

## Article

# Collective Energy Practices: A Practice-Based Approach to Civic Energy Communities and the Energy System

Nick Verkade \* and Johanna Höffken

School of Industrial Engineering and Innovation Sciences, Eindhoven University of Technology, Room ATL 8.406, P O Box 513, 1600 MB Eindhoven, The Netherlands; j.i.hoffken@tue.nl

\* Correspondence: n.verkade@tue.nl

Received: 10 May 2019; Accepted: 5 June 2019; Published: 11 June 2019

**Abstract:** Civic energy communities (CECs) have emerged throughout Europe in recent years, developing a range of activities to promote, generate, and manage renewable energy within the community. Building on theories of Social Practice, we develop the notion of Collective Energy Practice to account for the activity of CECs. This expands the practice-based understanding of energy, which thus far has mostly focused on energy practices of the home. Additionally, we build on earlier practice-based thinking to come to our understanding of a ‘system of energy practices’. This view places the collective energy practices of CECs in a broader mesh of sites of practice, including policymaking, commercial activity, and grid management. Taking account of the enabling and/or restricting the influence of this broad system of energy practices is crucial in understanding the development of CECs’ practices. We accomplish this through the qualitative analysis of our long-term empirical research of five Dutch CEC sites, but also draw on our earlier fieldwork on smart grid projects in the Netherlands.

**Keywords:** civic energy communities; community energy; local energy initiatives; grassroots innovation; energy transition; social practice theory; energy practices

## 1. Introduction

Civic Energy Communities (CECs) have been on the rise in many countries worldwide; specifically, in the Netherlands, CECs are showing steady growth since 2010. The fourth and most recent report by the sector’s network organization counts 353 local energy cooperatives in the Netherlands [1], a country with 380 municipalities. CECs are local citizen organizations that aim to make their ways of using and generating energy environmentally, politically, and economically more sustainable. They achieve this through a range of activities, including: defining the visions of local sustainability, offering energy efficiency measures to the community, organizing collective buying of solar panels, and developing collectively owned renewable energy generation. CECs have the potential to make a significant contribution to the future energy system in Europe through these activities [2]. It is of importance to study the emergence of current and future activities of CECs in order to understand this transitioning system [3].

In this article, we focus on the activities of civic energy communities, specifically those activities through which they aim to generate and manage energy collectively. We develop two central arguments in this paper. First, we argue that the activities of community energy can be better understood through the conceptual lens of collective energy practices. In this argument, we bring together research regarding the development of community energy and work that conceptualizes energy from a social practice perspective. We find a useful distinction between three categories of

collective energy practices: promoting individual energy practices; developing collective energy generation; and, developing collective energy management.

Second, we argue that, to understand the (continuing) emergence of these collective practices, it is crucial to identify the linkages of these practices with the broader system of energy practices. Here, we work with the notion of a system of energy practices, building on theory and applications that were developed by Schatzki [4,5], Nicolini [6], and Watson [7]. This systemic view based within practice theory sees the energy system consisting of all the practices through which it is made and sustained. We will identify the crucial interlinkages with this system of energy practices that explain the emergence of collective energy practices for CECs and how these have been hindered and/or enabled thus far.

By developing these two arguments, we address the following research question: how can we understand the emerging practices of civic energy communities within a changing energy system?

Community Energy has been a topic of research for quite some time, being largely focused on renewable energy generation activities. Much of this research uses notions that are related to transition studies and the multi-level perspective. Energy communities [8] are often seen as ‘niches’ [9] within an unsustainable and obdurate regime [10] where ‘grassroots innovations’ [11,12] can develop. Although these innovations can be technical [13], CECs often work with existing products that are applied in new contexts, where non-technological aspects are the subject of innovation [3,14]. We build on this body of literature, but from a different perspective: we approach the activities of CECs from the perspective of social practice theory, in which the actual activities through which energy is generated and managed are the central object of study. This set of activities is still expanding as new material and non-material elements become available to CECs, and the place of community energy in a transitioning energy system is still in flux. The concept of collective energy practices will be mobilized to characterize the diverse activities of CECs.

It is argued that CECs are important in the development of local energy practices, because they pioneer initiatives to generate and manage energy [15,16]. In this innovative role, CECs actively challenge and question conventional practices through which the energy system is organized [17]. The challenges that are posed by local renewable energy generation to the grid infrastructure are becoming very palpable in several regions of the Netherlands [18]. CECs also challenge the conventional energy system by developing activities around managing the way that their community-generated energy is used. It is thus necessary to also take account of the practices of established energy system actors to understand the emergence and potential for CECs’ energy practices. We do this by extending our concept of collective energy practice to be enmeshed in a broader system of energy practices, based on earlier system of practices work [7,19]. In this paper, we elaborate a practice-based perspective that captures both the specific practices of CECs as well as the practices of other sites in the energy system.

The following section reports on the methods that we used in our research into various sites of practice over a longer period of time. Section 3 is about collective energy practices, and it introduces our findings on three categories of collective energy practices of CECs. This is followed by a section where we take a more systemic perspective and show the various sites of practice that form the system of energy practices. We close with a discussion regarding the collective energy practices of CECs within the energy system, by highlighting their empirical and theoretical relevance.

## 2. Methodology

This paper is based on fieldwork at several sites of the Dutch energy system, as part of a longer ongoing research project on emerging energy practices in the Netherlands. The focal sites of energy practices for this paper are civic energy communities, and, in particular, innovative CECs that are, or were, early developers of collective energy practices. The CECs that were researched for this paper are exemplary for this innovative character because of projects that they are, or were, involved in. Five of these CECs were researched in-depth by following on-going projects and through semi-structured interviews with key individuals. These key individuals had been involved with initiating CECs, developing its practices, and interacting with other system actors. Interviews were

performed at the home or workplace of the interviewees, and they lasted 60 to 90 min. The interviews were transcribed and analyzed by hand by the authors. The empirical material presented throughout this text in the form of telling quotes comes from these interviews with key individuals from the CECs. All five CECs are represented at least once through telling quotes, which was chosen to also reflect the expressions that were made in the interviews with other CECs. Our understanding of CEC's collective practices was expanded and triangulated by visiting events and utilizing reports from the Dutch community energy network organization HIER, and personal experience working with CECs. Table 1 provides some more information regarding the CEC names, locations, and the numbers that we use to reference them throughout the article. Thus, the analysis is built on a mixed method, formulating and deriving insights on the several 'sites of practice' from the interview data and site visits, and further substantiating these with literature on the energy sector. This table also forms an overview of the methods used to research the several practice sites.

Descriptive data on the public and commercial practices through which grid management is performed and changed were obtained in the authors' earlier fieldwork in two Dutch smart grid experiments (SSmE and JEM2: see also [20,21]). Our data about policy practices, which we collected through interviews with practitioners, is enriched by including relevant other research literature describing these practices.

**Table 1.** Overview of researched practice sites and mixed methodologies.

Site of Practice	Organization/Project (Location)	Method
CEC #1	Duurzame Energie Haaren (Haaren).	Semi-structured interviews. Sector events & reports.
CEC #2	Member of Brabant Provincial commission social innovation and initiator of several CECs.	
CEC #3	Morgen Groene Energie (Nuenen).	
CEC #4	Escozon (Heeten).	
CEC #5	Endona (Heeten).	
Grid management #1	Project SSmE ("Together energy smart" — Haaren).	Interviews with grid manager Enexis, other project partners and participants. Observing project meetings.
Grid management #2	Project JEM2 ("Your energy moment 2.0" — Breda).	
Local Policy		Based on literature & interviews at CEC sites.
Commercial		Based on literature, the project partners in two projects mentioned above & interviews at CEC sites.
National Policy		Based on literature.

### 3. Results

This section is divided into two larger parts. The first part deals with our notion and findings of the collective energy practices of CECs. The second part takes on a broader view, introducing our notion of a system of energy practices, and reporting on the several sites of practice that make up this system.

#### 3.1. Collective Energy Practices

In this section, we focus on the activities of civic energy communities that affect the way that energy is used and produced in the Netherlands. We will do this from a perspective that is based on theories of social practice and introduce a notion that—as we will argue—better captures the activities of CECs. Practice theory [4,20] understands the social in terms of the actual practices of people, whose daily lives consist of engaging in socially prefigured, but still indeterminate and emergent, activities. This line of thinking has questioned the rationalist approach to how people relate to energy [21], and instead reframes energy consumption as an invisible, but often necessary, by-product of the meaningful practices that were performed in our daily life [22]. However, practice theory has also been used to understand recently emerging energy-related activity in the household.

A range of research that is rooted in practice theory has been carried out to study the emerging energy practices of the home [23–27]. The concept of *energy practices* has been proposed as a particular set of practices through which “... energy is highlighted, made visible, problematized, managed, stored or discussed, which in turn produces insights that can be used to shape [domestic] energy conditions [25]”.

The focus in this line of research has mostly been placed on the activity of individual householders, within the arena of the home. The notion of these home energy management practices [28] is useful for this level of analysis, but it does not fully capture the phenomenon of energy collectives. Energy practices, as a concept, applies to much of the activity of CECs, as they are explicitly bringing energy to the foreground, highlighting and problematizing it, making it a matter of concern for the people that are involved and (as an aim) the wider community. However, the activities of a CEC have a more collective dimension than home energy practices: they only emerge after a group of people comes together and goes on to develop projects that they individually could or would not have. This distinctness from home energy practices is why we adopt the notion of *collective energy practices*.

Collective energy practices consist of the smaller practices that are performed by the community members, interrelated and united under the collective practice of e.g., operating a community-owned solar park. As a collective, by developing these collective practices, the CEC assembles the resources that are available within the community into actual practices, which would not emerge otherwise. An approach that sees the activity of a CEC as operating at a ‘larger scale’ than the individual is similar to how we might describe the activity of any other organization from the practice-theoretical perspective. This means that the recognizable activity that we observe within a collective, whether it is a CEC or a coal company, is a set of interrelated practices that are performed by multiple people at different times and places [29].

As will be seen in the description of the different collective energy practices, these are not being developed and performed exclusively by CECs. However, based on their founding principles, CECs aim to carry out their collective energy practices differently from the collective energy practices of other actors [30]. This means that this collective energy practice for a CEC should often include notions of democratic process, equality, local ownership, and the adequate scaling of technology. In the context of CECs, the term *collective practices* thus takes on an additional meaning, beyond the indication that they emerge from a multitude of individuals. The collective notion also holds that the activities that are developed by CECs often explicitly aim to benefit their community, work toward community-owned energy resources, and make sure that the community’s wishes are in some way represented in the local development of the energy transition. Furthermore, it indicates that it is through these collective practices that the community they identify with is further established and shaped: the practices give meaning to the CEC, a reason to be organized as a collective.

We expand the toolkit of social practices to better understand the phenomenon emerging through the activities of CECs with the concept of collective energy practices. In the following section, we will provide a more detailed look into the collective energy practices of civic energy communities. We distinguish three collective energy practices of energy communities: promoting individual energy practices; developing collective energy generation; and, developing collective energy management. This distinction is initially based on the development path that we have seen for CECs, where these categories can be often seen as stages of development.

### 3.1.1. Promoting Home Energy Practices

The initial practices that most civic energy communities developed, apart from organizational practices, were aimed at promoting home energy practices among their participants. This distinct type of collective energy practices promotes and supports the growth of home energy practice that is organized at the community level. The CEC directly impacts the energy system by ‘circulating’ [20] technical and non-technical aspects of these home energy practices among the community members.

The widespread organization of community schemes for buying solar panels is the most visible of these collective energy practices: “The first few years, we have been very busy getting solar panels

onto houses” (interview CEC #1 & #3). During the significant decrease in solar PV costs in recent years, many initiatives for collectively purchasing solar PV were started in the Netherlands. Up to the year 2018, at least 248 smaller and larger projects were counted [31]. This collective energy practice benefits the CEC by reaching out and recruiting members, whom themselves benefit by being “unburdened” in obtaining (cheaper) solar PV. Similar community schemes exist that promote home insulation, heat pumps, or energy monitoring devices. The community can also promote new knowledge and meanings regarding energy besides these ways of altering the material arrangement through which energy is used and produced within the home. Examples that were observed in our cases that help to achieve this include education on energy saving at schools, displaying individual ‘sustainable’ successes within the community, and promoting their vision and knowledge within political and civil society. In doing so, individual energy practices of energy monitoring and energy saving are promoted within the community.

However, these collective energy practices are not exclusive to CECs. In fact, of all the collective solar purchasing initiatives up to 2015 the majority (in number and capacity) of these initiatives was started by commercial actors, consumer organizations, or governmental programs [32]. Similarly, energy companies now offer easy access to solar panels and heat pumps to their customers, as well as a host of apps and devices to monitor and reduce energy usage. The way that CECs perform these collective practices is not very different from how this practice is performed by other societal or commercial actors (interview CEC #2). However, as a relatively easy to organize practice, which also offers clear benefits to the community members, it proved to be a successful first step in the development of many CECs.

### 3.1.2. Developing Collective Energy Generation

Following the promotion of individual energy practices, many CECs have moved on to another category of collective energy practice: developing collective energy generation. This practice, especially collective solar PV generation, has been widely picked up by CECs and grew fast in recent years: The amount of collectively owned solar projects grew from 277 in the year 2017, to 450 in 2018 [1].

The collective practice that was recognizable as collective energy generation consists of a host of smaller and diverse practices, related by their contribution to the collective practice. Smith, Hargreaves, Hielscher, Martiskainen, and Seyfang [11] lists many tasks within the set of practices that CECs needs to perform in setting up community energy: “Groups have to study technical information [...], constitute themselves as legal entity, apply for grants, seek loans, raise money, think about insurance, permissions, marketing strategies” [...]. This illustrates that developing collective generation is a more complex collective practice than the previous category of promoting individual energy practices.

In itself, the practice of generating energy through solar parks, wind turbines, or, for instance, biomass facilities is of course not exclusive to CECs. CECs often set out to apply a different (broader) range of elements, which are rooted in the principles on which the community operates and is built [30]. This becomes visible in the way that CECs shape their collective energy generation practices. As we have observed in our fieldwork, a democratic process and equality are basic principles for most Dutch CECs, which have legally established themselves as cooperative associations. Equality takes shape not only in the equal voting rights of cooperative members, but also in designing the investment structure of collective generation to be equally accessible for everyone (CEC #4). Rather than finding the largest investor for a local project, our case studies show how ownership is split into small shares that practically anyone can buy limited amounts of. Local ownership is not intrinsic to all collective solar generation by CECs, some projects allow for investment by anyone. However, local ownership has been a common goal for CECs, and over time it has become established as a standard form through changes in tax legislation. We will return to this topic in the next section. Lastly, the adequate scaling of collective generation means that whatever the type and size of the project that is developed by the CEC, it corresponds with what the community deems necessary (CEC #4). Thus, the leading principle might not simply be to develop the largest or cheapest project

to have as much renewable energy as possible; the project should fit with the values and goals that a majority of the community finds important.

Such founding principles of CECs, which they aim to apply in the collective practices that they develop, are not always recognized in the way other actors might develop the same practice of collective energy generation. This is especially relevant in regard to solar parks in the Netherlands, where market based actors are also offering and developing solar projects within the municipality. In fact, private actors form the majority in developing collective generation, while CECs own a mere 2% of total solar power in the Netherlands [1]. The ‘booming’ growth of commercially developed solar parks has been increasingly met with discussion and opposition at the local level, because the values and principles of the community are often not included in these developments.

### 3.1.3. Developing Collective Energy Management

We distinguish a third category of collective energy practices, which are formed by the collective energy management practices that address how, when, and which energy is used within the community. Just like collective *generation*, the technologies through which collective energy *management* is achieved have a collective nature; people do not individually develop them, they are operated by and for a collective. Energy monitoring platforms for the community [25,33]; community energy storage [34]; the development of community virtual power plants [35]; and, operating micro-grids [36] are examples of this.

Energy management practices are not new, as the maintenance of the electricity system has always required careful control and balancing throughout the grid. However, a consequence of a renewables-based energy system is that there is a growing need to manage the dynamics of energy at the scale of the household and the community. A host of smart grid pilots and experiments has been conducted over the years to test how technologies (storage, smart appliances, and IT platforms), tariff schemes, regulations, and information feedback can be applied to create a demand response and manage energy usage at the local level. The palette of energy management practices through which the energy system is balanced and maintained grows as all of these elements are developed. Although grid management is, strictly speaking, not their responsibility in the current energy system, we observe that CECs are starting to explore how their communities might engage in these energy management practices.

One main reason for this is that it improves the amount of community-generated electricity that is actually used within the community. Besides any moral principles that the CEC might have on becoming self-sustainable, improving on this will likely also be financially rewarding. CECs anticipate changes in the degree to which their collective generation capacity has access to the grid infrastructure. The local grid is meeting constraints in its ability to accommodate all electricity generated by collective solar electricity generation (not just by CECs) in ever more parts of the Netherlands. Grid operators and the government are already exploring ways to limit the pressure that collective generation puts on the grid [37]. Measures, such as flexible taxation and/or pricing, lead to higher costs of using the grid, and the curtailment of solar parks is a flat loss of the generated energy [38]. These interventions are not unlikely (some DSOs see “curtailment as unavoidable” [18]) and they can be a push for the CEC as owners and users of the generated energy to decrease their demand of grid capacity, as this is likely to become limited and more expensive at times. Thus, collective energy management practices that achieve this will become a logical add-on to collective generation for CECs.

Another reason we find is that, even before these more critical measures have to be taken, energy management practices can support the growth and position of the CEC. “To maintain [the CEC] we must find a new business model for cooperatives, in which they perform tasks to unlock and retain as much value as possible (CEC #5)”. Practices that unlock and extract value from flexible energy usage and storage are growing, often as a core practice of market-based aggregators. These practices generate value by reducing the energy usage, making use of fluctuating energy prices, and offering flexibility services for grid management. The CEC can strengthen its business model by

performing these practices itself, by setting up and utilizing flexible capacity (a battery, aggregation) within the community.

### 3.2. Understanding Collective Energy Practices within a System of Energy Practices

The collective energy practices of CECs are developed and performed in deep relation with the energy system at large, which we understand as a socio-technical system. As Watson [7] argues, practices “are partly constituted by the socio-technical systems of which they are a part; and those socio-technical systems are constituted and sustained by the continued performance of the practices which comprise them”. Collective practices of energy generation and management make use of, but also affect, the material infrastructures of the energy system. Furthermore, the devices that are applied in these practices are produced, supplied, and installed by other organizations. However, beyond the technical dimension, collective energy practices also relate to, make use of, and have an impact on the financial, legal, political, and cultural dimensions of the socio-technical energy system.

Just as the activity of CECs can be understood as collective energy practices, so can the activity of other organizations that contribute to the energy system. The “methods of planning and policy-making” that make and shape an infrastructure can be “considered practices in their own right” [39]. In this sense, the energy system is itself a larger constellation of practices that build it, feed it, regulate, use, and manage it. This system persists “through the routinized actions of actors throughout the system, as they perform the practices which reproduce the institutions and relations comprising the system”. [7]. The ‘system of energy practices’ is thus defined “as a relatively stable configuration of linked practices and relations that together sustain a particular socio-technical mode of doing” [19], in this case generating energy and managing the electricity grid.

The system of energy practices is dispersed over many different sites of practice: the energy practices of an energy producer, a grid operator, or a policymaker all play a part in the broader system of energy practices. The particular socio-technical mode of undertaking energy generation and management is routinely re-constituted by these various sites of practice, and the activity of CECs is thus dependent and prefigured by the system of energy practices. However, at the same time, this does not presume that influence is exclusively in the hands of “professional and political practices” [39]; any one site of practice can, by doing things differently, challenge and change the system of energy practices. This change is affected by alterations in other sites of practice, such as the political and legislative arena, grid management and planning, or the market for technologies.

From our perspective on a system of energy practices, even though we have a particular interest in the energy practices of CECs, “appreciating the relations between practices—not just interdependent but also competitive relations—is in fact essential to understanding the dynamics within practices” [7]. This means that, to understand development and change in collective energy practices, it is imperative to follow their linkages into the places and practices of national policymaking, grid management, local government, and commercial activity in the energy system. This means that not only the collective practices of CECs have to be studied, but also the sites of practice that are important for their emergence, growth, or failure.

We can identify the crucial enabling or hindering linkages to other sites of practice throughout the system of energy practices by studying the practices of CECs. This process of studying one focal practice and tracing the important relations to other sites of practice is similar to the ‘zooming’ approach that was presented by Nicolini [40]. Some of these other sites of practice have been an object of our own empirical work, while we refer to in-depth studies of others where available for other practices. We will report on the crucial enabling and hindering relations to other sites of practice that we have identified in studying the collective energy practices of CECs in the remainder of the section.

#### 3.2.1. National Policy Practices

Several national policies figure strongly in the emergence of collective energy practices. First of all, the collective practices that promote individuals to acquire solar panels were enabled by a national governmental policy that made solar panels more economically attractive. Net-metering

policy for individual households' self generated solar electricity has had major consequences in this regard, and the VAT rebate on solar systems has been another supporting policy. The net-metering policy was made as a general governmental policy to promote individual solar energy generation, without the reference or influence of CECs. It merely acts as a 'prerequisite' to the emergence of this particular collective energy practice, which we have shown has been a very common first step for CECs. The net-metering policy was intended as a temporary support mechanism, but it has been extended several times and it will last until the year 2023, when it will be replaced by a different policy [41,42].

A second relation to the sites of national policy practice becomes apparent by zooming in on the development of collective energy generation. The investment and subsidy structure of collective energy generation can take different forms, but most of the community-based energy generation is shaped by a particular national policy instrument: the 'postal code rose' (PCR) arrangement. CECs that develop energy generation capacity in shared ownership, for instance, by wind turbines or larger solar installations, have argued that this self-supplied energy should not be taxed in the same way as grid-supplied energy. Before a policy instrument ultimately came about, the tax regime in place heavily limited the economic feasibility of community energy. Repeated attempts by policymakers and local energy representatives to fight for a different tax regime for community energy throughout recent years in the Netherlands have been documented by [43]. This process shows how energy transition at the local level intersects with the practices of the national government, where the concerns of CECs were constantly balanced against reduced tax incomes.

Ultimately, this process resulted in the postal code rose (PCR) arrangement, which exempts the energy supplied to owners of collective generation within the same and adjacent postal code areas from taxation. This PCR arrangement, in turn, became a steering element for the further development of CECs' collective energy generation practices, because it only applied to the specific legal form 'cooperative association'. Already before the PCR arrangement was established, many CECs organized themselves as cooperatives [1], but this national tax policy has further entrenched the cooperative form.

The net-metering and PCR arrangement are only temporary measures, and it is not completely certain for individual users and collectives what future policy might look like. The temporary aspect of national legislation is of influence on the collective energy practices of CECs, because it introduces further risks: "what are the parameters, who is going to ensure our continuity?" (CEC #3). CECs can look for support from the European level: recent rulings by the European Parliament on the 'Clean Energy for All Europeans' package strives for national policies within the European Union (EU) to further recognize and accommodate the generation and management practices of CECs [44,45]. The tax related legislative changes are one example of this accommodation. Another example is the "Experimenting arrangement" that was first established by the national government in 2014 [46]. Under this arrangement, cooperatives can deviate from the "Elektriciteitswet" (Electricity Bill), meaning that they can take on roles and responsibilities that they are normally excluded from.

### 3.2.2. Local Policy Practices

Sites of local governmental practices are another site with an important relation to the development of collective practices of CECs [47]. The practices of local government have proved a valuable source of support and "strong facilitation" for the development of many CECs (CEC #2) although the municipality only acts at the fringes of the system of energy practices. This support can consist of funds to organize events, physical space on (municipal) roofs or lands for energy generation, or signaling the importance of the CEC to other organizations and inhabitants. The link between CEC and municipal practices works both ways, because the municipality is also often dependent on the collective practices that were developed by CECs. The sustainability of the energy system is rising on most municipal agendas, since "Paris and Groningen have become serious issues (Refers to the Paris climate agreement, and to earthquakes resulting from gas production in the Dutch province Groningen)" (CEC #3). However, the municipal capacity to pursue this sustainable agenda is still limited [48], especially in smaller municipalities: "there simply is no capacity or

quality to bring it into practice” (CEC #3). Changing this takes a long time due to the long and fluctuating cycles of local government practices, such as elections, setting a policy agenda, developing programs, and eventually appointing civil servants. CECs fill this gap by developing collective energy practices that promote sustainable action by citizens of the municipality [1].

CECs’ collective energy generation practices can develop at a scale that exceeds the boundaries of individual municipalities. In some areas these municipalities have remained relatively small, so that, in deploying and connecting energy generation, CECs quickly run into these boundaries. In these cases, officials and planners from other municipalities also get involved, with their own visions and practices, complicating the process for the CEC. “But energy does not follow these boundaries... I think, regarding energy management and generation, the municipal boundaries in this particular area are completely outdated” (CEC #3). Thus, the physical limits of local governmental practice are not always where the practices of CECs want to end.

### 3.2.3. Commercial Practices

The practices of commercial organizations in the energy system also prominently figure in the development of collective energy practices of CECs. The sites of practice are dispersed over a range of different businesses, such as commercial energy generators, suppliers of energy generation and management technology, and organizations that offer support services to CECs. Commercial sites of practice in the energy system relate to the collective practices of CECs in various ways, from supporting to competing with CECs.

For instance, the CEC often collects offers from a few suppliers who will sell and install the technology in question in organizing the promotion of individual energy practices. The relation between the CEC and these suppliers are described as “ambivalent” (CEC #3): on the one hand, by promoting solar panels, heat pumps, or home insulation, the CEC basically organizes a market for the supplier. In this way, the CEC and the supplier can support each other’s practices. On the other hand, the commercially driven actors also perceive the CEC as a competitor and as costly, because the CEC usually wants a small discount for its members. From the supplier’s point of view, the collective practice of promoting individual energy practices can also be performed by the supplier itself. This ambivalent and possibly competitive relation between CECs and commercial actors is a theme that we find in the development of all CECs’ collective energy practices.

The relation between CEC’s and commercial practices can have a supportive character: the annual report of CEC network organization HIER [1] signals a “growing willingness of commercial market parties to cooperate with local communities”. This cooperative stance is, for instance, visible among some of the commercial energy generating companies. No CEC by itself has the capacity (and very few the license) to supply its members-clients with energy at any time. If a CEC wants to directly sell energy its members, then it needs to enter into a partnership with an established and licensed energy supplier. A few commercial and sustainable energy suppliers, such as Greenchoice, have positioned themselves as supporting community energy [1]. These companies often also offer additional administrative services to the still inexperienced CEC besides being the buyer and co-supplier of energy community generated energy. By taking care of these administrative practices, the commercial actor prevents a lot of overhead administrative costs for the CEC. By offering services to automate and professionalize the administrative processes that come with collective energy generation and postal code rose projects, commercial actors enable the further growth of community energy.

The routine practices of commercial actors can also be of hindrance to the CEC’s development of collective energy practices, despite a willingness to cooperate with CECs. We find that commercial organizations that the CEC has to work with or rely on in developing their collective practices are not attuned to this new player on the field. The variety of technological, legislative, and financial elements that need to be integrated into these collective practices are not readily on offer; instead, they come from a range of organizations that each offer partial solutions based on the limits of their expertise and responsibilities. Collective generation, but especially collective management practices, involve “all these incredible technological parts, that ultimately need to be integrated into one

solution. There is no party that I know that offers these integrated solutions” (CEC #3). Thus, these elements need to be integrated by the CEC, a complex task that does not make further growth of collective energy practices easier.

Furthermore, our research on CECs developing collective energy generation practices also shows the competitive side of the relation between CECs and the sites of commercial energy practices. Developing collective energy generation has also become an attractive business opportunity with the ongoing decrease in costs and substantial governmental subsidies. This has led to strong growth in solar park developments that are not in the hands of communities, and that are not postal code rose projects. These commercial practices of energy generation at the local level compete with CEC energy generation practices. Especially with the growing criticism of land-based solar parks, the amount of space for energy generation that they compete over is limited at the community level. “The community takes this step first, before the big companies start moving, too. Subsequently, it is the question if you want to keep doing that, as a small organization” (CEC #3). Commercial actors can now offer complete packages for solar parks to a land-owning farmer or municipality, with which it is difficult for a slower-moving, volunteer-based CEC project to compete on economic terms.

### 3.2.4. Grid Management Practices

Yet another site of energy system practices are the sites where the electricity grid is produced and managed. Especially, the regional distribution grid operators (DSO) in the Netherlands have been quite visible by setting up or joining experimental projects to develop and test mostly technical, measures that will help in managing the electricity grid at the local level. However, the practices of grid management have something of a dual nature, which also reflects on how they relate to the collective practices of CECs.

DSOs have developed innovative elements that are in close collaboration with CECs that are developing collective energy management practices. Our own research [20] has covered a DSO-led project, in which (some of) the tools for individual household energy management practices are introduced to a CEC, with the goal “to explore the potential of social cohesion for energy management”. In recent years, DSOs are increasingly faced with communities who want to take up responsibilities in managing their energy. A cVPP project by a CEC in Loenen [49], and the GridFlex project with the CEC in Heeten [50] who want to experiment (under aforementioned Experimenting arrangement) with a local energy market and offer flexibility services are examples of this. These collective energy management practices are very relevant for DSOs, because these can support the DSOs task of local grid management, which might need ‘smarter’ solutions than what the conventional grid management practices entailed thus far.

On the other hand, by far the largest task that grid operators work on is maintaining a stable and reliable grid at all costs. It is this core practice on which they are judged, and this leads to a very defensive and risk-averse stance versus the uncertainties of working with collective energy management practices by CECs (CEC #3). Bids that are offered on the market for flexibility services (made mostly by commercial businesses such as aggregators) need to satisfy strict demands on reliability, availability, and response time. In this sense, the collective energy management practices of CECs will likely be held to the same standards. This development is still young and whether CECs are able to meet these standards in their grid management practices remains to be seen.

Besides the physical space that is needed for land-based solar parks, commercial and CEC energy generation practices also increasingly compete for capacity on the grid. In particular, in less populated areas that have been laid out with relatively low grid capacity, the limitations of the grid to accommodate collective energy generation are becoming visible [1]. In these areas, but perhaps also more generally in the near future, this limited grid capacity can be a barrier to the growth of collective energy generation. Furthermore, the nature of the practices of grid construction and planning is such that lifting this barrier by grid expansion will take a long time. Especially, the planning procedures can take several years, because this part of the process is also entrenched in governmental practices [18].

#### 4. Discussion and Conclusions

The three categories of collective energy practices that CECs engage in are in quite different stages of development. The promotion of individual energy practices is ubiquitous among CECs, collective energy generation is growing fast, while collective energy management is currently undertaken by a fraction of CECs. We want to stress that not all CECs develop all of these collective energy practices, and there is not a fundamental ordering to these three sorts of energy practice. However, we observe that these collective practices are logically consecutive and increasingly complex steps in the development of CECs. Furthermore, we find that CECs become more enmeshed with the broader energy system of practices with each step of developing these practices. The collective energy practices of CECs become more impactful on the existing energy system and the practices through which it is maintained.

In each of our proposed categories of collective energy practices, CECs (still) take up a small share when compared to public and market-based actors. However, we do not wish to discount the role of the collective energy practices of CECs within the energy transition that is unfolding throughout the system of energy practices. As Watson [7] says, a practice based perspective on the energy system holds that changes to the system can result from changes in any site of practice: “if small interventions initiate or give momentum to positive feedback effects in desirable processes of recruitment and defection, their cumulative effects on the overall system can be substantial [7]”. CECs developing collective energy practices ahead of others, precisely because they do not purely operate from business as usual, commercial position, and can thus contribute to the growth of these collective practices overall.

As their development progresses, CECs are increasingly performing tasks that touch upon, both positively and negatively, the practices of other actors in the energy system, in particular, those of grid management and market-based actors, such as energy generators and aggregators. As we noted, CECs often are started from a fundamentally different position regarding sustainable energy as compared to the current socio-technical system [30]. The organization of ownership and decision-making, the distribution of benefits, and the scale of technology are aspects of collective energy practices in which CECs aim to be distinctive. However, as Hicks and Ison [51] find, in reality, that these aspects are actually continuums of choices between the community ‘ideal type’ and the business as usual way of designing collective energy practices. This means that ‘community energy’ is an ambiguous term and that CEC energy practices come in many different forms. This highlights how it is likely that the collective energy practices of CECs, as they develop, will be required to conform to the practices of other sites of the energy system. This is already visible in the fast development of collective energy generation, where CECs compete for resources and space on economic terms with market-based actors. The question is whether CECs in this dynamic can keep bringing their basic principles into the way that they design their collective energy practices.

We have shown that the relation between sites of practice is varied: they can be enabling or hindering, and this relation can change with time. An enabling relation is seen, for example, in commercial energy suppliers that facilitate CECs to supply energy to their members as a reseller, or offer administrative services in support of collective energy generation. Conversely, the other sites of practices also hinder collective energy practices. This is seen in the mundane practices of grid management (coupled with booming commercial energy developments), which have culminated in the current situation of grid-constrained areas with no more grid-space for collective energy generation. Over time, the practices in these different sites of the energy system can also change their relation to the practices of CECs. The postal code rose arrangement is a striking example of this, which changed the site of taxation practices from a hindrance to collective energy generation to one that supports this practice for CECs. This observation is line with Macrorie’s [19] earlier definition of a system of practices as “a relatively stable configuration of linked practices and relations that together sustain a particular socio-technical mode of doing”, in that the particular mode of ‘doing’ linked energy practices is relatively stable, but is always open to change. We might say that, with time, the relatively stable configuration of practices at each site of the energy system needs to change to accommodate challenging practices, such as those of CECs.

In this article, we approached the topic of community energy and its role in a transitioning energy system from the perspective of social practice theory. We introduced the notion of collective energy practices: sets of energy practices beyond those of the individual, which emerge from some form of collective organization. These collective energy practices work towards collectively defined goals and, by being performed, also shape and maintain the collective. Collective energy practice is a useful concept, because it adds to the thus far individual-focused conceptual toolkit of practice-based understandings of sustainable energy and the energy transition. Conversely, understandings of community energy can be approached from a practice-based understanding with this concept.

A main characteristic of a practice-based perspective is that, ontologically, it places the practice itself center stage, rather than whoever is performing that practice. The collective that performs the practice can be a civic energy community, but also another organization, such as a market-based company, a public or government institution, or an organization from civil society. The point of focusing on the practice and ‘leaving open’ who the performing actor is, is not only inherent to practice theory, but it allows a perspective in which different organizations develop their own, sometimes competing, versions of collective energy practices.

We also extended the view on practices outwards, building on earlier work on systems of practice by Watson [7] and Macrorie [19] to come to the notion of an energy system of practices. Our descriptions of several collective energy practices are powerful examples that their emergence must be understood as embedded and shaped by other sites of practice within this system of practices.

The research question that was formulated for this article was: how can we understand the emerging practices of civic energy communities within a changing energy system? In this article, we empirically and theoretically answer this question. Our current energy system is changing and we have shown that the emerging activities of CECs play a role in these dynamics. We theorize this empirical phenomenon, in which a range of energy practices is collectively organized, by using the notion of collective energy practices and we show how such practices unfold within the broader energy system. Thereby, we highlight the empirical and theoretical importance of collective energy practices, as it gives us guideposts for both understanding and shaping the transition of our energy system.

**Author Contributions:** Conceptualization, N.V. and J.H.; Methodology, N.V.; Investigation, N.V. Writing—original draft preparation, N.V.; Writing—review and editing, N.V. and J.H.; Supervision, J.H.

**Funding:** This research is fully funded by The Netherlands Organization for Scientific Research NWO.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Abbreviations

CEC	Civic Energy Community.
cVPP	Community Virtual Power Plant
DSO	Distribution System Operator.
PCR (arrangement)	Postal-code Rose (arrangement).

## References

1. HIER. Lokale Energie Monitor 2018. In *Lokale Energie Monitor*; Schwencke, A.M., Ed.; HIER opgewekt: Utrecht, The Netherlands, 2018.
2. Kampman, B.; Blommerde, J.; Afman, M. *The Potential of Energy Citizens in the European Union*; CE Delft: Delft, The Netherlands, 2016.
3. De Vries, G.W.; Boon, W.P.C.; Peine, A. User-Led Innovation in Civic Energy Communities. *Environ. Innov. Soc. Transit.* **2016**, *19*, 51–65.
4. Schatzki, T.R. *Site of the Social: A Philosophical Account of the Constitution of Social Life and Change*; Penn State Press: State College, PA, USA, 2002.
5. Schatzki, T. Where the Action Is (on Large Social Phenomena Such as Sociotechnical Regimes). Available online: <https://www.semanticscholar.org/paper/Where-the-Action-Is->

- (On-Large-Social-Phenomena-Such-Schatzki/f3ec3188fdff5fb14c1d346d34c6b3f8a55bb265 (access on 4 June 2019).
6. Nicolini, D. Is Small the Only Beautiful? Making Sense of 'Large Phenomena' from a Practice-Based Perspective. In *The Nexus of Practices*; Routledge: Abingdon-on-Thames, UK, 2016; pp. 110–125.
  7. Watson, M. How Theories of Practice Can Inform Transition to a Decarbonised Transport System. *J. Transp. Geogr.* **2012**, *24*, 488–496.
  8. Dóci, G.; Vasileiadou, E.; Petersen, A.C. Exploring the Transition Potential of Renewable Energy Communities. *Futures* **2015**, *66*, 85–95.
  9. Seyfang, G.; Hielscher, S.; Hargreaves, T.; Martiskainen, M.; Smith, A. A Grassroots Sustainable Energy Niche? Reflections on Community Energy in the UK. *Environ. Innov. Soc. Transit.* **2014**, *13*, 21–44.
  10. Geels, F.W. Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory Cult. Soc.* **2014**, *31*, 21–40.
  11. Smith, A.; Hargreaves, T.; Hielscher, S.; Martiskainen, M.; Seyfang, G. Making the Most of Community Energies: Three Perspectives on Grassroots Innovation. *Environ. Plan. A Econ. Space* **2015**, *48*, 407–432.
  12. van der Waal, E.; van der Windt, H.; van Oost, E. How Local Energy Initiatives Develop Technological Innovations: Growing an Actor Network. *Sustainability* **2018**, *10*, 4577.
  13. Ornetzeder, M.; Rohrer, H. Of Solar Collectors, Wind Power, and Car Sharing: Comparing and Understanding Successful Cases of Grassroots Innovations. *Glob. Environ. Chang.* **2013**, *23*, 856–867.
  14. Haxeltine, A.; Avelino, F.; Wittmayer, J.; Kemp, R.; Weaver, P.; Backhaus, J.; O'Riordan, T. Transformative Social Innovation: A Sustainability Transitions Perspective on Social Innovation. In Proceedings of the Social Frontiers: The Next Edge of Social Innovation Research: London, UK, 14–15 November 2013.
  15. Oteman, M.; Kooij, H.-J.; Wiering, M. Pioneering Renewable Energy in an Economic Energy Policy System: The History and Development of Dutch Grassroots Initiatives. *Sustainability* **2017**, *9*, 550.
  16. Hewitt, R.J.; Bradley, N.; Baggio Compagnucci, A.; Barlagne, C.; Ceglarz, A.; Cremades, R.; McKeen, M.; Otto, I.M.; Slee, B. Social Innovation in Community Energy in Europe: A Review of the Evidence. *Front. Energy Res.* **2019**, *7*, doi:10.3389/fenrg.2019.00031.
  17. Proka, A.; Hisschemöller, M.; Loorbach, D. Transition without Conflict? Renewable Energy Initiatives in the Dutch Energy Transition. *Sustainability* **2018**, *10*, 1721.
  18. Solar Magazine. Enexis En Tennet Maken Plannen Voor Netaansluitingsproblematiek Zonneparken. *Solar Magazine*, 1 March 2019.
  19. Macrorie, R. Reconstructing Low-Energy Housing Using 'Systems of Practice'. Ph.D. Thesis, University of East Anglia, Norwich, UK, 2016.
  20. Verkade, N.; Höffken, J. Is the Resource Man Coming Home? Engaging with an Energy Monitoring Platform to Foster Flexible Energy Consumption in The Netherlands. *Energy Res. Soc. Sci.* **2017**, *27*, 36–44.
  21. Verkade, N.; Höffken, J. The Design and Development of Domestic Smart Grid Interventions: Insights from the Netherlands. *J. Clean. Prod.* **2018**, *202*, 799–805.
  22. Shove, E.; Pantzar, M.; Watson, M. *The Dynamics of Social Practice. Everyday Life and How It Changes*; Sage: London, UK, 2012.
  23. Shove, E. Beyond the Abc: Climate Change Policy and Theories of Social Change. *Environ. Plan. A* **2010**, *42*, 1273–1285.
  24. Naus, J. The Social Dynamics of Smart Grids. Ph.D. Thesis, Wageningen University, Wageningen, The Netherlands, 2017.
  25. Hargreaves, T.; Nye, M.; Burgess, J. Making Energy Visible: A Qualitative Field Study of How Householders Interact with Feedback from Smart Energy Monitors. *Energy Policy* **2010**, *38*, 6111–6119.
  26. Smale, R.; van Vliet, B.; Spaargaren, G. When Social Practices Meet Smart Grids: Flexibility, Grid Management, and Domestic Consumption in the Netherlands. *Energy Res. Soc. Sci.* **2017**, *34*, 132–140.
  27. Röpke, I. The Roles of Households in the Smart Grid. 2013. Available online: [http://vbn.aau.dk/files/77312030/KU\\_Smart\\_grid\\_4.pdf](http://vbn.aau.dk/files/77312030/KU_Smart_grid_4.pdf) (accessed on 25 May 2019).
  28. Strengers, Y. *Smart Energy Technologies in Everyday Life: Smart Utopia?* Palgrave Macmillan: London, UK, 2013.
  29. Smale, R.; Spaargaren, G.; van Vliet, B. Householders Co-Managing Energy Systems: Space for Collaboration? *Build. Res. Inf.* **2019**, *47*, 585–597.
  30. Schatzki, T.R. *The Timespace of Human Activity: On Performance, Society, and History as Indeterminate Teleological Events*; Lexington Books: Lanham, MD, USA, 2010.

31. Van der Schoor, T.; Lente, H.v.; Scholtens, B.; Peine, A. Challenging Obduracy: How Local Communities Transform the Energy System. *Energy Res. Soc. Sci.* **2016**, *13*, 94–105.
32. PolderPV. Inkoop Acties Zonnepanelen in Nederland. Available online: [http://www.polderpv.nl/inkoopacties\\_Nederland.htm](http://www.polderpv.nl/inkoopacties_Nederland.htm) (accessed on 9 May 2019).
33. The Solar Future Vii—3. Inkoopacties. Available online: [http://www.polderpv.nl/nieuws\\_PV126.htm#6jun2015\\_TSF3\\_inkoopacties](http://www.polderpv.nl/nieuws_PV126.htm#6jun2015_TSF3_inkoopacties) (accessed on 9 May 2019).
34. Kloppenburg, S.; Boekelo, M. Digital Platforms and the Future of Energy Provisioning: Promises and Perils for the Next Phase of the Energy Transition. *Energy Res. Soc. Sci.* **2019**, *49*, 68–73.
35. Koirala, B.P.; van Oost, E.; van der Windt, H. Community Energy Storage: A Responsible Innovation towards a Sustainable Energy System? *Appl. Energy* **2018**, *231*, 570–585.
36. Van Summeren, L.; Wieczorek, A. Defining Community-Based Virtual Power Plant. Available online: <http://www.nweurope.eu/projects/project-search/cvpp-community-based-virtual-power-plant/> (accessed on 3 May 2019).
37. Hirsch, A.; Parag, Y.; Guerrero, J. Microgrids: A Review of Technologies, Key Drivers, and Outstanding Issues. *Renew. Sustain. Energy Rev.* **2018**, *90*, 402–411.
38. Netbeheer Nederland. *Position Paper—Aansluiten Duurzaam Op Land*; Netbeheer Nederland: The Hague, The Netherlands, 2019.
39. Bird, L.; Lew, D.; Milligan, M.; Carlini, E.M.; Estanqueiro, A.; Flynn, D.; Gomez-Lazaro, E.; Holttinen, H.; Menemenlis, N.; Orths, A.; et al. Wind and Solar Energy Curtailment: A Review of International Experience. *Renew. Sustain. Energy Rev.* **2016**, *65*, 577–586.
40. Shove, E.; Watson, M.; Spurling, N. Conceptualizing Connections: Energy Demand, Infrastructures and Social Practices. *Eur. J. Soc. Theory* **2015**, *18*, 274–287.
41. Nicolini, D. *Practice Theory, Work, and Organization: An Introduction*; Oxford University Press: Oxford, UK, 2012.
42. Energiea. Wiebes: Consumenten Kunnen Tot 2021 Nog Salderen. Available online: <https://energiea.nl/energiea-artikel/40072302/wiebes-consumenten-kunnen-tot-2021-nog-salderen> (accessed on 20 March 2019).
43. Rijksoverheid. *Salderingsregeling Verlengd Tot 2023*; Rijksoverheid: The Hague, The Netherlands, 2019.
44. Kooij, H.-J.; Lagendijk, A.; Oteman, M. Who Beats the Dutch Tax Department? Tracing 20 Years of Niche–Regime Interactions on Collective Solar Pv Production in The Netherlands. *Sustainability* **2018**, *10*, 2807.
45. REScoop.eu. European Parliament Puts Its Final Stamp on New Rules to Empower Citizens Energy Communities. ReScoop.eu. Available online: <https://www.rescoop.eu/blog/european-parliament-puts-its-final-stamp-on-new-rules-to-empower-citizens> (accessed on 28 March 2019).
46. Ministry of Economic Affairs. *Besluit Experimenten Decentrale Duurzame Elektriciteitsopwekking*; Ministry of Economic Affairs: Den Haag, The Netherlands, 2015.
47. Hoppe, T.; Graf, A.; Warbroek, B.; Lammers, I.; Lepping, I. Local Governments Supporting Local Energy Initiatives: Lessons from the Best Practices of Saerbeck (Germany) and Lochem (The Netherlands). *Sustainability*, **2015**, *7*, 1900.
48. Elzenga, H.; Schwencke, A.M. Lokale Energiecoöperaties: Nieuwe Spelers in De Energie. Available online: <http://asiseach.nl/wp-content/uploads/2016/11/2015-Artikel-PBL-Tijdschrift-Bestuurskunder-2015-artikel-Lokale-energiecoo%CC%88peraties-Elzenga-Schwencke.pdf> (accessed on 4 June 2019).
49. DPL. Community-based Virtual Power Plant Loenen. Available online: <https://duurzaamloenen.nl/community-based-virtual-power-plant-loenen> (accessed on 11 June 2019).
50. GridFlex. Gridflex Heeten. Available online: <https://gridflex.nl/> (accessed on 11 June 2019).
51. Hicks, J.; Ison, N. An Exploration of the Boundaries of ‘Community’ in Community Renewable Energy Projects: Navigating between Motivations and Context. *Energy Policy* **2018**, *113*, 523–534.

