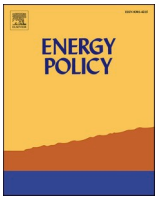
Energy Policy 162 (2022) 112808

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol



Stakeholder objectives for joining an energy community: Flemish case studies

Shary Heuninckx [a,*], Geert te Boveldt [a], Cathy Macharis [a], Thierry Coosemans [b]

[a] Mobility, Logistics and Automotive Technology Research Center, department BUTO, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050, Brussels, Belgium
[b] EVERGi, ETEC departement & MOBI Research Group, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050, Brussels, Belgium

ARTICLE INFO

Keywords:
Energy communities
Stakeholder participation
Stakeholder objectives
Case studies
Energy community design

ABSTRACT

Energy communities (ECs) are considered an important element of the current energy transition. Most studies have focused on how to specifically engage citizens in such communities. In this paper, the emphasis is on the objectives of other stakeholders. Only by taking all motivations and interests into account can a successful project be established.

In our study, relevant stakeholders, their objectives for joining an EC and the importance of each of these objectives were determined in a participatory manner through four Flemish pilot cases. The results provide an overview of general and context-specific elements that need to be taken into account when designing an EC as well as when setting up policy initiatives to stimulate large-scale EC roll-out. For potential members, financial incentives are the main drivers of participation but often not the decisive objectives. Their decision to join is influenced by a variable combination of social, economic, technical and environmental motivations. Local governments mainly want an EC to bring social and environmental advantages, and the local distribution system operator (DSO) only supports ECs when they can bring added value to their main grid and society as a whole and can help avoid major grid investments.

1. Introduction

With the introduction of more renewable energy assets to the general energy system, needs for integration have arisen along with new forms of energy distribution and exchange (Guerrero et al., 2010). One example is the energy community (EC), which can take many forms depending on, for example, its goals, circumstances and members (Moroni et al., 2019). With mainly renewable energy at their base, ECs aim to produce, consume and manage their own energy locally. With the growing importance of sustainability to the societal agenda, ECs have emerged as a means for the further uptake of local renewable energy technologies while making self-sufficiency possible and allowing for a more engaging and democratic governance of the energy system (Walker, 2008). A community-driven initiative such as an EC gives people as well as companies and institutions the opportunity to become empowered energy prosumers within a more decentralized energy system (Van Der Schoor et al., 2016).

Various research initiatives have demonstrated that engagement processes have a positive influence on stakeholder attitudes toward renewable energy initiatives and taking that into account their interests and values from the start leads to more project support (Barnett et al., 2012). Therefore, for the establishment of ECs, guidelines to help project initiators engage all relevant stakeholders in a participatory way and determine their needs and wishes can be a helpful means to create supported EC designs that incorporate these stakeholders' values. In this paper, a participatory method for the determination of stakeholder objectives is proposed with a description of how it was tested in different Flemish pilot cases and of the associated outcomes.

An important prerequisite to the deployment of ECs and the infrastructure linked to it is community acceptance (Huijts et al., 2012). Those who will be responsible for the implementation of such a system are only willing to do so if they trust it and can identify with the project. This can be facilitated by actively involving actors in the decision-making and setup process (Wolsink, 2012). By gaining insight into stakeholders' motivations to join ECs under various conditions, a system with a high community acceptance rate can be designed. However, detailed research on the main objectives of various specific stakeholders and whether they depend on local circumstances is missing. An overview of these factors can help initiators set up more supported ECs and promote large-scale roll-out, increasing the share of

* Corresponding author.
E-mail address: shary.heuninckx@vub.be (S. Heuninckx).

https://doi.org/10.1016/j.enpol.2022.112808
Received 24 June 2021; Received in revised form 11 January 2022; Accepted 16 January 2022
Available online 23 January 2022

renewable energy in the system.

Section 2 of this paper discusses existing literature on the involvement of various types of stakeholders in the energy system and their motivations to join an energy community. Section 3, 'Methodology,' explains the different research steps taken in four case studies to determine more specific stakeholder objectives. In Chapter 4, 'Case study results,' the outcomes of the objectives survey of all stakeholders involved in the pilot cases are outlined, while in Chapter 5, 'Discussion,' we present an analysis of the most notable results, adding to understanding of general motivations to join ECs. This work helps form a more overall understanding of important preconditions and offers initiators and developers of an EC (governments, park managers, citizen cooperatives, etc.) elements that they can incorporate into their designs to bring them more in line with the needs and wishes of the stakeholders involved.

2. Theoretical framework

2.1. Energy communities

While the traditional energy system mainly relies on a limited number of highly centralized large energy installations (driven by fossil fuels such as gas via thermal power stations or nuclear energy through nuclear power plants), an evolution toward a more democratic energy system with more decentralized renewable energy installations has been established (Burke and Stephens, 2018). This energy transition also leads to an increasing number of actors becoming involved in the production of (renewable) energy. To make optimal use of all energy produced locally, new initiatives are aiming to make various actors share energy. Provided that energy regulations and legislation are adapted to make this possible and that organizational preconditions can be met, these actors can set up or become part of shared energy projects in which they are mutually connected and are able to exchange energy.

An EC is one of the many new initiatives that are being driven by the energy transition. ECs can be defined as a way to organize collective energy actions (such as collective self-consumption or setting up a closed distribution system) but only based on open, democratic participation and governance and the provision of benefits for members or the local community, conforming with the eligibility criteria of official definitions (Roberts et al., 2019). ECs are often considered a solution to the problems that the energy transition might create in the existing energy grid and seen as an important driver toward the use of more renewable energy (RE) sources (van der Schoor and Scholtens, 2015). This has led to an increase in a broad range of EC initiatives over the years, creating more energy awareness along the way and giving end users a more powerful voice within the energy system (Kazmi et al., 2021).

European legislation states that participation in an energy community is voluntary, aiming for economic, social and community benefits, as opposed to purely financial profit. Two types of energy communities are defined: a citizen energy community (CEC) (European Parliament & Council of the European Union, 2019) and a renewable energy community (REC) (European Parliament & Council of the European Union, 2018). Within the research described in this paper, the term energy community is not restricted to the official CEC and REC definitions. Since national and regional definitions were not defined at the time of our case studies, all potential local initiatives that involve energy sharing between prosumers and/or consumers, paired with an increase in the share of renewable energy in the system, are considered ECs.

2.2. Stakeholder engagement

When designing and implementing an EC, the aim is to ensure that the concepts developed and considered relevant from a technical point of view satisfy the needs of all stakeholders (indirectly and directly affected by the roll-out of ECs). Only when the proposed concept is commonly accepted can implementation (which has to be done by these same stakeholders) be a success. Therefore, before a choice can be made on the type of EC that can be implemented in a specific location, a clear picture of what triggers actors to set up or join an EC is necessary. The best way to do this is by setting up a stakeholder engagement process in which all relevant actors are involved from the start (Reed, 2008). In this way, their input can be taken into account throughout the whole EC design and decision-making process. For stakeholders, knowledge and trust are built, so they feel a stronger link to the project. All of this can contribute to a better fitted design, a smoother planning process and more successful implementation. Prior research has already shown that the early engagement of local stakeholders is "reflected in lower costs, fewer delays and less uncertainty in the planning process" (DTI, 2003: 259).

To our knowledge, setting up an active engagement process to determine the relevant EC stakeholders and their objectives, as presented in this study, is new. Stakeholders are often actively engaged in local policy planning processes of energy matters or sustainability measures in general. This approach forms the basis of collaborative environmental decision-making, and throughout the years, many methods have been developed (King et al., 1998; Randolph and Bauer, 1999). Applications mostly revolve around governmental initiatives and high-level policy planning with a focus on citizen inclusion, but many ECs are initiated by private partners (e.g., business park managers) and involve stakeholders other than citizens (e.g., neighboring educational institutions or companies that want to share energy). Furthermore, in this study, the outcome is used for practical applications, more specifically the design of an implementable EC, and not only as input for a general planning vision or policy. Some stakeholder participation initiatives for more practical outcomes in the field of sustainable development have been set up, such as methods to decide on solar development localities and forms (Schelly et al., 2019) and for various forms of wind energy coproduction (Solman et al., 2021), but specifically for the design of an EC, no elaborate documented examples are found.

The method that is presented in this study offers a ready-to-use framework that can be applied in future EC set-up processes, to give all stakeholders the chance to actively participate and communicate their needs and wishes, that can in turn be translated in the EC design.

2.3. EC stakeholders

To obtain a clear image of all needs that have to be met by an EC design, insight into who relevant stakeholders are is essential. Stakeholders can be defined as the range of actors who are likely to use a system or be influenced either directly or indirectly by its use (Macharis and Stevens, 2003). A stakeholder analysis is needed to determine the relevant actors affected by the new energy system, with an interest in the consequences of the implementation of an EC, and hence with a need to be engaged throughout the EC design process. Every situation is different and has its own specifications. Depending on the geographical and legal context, the scale of the project, the goals of the EC, the target audience, etc., different stakeholders will have to be engaged. Therefore, for every new EC project, stakeholder analysis must be done anew. The relevant actors can be clustered into stakeholder groups whose representatives share the same objectives and criteria (Macharis et al., 2012).

Table 1 provides an overview of the general stakeholders that can traditionally be found within the energy market.

In an EC, more actors may play a role than in a traditional energy market model. An overview of the main ones, based on general project expertise from Flemish research project ROLECS and summarized in unpublished project deliverable 4.3 by Lode et al. (2019), is given in Table 2. Not all of them are part of every EC, but they might be decisive in the success of operationalization. Some EC initiatives, for example, might not have the needed financial means or legal know-how to set up a community among their members and could benefit from external third-party support (Gui and MacGill, 2018). This stakeholder overview

Table 1
Incumbent energy market stakeholders.

Stakeholder	Description
Transmission System Operator (TSO)	Entity responsible for the transport of energy usually on a voltage level of between 220 kV and 380 kV and over long distances (Koch, 2015)
Distribution System Operator (DSO)	Entity responsible for the distribution system for transporting energy from high to lower voltage areas. This incumbent is highly triggered by an increase in renewable energy sources (RESs) (Keay et al., 2014)
Regulator	Actor that regulates the energy markets and guarantees energy networks
Energy Supplier	Actor responsible for billing and contracting the grid operator with the consumer
Consumer	Energy end-user
Energy Producer	Entity responsible for energy production, traditionally based on centralized energy sources and fossil fuels

Table 2
Potential additional EC stakeholders.

Stakeholder	Description
Initiator	Initiator of the EC who can be a private person, private entity or social enterprise/NGO
External Investor	Private person or entity/NGO who invests in the EC
Insurance Party	Private entity providing insurance services to the EC
Financing Party	Private person, private entity or public body providing financial support schemes
EC participant	EC member who can be a private person or private or public entity and a consumer or prosumer
Asset Owner	Private person or private or public entity owning an energy producing or regulating unit that is part of the EC system
Engineering Office	Private entity ensuring the technical set-up and maintenance of the EC
EC decision-making body	Private or public entity responsible for decision-making within the EC
Government	Public entity responsible for decision-making at higher levels
Legal Party	Private or public entity that supports the EC with legal support

can be used as a starting point and inspiration for future EC project initiators, to determine all the relevant actors that need to be engaged throughout the set-up process.

2.4. Motivations for joining an EC initiative

Public acceptance is essential for a broad roll-out of new technologies and energy concepts, and many factors influence whether an actor tends to support the uptake of a new technology and, for example, join an EC initiative. For individuals, the decision is assumed to be influenced by attitudes, social norms, perceived behavioral control, and personal norms (Huijts et al., 2012). Most research on stakeholder objectives to be or become part of an EC focuses on these individuals and citizen communities. Conradie et al. (2021) examine what influences citizens' intent to participate in general. Attitudes toward renewable energy, environmental concerns, financial gains and a willingness to change behavior are important indicators. Considering only active EC members, in large communities, return on investment is the main driver behind membership, while for smaller communities, noneconomic determinants are the most influential (Bauwens, 2019). Dóci and Vasileiadou agree with these conclusions, adding that hedonic motivations such as community feeling also play a role (Dóci and Vasileiadou, 2015).

However, little information has been gathered on other stakeholders' motives. As not all ECs have citizens as their main members and as a various range of stakeholders with specific needs is involved in the implementation of an EC, a full overview of all objectives is needed. Li et al. (2013) performed a study on the objectives of all stakeholders within a rural community in Germany, where all energy production is community owned. The authors found that the citizens were mainly focused on community interests and financial gain (as was also the case for the local government) and less on environmental advantages. Global concerns, such as environmental issues, were mentioned as incentives by stakeholders involved in a less personal way, such as banking institutions and professional support agencies (Li et al., 2013). However, it is difficult to determine whether these conclusions are replicable to other similar or even varied situations, and the case study also only focuses on a community with mainly citizen members. Research on the motivations of retail investors of general renewable energy projects in Germany shows that forms of nonfinancial return, such as pleasure in participation and social status, are important objectives (Schall, 2020), but it is not clear whether this also counts for EC initiatives specifically. The goal of this paper is therefore to provide better insight into a varied range of noncitizen stakeholder motives for joining an EC to provide more overall insight into all preconditions an EC design should take into account. By exploring the objectives of various stakeholder types and comparing the results of four cases, our study provides a first general overview.

3. Methodology

3.1. Case selection

In 2019, a research project called ROLECS funded by Flemish institutions VLAIO and INNOVIRIS was set up to gain a deeper understanding of the development and potential role of energy communities in Belgium. Within this project, ten complementary pilot cases in which real-life ECs were set up were selected, addressing questions arising throughout such a process along the way.

Four of the pilot cases were selected for this study based on their variations in setting, scale and focus. In this way, the cases represent a varied range of key characteristics and potential challenges that are present in many other similar potential EC sites. The outputs and conclusions drawn may therefore be representative of a wide range of localities that share the same characteristics.

1. Haasrode (Leuven)is an old industrial site with individually operating businesses on the edge of an urban area. Almost no renewable energy projects have started up here, and there are no EC initiatives yet. Knowledge of and experience with energy themes is low among businesses.
2. Buurzame Stroom (Ghent)is a densely populated residential neighborhood with mixed income residents in an urban setting. There are no large-scale EC initiatives yet, and only a cooperative called Energent that groups 20 individual prosumer households has been established.
3. Green Energy Park (Zellik) is a business park in an urban setting that will be expanded with new developments to serve as a test case for new implementations. There is a preliminary idea about what the EC needs to encompass for the new developments, but knowledge on and experience with energy themes is low among the existing businesses.
4. Kortrijk Weide (Kortrijk) is a mixed-use project with existing facilities such as a public swimming pool and education campuses in an urban setting. The goal is to create an EC for electricity as well as heat connecting all buildings to a main sustainable energy source on one of the campus sites.

Table 3 provides an overview of the main general characteristics of the sites that are not unique to the specific case and that may be relevant for replicability purposes.

3.2. Stakeholder selection

For each of the case studies, relevant stakeholder groups, based on Tables 1 and 2, were selected by the pilot case coordinator, discussed

Table 3
Pilot case characteristics.

Characteristic	Haasrode	Buurzame Stroom	Green Energy Park	Kortrijk Weide
Build environment	Suburban area	Urban area	Urban area	Urban area
Potential EC members	Businesses	Residential households	Businesses and research institutions	Mixed: businesses, public services and educational institutions
Scale	Currently small scale (approximately 10 interested businesses)	Moderate scale (neighborhood)	Moderate scale (park with 70+ businesses)	Small scale (business park with 5 main actors)
Assets	PV	PV and home batteries	PV, wind turbines, energy storage, cogeneration facilities, heat network, and EV charging facilities	Combined Heat and Power (CHP), district heating, PV, biomass installation, EV charging facilities, and energy storage
EC knowledge level of potential members	Low	Mixed: high for cooperation members and low for others	Low for existing businesses and high for new development	High

with the project workgroup and presented to the selected stakeholders in a general start-up meeting to check whether everyone agreed on the list and found it complete.

3.3. Objectives selection

A list of potential objectives for joining an EC was put together (see Table 4) based on previous research on the motivations of local actors seeking to enter the energy supply market (Hall and Roelich, 2016), the professional experience of all pilot case coordinators and input from the main stakeholders of the case studies. No examples of such lists describing potential motivations to join an EC can be found in the existing literature.

The list of potential motivations for becoming energy suppliers that Hall and Roelich (2016) compiled was presented to the four project coordinators, who added elements and adapted some from the initial list. Next, during brainstorming sessions held at introductory meetings with the selected stakeholders at each pilot site, additional motivations were added.

Table 4
Potential objectives to engage in an EC.

Potential objective	Additional description
Improve energy efficiency	E.g., less energy loss due to a closer link between production and consumption
Grid stability, continuity and reliability	Avoiding power outages and electricity failures
Safety	Avoiding accidents by means of procedures and design
Security	Protection against cyberattacks or other rogue actions
Affordability	Installation, management and energy costs are within a feasible price range
Return on investment	Costs are proportional to financial gains
Lower energy bills	Short- and long-term net savings on energy bills
Replicability	The same EC system is applicable across different sites
User participation	A large number of EC participants within the site
Innovation	Pioneering in new techniques and systems
Employment	Setting up an EC creates additional jobs
Commercial validation of products and services	Being able to offer one's own energy-related products and services within the EC
Inclusiveness	Incorporating social costs and a contribution to the socially vulnerable
Community building	More cooperation and knowledge sharing
(Green) image building	Business card to the outside world
Energy independence/ Autonomy	Participatory self-management of the energy system and independence from market price fluctuations
Behavior change (Awareness)	Stimulates more concern for sustainability and more efficient use of energy in other aspects of daily life
Privacy protection	GDPR-proof data use
Increased renewable energy penetration	To the detriment of fossil fuels
Emissions reduction	Lower fossil fuel emissions and better air quality
Lower noise levels	The consumption of energy produces less noise

The objectives listed in Table 4 were then incorporated into a survey and sent to all selected stakeholder groups of the project cases, who were asked to assess the perceived relevance of the objectives on a 4-point scale ('not relevant,' 'somewhat relevant,' 'relevant' and 'very relevant'). For each group, at least one representative (institution) filled out the survey, with 8 businesses (100% of the businesses to be included in the EC) giving input for the 'consumer/prosumer' group in the Haasrode case and 5 businesses providing input (25% of the businesses to be included in the EC) in the Zellik case.

Only the objectives deemed 'very relevant' were selected for the successive objectives weighting exercise. For stakeholder groups with multiple representatives filling out the survey, the objectives deemed 'very relevant' the most were chosen for weighting.

3.4. Contributing weights to the stakeholder objectives

Once the survey was completed, for every case, a collective workshop with all stakeholder groups was organized to assess the importance of each of their objectives. For this, software was used that is designed by the MOBI department of the Vrije Universiteit Brussel[1] for the Multi Actor Multi Criteria Analysis (MAMCA) methodology (Huang et al., 2020).

The selected objectives were weighted through a pairwise comparison based on Saaty's AHP (Saaty, 1987), in which a stakeholder group indicates which one of two of their previously selected relevant objectives is the most important and to what degree. The stakeholder groups completed this exercise for every possible pair of selected relevant objectives. This allowed for a ranking of the objectives by importance for each stakeholder group. When more than one representative of a stakeholder group was present, they had to discuss and work together to give their input as a single group.

During the workshop, the results of the weighting exercise of each stakeholder group were shown to all participants, every stakeholder group was asked to explain its results, and these results were then discussed with all stakeholders in a large group discussion.

4. Case study results

4.1. Stakeholders

An overview of the stakeholder groups for each pilot case deemed relevant to include in the EC decision-making process is given in Table 5.

The stakeholders listed in italics are the ones that were actively involved in the design process, with the determination of their most important objectives for joining an EC initiative. All of these groups filled out the survey and participated in the workshop in which their objectives were weighted and discussed.

[1] https://mamca.vub.be/.

Table 5
Relevant stakeholders per pilot case.

Stakeholder type	Haasrode	Buurzame Stroom	Green Energy Park	Kortrijk Weide
TSO	Elia + Fluxys	Elia + Fluxys	Elia + Fluxys	Elia + Fluxys
DSO	*Fluvius*	*Fluvius*	*Fluvius*	*Fluvius*
Regulator	VREG (Vlaamse Regulator van de Elektriciteits- en Gasmarkt)	VREG	VREG	VREG
Energy Supplier	Varied	Varied	Varied	Varied
Consumer/ Prosumer	*Current businesses*	Current residents	*Current + new businesses*	*Current institutions*
Initiator	C-Valley	*Citizen Energy Cooperative*	Green Energy Park vzw	/
Intermediate party	*Intermunicipal company*	/	/	Intermunicipal company
Local government	*City of Leuven*	*City of Ghent*	*Municipality of Asse*	*City of Kortrijk*
External investors	/	*Potentially (real estate service company)*	*Potentially (Wind Energy Cooperative)*	*Potentially (asset investor)*
Various	/	/	*Real estate developer for new neighboring residential project*	/

4.2. Stakeholder objectives and their perceived importance

All stakeholders that were contacted within the different pilot cases filled out the survey on their objectives for joining an EC initiative. Within the preset list they could indicate the relevance of each of the mentioned objectives and could add new ones that they felt were missing but were important to them. The results for all stakeholder groups, as well as a general overview of the objectives selected as most important ('relevant' or 'very relevant'), are depicted in Figs. A.1, A.2, A.3, A.4 and A.5 of the Annex.

During objective selection, it became clear that current businesses at the Haasrode industrial site as well as those at the Green Energy Park site had similar needs and wishes, so they were grouped into a single stakeholder group called 'businesses.' For the Kortrijk Weide site, the

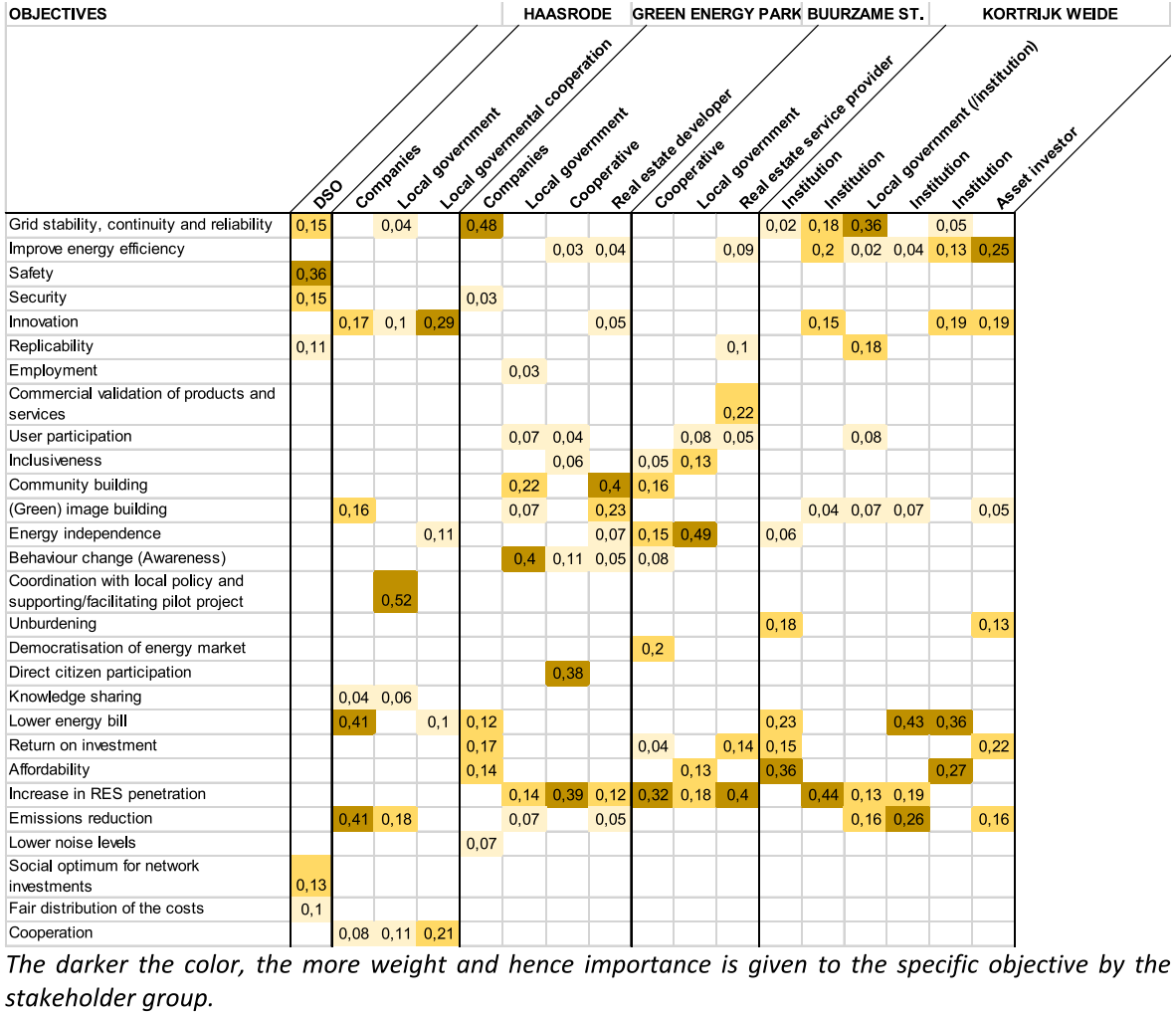


Fig. 1. Weights of the objectives of the various stakeholder groups
The darker the color, the more weight and hence importance is given to the specific objective by the stakeholder group. . (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

objectives of the institutions at the site often differed, mainly due to the potential different roles they would take up when forming an energy community (e.g., some will mostly consume energy while others will be main energy producers). Therefore, potential EC members in Kortrijk (educational, research and public service institutions) are considered different stakeholder groups.

All stakeholder groups were then asked to attribute a weight to their selected 'very relevant' objectives for becoming involved in an EC during a workshop using the online MAMCA software. The resulting graphs were immediately discussed among the stakeholders. An overview of the results of objectives selection and their weights are depicted in Fig. 1.

A representative of the DSO was present at all workshops, performed the weighting exercise and participated in the group discussion. The representative's input is applicable and the same for all four pilot sites.

4.3. Main workshop results

Among the case studies, the actors detected as the main stakeholders can be divided into four groups: (potential) EC members, the DSO, the local government and various site-specific (mostly external) actors.

The selected objectives can be grouped into four main categories, as depicted in Table 6.

The results of the objective selection and weighting are discussed for each of the four types of stakeholder groups. Fig. 2 gives an overview of the importance of certain categories of objectives for the different stakeholder groups across the case studies. '1' indicates an objective category of the highest importance and '3' indicates one of the lowest importance. These scores are a qualitative interpretation, with a value of '1' attributed when a stakeholder group representative attributed its highest weight/importance to at least one of the objectives that make up a category, a value of '2' denoting lower importance given and a value of '3' denoting an objective category not selected or assigned low importance.

4.3.1. (Potential) EC members

In the ROLECS pilot cases, different types of EC members were included: a citizen cooperative, companies, public actors and educational and research institutions were surveyed. The survey and workshop results show that for most of these entities, finance-related objectives are very important but are in most cases not the only decisive element.

Table 6
Objectives grouping into categories.

Objectives category	Objective
Economic objectives	Affordability
	Return on investment
	Lower energy bills
	Commercial validation of products and services
	Societal optimum for network investments
Technical objectives	Improved energy efficiency
	Grid stability, continuity and reliability
	Safety
	Security
	Replicability
Environmental objectives	Increased renewable energy penetration
	Emissions reduction
	Lower noise levels
Social objectives	User participation
	Innovation
	Employment
	Inclusiveness
	Community building
	(Green) image building
	Energy independence/Autonomy
	Behavior change (Awareness)
	Privacy protection
	Cooperation
	Fair distribution of costs (cost reflectiveness)
	Coordination with current planning and policy processes
	Democratization of the energy market
	Direct participation from citizens
	Unburdening

For businesses, the main concern is that the new energy system is futureproof with long-lived advantages rather than a large immediate return. In cases where financial gain was identified as the most important objective, it was noted that this does not necessarily have to be in the short term or by means of a direct gain. This is also proven by the fact that objectives of 'green image' and 'innovation', which create advantages in the long term, are being deemed important. In addition, the participating companies mentioned that the workshop discussion with other stakeholders and the information session on energy transition matters triggered them to be less focused on financial aspects. In the Green Energy Park case, businesses ascribe great importance to grid stability because it guarantees a reliable operationality of their company activities. It was indicated that an EC can cost more in the short term if it can ensure a more reliable and stable energy supply than the central grid because the direct financial loss would be compensated by long-term financial gains in operationality. This obviously depends on the type of company activity involved since, for example, an office building will often be less influenced by energy supply problems than an energy intensive production unit. At one site, the businesses indicated that generating a green image is still more important for them than being more environmentally friendly.

The objectives of the potential EC participants (mainly noncommercial institutions) in Kortrijk differ quite strongly, which is related to the role they would play in the EC. For institutions that would be the main supplier of energy within the EC and take on the most investment, the objectives mainly relate to financing and management aspects. They would have a high asset cost, higher financial risk and more responsibilities. Therefore, these institutions indicate that direct financial viability is crucial, as is (external) help for system development and management. They would not join an EC in which these aspects are not guaranteed. The other educational and research institutions have a broader range of objectives that make their financial objectives less exclusive, with environmental goals (that are part of broader organizational priorities), innovation goals (inherent to their activities) and technical prerequisites. As with the companies, their main focus in joining an EC is on strengthening their core activities and image to become futureproof institutions.

For cooperatives, environmental and social objectives are the main triggers for setting up or joining an EC. Since the social aspect of community building and the sustainability of the living environment are the main focuses of such cooperatives, they are more likely to engage in an EC form that is inclusive, that hands over much of its control to citizens and that is focused on increasing the supply of renewable energy.

A type of EC that requires closer cooperation between its members also receives a benefit from all potential EC participants. Companies and institutions believe that this can also lead to advantageous cooperation in other areas of activity, and citizens and public bodies believe it can strengthen social bonds and thus heighten the quality of living within neighborhoods. A precondition, however, is that the burden of organizing and managing the community is kept low for the participants. Participants want to be involved, but involvement cannot take up too much of their time and personal effort.

4.3.2. DSO

The DSO, as owner of the general energy grid infrastructure, mainly stresses technical objectives. It is important for the DSO that an EC brings benefits for society as a whole by helping avoid big grid investments and strengthening the regional energy grid system, as in most ECs, a link to the main grid still exists (be it to supplement energy shortages, guarantee energy supply in cases of emergency or offer stability services themselves). Another emphasis of the DSO lies in cost reflectiveness in that all energy bills should reflect the use of all

Stakeholders		Economical objectives	Technical objectives	Environmental objectives	Social objectives
EC members	Businesses	1	1	2	3
	Cooperatives	3	3	1	1
	Institutions	1	2	1	3
DSO		2	1	3	2
Local government		3	2	1	1
Other	Asset investors	1	1	2	3
	Real estate companies	2	3	1	1

Fig. 2. Objective importance per stakeholder group (with '1' denoting the highest importance and '3' denoting the lowest importance).

necessary infrastructure (and its maintenance) where an EC cannot be used as a mechanism to avoid contributing to general grid costs.

4.3.3. (Local) government

The various local governments involved in the pilot cases have their specific emphases, but overall, the main focus is on social and environmental aspects. While two local governments place the most importance on social components, two others mainly stress the added environmental value an EC should bring.

ECs are seen as a potential instrument to empower citizens and give them more control, leading to more awareness, participation, and inclusion and lower prices. Most local and regional governments have also set short-to mid-term goals to become CO2 neutral, and they believe that ECs can play an important role in reaching such objectives. In this regard, having a high replicability factor is also an important objective for ECs since it allows a quick upscaling of the roll-out of similar initiatives throughout the whole territory.

4.3.4. Other stakeholders

Depending on the specific local context, additional (external) stakeholders are essential to making an energy community operational. Sometimes external financial support is needed to be able to invest in the necessary assets; in other cases, the management of the local grid needs to be outsourced because of a lack of time or knowledge among EC members.

For these stakeholders, there is a clear predetermined role within the EC, and their objectives are related to this role and decisive for their participation. As is the case for EC prosumers who own a large share of assets in the system, an external investor is also concerned with the return on investment and the minimalization of financial risk. Building a positive image as an investor through environmentally friendly initiatives is a nice additional benefit, but this alone is not convincing enough to invest when a financial gain is not guaranteed.

A residential housing project developer will not facilitate the creation of an EC by investing in the necessary infrastructure (e.g., a heat network) when this is not perceived as offering added value to its project that attracts more buyers, raising the quality of housing or improving its company image. A real estate company with qualitative upscaling of buildings as its core business will only be interested in investing in EC assets if the type of EC that is deployed indeed creates an environmental and efficiency quality improvement and when the company, as a commercial service provider, can offer its own services within the community and can learn from this to provide such services through their other projects.

5. Analysis

A direct financial gain can help convince potential members to join an EC initiative, but if there is no short-term money to be made, other elements can still persuade commercial and residential private actors to become involved. For example, a new energy system that is good for the environment and for the company image can stimulate the growth of a business and create an (indirect) financial gain in the long term, which is considered by companies and institutions that are focused on strengthening their core activities for the future. Overall, it can be concluded that EC types that lead to a lower energy bill are favored by companies, but ECs that can guarantee a more stable and reliable energy supply than the central grid and that can generate futureproof long-term advantages are preferred irrespective of the direct financial gain. However, some workshop discussions with businesses show that they feel that the intrinsic advantages that emanate from becoming more sustainable are still limited. This is not the case for citizen cooperatives that feel ECs can be an important instrument for social inclusion. Therefore, they are more likely to support an EC form that gives more control to its members and is focused on environmental benefits.

The workshop discussions show that critical in setting up a supported EC is making sure that the community aspect reaches further than just an exchange of energy and also stimulates other forms of cooperation between its members without a great demand for effort in return.

For the DSO, it is of foremost importance that ECs can be reliable partners that bring added value to the main grid (which will always be needed). The DSO supports ECEC forms that are not only technically reliable but also bring social and technical advantages for non-EC members.

Local governments emphasize social and environmental objectives, which are currently embedded in all of their policy plans. During the discussion workshops, government representatives emphasized that the more an EC fits into these plans and can be used as an instrument to reach policy goals, the more it is supported. An EC can obtain more governmental support when it clearly strengthens community sentiment because of the close cooperation needed between its members and when it demands active involvement that makes people and companies more mindful of their overall environmental behavior, not only of their energy use patterns. New energy systems that stimulate the introduction of more renewables and lead to a reduction in general fossil fuel use also score well. The main focus on either potential environmental or social advantages is more dependent on the political ideology of the city council than on the geographical context.

Furthermore, the less site specific the type of EC is (or the more adaptable it is to different contexts), the more it complies with the local government's need for a quick and general roll-out.

For all other (external) stakeholders, their objectives are related to their predetermined role within the EC and are preconditions for their participation. They often join an EC with one main goal, and if it cannot be guaranteed that this goal can be fulfilled, they will not take part in the initiative, contrary to, e.g., potential members and local governments that are often still willing to participate even if not all of their initial requirements might be met. For these types of stakeholders, it is important to capture 'breaking point' objectives, which are very role- and site-specific.

The pilot case outcomes indicate that for the main EC stakeholder groups of future projects, the general results can be expected to be similar to those of the case study stakeholders, although the emphasis might differ slightly.

6. Conclusion and policy implications

The successful implementation of an EC starts with a design that is supported by and meets the needs of all stakeholders concerned. While most existing research focuses on citizen participation, our study provides insight into the motivations of other types of stakeholders to join an EC initiative.

Governments, as well as other actors who are initiators or developers of an EC (e.g., business park managers and citizen cooperatives), can incorporate these elements into their designs to bring them more in line with the needs and wishes of everyone who will be part of them. This information is also useful when setting up policy initiatives to stimulate the large-scale roll-out of EC initiatives, as it indicates which barriers should be approached to attract the interest of specific essential stakeholders and it shows which issues should involve a primary focus on regulation changes, facilitating measures and communication efforts.

The interests of similar stakeholder groups in a largely similar context have variations but in general turn out to be quite similar. For (external) stakeholders with a clear predefined role, the objectives are limited and often represent indispensable preconditions. When an EC design does not fully comply with these stakeholders' objectives, they will not participate. For more general stakeholder groups with multiple potential roles within an EC, such as local governments and companies as EC members, the objectives are broader and can vary over time, e.g., with the gaining of knowledge on energy matters, with other stakeholders' objectives, or depending on the roles they play within an EC. During the workshops, these stakeholders indicated that they were more open to adjusting their objectives and making compromises as long as they were actively involved in the design process.

While financial incentives are the main drivers of participation for potential EC members, they are often not decisive objectives. For example, for companies, a futureproof reliable energy system with long-term (environmental and technical) advantages is often deemed more interesting than one mainly focused on direct financial gain. For the examined noncommercial institutions, the focus when joining an EC is also on strengthening their core activities and image for long-term gains. For citizen cooperatives, environmental and social objectives are the main triggers behind setting up or joining an EC, with inclusiveness, more autonomy for citizens and an increase in renewable energy as major goals. An EC type that requires closer cooperation between its members (without much additional workload) is also preferred by all potential EC participants.

For the Flemish DSO, ECs mainly have to become reliable partners that bring added value to their main grid and to society as a whole, which is reflected by some technical objectives and an emphasis on cost reflectiveness. For local governments, the main objectives are social and environmental, driven by the wish to become CO2 neutral and to strengthen community sentiment and awareness among citizens. The emphasis can vary in different locations based on the local political focus.

Further research on more sites is needed to determine which objectives are intrinsic to specific stakeholders, regardless of the local context, and should hence play a part in every EC design. More research can also be done on the specific indispensable preconditions set by some stakeholders depending on the roles they play.

In addition, the workshop discussions show that stakeholder objectives can change over time depending on stakeholder' knowledge of EC systems, insight into other stakeholders' objectives, shifting political ideas, etc. It may be interesting to examine which parameters are influenced the most by knowledge enhancements and in what way this could influence potential outcomes of decision-making on ECs. In every EC design project, attention needs to be directed to future context shifts to create projects that can withstand potential changes in context and keep stakeholders involved.

To our knowledge, this was the first time that a stakeholder engagement process was used to determine the relevant objectives of different types of potential EC stakeholders. While many traditional engagement initiatives are initiated by governments for (policy) planning and tend to focus on citizens, the results of this research show that a similar engagement of various types of stakeholders aimed at practical applications (EC design) and initiated by nongovernmental actors also leads to useful output. When questioned about the effect of the workshop, the stakeholders indicated that the discussions led to a deeper mutual understanding of their needs and influenced their own selection and weighting of objectives. Therefore, the engagement process used led to a more realistic insight into the various stakeholder positions than theoretical studies or individual surveys could, providing input for an EC design with greater chances of support and implementation.

Sustainability means meeting both environmental and socioeconomic needs, and a participatory trajectory for energy communities is hence necessary to make long-term sustainable and viable decisions. This can guarantee the roll-out of more successful EC initiatives, for which until now no clear design processes or frameworks have been developed. Taking into account the stakeholder objectives specified as important in this study and further establishing an engagement process will help EC initiators create supported EC designs.

The participatory method that was used for the identification and weighting of all stakeholder objectives can also be applied as a standard engagement framework in future EC set-up processes. By surveying all relevant stakeholders on their EC needs, using the list of potential objectives that was compiled in this project, and organizing workshops for a joint discussion and weighting of the results, inclusive engagement in the early stages of the EC set-up is made possible. The outcome of this process delivers practical input for the EC design. The specific translation of the determined essential objectives into technical design EC elements, in a participatory way, can form an interesting topic for future research. To have a truly meaningful impact stakeholder engagement needs to be implemented throughout the whole EC set-up process, with appropriate participatory methods selected or designed for every specific stage of the project. Comparable research projects that focus on stakeholder engagement in these next EC set-up phases can deliver useful additional insights in light of the creation of an all-encompassing engagement framework for EC initiatives.

CRediT authorship contribution statement

Shary Heuninckx: Conceptualization, Methodology, Writing – original draft. **Geert te Boveldt:** Supervision, Writing – review & editing. **Cathy Macharis:** Writing – review & editing. **Thierry Coosemans:** Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This work was financially supported by VLAIO and Innoviris through Flux50 project ROLECS (HBC.2018.0527) and by the European Union through the project RegEnergy (INTERREG Northwest Europe Program).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.enpol.2022.112808.

APPENDIX

Annex – Pilot case stakeholder objectives

Colors indicate whether an objective was deemed very relevant (green) or relevant (yellow) to the stakeholder group.

For the Haasrode site, the provided objectives list was slightly different because it was the first case that was studied, and the feedback was processed into a minor rework of the survey for the other cases.

Potential objective	Businesses	DSO	City of Leuven	Interleuven
Grid stability, continuity and reliability				
Safety				
Security				
Reduce ecological footprint				
Lower energy bill + return on investment				
Replicability				
More cooperation				
Knowledge sharing				
User participation				
Innovation				
Employment				
Commercial validation of products & services				
Inclusiveness				
Customer satisfaction				
(Green) image building				
Energy independence				
Economic growth				
Privacy protection				
Additional:				
Societal optimum for network investments				
Fair distribution of the costs (cost reflectiveness)				
Coordination with current planning and policy processes				

really relevant

really relevant for most but not all representatives of the stakeholder group

relevant

Figure A.1. Stakeholder objectives for the Haasrode site

Potential objective	Energent	DSO	City of Ghent	Quares
Improve energy efficiency				
Grid stability, continuity and reliability				
Safety				
Security				
Affordability				
Return on investment				
Lower energy bill				
Replicability				
User participation				
Innovation				
Employment				
Commercial validation of products and services				
Inclusiveness				
Community building				
(Green) image building				
Energy independence				
Behavior change (Awareness)				
Privacy protection				
Increase renewable energy penetration				
Emissions reduction				
Lower noise levels				
Additional:				
Societal optimum for network investments				
Fair distribution of the costs (cost reflectiveness)				
Democratisation of the energy market				

Figure A.2. Stakeholder objectives for the Buurzame Stroom site

Figure A.3. Stakeholder objectives for the Green Energy Park site

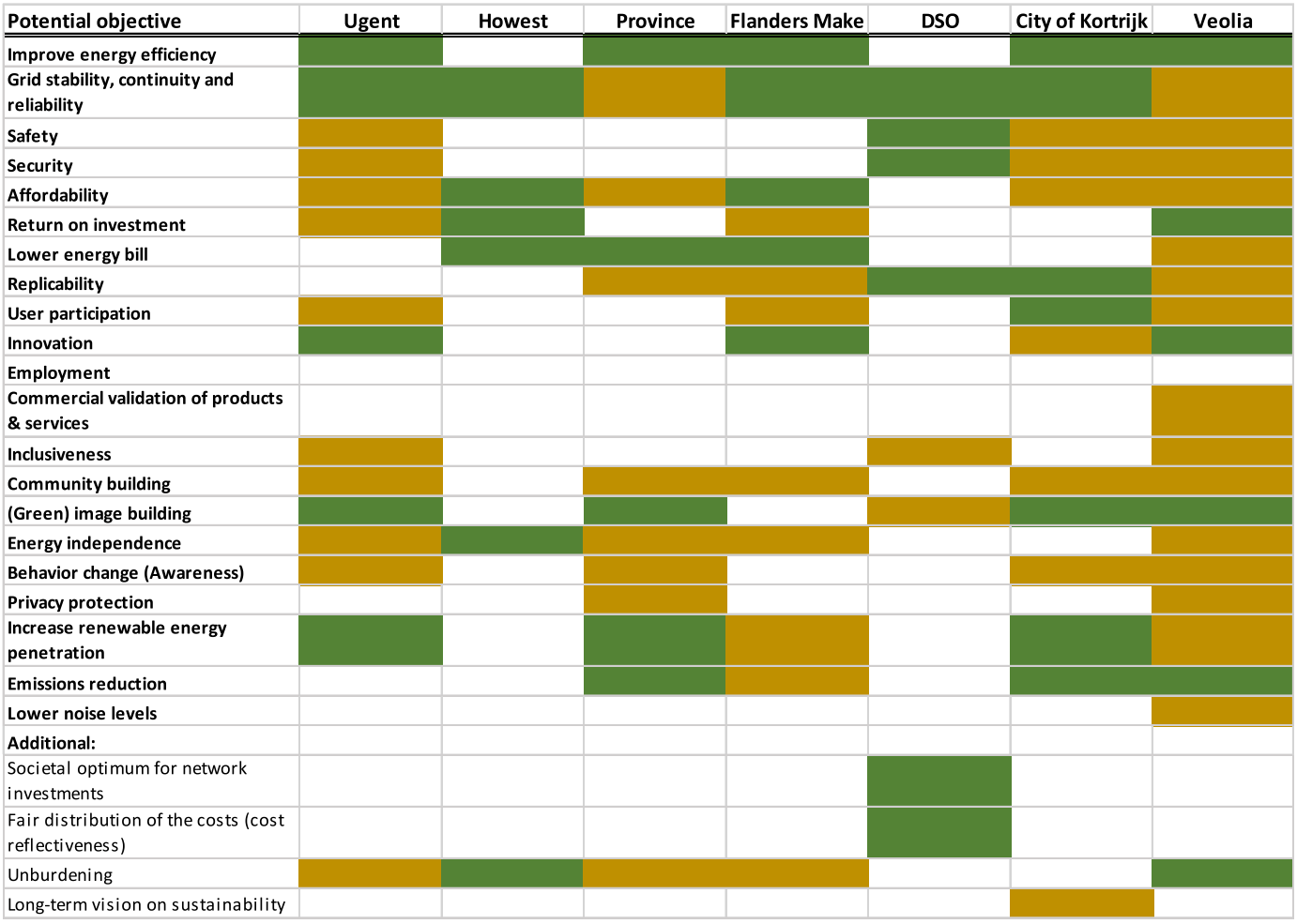


Figure A.4. Stakeholder objectives for the Kortrijk Weide site

OBJECTIVES	HAASRODE				GREEN ENERGY PARK					BUURZAME STROOM				KORTRIJK WEIDE						
	Companies	Leuven	Interleuven	DSO	Companies	Asse	Ecopower	Matexi	DSO	Energent	Ghent	Quares	DSO	Howest	Ugent	Kortrijk	Province	Flanders Make	Veolia	DSO
Grid stability, continuity and reliability		x		x	x				x				x	x	x	x		x		x
Improve energy efficiency							x	x				x			x	x	x	x	x	
Safety				x					x				x							x
Security				x	x				x				x							x
Innovation	x	x	x					x							x			x	x	
Replicability				x					x			x	x			x				x
Employment						x														
Commercial validation of products and services												x								
User participation						x	x				x	x				x				
Inclusiveness							x			x	x									
Community building						x		x		x										
(Green) image building	x					x		x							x	x	x		x	
Energy independence			x					x		x	x			x						
Behaviour change (Awareness)						x	x	x		x										
Coordination with local policy and supporting/facilitating pilot project		x																		
Unburdening														x					x	
Democratisation of energy market										x										
Direct citizen participation							x													
Knowledge sharing	x	x																		
Lower energy bill	x		x		x									x			x	x		
Return on investment					x					x		x		x					x	
Affordability					x						x			x				x		
Increase in RES penetration						x	x	x		x	x	x			x	x	x			
Emissions reduction	x	x				x		x								x	x		x	
Lower noise levels					x															
Social optimum for network investments				x					x				x							x
Fair distribution of the costs				x					x				x							x
Cooperation	x	x	x																	

Figure A.5. Overview of stakeholder objectives selected as 'very relevant'

References

Barnett, J., Burningham, K., Walker, G., Cass, N., 2012. Imagined publics and engagement around renewable energy technologies in the UK. Publ. Understand. Sci. 21, 36–50. https://doi.org/10.1177/0963662510365663.

Bauwens, T., 2019. Analyzing the determinants of the size of investments by community renewable energy members: findings and policy implications from Flanders. Energy Pol. 129, 841–852. https://doi.org/10.1016/j.enpol.2019.02.067.

Burke, M.J., Stephens, J.C., 2018. Political power and renewable energy futures: a critical review. Energy Res. Social Sci. 35, 78–93. https://doi.org/10.1016/j.erss.2017.10.018.

Conradie, P.D., De Ruyck, O., Saldien, J., Ponnet, K., 2021. Who wants to join a renewable energy community in Flanders? Applying an extended model of Theory of Planned Behaviour to understand intent to participate. Energy Pol. 151, 112121. https://doi.org/10.1016/j.enpol.2020.112121.

Dóci, G., Vasileiadou, E., 2015. "Let's do it ourselves" Individual motivations for investing in renewables at community level. Renew. Sustain. Energy Rev. https://doi.org/10.1016/j.rser.2015.04.051.

DTI, U., 2003. Our Energy Future–Creating a Low Carbon Economy. Energy White Paper, London.

European Parliament & Council of the European Union, 2019. Directive (EU) 2019/944 on common rules for the internal market for electricity and amending directive 2012/27/EU. Off. J. Europ. Union.

European Parliament & Council of the European Union, 2018. Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources. Off. J. Europ. Union.

Guerrero, J., Blaabjerg, F., Zhelev, T., Hemmes, K., Monmasson, E., Jemeï, S., Comech, M.P., Granadino, R., Frau, J.I., 2010. Distributed generation: toward a new energy paradigm. IEEE Indus. Electr. Mag. 4, 52–64. https://doi.org/10.1109/MIE.2010.935862.

Gui, E.M., MacGill, I., 2018. Typology of future clean energy communities: an exploratory structure, opportunities, and challenges. Energy Res. Social Sci. 35, 94–107. https://doi.org/10.1016/j.erss.2017.10.019.

Hall, S., Roelich, K., 2016. Business model innovation in electricity supply markets: the role of complex value in the United Kingdom. Energy Pol. 92, 286–298. https://doi.org/10.1016/j.enpol.2016.02.019.

Huang, H., Lebeau, P., Macharis, C., 2020. The multi-actor multi-criteria analysis (MAMCA): new software and new visualizations. In: Lecture Notes in Business Information Processing. Springer, pp. 43–56. https://doi.org/10.1007/978-3-030-46224-6_4.

Huijts, N.M.A., Molin, E.J.E., Steg, L., 2012. Psychological factors influencing sustainable energy technology acceptance: a review-based comprehensive framework. Renew. Sustain. Energy Rev. 16, 525–531. https://doi.org/10.1016/J.RSER.2011.08.018.

Kazmi, H., Munne-Collado, I., Mehmood, F., Syed, T.A., Driesen, J., 2021. Towards data-driven energy communities: a review of open-source datasets, models and tools. Renew. Sustain. Energy Rev. 148, 111290. https://doi.org/10.1016/j.rser.2021.111290.

Keay, M., Rhys, J., Robinson, D., 2014. Electricity markets and pricing for the distributed generation era. In: Distributed Generation and its Implications for the Utility Industry. Elsevier Inc., pp. 165–187. https://doi.org/10.1016/B978-0-12-800240-7.00008-4

King, C.S., Feltey, K.M., Susel, B.O., 1998. The question of participation: toward authentic public participation in public administration. Publ. Adm. Rev. 58, 317. https://doi.org/10.2307/977561.

Koch, S., 2015. Assessment of revenue potentials of ancillary service provision by flexible unit portfolios. In: Pengwei, D., Ning, L. (Eds.), Energy Storage for Smart Grids. Academic Press, Boston, pp. 35–66.

Li, L.W., Birmele, J., Schaich, H., Konold, W., 2013. Transitioning to community-owned renewable energy: lessons from Germany. Proced. Environ. Sci. 17, 719–728. https://doi.org/10.1016/j.proenv.2013.02.089.

Lode, L.M., Heuninckx, S., Koronen, C.A., 2019. ROLECS Deliverable 4.3 - Stakeholder Mapping and Scenario Building.

Macharis, C., Stevens, A., 2003. The strategic assessment of driver assistance systems: a multi-criteria approach. In: 7th Nectar Conference "A New Millennium", "Are Things the Same?" Umeå (Sweden).

Macharis, C., Turcksin, L., Lebeau, K., 2012. Multi actor multi criteria analysis (MAMCA) as a tool to support sustainable decisions: state of use. Decis. Support Syst. 54, 610–620. https://doi.org/10.1016/J.DSS.2012.08.008.

Moroni, S., Alberti, V., Antoniucci, V., Bisello, A., 2019. Energy communities in the transition to a low-carbon future: a taxonomical approach and some policy dilemmas. J. Environ. Manag. 236, 45–53. https://doi.org/10.1016/J.JENVMAN.2019.01.095.

Randolph, J., Bauer, M., 1999. Improving environmental decision-making through collaborative methods. Rev. Pol. Res. 16, 168–191. https://doi.org/10.1111/j.1541-1338.1999.tb00882.x.

Reed, M.S., 2008. Stakeholder participation for environmental management: a literature review. Biol. Conserv. https://doi.org/10.1016/j.biocon.2008.07.014.
Roberts, J., Frieden, D., D'Herbemont, S., 2019. Energy Community Definitions, Compile Project: Integrating Community Power in Energy Islands.
Saaty, R.W., 1987. The analytic hierarchy process-what it is and how it is used. Math. Model. 9, 161–176. https://doi.org/10.1016/0270-0255(87)90473-8.
Schall, D.L., 2020. More than money? An empirical investigation of socio-psychological drivers of financial citizen participation in the German energy transition. Cogent Econ. Finance 8. https://doi.org/10.1080/23322039.2020.1777813.
Schelly, C., Price, J., Delach, A., Thapaliya, R., Leu, K., 2019. Improving solar development policy and planning through stakeholder engagement: the Long Island Solar Roadmap Project. Electr. J. 32, 106678. https://doi.org/10.1016/j.tej.2019.106678.
Solman, H., Smits, M., van Vliet, B., Bush, S., 2021. Co-production in the wind energy sector: a systematic literature review of public engagement beyond invited stakeholder participation. Energy Res. Social Sci. https://doi.org/10.1016/j.erss.2020.101876.
van der Schoor, T., Scholtens, B., 2015. Power to the people: local community initiatives and the transition to sustainable energy. Renew. Sustain. Energy Rev. https://doi.org/10.1016/j.rser.2014.10.089.
Van Der Schoor, T., Van Lente, H., Scholtens, B., Peine, A., 2016. Challenging obduracy: how local communities transform the energy system. Energy Res. Social Sci. 13, 94–105. https://doi.org/10.1016/j.erss.2015.12.009.
Walker, G., 2008. What are the barriers and incentives for community-owned means of energy production and use? Energy Pol. 36, 4401–4405. https://doi.org/10.1016/j.enpol.2008.09.032.
Wolsink, M., 2012. The research agenda on social acceptance of distributed generation in smart grids: renewable as common pool resources. Renew. Sustain. Energy Rev. 16, 822–835. https://doi.org/10.1016/J.RSER.2011.09.006.