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

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A B S T R A C T

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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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