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Energy co-operatives in Spain: The role of social enterprises in the energy transition

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ABSTRACT

Decentralized and small-scale forms of organization are reappearing in Spanish's energy system. Co-operatives have a social approach based on three dimensions: the purpose of the initiative, the form of organization and ownership, and embeddedness. In this paper, we apply this analytical framework to twelve energy co-operatives in Spain. These collectively owned organizations are energy-marketing communities, and they have specific objectives: These are an ecological objective (to reduce energy consumption and generate renewable energy) and a social objective (to propose an alternative to the reality of the energy market and citizen empowerment). Energy co-operatives in Spain have been typified as social enterprises, and these social enterprises have experience in common energy service, with which they may mark their future role in local energy communities. These results show the consolidation of energy co-operatives as a sign of the maturity of Spanish society in the face of energy challenges.

1. Introduction

The Spanish electricity market began when the liberalization process started in 1998, as the market went from an oligopoly to seeing the entry of new agents (producers, transporters, distributors,¹ and energy-marketers). Subsequently, the market was legislatively opened, and the first free marketers² appeared. Today, the Spanish Iberian Market is marginalist, i.e., everyday sellers and buyers launch their offers with different prices under the management of the Spanish Iberian Market Operator (OMIE). Throughout this transition, we find three binding milestones: the explicit recognition of the figure of the energy co-operative³ (Law 24/2013, of 26

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¹ Energy distributors (regulated market): they are responsible for distributing electricity from the substations to the points of consumption (households), i.e., maintaining the distribution facilities and guaranteeing the quality of supply. Although there are many distributors in Spain, energy distribution is regulated (distribution costs are set by the government) and this market is formed by an oligopoly with five main distributors controlling 90% of the market.

² Energy marketers (free market): the intermediaries between the end customer and the rest of the market agents. They buy energy from the Spanish Iberian Market Operator and sell it to the end consumer and are free to set the price of their tariffs.

³ Article 6 of Law 24/2013, of 26 December, on the Spanish Electricity Sector, cites: "Marketers, which are those trading companies, or consumer and user co-operative societies, which, by accessing the transmission or distribution networks, acquire energy for sale to consumers, to other subjects of the system, or to carry out exchange operations...".

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December); joint self-consumption of energy⁴ (Royal Decree-Law 15/2018, of 5 October); and photovoltaic self-consumption under modern regulations (Royal Decree-Law 244/2019, of 5 April). Today, the State is proposing the need to continue addressing, among other matters, regulatory measures that facilitate the promotion of this type of energy generation and consumption (Royal Decree-Law 14/2022, of 1 August). Traditionally, the electricity market was monopolized and dominated by large energy production areas where localized energy models and territorial consumption were not favored, and where joint self-consumption of energy was prohibited (Fajardo, 2021). This rigid framework identifies a specific condition for the country's energy co-operatives: the condition of being committed and resilient. The phenomenon of co-operatives within the electricity sector is not new; the origin of the electric distribution co-operatives in Spain dates back to the 1920 s. Electric co-operatives have been present in Spanish legislation, as special supply co-operatives (providing water, gas, and electricity), since the first law on co-operatives in 1931, until Law 27/1999 on co-operatives where they are not mentioned, which does not prevent them from continuing to exist and being identified as such (Fajardo, 2021). Since the liberalization of the electricity market, new co-operative societies have entered the market, with most of them starting out as marketers and including multiple modalities in their daily activities, providing energy, and carrying out energy efficiency projects.

Nevertheless, the dominance of the big five energy companies (known as the energy oligopoly) persists in Spain, as they control 80% of energy production and 95% of commercialization. Moreover, the system is based on complex technological expertise (controlled by key expert groups and large companies), together with complex financial knowledge of markets and bidding mechanisms for the daily formation of energy prices (Pellicer-Sifres, 2020). At present, the amount of electricity from renewable sources is much higher than the amount demanded. The aim of the co-operatives is to change the energy model by increasing the demand for this type of energy in the country. One of the motives for this change is to involve the public in this transformation. Through participation in society, the use of renewable energy is promoted, which, in addition to saving money for members, will also bring them economic benefits and social gains.

Since 2012, national policies and regulations have been hostile to small- and medium-sized energy producers (Capellán-Pérez, Campos-Celador, & Terés-Zubiaga, 2018), and, in 2015, this was exacerbated by the problem of energy poverty⁵ (Pellicer-Sifres, 2020). Active public policies have been conditioned. These co-operative societies have seen how public policies to promote the Social Economy have been progressively reformulated over the last five years, moving from a centralized model based on direct economic aid to one whose purpose is to incorporate a more local approach (Morandeira-Arca, Etxezarreta-Etxarri, & Egia-Olaizola, 2023). Some regional governments have established specific measures in favor of co-operatives and renewable energy communities (Standal et al., 2023; Fajardo García, 2021). These include green public procurement criteria with social clauses or contracts reserved for social economy entities and/or renewable energy (Vaño Vaño, 2023), or investing in renewable installations for public institutions themselves (e.g., city councils installing photovoltaic panels).

These societies are a population of interest for research because they have a particular historical background in the country, and they stand out for their capacity to adapt to socio-legal transformations. Furthermore, it is worth mentioning the increase in new experiences of electric co-operatives, because of the concern for sustainability, as they are focused on the generation and consumption of green energies in Spain. This trend is related to a community approach and to entrepreneurship in renewable energy (Heras-Saizarbitoria, Sáez, Allur, & Morandeira, 2018). In many European countries, there is a significant evolution of decentralized and small-scale forms of energy organization. These different initiatives are often referred to as community energy,⁶ and today there is also the taxonomy of local community energy.⁷ While Spain shows a low level of dynamism in this community energy (Kunze and Becker, 2015), it exemplifies the quality of its energy co-operatives as opposed to the quantity, as there are few energies co-operative societies in the country (Heras-Saizarbitoria et al., 2018).

Recent academic research has paid attention to energy co-operative organizations (Cobeña-Ruiz-Lopera, Pérez-Suárez, & Sánchez-Torné, 2023). The dispersed literature focuses on the co-operatives' diffusion at the regional level, such as in Germany (Punt, Bauwens, Frenken, & Holstenkamp, 2021) and in the Netherlands (Bauwens and Eyre, 2017), and the types of energy co-operative business models (Dilger, Konter, & Voigt, 2017). In this context, the aim of this paper is to find out the type of orientation of energy co-operatives in Spain and whether they contribute to social welfare, assessing the social competence of the energy co-operative society.

⁴ The consumption by one or more consumers of electricity from production facilities close to and associated with those of consumption.

⁵ "Energy poverty was introduced as a key concept in the *Clean Energy for All Europeans* package in 2019 and has recently been reinforced with the launch of the *Fit for 55 package* which coincided with the increase in energy prices resulting from the war in Ukraine and (...). Alongside this package, the *Social Climate Fund* (European Commission, 2021) has been launched with the aim of protecting the most vulnerable consumers" (Martín and Sánchez, 2023, p.155).

⁶ A broad term that refers to local and citizen ownership and participation in the generation and distribution of renewable energy and energy efficiency. Community ownership and participation can take different organizational forms, ranging from households to social enterprises, municipalities, and multi-actor partnerships. Depending on the actors and objectives, community energy can take different legal forms. It has been shown that communities, or various groups and individuals, often come together to create small or medium-sized enterprises with a social or "community" purpose. Often these socially oriented enterprises are formed as partnerships, co-operatives, or municipal enterprises. The members or owners of these enterprises often (but not only) locate their projects in their own area. This differs from traditional renewable energy developers, which often develop projects based on traditional corporate entities to realize profit opportunities (Rescoop.eu).

⁷ This concept is not yet defined in Spain. Local energy communities are forms of collective self-consumption in which the people involved benefit from the energy they produce. The structure of local energy communities in Europe varies from small local communities and neighbourhoods that produce their own renewable energy, to larger scale projects where external actors such as electricity companies set up a local energy community to save money on the services offered (Spanish Ministry for Ecological Transition and the Demographic Challenge, MITECO).

Energy co-operatives in Spain are energy-marketing enterprises with a customer orientation, called member-customer. They are democratically organized and managed enterprises that carry out their activities in a responsible and supportive manner with the community. In them, their members satisfy their energy consumption. Their purpose is to provide, under the condition of quality, information, and price, a service for the consumption of electricity, used and enjoyed by their members and those who live with them on a regular basis. An energy co-operative is a company owned and controlled by the member-customers. Through this, member-customers obtain the energy they need, and they seek efficient consumption under the best information and price conditions. The main motivations for citizens to promote these organizations include the need to encourage the transition to renewable energies in view of environmental problems such as climate change and the scarcity of non-renewable resources, as well as the aspiration to regain social control of energy sources (Capellán-Pérez et al., 2018).

The link between the organization and the member-customer is relevant to the point of linking the concept of a co-operative with that of a social enterprise.⁸ Not knowing the social competence of the energy co-operative society in Spain, the integral approach of Becker, Kunze, and Vancea (2017) is applied, made up of three analytical dimensions: Purpose, Organization, and Embeddedness from the vision of "socio-community" energy. This may lead to energy co-operatives being important in energy justice and energy democracy (Shehabi and Al-Masri, 2022).

The findings on energy co-operatives point to them as a key dynamizing agent of local development. This is due to their leading the decarbonization of the local economy from the production of indigenous renewable sources to increase the country's energy independence (Pellicer-Sifres, 2020). While it is usual to think of the production and commercialization of electricity, the activities conducted by energy co-operatives go much further. A key way of reducing carbon emissions is to increase energy efficiency, coupled with energy storage, district heating, the fight against energy poverty, and sustainable mobility, such as electric car-sharing co-operatives (e.g., EH!CO!CHE) (REScoop.eu, 2021).

The paper is organized as follows. Section 2 gives an overview of the academic discussion on community energy and examines research on energy co-operatives in Spain. Section 3 describes the research methodology and data from the study conducted. Section 4 explains the results generated by applying the analysis. This is followed by the paper's conclusions.

2. Community energy and energy co-operatives: an overview

Energy communities are significant in the energy transition toward a decarbonized and decentralized electricity sector (Veenman, Kusters, & Beckers, 2021). These local energy initiatives are prolific and have different names depending on the location.⁹ All aim to create a sustainable society in energy generation and consumption, responding to a social commitment and recognizing the local situation, interests, and values of the communities involved. Exploring the transition potential of such initiatives allows us to understand the social aspects and the actors behind sustainable transformations. The literature on transition shows an awareness of this when it looks at multiple approaches under the umbrella of *Futures Studies* (Minkkinen, 2019) or *Futures Theory and anticipation* (there is a diversity of thematic frameworks: economic, environmental, social - the local network, community, and Not in My Backyard - conflict, political, local development, technology, and innovation. Veenman et al., 2021); *Democratic Theory* (the planning and implementation of energy projects is guided by the deliberative democracy model, which calls for an inclusive participation of citizens in decision-making processes and a discursive assessment of the generalization of interests. Krüger, 2022); *Transition Theory* (specific activities for a metamorphosis follow various methods and involves three processes: (a) the formation of a network of actors, (b) a learning mechanism, and (c) expectation management according to Hatzl et al., 2016, and transition management with a multi-level perspective according to Dóci et al., 2015); to *Sociological Theory* (the study of the temporality of the energy transition with a focus on everyday practice and discourse or the importance of future visions for policy making (Wagner and Matuszek, 2022). Today, attention is on community energy enterprise transitions based on conceptualizing a transition process composed of three phases: the community volunteering phase, the niche creation phase, and the niche expansion phase (Bauwens, Vaskelainen, & Frenken, 2022).

Finally, there is a debate about the tension between the transformation of the transition (energy and social) and the challenges it implies for energy communities.

Prior research agrees that community energy should benefit the communities they are embedded in (Creamer, Aiken, Van Veelen, Walker, & Devine-Wright, 2019; Van Veelen, 2018). Environmental and social commitment must be materialized (Kunze and Becker, 2015) and energy is already often linked to both for-profit and non-profit motives (Kalkbrenner and Roosen, 2016). So, energy enterprises also set up hybrid models combining commercial and co-operative objectives (De Bakker, Lagendijk, & Wiering, 2020). Few studies on community energy in Spain exist (Capellán-Pérez et al., 2018).

Community energy projects have various organizational and ownership types, one of the most notable ones being energy co-operatives that follow a membership-based logic (Dilger et al., 2017). Energy co-operatives in Spain are an emerging business model in the energy system (Heras-Saizarbitoria et al., 2018). The national context is marked by austerity, an energy-inefficient urban

⁸ According to the European Commission (2011), a social enterprise is "an operator in the social economy whose main objective is to have a social impact rather than to make a profit for its owners or shareholders. It produces goods and services for the market in an innovative and entrepreneurial way and uses its profits primarily to achieve social objectives. It is managed in an open and accountable manner, involving workers, consumers, and stakeholders affected by its business activity" (Nogales-Muriel, 2017, p.123).

⁹ E.g., Social renewable energy communities in the Netherlands (Dóci, Vasileiadou, & Petersen, 2015); Grassroots Initiatives (GIs) in the Netherlands (Veenman et al., 2021); Citizen Participation Initiatives (CPIs) in Austria (Hatzl, Seebauer, Fleiß, & Posch, 2016); Energy Communities in Greece (Fajardo and Frantzeskaki, 2021) or Energy Co-operatives in Germany (Karakislak, Sadat-Razavi, & Schweizer-Ries, 2023), among others.

fabric, and a centralized and oligopolistic energy system. In this oligopolistic reality with its energy poverty, collaborative networks and adaptability are the competitive advantage of emerging energy co-operatives (Capellán-Pérez et al., 2018).

So far, most of the work on these co-operatives in Spain (Cuesta-Fernández, Belda-Miquel, & Calabuig, 2020; Capellán-Pérez et al., 2018; Heras-Saizarbitoria et al., 2018) has highlighted the set of corporate values as the key to success. They are presented as solidarity organizations where this solidarity is seen as the shared responsibility to offer energy and common welfare to its members, their families, and the members of the community in general. The non-profit¹⁰ energy co-operative *Goiener*¹¹ is an example in Spain. This is an example of the socialization of renewable energy in Spain. It is an active agent of energy production, controlling its expenses and consumption according to the needs of each member-customer. This electricity trader supports the ability of each member-customer to manage the amount of energy they consume.

In the end, the published works on Spanish energy co-operatives explore the social and scientific impact of these enterprises (Romero-Rubio and De-Andrés-Díaz, 2015). To follow this line of exploration, in addition to the previous derivations, this research starts from the democratic theoretical current represented in the co-operative model.

3. A descriptive study: research methodology

The research by Becker et al. (2017) verified the social dimension of energy co-operatives. In reference to that work, this research establishes the extension and generation of knowledge about Spanish energy co-operatives. Spanish energy co-operatives are a cluster whose formation can be described as follows:

- Firstly, the electric co-operatives started up at the beginning of the 20th century. In those times, the national power grid did not reach regions in more remote areas that were difficult to access. It was necessary to supply electricity to these regions, most of which were rural areas. Therefore, these co-operatives were electricity producers and energy distributors (Cuesta-Fernández et al., 2020); and
- Secondly, renewable energy co-operatives started up in the 21st century and are citizen participation societies commercializing 100% renewable certified electricity to help toward the energy transition. They do not have a distribution activity and their activity is not limited to one location, but their scope of action is much broader, and they are founded under the paradigm of the change of energy model (Capellán-Pérez et al., 2018).

As there are very few studies dealing with the cluster of energy co-operatives in Spain, the population¹² is not clearly identified. Recent studies only identify renewable energy co-operatives (Capellán-Pérez et al., 2018; Jaio, Paredes, & Sánchez, 2016), although evidence on other energy co-operatives in the country exists (Cuesta-Fernández et al., 2020). The limitations of the population are important as they determine the statistical analysis and processing of the data (Table 1).

The first step carried out to define the sample was the specific directory creation of Spanish Energy Co-operatives in collaboration with *Union Renovables Coop.*¹³ The preliminary search yielded thirty-two social energy co-operatives in Spain according to the available data. All of them were invited to participate in the research. They were contacted by e-mail or telephone.¹⁴ In the end, twelve co-operatives with geographical and organizational diversity took part in the study (Heras-Saizarbitoria et al., 2018). The sample of this research (twelve energy co-operatives) is small, but it is representative of the country's identified population given that during the fieldwork for this research only thirty-two active energy co-operatives were found throughout the country. The study is significant concerning the rise of 21st century societies and their future projection, as well as their popularity.

Table 1 provides a description of the main objectives, data, approach, and methodology from the analysis for Spain. These will be presented later in detail. It also describes the methodology applied.

The questionnaire began with questions on three dimensions: 'Purpose', 'Organization', and 'Embeddedness' (Becker et al., 2017), and finished with open-ended questions aimed at enterprise managers about:

¹⁰ The profits derived from the commercialization of (green) electricity among its member-customers revert to the co-operative, and the member-customers themselves decide in an assembly how to allocate those profits. In turn, the member-customers may invest in renewable generation projects whose production will be consumed by the co-operative itself. The aim is for energy generated by the co-operative to be the same as that consumed by its member-customers.

¹¹ <https://www.goiener.com/>

¹² Total number of active energy co-operatives.

¹³ <https://www.unionrenovables.coop/>

¹⁴ "Ethics approval: the University of Seville does not mandate approval by the University's Research Ethics Committee for opinion surveys of this kind undertaken with professional respondents, and so no specific ethics approval was required for this research under University of Seville regulations. Three out of four authors belong to the University of Seville. Further information can be found in the Ethics Committee Frequently Asked Questions document at https://investigacion.us.es/docs/cetico/ceius/31.01.2023_doc_def_preguntas_frecuentes_APROBADO_EN_PLENO.pdf"

Table 1
Summary of data collection on energy co-operatives.

Population	32 Energy Co-operatives. Identification of the energy co-operative population in Spain: Cooperativa Eléctrica Algimia de Alfara; Cooperativa Eléctrica Albaterense; Cooperativa Eléctrica Catralense; Cooperativa Eléctrica Callosa de Segura; Cooperativa Eléctrica de Alginet; Cooperativa Eléctrica de Camprodon; Cooperativa Eléctrica Chera; Cooperativa Eléctrica de Guadassuar; Cooperativa Eléctrica Meliana; Cooperativa Eléctrica de Vinalesa; Cooperativa Eléctrica del Pozo; Cooperativa Eléctrica Señora de Gracia; Cooperativa Eléctrica Popular; Cooperativa de Energía Castellar; Econactiva; Cooperativa de Energía Castilla La Mancha; EFDUERO Cooperativa; EMASP Cooperativa; ENERCOOP; Energy Cooperativa; Cooperativa Eléctrica Museros; GOIENER Cooperativa; HELIA Cooperativa; LA SOLAR Cooperativa; MEGARA Cooperativa; NOSA ENERXIA Cooperativa; SENEQ Cooperativa; Cooperativa La Corriente; Solabria Cooperativa; Som Energía; Sot de Chera; Soterna Cooperativa; Zencer Cooperativa.
Sample	12 energy co-operatives.
Data collection	From 2018 to 2019.
Interview process	Semi-structured online and interviews.
Survey respondents	Managers of Spanish energy co-operatives.
Objective	To achieve an insight into: 1. Company profile. 2. Energy co-operative behavior. 3. The perceptions of the energy co-operative managers.
Research approach	Quantitative and qualitative approach.
Methods	T-test analysis, analysis of variance, and qualitative code. The elements have been tested using Cronbach's alpha coefficient, which ranges from 0.701 to 0.789, revealing an acceptable internal consistency.

- The relevant features of an energy co-operative;
- The competitive position of the energy community¹⁵ in question in the national market;
- The co-operative's energy type (electricity, renewable energy, recycling of electricity to produce renewable energy); and
- A business identification according to the start-up year.

The processing of each of the three blocks of the questionnaire is explained below.

3.1. Identification of the energy co-operative cluster profile

In an initial statistical analysis of the identification data by cluster, it was found that the prototype of an energy co-operative in Spain is an SME¹⁶ located in the north of the country whose annual turnover is less than €500,000 and whose size is between 1 and 9 members, the majority being men. Its economic activity is regional and consists of energy commercialization for domestic use. It supports between 1,000 and 11,000 supply points¹⁷ and provides less than 600 customers with services. Motivation and a sense of belonging are the reasons for being an energy co-operative's member-customer. Different aspects are identified such as that it democratizes decision-making by integrating local groups: It has an integrated management of social responsibility transmitted to the environment as its strategy: It also has an interaction with the community through local investments, cooperation with other co-operatives, and the idea of empowering citizens. Three types of objectives are identified: the ecological objective is to reduce energy consumption, the economic objective is to respond to the instability of energy prices, and the social objective is to propose an alternative to the reality of the energy market in calling for a non-oligopolistic energy market. This social objective is in addition to the primary objective of meeting the needs of their members and increasing their well-being (Borzaga, Carini, & Tortia, 2021). Further, the social objectives of co-operatives, their greater stability in employment and their greater commitment to sustainable and responsible consumption and growth all enhance local development (Gallego-Bono & Chaves-Avila, 2020; Sala-Ríos, 2023).

3.2. Methodology to identify the behavior of energy co-operatives

To determine the cooperatives' behavior, it was decided to analyze differences in three variables: Purpose, Organization, and

¹⁵ Royal Decree-Law 23/2020 of 23 June, approving energy and other measures for the economic recovery of Spain, defines Energy Communities as "legal entities based on open and voluntary participation, autonomous, and effectively controlled by the partners or members that are located in the vicinity of renewable energy projects owned and developed by such legal entities, whose partners or members are natural persons, SMEs, or local authorities, including municipalities, and whose primary purpose is to provide environmental, economic, or social benefits to their partners or members or to the local areas where they operate, rather than financial gain". The communities also use the local resources available to them (wind, solar, biomass). This makes them even more autonomous and reduces their dependence on external energy.

¹⁶ Small and medium enterprises.

¹⁷ The supply point is marked with a key of about twenty alphanumeric digits, which is essential to certify each energy supply (electricity supply has a supply point code, gas supply has a supply point code).

Embeddedness regarding two grouping factors (period of start-up¹⁸ and social enterprise¹⁹). This decision stems from other evidence that recognizes an energy co-operative as a social enterprise (Becker et al., 2017). A question was asked at this point: Is an energy co-operative in Spain a social enterprise?

The measurement scales of the latent dimensions of Purpose, Organization, and Embeddedness are based on validated scales (Huybrechts, Creupelandt, & Vansintjan, 2018; Van Veelen, 2018; Becker et al., 2017; Korjonen-Kuusipuro, Hujala, Pätäri, Bergman, & Olkkonen, 2017):

- The Purpose construct is founded on the three-dimensional structure of the Purpose scale: ecological purpose, social purpose, and economic purpose;
- The Organization construct is a multidimensional measure based on three dimensions: Involvement, Strategy, and Interaction; and
- Embeddedness is also a multidimensional variable founded on three dimensions: Operation, a Relationship with Social Movements, and a Relationship with Similar Projects.

Managers of Spanish social energy co-operatives were asked to rate their perceptions for each indicator from (1) "strongly disagree" to (5) "strongly agree" on a Likert Scale and this was subject to the ethics of human relations, to ethics in qualitative social research. The overall measure of the perception of the three dimensions is statistically significant (Table 1).

3.3. Methodology to identify perceptions of the energy co-operatives' managers

A qualitative analysis is performed based on the managers' subjective perceptions founded on four questions formulated from previous research on Spanish energy co-operatives and the specific observation of these authors. The four questions included in the questionnaire were:

- What characterizes the specific national energy co-operative industry?
- Would you say that in Spain there are three groups of energy co-operatives (electricity, renewable energy, and recycling of electricity to produce renewable energy²⁰)?
- Why is the specific energy co-operative industry positioned in the national market?
- Do you recognize the influence of diverse age groups with specific generational, ethical, and cultural characteristics as key to your behavior?

The aim was to find out about the energy co-operative managers' knowledge, both on operational practices and as a direct source of ideas. The data were reviewed, updated, and recoded manually.

4. Results on energy co-operatives' characteristics

This section sets out the similarities and differences between Spanish energy co-operatives. By identifying such characteristics, the existing energy co-operative is made visible, and this can help to outline its trajectory.

4.1. Energy co-operative profile

Table 2 represents the twelve energy co-operatives involved in this research (Group 1 consisting of 5 energy co-operatives and Group 2 consisting of 7 energy co-operatives), where there are two groups of Spanish energy co-operatives: the pioneer group mainly located in the region of Valencia (20th-century co-operatives) and the group of new energy co-operatives founded since 2010 (21st-century co-operatives).

A note on this table. Table 2 shows the characteristics of each group according to the highest number of responses within each group. A majority response is expressed in different formats: percentage (%), units, or statistical mean.

Many 20th-century co-operatives reside in the Valencia region. They are co-operatives of three or more members which have up to 9 employees, all males. They register less than 600 or more than 1000 member-customers. The reasons for affiliation as a member-customer are sharing values, motivation for social improvement, and a sense of belonging. The annual turnovers are less than 500,000 euros. The energy commercialization has a regional and local coverage. The energy use is residential, and it has from 1000 to

¹⁸ The variable *Year of start-up* is a dichotomous variable with value 1 for enterprises started up at the beginning of the 20th century and with value 2 for those enterprises started up in the 21st century (20th and 21st century co-operatives).

¹⁹ The criterion Social Enterprise is explained in nine categories (Becker et al., 2017): A continuous activity producing goods and/or selling services; A significant level of economic risk; A minimum percentage of paid work; Benefiting the community as an explicit purpose; An initiative launched by a group of citizens or by civil society organizations; A limited distribution of benefits; A high level of autonomy; Decision-making empowerment is not based on capital; The participation of the different stakeholders. *The enterprises in the sample ranked themselves and according to criteria 4, 5, and 8.*

²⁰ Moving from offering electricity distribution services (maintenance of distribution networks, sale or rental of meters, and meter registration) to integrating renewable energy services.

Table 2
Identifying the Profile of Spanish Energy Co-operatives.

Variable	Characteristics	
	Group 1 20 th -century co-operatives	Group 2 21 st -century co-operatives
Location	Valencia Region (50%).	Navarre Region (33.33%).
Number of Members	3 or more members (100%).	3 or more members (100%).
Number of employees	0 to 9 employees (83.33%).	0 to 9 employees (66.67%).
Presence of professional women	No (100%).	Yes (33.33%).
Turnover volume	Less than 500,000 euros (50%).	Less than 500,000 euros (50%).
Area of influence	Local (33.33%) and Regional (50%).	Regional (50%) and National (50%).
Type of activity	Commercialization (100%).	Commercialization (83.33%), Generation (16.67%).
Electricity use	Residential (66.67%).	Residential (66.67%).
Number of member-customers	Less than 600 or 1,000-9000 Member-Customers.	Less than 600 or 1,000-9000 Member-Customers.
Number of supply points	1,000 - 11,000 supply points.	100 - 600 supply points.
Membership as a member-customer	Share values (3.67), have a motivation for social improvement (4.67), and a sense of belonging (4.67).	Share values (4.50), have a motivation for social improvement (4.33), and a sense of belonging (4.33).

11000 supply points.

A third of 21st-century co-operatives, in contrast, is in the Navarre region; these are co-operatives of three or more members which have between 0 to 9 employees and do have professional women. They register less than 600 or more than 1000 member-customers. Affiliation as a member-customer is due to sharing values, motivation for social improvement, and a sense of belonging. The annual turnovers are less than 500,000 euros. The energy commercialization has a national and regional coverage. There are co-operatives that produce energy as well. The energy use is residential, and it has from 100 to 600 supply points.

The characteristics of the profile of energy co-operatives are those of the firm (number of employees, turnover volume, and number of member-customers). These co-operatives adapt to changes and to the reality of each moment as the difference pointed out in the presence of professional women, area of influence, and type of activity. There is expertise. In addition, the groups reveal eight significant elements as a Spanish energy co-operative according to the highest number of responses, as illustrated in Fig. 1.

Regarding these elements defined by Becker et al. (2017), the two groups of energy co-operatives show more similarities than differences. The main difference is in the ecological objective identified (Table 3). Spanish groups of energy co-operatives manifest themselves as social enterprises. Table 3 shows the statistical mean of each element. Therefore, the social profile of Spanish energy co-operatives can be defined based on eight elements.

There are some interesting overlaps between the two groups, such as their economic objectives, their participation in decision-making, their interaction, their strategy, their co-operative outreach, and their relations with social movements. Clearly, there are more coincidences than differences and this indicates entrepreneurial strength. The difference in the ecological objective and the social objective showcases the actual social enterprise nature. The energy co-operative is committed to nature and society.

Both give the same importance to the "Economic Purpose". Similarly, managers of energy co-operatives value "Interaction"; this is the highest valuation with respect to the other dimensions of the Organization (Involvement and Strategy). In the Embeddedness variable (Operation, Relationship with Social Movements, and Relations to Similar Projects), they all rate the "Operation" and "Relationship with Social Movements" dimensions similarly. On the other hand, the dimension "Relationship with similar projects" presents the lowest value compared to the other two dimensions and is the worst-rated between the two types of co-operatives.

At the same time, some significant differences can be noted between the two groups. The profile of Spanish energy co-operatives shows that at the beginning of the 20th century there were only enterprises based on the objective of benefiting the community, while in the 21st century co-operatives are based on benefiting the community and developing citizen initiatives. "Empowering citizens" registers differently. The 20th-century co-operatives were constituted to cover the basic need for energy and the final energy was a priority, whereas the 21st-century group does not have the basic need for energy, as the need is already covered. It is constituted under the understanding of energy as a common good, which gives them a commitment to improvement. Also, the groups differ in their ecological and social purposes: addressing energy poverty; creating jobs or employment; localizing energy value chains; sponsoring social or cultural activities.

The 21st-century co-operatives show a greater interest in "Interaction"(5.0) and a lesser interest in "Strategy"(4.17), i.e., they are concerned with business cooperation within strategy. They present a higher valuation of the Organization. They have the highest valuation of the three dimensions of Purpose, Organization, and Embeddedness, yet the results show that the 20th-century co-operatives have similar ratings in all three dimensions. This suggests that the energy co-operative in Spain has a community identity; it is a social enterprise. The slight difference between groups may be a consequence of the momentum of 21st-century co-operatives, a momentum based on a modern and expansive character, as these types of energy co-operatives are now being created.

4.2. Energy co-operatives' behavior

Energy co-operatives act in terms of *purpose, organization, and embeddedness*. The behavior of both groups of energy co-operatives is homogeneous in terms of the dimensions analyzed. The organization dimension is the most significant. Energy co-operatives prioritize

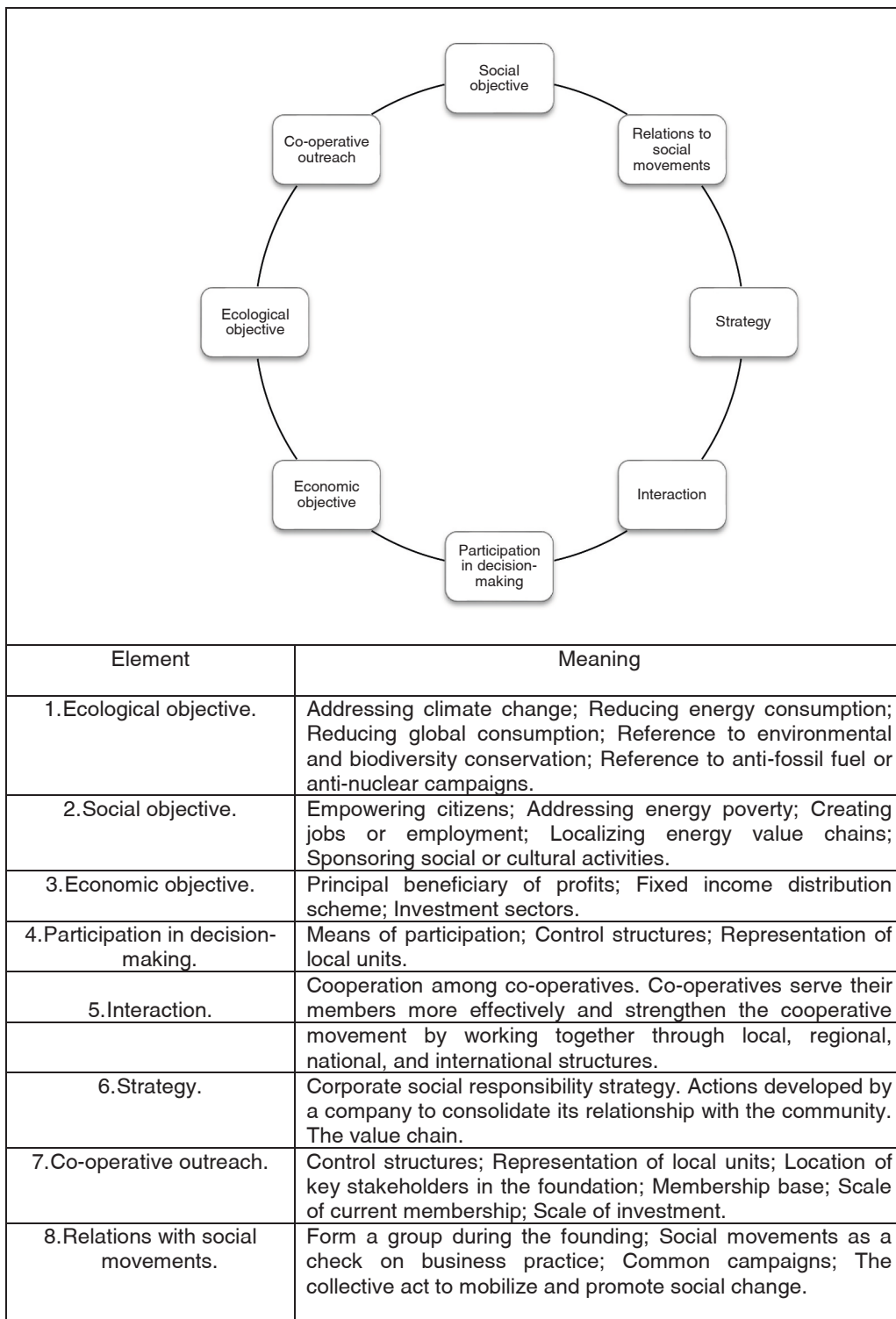


Fig. 1. The elements of the profile of Spanish energy co-operatives according to the integral approach (Becker et al., 2017).

the social and ecological purpose over the economic intention.

The time at which the enterprise was created does not determine any behavior, but it does show a progressive entrepreneurial fabric that has the capacity to blend the experience of the pioneer group (20th-century co-operatives) and the strength of the novel group (21st-century co-operatives). The community energy of co-operatives in Spain is a reality. It has a trajectory, since it has been

Table 3
Social profile of Spanish energy co-operatives.

Element	20 th -century co-operatives	21 st -century co-operatives
1. Ecological objective.	Reduce energy consumption (4.67) and reduce overall consumption (4.33).	Conservation of the environment and biodiversity (4.83) and renewable energy generation (4.83).
2. Social objective.	Propose an alternative to the reality of the energy market (4.67). Respond to the instability of energy prices (4.67). Demand a non-oligopolistic energy market (4.67).	Propose an alternative to the reality of the energy market (5.0). Call for a non-oligopolistic energy market (5.0). Citizen empowerment (5.0).
3. Economic objective.	Having a strong and supportive value chain (Know-how) (3.83). Responding to the instability of energy prices (4.50).	Having a strong and supportive value chain (Know-how) (3.83). Responding to the instability of energy prices (4.50).
4. Participation in decision-making.	Control and participation (4) and group integration (4).	Control and participation (4.67) and group integration (4.83).
5. Interaction.	Cooperation among co-operatives is a basic principle (4.83).	Co-operation among co-operatives is a basic principle (5.0).
6. Strategy.	Clearly state socially responsible behavior (4.50).	Clearly state socially responsible behavior (4.17).
7. Co-operative outreach.	Community energy as an aspiration to provide local benefits through local investments (4.83) and is a link to local development (4.67).	Community energy as an aspiration to provide local benefits through local investments (4.67) and is a link to local development (4.67).
8. Relations with social movements.	Share the idea of empowering citizens (4.17).	Share the idea of empowering citizens (5.0).

generated over a period, and it adapts to society. 20th-century co-operatives were created and maintained, and 21st-century co-operatives were created and expanded. Co-operative community energy is expertise. It can be perceived, as demonstrated by Wokuri (2021), that the impact of this model is limited because community energy is embedded between the state and the electricity market.

These findings on energy co-operatives in Spain are along the same lines as previous evidence on energy co-operatives. Energy co-operatives declare establishing general socio-ecological transformation objectives (Heras-Saizarbitoria et al., 2018). Alliances and partnerships enable co-operatives to act more professionally and increasingly operate in commercial- and market-oriented ways (De Bakker et al., 2020). So, these initiatives show strong relationships with different social movements and even a potential to transcend the local scale, together with a specific pursuit of participatory citizenship (Becker et al., 2017).

This paper provides new evidence of the phenomenon of energy co-operatives in Spain within academic research that is scattered and limited (Heras-Saizarbitoria et al., 2018). It is evident that further research is needed in specific areas such as the profile of the member-customer of community energy. The main evidence is that energy co-operatives in Spain are characterized as the social enterprise of the energy industry. However, there is a difference between the business perception and the reality of the co-operatives, since there are two groups of energy co-operatives in Spain that are not recognized by the co-operative managers interviewed. This lack of recognition between co-operatives in the same sector indicates a lack of cohesion.

The demonstration of these Spanish co-operatives as social enterprises in the energy sector makes them a topic of political and media interest, considering that all the energy co-operatives analyzed highlight their environmental and community contribution. There is still a lot to find out. Furthermore, the managers of Spanish energy co-operatives add organization and committed purposes (social and ecological) to the participatory management model as key factors. This distinction allows us to illustrate, according to our results, how the type of co-operative model, its organizational characteristics (e.g., its degree of democratic representation, its social capital, its impact on engagement), the stakeholders involved (whose size differences or time differences may affect dialog, their profitability, and strategic efficiency in an institutional context), and the market situation influencing transactions (the regulatory frameworks defining market conditions and co-operative development) define the scope of action (De Herde, 2023).

4.3. Perceptions of the energy co-operatives' managers

Based on the managers' answers, a list of key words was drawn up, as explained in Section 3.3: *attention to the user, clusters, energy efficiency, energy sovereignty,*²¹ *humanity, intergenerational relationships, quality of service, renewable energy, rights, specialization, tenacity, transparency, union, and vocation.*

Energy co-operative managers show a balanced management between co-operative values ("Commitment") and activity ("Know-how"). The member-customer is fundamental in the business strategy, as the managers prioritize the attention to the user. Energy co-operatives offer personalized attention in prices and consumption habits to meet the needs of their member-customers.

The existence of two groups in Table 3 is not identified at the formal level (co-operative member). The influence of intergenerational relationships established between co-operatives of different ages is recognized at the informal level through the responses, as they share characteristics and productive activity on a continuous basis over time. Some statements such as "There are not three clusters of energy cooperatives" and "the only intergenerational influence is the inheritance of the ancestors" were collected. For the managers of energy co-operatives, the co-operative energy sector in Spain prioritizes its attention to the user, transparency, and union, and this co-operative sector is positioned in the national energy market thanks to the quality of service and specialization.

²¹ It is the right of individuals, communities, and people to make their own decisions about energy generation, distribution, and consumption in such a way that they can adapt them to ecological, social, economic, and cultural circumstances, and without negatively affecting third parties. This term is linked to energy independence (Morandeira-Arca, Etxezarreta-Etxarri, & Egia-Olaizola, 2023).

As can be seen, community embeddedness is a key element in the principles of energy co-operatives since it mobilizes residents in the use of renewable energies within the framework of local development and the search for social cohesion. Moreover, it encourages social energy transition as energy efficiency and renewable energy development are promoted. Therefore, energy co-operatives work because their primary objectives are to maximize community welfare rather than to maximize sales or profits. They promote a rational use of energy in a link with energy sovereignty. Energy sovereignty lies in the ability of a community to decide how it wants to manage the energy it needs for the reproduction of its social life. Energy sovereignty opens the door for people to become active agents of energy production, controlling their spending and consumption based on the needs of each individual and the needs of the community (Krüger, Eichenauer, & Gailing, 2022). Member-customers are active agents of community energy in Spain.

5. Conclusions

This research typifies energy co-operatives in Spain as social enterprises suitable for creating local energy communities. In this regard, professionals can learn about the current strength of energy co-operatives in Spain through an integrated three-dimensional approach: Purpose, Organization, Embeddedness, and its application to socio-community energy.

Based on the results presented, energy co-operatives work because their objectives are in line with the needs of their member-customers, i.e., the provision of efficient and self-managed energy services. Energy co-operatives are customer-oriented to achieve common welfare.

In the Spanish context, there are two types of co-operatives: the pioneer (co-operatives of the 20th century) and the novel (co-operatives of the 21st century). They focus their strategy on personalized attention to each energy member-customer, and they prioritize the social and ecological purpose over the economic aim. They value the organizational dimension and the social purpose, which indicates that they comply with cooperative principles. The organizational principles of the co-operative movement are based on shared ethical values of cooperation and responsibility (such as equity, cooperation among co-operatives, and commitment to the community). The co-operative principles are the essence of the co-operative movement, one that aims at a common benefit, strengthening resources and improving the situation of the members, here member-customers. The social and environmental commitment to renewable energies and their distributed power generation ensure the future role of energy co-operatives as renewable energy co-operatives. In addition, energy co-operatives in Spain must adapt their capacity over time, this being a feature that helps their development and their future.

Based on the characteristics outlined here, the pioneer fits the term *Energy Community* (Art. 22 of EU Directive 2018/2001), and the novel fits the term *Citizen Energy Community* (Art. 16 of EU Directive 2019/944). Spanish energy co-operatives are the predecessors of the country's legislative delimitation. Therefore, this leadership is implicit in the empowerment of citizens in energy matters and represents an excellent opportunity to replicate this organizational model (Union Renewables Coop., 2021). However, the Spanish legal framework, in Royal Decree-Law 23/2020 of 23 June, only recognizes the figure of the *Energy Community* as a single term.

These derivations from the study conducted based on interviews of co-operative managers contain some biases or cognitive distortions, which are a psychological effect of judgments founded on the information available at the time. This is the result of making specific answers together with the subjectivity or selection of certain data according to each manager. It may be one of the origins of some of the limitations of this research.

Energy co-operatives fulfill a social purpose. This has an implication for policy makers and their decision-making. These decentralized electric organizations will be able to consider the proven viability of this democratic model. Although they are not widely known, these companies work well and show a strong commitment. From now on, their diffusion can be promoted. Local entities, with their exemplary role, should start planning the use of public spaces for the generation of green electricity, enabling in turn the provision of these spaces to the social energy initiatives of co-operatives based on the present and on proven experience. An example is the *Puebla de la Sierra Energy Community of La Corriente*.²² This is a recent example of collaborative implementation and development, a co-operative together with a municipality, and of a local energy community.

Similarly, our analysis can also help public decision-makers to identify public policies and specific measures to promote the diffusion of energy co-operatives in Spain. Here, work is being done on energy transition plans and this includes the promotion of local energy communities, a spur that can be generated through energy co-operatives. These can implement *local energy communities*, as already pointed out in the previous example. They can be the answer to the country's energy transition and involve greater citizen participation in the quest to improve the lives of communities. This situation also leads to the democratization of energy, i.e., turning consumers into producers, managers, and beneficiaries of energy to have a greater number of member-customers. The transition is based on acquiring the savings and efficiency of community renewable resources.

The people interested in creating an energy community in Spain can take energy co-operatives as a reference, since they have maintained a community and social energy service over time. They have proven to be accessible to all people who want a real commitment to the use of community energy. Community energy is an ideal instrument to respond to climate challenges while developing a social enterprise model, such as an energy co-operative. Co-operatives offer personalized attention to meet common needs, as well as investment for social purposes and community promotion.

Furthermore, faced with the challenge of a just energy transition, energy co-operatives are facing major changes, which range from extending the intervention of the consumer, distributed generation, electricity storage, carbon storage and capture, hydrogen

²² <https://lacorrientecoop.es/puebla-de-la-sierra/>

production systems, to renewable electricity generation technologies (more annual investment in energy infrastructures).

This work helps presidents, managers, and boards of directors of co-operatives to identify relevant approaches, organizational objectives, and measures to be analyzed in depth. For example, the current contribution of energy co-operatives to the improvement of the environmental impact and the link to a specific consumer profile pointing to consumers who are committed to clean energy could be of interest to the managers of these organizations. A practical recommendation would be to study and find out about the social return on investment (SROI) of energy co-operatives so a specific co-operative valuation system could be created, and to determine the links between energy co-operatives and ethical finance institutions, to promote inter-cooperation and consolidate a model that contributes to the well-being of citizens and the environment.

Beyond the Spanish case, the results obtained in this paper are interesting for other business cases and as a basis for other local development analyses as they can be applied to local energy communities. To learn about the presence of energy co-operatives in other territories or to learn in detail about these companies in their territories, good examples would be *Som Energy*²³ and *Nossa Energia*.²⁴ Both co-operatives are co-operatives of consumption and production of green energy that are concerned with establishing a 100% renewable and democratic energy model. They are operating and increasing their number of member-customers year after year. Both are in the north of Spain, Som Energia (Girona, Barcelona) and Nossa Energia (Vilagarcía de Arousa, Galicia). A study could be carried out to determine whether location is important in their business development.

The motivation and reason for being a co-operative member of an energy community in Spain is to meet the demand for energy, a green commitment, and the supply of commonly owned energy and the figure of the member-customer. According to this evidence, the member-customers are seen as people concerned about knowing the origin of energy and finding greater transparency as users. They are environmentally conscious and seek local energy production. In future research, a survey could be conducted on member-customers to get to know them and determine their profile. A survey could also be carried out on the motivations of Spanish households to participate in local energy communities. More information on energy co-operatives should then continue to be investigated.

Statements

- The work has biological applications. Not applicable for this section.
- The work was funded. Not applicable for this section.
- The work generates a conflict of interest. Not applicable for this section.
- The work has data and material availability (data transparency).
- The work has code availability (software application or custom code). Not applicable for this section.
- The work presents additional statements for articles in life science journals reporting the results of studies involving humans and/or animals. Not applicable for that section.
- The manuscript has been prepared under scientific ethics.
- The manuscript is subject to participation in the channels decided by the journal and to be published according to the journal's guidelines.
- We have nothing to declare.

CRedit authorship contribution statement

BENJAMIN HUYBRECHTS: Project administration, Investigation, Conceptualization. **ISADORA SÁNCHEZ-TORNÉ:** Software, Methodology, Formal analysis, Data curation. **MAR COBEÑA:** Visualization, Validation, Resources, Project administration. **MAC-ARENA PÉREZ-SUÁREZ:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Investigation, Conceptualization.

Declaration of Competing Interest

This manuscript is original and its four authors have contributed equally to its elaboration without having conflicts of interest.

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²³ <https://www.somenergia.coop/gl/>

²⁴ <https://nosaenerxia.gal/>

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