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Grid governance; what new roles for the community energy movement?

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1. Introduction

In the Netherlands, local energy cooperatives are increasingly active in the production of renewable energy. The Local Energy Monitor 2020 (Schwencke 2021) counted 623 local energy cooperatives in the Netherlands, which are spread over all provinces, all regions and 85% of municipalities.

In the past years, energy communities and prosumers also have received growing recognition on the EU-level, as is demonstrated in the Clean Energy Package (Lavrijssen 2017; Verde and Rossetto 2021). Some authors take this as the future governance model for a renewable energy system (Lowitzsch, Hoicka, and van Tulder 2020). Although not all member states have incorporated the new rules in their legal system yet, it is expected that the Clean Energy Package will stimulate community energy throughout the EU.

Many cooperatives have concrete plans to invest in energy projects, such as solar fields and wind turbines. Unfortunately, because of growing problems of net congestion in the Netherlands, room for such projects is increasingly limited. In their quest to help solve this predicament, energy cooperatives are developing new and innovative energy services, for example delivering grid services to distribution system operators (DSOs). However, there are numerous legal, technical as well as economic obstacles for such innovative energy services (Royal Haskoning DHV 2021).

The development of grid infrastructures in relation to the energy transition has been studied in transition theory (Verbong and Geels 2010). Also from an LST-perspective interesting analyses have been carried out (Bolton and Foxon 2015; Sovacool, Lovell, and Ting 2018). However, in these literatures, the focus mainly on the transformation from a fossil-nuclear to a renewable energy system. However, many argue that the structure of the energy system is also changing from a centralized to a decentralised system. Moreover, according to the community energy movement the energy system should also be inclusive and democratic. These various transformation pathways are compared by Funcke and Bauknecht, (2016; S. Funcke and Ruppert-Winkel 2020). Hojckova et al. (2018) analyse how three different electricity futures, the 'super-grid', 'smart-grid' and 'off-grid' are represented in the literature, as well as tracing how technologies, main actors and institutions are connected to these futures. To characterise the possible future 'prosumer markets', Parag & Sovacool (2016) sketch three possible market structures, one of which is based on 'organized prosumer groups.'

In the present energy system, the grid operators (DSOs) play a significant role. As Galeano Galvan et al. (2020) remark, they have a position from which they can influence the energy transition. However, as DSOs are traditional, centralized organizations, which are not used to communication with new entrants in the energy system, it is often difficult for RECs to engage with DSOs (Van der Waal, Das, and Van Der Schoor 2020). Furthermore, research showed that DSOs do not always give sustainability priority, compared to other values such as efficiency or security of supply (Edens and Lavrijssen 2019). Nevertheless, there are instances where DSOs actively facilitated the creation and growth of niches which could help solve grid problems (2020).

What is missing in the literature so far is attention to the more developed energy communities that we see nowadays, which go much further than organizing individual prosumers. These RECs often own

energy production units, such as solar parks or windmills. Furthermore, they often engage in experiments such as smart grids (Summeren et al. 2020; Kloppenburg, Smale, and Verkade 2019).
In fact, a whole landscape of different organisational constellations has emerged, where local cooperatives join forces with municipalities, housing associations, project developers, owners' associations, water boards, and others.

The variety of activities employed by these community energy organisations has also broadened considerably. Drawing on Social Movement Theory, we argue that these activities indicate that energy communities engage in 'prefigurative' activities; they create in their own environment the decentralized and democratic energy system that they strive for (Van Der Schoor et al. 2016). In this article, inspired by the models of Parag & Sovacool (2016), we aim to identify sociotechnical modules for a system design that accounts for these expanded roles and new situations.

This paper draws on a current research project on innovative community energy services in the Netherlands. The aim of this project is to investigate new roles for cooperatives in delivering innovative energy services to their clients, such as demand response, cooperative aggregator, or peer-to-peer energy delivery. Furthermore, we ask if and in what way the provision of balance services might be feasible and profitable for RECs. For these roles, we enquire what technical knowledge is needed, what the best scale and level is for such activities, and which business models are available. Also, the legislative aspects are an important aspect, in the light of the implementation of the Clean Energy Package.

This research is set up as a transdisciplinary project, where we develop questions and directions for solutions together with partners from practice. To that end, we have organized a series of meetings with community energy organisations, both local cooperatives and umbrella organisations. These meetings could either be with the large network connected to the research project, or with the expert group especially set up for the development of regional services. Furthermore, several interviews took place with interested renewable energy communities. It must be strongly emphasized that this is work in progress.

The paper is organized as follows. Section 2 contains a brief theoretical background. Section 3 describes the innovative energy services that are under development. Section 4 contains the discussion and conclusion.

2. Theoretical background

For our analysis, we rely on Social Movement Theory (Ruggiero and Montagna 2008), complemented with transition theories. As Touraine argues, a social movement is basically a conflict over governance of resources. In our case, we argue that the community energy movement represents a social conflict about the production and appropriation of energy resources, with the potential to foster new forms of organisation and governance of sustainable energy production (Touraine 1985). Ultimately, this conflict represents a struggle about different visions on how modern societies should provide energy in a more sustainable, but also a more democratic way (Burke and Stephens 2017). According to Rao (2000), social movements produce new organizational forms, for example because market mechanisms fail to reduce negative externalities or when parties with vested interests resist the arrival of newcomers in a market. In this vein, it is important to analyse how the incumbent energy companies react when they find an increasing number of energy communities create new organizational forms and take on roles traditionally undertaken by the incumbents. Geels and Turnheim discuss the role of incumbents in the energy transition, drawing on the Multilevel Perspective (Turnheim and Geels 2012; Geels et al. 2016).The axis of challengers and incumbents is critically examined by Hensmans (Hensmans 2003). The opposition by regime players to innovative newcomers is also analysed by (Berlo, Wagner, and Heenen 2017; Galeano Galvan, Cuppen, and Taanman 2020).

From an STS perspective, it is stressed that materialities, technologies and policies occur together and mutually influence each other. Pinker et al. (2020) connect these thoughts to energy communities and discuss their navigations through an already formed landscape. We build on these notions by closely following discussions by RECs about the development of the identified energy services. Practical, technical, financial, legislative, organizational, and political considerations intermingle in these deliberations.

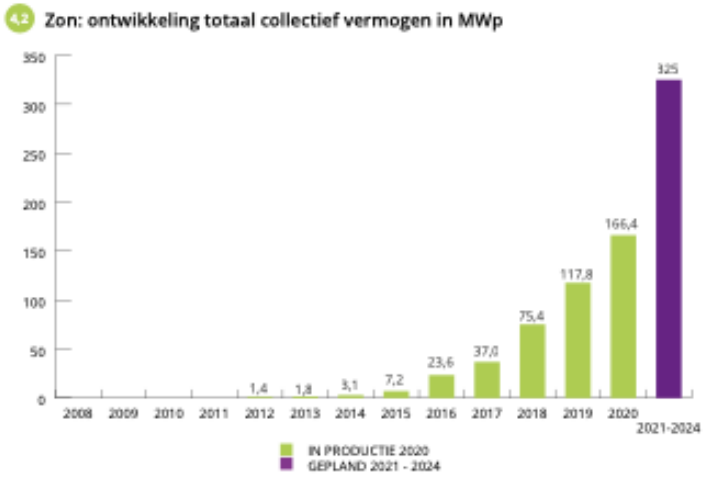
On a technical and economic level there is an extensive literature on the functions in the energy system that are central to our research, such as energy storage, demand response and aggregator services. Here, we focus in particular on studies that highlight experiences of RECs with these functions.
Cooperative energy storage projects are investigated by several authors (Koirala, van Oost, and van der Windt 2020; Kloppenburg, Smale, and Verkade 2019). Two important obstacles for realisation of storage are firstly the price of batteries and secondly the double taxation in the Netherlands. Communities that own energy assets, such as solar park, may consider supply management or curtailment to finetune their production with the prices in the energy markets (Segundo Sevilla et al. 2018). Curtailment is one of the options that will be investigated in our project.
There is a large literature on demand response, however this has mostly a technical or economic focus. Examples of pilot projects, such as Jouw Energie Moment and NiceGrid are described by Fonteijn et al. (Fonteijn et al. 2018). Furthermore, Gough et al. (2020) performed a literature study of 'prosumer flexibility'. However, expectations should not be too high, as is shown by Parrish et al. (2019) and Langendahl et al. (2019).
On a EU level, Horstink et al. (2020) performed a large investigation of prosumer initiatives, they find that only a limited amount of initiatives consider to offer energy services such as aggregation. Aggregator services in the Netherlands are investigated by Lampropoulos et al (Lampropoulos et al. 2018), focusing on barriers and solutions for flexibility in the Dutch energy system. Furthermore, an inventory of Dutch 'local marketplace projects' was drawn up by Goes and Volkerts (Goes and Volkerts 2017). Although these initiatives are commercial, not citizen-led, such findings can illuminate the opportunities that exist for RECs.
Some experiments with bottom-up net management are described by (Lammers and Diestelmeier 2017; Diestelmeier 2019; Van der Waal, Das, and Van Der Schoor 2020). However, there are to our knowledge no examples of RECs that have attempted to take up the role of the Balance Responsible Party or BRP. Klaasen and Van der Laan (2019 p. 7) argue that it is often not financially feasible or practical for RECs to take up this role themselves, due to their limited scale. For a description of the different roles and tasks of TSOs, BRPs and BSPs also see Van der Veen and Hakvoort (2016).

3. Energy communities: development and dynamics from 2015 – 2020

Since 2015, the growth and development of the community energy movement in The Netherlands has been monitored by Schwencke (2016, 2017, 2018a, 2018b, 2020, 2021). Every year a Local Energy Monitor has been published, amalgamating information from a wide range of sources, such as surveys, desk research and interviews. This series of six Monitors provides a rich overview of organisations, activities, energy projects and results of the Dutch community energy movement. Quantitatively, the movement has grown from 243 local energy cooperatives in 2015 to 623 in 2020. The growth of local cooperatives is slowing down, presumably because the present coops already cover 85% of municipalities, where 95% of the Dutch population resides. So, for most inhabitants there is an energy community in the area. In 2016 the number of active members was estimated at 50.000, in 2020 this amount has almost doubled to 97.000.

Production

The Monitors also show what these energy communities have achieved in the sense of installed power. For solar power this has grown from 7,2 MWp in 2015 to 166,4 MWp in 2020. For the period of 2021-2024 a growth to 325 MWp is in expected on the basis of projects that are in preparation.



Figuur 1: Total installed collective sunpower in MWp, Schwencke 2021, p. 44

For wind power the installed power has grown from 76 MW in 2015 to 230 MW in 2020. Construction for another 92,5 MW is in progress, while licenses for 65 MW are expected to be granted this year.

Figuur 6.1: ontwikkeling windvermogen in coöperatief eigendom in MW.

Figuur 2: Total collective assigned windpower in MW 2020, Schwencke 2021, p. 77

Activities

Although the development of solar and wind projects is an important activity for energy communities, in the course of the years the variety of energy-related activities has broadened out considerably. From the beginning, many RECs were active with the provision of 'local energy' to their own members. Since 2017 this local renewable energy was branded as a regional product and sold to large customers, such as municipalities and provinces.
Furthermore, 70% of RECs employed activities on energy efficiency, such as the organization of energy information markets, courses, support for the choice of energy measures, or providing heat scans. In 2019 the instrument 'energy coach' became more prominent. In several municipalities the

online information desks, called 'Energieloket', were executed by cooperatives. Other themes that gain prominence are the heating transition and the transformation towards 'gas-free' neighbourhoods. In 2017 the first cooperatives were identified that worked on projects to share Electric Vehicles, often in combination with facilities such as charging stations. In 2019, the interest in energy storage is increasing. In the same year Schwencke describes ten cooperatives which are involved in green gas projects. Innovative energy carriers like hydrogen are investigated, in 2020 several feasibility studies are underway.

Organisation

The majority of local energy cooperatives are organisations that are founded to develop energy projects in a specific town, city or neighborhood. Often, the cooperative is chosen as legal form because this is the most democratic form. However, citizens initiatives that are initiated by other organisations, such as village associations, can also be set up as a 'project cooperative'. Some project cooperatives specialize in one type of energy production, so we see wind cooperatives or heating-cooperatives. With the onset of the Postcoderoos facility, project cooperatives could also be founded by House Owners' Associations (VvEs). Moreover, cooperatives can be started by municipalities, by traditional energy providers, by farmers or by other businesses, A special form is the crowdfunding collective, later taken on by specialized crowdfunding platforms. Lastly, there are cooperative energy companies, which can be 'cooperatives of cooperatives'.

Many cooperatives join forces with other partners in project development. In the course of the six years cooperation is set up with municipalities, housing organisations, project developers, farmers' organisations, energy companies, Waterboards, Prorail, Rijkswaterstaat. We take this as indication that the community energy movement is aligning itself with other parts of society. The growing size of projects often leads to a more complicated consortium of multiple partners.

4. Energy services: drivers and opportunities for energy communities

In section 2 we briefly described the new roles that are now under investigation by RECs in the Netherlands. However, an important question is why these new functions came into view. What are the drivers that stimulated RECs to venture into new territories of the energy system? The Local Energy Monitor provides some indication of the timing of new proposals in reaction to obstacles that arise for RECs. In 2020, the lack of grid capacity is first mentioned, by 40% of the participating RECs. In 2020 the Monitor mentions two examples of local cooperatives that experiment with flexibility. The national umbrella organisation Energie Samen started preparations for a cooperative aggregator. Also, several projects have started in relation to the Experiments Facility (Van der Waal, Das, and Van Der Schoor 2020). Other solutions worked on by RECs are energy storage and cable pooling (Schwencke 2021).

In the preparation of this research project, we carried out interviews with key persons in the community energy movement in The Netherlands. An important obstacle that was mentioned with increasing urgency is the lack of capacity of the electricity network for new energy production units, such as solar parks. Furthermore, spokespersons argued that with certain activities RECs in fact performed 'grid services', that were however not paid for by DSOs. Here, we refer to activities such as neighbourhood energy storage or zero-on-the-transformer (Koirala, van Oost, and van der Windt 2020). REC-spokespersons were looking for business and organisation models that could help to relieve net congestion against a reasonable price.

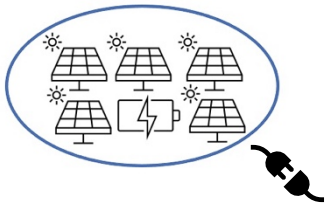
To enquire after the relevance of such innovative energy services for a broader group of RECs we interviewed six RECs in the northern region of the Netherlands, which is most affected by net congestion. These RECs all have realized one or more solar parks, in a capacity from 204 to 8000 PV-panels. Membership varied from 29 to 1000.

In five of these cases, net congestion caused problems and delays in realising new projects. In one case, subsidies were acquired, capacity on roofs was obtained, but then realisation was not possible at all. In another case, a planned project of 1600 PV panels had to be scaled down to 200 PV panels. In three cases, net congestion did cause delays, but eventually the solar park was realized.

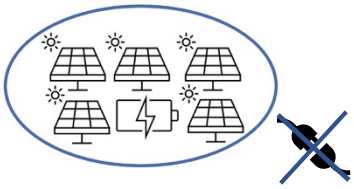
For specialised knowledge of energy regulation two of the RECs in this sample indicated that one of their active members was a lawyer. Two others indicated that they were dependent on knowledge institutions and the national umbrella of energy communities to provide such information.
Knowledge of the concepts such as aggregator, flexibility, congestion management, demand response varied. All groups were interested in new energy services in some form if their members would agree. They were interested in energy storage and in a cooperative aggregator. However, all groups indicated they would need expert support to set up such services or preferred to join a cooperative project.
Our interviews so far indicate that net congestion is an important driver of current interest in new services, combined with the need to get a reasonable payment for delivered grid services. However, the knowledge base to perform these functions is yet undeveloped, so expert help will be essential.

The energy services that are envisaged in the project are the following.

a. Cooperative solar (or wind) park combined with battery storage
One of the partners in the CiB-project is Escozon from Heeten. Together with Endona, a local REC, they realized a solar park in which room was reserved for a battery. This consortium has earlier experience with batteries at a household level and is an active member of Grid Flex, a EU-funded project on flexibility. See also (Koirala, van Oost, and van der Windt 2020).

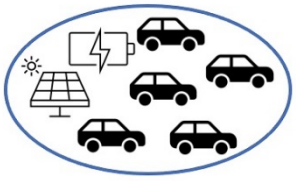


b. Cooperative solar (or wind) park combined with curtailment or controlled supply management. Recently, negative energy prices and high unbalance costs led to financial problems for energy cooperatives. Curtailment, or in other words briefly switching off the energy production unit could be a solution, especially for RECs that own solar parks. Although this may seem undesirable, it can help financial results in specific circumstances.



c. Aggregator services
An aggregator collects flexibility from multiple customers and sells this on the energy market or as a service to a DSO. This is a relatively new role in the energy system, so far there is little experience with it.

d. Demand response
For a REC, de management of supply and demand can be important, for example to reach the goal of 'zero-on-the-transformer' and thus help smooth peaks and troughs in the network. However, for the near future, a recent report shows that only electric vehicles in combination with charging outlets and heat pumps are feasible alleyways to develop flexibility (Van Gerwen et al. 2021). In the Northern region several projects are experimenting with this approach.



e. Balance services
Continually, the balance between supply and demand of electricity has to be maintained. Small energy producers usually delegate financial and administrative obligations for maintaining balance to Balance Responsible Parties. On a daily basis, a BRP indicates what the expected electricity production, consumption and external trade is. This function requires considerable knowledge as well as financial reserves. Nevertheless, it is considered useful to pick apart the different tasks of a BRP and investigate if at least part of these tasks can be carried out fruitfully on a cooperative basis.

However, the role of Balance Service Provider (BSP) could be within reach of RECs, at least in the Netherlands Escozon has recently acquired the necessary license to act as BSP.
It is expected that learning about balancing services can help RECs to negotiate better deals with existing BRPs and allow them to expand their business in this direction.

5. Discussion

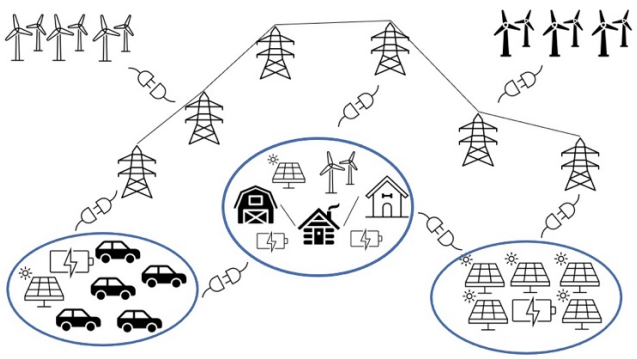
The research project to investigate new roles and energy services for RECs is only in its first year, so in this conference paper our intention is merely to set the scene. Nevertheless, the energy services that are developed show that the community energy movement is developing itself on a continuing basis. It has come a long way from the early days of organising individual prosumer actions. The setup of collective production facilities has already become rather common. The wish to develop grid services stimulates acquisition of knowledge and necessitates a robust financial basis. Energy communities now aim to take up roles in the full energy chain: as energy producer, distributor, energy trader and prosumer.

As a social movement, we argue that these new services can be called 'prefigurative practices'. Such prefigurative practices are different from 'activist practices' in the climate movement, because here an envisaged new energy system. with the investment of their own time and money.
New organizational forms emerge, in which RECs cooperate with other societal partners to be able to develop large projects for wind and sun power.

Community energy collectives are not restricted to representing prosumers which have an individual relation to the energy system. The community energy movement has evolved, so that RECs can provide services to all types of consumers, regardless of individual ownership of energy production units. Community energy cooperatives increasingly own and manage energy assets, such as solar roofs, solar parks, windmills.

Furthermore, we see that RECs operate as a social enterprise. The original goals or the community energy movement are still adhered to, but to guarantee continuity as an enterprise it is important to develop profitable business models and to engage paid employees in addition to volunteers.

We identify new types of actor constellations managed by RECs. These constellations can be interpreted as elements of a decentralised energy system with variable energy clusters, managed by RECs. In particular, we investigate combination of a solar park with energy storage, supply management of cooperative assets, developing the role of aggregator, demand management and balance services.



To develop and manage these new functions takes a heavy toll in the form of knowledge acquisition, negotiation skills, organisation strength, and finally the capacity to take financial risks. The community energy movement is therefore considering new organisation and business models to be able to take

up these challenges. Expanding to more segments of the energy system could lead to more profitable economic activities, that ensures continuity for the social enterprise of RECs. To that end, RECs need to scale up; for knowledge and time intensive jobs such as energy trade and management of energy facilities it is deemed essential to include a larger volume of energy assets. These activities bring substantial financial risks with them, so the economic buffer should be relative to that.

In this paper, we have drawn a first sketch of how the community energy movement aims to develop new functions within the existing regulatory framework. As the project advances, we will further investigate the described constellations together with our research partners from the community energy movement.

Presenting author – Dr Tineke van der Schoor started her career in the field of sustainable development. She has worked for multiple environmental NGOs and as a sustainable development consultant. She also was a delegate for NGOs to several UN-meetings on environment and development. In 2010 she joined the Hanze University of Applied Sciences as a researcher, focusing primarily on the energy transition. In this period, she carried out several research projects on the community energy movement. Other research topics are historical buildings and energy renovation.

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