberalization and Europeanization of the electricity market. Besides that, energy saving measures received higher political attention than the support of renewable energy.}, and so far policies have been rather ineffective (Verbong and Geels, 2007), partly due to their volatile and inconsistent nature (stimulating either the supply of or the demand for RES) (Agnolucci, 2007). Hence, for a long time, the inadequate institutional conditions also prevented the appearance and spread of renewable energy communities.

**Feed-in system (SDE, SDE+)**

In the Netherlands, the Support Policy of Renewable Energy Production (Stimuleringsregeling Duurzame Energieproductie, SDE) was introduced in 2008. SDE is a fixed-premium mechanism (having the characteristics of both fixed and premium designs of feed-in systems), which covers the gap between the spot-market price and a required feed-in price. Because this required price of renewable energy is fixed, SDE can belong to the market-independent design. However, the gap between the two prices is always changing due to the fluctuating spot-market price. Therefore, SDE can also be classified under the premium category (Couture and Gagnon, 2010). In any case, \textit{output price risk} is thereby reduced. For different technologies, different feed-in prices are set. The complete subsidy period was extended from 10 to 15 years in 2012, and the SDE, as well as its successor policy SDE+, are supposed to be technology neutral. However, more than two-thirds of the subsidies were provided for biomass or green gas projects in
2011, and small-scale solar PV projects were not financially supported at all, even though this technology is the most popular technology among individual or community investors (Rabobank, 2012).

The first version of this spot market gap feed-in model was special in the sense that the marginal costs were covered by government subsidies and not passed onto the customers’ bills. However, this entailed the risk that in the event that the budget was depleted in one year, newcomers could not benefit from this system, thereby making this design more uncertain and less reliable, which increased the output price risk. Although the Dutch government introduced an SDE+ levy for both individual and business customers in 2013 and devolved the SDE finance to the customers, unlike in Germany the SDE+ budget has still a finite amount of money. Each year, the projects are evaluated according to certain criteria and receive funding on a first come, first served basis until the budget is depleted. This principle may negatively influence investors’ confidence and makes the profit less reliable and calculable in the long run than it is the case with the EEG in Germany (Couture & Gagnon, 2010).

Also regarding grid balancing, the Dutch legislations are less favorable than their German counterparts. Grid operators are responsible for the electricity balance in the network, and they can refuse the connection of electricity producers in the case of overproduction. In every case, electricity producers have to bear the costs of establishing the grid connection and, above 10 MW production, they are even obliged to arrange the connection according to the grid administrator’s requirements. In that case, producers can be refused connecting to the closest point and be required to find another connection point further away, which puts an extra financial burden on generators. Hence, balancing and demand risk are considerably high in the Netherlands. Moreover, there is an obligation for grid operators to buy the electricity only up to 10 MW, which also increases contract and volume risk for larger projects, because above that amount, they also have to negotiate the contract details according to the grid operators requirements (“Electriciteitwet,” 2010).

Tax incentives
As compensation for these less favorable balancing conditions, we can find a special regulation, the Dutch saldering law (which can be translated as: ‘balancing’). This tax incentive makes it possible for small producers that generate energy from solar PV or small wind turbines to either use the electricity directly behind their meter, or, where the electricity is produced on the property of the producer, they can sell it to the electricity grid and buy it back later on retail price. Up to 5000 kWh/year of behind-the-meter produced electricity is exempt from VAT and energy tax. This is called saldering. This tax exemption also applies to communities that live in condominiums and install solar PVs on their roof together, but the generated energy has to be delivered to the households separately with the help of an energy distributor device. In this case, the households are allowed to do the saldering individually after the energy they receive. As a consequence, for small producers, the output price risk drops considerably. However, the saldering does not apply to individuals or communities that own an installation not located on the property of the producer(s). According to the Energieakkoord, the regulations changed on 1st January 2014, so that communities generating energy from other resources (not only solar and not necessarily on their own property), although still not eligible for the saldering, can apply for 7,5 € cent per MWh deduction from the energy tax and VAT. However, the supporters of community-based energy production find that this law is still not favorable enough for renewable energy communities, which is the reason that such communities, together with networking organizations and the support of companies and


45 Energy Agreement for the sustainable growth of over forty organizations, including the government, employers, trade unions, nature and environmental organizations, other social organizations, and financial institutions.

university professors, have lobbied extensively for the extension of the saldering law to collective self-supply (Dóci et al., 2015).

**Investment incentives**

In the Netherlands, there are several subsidies available for all types of renewable technologies, especially at the regional or provincial level. Local or regional governments in some cases also offer specific subsidies (e.g., *Regionaal Samenwerking Programma* in Gelderland, *Zon op je Dak* in Amsterdam Zuid), guarantees or loans for particular projects.

**Soft loans**

The *Green Funds Scheme* (Regeling groene projecten) in the Netherlands is a special type of soft loan, which was launched in 1995. It allows individual investors to invest in specific green funds at designated banks at a lower interest rate, which is compensated by environmental tax credits. The banks then use this money to offer cheap loans for environmental projects at an average interest rate 1% lower than what is available on the market (NL Agency, 2010). When a project wants to benefit from the Green Funds Scheme, it has to apply for a green declaration from the government after meeting specific criteria; this declaration is valid for 10 years. The loan is specifically made for projects that would have difficulty getting financed otherwise. The projects can apply for up to 75% of the investment costs to be covered by the loan. In general, the Green Funds Scheme reduces the capital risk and that is why it is considered a success: since it began, more than 5000 projects have benefited from these loans.

In Table 2, we summarize the instruments that address the different types of risk in our analytical framework for the two countries. Based on our qualitative analysis we give an approximate indication (effective, partly effective, not effective) as regards potential risk mitigation effects of certain instruments from the RECs’ point of view. In case an instrument can com-

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pletely eliminate a risk we regard it as an effective one. When it can decrease the level of the risk, but cannot eliminate it, we consider it as partly effective. Finally, in case the instrument could neither eliminate nor decrease the risk, we find it is not an effective instrument from this point of view.

<table>
<thead>
<tr>
<th>Risk type</th>
<th>Germany</th>
<th></th>
<th>Netherlands</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Support instruments that address this risk</td>
<td>Effectiveness of the support instruments in eliminating this risk</td>
<td>Support instruments</td>
<td>Effectiveness of the support instruments in eliminating this risk</td>
</tr>
<tr>
<td>Demand risk</td>
<td>feed-in system (EEG)</td>
<td>effective</td>
<td>feed-in system (SDE/SDE+)</td>
<td>not effective</td>
</tr>
<tr>
<td>Contract risk</td>
<td>feed-in system (EEG)</td>
<td>effective</td>
<td>feed-in system (SDE/SDE+)</td>
<td>not effective</td>
</tr>
<tr>
<td>Price risk</td>
<td>feed-in system (EEG)</td>
<td>effective</td>
<td>feed-in system (SDE/SDE+) /saldering (only for small producers)</td>
<td>partly effective</td>
</tr>
<tr>
<td>Volume risk</td>
<td>feed-in system (EEG)</td>
<td>effective</td>
<td>feed-in system (SDE/SDE+)</td>
<td>not effective</td>
</tr>
<tr>
<td>Balance risk</td>
<td>feed-in system (EEG)</td>
<td>effective</td>
<td>feed-in system (SDE/SDE+)</td>
<td>not effective</td>
</tr>
<tr>
<td>Capital</td>
<td>feed-in system</td>
<td>partly effective</td>
<td>subsidies/soft</td>
<td>partly effective</td>
</tr>
</tbody>
</table>
Table 2. Effectiveness of support instruments in decreasing investors’ risks in Germany and the Netherlands from the RECs’ point of view

<table>
<thead>
<tr>
<th>Risk</th>
<th>Instrument</th>
<th>Summary</th>
<th>Instrument</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>/subsidies</td>
<td>EEG/soft loan (KfW)</td>
<td>Decrease risks</td>
<td>Green Funds Scheme</td>
<td>Decrease risks</td>
</tr>
<tr>
<td>loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3 Community perception of the support instruments

The second part of this paper explores how renewable energy communities perceive the national support system and whether and how it affected the community members’ investment decision. To do so, we conducted 16 semi-structured interviews altogether with members of two Dutch (Amsterdam Zuid, Leeuwarden) and two German communities (Jühnde and Freiamt) and analyzed documents, such as communities’ business plans, minutes of meetings, etc. The scope conditions for our research population were: 1) communities in the Netherlands or Germany that invested in renewable energy; 2) the investment is a citizen initiative; 3) the members of the initial investment community (people who bought the technology) live in the same location/region; and 4) all of the members of the investment community are shareholders in all or at least one of the technologies.

Renewable energy communities in the Netherlands and Germany differ with respect to their size (ranging from small communities with a few members to large communities of 3000 members), location (islands, villages, city neighborhoods, districts in small towns, or just small communities in apartment buildings), and the technology they use (solar PVs, water pumps, wind mills, biomass power plants). These projects also encompass different organizational forms, such as wind or solar cooperatives, joint solar procurement projects and small energy companies that produce and supply energy not only for their members but also to other customers (Schwencke, 2012). Therefore, we used the diverse case method for case

48 We conducted interviews with the frontrunners who initiated and invested more time and effort in these projects, thus they had more experience and stronger opinion on the support instruments that helped or hindered their project.
selection, as diverse cases of the population are likely to be representative of the full variety of cases (Seawright and Gerring, 2008). Consequently, we chose four cases from different locations (village, small town, city), with different sizes and with different technologies and resources (wind, solar, biogas, thermal water).

In each case we had a contact person, who helped us to get in touch with other community members, so we could do face-to-face interviews usually by visiting locals. We conducted interviews only with frontrunners of each REC (community members who actively participated in the organization of the projects), since they had direct experience, knowledge and opinion as regards support instruments that we were studying. An average interview took one hour. All of the interviews were recorded and transcribed, and our interviewees are anonymized for the purpose of this article. The interview guide covered, among other things, the following questions:

- What type of governmental or federal support could you count on? Did that support influence your motivations and decisions during the process?
- Did you use subsidies? Which one(s)? Did this subsidy influence your decision on the technology or on your target?
- Were there any regulations that helped or hindered the project?

Our analysis so far has suggested that there is a substantial difference between the two countries in terms of the effectiveness of the support systems in the assistance of renewable energy communities. As a further step, in this section we investigate whether the perception of the communities also supports our results and whether they could benefit from all of the support the instruments provided.

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49 The advantage of this method is that a full range of variation increases the representativeness of the results that the researcher finds based on the analysis of the selected cases. Its disadvantage is that in case the distribution of different cases is not equal within the population, but the researcher selects cases from every type of cases equally, it can distort the results. Still, the diverse case method is regarded the most representative method from all small-N sample methods (Seawright and Gerring, 2008).
4.3.1 Freiamt

Freiamt has 4300 residents and is located in the southwest of Germany, near Freiburg. Since 2007, the village has produced 14 million kWh of electricity from renewable energy sources annually, exceeding the village’s electricity demand by two million kWh. The electricity is produced from multiple renewable energy sources: five windmills, 240 roof-mounted PV panels on private houses, two small hydro power plants and two biogas plants constructed in 2002 and 2007. In addition, 150 private houses have installed solar thermal collectors for water heating. All of the generated electricity is fed into the national grid.

All our interviewees concurred that the project would not have been realized without the Renewable Energy Sources Act (EEG). As interviewee 1.2 said, “We were lucky and are still lucky to have the Renewable Energy Sources Act, and we receive a fixed tariff of about 9 eurocent/kWh.” Another advantage of the EEG was also mentioned: “Without the tariff and the obligation for energy suppliers to buy our electricity regulated in the RESA (EEG), not a single bank would have given us a loan. This is very clear. For those who give us the permits, the financial situation of the project formally should not be influential, but it played an important role for them to see that there is an economically viable project with citizen’s involvement, and they knew the money would stay in the region.” (Interviewee 1.4)

The second most influential support instrument was the KfW soft loan that provided the necessary initial capital for realizing the project (see the table of quotes including the opinions of our interviewees on each support instrument in the Appendix 3). Therefore we can state that both the EEG and KfW had a high level of perceived importance. Finally, even though the community received no subsidies for the investment, they benefited from other support of the local government, which, according to our interviewees, was also essential for obtaining all permits for the setup of the windmills. Still, in our analysis we regard the level of perceived importance of the investment incentives low in this case, thereby acknowledging that the community received some governmental support, but not in a systematic way through a support instrument.
The second case that we analyze is Jühnde, an agricultural village in Lower-Saxony, Germany, with a population of 780 residents. They produce both heat and electricity 100% from renewable energy resources and cover all of the energy needs of the investing community. The core of the energy production comes from a combined biogas power plant that uses methane, which is complemented in the winter by wood chips. The heat is distributed via a local grid to the households. The total heat production of the village is 6500 MWh/year, while 5000 MWh of electricity is produced annually (about double the amount of the local consumption). The project cost was 5.3 million euros, one-third of which was paid with governmental and regional funds and the rest by the residents and various business investors.

There was a general agreement among our interviewees about the role the EEG played in the financial feasibility of the project: “It would not exist without the EEG. Just consider the 800,000 euros we generate from electricity and the 200,000 euros from heating. You cannot do such a project without that.” (interviewee, 2.2) KfW was mentioned only one time, without discussing its importance in detail. However, Jühnde was a special case in terms of subsidies, because they received the largest amount (1.2 million euros) from the Federal Agency for Renewable Resources (FNR). In addition, they also received additional support in the form of regional and local subsidies. Still, this amount was not sufficient for the investment; however, it was enough to receive the missing part from the bank as a loan: “Not a single bank would have given us a loan. But with these funds, it was not a big problem, because there was no big risk for the banks.” (interviewee 2.4) In conclusion, the community found both the EEG and the subsidies highly important, while we can regard only a low level of perceived importance to KfW.

In summary, both German communities found the feed-in system as a whole (EEG) the most important instrument; however, the perception regarding the effectiveness of the soft loan (KfW) was less univocal. While

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50 In the description of our cases, we draw heavily from the Doci et al., 2015 article.
Freiamt found it essential, community members in Jühnde mentioned it only one time, not giving much importance to it. We could find a similar division with regards to the subsidies: while Jühnde received a large amount of national, regional and even local subsidies, Freiamt only received another type of support, namely political support, from the local municipality, which was still vital in their opinion. Certainly, subsidies in Germany are available at the regional and local level; therefore, it is more a matter of location whether a community can avail itself of them. Thus, these two instruments expected to lower the risk did not in fact do so in our cases.

4.3.3 Amsterdam Zuid

The community is located in the south of Amsterdam: a houseboat area including 80 boats. They installed solar PVs on the top of the roofs of the houseboats. In 2008, 35-40 people joined the project, which was repeated two times in the following years. With the installation of the PVs, a few residents could already achieve 100% self-sufficiency, but most of them produce only 30-40% of the electricity they need. Each solar panel cost 3000 euros, and the subsidy was 1200 euros. For the heating, they received 1000 euros per person from the national government.

In this case, the feed-in system (SDE) and soft loans did not play any role in the investment, or at least it was not mentioned by any of our interviewees. However, subsidies were very important for the implementation of the project according to the community members: “Yes, we started the whole project just because of the subsidy..” (interviewee 3.3) “... it covered 40% of the price in the first year and 20% in the later years. It made everything easier.” (interviewee 3.1) Even though one of the initiators ordered all of the solar panels and helped people apply for subsidies, they received financial support individually.

Opinions were divided on the role of the saldering law in the project. Interviewee 3.2 said that “Saldering was really essential; without it, we wouldn’t have invested in this project.” While other interviewees claimed that they did not even use it: “We didn’t make use of it because some elec-
tricity companies, like Greenchoice buys the electricity that you feed into the grid.” (interviewee 3.1). Since solar PVs were applied individually, each household could decide whether to make use of the saldering or not. The answers that we received show the ambiguous perception of this support instrument, especially when it gets to the community level: “Because of the bad design of the energy taxes [saldering], we couldn’t set solar panels on the roof of the football club and use that energy in our homes.” (interviewee 3.3)

4.3.4 Leeuwarden

Our fourth case is a residential community in a dwelling house in Leeuwarden. There are 24 households in the building, and 11 of them participated in the project, which was initiated by two residents who wanted to make use of the large roof by installing solar PVs. The investment cost 58 000 euros. On a yearly basis they produce 12 500 kWh, which is consumed by the whole building (association of owners) and not by individual households; the rest of the electricity is sold to the grid. Although they cannot directly benefit from the generated electricity, they can use their profit (which they receive from the energy company and the owners association for the energy) to cover the price of the electricity that they pay individually.

The community faced some difficulties at the beginning of the project: “We didn’t have enough money for the project. So we decided to ask for a bank loan, but the banks refused us. Finally, one of the residents offered a loan for the project, and we will pay it back bit by bit from our profit.” (interviewee 4.1) This means that the community could not use soft loans for the project, and they had to find an alternative solution for providing the initial capital. Another difficulty was related to the legal entity that they had to create for the implementation of the project and the taxes that it involved. Fortunately, they also found a solution for that: “Then, we established an official association. But we don’t make profit, so we didn’t want to pay a tax after the association. The tax service accepted our request, but we had to register at the Chamber of Commerce.” (interviewee 4.1) Finally, this community could make use of the SDE tariffs and they also ben-
efited from regional support in the form of subsidies and professional help provided by the local government, which instruments were perceived highly important.

In conclusion, the perception of the feed-in system (SDE) in the Netherlands was rather ambiguous compared to the German cases. While the community in Amsterdam Zuid did not use it at all, one interviewee in Leeuwarden found it important. Certainly, it is also related to the use of the saldering law and the amount of electricity the community produced. This case demonstrates the weakness of this regulation, because it excludes communities from its beneficiaries. In both projects, however, subsidies played very crucial role in the investments, and in Leeuwarden, the municipality even provided additional help for the community by sending an expert to help with the investment. Surprisingly, none of the communities could benefit from a soft loan, even though the community in Leeuwarden left no stone unturned to raise money for their project, but their loan request was rejected everywhere. It seems that the Green Funds Scheme is not available for all investors.

In Table 3, we summarized the level of perceived importance (zero, low, medium, high) of the different instruments we investigated in our cases. We did a qualitative analysis of the answers our interviewees gave, which we grouped according to what they said, what adjectives they used in relation to each instrument. In case most of the opinions were positive about a certain instrument we regarded it as highly important, however, ambiguous opinions were given medium level of perceived importance, such as the saldering. Finally, we gave low level of importance to an instrument if relevant opinions were rather negative. Zero in the table means that even though the given instrument is available in that certain country, our interviewees did/could not take advantage of it. To reduce subjectivity, both authors of this article conducted the analysis separately to be summarized afterwards. To show how we came to our conclusions, we listed all the quotes on each instruments in a table (see Appendix 3), which we based our evaluations on.

| Support | In- Freiamt | Jühnde | Amsterdam | Leeuwarden |
|---------|-------------|--------|-----------|------------|------------|

108
<table>
<thead>
<tr>
<th>Instrument</th>
<th>Zuid</th>
<th></th>
<th>Zuid</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed-in system</td>
<td>high</td>
<td>high</td>
<td>zero</td>
<td>high</td>
</tr>
<tr>
<td>Investment incentive</td>
<td>low</td>
<td>high</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Tax relief</td>
<td>-</td>
<td>-</td>
<td>medium</td>
<td>zero</td>
</tr>
<tr>
<td>Soft loan</td>
<td>high</td>
<td>low</td>
<td>zero</td>
<td>zero</td>
</tr>
</tbody>
</table>

*Table 3. Level of perceived importance of the support instruments*

### 4.4 Conclusions

The aim of the article was to assess and compare the effectiveness of national support systems from a specific investor’s perspective, the perspective of renewable energy communities. By doing so, we followed a new research line that evaluates support systems according to their effectiveness in reducing the types of risk that investors face at the construction, during the operation or while finding the market demand (Bolton and Foxon, 2014).

Our analysis showed that the German EEG offers the most supportive conditions for RECs, because it covers all of the risks under the trade and strategic-instrument components that hinder community investment in renewable energy. It guarantees a stable and predictable price for every unit of electricity produced, which makes *output price, demand* and *contract risk* close to zero. Furthermore, generators do not have to worry about the *volume* and *balancing risk*, because it secures the purchase of electricity produced without limitations and takes over the responsibility of balancing too. In general, the EEG seems to be a very effective support instrument that addresses on its own most of the risks that RECs face. Still, an important problem remains out of its scope, namely the difficulties
with collecting the necessary amount for the investment\textsuperscript{51}. Fortunately, the combination of EEG with local subsidies and with a favorable soft loan scheme (KfW) is also possible, which instruments help in the elimination of \textit{capital risk}. Therefore, it is valid to state that the German support system (including these instruments) provides an optimal investment context for renewable energy communities.

In general, the Dutch support instruments lag behind the German system in terms of risk management, providing less advantageous investment conditions for renewable energy communities. \textit{Output price risk} is reduced to a certain extent by SDE and SDE+, but because of the first come, first served principle the future profit is less reliable and calculable in this case. They can also benefit from the obligation of grid operators to purchase electricity up to 10 MW, which decreases \textit{demand} and \textit{contract risk} to a high extent. However, these support instruments help only individual electricity producers or small communities (they can benefit only from the obligatory electricity purchase). Larger communities or communities with a high level of ambition, such as 100% self-sufficiency, as it was the case in Germany, must arrange and pay for the grid connection, if they are allowed to do so. Furthermore, communities can benefit from the saldering only to a limited extent. Thus, in their case, \textit{balancing}, \textit{demand}, \textit{volume} and \textit{contract risks} are relatively high. Fortunately, the conditions to receive soft loans and subsidies are similar to the German situation; thus, \textit{capital risk} is rather low in the Netherlands, too. Thus, communities can combine soft loans with investment incentives, which help in the initial phase of the investment and later they can make use of the feed-in system that reduces risks in the operation phase, although just to a limited extent. Probably due to the above reason and since saldering provides real support only for individual investors, the ambition level of Dutch RECs is much lower than the one of German communities, resulting in cheaper and less complex projects, using mainly solar PVs. Therefore, we cannot confidently place the Dutch support system even into the political investment context, since it would require safe conditions with the prospect of low profit. Rather, it is located in between the political and minimal investment context.

\textsuperscript{51} Although, EEG paves the way to bank loans, which reduces \textit{capital risk}, it does not directly provide help to obtain subsidies or advantageous loans.
texts: even though it provides some type of security for small producers, for communities the risks that can endanger a renewable investment are comparatively high.

In summary, we see that in both cases the instruments designed and expected to reduce specific types of risk do not always do so in practice, and this is reflected in the perceptions of these investor groups. It could be the case that certainty with respect to specific types of risk is more important for investment than others, which could explain the differences between the two countries regarding the number of RECs. Still, it is no wonder that the well-designed feed-in system that addresses several risks at the same time has the highest perceived importance in Germany, while in the Netherlands subsidies were perceived to be the most important instrument even though they decrease only capital risk. The Dutch feed-in system addressing all types of production risks are considered less reliable and important among community investors, which shows a potential mismatch between the perceived importance of the instrument and its intended importance in risk reduction due to its poor design. The lack of sufficient risk assessment in the Netherlands resulted in fewer and simpler projects in terms of the portfolio of technologies they use and the kWh of electricity they produce compared to Germany.

This has direct practical implications, if we wish to support renewable energy communities. Policymakers would need to pay more attention to the investor type specific characteristics, because better communication and tailor-made design can increase the effectiveness of support instruments in addressing risk, thereby providing more effective support for renewable energy investors. In addition, our case studies suggest that RECs give different levels of importance to certain types of risk depending on the technology used and scale of the project. Thus optimal support policies should address various types of risks.

**4.5 Discussion**

By employing theory led analysis, we not only assessed the effectiveness of support systems in risk mitigation, but we also made some theoretical
and methodological contributions. Still, some questions remain open to be investigated by future studies. Our first theoretical contribution was introducing new indicators, thereby complementing Dinica’s framework (2006) and putting the theoretical evaluation method into practice by studying and comparing the Dutch and German support systems. However, besides financial elements there are also other factors that could determine RECs investment decisions, that future studies can shed more light on.

Our second theoretical contribution was approaching the investors as not one homogeneous group, but making a distinction based on whether it is an individual, a community or a firm that makes the investment. We argued that the level of initial capital, the level of ambition regarding the type and complexity of their projects, or the extent to which they are risk averse can vary among the three investor categories. A limitation, however, is that the paper evaluates support instruments only from the communities’ perspective and the assessment of the two other investors’ types are still awaited, which could be the subject of further research.

Our methodological contribution was conducting interviews to gain a better understanding of the perception of investors to see whether the policy makers’ intentions with certain instruments could succeed in their objective. The limitation of our qualitative analysis is its subjectivity, which we tried to reduce by conducting a double evaluation of the results by the two authors separately, but we could not exclude this subjectivity completely. That is why it could be further strengthened by some quantitative research methods that provide more accurate and representative data on the perceived importance of certain support instruments in RECs’ investment decisions.

Besides the field specific contributions the paper also contributes to a stronger position and better evaluation of social science related disciplines and methods in energy studies, which is so far one of the weakest points of this research field (Sovacool, 2014).

As a final point, we also want to draw attention to the contradictory aspect of renewable support instruments. Although in some cases tailor made support policies that mainly aim at decreasing investors’ risks not
necessarily guarantee the growth and productivity of renewable projects at the same time (Goldberg et al., 2006), our analysis shows that the effective risk assessment in Germany could lead to a higher number of REC projects and it could also increase their ambition level compared to the Netherlands. Nevertheless, the price that the government pays for maintaining such a support system does not necessarily pay off in the end making the support of RECs and renewables in general expensive and not cost effective.

This could be one of the reasons for the recent developments in Germany, namely, the essential changes in the EEG regulations introduced by the federal government in 2014, which created a completely new situation for renewable investors, including RECs. According to the new regulations, new renewable installations above 500 kW installed capacity have to market the electricity they generate at the wholesale market, which gives no guarantee for purchase or fixed prices. The German government also introduced a sliding premium that covers the gap between the market price and a predefined reference tariff level. However, when the market price is higher than the reference tariff level, no premium is paid. Exceptions are only granted for small RES plants with capacities below 500 kW (from August 2014) and 100 kW (from 2016) (Held et al., 2014).

As a result, considerably fewer energy cooperatives were founded in Germany in 2014 than one year earlier (Müller and Holstenkamp, 2015), and the long-term effects on either community-based energy production or on the entire renewable energy sector are not yet foreseeable. However, what we can already see is that the findings of Lelarge et al. (2008) are valid also in this case that tailor made support instruments can create dependence on government policies and RECs have difficulties to manage within pure market circumstances. Still, further research is needed to explore the consequences of changes in the EEG both for community energy production and for the renewable energy sector.
Chapter 5 – Exploring the transition potential of renewable energy communities

Gabriella Dóci, Eleftheria Vasileiadou, Arthur Petersen

Abstract: Renewable energy communities are grassroots initiatives that invest in ‘clean energy’ in order to meet consumption needs and environmental goals and thereby – often unwittingly – conduce to the spread of renewables. Our aim in the present study is to explore the potential of renewable energy communities in the Netherlands, as social niches, to contribute to transitions in the energy system. To do so, we propose three proxies for measuring the transition potential of social niches, based on proxies for technological innovations derived from the literature. In addition, we reinterpret the notion of niches and the way transition occurs by arguing that niches are complex systems in which both technological and social innovations develop simultaneously and that during a transition entire niches link up with the regime. Furthermore, we make a distinction between internally and externally oriented niches based on their orientation and application focus. We use a comparative case study analysis complemented by a systematic literature and documentary review to show that these communities are already changing the Dutch energy system, by connecting to regime actors. Their further advancement depends on strengthening their links to established actors, but also on providing a favorable regulatory framework.

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Keywords: Multi Level Perspective, social niche, social innovation, renewable energy communities

5.1 Introduction

Transitions, that is, large scale transformations of a societal subsystem, offer a specific way to conceptualize futures: as long-term processes which involve radical shifts to novel configurations, and mobilise multiple actors (Verbong and Loorbach, 2012). In transition studies, these processes are typically assumed to have an explicitly normative orientation, focusing on the elusive concept of sustainability: for instance energy transitions have been advocated to address multiple challenges that the energy system faces, such as rapid depletion of resources, air pollution, greenhouse gas emissions, energy poverty and nuclear risks (Markard et al., 2012). The literature is less clear about the agents of this energy transition, and the concrete activities that can lead to transitions, even though several methods are advocated, such as strategic niche management (Schot and Geels, 2008) and transition management (Loorbach and Rotmans, 2010), which both build on the multi-level perspective (MLP). However, these transition theories have been criticized for, among other reasons, neglecting agency (Geels and Schot, 2007; Hoffman, 2013; Smith et al., 2005; Vasileiadou and Safarzyńska, 2010) and putting too much emphasis on technological niches (Berkhout et al., 2004; Geels, 2005), even though some more recent work has tried to address both challenges (Neuvonen et al., 2014). In addition, grassroots initiatives have been somewhat neglected as potential niches (Seyfang et al., 2014) in which both technological and social innovations can develop (Seyfang and Smith, 2007).

In this article we introduce a special type of grassroots initiative, namely renewable energy communities (RECs), which can be drivers of energy transitions. Such communities produce or invest in the production of renewable energy to cover their own energy needs, and they have become
quite numerous over the last decade in many western countries\textsuperscript{53}. Exploring the transition potential of such communities enables us to also take a new perspective on sustainability transitions into account, focusing not on the technological aspects, but on social aspects and the agents behind sustainability transitions. As such, we view niche activity as fundamental in bringing about such transitions.

The question we address in this paper is to what extent renewable energy communities, as social niches, have the potential to scale up and contribute to energy transitions. To answer this question, we introduce three proxies for measuring the transition potential of social innovations, based on Geels and Schot’s (Geels and Schot, 2007) four proxies for measuring the transition potential of technological innovations, and we examine some of these communities. For our analysis, we use the results of a comparative case study, which focuses on four different cases in the Netherlands. We provide an overview of the state of RECs in the Netherlands, from both demand side and supply side perspectives, examining all the services, as well as legislation and policies in force that are related to them. In addition, through our cases we illustrate the heterogeneity of communities with regard to their locations, size, technologies and motivations.

Thereby we contribute to transition studies, by focusing on elements that are rarely taken into account, namely: demand side factors as well as the role of civil society in transitions. We further elaborate the notion of niches, in order to provide a comprehensive answer on how social innovations evolve and transform the incumbent energy system. Thus, besides studying the state of renewable energy initiatives in the Netherlands from the transitions perspective, we also contribute to a better understanding of sustainability transitions.

\textsuperscript{53} http://www.rescoop.eu/rescoop-map
5.2 Theoretical framework

5.2.1 Multi-level perspective

To study the transition potential of renewable energy communities we use the framework of the multi-level perspective (MLP), which helps us gain a better understanding of socio-technical (ST) transitions, how innovations emerge and how they shift the incumbent regime toward sustainability. The MLP distinguishes between three interdependent system levels through which transition occurs: the landscape, the regime and the niche levels. The three socio-technical levels are forming a nested hierarchy and their co-evolution is necessary for transition. According to the traditional or niche-driven typology of transitions (Quitzau et al., 2013), the regime is in favor of incremental changes, which reinforce the dominance of current actors and technologies; therefore only radical changes can induce transition (Elzen and Wieczorek, 2005). When mismatches occur at landscape level or within the regime ‘windows of opportunity’ arise, where radical innovations (innovations that are fundamentally different from solutions used by the incumbent regime and that consist in a high degree of new knowledge (Dewar and Dutton, 1986)) can break through and enter the meso-level of the ST system.

Accordingly, some time after new radical technologies have emerged in niches, they can leave these protected spaces, take over from the incumbents and, together with wider changes, form a new regime (Geels, 2004). This process takes place step by step, when changes in one element of the regime (e.g. the emergence of a new technology) induce changes in other elements, thereby reconfiguring the entire system. Consequently, new regimes may grow out of old ones (van den Ende and Kemp, 1999).

Landscape

The macro or landscape level represents external processes and factors that influence the regime, and it is beyond the control of the meso-level’s actors. A distinction can be made between slow changes (such as macro-economic or macro-political developments, cultural or demographic
changes, climate change) and relatively rapid developments that can create an external shock to the regime (such as wars, oil or economic crises, floods, extreme droughts, etc.) (Geels, 2005). Changes at the landscape level either reinforce the incumbent trajectories or put pressure on the regime. This pressure destabilizes the regime’s structure and creates windows of opportunity, where radical innovations can break through (Geels, 2002).

**Regime**

The socio-technical regime is a semi-coherent set of rules put into practice by different social groups and located between the landscape and niche levels (Geels, 2002). Within the socio-technical regime several sub-regimes can be found (science regime, policy regime, socio-cultural regime and the users, markets and distribution networks regime), which represent different social groups and which are aligned to each other by rules. The ST regime, however, does not include the entirety of these regimes; it is rather a grammar or rule set among them (Geels, 2004). In contrast, Safarzyńska et al. (Safarzyńska et al., 2012) define the regime as a combination of tangible and intangible elements which encompass besides rules also material artifacts. Alkemade et al. (Alkemade et al., 2009) describe the regime as an interdependent complex system composed of numerous combinations of subsystems. They argue that it is built up from several interdependent subsystems combined in different ways, which determine the fitness of the regime; all possible combinations of subsystems form the design space of the regime.

Thus, within the socio-technical regime, several sub-regimes representing different social groups are linked to each other by a semi-coherent set of rules. The rules that connect them determine the development of innovations that, according to Geels (Geels, 2002), at the regime level are merely of an incremental nature. This provides stability to the regime, which is resistant to radical change.

Transition scholars agree that the regime is characterized by path dependence and lock-in (Unruh, 2000), which reinforce the dominance of the in-
cumbent actors, technologies, rules, institutions, practices and infrastructure, thereby stabilizing it.

Niches

Niches form the micro-level of the socio-technical system; they provide protected spaces for innovations (Geels, 2004). Niches create special conditions for new technologies, which would not be able to succeed under market circumstances due to their low technical or economic performance. The niche actors are assumed to develop innovations with the intention that they will be used in the regime or even that they become the dominant technologies in the regime (Geels, 2011).

Nevertheless, the MLP theory has been criticized by several scholars (Kern, 2012; Markard and Truffer, 2008; Smith et al., 2010), among other reasons, for focusing exclusively on technology and neglecting thereby social and cultural aspects in transition (Geels, 2005) and for referring to innovations as technical artifacts without considering other options, such as social or grassroots innovations (Seyfang et al., 2010). The MLP underplays the effects of social and cultural aspects that co-evolve with technologies during a transition (Genus and Coles, 2008). Addressing these criticisms, recent Strategic Niche Management (SNM) literature makes a distinction between market niches (small market segments), technological niches (a sort of ‘laboratories’ for experimenting with new technologies) and social niches, which refer to specific social groups, such as NGOs, governmental organizations or local communities that develop new methods and solutions for their own social problems (Witkamp et al., 2011). A social innovation that develops in a social niche is thus not simply an artifact as a technology, “… but a new way of doing business and solving a social problem driven by an emerging social group” [21 p. 672]. Technological innovations in this respect are not at the center of the niche, but they rather serve as tools for addressing social needs. Renewable energy communities can thus also be regarded as social niches that introduce social innovations in the electricity market, because they combine production and consumption in the household segment, which results in new forms of organizations, busi-
Another shortcoming of much early MLP work is the assumption that all niches have the same purpose, and that the intention of niche actors is to induce transition. Geels and Raven [23 p.379] argue that the niche actors “… are willing to invest resources (money, people) in projects, if they have a shared, positive expectation of a new technology”. Indeed in much early MLP and SNM work, the expectation is that niche actors develop innovations, which would break through in the regime at a later stage (Rob Raven, 2012). However, it is also possible that niche actors do not have the primary aim of ‘sending’ the technology into the regime.

Building on this, we argue that niches can differ with respect to their actors and their purposes. Niches created by market actors who want to invent and develop new technologies for later regime use are different from social groups which have specific needs that cannot be satisfied by incumbent regime products. This latter groups’ (such as grassroots communities or the army) purpose with the niche creation is to nurture innovations that are able to meet their special needs, and it is possible that they only aim at internal use of the innovation (Chilvers and Longhurst, 2016). Consequently, a distinction can be made according to the orientation focus of niches, thereby defining externally and internally oriented niches. Furthermore, we can also differentiate them regarding their application focus. The externally oriented niches are organized around a technological innovation and the other components of the niche are subordinated to it. Contrarily, in the internally oriented niches the emphasis is not on the technology itself: technologies serve more as tools that actors use for their special purposes. In this case social innovations can play as important a role as the new technologies. This distinction between internally and externally oriented niches fits well the distinction of Witkamp et al. (Witkamp et al., 2011), in that most social niches are internally oriented, whereas market and technological niches are typically externally oriented.

In section 3, we analyze renewable energy communities, which, as we will argue, form an internally oriented niche. These communities aim for local clean energy production and they are driven by a common social need,
namely to produce energy independently, and by different values, such as environment protection, patriotism by supporting the local economy, or the value of working for the community. Hence their primary goal is to meet these expectations and innovations (both technical and social innovations) are the tools serving these purposes. Thus they have no direct aspiration to develop innovations for later regime use, but only do this for internal utilization. Consequently, RECs constitute an internally oriented, social niche developing grassroots social innovations (Hexaltine et al. 2014). Even though internally oriented, RECs still have the potential to enter the regime and contribute to energy transitions, for instance through a trajectory of emergent transformation of the regime, configuration pathways, or even technological substitution (Geels and Schot, 2007). Indeed Smith et al. (Smith et al., 2005), when describing different transition contexts, suggest that regime transformation may be unintended, and uncoordinated, a contingent outcome of historical processes. We now turn to examine the transition potential of RECs as social niches, by introducing three proxies based on previous studies.

5.2.2 Transition potential

In order to answer our research question, first we have to define proxies according to which we are able to assess the transition potential of social innovations. Geels and Schot (Geels and Schot, 2007) introduced four proxies for technological innovations. The proxies are the following: “(a) learning processes have stabilised in a dominant design, (b) powerful actors have joined the support network, (c) price/performance [ratios] have improved and there are strong expectations of further improvement (e.g. learning curves) and (d) the innovation is used in market niches, which cumulatively amount to more than 5% market share” (Geels and Schot, 2007). Even though they are certainly useful, they are still oriented towards technological innovations. In case of social innovations the first two proxies are still relevant, but they have to be reinterpreted in terms of the social novelties. In addition, we introduce a third proxy, namely the heterogeneity of the niche that, as we will argue, also influences the transition potential. These proxies will be applied to RECs in section 3.
Stabilized learning processes at global system scale

Geels and Schot’s (Geels and Schot, 2007) niche interpretation is based on the MLP definition that sees niches as laboratories where technological innovations develop that leave this protected space when transition occurs. However, for assessing the potential of RECs to lead to transition, we need to avoid the exclusively technological focus at the niche level. Indeed RECs are not about developing a technological innovation, but introduce social innovations, new energy production practices, new behaviors for supporting and managing social groups and new solutions for solving energy autonomy problems. In order to include social and cultural elements in our interpretation of transition, we need a different understanding of niches. We see niches rather as complex systems that consist of all the system elements which can be found in the regime, for instance financial network, suppliers, producers, users, even if they are less developed and not articulated that well.

In other words: in niches certain social groups can develop innovations, not only technological, but also social innovations: new strategies and practices that strengthen civil society and meet social goals (Mulgan et al., 2007). In contrast to the incumbent regime actors, these social groups have a special interest in the innovation and that is why they are willing to invest money, time or energy and take also the risk of failure. Since the innovation might not survive in market circumstances, they have to create the necessary physical and social infrastructure. Thereby a whole new system develops with all the system elements, similar to the socio-technical regime. Niche actors form the user and distributor network, which is built up around the innovations. The practices they use and the patterns they establish provide the socio-cultural elements of the new system. In case the niche reaches a certain size with a large number of actors or generates special features that cannot be regulated by the incumbent rules, or due to the strong advocacy power of the niche actors, the government can be expected to establish new policies specifically targeting them.

Geels and Raven (Geels and Raven, 2006) conceptualize niches as proto-regimes that have a structure similar to the regime, although they consider only the developing network among similar local niches that share the
knowledge and practices with each other thereby forming a global niche (with ‘global’ in this context referring to the whole socio-technical system). Similar to our suggestion of niches as complex systems, Raven (Rob Raven, 2012) modeled the development of the niche from local to global niche-level in five steps, starting with 1) formation of local groups and 2) experimenting with socio-technical innovations, followed by 3) sharing of knowledge and practices with other local groups that lead to 4) the formulation of generic rules and lessons at the global niche-level, resulting in 5) stable and institutionalized forms thereby creating a proto-regime. Markard and Truffer (Markard and Truffer, 2008) also claim that niches are protected spaces, which are similar to the regime in their structure; although the scale of aggregation and stability is much lower in this case.

In summary, niches at local scale that share goals, experiences, practices and knowledge can be considered as one global niche, which thereby becomes a proto-regime (Hielscher et al., 2011). Thus according to our interpretation of Geels and Schot’s first proxy (Geels and Schot, 2007), relevant indicators for measuring the transition potential of social innovations are the common knowledge and goals, as well as the generic rules and lessons that local niches share at the global scale of the socio-technical system.

Support by powerful regime actors

As the MLP theory describes it: transition is a complex process, which requires transformations at all three system levels. Pressure on the regime level provoked by either external landscape processes or internal regime processes opens windows of opportunity where innovations can break through and become dominant (Geels, 2004). Yet, it is not explained what happens to all the other dimensions of the niche when the innovation leaves the protected space and enters the regime. Do they disappear?

This question implies another interpretation of transition: as we discussed above, we see niches as complex systems; when transition occurs the elements of this complex system establish links to incumbent social groups – niches are thus able to influence and change regime elements through the networks they create and form. Consequently, the entire niche that repre-
sents the rule set of new social groups is able to enter the ST regime by creating links between its sub-elements and sub-regimes, thereby destabilizing and shifting these parts of the regime. Moreover, Quitzau et al. (Quitzau et al., 2013) claim that such link up is not just a one sided process, but that in some cases incumbent actors initiate the modification of already existing practices and rules, by this means creating space for radical innovations. This process may trigger changes in the entire ST system; however, it does not necessarily lead to its complete transformation.

As Geels and Schot (Geels and Schot, 2007) also suggest, to assess the transition potential of a niche, it is also important to examine the capacity of a niche to build many and strong links to the sub-regimes and thus gain the support of powerful regime actors, for instance, financial institutions, or policy makers. The more and the stronger links (i.e. financial support, information exchange, education, political lobbying, etc.) the niche is able to set up, the stronger its position becomes in the ST regime, which is more likely to result in a successful transition.

Consequently, the breakthrough of the niche and transition can take place, if the niche is able to attract a large number of regime actors and to create strong links with social groups in the sub-regimes. By this means the niche is partly building on the existing regime, but at the same time it alters it and shifts it in a new direction. Therefore we can use as an indicator for the second proxy the types, amounts and/or strength of links between niche and regime actors.

**Heterogeneity**

In addition to the first two proxies to assess the transition potential of social niches based on Geels and Schot (Geels and Schot, 2007), we introduce a third proxy: the heterogeneity of the niche. We argue that heterogeneity is a prerequisite for these communities to have the potential for scaling up (Seyfang and Smith, 2007).

Certainly, social groups that are different from the incumbent regime actors, because they share different values or social needs, can grow to their maximum capacity (Seyfang and Smith, 2006). However, without attract-
ing more actors from the regime, they will never break out of the niche level. Seyfang and Smith (Seyfang and Smith, 2007) distinguish two types of grassroots innovations. The first one does not seek to transform the regime and remains in the grassroots niche and the other one can diffuse and change the regime (Seyfang and Smith, 2006). Grassroots innovations that position themselves in opposition to the incumbent regime and share a specific ideology, thereby forming homogeneous groups, have difficulties scaling up and attracting a wide range of actors from mainstream society. Therefore, the sharing of a homogeneous ideology as motivation behind the formation of the niche leads to difficulties in scaling up. On the other hand, those grassroots communities which can create a new ‘system of provision’, can generate transformation in production and consumption patterns and can create new institutions that provide better solutions for a large variety of actors within the regime, have the capacity for transition. We expect that niches that are heterogeneous enough in terms of the variety of the actors, their motivations, the innovations they use (e.g., within the broad category of RECs, different groups can use wind, solar, biomass or other technologies depending on their special needs and resources) and the conditions they are operating under, have the potential for regime transformation.

This argument about the criterion of the heterogeneity of niches for determining transition potential relates to the suggestion by Hoogma et al. (Hoogma et al., 2002) that the breadth of the niche actor networks is important for learning to occur: networks dominated by regime insiders hinder second-order learning and niche development. Raven (Rob Raven, 2012) also points to the important role of a diversity of actors and local sites in Danish wind energy niche building. Therefore, with respect to RECs as social niches, the proxy of heterogeneity can be understood in two different ways:

1) heterogeneity of the communities regarding their size, location, the technology they use – since these are the most important characteristics of renewable energy communities;
2) heterogeneity of the members in terms of their motivations, education or financial status – which relate to the ideological homogeneity described elsewhere (Seyfang and Smith, 2006).

In summary, the proxies and their indicators for measuring the transition potential of social niches are the following:

<table>
<thead>
<tr>
<th>Proxy</th>
<th>Indicators</th>
</tr>
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| 1     | Stabilized learning processes and generic rules that all the similar local niches share at the global system scale | - Common knowledge and goals or projects  
- Generic rules and lessons  
- Events, associations and platforms for networking |
| 2     | Support of powerful regime actors through links with sub-regimes that strengthen the collaboration between niche and regime actors | - Links with powerful regime actors from different sub-regimes; strength and/or breadth of links |
| 3     | Heterogeneity of the global niche with respect to its communities and members | - Community heterogeneity: size, location, technology  
- Member heterogeneity: motivations, education, financial status, age |

Table 1: Proxies for assessing transition potential and accompanying indicators

The three proxies we introduce are treated as analytically distinct, but they are actually mutually influencing each other, in a feedback loop: for instance, the more heterogeneous the niches are, the more actors of the regime it can draw, and the stronger the networking across the niches is as well. In addition, the more heterogeneous the niches are, the stronger are the learning effects. There may also be negative feedback loops: the niche networking and learning process may endanger innovation, as it could lead to some sort of convergence, or closure of technological and behavioral solutions across the niches. However, the heterogeneity of the
niches prevents such a convergence, and can ensure that learning leads to
different and not uniform technological and behavioral solutions.

5.3 Analysis

5.3.1 Methodology

The empirical analysis is based on systematic literature and documentary
review including reports and websites of organizations that focus on RECs
in the Netherlands, collected in the period 2012–2013. This data was then
examined using the different indicators outlined in Table 1 above.

In addition, to assess the proxy of heterogeneity, we conducted four case
studies in the Netherlands based on 22 semi-structured interviews with
members of RECs, both with the frontrunners, who initiated and invested
more time and effort in these projects, and with average members, whose
contribution was smaller. In each case we had a contact person, who
helped us to get in touch with other community members, so we could do
face-to-face interviews usually by visiting people at their homes. The in-
terview guide covered, among other things, the personal motivations for
participating in a joint investment project, the way they organized the
procurement of the technologies, the barriers they faced, the partners
they cooperated with and the institutional help they received. In addition
to the community members, we also interviewed companies and local
municipalities that helped the communities.

Thus, we use global niche-level data to assess learning processes and sup-
port from regime actors, while we use the case study material to assess
heterogeneity. The latter was deemed necessary to delve into the motiva-
tions of individuals, which could help us assess whether the communities
had mainly ideological reasons or not. Table 2 (below) clarifies the type of
data we analyzed for each proxy, and their accompanying indicators.

The scope conditions for our research population were: 1) the community
that invested in renewable energy is located in the Netherlands; 2) the in-
vestment is a citizen initiative; 3) the members of the initial investment
community (people who bought the technology) live in the same location/region; and 4) all the members of the investment community are shareholders in all or at least one of the technologies. We made a distribution-based case selection, since diverse cases of the population will better reflect the full variety of cases. Consequently, we chose four cases from different locations (village, small town, city), with different sizes and with different technologies and resources (wind, solar, biogas, thermal water).

The selected cases are the following: 1) TexelEnergie, which grew into an energy delivering and producing company from a local citizen initiative, and which today has more than 3,000 shareholders; 2) a houseboat neighborhood in the area Amsterdam Zuid that conducted collective procurement of solar PVs; 3) a collective procurement of solar PVs in a dwelling house in the city of Leeuwarden; and 4) a community in the town Culemborg, which took over the local heating company and now provides heating to the district of Eva-Lanxmeer in the town.

<table>
<thead>
<tr>
<th>Proxy</th>
<th>Indicators</th>
<th>Data used</th>
</tr>
</thead>
</table>
| 1     | Stabilized learning processes and generic rules that all the similar local niches share at the global system scale | - Common knowledge and goals or projects  
- Generic rules and lessons  
- Events, associations and platforms for networking | - Global niche-level: Document analysis, based on annual reports, website documentation, legal documents, consultancy reports, minutes of workshops and various events |
|   | **Support of powerful regime actors** through links with sub-regimes that strengthen the collaboration between niche and regime actors | - Links with powerful regime actors from different sub-regimes; strength and/or breadth of links | - **Global niche-level**: Document analysis, based on annual reports, website documentation, legal documents, consultancy reports, minutes of workshops and various events
- **Four case studies** |
|---|---|---|---|
| 3 | **Heterogeneity of the global niche** with respect to its communities and members | - Community heterogeneity: size, location, technology
- Member heterogeneity: motivations, education, financial status, age | - **Four case studies** (interviews and document analysis) |

**Table 2.** Proxies for assessing transition potential, accompanying indicators and the data used
5.3.2 To what extent do RECs share stabilized learning processes, forming thereby a global niche?

For assessing the transition potential of RECs we start with exploring how RECs at local scale network with each other. Since we want to show how separate communities connect, learn from each other, use the same practices and join for a common goal, thereby forming one global niche, in this sub-section we provide a broader picture of them based on the literature and documentary review we did.

Citizen initiatives dealing with energy are rooted back to the end of the 80s in the Netherlands. There are no precise data on the number of Dutch RECs; however, we can estimate that it lies somewhere between 150–300 (Schwencke, 2012). Although RECs usually work independently and try to develop their business plans for the procurement and installation of the renewable technology on their own, today there are already several platforms, networks and organizations that provide help for them and maintain websites, publish newsletters and organize workshops or education clubs (HIER opgewekt, Nieuwe Nuts Innovatie Netwerk, Wij krijgen kippen, LDEB, Rescoop, Organisatie voor duurzame energie, E-decentraal, Stichting ODE and Energie Plus). Through these platforms communities can learn from each other and be up to date about all the important aspects and news that are necessary for their establishment and operation. In this way separate communities get to know each other, form a social network and learn how to adopt the best practices and how to cope with problems.

Moreover, there are several campaigns for collective procurement, which aim to incentivize people to buy solar PVs or windmill shares collectively (Windvogel, Zeeuwind, Urgenda, Betere Wereld, Natuur en Milieu, Vereniging Eigen Huis, ZonEffect, MetdeZon, Zutphense Energie Transitie and SolarBlitz). Nudge, for example, has a specific campaign, in which they are looking for so-called district mayors, people who would gather local citizens and organize the procurement of solar PVs for them with help from Nudge, thereby facilitating the creation of new RECs.

Other organizations (e.g. Zon op Nederland) facilitate communities whose members have no space for installing solar PVs on their own properties, to
collaborate with farmers or institutions (schools, offices) that can have their roofs rented by the community. One example is *Energie van boer en buur*, a citizen initiative which, together with farmers, invests in solar PVs that are installed on the stables and sheds of the farmers. In its first version citizens contributed €250 to the project, for which they got vouchers in the value of €300 for which they could buy products from the farmers. In the second version of *Energie van boer en buur* there are 27 farms involved throughout the country and the community members invest €300 in exchange for shares and electricity supply (Schwencke, 2012). In many cases these campaigns and organizations grew out of local initiatives, and solutions or procedures that a renewable energy community used once pass on to the others. In this manner they create patterns and new practices that become knowledge capital of the niche.

However, the most important and striking example showing that these communities form a global niche and share common goals, is the organized lobby work aimed at the government for the extension of the so-called ‘saldering’ law. Currently, people are not allowed to supply their own electricity without paying VAT and energy tax, if it is not produced behind their own meters. It means that, in case the electricity installation is not located on the property of the owner, but somewhere else, and the produced electricity is fed into the grid, the person has to pay VAT and energy tax on top of the electricity price that he could sell the energy for, when he buys it back. In case the electricity is produced on the owner’s property, the producer is exempt from the taxes and VAT up to 5,000 kWh per year. This is called ‘saldering’ (which can be translated as: ‘balancing’). However, the regulation cannot be applied either on individual investments in case they lack space for the installation on their own property, or on collective energy production. Therefore, several RECs, together with networking organizations such as the *Wij krijgen kippen*, *Windvogel*, *Klimaatverbond* and *Amsterdam Stadsdeel Zuid*, and with the support of companies (e.g. *Greenchoice*, *Liander* and *ASN*) and university professors
wrote a petition and lobbied extensively for the expansion of the saldering law to also include collective self-supply.\(^{54}\)

Reviewing all these examples we conclude that RECs in the Netherlands can indeed be regarded as one global niche, through stable learning processes organized by several platforms, which encompass all the elements that can be found in the ST regime. They share common knowledge and goals and they become the locus of social innovations in the form of new practices and behavioral patterns.

5.3.3 To what extent do RECs have the support of powerful regime actors through links with sub-regimes?

To collect examples for the links that RECs have established with sub-regimes and for the support they have gained from regime actors we used both the data we collected through reports and websites of organizations that deal with RECs in the Netherlands, and also the data from our interviews.

In general we can state that RECs in the Netherlands have already created several links with sub-regimes. There are numerous national and provincial measures to support the establishment of such communities or help their operation, suggesting that regional and, to an extent, national authorities are supporting RECs. Green Deals are especially targeting them by eliminating obstacles. Firstly, the national government provides financial help for such initiatives through the MKB+ (midden en kleinbedrijf – small and medium business) Innovation Fund and tax deduction for research and development. Secondly, the government helps as mediator in matchmaking and negotiating with all parties involved in community projects. Finally, it tries to reduce unnecessary administrative burden and other legal obstacles. In addition, at provincial and local level we also find cases where the government contributes to the realization of community projects. The municipality of Amsterdam, for example, started a pilot pro-

ject that provides an alternative solution for the lack of collective saldering law. The residents of an apartment complex can do virtual saldering for the electricity produced by their solar PVs set up on their roof.

And not only the government supports RECs, but also companies see the potential in this niche and establish links with it. Greenchoice and Aliander, for example, offer specific leases and loans, they help in the administration of local energy cooperatives, or also find alternative solutions for collective saldering. Windvogel supports local energy initiatives financially. Trianel, Eneco and Anode offer support services, act as intermediaries, use their formal and informal networks in lobbying for self-supply or make Green Deals with the communities. Moreover, in case a community is not able to organize the project itself and needs additional help, there are also several consultancies that are specifically helping local renewable energy projects, such as Relocal, C8 foundation and Eversheds Faasen. Finally, there are several banks, like Triodos bank, Rabobank and ASN bank, that give special loans and also services. Rabobank has specialists that support energy cooperations and Triodos organizes a master class about financial models for energy initiatives.

In our cases we also saw many examples of cooperation with regime actors. In Culemborg the local municipality invested €3,000 in the Thermo Bello project and it also gave a financial guarantee to the bank for the loan (€70,000); thereby the community could get a two percent lower interest rate from the bank. The alderman helped the community to lobby at the provincial level; thereby the Province of Gelderland supported the necessary expansion of the pipelines for the distribution of the heat with €150,000. In the case of the dwelling house in Leeuwarden, the local government provided an expert who helped the community realize the project. When the residents from the houseboat area from Amsterdam wanted to invest in solar PVs, the technology supplier saw the potential in a community project and offered reduced prices, if the people did collective procurement. Finally, the community in Texel cooperated with a local energy company whose professional help was crucial for the realization of such a project.
As we see, there are different links established with the regime. The policy sub-regime regards RECs important enough to create policies for their support, and actors from different governmental levels provide financial and professional help for the investments. There are also actors from the market, distribution and financial sub-regimes that see the potential in these communities and help their establishment and operation by providing loans, support services, or by using their official and unofficial networks for lobbying in their favor to the government. Finally, NGOs and associations that operate in the socio-cultural sub-regime and try to change the carbon dependency of the ST regime from the inside, view RECs as a potential alternative to the fossil based energy system and therefore they support them and set them as examples for incumbent regime actors.

5.3.4 To what extent are RECs heterogeneous in terms of actors, technologies and conditions under which they operate?

Using the third proxy and its indicators for determining the transition potential of RECs we turn our focus to the level of heterogeneity regarding the communities (size, location, technology) and their members (motivations, education, financial status, age). The assessment of this proxy mostly relies on the data we collected in our cases.

We found that the communities were different in their size (ranging from small communities with a few members to large communities having 3,000 members), in their location (an island, a house-boat neighborhood in Amsterdam, a district of a small town or a dwelling house), and in the technology they use (solar PVs, water pumps, wind mills and a starting project on a biomass power plant).

Case 1: The biggest community studied is located in Texel, an island in the north of Holland with a population of 13,644 inhabitants. Around one fourth of the inhabitants are members of the renewable energy community, which has grown into an energy company. TexelEnergie delivers renewable energy, electricity and gas to businesses and private clients in Texel and in the rest of the Netherlands. TexelEnergie buys and sells not only renewable energy, but also produces it from solar PVs and windmills.
Currently the company is also working on a biomass and a smart-grid project. The idea of TexelEnergie was conceived by three local citizens who wanted to support the local economy and help the island to become sustainable. After the involvement of nine other residents, they started the energy initiative in 2007. The news spread on the island and by the end of the first year 600 people joined the project; now there are 3,000 shareholders of the company.

Case 2: A houseboat neighborhood in Amsterdam Zuid constitutes the second renewable energy community studied, which has 50 members. Four local people started the project in 2008, when they wanted to buy solar PVs on their own, but they got an offer from a supplier that, in case they bought PVs in large quantities, they could get them at a reduced price. That is why the four initial citizens involved other people from the neighborhood, who found the option of environment friendly energy production attractive, and the project became a big success. Therefore, the collective procurement was repeated in the two following years.

Case 3: Our third case is a residential community in a dwelling house in Leeuwarden. Eleven households from the building participated in the project, which was initiated by two residents who wanted to make use of the large roof by installing solar PVs. The energy they produce is used by the whole building (association of the owners) and not by individual households; the rest of the energy is sold to the grid. Their main motivation was producing clean energy to protect the environment; besides that, they found it “exciting” to work together and they wanted to gain some profit too.

Case 4: Our final case is different from the previous ones in the sense that the community produces heat and not electricity from renewable energy. Thermo Bello is a district heating company owned by residents in the district EVA Lanxmeer, which is located in Culemborg, a small town near Utrecht. The story of Thermo Bello started in 2006, when Vitens, a public water company wanted to sell its subsidiary, a local heating system. The company distributed heat that is produced in the process of cooling down drinking water. The director of Vitens wanted to sell the heating system as soon as possible. Since there was no big company interested in this system...
at that time, even though he offered it much under market price, he also asked the local municipality and the association of house owners whether they wanted to buy it. Although the municipality didn’t show any interest, there were four residents who saw potential in it and decided to investigate the option of setting up a local energy company and taking over the heating system. Sixty-eight people from the neighborhood participated in the project and contributed either financially or actively to the process. They had diverse motivations. Firstly, they were afraid that Vitens would sell the heating system to a big company, which would then increase the heating price and not give the residents any control. Secondly, they saw it as a challenge and they found it exciting to realize such a project. Finally, they also had ecological reasons. Through a well-managed local community company they could save a lot of energy, which is good for the environment.

Our cases show also heterogeneity in terms of their members. Firstly, we found individuals with heterogeneous motivations in each of the cases. Most of the people claimed that the protection of the environment was their main intention for participating in the project, but also the expected financial benefits played an important role in their decision. Besides that, people who actively participated in the organization process found it a good opportunity to get to know their neighbors and do an inspiring and creative project with them. Furthermore, newcomers found it a great opportunity to get accepted by the community and it made their integration easier.

Secondly, each case is rather heterogeneous in terms of the education level, financial capital and age of the people involved. The community in Amsterdam Zuid is the most striking example of this heterogeneity, with, on the one hand, old, mostly lower educated working-class residents that moved to the house-boats neighborhood in the 60s and 70s, because they did not want to fit in the framework provided by mainstream society. On the other hand, the community also includes a second generation, rather wealthy intellectuals that could afford to live in luxury house-boats in the capital of the Netherlands, when the price of houseboats went up in the last decades.
The variety of conditions (location and size of the community), type of people involved (regarding their age, education and financial capital), motivations and technologies shows that the niche of RECs is heterogeneous, encompassing diverse groups and different people. Consequently, participating in a renewable energy project at community level can be an option for many people. Thus we have evidence to claim that RECs meet also the requirements of the third proxy.

5.4 Conclusions

The aim of this article was to explore the transition potential of renewable energy communities, as social niches, by using and further elaborating the analytical framework of the multi-level perspective. To do so, we introduced three proxies and accompanying indicators, extending earlier theoretical work (Geels and Schot, 2007), to study the transition potential of social innovations and thereby social niches. The first proxy is the generic rules and lessons learned at the global system scale that make similar but separate local niches to compose one global niche. In the case of RECs in the Netherlands we showed that they indeed network and learn from each other and have all the system elements of the regime, thereby forming a proto-regime. The second proxy is the support of powerful actors and links built up with sub-regimes. We described how RECs attract numerous regime actors in the Netherlands, such as the government at the local and provincial level, financial institutions and companies; in such a way RECs thus create useful links to the regime. The third proxy that we introduced is the heterogeneity of the niche regarding its actors, their motivations, the technologies they use and the conditions they are operating under. The more heterogeneous the niche is – which is the case for the examples of RECs in the Netherlands discussed in this article – the more likely it can expand and become an influential part of the regime.

These three proxies of transition potential for social niches have been also discussed in earlier work (Geels and Schot, 2007; Hoogma et al., 2002; RRaven, 2012), albeit not as systematically, or explicitly. The interrelation among these three elements can result either in positive feedback loops, reinforcing the transition potential (the more heterogeneous, the more
learning potential and so on). But it may also result in hindering the transition potential (for instance, the more support from regime actors, the higher the pressure for closure towards traditional solutions and behaviors). Further work is necessary to clarify the interrelations among these three elements, and the different types of transition pathways that result from different types of relations among them. Aside from elaborating the notion of transition potential of social niches, we aimed to make further contributions to transition theory. We reinterpreted the notion of niches and transition paying special attention to social innovations and their role in sustainability transitions. Building on earlier work (Geels and Raven, 2006; Markard and Truffer, 2008; Raven, 2012), we argued that niches are not just protected spaces for the development of innovations, but they constitute complex systems themselves, containing elements similar to those of the regime (actors, rules, material artifacts, practices, etc). Such a conceptualization can also help mainstream the use of methodological tools, such as agent-based modeling, or social network analysis, in studies of niche dynamics; in fact previous work has used such tools, with very interesting results (Caniëls and Romijn, 2008; Lopolito et al., 2011; Safarzyńska and van den Bergh, 2012).

Furthermore, transition does not necessarily mean a complete shift to another regime, since the ST regime itself is not a unitary whole, but rather an interlinked system of several sub-regimes (Genus and Coles, 2008; Witkamp et al., 2011). Thus, changes in some segments do not necessarily lead to the whole transformation of the regime and both technical and social innovations can coexist with incumbent technologies and practices. In addition, each sub-regime is further fragmented by different social groups that have different interests and orientations. Links between diverse social groups from diverse sub-regimes compose the structure of the regime and during transition new links are established with niches, which thereby become a new segment of the entire system.

Such a diagnosis relates to specific future trajectories of niche–regime interactions. Following the typology introduced in previous work (Geels and Schot, 2007), we believe that the situation of RECs in the Netherlands resembles that of a reconfiguration pathway: innovations developed initially in niches, which are adopted by parts of the regime as they solve local
problems, or, create new (business) opportunities, we can add. This adoption by the regime may, in the beginning, leave the basic regime rules unchanged, but as regime actors explore new combinations, and pressures from the landscape add up, such a process can lead to major transformation and regime change (ibid.).

We made a distinction between *internally* and *externally* oriented niches based on their orientation and application focus arguing that the former do not primarily intend to develop innovations for later regime use, but rather to meet internal purposes without having the intention to induce transition. The lack of intention, however, does not necessarily prevent these niches from contributing to sustainability transitions. RECs can be considered as an internally oriented niche that, even without primarily aiming at transition, can build up links with the incumbent regime, and thus have the capacity to scale-up and trigger changes. Although this process does not inevitably lead to a complete regime shift, RECs have the potential for becoming an important part of the current energy system and play a role in the transition toward a sustainable market-economy.

Besides defining their orientation and application focus, we also claimed that RECs are social niches, where new practices, consumer and producer behaviors develop, thereby changing the traditional way of energy production and the role of civil society in the energy transition. Although the emphasis here is on the social innovations, while technological innovations serve more as tools to meet internal needs, both innovations are present and nurtured by the communities that create adequate conditions for them, which are different from market expectations. In this regard, we see differences between social and technological innovations. While technological innovations developing in market or technological niches always entail the emergence of social innovations, such as new practices, generic rules and lessons, if social innovations are in the focus of the niche development, this process does not necessarily require the presence of technological innovations (e.g. bio-agricultural communities, community development) too.

Even though in this article we provided an overview of these communities in the particular institutional and governance setting of the Netherlands,
we have not specifically focused on the influence of institutions and governmental policies on the transition potential of RECs; this remains a point for further research. As a final remark, we have to note here that in case RECs spread in the regime and a very large number of communities decide to invest in renewables, it may result in problems in the operation of the electricity grid. The current energy system is tailored to centralized and large-scale energy production, which is not yet able to bear and balance fluctuating energy supply (Lund, 2007). That is why without restructuring the whole system the large spread of renewables and thereby RECs is impossible in the future. The concept of ‘smart grid’ could provide a possible solution for this problem (Grijalva and Tariq, 2011). Further empirical investigation can explore how the development of a ‘smart grid system’ (Hoppe et al., 2015) could help the spread of RECs either in case of one national or several local ‘smart grid’ projects.
Chapter 6 – Conclusions

This thesis has been based on the idea that the transition to a sustainable energy regime, which is required to avoid the dramatic consequences of climate change involves not only changes in technology and production patterns, but also necessitates the introduction of new actors, who could invest in renewable energy production. Without a large expansion of renewable energy producers the chances for a transition to a renewable based energy system remain limited. Hence, besides strengthening the current stakeholders of this change, it is also inevitable to explore new groups of actors, who could become the future investors of renewable energy. This thesis has focused on such a group, namely renewable energy communities (RECs), and examined their transition potential. The purpose of this research has been to gain a better understanding of renewable energy communities, so as to assess their potential spread and scaling-up.

6.1 Summary of key findings

The investigation was executed at four different levels through the use of different theoretical lenses (see table 1 for an overview).

<table>
<thead>
<tr>
<th>Societal level of investigation</th>
<th>Aspects studied</th>
<th>Theoretical lens of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual level</td>
<td>Personal motivation for community investment</td>
<td>Goal-framing theory</td>
</tr>
<tr>
<td>Group level</td>
<td>Group formation and project organization methods of RECs</td>
<td>Collective action theory, Teamwork theory, Grassroots theory</td>
</tr>
<tr>
<td>Institutional level</td>
<td>Support instruments from the RECs’ perspective</td>
<td>Investor-oriented risk assessment</td>
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</tbody>
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Table 1: Levels of analysis, aspects studied and theoretical lenses applied

<table>
<thead>
<tr>
<th>Levels of analysis</th>
<th>Aspects studied</th>
<th>Theoretical lenses applied</th>
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<tr>
<td>System level</td>
<td>Transition potential of RECs as a social niche</td>
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</tr>
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</table>

In this way external factors that could possibly influence RECs, such as the influence of governmental institutions or the location of the communities, were considered. The key findings of the research are illustrated in the following.

At individual level, the research investigated personal motivations for joining a renewable energy community and investing in joint renewable energy projects by using Lindenberg’s goal-framing theory (2007). The results show that regardless of size, location and applied technology, the members of all investigated communities were driven mainly by gain and normative motivations and hedonic considerations played a minor role.

At group level, the research found that contrary to Olson’s (1965) expectation about voluntary collective action, renewable energy communities can realize a project of a certain complexity while counting on only a limited number of volunteers who develop the project without receiving any additional reward and who are also willing to accept free-riding. However, the larger the size of the community and the higher the complexity of the project (varied technology portfolio or technologies that generate both heat and electricity), the more likely it is that the community needs to take a formally organized structure or count on external help (expert, manager). Therefore, the investigation indicated that these two factors, the size of the community and the complexity of the project, influence the composition and structure of RECs.

At institutional level, based on Dinica’s risk assessment framework (2006) the research assessed the effectiveness of national support instruments in decreasing investors’ risks from the perspective of RECs. The analysis revealed differences between the German and the Dutch institutional contexts. The German system provides an optimal investment context (the
support system ensures high profitability potential with low risk) that largely decreases or eliminates all the investors’ risks, while the Dutch support instruments are less supportive in this regard or benefit only small-scale energy producers (below 10MW/h). The latter instruments negatively affected the ambition of RECs to scale up their projects. Furthermore, the lack of sufficient risk assessment in the Netherlands resulted in fewer and simpler projects in terms of portfolio of technologies compared to Germany.

At system level, three proxies were introduced to assess the transition potential of RECs as social niches (*1.Stabilized learning processes at global system scale, 2.Support by powerful regime actors, 3.Heterogeneity*). First, the investigation concluded that RECs learn from each other, establish networks and use similar practices and production patterns thereby forming a global level niche. Second, they enjoy the support of powerful regime actors such as energy companies, banks, local governments, etc. and they establish links to sub-regimes (e.g. financial, policy, energy). Third, RECs are heterogeneous in terms of their actors, the technologies they use and the conditions they are operating under. This heterogeneity increases the likelihood that their niche can expand and become an influential part of the regime. The interrelation among these three elements can result in positive feedback loops, thus increasing the RECs’ transition potential.

### 6.2 Reflections on the interplay of the findings

Besides listing the main findings it is also important to see the results of the research in their interplay, which requires an interconnected summary that links results at different levels while looking at different aspects. Hence, in the following some reflections on the interplay of the findings at individual, group, institutional and system level are presented.

#### 6.2.1 Interplay of findings at individual and group levels

A first observation is that neither the location nor the institutional background had an influence on personal motivations and group for-
information/organization. Thus, regardless of whether a REC was located in a village or in a city, in Germany or in the Netherlands, the most dominant motivations were related to the gain goal-frame, followed by normative motives. Similarly, at the group level neither the location nor the institutional factors appeared to be influential, but rather the complexity of the project and the size of the investment community shaped the way community members realized their projects.

Secondly, there was no difference between frontrunners (members who participated in the organization of the project, besides financially supporting the project) and average members (those who participated only in making the most important decisions and financially supported the project) in terms of the dominant motivations to invest in renewables jointly, thus mainly the same gain and normative triggers lead people to join RECs regardless of their later role in the project organization (frontrunner or average member). However, the motives behind the altruistic behavior of participating in a working group and delivering the tasks on a voluntary basis were mostly hedonistic (e.g. the wish to integrate into the local community, to receive media attention or to work together with others to have fun and get to know fellow citizens) and normative goal-frames (e.g. to receive honor and appreciation of others, to increase the living standards). Thus, joining a REC is primarily defined by gain and/or normative considerations, while the decision to participate in the project organization (i.e. to become a frontrunner) is mainly driven by hedonic and partly normative reasons.

Besides having the initial motivations to join a REC, frontrunners, who worked voluntarily on the project without receiving any reward for their job, needed to maintain high levels of enthusiasm and motivation throughout the implementation of the project. In case, for example, one of them decided to quit, the other members of the group could do nothing but accept the decision and take over the tasks. In general, in such a situation to prevent the disintegration of the group, the continuous reinforcement of the motivations of the remaining members of the group was necessary. It was found that such a reinforcement of the motivation – where it was needed – was achieved by the constant involvement of the members of the group into the decision making process and completion of the
tasks, the continuous share of information across group members and the regular setting and achieving of small goals showing that the project was progressing.

6.2.2 Interplay of findings at individual and institutional levels

Actions, however, are not only influenced by motivations and the behavior of other members of the community; they are also affected by the social context and the institutional structure in which the action takes place (Lindenberg and Foss, 2011). Likewise, the dominance of a particular goal-frame in a given situation – and thus the motivations having the most effect on individual actions – is also influenced by institutions. If institutions reinforce the motivations within the dominant goal-frame, people choose the top option and act accordingly. For example, the support of the local governments or of national policy instruments could strengthen gain motivations. Many of the interviewees claimed that without the help of the Renewable Sources Act (EEG) in Germany they would not have decided to participate in the project. Since this instrument substantially decreased several risks of the investments and thereby increased the chance for its profitability, EEG reinforced the already existing gain motivations. In this case, the dominant motivations in the gain goal-frame were further strengthened by the institutional goal-signal affecting gain considerations.

However, if institutions give goal-signals that oppose the dominant motivations, it will weaken the dominant goal-frame (Lindenberg and Steg, 2007). In the Netherlands, for example, support instruments have provided advantageous conditions only for small-scale projects, while electricity purchase above 10 MW/h has suffered from high output price, demand and contract risks. High risks endanger the cost-efficiency of the investment in the long run. As such, institutions gave a goal-signal to the people’s gain goal-frame, incentivizing them either to modify the top option or aim at lower ambition level (i.e. to decrease the quality or the complexity of the investment) or, in order to avoid a disadvantageous investment, to withdraw from the plan. This was the main reason why Dutch RECs had much simpler projects than the German communities, even though their
members originally had the same willingness and motivations to invest in renewable energy.

6.2.3 Interplay of findings at individual and system levels

At system level the transition potential of RECs as social niches was assessed according to three proxies that have relevance also at individual level. First, it was showed that RECs form a global-level niche. Separate RECs connect through platforms, networks and organizations, where they exchange experiences and learn from each other and join for a common goal. At the same time, they also run campaigns to raise awareness among citizens or to incentivize individuals to form new renewable energy communities. The knowledge and help that these organizations provide reduce uncertainty and transaction costs at the initial phase of the investment, which in turn reinforced gain motivations to invest in renewables in a community.

Second, RECs also enjoy the support of different regime actors and they established links to sub-regimes. For example, NGOs and associations that operate in the socio-cultural sub-regime and try to change the carbon dependency of the socio-technical regime from the inside considered RECs as a potential alternative to the current fossil-based energy system and set them as examples for incumbent regime actors. Those organizations populate the idea of community-based energy production, which provide normative triggers for individuals to invest in renewables jointly.

Third, it was also shown that RECs have a high transition potential, because they are heterogeneous enough (both in terms of the communities regarding their size, location and the technology they use and in terms of the members regarding their motivations, education and financial status) to attract a wide range of actors within the regime to join them. At the individual level, a large variety of motivations could be found for joint renewable investments, from gain through normative to hedonic ones, hence different people driven by different motivations could all meet their expectations in such a community project. Besides that, RECs also showed
a high level of heterogeneity in terms of education level, financial capital and the age of the people involved.

6.2.4 Interplay of findings at group and institutional levels

While the national support instruments had a visible influence on individual motivations to join a REC and invest in renewable energy, according to the results they had no direct influence on the group formation and project operation in either Germany or the Netherlands. In this regard, what mattered were the size of the community and the complexity of the project. However, the ability of the support system to reduce investment risks was in a strong correlation with the ambition level of REC members and thereby with the complexity of the project. Since RECs tend to be more risk averse compared to traditional commercial actors in the electricity market\(^5\), only within the optimal investment context that ensures low level of investment risks and high profitability are they willing to aim for high ambition level (even 100% self-sufficiency) and for high complexity projects (e.g. combining different technologies including expensive and complex ones, generate electricity and heat at the same time). This effective capacity to assess and take risks in Germany led to a higher number and more complex REC projects compared to the Netherlands.

Furthermore, the higher the risk of the investment, the more the trust among the members matter (Walker et al. 2007). In other words, the higher the risk of the investment, the more likely it is that only strong communities\(^6\) can realize renewable energy projects, because they are more likely to cooperate with each other and have a formal agreement on task distribution, rights and mandates of the members, or the phases of the project development, which are essential conditions to cope with conflicts and risks. At the group level, transparency, a continuous flow of information and the introduction of a code of conduct have shown to in-

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55 This is due to their lack of entrepreneurial experience and inability to mitigate risks by dividing investment across more projects (Enzenberger et al., 2003).

56 In a strong residential community people know each other personally, the level of trust between the residents is high and already established normative rules regulate interpersonal relationships.
crease the level of trust, thus mitigating the risks of the investment. At the institutional level, support instruments that are able to address, reduce and eliminate the risks of community investment (such as the Germany Renewable Energy Sources Act) could create the best environment for community investments.

6.2.5 Interplay of findings at group and system levels

The investigation at system level came to the conclusion that RECs have established several powerful links to sub-regimes. The RECs’ niche is partly building on the existing regime, but at the same time it alters it and shifts it in a new direction, by introducing new actors, new behaviors, new production patterns and new technological solutions. As a consequence, at group level RECs can benefit from the support of NGOs and market actors who could collect and provide best practices and additional services to them or take over the lead in project development. In other words, there are already several actors from the market, distribution and financial sub-regimes who see the potential in these communities and help their establishment and operation by providing loans, support services, or by using their official and unofficial networks for lobbying in their favor before the government.

6.2.6 Interplay of findings at institutional and system levels

At system level the first two proxies (i.e. RECs form a global level niche and they enjoy the support of powerful regime actors) that help assess the transition potential of renewable energy communities had also relevance at institutional level. The most striking example of the first proxy that shows that RECs share common goals and thereby form a global level niche is the organized lobby work aimed at government to extend the Dutch saldering law (providing tax exemption for small-scale producers, mainly individuals) to also collective self-supply.57 As such, RECs at system

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57 This initiative could achieve some change the regulations (although RECs are still not eligible for the saldering, they can apply for 7,5 € cent per MWh deduction from the energy tax and VAT) even if it is less advantageous that they originally aimed for.
level form a global level niche and try to change the institutional conditions of the ST regime in their favor.

The same example is relevant from the perspective of the second proxy, as it shows that RECs have already established links with sub-regimes and receive the support from powerful regime actors. This research has found also other examples proving that the policy sub-regime regards RECs as important enough to create policies in their support, including financial and professional help. In the Netherlands, for example, the *Green Deals* policy especially targets RECs by eliminating a number of obstacles to investment. Firstly, it provides financial help for such initiatives through the MKB+ (*middelenkleinbedrijf* – small and medium business) Innovation Fund and tax deduction for research and development. Secondly, the government helps as mediator in matchmaking and negotiating with all parties involved in community projects. Thirdly, again the government tries to reduce unnecessary administrative burden and other legal obstacles. Finally, at provincial and local level there are also cases where the government contributes to the realization of community projects.

### 6.3 Limitations of the thesis and recommendations for further research

Even though the research aimed to study renewable energy communities at many levels and with regard to several aspects, the framework of the PhD research (limited availability of time and resources) restricted the scope of the investigation. First of all, only qualitative methods were applied, based on a limited amount of data and number of case studies. The study of a larger number of communities and the use of quantitative methods, such as questionnaires, could increase the significance of the results.

Second, this investigation has focused exclusively on successful cases, therefore the results are based on a comparison of RECs that *could* realize their project, implement technologies and generate energy that benefits all the members of the investment community. However, it would be very interesting to understand also the reasons for failure in other projects,
and explore further the factors that make a renewable energy project at the community level successful.

Third, the cases studied in this research were not only successful, but also all the selected RECs were formed in already existing strong communities, where people knew each other personally and the level of trust was high among the residents. These conditions seem crucial for the success of project organization, because people had to trust the frontrunners that the project they financed would indeed benefit the community. Trust was necessary when difficulties occurred, as when the implementation time was prolonged. However, it would be also interesting to see how communities with weak ties among their members can organize energy projects and cope with the problems of collective action. Are there also in these cases altruistic people willing to take over the organization tasks voluntarily and become frontrunners, or do they use different solutions to successfully deliver the project?

Finally, the research studied the influence of governmental institutions on RECs, how adequate support instruments addressing investment risks can increase the ambition level of the communities, or the other way around, i.e. decrease the complexity of the projects if risks are comparably high. However, there are other factors that could potentially influence the ambition level or success of community based energy projects, such as local opposition, unforeseen financial or technological difficulties, or the lack of volunteers and professional help for delivering the project, etc. Further research should unfold in what form and to what extent these other factors can indeed influence or endanger the success of REC projects.

6.4 Final considerations

This research made several theoretical and methodological contributions. It introduced proxies and accompanying indicators, extending earlier theoretical work on socio-technical transitions, to study the transition potential of social innovations and associated social niches. It also reinterpreted the notion of niches and the way how transition occurs, paying special attention to social innovations developing besides technological innovations.
Further, it also made a distinction between internally and externally oriented niches based on their orientation and application focus, claiming that RECs are internally oriented social niches that develop innovations for internal purposes and not for later regime use.

The findings also showed that contrary to Olson’s (1965) expectation about voluntary collective action, it is possible to organize a project based on the voluntary contributions of only a few members. Thus the way how RECs dealt with free-riding was by accepting it, through the willingness of some altruistic members to create the collective good that benefited all members of the community without receiving any reward for their work. However, the larger the size of the community and the complexity of the project the more likely it is that the group needs to formally organize the procedure or count on external help.

Contributions to Dinica’s (2006) investor-oriented risk assessment framework were the introduction of new indicators and the testing of this theoretical evaluation method in practice. In addition, the research approached the investors as not one homogenous group, but made a distinction between different types of investors (individual, community, firm). It was argued that the level of initial capital, the level of ambition regarding the type and complexity of their projects, or the extent to which they are risk averse can vary among the three investor categories. As a methodological contribution, the research used interviews to gain a better understanding on the perception of investors to see whether the policy makers’ intentions with certain instruments could succeed in their objective.

Finally, the social relevance of this research deserves to be highlighted, since the adequate and tailor-made support of renewable energy communities would benefit not only their members, but it could also strengthen their links to actors in sub-regimes and thereby contribute to energy transitions. The significant increase of the share of renewables in the energy market is impossible without a large involvement of new investors, and it will be essential to support a new potential group that emerges and is ready to take part in the change process. Adequate support can come only from a thorough understanding of this group’s motivations, expectations,
capacities and needs. This research has hopefully contributed to further the understanding of such emerging groups.
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Appendix 1 – Description of project development in all the cases

Jühnde

The idea of a self-sufficient bio-energy village was developed in the University of Göttingen in 2001 as an experiment for a complete shift from fossil energy production to renewables. The university contacted several villages, to choose the village that could participate in the experiment. In each village, the researchers gave a presentation of the danger of climate change and the depleting fossil-fuel resources and of the financial and environmental benefits of a bio-energy project. The community in Jühnde showed such a large interest that the mayor together with other members and local farmers organized a field trip to a wood chip heating system and to a biogas power plant to learn more about these installations.

On the same day of the field trip, the villagers founded an initiative named “Initiative Bioenergiedorf Jühnde“. Its mission was to create knowledge on bio-energy in the community, to determine a position towards bio-energy and later to actively support the campaign to get selected by the university. Several working groups were organized within this initiative according to the different professions and interests of the community members.
Finally, Jühnde was selected across 54 villages on the basis of local support (more than two thirds of the people supported the project) and agriculture, since the farmers were able and willing to produce crops for the biogas power plant. At the beginning of the project, the university actively participated in the organization of the working groups. However, after some time, the researchers retained an observing position. In the following years, the villagers became more and more independent towards the moment that the whole system started operating in 2005. During the whole process, the community was involved in all decision making.

After 2005, the project was led by a project manager from Eco-Institute, a private company that supported the foundation of the local cooperative. Today 70% of the local residents are members of the cooperative, which organized the whole process within four years. At present, 12 other villages in the region want to become the next bio-energy village.

**Freiamt**

The community project started in 1996, when an external investor approached the villagers to buy land in Freiamt in order to construct wind farms. The population reacted in a skeptical way and nobody sold their land. Instead, some community members got curious about this option and wanted to investigate whether there was a potential to gain money with wind energy. Hence, seven community members founded an association for the promotion of wind power (Verein zur Förderung der Windenergie in Freiamt) in 1997, with the aim to set up two windmills. As a first test, the association put up a wooden pole in 1997 to make measurements and get data on wind speeds. The results were very promising, so the association concluded in 1999 that it is economically viable to construct a windmill there. The same year, the association started the project to construct two windmills and asked the relevant authorities for the necessary permissions. Two private companies joined the project as partners.

In 2000 a private company (Freiamt Windmühlen GmbH & Co. Beteiligungs KG) was set up in order to execute the project. The company initially had
150 (now 200+) private shareholders, more than 50 of them being community members in Freiamt. Until today five windmills have been constructed and operated by Freiamt Windmühlen GmbH & Co. Beteiligungs KG. All electricity from wind energy in Freiamt is fed into the national grid. The association for wind power is still active today (2015) and according to the village’s mayor, it has established itself as an influential body for all community members. Today, the company has 350 active shareholders with a third of them being community members, while the rest of the shareholders live in neighboring villages.

In addition, Freiamt has more than 240 PV systems installed on private homes. The association for wind energy tried to construct several PV systems jointly with community members. However, there was not much interest from the citizens who rather preferred to install their solar systems individually, without collective action (“If my neighbor puts a PV system on his roof, I will too”). As they said, installation was much easier and cheaper than the wind project, so there was no sense for them to do it collectively. Also, there is a small biogas plant operated by a local farmer. Nineteen private homes and one school are connected to it.

Amsterdam Zuid

Four local people started the project in 2008, when they wanted to buy solar PVs on their own, because that year the local government launched a solar program for subsidizing individual application of solar PVs. However, when the technology supplier offered them 20-30% price discount in case they bought PVs in large quantities, the initiators decided to involve other people from the neighborhood. They organized a meeting in the local association, but not enough people came. So they cooperated with a few other enthusiastic residents to organize a communication campaign to attract as many people as possible. They put advertisements in the local newspaper, distributed leaflets and they also went to each boat personal-
ly. Visiting all the residents one by one proved to be the most effective way of involving people in the project. In the end, 35-40 people joined them.

Finally, one of the initiators ordered all the solar panels, and helped people apply for subsidies. When the solar panels arrived, the people got together and helped each other to put them on the roofs of the boats. After the first year, the initiators repeated the whole project twice. The last time, even though they didn’t go to each people’s house, there were already people who came to them to join. The municipality’s solar program continued in the following years, so they could apply for subsidies again.

**Eva-Lanxmeer**

This district is different from the other parts of the town, and it also has a different history, since it was a planned ecological project of the local municipality. The eco-houses are built around common gardens, which people can cultivate together, producing seasonal fruits and vegetables; no cars are allowed. Besides that, Eva-Lanxmeer can boast a very strong community with an intensive social life. People know each other and every hof (courtyard) has its own projects and parties that the residents organize.

The story of Eva-Lanxmeer started in 2006, when Vitens, a public water company wanted to sell its subsidiary, a local heating system. The company distributed heat emitted in the process of cooling down drinking water. Since there was no big company interested in this system at that time, even though Vitens offered it much under market price, the company also asked the local municipality and the association of house owners whether they wanted to buy it. Although the municipality didn't show any interest, there were four residents who saw the potential in it and decided to investigate the option of setting up a local company and taking over the heating system.
At the beginning of the following year a business development association was set up (Vereniging Ontwikkeling Exploitatie Warmtenet – VOEW) and the local inhabitants could become members of this association. In the end, 68 people joined the association. They set up 4 working groups (financial, organizational, communication and technology) with 5-6 people in each group led by the board members of the association. Everybody worked voluntarily. They put together all the information in a feasibility study and wrote a business plan.

In 2008 they presented it in the next assembly of the Bell (local association - vereniging van eigenaren), which would decide whether to realize this project. The large majority of the people was positive. So they could establish a limited liability company with shares (Thermo Bello). Finally the company started its operation in 2009 and took over the heating system from Vitens.

**Texel**

The story of the company started with three local people who wanted to make the island sustainable and support the local economy. Together with 9 other residents they started the energy initiative in 2007. As a first step they involved the local residents to participate, by the end of the first year 600 people joined the project and now there are 3000 members of the company. In the beginning the company was just an energy distributer that purchased clean energy (electricity and heating) in the stock exchange and distributed it to its customers. Later on they started to produce energy as well, which is planned to replace the distribution in the long run, so they can become exclusively electricity producers. Texel Energy’s future plan is to set up more solar panels, wind mills and they have just started a biomass power plant and a smart grid project.

Since the cooperation was established the members can participate only in the decision making about major investments in a general assembly in every year. The office is responsible for the daily decision making. Between the members (general assembly) and the office there is a third body that is also allowed to make decisions, this is the supervisory board which
appoints the director and controls the office. The members of the board are all experts helping voluntarily the company. They are elected by the generally assembly.

Leeuwarden

The initiative started with three residents of the building, who decided to make use of the big roof and put solar panels on it. The three initiators started to gather information about possible subsidies and suppliers. After gathering all information they asked the other residents whether they want to join. 11 households expressed their interest in the project, so they made a business plan. They also set up a committee that managed the whole process. In the beginning only the initiators were members of this committee and later one more resident joined this group. Finally, they established an association for the management of the project, called Doorzon van Wilhelminastraat.

Since the community did not dispose the sufficient amount for the investment, they decided to ask for a bank loan, but the banks refused this request. Finally, one of the residents offered a loan for the project and the other residents will pay it back bit by bit from their profit. Further, the community negotiated with the tax service about the energy taxes. They argued that because of the community does not make profit with this investment they do not want to pay taxes. The tax service accepted this request.
Appendix 2 – Phases of project development

**INITIAL INVESTIGATION**

**Freiamt**

A group of investors approached Freiamt in the 90s to lease lands for setting up windmills. One of the villagers heard about these meetings and he convinced a few others to wait and think of other options before they sign any of the offered contracts. When they found out that the price the investors were offering was very low, they decided not to release their lands. However, this small group of villagers got interested in the idea of setting up windmills in the village. They decided to measure the wind potential to be able to judge if it is worthy to invest.

**Jühnde**

In Jühnde the mayor was contacted by the university researchers to ask him for participation in the competition of becoming the first bio-energy village in Germany. In order to investigate this option he organized field trips and set up working groups with some enthusiastic members to learn more about such a project and be able to decide on the participation.

**Eva-Lanxmeer**

In Eva-Lanxmeer a few local residents found the offer of the water company an interesting opportunity and even though the local association was not interested in purchasing the heating system they wanted to investigate this option.

**Amsterdam Zuid**

The only case where no investigation was done in advance was the project in Amsterdam Zuid, although after the involvement of other residents the investigation of the best technological and financial options were done also in this case.
INFORMING/INVOLVING THE COMMUNITY MEMBERS AND FORMATION OF THE INVESTMENT COMMUNITY

Freiamt

After receiving promising data regarding the wind potential of the hill in Freiamt the core group of initiators became enthusiastic to do this project on their own without giving this opportunity to big investors. The villagers established an association for promoting wind energy in Freiamt and for doing the measurements. They also organized information events where all the residents were invited and could decide on the participation in the project.

Jühnde

The mayor organized a general assembly where he invited the university researchers to give presentation on a bio-energy project and where people could decide on the participation.

Eva-Lanxmeer

In Eva-Lanxmeer, after some unsuccessful information meetings where only a few people showed up, a business development association was set up and the local inhabitants could become members of this association.

Amsterdam Zuid

Only in Amsterdam Zuid there was no need of general assemblies and the approval of the community for the project. In this case the initiators communicated with the residents in emails and personally throughout the whole project, but certainly also in this case all the residents were informed and offered the possibility to join the work of the initiator group.

SETTING UP A WORKING GROUPS / HIRING A MANAGER

Freiamt
After receiving the approval for the preliminary building application they decided to hire a professional manager who could help make all the necessary transactions.

**Jühnde**

The working groups that were already established during the initial investigation phase continued their work after winning the competition; however, this time they got professional help from the researchers who also moderated their meetings. At the same time, for more specific works, such as the planning of the heating-grid, they also hired a manager.

**Eva-Lanxmeer**

A business development association was set up, which had 4 working groups (financial, organizing, communication and technology) with 5-6 people in each group. All the members worked voluntarily. In every working group there was a member of the board of the association and they put together all the information in a feasibility study and wrote a business plan.

**Amsterdam Zuid**

The core group of initiators was responsible for the organization of the project. They did not set up working groups or hire a manager.

**BUSINESS PLAN DEVELOPMENT**

**Freiamt**

The manager was responsible for developing the business plan in close cooperation with the core group members. At a general assembly the whole investment community had to approve it.
The working groups were responsible for the business plan development; however, the researchers helped them with all the specific calculations, such as the capacity of the heating system, the amount of biofuels they needed, etc.

**Eva-Lanxmeer**

The working groups developed the business plan. At the end they organized a general assembly where people could comment it they had to approve it.

**Amsterdam Zuid**

Since it was a rather simple project where people became private owners of the PVs, even though they did the procurement together, there was no need for a business development.

**Setting up a legal entity (cooperation)**

**Freiamt**

They established the Freiamt Windmühlen GmbH und Co KG in order to let the citizens participate in the investment, which has paid employees; the manager became its director.

**Jühnde**

In the beginning there was an initiative. It was very open and privately organized. Then they set up a company (Gbr) that represented the villagers in the negotiations with the ministry. Finally, they set up a cooperative.

**Eva-Lanxmeer**

A business development association was established and the local inhabitants could become members of this association. A private limited company was set up that could represent a community as legal entity. The leaders of the association became the manager and employees in it.
Amsterdam Zuid
Because of the same reason they did not set up any kind of legal entity.

PERMITS / FUNDS / TECHNOLOGY

Freiamt
The manager took care of the project management; the design of the land leasing contracts, the commissioning of the wind turbine producer, the financing, the founding of the company. But he did everything in close agreement with the citizens of Freiamt.

Jühnde
The working groups were responsible for getting the permits and funds. They did an extensive lobbying at all levels of the government to receive funding. They were looking for technologies that perfectly fitted their personal needs.

Eva-Lanxmeer
Since it was an already operating heating system that they took over, there was no need to get permits and choose the best technology; however, they still needed funds for the project, which they got subsidy and bank loan for. The association was responsible for getting the funding.

Amsterdam Zuid
The core group helped the members to apply for the subsidies individually and get the necessary permit. They purchased the technologies together.

CONSTRUCTION

Freiamt
The construction of the windmills was led by the manager and the company.
Jühnde
The construction was supervised by a manager who also planned the heating grid.

Eva-Lanxmeer
They did not have to construct the heating system; however, they still had to take over all the administrative duties of the original owning company. The administration of Vitens was very chaotic; they did not know how they calculated the tariffs for the clients. Some clients were not even registered. The community had to go after the information and ask different people to find answers on these questions.

Amsterdam Zuid
After the PVs were delivered the community members helped each other to set them up on the roofs.

OPERATION

Freiamt
The company led by the manager is responsible for the operation of the windmills. There is also a clear separation of the day-to-day business management tasks, which are executed by the management, and the strategic decisions (like e.g. whether another turbine should be constructed, how high the investment should be, the height of the shareholder distribution) are made by the shareholders. The shareholders can fire the management, they decide over the shareholder distribution and they decide the strategic choices and basic changes.

Jühnde
Today the managing directors of the cooperative receive a salary. They get paid to keep the plant running and to take care that everything is done properly. The managing directors have to ensure that the plant operates economically efficient and they have to invest quite a lot of time in this besides their regular jobs. The supervisory board members get approx. 30 € when they meet.
Eva-Lanxmeer

At the moment the private limited company is responsible for the operation of the technology and the shareholders receive the profit. The employees of the company are paid for their work.

Amsterdam Zuid

Everybody is individually responsible for the operation of his/her PV.

Appendix 3 – Citations of interviewees

FEED-IN SYSTEM

Germany – Freiamt

“The only support was the Renewable Energy Sources Act (EEG), which gave us security for the whole lifespan of the project.” “The EEG gave us security in terms of having a guarantee that we will get a specific amount of money for the electricity during the whole period of the project. With this we weren´t in a situation where you are dependent on the energy supplier who is buying your electricity and who could cancel the contract at any time. Therefore it was very important to have a law that gives you this kind of guarantee.” (Interviewee 1.1); “We were lucky and are still lucky to have the Renewable Energy Sources Act (EEG) and we receive a fixed tariff of about 9 € cent/ kWh.” (Interviewee 1.2); “The project would not had been realized without the Renewable Energy Sources Act (EEG) because with this, you already know in advance how much money you will receive for the electricity you produce. Without this Act we also would not have received any loans from the banks. Besides that the EEG obliges energy suppliers to buy the electricity and to connect us to the grid, which
were crucial.” (Interviewee 1.3); “Without the tariff and the obligation of energy suppliers to buy our electricity regulated in the RESA (EEG) not a single bank would have given us a loan. This is very clear.” (Interviewee 1.4); “The EEG was a success factor too, because it created the economic basis for everything here.” (Interviewee, 1.5)

**Germany – Jühnde**

“This project would not exist without the EEG. Just consider the 800.000 € we generate from electricity and the 200.000 € from heating. You cannot do such a project without that.” (Interviewee, 2.2); “In addition, we did not only receive financial funding from the government but we also received financial support through the EEG. The project would not exist without the EEG, that´s absolutely clear.” (Interviewee, 2.3); “The EEG is designed in a way that you can operate a biogas plant with very good economic benefit. And the EEG influenced us to design the plant in a way so that we could produce as much electricity as possible.” (Interviewee, 2.4); “The EEG was a key factor because the electricity price is so cheap otherwise. We also get additional fee for the manure according to the EEG. The subsidies were very important but we got them only one time, but the feed in tariff is always there.” (Interviewee, 2.5)

**Netherland – Amsterdam Zuid**

**Netherland – Eva-Lanxmeer**

“The SDE and SDE+ helped us to increase our ambition level and aim for more PVs and more self-generation than what we planned initially. It was important for the realization of this project.” (Interviewee, 4.1)
**INVESTMENT INCENTIVES**

**Germany – Freiamt**

“...there were no direct subsidies.” (Interviewee 1.1); “I don´t know about any subsidies we received.” (Interviewee 1.2); “There were no direct subsidies for the project I know of.” (Interviewee 1.3); “There was no direct subsidy from the government. The municipality supported us during the phase when we applied for the construction permit. Like I told you before we had personal meetings with politicians and decision-makers from the authorities and during those meetings the former mayor and the municipality council members were present too. The municipality council as well as the mayor sensed that our project can have a positive benefit/outcome and they supported the negotiations for the construction permit from the very beginning on. And of course, our negotiation position was good because all municipality council members always voted unanimously in favor of our project. This was a clear signal to the district government that everybody in Freiamt supports this project. We really had the feeling that we received a lot of support from the municipality.” (Interviewee, 1.4)

**Germany – Jühnde**

“We received 1.2 Million € from the Federal Agency for Renewable Resources (FNR) that coordinated the area of bioenergy and belonged to the Agricultural Ministry. And we also received 100.000 € from the government of Lower-Saxony. We were disappointed because we would have wished for more money from the federal state and it was really a torture to get those funds. And we received 100.000 € from the regional government in Göttingen, 25.000 from the municipality of Dransfeld and the municipality of Jühnde gave us the property, which is worth 40.000 € as well as 10.000 € in cash because we had to pay a bill. Still, it was very important to get all these funds to keep the project running.” (Interviewee, 2.1); “We only received the funding from the FNR. And 100.000 € from the federal state. We needed that money.” (Interviewee, 2.2); “The ministry gave us 1.3 million € subsidy for the construction of the hot water grid. It took a long time for them to decide how to label the money. They said
that there is some kind of subsidies for pilot projects, but then the villagers had to promise that they will finish the whole project. But all in all, these subsidies were essential, without them we couldn’t have realized the project.” (Interviewee, 2.5)

**Netherland – Amsterdam Zuid**

“We used the so called ‘Green focus’, it is a subsidy which covered 40% of the price in the first year and 20% in the later years. It made everything easier.” (Interviewee, 3.1); “Without the subsidy I think it could have worked. For me it wasn’t that important.” (Interviewee, 3.2); “Yes, we started the whole project just because of the subsidy. We received some subsidy from the local government, called ‘Zon op je dak’, and the national government also gave us subsidies for the heating.” (Interviewee, 3.3); “Back then we couldn’t have realized the project without subsidies. It was very important to convince the people to join the project, because PVs were very expensive that time.” (Interviewee, 3.4); “The subsidy were very important to convince the people to join us, without it I don’t think that so many people would have joined us” (Interviewee, 3.5)

**Netherland – Eva-Lanxmeer**

“We got subsidy from both the government and the regional government. The state subsidy was 30 cent subsidy/ kWh up to 12500 kWh/year maximum, which was very important. The province offered 3000€ incentive grant. Both of the subsidies were crucial for the realization of the project.” (Interviewee, 4.1)

**SOFT LOANS**

**Germany – Freiamt**

“The financial support we received was the preferential loan from the KfW but there were no direct subsidies.” (Interviewee 1.1); “I don’t know exactly if the Commerzbank gave us a loan from the KfW but I think the interest rates were just a bit below the market level.” (Interviewee 1.2);
“The government offered very advantageous loans, namely the KfW loans.” (Interviewee 1.4)

Germany – Jühnde

“We also got bank loan from the Kfw and also some money from the LEADER program which is EU subsidy. (Interviewee, 2.5)

Netherland – Amsterdam Zuid

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Netherland – Eva-Lanxmeer

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TAX INCENTIVES

Germany – Freiamt

Germany – Jühnde

Netherland – Amsterdam Zuid

“We didn’t make use of the saldering, because some electricity compa-
nies, like Greenchoice buy the energy which you feed into the grid. So you
get a better price.” (Interviewee, 3.1); “Saldering was really essential,
without it we wouldn’t have invested in this project.” (Interviewee, 3.2);
“Because of the bad design of the energy taxes [saldering], we couldn’t set
solar panels on the roof of the football club and use that energy in our
homes.” (Interviewee, 3.3); “The saldering was a supportive regulation,
which mattered when people made the investment decision.” (Interview-
eree, 3.4) “We found the support of the saldering very important; it
wouldn’t have been worth it.” (Interviewee, 3.5)

Netherland – Eva-Lanxmeer

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