Energy communities and their ecosystems A comparison of France and the Netherlands

Anne-Lorene Vernay, Carine Sebi

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Abstract:

Energy communities—groups of citizens, social entrepreneurs and public authorities who jointly invest in producing, selling and managing renewable energy are expected to play a prominent role in the energy transition. Energy communities are fragile individually and they need to pool resources and coordinate their actions to become robust collectively. This paper adopts an ecosystem perspective and aims to identify characteristics that an energy community ecosystem should exhibit to help energy communities emerge, grow and eventually fully realise their potential to transform the energy sector. It compares energy communities in two countries, France and the Netherlands, where energy community ecosystems have attained uneven levels of maturity. We argue that an energy community ecosystem can fully realize its potential if: 1) it revolves around keystone actors that can foster diversity; 2) it is structured around local capacity builders that can act as catalysers; and 3) it develops both competing and symbiotic relations with incumbent energy actors.

Keywords: Energy communities; Ecosystem; Renewable energy

1. Introduction

The energy sector was historically designed as a centralised and hierarchical system that was to be managed by central governments and large national state-owned mono- or oligopolies (Domanico, 2007), as illustrated by the development of nuclear power in France (Topçu, 2013). Ordinary citizens have been largely excluded from the governance of the energy sector (Bauwens, Gotchev, & Holstenkamp, 2016). Various developments indicate that this situation will change and that the citizenry will play a more important role in the sector in years to come (Corsini, Certomà, Dyer, & Frey, 2019).

Citizens can participate in the energy transition by joining groups known as energy communities. Energy communities involve groups of citizens, social entrepreneurs, public authorities and community organisations who participate directly in the energy transition by jointly investing in, producing, selling and distributing renewable energy (Interreg Europe, 2018). Energy communities also undertake information campaigns and actions that help citizens better manage their energy production and consumption.

Many observers envision energy communities as alternative means of financing the transition, increasing social acceptance and pushing citizens to adopt more virtuous behaviour (Vasileiadou, Huijben, & Raven, 2016; Yildiz, 2014). As such, energy communities are expected to play a prominent role in the energy transition (Berka & Creamer, 2018; Capellán-Pérez, Campos-Celador, & Terés-Zubiaga, 2018; Eitan, Herman, Fischhendler, & Rosen, 2019; Varho, Rikkonen, & Rasi, 2016). The European Commission recognised for the first time the role that energy communities might play in the framework laid out in a proposed legislative measure—the Clean Energy package (2016)—and estimates that by 2030 more than 50 GW of wind power and more than 50 GW of solar power could be owned by energy communities, representing, respectively, 17 % and 21 % of installed capacity. A recent study estimated that, by 2050, almost half of all EU households could be involved in producing renewable energy, about 37 % of which could come through involvement in energy communities (CE Delft, 2016).

Nevertheless, energy communities today seem vulnerable (Seyfang, Hielscher, Hargreaves, Martiskainen, & Smith, 2014) and have not yet reached their full potential. Multiple barriers that impede the development and growth of energy communities have been identified in the literature, including economic, financial, organisational, and legal factors (Gorroño-Albizu, Sperling, & Djørup, 2019; Mirzania, Ford, Andrews, Ofori, & Maidment, 2019). So far, much of the relevant research has focused on barriers to the development of individual energy communities. Kooij et al. (2018) observed that energy communities need external support (e.g. networking, lobbying, financial, and technical supports) to grow and flourish. While a single community is rather fragile, communities can be robust collectively if they cooperate with the right actors (Lancement & Cadre, 2018). We have limited knowledge, though, about how such support is organised and structured.

In this paper we analyse and discuss the role supporting organisations play in the emergence and growth of energy communities. To do so we propose adopting an ecosystem perspective. Ecosystems are sets of organisations that are interdependent—the success of one depends on the success of others—and that need to coordinate relationships between and among themselves to succeed (Jacobides, Cennamo, & Gawer, 2018; Tsujimoto, Kajikawa, Tomita, & Matsumoto, 2018). We argue that adopting an ecosystem perspective is especially suited to the analysis of energy communities and their supporting organisations given that energy communities must pool resources and coordinate their actions if they are to facilitate deep transformation of the energy sector (Bauwens et al., 2016; Proka, Hisschemöller, & Loorbach, 2018).

The aim of this paper is to identify characteristics an ecosystem should exhibit to help energy communities emerge, grow and eventually fully realise their potential to transform the energy sector. The results are based on a comparative analysis of two countries, France and the Netherlands, where energy community ecosystems have attained uneven levels of maturity. We argue that, whether or not an energy community ecosystem can fully realize its potential to transform the energy sector depends on three factors: 1. the influence of keystone actors and their capacity to foster diversity, 2. the way the ecosystem is structured locally around cooperative capacity building, and 3. the capacity of the ecosystem to recruit incumbents and induce change in their dominant logic.

The following sections present the literature review related to energy communities and ecosystem theory and then our research methodology. In the results section we describe and compare the Dutch and French energy community ecosystems: the functions they fulfil, who provides these functions and how resources flow in the ecosystem. The comparative analysis makes it possible to formulate recommendations to help energy communities overcome barriers that they are likely to encounter.

2. Literature review

2.1. Literature review: energy communities

Energy communities share a common understanding that "solving energy issues requires integrated solutions at all societal and institutional levels" (Klein & Coffey, 2016). Issues that are not taken sufficiently into account by the existing institutional and policy framework including, first and foremost, the ecological and environmental impacts (Foxon, 2011). By drawing on domestic savings, energy communities can contribute to financing decentralised renewable energy production (Johnson & Hall, 2014). This is especially important given that public authorities often lack the means to finance local renewable energy production and private companies are reluctant because of high transaction costs and risk–return concerns related to small local projects (Vasileiadou et al., 2016; Yildiz, 2014). Many researchers also note that energy communities can increase citizen acceptance and mitigate resistance against new local infrastructure and technologies related to the energy transition (Azarova, Cohen, Friedl, & Reichl, 2019; Interreg Europe, 2018; Rogers, Simmons, Convery, & Weatherall, 2008; Viardot, 2013). By providing a direct link between the production of local energy and private individual consumers (investing in it), these communities constitute a response to this vow of energy independence, heralding the emergence of a disruptive model where social welfare is distributed and managed by citizens. Finally, by educating people about energy, empowering and promoting actions that support more vulnerable consumers, energy communities can also fight energy inequalities and energy poverty (Brummer, 2018; Capellán-Pérez et al., 2018; Saintier, 2017) and offer access to 'affordable energy' (Berka & Creamer, 2018).

Despite their promise for contributing to the energy transition, the potential of energy communities is far from being fully realised and their future is uncertain (Capellán-Pérez et al., 2018; Gorroño-Albizu et al., 2019; Hufen & Koppenjan, 2015; Proka, Loorbach, & Hisschemöller, 2018; Seyfang et al., 2014). Scholars have identified many barriers that result from both exogenous and endogenous factors. Among the exogenous factors, the literature identifies strong dependence on a national policy and legal framework (Herbes, Brummer, Rognli, Blazejewski, & Gericke, 2017; Mirzania et al., 2019; Oteman, Wiering, & Helderman, 2014). Indeed, there are limits to what civil-society-led projects can achieve on their own and they require consistent policy support (Seyfang et al., 2014). Adequate rules for grid connection have for instance been identified as key to the emergence of energy communities (Bolinger, Wiser, Milford, Stoddard, & Porter, 2001; Breukers & Wolsink, 2007). Energy communities' economic model is also led predominantly by public policy such as feed-in tariffs (FITs) or other public incentives (Herbes et al., 2017). Tews (2018) discusses and criticises the fact that many projects could not emerge without these aids. Mirzania et al. (2019) illustrate this strong dependence by citing the British case, when the government decided to remove the FITs in 2016: 'a move that dramatically affected the renewable energy industry in general and the community renewable energy sector in particular'.

We also want to mention that the biophysical conditions under which a project is developed shape the type and potential of an energy community based on the availability of local renewable resources (e.g. wind speed, solar hours, etc.). (Kooij et al., 2018). Concerning endogenous factors, energy communities depend heavily on their members' willingness to participate. Citizens participating in these projects are led principally by hedonic motivations (Dóci & Vasileiadou, 2015) and the idea of being part of a local social movement (Kalkbrenner & Roosen, 2016; Seyfang, Park, & Smith, 2013). These forms of engagement carry some drawbacks related to, among other things, availability (lack of time), professionalism (insufficient knowledge or skills), and social and economic change (ageing of the volunteering force) (van der Schoor & Scholtens, 2015).

All these studies focus their analyses mainly on individual energy communities by conducting longitudinal case studies (Lakshmi & Tilley, 2019; Lehtonen & Okkonen, 2019; Mahzouni, 2019; Yalçın-Riollet, Garabuau-Moussaoui, & Szuba, 2014) or adopting a country-specific prism (examples include Herbes et al., 2017; Koirala et al., 2018; Mirzania et al., 2019; and Yildiz, 2014). Some scholars have however highlighted the importance of 'inter-organisational' actions between cooperatives (Bauwens et al., 2016) and the need for energy communities to coordinate their actions (Proka, Hisschemöller, et al., 2018). In line with Kooij et al. (2018), we posit that energy communities need external support (networking, lobbying, financial, and technical assistance) to achieve their main goals. We argue that analysing how this support is structured would enrich our understanding of the challenges faced by energy communities in fulfilling their potential to contribute to the energy transition. In the next section, we propose adopting an ecosystem perspective to analyse energy communities and their supporting organizations.

2.2. Introducing ecosystems theory

The concept of an ecosystem in the commercial or civil domain is a metaphor borrowed from biology to refer to a group of organisations that interact with one another and are interdependent (Boons & Bocken, 2018; Jacobides et al., 2018; Tsujimoto et al., 2018). The metaphor recognises that organizations do not exist in isolation but depend on one another to gain access to complementary resources and capabilities (Håkansson & Snehota, 1995). The concept has become increasingly important in the work of both scholars and practitioners in the fields of technology and innovation strategy (Adner, 2017; Teece, 2016) and management (Adner & Kapoor, 2010; Kapoor & Lee, 2013). The ecosystem concept has been used to study how a set of interrelated organisations can develop new products, services or technologies when they operate autonomously but are interdependent (Jacobides et al., 2018; Tsujimoto et al., 2018). Such interdependence arises because organisations develop assets that complement one another and increase each other's market value (Brandenburger & Nalebuff, 1997). These complementary assets can be very diverse, ranging from access to distribution channels to connections with end customers to the provision of knowledge and expertise (Teece, 1986). A central argument is that an ecosystem succeeds only if actors coordinate their activities and in many cases engage in joint innovation activities (Adner, 2012; Adner & Kapoor, 2010; Kapoor & Lee, 2013).

Scholars have emphasised several aspects of the ecosystem concept depending on their objectives (Adner, 2017; Jacobides et al., 2018; Tsujimoto et al., 2018). In this paper we take an ecosystems-as-affiliations perspective (Ander, 2017). From this perspective, an ecosystem is a community of organisations that affect each other through their activities (Teece, 2007). Ecosystem members may be customers, suppliers, technology providers, business associations, or knowledge-sharing platforms (Iansiti & Levien, 2004; Moore, 1996). The strand of the literature that adopts this perspective stresses that organisations belonging to an ecosystem commit themselves to a 'shared fate' (Iansiti & Levien, 2004): the performance of individual actors depends on the performance of other actors in the ecosystem. Various studies also point to the role of keystone players—also called lead firms (Williamson & De Meyer, 2012) or ecosystem captains (Teece, 2016)—in the emergence and evolution of an ecosystem (Teece, 2007). The health of an ecosystem depends on the success of keystones in creating common complementary assets that others can build on to develop their own offerings (Iansiti & Levien, 2004). Scholars also show that a range of dynamics can be at play within an ecosystem (see Boons & Bocken, 2018): some organisations may for instance compete with one another for access to resources; others may have mutualistic relations in virtue of which the success of one benefits the other; some organisations may also have symbiotic relations and reinforce one another. When they do, they may start to co-evolve with one another and adapt to each other's capabilities (Iansiti & Levien, 2004; Teece, 2016).

2.3. Applying ecosystem theory to energy communities: question raised

We argue that analysing energy communities and their supporting organisations from an ecosystem-as-affiliations perspective—further referred to as an ecosystem perspective—can provide new insights and help us better understand the role that supporting organisations play in the emergence and growth of energy communities. Taking an ecosystem perspective involves analysing three ecosystem characteristics. First, it encourages analysing the functions that are fulfilled by ecosystem actors by considering the types of support ecosystem actors provide. This will provide information about how well an ecosystem functions. An ecosystem may not function well if for instance some functions are or not sufficiently present. Linked to this, it is also interesting to consider the trophic level at which the functions are being fulfilled (Tsujimoto et al., 2018): are these functions provided locally or nationally and why?

The second ecosystem characteristic that is interesting to analyse relates to the types of ecosystem actors that are present. One may look at whether these actors are dedicated to energy communities or whether they are incumbent organisations long active in the energy sector. One may also consider whether they are public or private organisations, whether they operate on a for-profit or not-for-profit basis. Such an analysis would provide information about the level of diversity present in an ecosystem. Ecosystem diversity influences how resilient an ecosystem is to change (Tsujimoto et al., 2018), with greater diversity leading to greater resilience (Göthlich & Wenzek, 2004; Loreau, 2010). Moreover, additional insights into ecosystem resilience may come from analysing whether keystone actors are present (Iansiti & Levien, 2004) and the type of organisation that fulfils that role and the sources of their resources.

Third, to understand how healthy an ecosystem is, one may look at ecosystem resources (Jacobides et al., 2018). Resources may be financial, human, or material (Boons & Bocken, 2018). Energy communities depend heavily on public policies (Mirzania et al., 2019; Oteman et al., 2014), especially regarding the extent to which and how they allow a community's ecosystem to access financial resources. Understanding the relative abundance of available resources, where these resources come from, and how they flow in the ecosystem (Boons & Bocken, 2018) may help explain why one ecosystem performs better than another. Moreover, it may also be interesting to consider the type of relationship that exists between energy community ecosystems and incumbents in the energy sector. Do they compete for resources or do they complement one another in creating value by forming a more symbiotic relationship (Boons & Bocken, 2018)?

We posit that understanding how an ecosystem functions, the type of support it provides, the diversity of actors that composes it and the resources to which it has access will provide additional and novel insights that will enhance our understanding of the dynamics behind the emergence and growth of energy communities.

3. Methodology

The following section presents the empirical setting as well as the ways in which we collected and analysed our data.

3.1. Comparing ecosystems in two countries

This paper aims at understanding how configuring an ecosystem around energy communities influences the emergence and growth of the latter. To do so we compare ecosystems in two countries where energy communities have been gaining importance: France and the Netherlands. These two countries are interesting to compare because their energy communities have reached uneven stages of development. In France, the energy-community phenomenon is emerging while in the Netherlands the movement is more mature and energy communities are becoming recognised as key actors in the energy transition (AS I Search, 2019).

To provide a few numbers, in France the latest census carried out by the Énergie Partagée Association counts nearly 300 energy projects involving 11,000 citizen shareholders that produce 65 GWh/year of energy (i.e. 0.2 % of France's annual renewable electricity production in 2016). Since 2014, the number of these initiatives has multiplied fourfold (Energie Partagée, 2019) showing that the movement is gaining momentum. Actors in French energy communities aspire to represent 15 % of renewable infrastructure by 2030. In the Netherlands, according to the Local Energy Monitor HierOpgewekt, 484 communities are active. These energy cooperatives involve 70,000 Dutch citizens. The solar power capacity of these cooperatives reached 74,5 MWp in 2018 (i.e. 2 % of all installed solar power in the Netherlands), and wind capacity was close to 16 MW in 2018. In 2018 for instance the number of cooperatives increased by 20 %. This trend is expected to continue and the country has included in its climate agreement a dedicated target: local actors should hold 50 % of the country’s renewable electricity capacity (excluding off-shore sources) by 2050.

3.2. Data collection and analysis

This research is based on both secondary and primary data. As secondary data, institutional reports and academic publications provided us with a good understanding of the energy community movements in France and the Netherlands. Primary data in the form of 41 semi-structured interviews conducted with experts, energy communities, and their supporting organisations were used to understand the challenges faced by energy communities and the role supporting organisations play in helping them overcome these challenges. Table 1 summarizes all the data collected and provides a detailed overview of the type of information we obtained. The analysis was conducted in an iterative manner as we moved back and forth between the data and the theoretical constructs. For the sake of conciseness, however, we will describe the procedure in a stepwise manner. First, we focused on energy communities themselves and categorised the types of challenges they face. We also coded for elements related to the identity of a given community and that perhaps explain why it exists. Second, we coded for how energy communities try to resolve their challenges and whether they do that on their own or by seeking help from other organisations. This enabled us to identify which actors belong to a given ecosystem. We considered that they had to coordinate their activities with energy communities and engage in interdependent value creation to be considered part of the ecosystem. This for instance excluded the French DSO that is important for energy communities but not actually part of their ecosystem. This also made it possible to identify which actors were important in the ecosystem and whether some actors could be considered keystones. We coded for keystones when we considered whether an actor was an obligatory passage point for many energy communities. Third, focusing on supporting organisations, we coded for the functions they fulfil in the ecosystem. We also coded for the type of complementary assets that they provide, whether they are generic or specific to energy communities (Teece, 2018). Finally, we also coded for financial resources to highlight where they enter the ecosystem and how they flow between actors.

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4. Results

4.1. Comparing energy communities at the individual level

Energy communities lie at the core of the energy community ecosystem. We have observed important differences between French and Dutch energy communities. To understand these differences, it is first important to observe that, even though their objectives are similar—they all aim to empower citizens to take part in the energy transition and participate in local renewable energy production—French and Dutch energy communities are rather different with respect to how they try to achieve their goals.

The first difference between French and Dutch energy communities concerns the types of activities that energy communities organise. In France, energy communities typically focus on collecting investments from citizens to buy and install local renewable energy capacity. Few have diversified their activities to include energy-saving measures. In the Netherlands, energy communities often pursue very diverse activities, including energy production, energy efficiency, energy literacy, collective buying of electricity, and sometimes even electric mobility. They may also conduct short-term research projects for local public authorities. Three factors may explain these differences. First, the energy community movement is more recent in France and practitioners explained that developing renewable energy production is typically how an energy community begins as it directly provides visible and concrete results. Many interviewees mentioned considering broadening the scope of their communities even though they have not done so yet because of a lack of means or experience. Moreover, energy communities in France often lack sufficient membership to organise activities such as buying electricity collectively. Finally, another explanation of the differences between French and Dutch energy communities may be that, in France, many municipalities have created local energy agencies that are in charge of supporting energy literacy and energy efficiency, and energy communities do not want to compete with already existing public organisations.

The second difference between French and Dutch energy communities relates to their respective revenue models. This issue links directly with the level and structure of national subsidies. In France, energy communities generate revenue largely by selling kWh of renewable electricity. They benefit from FITs that are digressive over time and can differ depending on the size of a project. To illustrate this feature, the French Decree, published in 2017, caused a sharp 12 % decrease in the tariff targeting the smallest photovoltaic (PV) projects (with capacity below 9kWc) traditionally developed by emerging energy communities. Today projects need to reach a minimum size of 36 kWc to be economically viable. In general, large communities (with energy capacity exceeding 1MW, such as wind farms) present their projects as profitable to their shareholders (with returns of around 3 %-4 %), while smaller ones (rooftop PV plants, below 100kW) communicate returns on investments that are quite symbolic (around 0.75 %). We also observe regional differences depending on whether local governments offer energy communities dedicated grants.

In the Netherlands, energy communities also earn money per kWh they deliver but the size of a project is not a differentiating factor in determining its economic viability. Smaller projects tend to choose postcode schemes that enable their community members to benefit from lower energy bills and reduced taxes on the electricity their shares produce locally. Large projects prefer benefitting from FITs under the Stimulation of Sustainable Energy Production (SDE +) scheme. Moreover, energy communities have two additional sources of revenues. First, local energy suppliers pay an energy community a fee for each of their members who becomes a customer of the supplier, generating additional revenue for the community. Energy suppliers see this as a more efficient way to spend money on marketing. Finally, Dutch energy communities also typically charge small membership fees that provide access to the activities they organise.

The third difference between French and Dutch energy communities concerns the ‘raison d’être’ of energy communities, their identity. This issue is linked to the characteristics of their respective national energy sectors. In the Netherlands, the energy mix is based largely on fossil fuels (e.g. 80 % of Dutch electricity is generated from fossil fuels; Enerdata, 2019) and the sector is dominated by three large energy companies, two of which have been acquired by foreign companies. Moreover, while many Dutch consumers enter into green electricity contracts, very little renewable energy is produced locally, most being imported from Scandinavian countries. To give an idea of the order of magnitude, in 2017 69 % of Dutch consumers had green electricity contracts (ACM, 2017) while renewables accounted only for about 15 % of Dutch electricity consumption (CBS, 2018). This may explain why cooperatives often use words like ‘from us for us’ and ‘from our own ground’ and explain their strong focus on moving away from fossil energy towards what the local energy monitor calls ‘positive energy’ (see also Proka et al., 2018).

In France, the situation is very different. First, the energy mix is characterized by low carbon intensity (e.g. 8 % of French electricity is generated from fossil fuels, Enerdata, 2019), reflecting the large shares of nuclear and hydropower. Moreover, the sector is dominated by one national champion. Energy communities often exist to fight against the supremacy of this national champion and place citizens at the heart of decentralised energy production. Energy communities are also often created to offer an alternative to nuclear power. As explained by one of the experts interviewed, energy communities ‘often result from citizen initiative from activists that begin projects’. This may also explain the why French energy communities find it important to promote their governance model that is often based on a ‘one-person one-voice principle’.

4.2. Comparing ecosystems: functions and actors

Energy community ecosystems in France and the Netherlands include a variety of supporting organizations. The data showed that they fulfil four categories of functions: 1) lobbying, 2) networking and knowledge-sharing,3) technical and commercial support, and 4) financial support. In this section, we discuss each of the functions generally. We then compare how they are fulfilled in the two countries and by which type of actor, focusing in particular on points of divergence.

Moreover, the empirical investigation revealed an important actor that we named ‘local capacity builders’ that play a hybrid role at the intersection of these four categories. These capacity builders are also presented and discussed.

Lobbying

Energy communities propose a new model for the energy system, one that strives for decentralised and renewable energy, a model in which not only large private firms but also citizens should have a say in governance. To exist and grow, energy communities need to be recognised by policymakers as important actors and be granted operational space in this hyper-regulated sector (Kooij et al., 2018). That is why the first function of the ecosystem includes lobbying activities. Lobbying for energy communities is usually conducted by associations or NGOs, such as Rescoop at the EU level.

The main difference between France and the Netherlands lies in the diversity of interests that are represented. In France, lobbying is conducted by two sister organisations: Energie Partagée (“Shared Energy” in English), an association which supports and finances renewable energy projects, and Enercoop, which is a green energy supplier. These organizations feature overlapping governance structures and represent the interests of citizens and public authorities who are driving sustainable energy initiatives. While Enercoop functions as a not-for profit private company, Energie Partagée Association (EPA) is funded by its members and by subsidies from the French central government. In the Netherlands, a wide range of organisations have been created historically, each supporting a specific interest: Pawex represents the interests of individual wind turbine owners, many of whom are farmers; ODE decentral represents the interests of renewable energy producers and consumers; Hoom is a cooperative supporting local energy savings; Rescoop NL supports citizen-led initiatives to produced renewable energy. These actors realised that they all share a common vision: the energy transition cannot be realised without active citizen participation. In 2018, they decided to create a single overarching organisation, Energie Samen (“Energy Together” in English). By merging, they expect that speaking as a single voice will reduce confusion and give them greater lobbying power to shape policies to their advantage. Energie Samen is funded via membership fees paid by energy communities.

Knowledge-sharing and networking

The second function of energy communities involves networking activities. Energy communities are highly localised projects driven by volunteers. Even though previous research has shown that active members often have sectorial expertise (Radtke, 2014), the complexity and norms imposed by the energy sector create high barriers to entry for energy communities. That is why sharing knowledge and best practices is especially important for these community formations. Even though knowledge-sharing often takes place bilaterally between energy communities themselves, dedicated associations also exist that centralise information, provide tools to facilitate decision-making and organise events to create networks of member energy communities. These associations also map on-going collaborative energy project experiences in a given country, making them more visible both individually and as a movement.

In the Netherlands these activities are structured around a single knowledge-sharing platform, Hier Opgewekt ('produced here' in English) which is set up at the national level. Hier Opgewekt is supported financially by three distribution system operators. Moreover, it is noteworthy that incumbent energy suppliers also help individual energy communities navigate national policy schemes. In France, two competing structures exist, both covering large parts of the French territory: Énergie Partagée Association (EPA) and Centrales Villageoises ('village power plant' in English). Both French associations support citizen projects but Centrales Villageoises promotes smaller ones and under the condition that it is implemented using local resources and competencies (aimed at fostering a social and solidarity economy).

Even though on the surface the ambitions of French and Dutch knowledge-sharing platforms seem quite similar, we observe important differences regarding what precisely these platforms do. In France, both structures support rather homogeneous local energy community–development activity based on citizen and regional engagement, with a clear objective of becoming more independent from national incumbents. In the Netherlands, Hier Opgewkte offers a place where energy communities can challenge how they can best reach their objectives, where they can question their identity and purpose. For instance, they discuss the pros and cons of interacting with incumbent energy actors or discuss tensions between being volunteer-based and employee-based initiatives. Moreover, the Dutch platform has also put considerable effort into developing communication tools in the form of stories that energy communities can use to generate local interest.

Financial support

The third function in an energy community's ecosystem is financing. Energy communities need money to finance the projects they want to implement. Even though some communities choose to collect funds on their own, others rely for instance on crowdfunding platforms to help them set up campaigns and raise funds from citizens who live more or less close to the projects they want to implement. Similarly, managing the distribution of dividends to shareholders is also something energy communities need to organize well. This is especially important given that the money they raise often comes from citizens who have invested portions of their savings in an energy community. Crowdfunding platforms can also help energy communities manage funding in a professional manner.

Crowdfunding of renewable energy projects is organised differently in France and the Netherlands. In France, even though many private crowdfunding platforms exist, one actor clearly stands out as central to energy communities: Energie Partagée Investissement (EPI). EPI facilitates the collection of citizens' funds and invests in renewable energy production sites led by citizens. It has become an obligatory passage point for big projects (e.g. wind or solar farms with capacity exceeding 1MW). It finances itself by charging a fee on the money collected. In the Netherlands, this process is more widely distributed and various private actors are active in this niche, including Greencrowd, Zon op Nederland, and one planet crowd.

Moreover, governments in both countries are (planning to) set up special funds to finance the developmental phase of energy community projects. Many interviewees mentioned that the developmental phase is costly and risky for energy communities. Several projects have not yet been implemented because energy communities encounter difficulty financing this phase. In comparison with project developers, energy communities, especially when they are just starting, also lack the means to spread risks over multiple projects. Energy communities and their representatives have lobbied government agencies to remedy this situation. In France, this resulted in the creation of a fund managed by EPI called EnRCiT (EnRciT, 2019) and in the Netherlands the government agreed to create a development fund which is still in development (ODE Decentraal, 2018).

Operational and technical support

Finally, the last function in an energy ecosystem revolves around actors that provide operational and technical support. To implement projects, energy communities manage a very large number of tasks. This includes identifying suitable sites, performing impact-assessment studies, negotiating contracts with site owners, selecting and acquiring technical components, contracting with service providers for electrical engineering or opportunity-assessment studies, securing grid connections, finding insurance providers, organising and following installations, monitoring plants and performing maintenance activities, and sometimes also selling electricity to their members. In most cases, energy communities lack the internal capacity to internalise all these activities and subcontract them to professional organisations. Moreover, energy communities seeking to mobilise citizens also need to invest considerable time in communicating who they are and publicizing their missions. They do so by publishing tracts, creating websites, and organising events. Our interviews revealed that energy communities, especially when they have been initiated by technically minded people, need help to better communicate to the general public.

We noted three main differences between the mechanisms through which France and the Netherlands provide operational and technical assistance to energy communities. First, in France technical and operational support is often performed by local energy agencies or local representatives of the EPA, all financed by public funds. In the Netherlands, this function is mostly organised by private-sector organisations. Second, energy suppliers play an important role in both countries. In France, however, only one supplier, Enercoop, is involved. In the Netherlands, several energy suppliers provide services including both technical/legal and financial support, such as Greenchoice and the historical incumbents Eneco and Engie. Third, in both countries, cooperatives have been developed to increase the autonomy of energy communities in their relations with incumbent actors. In France, everything is centralised around the aforementioned Enercoop, which enables energy communities to indirectly supply electricity to their members and bypass incumbent energy suppliers. In the Netherlands, however, various actors exist covering larger segments of the value chain. Cooperative energy suppliers exist at the national level (e.g. OM) and the regional level (e.g. Energie van ons in the north and Achterhoekse Energie in the east) that allow energy communities to supply electricity to their members. Moreover, cooperatives also exist that provide specific services to energy communities, services that require economies of scale. Ecode, for instance, has since April 2018 offered an ICT platform specifically tailored to the needs of energy communities. Another example is Hoom, which developed tailored support and coaching for energy communities that want to promote energy efficiency. Interestingly, Hoom benefits from temporary financial support from one of the Dutch distribution system operators and the ambition is to become entirely financed by energy communities, who pay for the services they offer.

4.3. Local Capacity Builders: local catalysers

Our analysis has revealed that, at the intersection of the four ecosystem functions, local capacity builders play a very important role. They can centralise and mutualise information, they act as intermediaries providing access to the supporting ecosystem, they can make it possible to initiate larger projects, and they can become energy community trustees locally. In so doing, these capacity builders act as local catalysers speeding up ecosystem growth locally.

The need for local capacity builders stems first from the fact that implementing projects can be very time-consuming for energy communities. When a project is completed, volunteers will have gained considerable new knowledge and expertise. Many interviewees also mentioned, though, that volunteers do not always have the motivation to carry out another project, which can put an end to the growth of a community. Besides, to implement projects, initiators of energy communities need to understand the norms and rules prevailing in the energy sector and this requires specific knowledge and expertise (van der Schoor & Scholtens, 2015). In both France and the Netherlands we observed that, after the successful implementation of a first project, a few active members often create a cooperative local capacity-building group to ease the burden on future project initiators. They provide local support for many kinds of operational activities regarding technical, commercial, financial or networking issues. These capacity builders often adopt a pre-defined scale of action typically encompassing several municipalities with a common identity. Gresi 21 in France, for instance, encompasses a municipality in the area known as Gresivaudan. Similarly, Kennemer Energie in the Netherlands encompasses all the areas in the so-called Kennemerland. Such capacity-building groups also provide a good overview of all ongoing projects or initiatives and represent "one-stop shops" where potential volunteers can be linked with projects.

Moreover, local capacity-builders also represent intermediaries between initiators and the supporting ecosystem. They provide access to the ecosystem even for individuals who do not belong to existing networks. Moreover, in France specifically we observed that several small energy communities do not meet the conditions required by ecosystem actors (e.g. achieving a generation capacity that exceeds 1MW) to benefit from their support. They depend on their own capabilities and resources to develop and grow. We find that what these communities manage to achieve depends heavily on the personal networks that their founders are able to mobilise. For small energy communities, setting up a local capacity-building group can enable initiators to benefit from the ecosystem by granting them access to the network without formally drawing on (or paying for) it. We also however observed that evolving FITs are restricting access to financial resources to increasingly larger energy communities. This is discouraging new groups of citizens from developing small projects aimed principally at sensitising local inhabitants to the energy transition. Instead, energy communities are pushed to grow and evolve in the direction of projects that fit the characteristics required by the ecosystem chosen by the government with little regard for their specific attributes and needs.

Furthermore, small energy communities often lack the capacity to implement large renewable energy projects such as wind farms on their own. When they want to take up the challenge, we observed that they often join with other energy communities in their regions to mutualise their resources. In the municipality of Dordrecht for instance, two local capacity builders, the Energy Cooperative of Dordrecht and Drecht Energy, have joined forces to build a wind turbine on industrial terrain. Similarly, in France, some communities are seeking to diversify their activities by investing in bigger projects that they could not carry on alone by teaming up with other partners. This is the case of the Chamole citizen-led wind farm community that has been bought by a group of cooperatives, namely SEM Énergies Renouvelables Citoyenne, la SCIC Jurascic, la commune de Chamole, an d ERCISOL et Énergie Partagée.

Finally, energy communities lack credibility as energy actors. Our interviews enable us to attribute this lack of credibility to three factors. First, citizens have long been excluded from the energy sector and are not considered credible partners. Moreover, volunteer turnover can occur quickly. This implies that people who carry out projects change rather frequently. This is a source of uncertainty for key actors (i.e. clients, suppliers and partners) with whom energy communities need to collaborate. Finally, energy communities develop projects that are designed to operate for several decades. Because they are volunteer-driven organisations, though, other energy actors doubt they can sustain themselves over such long periods. Local capacity-builders can act as local trustees for energy communities. They may take over project management if initiators leave and are not replaced. If they are able to support sufficiently many projects and be remunerated for doing so, they may be able to move to a hybrid structure (partly volunteer-based, partly employee-based) resulting in a more stable organisation that is able to manage daily activities and function as professional and externally more credible organisations.

To conclude this presentation of our study findings, we believe it is worth mentioning that we observed important differences between French and Dutch energy communities, namely that in the Netherlands financing for community cooperatives comes both from public funds and from energy communities themselves that pay them to outsource some activities. In France, however, energy communities barely have the means to pay for their community cooperatives, who rely mostly on volunteers or on local public funding where it is available.

5. Discussion

Our data show that French and Dutch energy community ecosystems are built around the same four functions: 1. lobbying, 2. networking and knowledge-sharing, 3. financing and 4. technical and operational support. We have also observed important differences in the types of technical and operational support provided. While the French ecosystem provides support mainly in organising the production of renewable energy locally, the Dutch ecosystem offers more diverse support: supplying electricity to members, managing member relations, putting energy efficiency measures in place. Other differences between these ecosystems concern the types and diversity of actors that play roles in the ecosystem and the way the supporting ecosystem accesses financial resources.

Our data show, first, that the Dutch ecosystem revolves around several national keystones that manage lobbying and knowledge-sharing. For other functions (financing and technical and operational support) there is no clearly identifiable national keystone, as various actors compete to provide energy communities with the complementary assets they need. This results in an ecosystem that appears as a single or monolithic phenomenon at a high level but that spurs great diversity at the local level, as energy communities can draw on the supporting ecosystem that corresponds best to their own missions and objectives. This scheme also creates an environment that is favourable to innovation, as actors must differentiate themselves to be more attractive to energy communities. In the French case, however, two sister organizations act as keystones for most of the ecosystem functions that have been identified. The empirical investigation also revealed that current policy schemes reinforce these keystones by pushing energy communities to evolve (i.e. grow) so as to fit with the dominant model supported by these organizations.

Ecosystem theory stresses that keystones play a key role in shaping the development of an ecosystem (Moore, 1996; Teece, 2016). Our research sheds light on the ambiguous role keystones can play in energy community ecosystems. We argue that when, as in the Dutch case, they represent umbrellas for a wide variety of initiatives, they can be the key to securing institutional support from the government (Kooij et al., 2018). On the other hand, concentrating too much influence in a single keystone, as has occurred in the French case, may be detrimental to the long-term development of the ecosystem. For energy communities, depending on a single keystone reduces the degrees of freedom they need to develop in alignment with their own identities. Instead, because of their central position, keystones may end up dictating the co-evolution process (Lewin & Regine, 1999; Peltoniemi & Vuori, 2004) and increase homogeneity in the ecosystem. This may have negative effects over the long term, insofar as homogeneity is known to be unfavourable for innovation (e.g. (Grabher, 1993) (Grabher, 1993)).

Moreover, the data show that, at the local level, cooperative capacity-builders are also important keystone players that can act as catalysers and boost the growth of an ecosystem. On the one hand, capacity builders hold the potential to help professionalise energy communities and make them credible partners with which to work. On the other hand, by providing personalised support to initiators, facilitating physical contacts between community members, and raising trust (Koirala et al., 2018), they also make it easier to initiate individual projects. This is crucial to building the social capital necessary for these organisations to succeed (Walker, Devine-Wright, Hunter, High, & Evans, 2010) and create momentum locally. Whether such capacity builders can sustain themselves robustly depends on their own capacity to be financed. Here the Dutch and French ecosystems function very differently. The French ecosystem depends heavily on volunteers and dedicated public funds while the Dutch ecosystem can be financed directly (at least partly) by energy communities. Dutch energy communities can decide from which organisations to draw support while French communities depend on organisations that are deemed competent by local authorities or the national government.

Furthermore, our data show that French and Dutch ecosystems are very different regarding the diversity of actors that comprise them and ecosystem interactions with incumbent actors. In France, the ecosystem revolves around small specialised players (Energie Partagée – EPA and EPI - and Enercoop) and public organisations. The ecosystem develops as an independent entity that interacts with incumbent actors only by necessity. Incumbents hardly contribute to the ecosystem and the French energy community ecosystem has developed as a separate niche that competes for resources with the rest of the sector. In the Netherlands, the ecosystem is composed of a diversity of small, specialised actors (e.g. hieropgewekt, HOOM, Om nieuwe energie) and large incumbent actors (e.g. Greenchoice, Eneco). Public organisations are scarcely present. Relations with incumbent actors are characterized by sharp contrasts. On the one hand, part of the ecosystem seeks to empower energy communities to become autonomous and compete with incumbent actors. On the other hand, another part of the ecosystem is pragmatic and collaborates with energy incumbents if doing so facilitates access to complementary assets (e.g. specific expertise) or generates increased revenues.

We argue that, by competing solely against incumbents, the French ecosystem risks remaining a small niche that is unable to contribute substantially to the transformation of the sector. On the other hand, the Dutch ecosystem is more likely to induce sectorial change by combining competing and symbiotic relations with incumbents. Previous research has shown that, because of their established market presence, incumbents have the capacity to transform mass markets, something small new entrants have difficulty achieving (Hockerts & Wüstenhagen, 2010). Transforming the energy sector will require changing the dominant logic of actors in an industry (Bidmon & Knab, 2018) and especially the dominant logic of incumbents. It implies changing the shared understanding of how best to create and capture value in an industry (Sabatier et al., 2012). Recent research suggests that reinforcing effects between three mechanisms are needed to induce change in a dominant logic: undermining existing logic, creating a new logic, and complementing the novel logic (Vernay et al; 2019). We argue that by competing with incumbents, the Dutch energy community ecosystem contributes to undermining the existing logic centred on the utility and showing that an alternative logic that empowers citizens is possible. Moreover, working hand in hand with incumbents provides disconfirming evidence of the viability of the current logic. This is likely to trigger a self-reinforcing mechanism that leads to the emergence of a virtuous cycle that could induce change in the dominant logic (Vernay et al, 2019).

6. Conclusions and recommendations.

Energy communities are expected to play a central role in the energy transition (Berka & Creamer, 2018; Capellán-Pérez, Campos-Celador, & Terés-Zubiaga, 2018; Eitan, Herman, Fischhendler, & Rosen, 2019; Varho, Rikkonen, & Rasi, 2016) and as such are attracting considerable attention from policymakers. Energy communities also, however, face multiple barriers and their full potential has not yet been exploited (Seyfang et al., 2013). This paper began with the observation that energy communities are rather vulnerable when they stand alone but they can be robust collectively if they cooperate with the right actors (Lancement & Cadre, 2018). Our study compares the French and Dutch energy community ecosystems with the aim of better understanding how an ecosystem should be structured to support the emergence and growth of energy communities and ensure that they can transform the energy sector and empower citizens to participate in it.

The paper contributes to the growing body of literature on ecosystems. It shows how the ecosystem concept can be used to study an emerging phenomenon such as energy communities. It provides guidance for structuring the analysis of an ecosystem and illuminates how the structure and dynamics of an ecosystem influence its capacity to induce sectorial change. It also provides evidence of the importance of thinking at trophic levels (Tsujimoto et al., 2018) and about the contrasting role that keystones can play in an ecosystem. We deem such an approach to be pertinent to the study of other contexts such as the development of shared mobility services or energy efficiency services, particularly for in-depth building retrofits.

Our paper also contributes to the growing body of literature on energy communities and generates two recommendations for policymakers. First, policymakers should not favour a single keystone actor but should instead leave room for a diversity of energy community initiatives. In fact, policymakers should not only see energy communities as a means to increasing renewable energy production nationally but also as having a pivotal role to play in sensitizing citizens to energy and climate issues and promoting energy efficiency. Second, local capacity-builders have a pivotal role to play as catalysers and we recommend designing institutional support to help these organisations emerge and sustain themselves over time.

Finally, this paper argues that having both competing and symbiotic relations with incumbents is more likely to transform the energy sector. We are conscious however that this places energy communities at risk of being overrun by incumbents. More research is needed to understand how best to manage relations with incumbents to protect the identity and raison d'être of an energy community.

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Table 1: Details on data collection		
Source of data	**Type of Data**	**Use in Analysis**
Archives (institutional reports and scientific publications)	About the French context: • Institutional reports published by Energie Partagée (2017 & 2019), Ademe (Carpenè, 2018), Le Cler (revue CLER info), CEREMA (Lancement & Cadre, 2018), RESCOOP (2018), IDRRI (IDRRI, 2019) About the Dutch context: • Institutional reports published by HierOpgewekt as well as scientific publications (Verbong & geels, 2007), (Van Doorn & Hendrix, 2014), (Doci, 2017), (Saris, 2001)	For both countries: • Identify communities, ecosystem actors and specialists to contact for interviews • Identify state of development of communities • Highlight some of the general challenges and success factors
Semi-structured Interviews	***With experts*** *In France* • *3 interviews with specialists from ADEME, CLER and CEREMA* *In the Netherlands* • *3 interviews with independent researchers*	• *Understand global national dynamics* • *Highlight main challenges faced by energy communities* • *Identify ecosystem actors*
	With energy communities *In France* • *14 interviews with energy community initiators or leaders, including Energ'y Citoyenne, Buxia énergies, ICEA, BEC, Ercisol, Gresi21, les ailes de taillard, forestener, Comwatt, Prats de Mollo, 123 soleil* *In the Netherlands* • *Interviews with 5 energy community initiators or leaders, including Calorie, Kennemer energie, Energiek Schiedam, AGEM, Watbeters*	• *Understand how they work and are organized* • *Clarify what their ambitions are* • *Highlight the barriers they face to reach their ambitions* • *Identify ecosystem actors they rely on and understand how they support them*
	With representatives from the ecosystem *In France* • *9 interviews with representatives from the ecosystem, including networks (les Centrales Villageoises), financial partners (Energie Partagée investissement), energy agencies (Hespul, ECLR, AURAEE), municipalities (Ville de Grenoble), distribution system operators (Enedis), green energy suppliers (Enercoop), and NGOs (Coopawatt)* *In the Netherlands* • *11 interviews with representatives from the ecosystem, including national cooperatives (Rescoop NL; HOOM,DE Unie, OM, Energie van ons, Qurrent), energy retailers (Greenchoice), financial partners (Greencrowd), associations (Nudge), and DSOs (Buurkracht, Alliander)*	• *Understand how they support or interact with energy communities, how this has evolved and may continue to evolve* • *Clarify how they finance their activities* • *Highlight how they describe the challenges faced by energy communities*

Dr. Anne-Lorène Vernay is Assistant Professor at Grenoble Ecole de Management, France. Her research focuses on how organizations (for and not for profit) in the energy sector develop innovative business models in response to the energy transition and on the role of business models in sustainability transition.

Dr. Carine Sebi is Assistant Professor at Grenoble Ecole de Management. Her research focused on energy efficiency policy implementation and evaluation. She is currently analysing citizens and consumers’ behaviours towards new energy services, products or models.