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Community participation in electricity markets: The impact of market organisation

Laura H.G.J. Van den Berghe, Anna J. Wieczorek *

School of Industrial Engineering & Innovation Sciences, Eindhoven University of Technology, PO Box 513, 5600MB, Eindhoven, the Netherlands

A R T I C L E I N F O

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A B S T R A C T

Energy communities are considered important drivers of the energy transition. While they have mainly focused on collective energy generation, they are increasingly getting involved in the provision and trading of energy and in flexibility services. This change of focus creates opportunities to participate in electricity markets but proves to be challenging because of the current electricity markets serving incumbency. In this study, we conduct an in-depth analysis of how broader market organisation impacts participation of energy communities in electricity markets. Drawing from transition studies and economic market literature, we develop a framework for analysing market organisation. Based on a literature review, observations and semi-structured interviews with communities and market actors, we conclude that, as a result of conflicting community and market logic, communities often adjust their business models to participate in the markets, which could jeopardize their potential to contribute to radical system change.

1. Introduction

A transition towards a more reliable, affordable and sustainable energy system ranks high on both research and political agendas (European Commission, 2021; Köhler et al., 2019). Such a transition requires a fundamental re-organisation of the way societies have produced and consumed energy (Wieczorek and Berkhout, 2009), i.e., with more space for decentralised renewables and bottom-up initiatives, such as citizen collectives.

One of the initiatives that has emerged in the recent years, are energy communities. Energy communities can be characterized as bottom-up collectives that aim to create benefits for their members through energy-related activities that correspond with the members' interests, values and needs (Dóci et al., 2015). These interests and needs can be of environmental, institutional, social and economic character (van Summeren et al., 2020; Hicks and Ison, 2018). Together with the voluntary and open membership, high degree of community ownership and decision making, and fair value distribution, these characteristics show that communities operate on a distinct type of logic, the community logic (van Summeren et al., 2020). Energy communities have been acknowledged to play a key role in the energy transition through organising collective generation, renewable energy group purchasing and awareness raising (Gui and MacGill, 2018). Increasingly, the communities are interested in new activities on the electricity market such as the provision and trading of energy and flexibility services (van Summeren et al., 2020; Verkade and Höffken, 2019). Their equal participation in these activities and their increased role in electricity markets, however, is hindered by several barriers (Reis et al., 2021; Wittmayer et al., 2021).

* Corresponding author.
E-mail address: A.J.Wieczorek@tue.nl (A.J. Wieczorek).

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One of these barriers are the market barriers, and despite the critical role of markets for the uptake of the new, community-orientated business models, they have been studied the least compared to other, e.g. behavioural, organisational and institutional barriers (Brummer, 2018). Market barriers can be defined as all obstacles conditioned by the market context (Weber, 1997) which prevent market entrants and participants from performing their activities in the market. In electricity markets, decreasing wholesale prices, ineffective demand curves and market power issues form barriers for market entrants (Milligan et al., 2017). Market barriers that specifically hinder energy communities are: costly grid connections (Walker, 2008; Sebi and Vernay, 2020), unfavourable and uncertain support schemes (Bauwens et al., 2016; Reis et al., 2021; Nolden, 2013; Walker, 2008), the implementation of auctions for the distribution of renewable energy support (Grashof, 2019; Gsänger and Karl, 2020; Capellán-Pérez et al., 2018), high levels of competition for resources (Bauwens et al., 2016) and rigid market structures (Reis et al., 2021). Mourik et al., (2020); Brummer (2018) and Vallecha et al., (2021) argue that these barriers originate from a regime favouring centralised, fossil fuel-based production, where scale legitimizes a viable business case. The barriers can be addressed through policy interventions (Brown, 2001), but these are often found ineffective in electricity markets because of misalignments in how the markets are organised at different governance levels (Peng and Poudineh, 2019). Boon et al., (2022) created a framework for market formation to diagnose misalignments and to support transformative policy interventions. However, while it is recognised that the way markets are organised plays a vital role for community activities and business models, no systematic analysis exists that unpacks the relationship between the organisation of markets and community participation in these markets. Moreover, the concept of markets and their organisation in relation to transitions requires further elaboration as profound conceptualisation is missing (Boon et al., 2020). This paper aims to fill these gaps by exploring how market organisation impacts community participation in electricity markets in the context of the ongoing energy transition. To this purpose, this paper tackles the following research question:

Which barriers and opportunities related to market organisation influence the participation of energy communities in electricity markets?

This paper contributes to transition studies by providing a framework for market organisation that helps analysing markets and the space it creates for socio-technical innovations. The framework is built by drawing from multiple strands of economic market literature to develop a rich understanding of how markets operate (Section 2). Section 3 discusses the research methodology. In Section 4, the framework is used as a lens to study barriers and opportunities related to market organisation that influence the participation of energy communities in electricity markets. Empirically, this paper focuses on Dutch and Flemish energy communities. Section 5 provides a discussion of the results and Section 6 concludes the paper.

2. Theoretical building blocks

In this section, we develop a framework for market organisation, using transition studies and economic market literature.

2.1. Transition studies

The focus of transition studies lies on the underlying processes and patterns of the radical transformation of socio-technical systems towards new, more sustainable configurations. Socio-technical systems are structured along three interactive dimensions, which provide valuable insights into how transitions can unfold (Geels, 2004; Summeren et al., 2021; Rohracher, 2001; Fünfschilling and Truffer, 2016; Geels and Turnheim, 2022): actors, institutions (i.e. rules, norms and beliefs) and technologies (i.e. resources). The interactions take the shape of actors creating institutions and developing resources while simultaneously being enabled and constrained by these (Fünfschilling and Truffer, 2016; Geels, 2004), resulting in deep system structures. System structures develop over long periods of time, and as such create path dependencies and barriers to many emergent alternative behaviours, practices and technologies that do not comply with the status quo. The concept of the socio-technical regime was introduced to describe this phenomenon. Markets are part of this regime. They are the institutionalised structures that, together with other dimensions, create path dependencies and system stability (Geels, 2002) through rigid market institutions, supply and demand rules, price mechanisms, competition, user practices and routines (Smith and Raven, 2012), and are therefore referred to as the 'market regime' in this paper.

The strength of the regime (and thus also the market part of this regime) depends on the degree of institutionalization, the structure coherence and the institutional logic (Fünfschilling and Truffer, 2014). Thornton and Ocasio (2008, p.2) define institutional logic as 'the socially constructed, historical patterns of cultural symbols and material practices, including assumptions, values and beliefs, by which individuals and organisations provide meaning to their daily activity, organise time and space, and reproduce their lives and experiences. Thornton et al., (2012) further argue that institutional logics represent frames of reference that condition actors' choices for sense making and actions. These frames are shaped by different institutional orders influencing behaviour in a specific way: the state, the market, the corporation, the profession, the family, the religion and the community logic (Thornton et al., 2012). The market logic can be characterised by transactions that maximise economic efficiency, profits and shareholder value, as it finds its roots in Western capitalist ideas. Although the market logic prevails in markets, behaviour and practices of market actors that ensure personal reputation, loyalty, long-term stability and quality reveal the presence of other institutional logics in markets (Thornton et al., 2012). Being deeply rooted in the market structures, practices and values systems, the institutional logics stabilise and strengthen the market regime.

Although strong and highly institutionalised (Fünfschilling and Truffer, 2014), the market regime can be overthrown by disruptive socio-technical innovations that gain market share in mainstream markets or emerge in new markets (Dijk et al., 2015), also called lead markets (Losacker and Liefner, 2020; Walz and Köhler, 2014; Quitzow et al., 2014), through social network building, aligning expectations and learning (Schot and Geels, 2008). Market formation of new markets often occurs around a particular innovation: the technological innovation system (TIS) (Hekkert et al., 2007), and in close interaction with actors through the use of market devices

(Karnøe et al., 2022), mediation (Hyysalo et al., 2022), intervention strategies (de Vasconcelos Gomes and da Silva Barros; Valor et al., 2021) and market segmentation (Dewald and Truffer, 2011). Additionally, market formation is described as a geographically embedded process (Dewald and Truffer, 2012). Yet, limitations of market formation and mechanisms related to sustainable and just transitions in certain geographical and institutional contexts call attention to non-market exchanges and economies (Groenewoudt and Romijn, 2022; Sareen et al., 2021; Beumer et al., 2022)

To conclude, transition studies consider the radical transformation of socio-technical systems, which are structured along three interactive dimensions: actors, institutions and resources. Markets are seen as one of the institutionalised structures, which are geographically bounded and influenced by a prevailing market logic.

2.2. Economic market literature

Markets have been studied in many disciplines (e.g. sociology, economics and marketing) which have all developed their own understanding of what 'the market' is. Möllinger (2009) argues that research on markets is rather fragmented and advocates taking a systemic perspective which aggregates the insights from the different market disciplines. Whereas Möllinger (2009) only makes use of the economic sociology and the new institutional economics to embody this systemic perspective, we also include a third discipline, i.e. the evolutionary economics as it lays important foundations for transition studies (Grin et al., 2010) and provides conceptual linkages with transitions.

2.2.1. Economic sociology (ES)

Economic sociologists conceptualise markets as social constructions in which actors interact with each other to come to an exchange based on social connections and arrangements (Fligstein and Dauter, 2007). Actors play a central role in the market and are defined as subjective agents with an own set of economic, cultural and socio-cognitive preferences valuing loyalty, long-term continuing relationships (Granovetter, 1985) and stability (Fligstein, 2001; Mote, 2003) instead of only economic efficiency. As such, market studies include identifying, understanding and measuring impact of actor networks, the actor's position in these networks, power structures, trust relationships, institutional contexts and cultural aspects (Fourcade, 2007). In addition, the subdiscipline 'market sociology of things' brings attention to the role of objects in framing markets, by studying amongst others (calculative) market devices (Callon and Muniesa, 2005; Geiger and Gross, 2018), supermarket retailing and market infrastructure (Cochoy, 2007; Cochoy, 2008), notions of performativity arguing that ideas and theories about markets shape the market itself (Kjellberg and Helgesson, 2006; Aspers, 2007; Cochoy et al., 2010), and the social life of products and goods (Callon et al., 2002; Appadurai, 1988). Qualification is part of this social life and means association of products and goods with specific values, attributes and symbolic qualities that distinguish them from those of competitors (Callon et al., 2002; Beckert and Aspers, 2015). Qualification can be achieved through social networks, new principles of worth, scripts, standards and rankings (Beckert and Aspers, 2015; Kjellberg and Helgesson, 2007; Beunza and Stark, 2004; Dubuisson-Quellier, 2013). Consequently, ES contests the idea of market products being purely defined by prices for economic value creation.

2.2.2. Evolutionary economics (EE)

Evolutionary economists conceptualise markets as complex and dynamic systems which spur innovation through competition encompassing mutation, reproduction and selection processes (Nelson and Winter, 1982; Shiozawa, 2004). By taking a systemic perspective, EE goes beyond the concept of market failures acknowledging system failures (Anderle, 2020), and beyond the static equilibrium identifying dynamic, 'creative destruction' processes which perpetually reinvent the system through innovation (Schumpeterian theory). Innovation enables the adjustment of product attributes and values to customer needs until the dominant design emerges in the market as the result of competition (Utterback and Abernathy, 1975). These innovations are not only induced by firms, but also by iterative user-producer interactions (von Hippel, 1986), making actor roles less fixed. Although the role of users is acknowledged to be important, EE predominantly focuses on firms (Grin et al., 2010). Firms are heterogeneous actors, with their own routines, capabilities and strategies, leading to variation in the market, but at the same time creating path dependency as a result of rule-based behaviour based on routines and heuristics (Grin et al., 2010).

2.2.3. New institutional economics (NIE)

The main focus of NIE lies on the reduction of transaction costs as a way to optimise economic efficiency. Transaction costs are all costs related to daily market operations such as search, information retrieval, contract formation, control and enforcement. The existence of these costs means that not all market information is publicly available. It also raises questions whether resource allocation should be provided in the market or organisational context, as high transaction costs can be avoided by internalising activities (Williamson, 1979). As such, NIE conceptualises markets as areas for efficient resource allocation and exchange beyond the organisational boundary. Although NIE presumes actors with bounded rationality, own preferences and the ability to shape institutions (Williamson, 1981), the role of actors only receives minor attention. In that sense, the market conceptualisation of NIE highly contrasts ES (Richter, 2005), even though both disciplines take an institutional perspective. The institutional perspective of NIE originates from the idea that markets with imperfect information require governance. NIE studies two aspects of institutions: the institutional environment and institutional arrangements (Williamson, 1998, 2000; Furubotn and Richter, 2010). The former includes broader aspects of market organisation, i.e. coordination between many suppliers and buyers about the common usage of money, units of measurement, price mechanisms etc. The latter is about contractual governance structures between two parties. North (1990) makes a distinction between formal and informal institutions. Whereas formal institutions include contracts, and political (e.g. constitution)

Table 1
Overview of 3 different economic disciplines and their conceptualisation of the market.

	Economic sociology (ES)	Evolutionary economics (EE)	New institutional economics (NIE)
Market conceptualisation: markets are viewed as …	Social constructions that facilitate exchange	Complex and dynamic systems that spur innovation through competition	Areas for efficient resource allocation and exchange beyond the organisational boundary
Market values	Stability, long-term relationships, loyalty	Innovation	Economic efficiency
Mechanisms that drive markets	Social connections and arrangements	Competition and innovation through user-firm interactions	Transaction costs
Actor role	Key role for actors	Key role for actors, specifically firms	Minor role for actors
Actor characteristics	Subjective agents with an own set of economic, cultural and socio-cognitive preferences	Agents with own set of preferences and routines	Not fully rational agents with own set of preferences
Core aspects	Networks, unique actor preferences, institutions, objects	Innovation, increased user roles	Different aspects and types of institutions

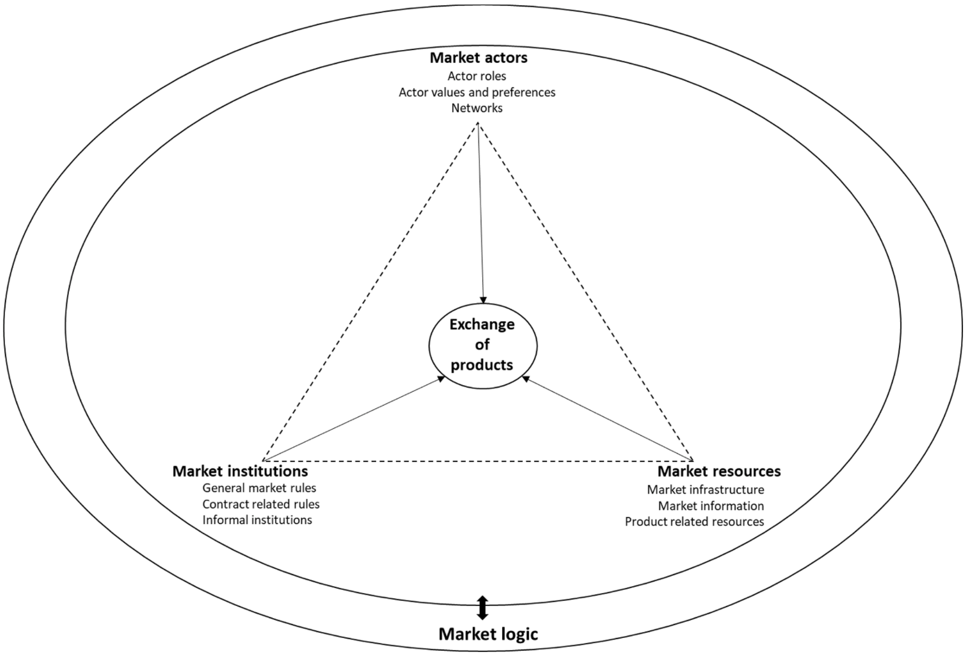

Fig. 1. Conceptual framework of market organisation in the context of socio-technical transitions, showing that markets are organised for the purpose of product exchange which is shaped and structured by 3 mutually interacting elements, i.e. market actors, market institutions and market resources with their own specifications and embedded in a broader market logic.

and economic (e.g. property rights) rules, informal institutions comprise non-written, often socially derived rules covering customs, routines and codes of conduct (Zenger et al., 2001; Richter, 2005; Williamson, 2000).

A summary of these disciplines can be found in Table 1.

2.3. Conceptual framework of market organisation

Building further on Möllinger (2009), we take a systemic perspective on markets. We draw from the transition studies to frame market organisation as encompassing market actors, market institutions and market resources interacting within a certain market logic that shape the exchange processes. To further enrich and specify these elements, we draw from the economic market literature.

2.3.1. Exchange of products

Markets are organised to facilitate the exchange of products between actors (ES, EE, NIE). Market exchange is not limited to trade, but also incorporates other transactional activities such as search, information retrieval, contract formation, control and enforcement (NIE). Exchange can be considered as the central activity in markets which is shaped by market actors, market institutions and market resources (Fig. 1). Products are the subject of the market exchange and can be goods (e.g. computers), services (e.g. telecom services) or resources (e.g. labour).

2.3.2. Market actors

Following the transition studies, we understand market actors as knowledgeable agents who create institutions and develop resources while being constrained by these at the same time (Fünfschilling and Truffer, 2016; Geels, 2004). Insights from the economic literature reveal that actors are also subjective agents with their own networks, values and preferences (ES), and who can perform a variety of roles in innovation and market processes (EE) (Fig. 1). These values and preferences are often reflected through product characteristics as the result of the qualification process performed by actors (ES).

2.3.3. Market institutions

Building on NIE, we distinguish between formal and informal, and general and contract specific institutions, leading to three categories: the general market rules, the contract related rules and the informal market institutions (Fig. 1). The general market rules coordinate the market environment through price mechanisms, regulation, sanctions, standards etc. Contract related rules refer to contractual governance structures between two actors (e.g. contractual prices and volumes, after-sales service, payment mode etc.). The informal market institutions cover customs, codes of conduct, norms about market behaviour and ways of operating.

2.3.4. Market resources

We identify market resources consisting of market infrastructure (ES), market information (NIE) and product related resources (EE) (Fig. 1). The market infrastructure physically shapes the exchange area. Market information affects exchange through its public availability. Products, as subject of exchange, rely on all kind of resources (raw materials, financial, human, cognitive) for their development and production, which connects subsequent markets in the product value and/or supply chain.

2.3.5. Market logic

The institutional logic theory (Thornton et al., 2012) defines the market logic as the representative frame that influences behaviour and practices in the market context through strategies of economic efficiency, profit and shareholder value maximisation. Insights from ES and EE, however, show deviating market strategies through the valuation of loyalty, long-term relationships, stability and innovation. While acknowledging the influences of other institutional logics in markets, we follow Thornton et al., (2012) by stating that markets operate on a market logic of efficiency and profit maximisation, because this logic is prevailing. The market logic, being deeply rooted in the market structures, practices and value systems, provides a grammar for market organisation (Fig. 1). By doing so, it creates strong alignment between the market elements contributing to stability and path-dependency. A change in market logic as the result of disruptive socio-technical innovations, however, could, in certain circumstances, open the door for a transition by bringing cracks into the regime.

Based on the above, we define markets in relation to transitions as spaces of competition between incumbent and new, innovative ways of organising exchanges where market logics of efficiency and profit maximisation are getting increasingly contested.

3. Methods

In this paper, we study the impact of market organisation on community participation in electricity markets. Empirically, this paper focuses on energy communities and existing electricity markets in the Dutch and Flemish context. These contexts are relevant and interesting because of the following two reasons: (i) well-going transposition of the EU Clean Energy for all Europeans Package (CEP), which aims to put citizen central in the energy transition through active market participation (REScoop.eu, 2022; European Commission, 2019), and (ii) the growing popularity of energy communities in these areas. The Netherlands, for example, after five years of exponential growth, counts anno 2021 676 energy communities covering around 85% of the Dutch municipalities (Hieropgewekt, 2022). Many of these communities are rather small (165 members on average) and operate at the village or municipal level. This is most likely the result of the popular postal code subsidy scheme (ECoop BV, 2022) for local energy production as this scheme promotes citizen participation in local energy production and roof sharing projects. The community landscape in Flanders counts relatively few communities compared to the Netherlands (around 20 registered ones), but these communities seem to be overall larger and quickly growing; about 25% of them have more than 1.500 members and operate in multiple regions and municipalities (REScoop.eu, 2021).

To answer the research question, we performed a qualitative research based on data analysis from semi-structured interviews, observations and grey literature, which enables the development of a rich understanding of community experiences related to their participation in electricity markets. The interviews were held with energy communities, being the main focus of this paper, and with active market players to gain deeper insights into the market dynamics. Concerning the selection of energy communities for these interviews, we put minimum requirements regarding scale and activities following the assumption that these parameters are positively correlated with market experiences. Using the Dutch local energy monitor (Hieropgewekt, 2021) and the Flemish list of REScoops (REScoop.eu, 2021), we selected communities based on the compliance with at least one of the following criteria: active as energy supplier and/or aggregator on the market, involved in relevant research projects (i.e. about markets and new activities), minimum total PV production of 500 kWp, proxied by at least 10 realised PV projects if total capacity is not publicly available, and minimum number of realised/ongoing wind projects of 2 (see Appendix A). These selection criteria resulted in a pool of 45 energy communities. To maximise the information we could get for our research, we categorised these communities, based on a screening of their websites, into 2 groups according to their activities. Communities active as supplier and/or aggregator on the market and involved in relevant research projects were categorised in group 1, all remaining communities in group 2. As the communities from group 1 already have market experience, they are highly relevant for our research. As such, these were contacted first. We interviewed 7 of these communities. To retrieve additional data, we randomly contacted the communities from group 2 until no new knowledge could be

Table 2
References to the interviews.

Index number	Organisation
EC1	Beauvent CV
EC2	Campina Energie CV
EC3	Coöperatie Dalfsen Stroomt U.A.
EC4	Duurzame energiecoöperatie Apeldoorn
EC5	Coöperatie Deltawind U.A.
EC6	Denderstroom CV
EC7	Deventer Energie Coöperatie U.A.
EC8	Energiecoöperatie Leur E.O.
EC9	Coöperatie Ecostroom.nu U.A.
EC10	Energent CV
EC11	Coöperatie Lochem Energie U.A.
EC12	Energie Coöperatie Loenen
ECSUP1	Ecopower CV
ECSUP2	Wase Wind CV
ECAGR1	Endona-Escozon
COCSUP1	Energie van ons
COCSUP2	OM nieuwe energie
CA1	Next Kraftwerke Benelux

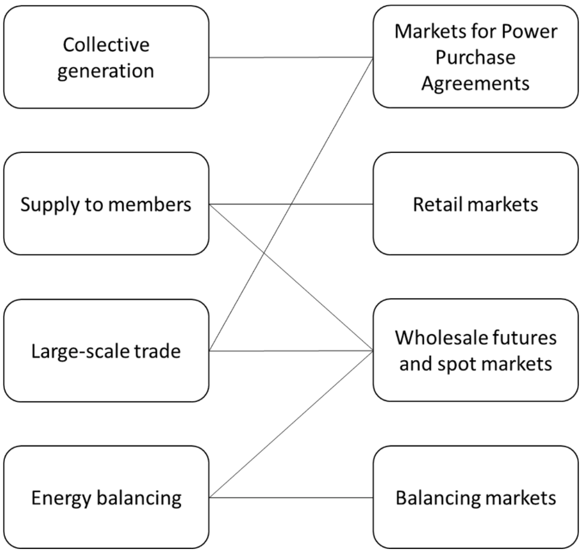

Fig. 2. Community activities (left) in the current electricity markets (right).

retrieved, which resulted in 8 additional interviews. During the interviews, we specifically asked about interests in, relevance of and knowledge about certain activities and markets, general market experiences and challenges to perform market activities. Additionally, we also interviewed 3 active market players, i.e. 2 Dutch cooperative suppliers, of whom the members are also cooperatives, and a commercial aggregator involved in residential flexibility projects in the Netherlands and Flanders. The aim of these additional interviews was to gain insights into how markets for certain activities are organised and which barriers market players envision for small market entrants such as energy communities. This approach resulted in a final number of 18 semi-structured interviews (Appendix B). The interviews took between 45 and 90 min and were held between May and September 2021. The references to the interviews include an index number (Table 2). In addition to the interviews, we reviewed regulatory reports, technical market reports, the communities' websites and websites from relevant market actors, such as grid operators, regulators and market operators. We also participated in workshops and research project meetings related to community development (Appendix C). Moreover, as part of the NWE Interreg cVPP project [588], we closely followed 2 energy communities who deploy smart technology to increase their agency in the system, for more than a year. These observations provided deeper insights into the requirements for market activities. The data from the interviews and observations were transcribed verbatim using the Nvivo Transcription software. Next, the data from the 3 different sources, i.e. the interviews, the literature review and the observations, were coded using the categories of the framework in Section 2.3.

4. Results

In this section, we first elaborate on how the current European electricity market is organised (Section 4.1); and then, we apply our framework as analytical lens to study barriers and opportunities for Dutch and Flemish energy communities in relation to their participation in the electricity markets (Section 4.2). This participation concerns the ability to be active in the market and perform all the activities in relation to and in support of exchanges, in this case the buying and selling of electricity.

4.1. European electricity market organisation

Electricity as a product of market exchange differs from traditional market products due to its specific physical properties, such as non-storability, susceptibility to transport losses and the required real-time balance of consumption and production to keep the physical grid stable. Dealing with these challenges has led to the emergence of multiple, highly interconnected electricity markets, each with their own market organisation. While most of the existing markets are organised at the national or international level, sustainability and democratisation trends have also given rise to market formation at the local level. In this section we describe the existing electricity markets, which include the wholesale futures and spot markets, the markets for Power Purchase Agreements (PPA's), the retail and the balancing markets in Europe that are relevant for Dutch and Flemish energy communities who are interested in generation, supply, trade and balancing activities (Fig. 2).

Wholesale futures markets provide the opportunity to trade electricity at a predetermined price for a specific future delivery time until two days before the delivery (Deng and Oren, 2006). When approaching delivery day, trade shifts to the spot markets. These two markets facilitate the large-scale trade of electricity and are organised through anonymous, central trade platforms, often including a price-based auction mechanism. Electricity trade can also be organised bilaterally, without a central platform. The market for PPA's enables such bilateral trade for medium to large volumes, which encourages negotiations and tailored contracts. Market actors make use of decentralised sales and communication channels to connect to each other and negotiate their contracts. In the negotiations, the renewable and locally produced nature of electricity is gaining importance in addition to the price, making this market highly relevant for energy communities who have excess PV or wind generation. In addition to the wholesale markets, communities can also sell their excess generation back to their members. This activity is referred to as energy supply and takes place on the retail market, although trade on the wholesale markets is required as well to guarantee supply security at cloudy or windless times. The retail markets are organised through decentral sales and communication channels as well, connecting suppliers to households and SMEs. Another activity that can be performed in the electricity markets concerns real-time balancing to secure grid stability. Balancing requires actors to be flexible with their production and consumption, often referred to as 'flexibility'. Imbalances can be avoided by locally consuming as much of the production as possible in combination with trading excesses on the spot market. Imbalances can be solved through the procurement of flexibility on the balancing markets. These balancing markets are organised by the grid operators through price-based auction mechanisms on anonymous, central trade platforms.

4.2. Barriers and opportunities for community participation in electricity markets

Community participation in electricity markets concerns the ability of energy communities to perform all the activities related to

Table 3
Overview of the impact of the market organisation on the participation of Dutch and Flemish energy communities in the electricity markets.

Elements of market organisation		Barriers for energy communities	Opportunities for energy communities
Market actors	Actor roles	Old, predefined roles leave little space for communities	Legal acknowledgement of energy communities and aggregator role as a result of ongoing CEP transposition
	Actor values and preferences	Pure price-based valuation in wholesale and balancing markets	Increasing valuation of environmental and social values in retail and PPA markets, for which communities have a competitive advantage.
	Networks	Anonymous, price-driven networks in the wholesale and balancing markets	Valuation of personal networks in retail and PPA markets; Collaborations in the form of partnerships or a structure of 'cooperative of cooperative'
Market institutions	General market rules	All rules requiring extensive knowledge and experience, high levels of liquidity, specific technological assets and/or keeping up with changes	Guarantees of origin; Exemption from supply license on retail markets as a result of ongoing CEP transposition
	Contract related rules	Severe sanctions for non-delivery of the bid flexibility in balancing markets	Negotiations for tailored contracts
	Informal institutions	Unable to develop adequate market strategies due to high market complexity and lack of knowledge and experience	Collective generation
Market resources	Market infrastructure	Lack of resources to build and sustain decentral market infrastructure	Economies of scope for shared market infrastructure
	Market information	Uncertain and risky business case on wholesale and balancing markets; Administrative burden on retail markets	High availability of information on retail markets to assess the business case
	Product related resources	Barriers to build generation and flexible assets as a result of societal resistance, bureaucracy, unfeasible business case, lack of locations, capacity shortages, lack of political vision, inter-community competition and support auctions.	High experience in organising collective generation
Market logic		Scale and professionalism required	

and in support of the selling and buying of electricity, including real-time energy balancing. Whereas community participation in the PPA markets is high because of high involvement and experiences in collective generation projects such as rooftop PV and to a lesser degree wind turbines, the markets that facilitate supply, trade and balancing are less accessible. In this section, community participation in electricity markets is assessed by using our framework (Section 2.3) as analytical lens to study barriers and opportunities arising from the actor, institutional and resource element and the market logic (Table 3).

4.2.1. Market actors

Actor roles. Until recently, actor roles in electricity markets had been subdivided into general and well-distinguishable categories: producer, consumer, supplier, grid operator, market operator, Balance Responsible Party (prevents imbalance) and Balance Service Provider (solves imbalance through flexibility provision). The recent Clean Energy for all Europeans Package (CEP) (2019) and its transposition into national law, however, have created opportunities for new actors and roles to emerge, because of its aims to put the citizen central in the energy transition. Dutch and Flemish energy communities, for example, can gain access to the market thanks to the inclusion of the renewable and/or citizen energy communities (REC/CEC) definition into national law, recognising them as new actors in the energy system. Additionally, the legal acknowledgement of the aggregator role, legalising demand response and (residential) flexibility aggregation, opens doors for communities to balance energy. Despite the new actor roles, remains of the old, fixed actor roles which require specific behaviour and activities, limit the space for energy communities to operate according to their interests and believes.

Actor values and preferences. Actor values and preferences are often reflected through product qualities, which consist of price, transparent contracting and local, cooperative and renewable energy production. Contrary to the wholesale and balancing markets that are merely organised through price driven mechanisms, product qualities related to sustainability and fairness are increasingly valued in the retail and PPA markets. Though, it has been estimated for the retail market that price is still the decisive factor for 80% of the customers (COCSUP1). As communities are highly associated with values of sustainability and fairness, they could gain a unique market positioning as suppliers in the retail market and as producers in the PPA market. On the contrary participation in the price-based markets is more challenging because communities cannot make use of their competitive advantage nor easily exploit economies of scale to win the price-based competition.

Networks. Buyer-seller networks in markets can be described through the number of connections an actor has and the nature of these connections. In retail and PPA markets, actors have a high number of connections as the result of the decentralised infrastructure connecting buyers and sellers. These connections tend to be rather personal through value entanglement which creates mutual understanding. In contrast, wholesale and balancing markets consist of anonymous, price-driven buyer-seller networks, with often only one connection to the central market operator. Although personal buyer-seller connections facilitate participation for energy communities in retail and PPA markets, the high number of connections raises costs and resources to maintain the network. To acquire the necessary resources, communities often collaborate with market parties involved in similar activities. As such, they create networks and relationships at the seller side instead of competition.

The network building can unfold in collaborations with green, commercial or with cooperative parties. Cooperative collaboration can take two forms: inter-community partnerships, in the case of Flanders, and a ‘cooperative of cooperatives’ structure in the case of the Netherlands. A rationale for the form of collaboration as seen in the Netherlands is:

> “Individual cooperatives should not be active on the markets but should pass this activity to a trusted party. And who is that trusted party? That is a party of whom you have ownership, so cooperatives with cooperatives as members … Then you are certain that when money is earned, you also see that money back.“ Quote ECAGR1

Despite the benefits of the cooperative model, Dutch and Flemish communities prefer collaborations with commercial parties for the supply of own generation because of the possibility to collaborate with a single party for both generation and supply contracts (EC4, EC7, EC8, EC11), more competitive price conditions (EC7, EC9), the recent emerging of the cooperative of cooperatives structure (EC3, EC7, EC11), and the dominant market position of some cooperative suppliers (EC2, EC6 and EC10).

4.2.2. Market institutions

General market rules. General market rules contain all rules that coordinate the broader market environment. In the electricity markets, this takes the form of product requirements (e.g. guarantee of origin, response time and accuracy of technologies for balancing energy), actor restrictions (e.g. supply and trade licenses), price regulations (e.g. mandatory price publication) and activity constraints (e.g. procedures for invoicing and customer acquisition at retail level). Often these rules create barriers for energy communities because they require having extensive knowledge and experience, high levels of liquidity, specific technological assets and/or keeping up with changes. For example, product requirements on the balancing markets require flexibility of at least 1 MW, provided within a few seconds to minutes depending on the urgency and for a period which can be up to 4 consecutive hours. The Dutch and Flemish energy communities experience these requirements as difficult to comply with as they work with small, weather dependant assets that cannot guarantee a 4-hourly production. They also often lack the knowledge to develop competitive bidding strategies and the liquidity to invest in advanced bidding algorithms (EC10, EC12, ECSUP1, ECAGR1). As such, communities either avoid this market, seek collaborations with experienced market actors, or explore the creation of a cooperative of cooperatives. At the same time, some market rules offer opportunities for energy communities. For example, guarantees of origin, which are required for all contracted electricity to avoid the double counting of green energy (European Commission, 2009; European Commission, 2018), could create a competitive advantage for community suppliers with own production assets and certificates through increased reliability of their unique product offer and the refrainment from market negotiations (COCSUP1). In addition, the central position of citizens in the CEP requires the alleviation of discriminating rules against communities, which has for now been transposed in the Netherlands through the exemption of the supply license for communities supplying their own produced energy to members, relieving them from amongst others minimum capital and organisational requirements.

Contract related rules. Contract related rules are all rules that govern the closure of contracts, and can be tailored, e.g. in PPA markets, or standardised, e.g. the other markets. As tailored contracts leave room for negotiations, energy communities can more easily turn the local, renewable and cooperative nature of their electricity to their advantage, increasing participation in these markets. Contract related rules do not only relate to product delivery, but also to rule compliance and contract breach. In the balancing markets, for example, consequences for contract breach depend on the contract type. Two types exist: precontracted bids and free bids. Actors with precontracted bids promise to keep a certain amount of capacity available, which obliges them to bid in the balancing market on times grid operators require them to. Free bidding actors, on the contrary, are free to decide whether to bid or not. Sanctions for non-delivery of the bid volume include high penalties and permanent market exclusion in case of precontracted bids and temporary market exclusion in case of free bids. Because these sanctions form a high risk for unexperienced communities operating mostly with weather dependant and thus difficult to forecast solar PV and wind, energy communities avoid activities on the balancing markets.

Informal institutions. Informal institutions include customs, codes of conduct, norms about market behaviour and general ways of operating in the market. Market strategies that require tacit market knowledge can be considered as one of these informal institutions, because they provide ways to operate in the market and best practices for long-term and profitable business operations. The Dutch and Flemish communities indicate that not having adequate and competitive market strategies, due to a lack of experience and market knowledge, forms the largest barrier for participation in electricity markets. Yet, those strategies are needed for bidding on balancing markets (EC1, EC10, EC12, ECSUP1, ECAGR1), reducing risks on spot markets (i.e. hedging) (ECSUP1, ECSUP2, EC7, COCSUP1), subsidy applications (EC4, EC8, EC9), and long-term business viability (ECSUP1). Taking a combined producer-supplier role in retail markets is an example of a market strategy that increases long-term business viability.

> "What causes that we have not gone bankrupt in the past years, while many other suppliers have? We match our consumption and production. Because we have a lot of production assets, we can control prices for consumption. Without own production assets, you are fully exposed to market prices [on wholesale markets]. … Production assets create stability. It is not a requirement, but it certainly helps to be active on the retail market on the long term." Quote ECSUP1

Because collective generation is the main community activity, such a strategy could be doable, except that it requires a large production scale that often exceeds the community needs. To run break-even as a producer-supplier, a few thousands of customers are needed, which is a scale most communities have no intention to reach (EC10). Without own production capacity, the scale for a viable supply business case can increase tenfold (EC10).

4.2.3. Market resources

Market infrastructure. The market infrastructure physically shapes the market environment and can be organised in a central or decentral way. While wholesale and balancing markets operate through central platforms for trading, communicating and invoicing, the infrastructure in retail and PPA markets consists of multiple channels which are owned, built and maintained individually by the market actors themselves. Examples of decentral infrastructures are customer service desks, websites to inform customers, customer relationship management and invoicing systems. As energy communities often don't have sufficient resources to build and maintain the necessary infrastructure, especially compared to incumbents exploiting economies of scale and scope, market infrastructure forms a barrier for participation in electricity markets (EC1, ECSUP2, EC6, EC10, COCSUP1, COCSUP2, ECSUP1). Creating economies of scope from shared market infrastructure for multiple activities, e.g. electricity supply in combination with (renewable) heat supply or flexibility provision, however, could alleviate this barrier (EC1, EC10).

Market information. Market information can range from fully disclosed to publicly available. In balancing markets, for example, available market information is limited to the publication of market prices, volumes and participant lists, while spot and futures markets are even less transparent as they only publish the market prices. When market information lacks, the community business case becomes uncertain and risky. Therefore, energy communities avoid direct activities on the balancing, futures and spot markets (ECSUP1, ECSUP2). Retail markets, however, have a rather high availability of market information which has a positive effect on the community business case. The information is highly available because of severe market regulation protecting customers and materialises through guarantees of origin, codes of conducts, mandatory price and contract publications, and price comparisons, but this leads to a heavy administrative burden for communities.

Product related resources. To sell, trade, supply and balance energy on the electricity markets, generation and flexible assets are needed that produce the energy or provide the flexibility. Although highly experienced in the organisation of collective generation, the Dutch and Flemish communities experience difficulties concerning the implementation of these assets. These difficulties include societal resistance against wind turbines and solar PV parcs, long bureaucratic processes to obtain the license to build, unfeasible business cases for home batteries, decreasing availability of suitable locations to build new assets, grid capacity shortages, lack of political vision concerning renewable energy strategies (the Netherlands), increased competition over new generation projects (Flanders) and the auctioning system for renewable energy support. We discuss the two latter in more detail below.

The community landscape in Flanders consists of a small pool of relatively large communities and a larger pool of small communities. The large communities often have widespread working areas, spanning multiple Flemish municipalities and provinces, to increase their generation capacity and grow quickly. Being more experienced and having some economies of scale, these communities' chances to win tenders for new generation projects are relatively high, leaving the small communities empty handed. The overlapping working areas of large and small communities have resulted in competition over generation projects and in tension between the communities (EC1, EC2, EC6, EC10).

Another barrier for generation asset implementation concerns the auctioning system for renewable energy support. Support auctions require actors to bid for the amount of support they would like to receive. As only the cheapest bids are selected, communities risk uncertain and less profitable business cases due to inadequate bidding, large competition, upfront investments and relatively high costs for small to medium rooftop PV, which are often the community's main focus (EC 4, EC5, EC6, EC8, EC9, EC10).

> "That [support auctions] is what many energy communities stumble upon, because these are often smaller projects. Rooftop PV is more expensive than PV parc, which is more expensive than wind. At this moment, wind sometimes is more expensive than biomass and geothermal technologies, which now receive the largest part of the support budget. The most expensive technology often doesn't receive any support." Quote EC5

Despite criticism on the support auctions, energy communities try to comply with it.

> "It is a matter of accepting the reality and working with what you have. You can be mad at the system, but you also have to operate in it. Is the system fair? Yes, it is. … Is it convenient? No, for many people not. Does it provide certainty? No, not always. Is it annoying when you want to realise a project? Yes, it is. But that is what we have to work with." Quote EC9

4.2.4. Market logic

Current electricity markets operate following a market logic of scale, professionalism and cost efficiency, which is reflected through heavy price competition, economies of scale as a result of high investment costs for production assets and technological infrastructure, high share of fixed costs opposed to variable costs and the sunk nature of these costs. The Dutch and Flemish energy communities experience such a market logic as a barrier for participation in electricity markets. Scale requirements can be operationalised through multiple dimensions: the production capacity, the number of community members, which is a proxy for potential customers, and the staff number, whether voluntary or employed. Even though a sufficient scale can open doors for community participation in the market, some communities indicate that they might never reach such a scale, and some don't even want it.

5. Discussion

This paper aimed to study the impact of market organisation on the participation of Dutch and Flemish energy communities in the current electricity markets, and as such aimed to contribute to a better understanding of the role of markets in transitions. We defined markets as spaces of competition between incumbent and new, innovative ways of organising exchanges where market logics of efficiency and profit maximisation are getting increasingly contested. Furthermore, we conceptualised market organisation through three interactive market structures embedded in a broader market logic (Fig. 1), which allowed to analyse markets at the actor, institutional and resource level, going beyond the pure institutional perspective that is often taken by transition scholars. A system perspective on markets acknowledges the connections between market and system actors, resources and institutions. Moreover, it makes it possible to discuss topics as market creation in niche development and market decline in system destabilisation, which are highly relevant because 'market' is one of the most important regime dimensions where a radical change needs to occur and where a battle between niche and regime usually takes place.

Such a battle also occurs on electricity markets for community energy. Energy communities perform four main activities in the current electricity markets: generation, supply, trade and balancing of electricity. While supply, trade and balancing gain popularity amongst energy communities, organising collective generation remains the most popular activity. Although not a requirement, having own generation is key to perform supply, trade and balancing activities as it reduces risks and dependencies on other market actors, and increases the community's competitive advantage. Energy communities, however, increasingly encounter difficulties to build new generation assets, despite their high level of experience in organising collective generation.

First, and similar to Grashof (2019), we find that the implementation of renewable energy support auctions forms a major barrier for energy communities to realise new generation, because they can often not compete with the incumbents. These auctions are part of a marketisation process of government support aiming to increase cost efficiency through competition. Yet, research has proven that auctions are not necessarily more cost efficient than the non-market alternative, i.e. feed-in tariffs (BBEn, 2021; Couture and Bollweg, 2021). The auctions follow a market logic of economic efficiency and profit making, which requires scale and professionalism. Energy communities, however, rather operate on a logic of trust, personal connections, and social, institutional and environmental values and ideologies (vs. profits) (Thornton et al., 2012; van Summeren et al., 2020), which is reflected in their organisation around open, voluntary membership and governance (vs. professionalism), local embeddedness (vs. scale) and fair value distribution (vs. economic efficiency) (Dóci et al., 2015; Gui and MacGill, 2018; van Summeren et al., 2020). Market and community logics are thus hard to reconcile. The effectiveness of EU energy policy can be questioned as it claims to put citizen and communities central in the energy transition but imposes further marketisation at the same time. Moreover, changes in market mechanisms, e.g. license exemption for community suppliers in ongoing Dutch CEP transposition, might be insufficient to increase community participation in markets as it doesn't guarantee a viable business case for long term market activities. Markets being highly institutionalised and rooted in the market logic make it very difficult to reorganise the market in a way that treasures the community business models.

Second, new generation projects are increasingly hindered because of inter-community competition over resources. For example, the Flemish community landscape is dominated by a few large, growth driven communities and many small communities. Whereas the small communities are mostly locally embedded in specific municipalities, the large communities operate without geographical boundaries, initiating activities in multiple municipalities and covering widespread territories. Consequently, projects in one area cannot be attributed to one specific community resulting in inter-community competition over new generation projects and in tensions which could ruin relationships and even the community image to society. These tensions point at conflicting logics, of which heterogeneity in community organisation and underlying logics lies at the basis. Bauwens (2019, 2020) makes the distinction between large communities of interest who rather pursue economic values and tend to be more growth-driven, on the one hand, and the small, local communities who rather follow environmental and social ideologies on the other hand. We argue that the former communities rather operate following the market logic, whereas the latter rather to the community logic. The inter-community tensions could jeopardise the implementation of collective generation projects, and therefore broader participation in electricity markets as well.

Energy communities can overcome the conflicting logics through several strategies, including collaboration, growth, diversification and product differentiation. Collaborations in the form of partnerships with commercial actors or experienced cooperatives, and in the form of 'cooperative of cooperatives' could help energy communities to deal with the scale requirement as part of the market logic. Because of full ownership and decision making by all the collaborating communities, the 'cooperative of cooperatives' structure enables participation in markets without the risk of losing the community identity. Aligned logics of the communities could be a success factor of this new organisational structure. Growth and diversification could put the community logic at risk as a result of conflicts with the initial value proposition and local embeddedness. Product differentiation, in contrast, embraces the community logic by distinguishing the community's electricity from those of commercial actors through the focus on local, renewable, fair and transparent generation. Although such differentiation could open doors for community values to crack the prevailing market logic, this happens so far only in niche markets with only little impact on the market regime. Even though the energy communities experience the current market regime as hindering, our results show that they merely see the market as given and keep operating within its boundaries following fit-and-conform strategies (Smith and Raven, 2012), which raises questions about their transformative power in relation to the energy transition.

For communities to unlock their full transformative potential, there is a need to overcome the conflict between the market and the community logic. The set of strategies, changes in market organisation and new market formation will be decisive for the role of energy communities in the future energy system and will largely shape the trajectory of the energy transition.

6. Conclusion

This paper aimed at understanding the impact of market organisation on the participation of Dutch and Flemish energy communities in the current electricity markets.

We conclude that in the current regulatory context, and despite the unfolding transition in the energy sector, communities are not yet empowered to fully benefit from participation in the electricity markets. Even highly organised cooperatives continue to experience barriers related with the current incumbency-orientated organisation of the markets. Energy communities are often forced to adjust their business model by giving up their values, enlarging scale and professionalizing. The transposition of the Clean Energy for all Europeans Package (CEP) is expected to alleviate some of the institutional barriers by officially recognising energy communities as new actors and reorganising some market mechanisms. It is however uncertain whether this will be sufficient to protect the community business models from the market influences, and as such the transformative potential of energy communities. An energy system based on inter-community collaborations and aggregation seems to be a promising pathway to ensure a just and sustainable transition.

The theoretical conceptualisation of the market organisation as a configuration of three structural elements, i.e. market actors, market institutions and market resources, influencing exchange processes and embedded in a broader market logic, proved a useful tool to discuss the interplay between current markets and community participation. The market logic provided a valuable proxy for how markets are organized and how they operate. The structuring elements helped systematically identify barriers and opportunities for community participation in markets. We could thereby conclude that at the core of it lies the discrepancy between market and community organisation as a result of conflicting institutional logics: the community and the market logic.

There are several new research avenues that emerge from this study. Firstly, our chosen data pool consisted of rather large and professional Dutch and Flemish energy communities to secure input on existing or intended market activities. Future research could explore the general interests of less professional energy communities in market activities to assess the need to solve the barriers identified in this paper. Second, interviews were held with community representatives, whose statements are often based on personal experience, rather than on market research and extensive analyses of the community members' interests. As only a limited number of research covers community members' preferences related to new activities (exceptions are Kubli et al., 2018 and Daziano, 2020), future research could explore this topic further. Finally, to answer the research question, we have restricted ourselves to the study of current electricity markets despite many newly emerging markets on a local level in which energy communities could play a large role.

Future research could study how the involvement of energy communities in this local market formation could impact the overall market design.

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Declaration of competing interest

None.

Data availability

The authors do not have permission to share data.

Appendix A. Selection criteria of case studies for interviews

A The Netherlands:

We selected 32 energy initiatives out of 487 from the inventory of the local energy monitor Hieropgewekt (2021) for interviews, based on compliance to at least one of the following criteria:

- Community has more than 2 realised or ongoing wind projects, with ownership of 100%. This resulted in 9 cases: Zeeuwind, Windcentrale/ projectcoöperatie, Deltawind, Meerwind, De Windvogel, VogelwijkEnergiek, Westfriese Windmolen Coöperatie (WWC), Doarsmune Reduzum and Kennemerwind
- Community has developed PV projects without external expertise and has a total production capacity above 500 kWp. This resulted in 20 cases: ECOstroom.nu, deA Apeldoorn, Hilverzon, Endura, Enschede Energie, KennemerKracht, WeertEnergie, Stichting Loenen Energie Neutraal, Zuiderlicht, Energiecoöperatie Leur, Eigenwijkse Energiecoöperatie, Vallei Energie/ Coöperatie Wageningen op Zon, EcoBuren, Hof van Twente op Rozen, Gebiedscoöperatie Nieuwkoop, EC Bodegraven-Reeuwijk, BRES Breda, Dalfsen Stroomt, ValleiEnergie and LochemEnergie
- Communities that don't reach a minimum capacity of 500 kWp but are involved in at least 2 ongoing wind projects (without 100% ownership requirement) are also included. This resulted in 2 new cases: DeventerEnergie and Noordenwind
- Community is involved in relevant research projects. This resulted in 2 new cases: Endona-Escozon and Eemnes Energie

After a final check of the list based on website screening the community 'Vallei Energie/ Coöperatie Wageningen op Zon' was removed, because this is a collaboration of two cooperatives. This resulted in a final list of 32 potential Dutch communities for interviews.

B Flanders:

We based our selection on the Flemish REScoop.eu member list (2021), which counts 21 Flemish members. Energie2030 was excluded because of its international character, which doesn't fit the focus of this research. Next, communities were categorised based on the number of realised PV projects, used as a proxy for total PV production capacity, and realised or ongoing wind projects. Communities with less than 10 realised PV projects and 0 or 1 realised or ongoing wind projects were removed from the list. This resulted in a final list of 13 potential Flemish communities for interviews: Beauvent, Bronsgroen, Campina energie, Coopstroom, Denderstroom, Ecopower, Energent, Klimaan, Pajopower, Stroomvloed, Vlaskracht, Wase Wind and Zuidtrant.

Appendix B

Table B.1

Table B.1
Final list of interviews.

Organisation	Organisational type	Current activities (collective generation, energy supply, energy balancing and flexibility provision)	Participation in research project published on website	Size (number of cooperants)	Country
Beauvent CV	Energy Community	Collective generation; Flexibility provision	N.A.	5000–9999	Belgium
Campina Energie CV	Energy Community	Collective generation	N.A.	1000–2999	Belgium
Coöperatie Dalfsen Stroomt U.A.	Energy Community	Collective generation	N.A.	100–999	the Netherlands
Duurzame energiecoöperatie Apeldoorn	Energy Community	Collective generation	N.A.	100–999	the Netherlands
Coöperatie Deltawind U.A.	Energy Community	Collective generation	N.A.	1000–2999	the Netherlands
Denderstroom CV	Energy Community	Collective generation	N.A.	100–999	Belgium
Deventer Energie Coöperatie U.A.	Energy Community	Collective generation	N.A.	100–999	the Netherlands
Energiecoöperatie Leur E.O.	Energy Community	Collective generation	N.A.	100–999	the Netherlands
Coöperatie Ecostroom. nu U.A.	Energy Community	Collective generation	Virtual Power Plant	1000–2999	the Netherlands
Energent CV	Energy Community	Collective generation	NWE Interreg cVPP	1000–2999	Belgium
Coöperatie Lochem Energie U.A.	Energy Community	Collective generation	NWE Interreg ECCO	1000–2999	the Netherlands
Energie Coöperatie Loenen	Energy Community	Collective generation	NWE Interreg cVPP	100–999	the Netherlands
Ecopower CV	Energy Community	Collective generation; Energy supply	N.A.	More than 10.000	Belgium
Wase Wind CV	Energy Community	Energy supply	N.A.	1000–2999	Belgium
Endona-Escozon	Energy Community (in collaboration with project organisation)	Collective generation; Flexibility provision	GridFlex Heeten; FlexCoop; Wattflex	N.A.	the Netherlands
Energie van ons	Cooperative of cooperatives	Energy supply	N.A.	100–999	the Netherlands
OM nieuwe energie	Cooperative of cooperatives	Energy supply	N.A.	1–99	the Netherlands
Next Kraftwerke Benelux	Commercial aggregator involved in residential flexibility	Energy trading; Flexibility provision; Energy balancing	N.A.	N.A.	The Netherlands and Belgium

Appendix C

Table C.1

Table C.1
List of observations and participation in project meetings.

Date	Topic	Meeting type	Participants
07/12/2020	How energy communities could use smart technologies to become a cVPP	Intake collaboration between NWE Interreg ECCO and cVPP project	Energent, Halnet, Innovatiesteunpunt
07/12/2020	How energy communities could use smart technologies to become a cVPP	Intake collaboration between NWE Interreg ECCO and cVPP project	Energent, Zuidtrant, Innovatiesteunpunt
09/12/2020	Getting to know the cVPP in Ghent	Online meeting	Energent
13/01/2021	Getting to know the cVPP in Loenen	Online meeting	Duurzame Projecten Loenen
14/01/2021	Kick-off meeting: introduction of the COMETS project and scoping of the benchmarking study	Online meeting COMETS project	COMETS National Research Team (Belgium)
18/02/2021	Kick-off capitalisation trajectory of the implemented cVPP's	8th Online consortium meeting NWE Interreg cVPP project	Translyse, Duurzame Projecten Loenen, Gemeente Apeldoorn, Energent, Tipperary Energy Agency, Community Power, Eindhoven University of Technology, REScoop.eu, Qirion, Alliander

(*continued on next page*)

Table C.1 (*continued*)

11/03/2021	Getting to know the collective action initiatives, their missions, goals and struggles	Online meeting COMETS project	COMETS National Research Team (Belgium)
31/03/2021	Market access for decentralised, low-voltage assets on the Belgian balancing markets	Workshop Ioenergy project	Ecopower, Energent, Next Kraftwerke, Energie ID, Elia
01/04/2021	Kick-off meeting: introduction of the LEG Oyenbrugmolen project	Online meeting LEG Oyenbrugmolen project	Energent, Noordlicht, Gemeente Grimbergen
07/04/2021	Discussion which Belgian balancing markets (FCR, aFRR or mFRR) should be targeted	Workshop Ioenergy project	Ecopower, Energent, Next Kraftwerke, Energie ID,Elia
14/04/2021	Business models for citizen involvement in the Belgian balancing markets	Workshop Ioenergy project	Ecopower, Energent, Next Kraftwerke, Energie ID, Elia
31/05/2021	Update on capitalisation of cVPP's	9th Online consortium meeting NWE Interreg cVPP project	Translyse, Duurzame Projecten Loenen, Gemeente Apeldoorn, Energent, Tipperary Energy Agency, Community Power, Eindhoven University of Technology, REScoop.eu, Qirion, Alliander
03–05/11/2021	Update on capitalisation of cVPP's, cVPP demonstration in Loenen, discussion on cooperative aggregator proposal, future developments of cVPP	10th Consortium meeting NWE Interreg cVPP project in Loenen	Translyse, Duurzame Projecten Loenen, Gemeente Apeldoorn, Energent, Tipperary Energy Agency, Community Power, Eindhoven University of Technology, REScoop.eu, Qirion, Alliander, Ecopower, Escozon, Kamp C

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