Journal of Cleaner Production 170 (2018) 581–590

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Understanding the scaling-up of community energy niches through strategic niche management theory: Insights from Finland

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ARTICLE INFO

Article history:
Received 11 April 2017
Received in revised form
15 September 2017
Accepted 15 September 2017
Available online 19 September 2017

Keywords:
Community energy
Niche
Strategic niche management
Scaling-up
Renewable energy

ABSTRACT

The growing phenomenon of civil society involvement in renewable energy generation has attracted researchers' interest. However, rather little is known of how a diverse and relatively small sector such as community energy could scale up and promote a change in energy production. We examine this issue through the lens of Strategic Niche Management (SNM) and conceptualize community energy as a socio-technical niche that holds the potential to promote a transition to renewable energy. Drawing on interview data with members of community energy projects and experts in Finland, we identify different types of community energy projects and the factors that may prevent them from scaling up. The study contributes a typology of community energy projects by showing which initiatives could be more inclined to be part of a strategy aiming at scaling up the sector. It also shows the tensions of SNM in the context of non-market-driven innovation, highlighting how exogenous factors such as cultural aspects, the specific context in which community energy develops and the characteristics of community groups are also relevant in the scaling-up process.

1. Introduction

With a share of 42% of global CO2 emissions, energy production is the human activity that contributes the most to climate change (IEA, 2016). To reduce the emissions in the energy sector, policy-makers have sought to promote renewable energy. However, despite the impressive growth of clean energy sources in recent years their share in global energy consumption remains just 19% (REN21, 2016). Considering that in the next three decades the energy demand is expected to be almost 69% higher than today (IEA, 2016), a rapid transition towards clean energy is needed.

The recent diffusion of renewable energy sources has been triggered by the improved performances and cost reduction of technologies such as solar photovoltaics (PV), heat pumps, small biomass cogeneration (CHP) plants and the use of alternative fuels in transportation (Dhinesh et al., 2017). Together with the rise of renewable energy in transportation and energy generation also smart energy management solutions that allow grid automation are diffusing (Amini et al., 2013). These technologies are not only promoting a change in the conventional way energy is provided but also enabling new actors to participate in energy production and saving. Among them are prosumers, groups of citizens and local communities. Although there is no strict definition, the involvement of these civil society members in energy generation and saving can be defined as community energy (Seyfang et al., 2013).

Within Europe, there are profound differences in the degree of citizens' participation in energy production and saving. Two frequently cited countries that have promoted a successful community energy approach are Germany and Denmark (Walker, 2008). Besides these well-known examples, however, community energy is growing in other countries as well, including the Netherlands (Boon and Dieperink, 2014), Scotland (Bomberg and McEwen, 2012), Spain (Kunze and Becker, 2015), Italy (Wirth, 2014), and England (Seyfang et al., 2013).

The emergent phenomenon of civil society involvement in renewable energy generation has attracted researchers' interest. The extant literature on this topic has dealt with the definition of community energy (Walker and Devine-Wright, 2008), organization form and embeddedness in social movements (Becker et al., 2017), drivers (Walker et al., 2007) and barriers (Bomberg and McEwen, 2012), role in increasing renewable energy acceptance (Ruggiero et al., 2014; Zoellner et al., 2008) and socio-economic benefits (Hain et al., 2005; Phimister and Roberts, 2012). More

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https://doi.org/10.1016/j.jclepro.2017.09.144
0959-6526/

recently, some studies (Seyfang and Haxeltine, 2012) have begun exploring the role a community energy approach may play in accelerating the transition towards clean energy. However, this research remains unclear on how a very diverse and relatively small sector such as community energy could scale up and promote a change in the dominant way of energy production. This is an important question because incumbent energy producers oppose a deeper penetration of renewable energy (Geels, 2014; Ruggiero et al., 2015) due to its negative implications for the profitability of conventional power plants (Ruggiero and Lehkonen, 2017).

To investigate this issue in more depth, we look at the case of Finland, which has recently been showing signs of an emerging community energy approach (Maan Ystävät, 2016; Martiskainen, 2014). We carry out an analysis through the lens of strategic niche management (SNM; Kemp et al., 1998; Schot and Geels, 2008) to address the following research question: What types of projects are emerging in the Finnish community energy niche and what factors could be preventing them from scaling up?

The research analysis relies on 19 semi-structured interviews with two different groups of interviewees: (a) community energy project leaders ($n = 13$), and (b) representatives of various expert organizations and institutions ($n = 11$) that are involved in the community energy sector in Finland.

The paper has two important contributions. First, it provides new empirical data and a typology of community energy projects in the Finnish context, showing which initiatives could be more inclined to be part of a strategy aiming at scaling up. Second, it shows the tensions of SNM in the context of non-market-driven innovation, highlighting how exogenous factors such as cultural aspects, the specific context in which community energy develops and community groups' characteristics are also relevant in the scaling-up process.

The rest of this paper is organized as follows: in Section 2 we describe the theoretical frame underpinning this study and how SNM can be used to guide niche development within the context of community energy. Section 3 explains our research methodology, including details of data collection and analysis. In Section 4 we report the research findings, while Section 5 discusses their significance and Section 6 presents some conclusions.

2. Theoretical framework

2.1. Strategic niche management

Strategic niche management (SNM) emerged in the 1990s to address the problem of why sustainability-oriented innovations such as the electric car would not be able to bridge the gap between R&D and market introduction (Kemp et al., 1998). Building on insights from evolutionary economics, SNM scholars argued that sustainability-oriented innovations do not diffuse because firms, users, policymakers and scientists are bounded by rules. These rules determine the existing engineering practices, corporate governance structures, manufacturing processes and product characteristics (Geels, 2002). The overall set of rules guiding both engineers and social groups constitutes what Geels (2002) calls a "socio-technical regime". Socio-technological regimes provide stability to the activities of different social groups but become locked in and, thus, "path-breaking innovations" do not diffuse (Kemp et al., 1998; Smith and Raven, 2012). However, some scholars (Kemp et al., 1998; Geels, 2002) have observed, on the basis of historical case studies, that socio-technical regimes change and the transformation process takes place in small market niches. Consequently, SNM highlights the importance of artificially creating niches as initial test-beds for radical innovations (Schot and Geels, 2008). Because niches are protective spaces that allow for the experimentation of new social and technological configurations, they are referred to as socio-technical niches (Smith et al., 2016). In the literature there is no clear definition of a socio-technical niche, but it can be understood as a "constellation of culture, practices and structure that deviates from the regime [and] can meet quite specific societal needs, often in unorthodox ways" (Van den Bosch and Rotmans, 2008, p. 31). In this study we conceptualize community energy as a socio-technical niche that holds the potential to promote a transition to renewable energy.

Socio-technical niches are different from market niches (Smith and Raven, 2012). Market niches emerge when a new technology has more advantages than an established one for certain applications or a certain group of users (Schot and Geels, 2008). On the contrary, socio-technical niches are proto-markets in the sense that they precede market niche development (Kemp et al., 2001). Their aim is to temporally protect technological innovation from market pressures that may inhibit its development (Schot and Geels, 2008).

The literature on the development of socio-technical niches centres on the notion of niche nurturing (Kemp et al., 1998). Nurturing involves three important steps: shaping of expectations, learning, and networking (Schot and Geels, 2008). The shaping of expectations is a fundamental step in niche development because it provides direction for learning, attracts attention, and legitimates niche protection (Schot and Geels, 2008). Expectations can contribute to successful niche development when they are shared by many actors, are specific and their content is substantiated by current projects (Schot and Geels, 2008). Learning aims at finding solutions for overcoming barriers that prevent an innovation from functioning properly (Mourik and Raven, 2006). It should not just be limited to the accumulation of facts and data (i.e. first-order learning), but should also stimulate a change in cognitive framing and assumptions (second-order learning) (Schot and Geels, 2008). Networking contributes to create alignment inside a niche and coordinate the actors that can support local projects. It is considered to be most effective when networks are broad, include regime actors and there is substantial resource commitment by its members (Raven et al., 2016).

Another important process discussed in the literature is the scaling-up of niches. *Scaling-up* refers broadly to "moving sustainable practices from experimentation to mainstream" (Van den Bosch and Rotmans, 2008, p. 34). Some authors understand this as the process of niche building from local projects to a global niche (Geels and Raven, 2006; Geels and Deuten, 2006). A global niche emerges with the accumulation of local experiments over time and is taken as an indicator of an emerging community or a field (Geels and Raven, 2006). A global niche develops when local projects start to interact and share cognitive rules (Schot and Geels, 2008). The interaction between projects does not happen automatically but needs to be promoted by dedicated intermediary organizations (Geels and Deuten, 2006). The role of intermediary organizations is to foster networking and the aggregation of knowledge. They translate lessons from local experiments into more generic knowledge and use it to frame and coordinate local projects (Geels and Raven, 2006). This concept of scaling-up is also known as broadening (Van den Bosch and Rotmans, 2008) or accumulation (Naber et al., 2017) and refers essentially to the idea of repeating a sustainability experiment in new contexts and linking it to other domains.

According to other authors, scaling-up is the process by which sustainable practices developed in niches are translated (Smith, 2007) or embedded (Rotmans and Loorbach, 2006) into the regime. They label this second type of scaling-up as the societal embedding of experiments (Deuten et al., 1997; Kivisaari et al., 2004). In this study, we use the first conceptualization of scaling-up, referring to the process of niche building from local projects to a global niche illustrated by Geels and Deuten (2006) and Schot and Geels (2008).

A crucial aspect discussed in more recent literature and linked to the conceptualization of scaling-up is niche empowerment (Smith and Raven, 2012). This process involves activities that allow niche innovation to compete with an incumbent regime. Smith and Raven (2012) have identified two main strategies adopted by key niche actors for niche empowerment: (a) fit and conform, and (b) stretch and transform. The first aims to demonstrate that niche innovation can be perfectly integrated into the existing regime without bringing too much change to existing markets, institutions, infrastructures and base knowledge (Raven et al., 2016). The second, in contrast, tries to change the rules of the game by reforming institutions and setting new norms for sustainability (Smith and Raven, 2012). In both empowerment strategies, narratives are employed by niche advocates as political devices to promote their cause.

Among other things, the SNM approach has been criticized by some authors because of its predominant focus on technology, thus neglecting the more "social" aspect of innovation (Hielscher et al., 2013). For instance, Hegger et al. (2007) point out that because the real challenge in sustainability transitions is more in dealing with the complexity of the social reality rather than in technological improvement, the focus of niche experimentation should be on concepts and guiding principles. This ultimately would broaden the current innovation processes that Hegger et al. (2007, p. 743) see as being "so often dominated by engineers".

SNM has been utilized in the context of community energy studies only in a handful of papers, including Martiskainen (2017), Hargreaves et al. (2013), Seyfang et al. (2014) and Smith et al. (2016). These works have highlighted that even though community energy can be thought of as a form of both social and technological innovation, its key innovative element pertains especially to its social dimension, that is, to the motive to provide initiatives that also have social benefits in mind (Seyfang and Smith, 2007). This less market-driven rationale of community energy projects is in conflict with the core assumption of SNM that expects local projects to be scaled up in a linear way (Hargreaves et al., 2013). Therefore, we use SNM theory to further our understanding of its applicability to the community energy domain and identify the factors that prevent the sector from growing.

2.2. The notion of community energy

Community energy has different definitions depending on the context in which it operates. As a result, there is no unanimous consensus among researchers or practitioners on what the term should mean (for different definitions, see Middlemiss and Parrish, 2010; Parkhill et al., 2015). For example, in the UK context, community energy generally means sustainable energy projects which are initiated, led and developed by a range of civil society actors such as charities, cooperatives and neighbourhood networks (Middlemiss and Parrish, 2010). Such projects are very diverse and include a variety of technologies, group structures and motives for development (Seyfang et al., 2013; Walker and Devine-Wright, 2008). The notion of community (i.e. what it means to act together as a group and develop energy projects) is particularly highlighted in the UK context (Parkhill et al., 2015). In Germany, meanwhile, the term *Bürgerenergie* ('citizens' energy'), is commonly used to indicate community energy projects (Degenhart and Nestle, 2014). A project can be defined as *Bürgerenergie* in a narrow way or in a broad one (IEA-RETD, 2016). In a narrow way, it implies that citizens need to have the majority of the voting rights in an organization running a community project and to live in the region where the investment is made. In contrast, a project is understood to be *Bürgerenergie* in a broad way when the citizens have minority participation and do not all live in the region (what Walker, 2008 also refers to as community of interest). Thus, in Germany the definition of community energy often emphasizes more citizen ownership and control than inclusiveness.

2.3. Community energy in the Finnish context

In Finland two recent examples of community energy initiatives are joint acquisitions of solar panels by private citizens and small towns (Korjonen-Kuusipuro et al., 2017; Ruggiero et al., 2015) and a campaign started by the NGO Friends of the Earth to promote community participation in energy production (Maan Ystävät, 2016). These initiatives are often discussed under the term *lähienergia*, which translates as 'local energy' or 'nearby energy'. The concept of *lähienergia* was first developed by the Finnish Innovation Fund (SITRA), and is defined as "energy saved by a user or users collectively or renewable energy purchased from local production" (Syvänen and Mikkonen, 2011, p. 7). In the Finnish context, local energy can be understood to mean energy saving and renewable energy projects that use local resources and which also have links to community action. Furthermore, while community energy projects address both heat and electricity, in the Finnish context the focus of community energy has often been on heat (Martiskainen, 2014).

Community energy remains relatively small, but there is an increasing interest in small-scale distributed energy production and the possibilities for people to generate their own energy from renewable sources (Varho et al., 2016). The National Energy and Climate Strategy plans of the Finnish government in 2013 recognized that small-scale distributed electricity may play a significant role in reducing the consumption of electricity and increasing energy self-sufficiency (TEM, 2013), even though there is less focus on citizen-led solutions.

In terms of the number of community energy projects established in Finland, there is relatively little knowledge about the sector's current situation and how many community energy projects have actually been established. In 2014, however, the Ministry of Economic Affairs and Employment had a working group for advancing small-scale generation, and its aims included collecting data on small-scale generation and advancing knowledge of the sector's development.

With regard to policy support, Finland has adopted limited policies that would promote small-scale distributed energy production and citizen participation. Over the years, the main objective of policymakers has been to secure cheap energy for energy-intensive industries by giving priority to large centralized solutions (Huttunen, 2014). Currently, small-scale renewable power generation is supported only by investment grants (TEM, 2013). However, they can be awarded only to companies, municipalities and other legal entities such as federations, associations or foundations but not to private individuals (RES-Legal, 2014). For heat production, there is a price-based incentive for CHP plants called a "heat bonus", but it is available only to CHP plants utilizing biogas or biomass with a minimum capacity of 1000 kVA (RES-Legal, 2014).

3. Methodology

Fig. 1 shows the research process followed in this study. The theoretical framework derived from SNM theory was used to create the interview guide and analyse the data. The results obtained were then fed back into the theoretical framework to contribute to the extant theory on the scaling-up of socio-technical niches. Sections 3.1 and 3.2 illustrate the details of how the data was collected and

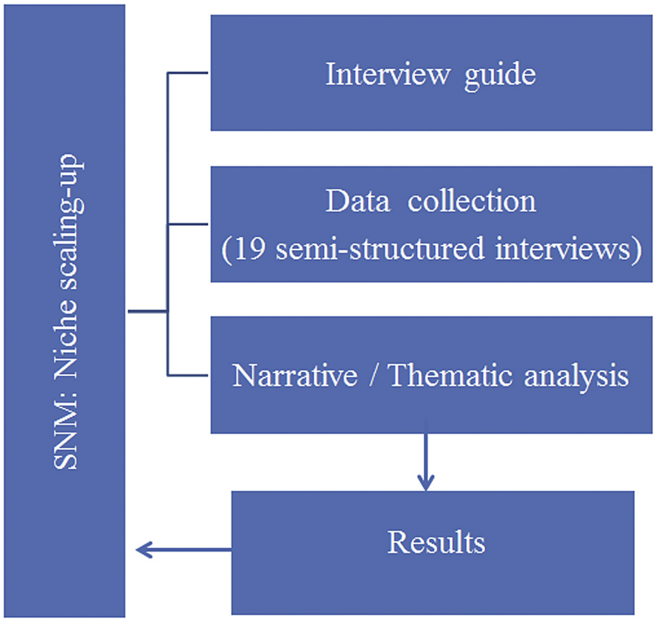

Fig. 1. Research process.

analysed.

3.1. Data collection

This study is based on primary data collected through 19 semi-structured interviews with two groups of interviewees. The first group consisted of people who were directly involved in community energy projects in Finland (i.e. community energy project leaders, $n = 13$). The chosen projects have different ownership models as well as various renewable energy sources (See Table 1). The interviews conducted with community energy project leaders focused on critical success factors for community energy projects and included five key themes as illustrated in the work of Seyfang et al. (2013). These were related to group vision and commitment, the resources needed in project development, relationship with the rest of the community, and the role of networks and policy.

The second group of interviewees consisted of representatives of various expert organizations and institutions that are involved in the community energy sector in Finland ($n = 11$). These were those actors that, as Van den Bosch and Rotmans (2008, p. 35) have stated, "can build an enabling environment for change". The expert interviews focused on key issues surrounding niche development, such as the state of the art of community energy in Finland, the potential for community energy development in Finland and how community energy projects could scale up.

All the interviews were conducted in Finnish and took place between March and June 2016. They were digitally recorded and subsequently transcribed verbatim. The interviewees were given the opportunity to remain anonymous. Therefore, we report in Tables 1 and 2 only some general information about the type of project or organization they belonged to.

Table 2
Description of expert organizations involved in the study and number of interviewees.

Intermediary organizations and niche actors	Number of interviewees
Lobbying organization	1
Expert company	1
Ministry	1
Regulatory agency	1
University	2
Ministry	1
Funding agency	1
Ministry	1
Member of Parliament	1
Solar energy expert	1

3.2. Data analysis

Narrative analysis was used to analyse the transcripts of the interviews with people who were involved in community energy projects in Finland. This method was chosen to create an understanding of how the projects were organized and how social relations were constructed (Eriksson and Kovalainen, 2008). The analysis was based on the belief that narratives are about human action and experience (Eriksson and Kovalainen, 2008). We used narratives to understand the development of the Finnish community energy projects, paying attention to the role of expectations, networking and learning illustrated in SNM theory (Schot and Geels, 2008). In our analysis, our first aim was to construct an abstract of each project based on the interviews. The abstract summarizes the events or incidents of the story (Labov and Waletzky, 1967). For that purpose we coded the section in which interviewees discussed the background and starting points of the projects, the challenges and support during development, and their current situation. On the basis of these, we were able to summarize the abstract of each project. We then integrated themes arising from our theoretical framework: shaping of expectations, learning, and networking (Schot and Geels, 2008). We coded the sections in which interviewees talked about these issues and analysed the meaning given to them in the narratives. We observed that some narratives shared certain aspects, and then started to form our typology of project stories. As a result of this process, three typologies of stories on the development of community energy projects were formed.

On the other hand, the transcripts of the interviews with the various expert organizations and institutions were analysed with a thematic analysis method (Braun and Clarke, 2006). This method was chosen to identify the main themes surrounding the issue of

Table 1
Details of community energy projects included in the study and number of interviewees.

Project	Organizational form	Renewable energy technology	Number of interviewees
1	Development association	Biomass	3
2	Housing company	Solar energy	1
3	Local homeowners' association	Solar energy, heat pump	1
4	Joint ownership between a private company and a cooperative	Biomass, wind energy	1
5	Ecovillage	Biomass	1
6	Cooperative	Small hydropower	1
7	Purchase group	Solar PV	1
8	Cooperative	Wind energy	1
9	Housing company	Biomass	3

how to promote the growth of the Finnish community energy niche. The themes of the interview guide served as a broad framework in which an inductive approach (Thomas, 2006) was used to allow important categories to emerge from the raw data. The written transcripts of the interviews were imported to data analysis software and segments of text that appeared to be meaningful to the research question were coded. Subsequently, all codes were pieced together to see how they could potentially form a category. The initial categories obtained were then reviewed and refined according to the principle of "internal homogeneity and external heterogeneity" (Patton, 2002, p. 465) and classified under the three conceptual themes of shaping of expectations, learning, and networking (Schot and Geels, 2008).

4. Results

4.1. Narratives of community energy project development

Based on the narrative analysis of interviews with project actors, a typology of stories related to community energy project development was formed. We identified three types of community energy projects: cost reduction, technical expertise, and system change. Table 3 reports a short abstract of each of the three types of stories found and the characteristics of the process of networking, learning and articulation of expectations identified in each one of them.

4.1.1. Type 1: cost reduction projects

Type 1 projects were called *cost reduction projects*. These include Projects 1 and 3. The project abstracts describe them as local initiatives, limited to small areas such as a property, a block or a small village community. The main drivers of the projects were either a particular need or the perceived benefits of community energy. In Project 1, the village development association wanted to reutilize the village school that had been closed and for which they needed heating. In Project 3, the main reason was instead the concern of homeowners over rising electricity prices.

In the cost reduction projects, the expectations were cost related. In Project 1, they aimed at low-cost heating and electricity for the old school building that the villagers wanted to use. In Project 3, the main motivation was cost savings, since electricity prices had been rising and households were concerned about energy issues. Environmental reasons played only a minor role. In Project 1, "not causing pollution" was mentioned as a "by-product". In Project 3, environmental reasons were not mentioned as often as increasing understanding of alternative energy sources. During the implementation process, the projects were supported by the local communities and also received publicity in TV news and radio.

Despite the expectations, Project 1 was not profitable at the time of the interview due to value added tax liability. The project participants had not understood before starting the project that this tax needed to be paid. As a result, the project members were planning to generate more income by renting a part of the old school building. In Project 3, the interviewees felt that their targets, especially cost savings, had been reached.

Networking and learning were also intertwined in these projects. Both had a couple of strong key actors as the driving force behind the initiatives, but their skills, expertise and finances were limited. Therefore, they searched for external support. In Project 1, they received help from forest owners and woodchip entrepreneurs in their village, a loan from a bank and financial support from the local Centre for Economic Development, Transport and the Environment (ELY Centre). In Project 3, the initiative was supported by the board of the housing association and they received EU funding from the local rural development association. In addition, they took a loan from a bank before EU funding was received. Technical expertise was provided by two teachers at the local technical college, the administration of the local housing fair, and a professor from a technical university. In both projects, this type of network-based learning was a prerequisite for implementing the project, without which the projects would not have been implemented. However, there was no indication of learning and networking between community energy projects nor was there evidence of interest in expanding the projects.

4.1.2. Type 2: technical expertise projects

Type 2 projects were called *technical expertise projects*. These include Projects 2, 5, 6 and 9. The project abstracts describe them as local initiatives, limited to small areas such as a property, a block or a small village community. All four projects were strongly based on existing know-how among key project members at these locations. The reasons for starting a project varied: an outdated heating system (Project 2), energy self-sufficiency (Project 6), an ecological lifestyle (Project 5), and energy and cost savings (Project 9). In all of the projects, environmental protection or energy self-sufficiency were, in addition to possible cost savings, important sources of motivation.

During the development of the projects, two of them (2, 5) received no external support for planning or implementation. The key project members were not able to identify funding possibilities. In Projects 2 and 9, community members' attitudes were mentioned as a strong supporting factor. In Project 5, the interviewees mentioned ecological lifestyle as the main driver for the renewable energy initiatives. Project 6 was based on an already existing floodgate without which they could have not started the project. Cooperation with the local energy company was mentioned as a supporting factor. On the other hand, technical challenges and the need for learning by doing were mentioned as hindrances, as was the lack of economic incentive in feeding surplus electricity into the grid due to the high distribution fee. In addition to these, Project 9 featured technical difficulties and opposition from local community members due to the noise caused by the pellet delivery truck.

The technical expertise projects seemed to have fulfilled expectations. In Project 2, the goal had been a 50% cost reduction, and it was achieved. In Project 5, the ecovillage members are happy with the results but were still wishing to increase the level of energy self-sufficiency. Project 6, seemed to be profitable and "it is paying itself back". In Project 9, the new system worked well and led to cost savings. In all the technical expertise projects, expectations of cost savings were supported by either environmental reasons or aims for self-sufficiency.

In regards to learning and networking, all the technical expertise projects had active key members who also possessed know-how and practical experience in the field of renewable energy. For this reason, very little evidence of a need for learning in external networks was identified in the interviews. Internal learning in the projects was, however, reported. In Project 2, the key members had prior experience with solar power. In Project 5, the key members of the ecovillage possessed the required know-how, but they also cooperated with a local energy technology firm to find alternative solutions and devices. A local entrepreneur supplied woodchips for them. They also had cooperation with some other eco-communities through voluntary work. In Project 6, the houses involved in the hydropower plant were family members' and one of them had previous technical knowledge of hydropower generation. They received financial support from the local ELY Centre and from the Ministry of Economic Affairs and the Environment. They cooperated with the local energy company to sell excess energy to the local grid. They had no connections with other similar projects. In

Table 3
Typology of Finnish community energy projects.

Type	Project	Abstract	Networking and learning (interlinked throughout the data)	Expectations
Cost reduction projects	1,3	External support as a prerequisite. Aim for low cost, not so much environmental reasons. Local, limited locations. No aim to expand the project.	Closed networks, learning from chosen external support and/or suppliers. No indication of learning and networking between the projects. No experienced need for wider learning since no aims to expand	Lower costs
Technical expertise projects	2,5,6,9	The know-how of key actors as a starting point and motivational factor; environmental reasons equally important (or prioritized). Local, limited locations. No aim to expand the project.	Existing know-how, internal learning in the project. Cooperation with suppliers reported (learning from them). Minor indication of learning and networking between the projects.	Environmental and cost savings
System change projects	4,7,8	Aim to create a new way of producing energy to facilitate societal change. Less limited projects, not so strictly limited locations. Aim to expand.	Strongly based on key actors' existing know-how. Aim to spread information. Open networks, not strongly dependent on small geographical locations. Wider networks, some benchmarking with prior projects.	Interest in increasing renewables Wider new solutions and changes in society

Project 9, the key project members visited similar pellet facilities in the surrounding area and learned how the technology works. They also reported cooperation with the equipment supplier. In contrast to Type 1 projects, Type 2 projects based on technical expertise were less focused on learning in external networks. However, as was the case for Type 1 projects, participants in Type 2 projects expressed a lack of interest in expanding their initiatives.

4.1.3. Type 3: system change projects

Type 3 projects were called system change projects. This type includes Projects 4, 7 and 8. The project abstracts summarize these initiatives as system change projects strongly based on the interest of their members to diffuse certain new technologies or knowledge about renewable energy production. They possessed in-depth information on renewable energy due to their backgrounds. In Projects 7 and 8, the members were private persons, but in Project 8 it was a company. In this project, the need for electricity and heat was combined with a company's need for product development, specifically, to develop a method for electricity and heat production on a local small scale. The project was a result of cooperation between the company's R&D department, employees, business partners responsible for planning the grid, the local municipality and families who wanted to build a small, decentralized system. These actors wanted to focus on local and renewable energy sources. In Projects 7 and 8, the starting point was the concern over climate change and the willingness to increase the use of renewable energy sources. The outcome of Project 7 was a joint purchase of solar panels for 20 detached houses whereas in Project 8 the outcome was the establishment of a wind power cooperative.

Each project faced challenges during the implementation. Project 4 seemed to work technically, but the electricity market regulation hindered its expansion. Project 7 received local media attention, but convincing people to buy solar panels as part of a group was still seen as relatively challenging. Moreover, it was felt that the low solar production in the winter coupled with the high distribution fee paid when electricity is fed into the grid were factors discouraging the use of solar panels in Finland. In Project 8, the bureaucracy related to obtaining authorization to start raising capital on the equity market was seen to be particularly challenging.

At the time of the interview, Projects 4 and 8 were struggling due to financial reasons. Project 4 did not achieve profitability during its first five years. The technical issues were solved but the feed-in tariff scheme and the electricity market regulation hindered it. However, at the time of the interview, heat was used in the local grid and electricity was also being sold to the grid. Project 7 was successful and the amount of members was increasing. Their motives for participating varied from environmental and economic reasons to energy self-sufficiency and having a new hobby. The project was profitable for the members. They used about half of the energy produced and the rest they sold to the grid.

Concerning expectations, Project 4 was established to promote product development for the company, but the profitability aims were not achieved. Project 7 was based on the general interest in increasing solar energy in Finland, and due to its expansion as well as the notable media attention, the project supporters were satisfied with the results. Project 8 aimed at increasing wind power in Finland, but at the time of the interview the profitability goal of the cooperative had not been met.

With regard to networking and learning, the three change agent projects evidenced wider networking than Type 1 and Type 2 projects as well as promoted the participation of multiple actors. Project 4 was focused on learning, since the company wanted to build the project as an experiment. However, learning was reported to happen by trial and error instead of in networking. Project 7 was initiated by two key project members, but it received help from a range of actors. These included the local energy company, which also purchased some of the solar energy produced by the project. The key project members possessed practical experience and technical know-how before the project. The project had a clear aim to expand. They distributed information concerning solar power in their learning workshops and in lectures given by the two project members. Project 8 was based on technical know-how and the interest in wind power of one of its key members. This project networked with similar projects in Finland and Sweden as well as with educational organizations. Those contacts provided them with, for example, information on different ownership structures for wind power production, technical expertise and discussions on opportunities for increasing cooperation. In contrast with the other project types, system change projects were the only group of initiatives showing strong evidence of networking and learning between projects and a clear aim to expand the initiatives.

Fig. 2a, b and 2c illustrate the differences between the three types of projects described above. The black dots represent the community energy projects, the circle around them the niche and the arrows show the direction of learning and networking they have. In Fig. 2a, all the arrows go from the black dots towards outside the circle meaning that cost reduction projects are not interlinked and try to learn and network with actors outside the community energy niche. In Fig. 2b there are fewer arrows from the black dots towards outside because technical expertise projects are more focused on learning internally. The dashed arrow illustrates, however, the presence of some weak interlinks between the projects. In both Fig. 2a and b the circle around the black dots is dashed to illustrate that there is less evidence of niche building. Finally, in Fig. 2c all the arrows point to the black dots because there is evidence of networking and learning among projects within the niche.

The expert interviews showed that while the definition of community energy is usually understood to mean local energy (see 2.2), discussion remained around what forms such local energy could actually take in Finland. Community energy in the Finnish context also includes a range of project types. Examples mentioned by the interviewees ranged from, for instance, the extreme of a village owning and producing its own energy independently from the grid to joint purchases of renewable energy technology or owning shares in a renewable energy project. In the latter case, these were likely to be owned by a utility rather than a community. However, as one interviewee said, “we have to think what different formats this type of communal energy could have”, indicating that the concept of community energy is not set in stone and that there is room for visioning what community energy in the Finnish context means. This visioning also involved the use of good examples of pioneering projects, especially those that would be willing to share issues that did not work out and the challenges linked to such projects.

We would need those brave pioneer examples. Communities who would be ready to provide a face for this issue and also tell about good as well as painful issues, what didn't work and what worked well. People here are quite sceptical about issues that sound too good: it is either marketing or otherwise too good to be true. We ought to find those real user experiences and promote things that way.

The interviews did not show evidence of key actors agreeing on a joint vision of community energy in Finland. On the contrary, several issues remained to be addressed. Some interviewees also felt that there is a need in Finland to consider how the community energy sector could be promoted overall. The sector should not be supported just as “a goal in its own right” but instead the focus should be on increasing renewable energy, efficiency and flexibility in the energy system:

If we get more renewable energy, more efficient systems, and more flexibility within our energy system with it, then there is a good reason to promote it. We have to think about it this way, rather than just support a certain communal energy model for the sake of it.

The same interviewee also mentioned that it would be good to find a replicable model that would make it easier for people to switch to renewable energy. This would also be something that could be supported financially or by some other support means.

Finland's energy policy was seen as being unsupportive of community energy and as more oriented to centralized energy solutions or individual household solutions. Interviewees mentioned especially the Electricity Market Act as a potential barrier to community energy. The Act requires that those who sell electricity outside their own property must connect to the national grid and pay a transfer fee, which is half the price of electricity. This makes, in particular, cooperatively produced energy unprofitable.

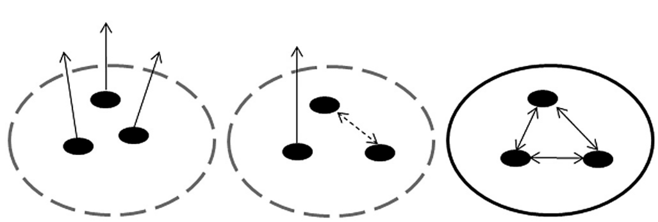

Fig. 2. Typology of community energy projects.

The recognition of small-scale energy production in government programmes and communities working together with energy companies were mentioned as potential solutions for supporting the diffusion of community energy. Furthermore, some of the experts believed that with greater interest in small-scale generation from the public and the EU ambition to introduce new near zero–energy buildings from 2020 onwards, concepts such as building integrated renewable energy will become more relevant in Finland as well.

In addition to policy support, the opportunities for community energy were considered likely to depend on a specific context, such as whether projects are situated in cities, small towns, villages or rural areas. The experts indicated that these locations will face different issues in terms of their resource, skills and knowledge bases as well as their financial and technological solutions.

Regarding what community energy could represent in the Finnish context, interviewees also mentioned cultural aspects. They pointed out that there is a rather strong culture in Finland of watching what your neighbours are doing – that is, whether they have done something before you have or whether you have achieved something first – which could influence community energy projects and shape expectations for the sector. For example, concepts such as joint ownership, which is often used as a model in community energy projects (see e.g. Kunze and Becker, 2015; Seyfang et al., 2013) was relatively rare in Finland – one interviewee mentioned the lack of joint ownership in farming equipment as an example:

> … for instance, in agriculture we have a very limited number of jointly owned combine harvesters. Every farm has its own and this is the case in many other issues. Joint ownership, for some reason, does not feature strongly in our culture. We should talk about it, about why it is not an option for us.

As one interviewee pointed out, however, there are cooperatives in other sectors, with two million in housing alone, regulated by the Limited Liability Housing Companies Act. These could provide great potential for community energy solutions as well because, in a way, the organizational structure is already in place.

In the views of the interviewees there was a need to discuss what ownership of community energy projects could be like, for example, would they be owned by the community itself or some other actor, like a municipality or an energy utility and how they could be financed. In a culture where people are keen to see what others are doing, expectations could be further shaped by obtaining commitment to projects early on through the engagement of communities during the design and planning stage of projects. Furthermore, the experts believed that identifying areas with strong pre-existing community cohesion might be essential to the success of community energy projects: “if you have a strong local community for some other reason, then it could also get involved in energy issues”.

4.1.4. Learning and networking

With regard to learning and networking, the interviews with the experts showed that while there were intermediary organizations active in the sector in Finland, this activity remained limited to a small, albeit increasing, number of organizations and to ad-hoc, rather than strategic, action. In addition, although some of these intermediaries had organized projects focused on small-scale generation and had self-generation as a starting point, they lacked a strong community aspect.

Some of the examples of intermediary activity mentioned in the interviews included the HINKUmap and the Green Doors energy walks organized within the Carbon Neutral Municipalities

(CANEMU, or *HINKU* in Finnish) project initiated by the Finnish Environment Institute. The first is a simple database of projects located in Finland, and it does not provide lessons from those projects. The second is an initiative that promotes visits to households with sustainable energy projects by groups of interested people. According to the interviewees, the latter activity provided an opportunity for people to share their experience and ask questions covering topics such as project costs, realized savings, the installation process, and potential for financial aid such as grants.

Motiva and the Finnish Clean Energy Association were two intermediary organizations mentioned in the interviews that seemed to somewhat share learning from projects, and provided information on solar power, in particular. However, they were seen as having a different focus, with the first more linked to advocacy work and policy lobbying, and the second to the provision of local energy advice.

In the view of the experts, expanding intermediary and advocacy work could benefit the sector. Nevertheless, questions remained over who would be best placed to share information and knowledge about community energy. For instance, one interviewee said that community energy project owners might not see it as their role, and hence there could be a need for the intermediary organizations to provide and share information nationwide. This would also include framing community energy and thus building stronger expectations for the niche:

The Finnish Clean Energy Association should organize a local energy day to get everyone together. This issue should be framed more strongly. Through international examples and Finnish examples.

A question was also raised over who should be responsible for the actual energy generation system in smaller scale projects, especially in cases where people were selling electricity back to the grid and needed to deal with actors such as network operators. In other words, community energy projects needed to consider a multitude of issues before development could begin, with the skills base and agreed responsibilities being key issues to consider. Some interviewees said that there might, for example, be a need for intermediary organizations who could arrange all of this and sell that service to community organizations, though it remained open as to who would set those up and whether they ought to be profit-making companies or public companies.

5. Discussion

The analysis of the narratives emerging from the interviews with specific community energy projects revealed that there are some networks fostering the sharing of experiences and learning between projects, but they are, in general, not yet broad or deep in the Finnish context (Schot and Geels, 2008). In many instances learning between projects is limited, though system change projects show the highest degree of networking, learning, and interest in expanding. System change projects, therefore, constitute what Seyfang and Smith (2007, p. 593) call a “strategic niche” – in other words, a niche that seeks larger scale transformation – and could be the starting point for an overall strategy aiming at scaling up the community energy sector.

Regarding the wider scaling-up process, results from the thematic analysis with experts indicate that there are factors preventing the niche from scaling up to the global niche phase. One of the main limitations is the lack of a shared vision of what community energy should mean in the Finnish context. This is shown in the differing aims for expansion among the three types of projects identified, the limited national policy support for community energy, and the continuing discussion among experts on who should support the sector. Previous studies have demonstrated that a shared vision is essential for successful niche development (Seyfang et al., 2014), especially in attracting external support such as funding, resources and policy support (Raven and Geels, 2010).

Another factor limiting projects from scaling up to the global niche phase is the failure of existing intermediary organizations to aggregate local experiences into more abstract knowledge (e.g. best practices, tool kits, business models) to frame or coordinate the projects on the ground (Geels and Deuten, 2006). Moreover, their actions do not seem to follow an overall strategy, as the SNM literature would prescribe (the “dedicated work” talked about in Geels and Deuten, 2006, p. 266). The lack of dedicated work by intermediaries is a crucial aspect that has been discussed in prior research on community energy development (see e.g. Hargreaves et al., 2013). To promote niche upscaling, intermediary organizations need to aggregate knowledge, create networks that assist new community energy projects and campaign for niche development (Hargreaves et al., 2013). The third point relates to what Smith and Raven (2012) call niche empowerment – creating powerful narratives as political devices to promote the community energy niche. In the case of Finland, where the local context for most of the current projects is essential, local/regional intermediaries carrying out knowledge aggregation and lobbying activities could be better placed to support the development of the community energy niche than national ones are.

The findings of this study have particular significance for SNM theory and the study of community energy as a form of grassroots innovation (Seyfang and Smith, 2007; Smith and Seyfang, 2013). The process of scaling up local projects to the niche level illustrated in SNM does not seem to be as straightforward in the community energy sector, and it might be contingent on the type of projects and exogenous factors. As for the type of projects, this study found that some community energy initiatives do not wish to be scaled up. This had already been suggested by Seyfang and Smith (2007).

With regard to exogenous factors, this study revealed that cultural aspects, the specific context in which community energy develops (e.g. a rural or urbanized area) as well as the characteristics of community groups such as community cohesion (Martiskainen, 2017; Seyfang et al., 2013) may be important antecedents of the processes that lead to the scaling-up of local projects (Schot and Geels, 2008). The consideration of exogenous elements such as the presence of favourable pre-existing conditions would imply that prior to applying SNM prescriptions, intermediary organizations could look for strong local communities that are already engaging in other communal activities and that could, therefore, be more fertile ground for community energy projects (Stewart and Hyysalo, 2008). Identifying such communities could result in the development of system change projects, in other words, those with the highest interest in expanding the niche, sharing learning and networking.

Although this study has identified initiatives that may contribute to expanding the community energy sector, future research should address the question of how to involve unwilling community energy actors in the scaling-up process and how to deal with conflicting expectations.

6. Conclusions

This paper aimed at better understanding the scaling-up of community energy niches as a strategy to accelerate the transition to clean energy production. It applied SNM theory to fulfil two goals. First, to understand what types of community energy projects exist in the Finnish community energy niche and, second, to identify the factors that may prevent them from scaling up, that is, moving from the level of local projects to a global niche. To address these two research tasks, we carried out a narrative analysis as well as a thematic analysis of interviews with community energy practitioners and experts.

Three types of community energy projects were identified: cost reduction, technical expertise, and system change projects (see Table 3). Of these, only system change projects showed a potential for scaling up. At the global niche level the most important factors limiting the scaling-up included the lack of a clear vision for the sector and of dedicated work by intermediary organizations coupled with an unfavourable policy and regulatory framework.

The study makes two important contributions. First, it provides a typology of community energy projects showing which initiatives could be more inclined to be part of a strategy aiming at scaling up the sector. Second, it shows the tensions of SNM in the context of non-market-driven innovation highlighting how exogenous factors such as cultural aspects, the specific context in which community energy develops and community groups' characteristics are also important in the scaling-up process.

In the context of Finland, there are encouraging signs of a possible future expansion of the community energy niche, especially in light of the fact that it may help the country in increasing its share of locally generated renewable energy (Varho et al., 2016; Ruggiero et al., 2015). However, moving more decisively in that direction would require more support for the various projects as well as more dedicated work by intermediary organizations to facilitate networking and learning activities.

Acknowledgements

This paper is part of a wider research project for a PhD thesis. It was carried out with funding from the University of Jyväskylä. The work has also been supported by the Centre on Innovation and Energy Demand via the RCUK's EUED Programme [grant number EP/K011790/1]. The authors of this article are particularly thankful to Lotta Pirttimaa, Anu Aukeala and Leena Kontinen for the valuable aid in the collection of the data. The authors would also like to thank the three anonymous reviewers for their helpful comments.

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