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David against Goliath? Challenges and opportunities for energy cooperatives in Southern Europe

Ana Delicado^{a,*}, Marta Pallarès-Blanch^b, Ramón García-Marín^c, Carolina del Valle^d,
María-José Prados^d

^a Instituto de Ciências Sociais da Universidade de Lisboa, Portugal

^b Local Rural Development and Strategic Planning Consultant, Spain

^c Universidad de Murcia, Spain

^d Universidad de Sevilla, Spain



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ABSTRACT

Unlike in some northern European countries, renewable energy cooperatives in Portugal, Spain and Italy are few and represent a very small share of the energy market. This article aims to understand the social, political, economic and cultural factors that affect the development of renewable energy cooperatives in southern Europe, but also the opportunities and benefits cooperatives offer over other energy providers in the energy transition. It is based on a comparative analysis of four case studies of cooperatives in Portugal, Spain and Italy, relying on document analysis, observation and interviews with cooperative representatives, complemented with legal, policy and statistical data for contextualisation.

We ascertain that energy policies have favoured large utility companies and concentrated energy generation, while a lack of civic culture of participation and mistrust of cooperatives have also hindered their development. Furthermore, we show how cooperatives have unique features that make them valuable actors in energy systems: promotion of environmental and social values, local embeddedness, flexibility to diversify activities, ability to mobilise networks of similar organisations and fostering democratic governance and participation.

1. Introduction

This article stems from several interlinked research projects on renewable energy landscapes that seek, among other objectives, to understand the role of social innovations and public engagement enhancing sustainable renewable energy (RE) systems in southern Europe. It focuses on a particular type of social innovation, renewable energy cooperatives (REC), which are legally recognized, decentralized, non-governmental initiatives of local communities and citizens to promote the production and consumption of renewable energy [1]. Since they are considered as important tools to democratise energy and bring citizens closer to energy generation, their roles, benefits and challenges have been amply discussed in the literature. However, much of this discussion is focused on countries where cooperatives thrived and became important players in energy systems. Far less attention has been paid to countries where these organisations lag behind and struggle to compete in adverse environments, even though under a similar European energy policy framework. This article addresses this gap, by

examining REC in three southern European countries: Portugal, Spain and Italy.

This article is structured around two research questions: 1) Which social, political, economic and cultural factors hinder the development of REC in southern Europe? 2) What benefits do REC offer over other energy providers in the energy transition (from fossil fuels to renewable energy as the basis of the energy systems) in the given geographical context that make them worthy of support to overcome their underdevelopment?

For this purpose, we carried out case studies of four REC in Southern Europe: one in Portugal (Coopérnico), two in Spain (La Solar and Som Energia) and one in Italy (Energia Positiva).

The article begins with a summary review of how the topic of REC has been addressed in the literature. This is followed by an analysis of the political, economic and socio-cultural context that frames REC in Southern Europe. The fourth section is devoted to the description of the methodology used in this study. Next, we opted to combine the results and discussion, in order to contrast own findings with previous work on

* Corresponding author at: Instituto de Ciências Sociais, Av. Prof. Aníbal de Bettencourt, 9, 1600-189 Lisbon, Portugal.

E-mail address: ana.delicado@ics.ulisboa.pt (A. Delicado).

this issue and with the situation in other European countries. This section is organised into two subsections: how REC envision the main challenges they face in these countries, due to political (lack of political support), economic (competition with large utility companies), social and cultural factors (lack of trust in cooperatives); and the opportunities REC offer in terms of upholding environmental and social values, local embeddedness, diversification of activities and services provided to their members, generation of networks and mutual support with other similar organisations and local actors, and governance and participation.

2. Literature review on renewable energy cooperatives

European energy policies have increasingly acknowledged the need to bring citizens closer to energy issues, awarding them more control and opportunities for participation. There are multiple forms of materialising this control and participation, such as energy communities, smart local energy systems or collective renewable energy projects, but in this article, we will focus on renewable energy cooperatives (REC), legal entities owned and democratically controlled by their members. They are considered an 'effective and cost-efficient way to meet citizens' needs and expectations regarding energy sources, services and local participation' [2].

RESCOOP, the European federation of energy cooperatives, created in 2013 [3], currently has the participation of 1900 cooperatives, which bring together 1.25 million citizens (<https://www.rescoop.eu/>).

In some countries in Europe, particularly Denmark, Germany and the Netherlands, energy cooperatives play a relevant role in the production and commercialisation of renewable energy and are a growing model [4–11]. They arose in the 1980s and 1990s from the anti-nuclear movements [3] and grew quite substantially in the 2010s due to favourable policy measures [9,10] and technological innovations (such as cheaper solar panels [4]). However, recent reversals of policy in Denmark and Germany replacing feed-in tariffs with auctions run the risk of having adverse effects on cooperatives, even though special provisions for promoting the diversity of energy actors are being made [8–13].

REC have specific traits that differentiate them from commercial, profit-oriented actors in the energy sector. First, the fact that their main aim is not to seek profit to distribute to investors but rather 'to satisfy a common pre-existing requirement or need, in order to give members or share/stakeholders a greater advantage or saving than would otherwise have been possible separately' [14]: 247. The members become owners of their own electricity company. This allows cooperatives to offer lower prices to the consumer, even though they usually require customers to become members, with the associated costs, usually an initial fee to join [5,15,16].

Another distinctive feature of REC is the dedication to the promotion of sustainability, efficiency and energy transition, often stipulated in their statutes. REC are based on the development of environmental and social awareness and they aim to provide consumers with an alternative to the dominating energy model developed during the last century [9,10]. Wierling et al. [10] define as one of the key characteristics of REC the motivation to accelerate the transition to sustainable energy systems, fostering community spirit. Klage and Meister [9] characterise REC as driven by values, not by profit, contributing to sustainable development and to energy justice. REC tend to share members and causes with other ecological movements, forging connections not just among themselves or with national and supranational federations of cooperatives, but also with organisations of the third sector that operate in the field of sustainability and social and environmental justice [3,5,13,15,17,18].

Another one of the most touted characteristics of REC is their democratic governance and the opportunities for citizen participation they offer [4,5,9,10,15,16,19,20]. REC are based on participatory decision-making, by guaranteeing citizens ownership of the energy generation

infrastructure and direct participation in the management of the organisation [4,7,9,10,19]. Decisions are voted on in assemblies, where tariffs are also usually set. According to Candelise and Ruggieri [21].

Cooperatives are the legal form mostly used in the European CE [Community Energy] sector and are generally deemed to provide the best institutional framework for locally owned and participatory approaches to renewable energy projects. They encompass both the social and economic dimension in their scope and are characterized by a 'one head one vote' decision-making process, with the aim to provide higher levels of co-determination.

[21]:5

However, these authors state that participation of cooperative members may be restricted to votes in the annual general assembly and that other legal forms of community energy, such as companies owned and managed by citizens, may also promote participation.

REC-owned RE facilities are usually smaller and built in more consensual locations, with lower visual and environmental impacts (e.g. rooftops), that raise less public concern and controversy, and are often accompanied by "creative solutions that benefit the development of local communities" [10]: 2. Especially locally or regionally based cooperatives ensure greater proximity between production and consumption, which allows for more efficiency and fewer transport losses [7] but also to relations of proximity with citizens/consumers [5,15,17,18]. As such, REC contribute to a higher uptake of renewable energy [8] and to increase the social acceptance of renewable energies [4,8–11], by placing them in a global framework that takes into account the values and meanings of the territories and communities where they are implanted, going beyond technical, technological and business issues [22].

Whereas REC in Northern Europe have received plenty of attention from researchers, the same cannot be said regarding southern European REC. Although there have been some articles about the RE cooperative landscape in Spain [1,6,18,23,24], most studies tend to focus on Som Energia, the oldest and largest energy cooperative in the country, leaving out other cases that may be significantly different. The inception of energy cooperatives in Spain can be traced to the electrification of remote localities in the 1920s and 1930s, some of which remained to the present day and started retailing green-certified electricity to their local customers or even owning solar power plants [24]. The boost given to renewable energy policy from the beginning of the 21st century onwards and despite several changes in its objective and means, the repeal of the 'sun tax' (see below), together with a growing social awareness of renewables, the increase in energy poverty in many families (especially during the 2008–2013 crisis), and a politicisation of the energy issue, favoured a new take-off of cooperatives. Som Energia, in the city of Girona in Catalunya, was the first to be created (2010), followed by Zenser (2011) in Malaga and Goener (2012) in the Basque Country. These three cooperatives laid the foundations for the model on which others have subsequently been created, such as Econactiva (2014), Megara Energia (2015), La Solar (2016) and Nosa Enerxia (2017), among others. At the time of writing, there are around 24 renewable energy cooperatives in Spain and a federation of cooperatives, Union Renovables. REC in Spain have the statute of consumer and user cooperatives.

In Portugal, the only renewable energy cooperative is Coopérnico, which is mentioned only sporadically in a few articles [16,25,26]. There is also a handful of small electricity distribution cooperatives, also a legacy of the process of electrification of the country in the early 20th century. These small cooperatives emerged in the 1930s to bring electricity to remote areas and survived the concentration in the national electricity company EDP in the 1980s.

Candelise and Ruggieri [21] provide one of the few overviews of energy cooperatives in Italy, whereas Magnani and Osti [17] include cooperatives in their analysis of the role of civil society in Italy's energy transition. The first energy cooperatives also emerged in Italy in the

early 20th century, in particular hydroelectric cooperatives established in alpine regions, some of which are still in existence [17]. Candelise and Ruggieri [21] identified 11 energy cooperatives, founded between 2008 and 2017, involving close to 2800 citizens (the largest 915 and the smallest 123). Only four emerged from bottom-up approaches, through initiatives of citizens or grass-root organisations, while the others were led by institutions. Four have a local scope and seven a national one. These cooperatives are RE producers, mostly of solar energy, some with larger facilities on the ground and others with smaller ones on rooftops. Members obtain electricity bill savings (proportional to quota) or other monetary benefits (return for investment). Osti [27] considers that this type of democratic non-profit organisations specializing in the provision of environmental services is underdeveloped and undersized in Italy, despite their potential for enhancing social and environmental sustainability.

3. Political, economic and socio-cultural contexts that frame REC

One of the key tenets of this article is that the political, economic, and socio-cultural contexts of these three Southern European countries play an important role in delaying and hindering the development of REC. It is thus relevant to draw in broad strokes these contexts.

The policy framework of renewable energies, particularly in Portugal and Spain, has been far from favourable for REC. RE promotion policies based on auctions favourable to large tenders led to a situation in which most wind farms and solar power plants are large in scale and owned by the main utility companies [18,26,28,29]. In both countries, feed-in tariffs for renewables were at some point blamed in political discourse for energy price rises [6,18,29]. In Spain, until 2018, the so-called ‘sun tax’ (Real Decreto 900/2015) severely limited the possibility of carrying out community projects based on renewable energies, especially solar photovoltaic [6,13,25].

Capellán-Pérez et al. [18]: 215 characterise the situation Spanish cooperatives face as ‘a hostile regulatory and economic context’. The authors describe how cooperatives faced instrumental (legislation against RE, removal of subsidies, relaxing environmental rules), material (favouring of other energy technologies, tax rebates) and institutional resistance (soft political response to oligopolistic power of the large electrical companies and connections to political power). The links between political and corporate power, with so-called ‘revolving doors’ in which former government office holders occupy positions on company boards and vice versa, are a phenomenon documented in Portugal [30,31] and in Spain [18,32,33] that often involves the energy sector.

Conversely, in Italy, Magnani and Osti [17] consider that generous feed-in tariffs and a net-metering system introduced in 2009 favoured the development of new solar photovoltaic cooperatives. However, the authors point out that the unbundling rule, which separates the production of electricity from its sale, acts as a barrier for the development of cooperatives, together with ‘the complexity of regulations on the sale of electricity, the number of actors involved, and the need to complement different discontinuous energy sources [that] requires a degree of specialized knowledge and organizational capability not available to small cooperatives’ [17]: 151.

Regarding the economic context of RE generation and distribution, REC in Southern Europe operate in markets almost entirely dominated by large utility companies. The liberalisation of the energy market in the 1990s ended the monopoly of the incumbents (former public companies), and replaced it with an oligopoly of large private companies [6,13,24,34]. Three large utility companies dominate the market in the Iberian Peninsula, EDP (originally from Portugal), Iberdrola and ENDESA (originally from Spain). The latter is currently 70 % owned by the Italian electricity company Enel (whose main shareholder is the Italian State). In Italy, Magnani and Osti [17]: 155 ascertained that ‘the rigid, centralized, collusive national energy system leaves no room for new actors, especially if they are marked as green and social innovators’.

Unlike the countries where the RE cooperative movement is stronger, large electricity companies in Spain and Portugal joined early the RE sector (after the favourable policy conditions described above) and now dominate it [5]. According to the e2p project [35], in Portugal, just 10 companies own 86.5 % of wind generators and just three companies (EDP Renováveis, VENTIENT/IBERWIND and New FINERGE) own half of them. APREN, the Portuguese RE association has among its most influential members the large electricity companies. In Spain, according to the Wind Energy Association, in 2020 just five companies owned close to 60 % of the total wind power installed capacity. In Italy, an offshoot of the former incumbent (Enel Green Power) owns 602 hydro, wind, solar, and geothermal power plants with a total installed capacity of 14.1 GW. Therefore, REC in these countries compete in an RE market dominated by “Goliaths”, that have mostly been favoured by government policies, leaving little room for alternative, community-based players.

Finally, according to the literature, civic participation and interpersonal trust are strong drivers for a robust REC sector [4,13,36]. Data from the European Values Survey 2017 [37] show that civic participation rates in these southern European countries are fairly low: despite this survey not having specific questions about cooperatives, when interviewees were asked whether they belonged to a large selection of civil society organisations (from religious organisations to mutual aid groups, including professional associations, sports and recreation or cultural activities groups), 88.7 % of Portuguese, 73.9 % of Italian and 68.6 % of Spanish respondents declared to belong to no civic organisation, whereas the European average was just 46.6 %. Regarding interpersonal trust, the same survey shows that less than half the respondents in the three countries state that most people can be trusted: 41.5 % in Spain, 27.1 % in Italy and 17 % in Portugal. In the last two cases, this is well below the European average (35.4 %) and the countries where the RE cooperative sector is stronger (Denmark 74.1 %, Netherland 59.5 %, Germany 44.8 %).

Furthermore, according to Bauwens et al. [7] attitudes towards the cooperative model also play a relevant role in explaining the success of REC:

In countries where the cooperative movement has an old and well-established tradition, people know about this legal structure and are aware of its benefits. In countries where the general public and other actors are less familiar with this model, this low awareness may potentially constitute a “cognitive barrier”. On the other hand, unwelcome experiences with a specific type of cooperative model can constitute a “(negative) historical legacy”.

[7]: 138

Portugal has a complicated history in terms of the cooperative sector. The first cooperatives in Portugal emerged in the 19th century but the authoritarian regime that lasted between the mid-1920s and the mid-1970s repressed most cooperatives, with the exception of some agricultural cooperatives, which played a relevant role in the economy and agricultural policy [38,39]. The democratic revolution in 1974 oversaw an explosion of cooperatives, mentioned in the Constitution of 1976 as worthy of government support, but many floundered after a few years, particularly in the agricultural and industry sectors. In the 1980s to the mid-1990s, government policies discouraged the development of cooperatives, with a slight reversal since 1995 [38]. Nearly two decades after, Almeida’s [38] characterisation of the cooperative sector as having low visibility and a minority weight in the capitalist market system in Portugal remains true. According to Cooperatives Europe [40], just 5 % of Portuguese residents are members of cooperatives.

In Spain, during the period of dictatorship (1939–1975), cooperatives were placed under strict political control, curtailing the participatory dimension that it is in their nature [41]. After the Francoist period, the cooperative movement resurfaced with an increase in the number of cooperatives at rates higher than 40–50 % [42]. With the entry of Spain into the European Union, there was a slowdown in the rate of creation of cooperatives, but they started to increase again in

number at the beginning of the 21st century, also generating a dense legal framework [43]. Data from Cooperatives Europe [40] estimates that the proportion of cooperative members in Spain is 18 % (close to the European average).

Therefore, at least in Portugal and Spain there is some evidence that unfavourable attitudes towards cooperatives may also hinder the development of REC.

4. Methodology

The article is based on four case studies of energy cooperatives in Southern Europe: one in Portugal (Coopérnico), two in Spain (La Solar and Som Energia) and one in Italy (Energia Positiva).

The choice of these three countries (leaving out others that are also located in Southern Europe) is justified by the commonalities between them in terms of available RE resources, political, social and cultural similarities and the late development of REC. It is also shaped by the research projects in which the article is based (see acknowledgements) and the consortium that is developing them.

The cooperatives were chosen according to different criteria: in Portugal there is only one to choose from; in Spain we aimed to cover both types of cooperatives in terms of geographical scope (national and regional), to include the oldest and largest cooperative (Som Energia) and to select the regional cooperative and local group closer to the co-authors (Murcia and Seville, respectively); in Italy, the choice was determined by personal contacts of the person who conducted the fieldwork. Nevertheless, the small number and selection procedures of the sample of cooperatives do pose some limitations to the generalisation of results, particularly in the case of Italy.

This multiple-cases approach (when one study contains more than a single case), often considered as offering more compelling evidence and making the studies more robust [44], allows us to draw comparisons (across countries, but also across types of cooperatives), but also to gather more in-depth insights into the phenomenon of cooperatives in southern Europe and the role of contextual factors. It also poses some challenges, in terms of the specificity of political and legislative traditions (albeit now mostly framed by EU directives) and in conducting comparative analysis with materials in three different languages (translated into a fourth one for the purposes of this article).

The methodology adopted was fundamentally qualitative: we seek to understand the phenomenon of RE cooperatives rather than quantify or explain or test a particular theory. Although the analysis was steered by the theoretical framework of energy democracy (the need to widen the ownership of energy production and in particular the role of RE cooperatives), that guided the production of interview schedules and the analytical grid, the approach was also inductive, the results derived from observation of primary and secondary sources: document analysis, interviews, and unstructured observation at events (Table 1). The document analysis focused on documents produced by the cooperatives themselves: statutes, websites, leaflets, project fact-sheets, etc. From the analysis of these materials we gathered factual information about the cooperatives, their activities and mission statements.

The interviews were conducted between December 2018 and April 2020. Based on the literature review and the research questions, an interview script was designed, which served as a guideline for the semi-directive interviews applied to key informants in each cooperative. The interview protocol addressed issues such as the legal status of the cooperative, the number and type of members, the objectives and activities performed, the organisations with which they had contacts, the difficulties experienced throughout the lifetime of the cooperative, and the advantages of the cooperative model. The interviewees were appointed by the cooperatives themselves, in order to ensure that they would have direct knowledge of the cooperative's operation. In the case of Som Energia, two interviews were conducted, one with a member of the national board and the other with two members of a local group in a town near Seville. Thus, five interviews in total were conducted. Each

Table 1
Methodology for the REC case studies.

Name	Coopernico	Som Energia	La Solar	Energia Positiva
Documents collected	Statutes Website Manifesto Press releases Fact-sheets	Statutes Website	Statutes Website	Statutes Website
Date of interview	3 December 2018	26 April 2019 25 May 2019	12 June 2019	21 April 2020
Events observed	Greenfest, September 2019 International Conference Energy Communities, November 2019 General Assembly, March 2022	TERRYER Closing Seminar, September 2021	Jornadas Agenda 2030: Movilidad Sostenible Y Transición Energética, November 2018 ODSesiones UMU 'Energía asequible y no contaminante', December 2019	

interview lasted about an hour and they were recorded and fully transcribed to ensure the accuracy of the analysis. From the analysis of the interviews we gathered information on perceptions, attitudes, and experiences that are absent from documents.

Unstructured observation was also carried out at events organised by the cooperatives or by other entities in which the cooperatives participated (annual meetings, seminars, information sessions, and eco-fairs) in Portugal and Spain. From the analysis of these materials we gathered information on how cooperatives communicate and engage with their members and prospective members, as well as additional information on activities and services provided.

The analysis of the interview transcripts, documents and field notes was done manually, by creating a Word document in which a comparative thematic grid of the four cases was designed. The cases were placed in the columns. Each of the rows contained a dimension, identified through the literature review and in line with the research questions: date of inception, geographical scope, legal status, objectives, produces RE, sells RE, other activities, number of members, number of clients/contracts, profile of members, participation of members, dissemination for increasing membership, cooperation/support, difficulties, connections with government, connections with private organisations, membership of federations, advantages of energy cooperatives, role in social acceptance of RE, benefits for local economy, hurdles for energy cooperatives, promotion for energy cooperatives, and RE impacts. The cells contained the results of the data analysis, including relevant citations from the documents and interviews (in the original language). All co-authors revised the analysis. Throughout the article, citations from the interviews or documents are used for illustrative purposes. The analysis is complemented with legal, policy and statistical (e.g., European Values Study) data for contextualisation.

In Table 2, some summary information on the REC studied is presented. Coopérnico (Portugal) was created in 2012. It has a national reach and ten local groups. It has the legal status of a service cooperative (Decree-Law 323/81, 4th December 1981) and owns 27 solar photovoltaic projects in rooftops of third sector organisations, schools and municipalities (plus two under construction). Until November 2019, it sold RE to its members through a business partner (with scarce guaranty of RE sources), when it was finally able to enter the market as an electricity supplier. It currently has 2492 members, but just 763 contracts, down from over 1400 contracts at the beginning of 2022 (the extraordinary rise in electricity prices throughout 2022 led to Coopernico recommending clients to find other providers with lower prices).

Som Energia (Spain) emerged as a project that sought, through

Table 2
Summary information on the REC studied.

Name	Coopérnico	Som Energia	La Solar	Energia Positiva
Country	Portugal	Spain	Spain	Italy
Date of creation	2012	2010	2016	2015
Legal status	Services Cooperative	Consumer and user cooperative	Consumer and user cooperative	Production and consumption cooperative
Number of members ^a	2492	82,572	301	811
RE generation	Yes	Yes	No	Yes
Annual production (GWh)	3	24.6	–	8.2
RE commercialisation	Yes	Yes	Yes	Yes
Number of contracts ^a	763	124,460	1668	811

^a In September 2022.

citizen participation, to move towards a change in the energy model. It was founded by a group of faculty and students of Girona University and had connections to Ecotècnia SCCL, a Catalan cooperative created in the early 1980s that manufactured and installed wind turbines. In 2011, Som Energia was already marketing electricity that was certified as 100 % renewable, and launched the first advances in the generation of renewable energy. Currently it owns 10 solar farms, one biomass plant, and one hydropower dam (plus 2 other projects under construction), generating 24.6 GWh/year. However, this represents only 5 % of the demand of its members, so the remaining 95 % is bought from certified RE producers. It has over 82 thousand members and 124 thousand electricity contracts. Again, due to the considerable rise in electricity prices during 2022, Som Energia made an effort to find providers with lower prices for customers.

La Solar, founded in 2016, like most Spanish REC is not a RE producer and does not own RE facilities. It has a regional scope (Murcia) and a fairly low number of members (301) and electricity contracts (1668).

Energia Positiva (Italy), created in 2015, is a production and consumption cooperative. It has its own RE infrastructures generating about 8.2 GWh/year (80 % solar photovoltaic, 15 % hydro and 5 % wind) but it does not sell electricity directly to its members, it has a partnership with a national electricity retailer.

5. Results and discussion

5.1. Challenges for REC

As seen above, there are particular circumstances in the political, economic and sociocultural context in these southern European countries that make it more difficult for REC to emerge and to thrive. But do the testimonies from REC representatives support this assertion? The following sub-sections address the challenges in these three domains.

5.1.1. Political challenges

As seen above in Section 3, the political and policy framework in Southern Europe is far from favourable to the development of REC. Interviews with REC representatives consubstantiate the lack of political support, and even discrimination, cooperatives face.

The weight of large companies in designing public policies was highlighted in the interviews:

Despite directives at the European level that support the creation and development of activities such as energy cooperatives, individual countries have yet to implement laws at the national level that concretely allow the development of cooperatives. Governments should listen more to cooperatives, as they are more representative of public will than large companies in the energy sector. The “traditional players” seem to be very slow in accepting these new directives (“Clean Energy package”) and their interest is still focused too much only on the sale of energy to final customers.

(Interview Energia Positiva)

explained in some cases by the questionable practice of “revolving

doors” between the public and private sector:

[This is] how the oligopoly works here [laughs]. There is constant collusion here between the big energy companies and politicians. Everyone here knows that the politician who retires ends up working on the board of directors of a power company. What's more, we [cooperatives] are seen as enemies.

(Interview - Som Energia local group)

Our interviews confirm that the ‘sun tax’, in place in Spain until 2018, was detrimental to cooperatives:

Spain even had the sun tax, there was a large number of restrictions on this type of installations, the retroactive cuts of installations that already existed, etc.

(Interview - La Solar)

The repeal of this law (Real Decreto-ley 15/2018) set the conditions for the development of prosumption, energy generation in cooperatives and later energy communities. Recent changes on the legislation on self-consumption in Portugal (Decreto-Lei n. 162/2019) and Spain (Real Decreto 244/2019) may help REC, even though they have a more general application to individual households and energy communities [20,25]. However, large companies can also take advantage of it to get into this niche market (see below).

In Spain, according to the interviews, cooperatives also faced policy changes and instability:

We suffer from the difficulties of the electricity sector due to its complex and also unstable regulation depending on the political ups and downs. This also affected the renewable generation strategy because there were very important changes in relation to the support for renewables (suspension of premiums, lack of definition in the support for self-consumption, etc.) that have made it very difficult to develop these lines of work more clearly.

(Interview - Som Energia)

REC also experience significant financial hurdles in entering the energy commercialisation market, since the entry threshold to the sector is quite high. Regulations determine that new operators have to present large bank warranties (currently €200,000 in Portugal, a 100 % increase of the value before 2018) and navigate legislation and regulations that are often complex and opaque:

To get into the market there are a number of hurdles. The sector is opaque, the sector is closed, the legal framework is not designed for new models and new companies with different models to enter the sector. And at this moment we have established the bank guarantees of €200,000 to enter the sector. €200,000 euros is a lot of money (...) the world of commercialisation is much more financial than technical or engineering

(Interview - Coopérnico)

All REC affirm that they receive no support from national governments. In Spain, regional governments have quite different attitudes. Whereas Som Energia enjoys some support from the government of Catalonia (see below), La Solar face difficulties in being recognized by regional authorities.

the interest of the regional administration in this type of cooperatives is nil (...) In this region, we feel that there is no interest at government level in this type of cooperatives; an effort is made in worker cooperatives, but there is very little interest in consumer and user cooperatives.

(Interview - La Solar)

REC try to overcome this challenge by developing lobbying activities towards public administration, so far with limited success.

We try to do this [lobby] through meetings with political representatives, usually the more progressive ones. We are trying to get the cooperative model to be taken more into consideration.

(Interview - La Solar)

In short, REC representatives, particularly in Portugal and Spain, acknowledge that REC face a hostile political environment, that has been much more favourable to large profit-seeking operators and concentrated large-scale production. Legislators and policy makers have failed to make provisions for smaller, non-profit energy producers and there are no support programmes they can apply to.

5.1.2. Energy market

As mentioned above in Section 3, the electricity market in Portugal and Spain is largely dominated by large companies, leaving little room for REC. Coopérnico in Portugal, with under a thousand contracts, has very little weight in an electricity market with 5.6 million domestic consumers [45] that is controlled by just seven companies that hold 95 % of the market [46]. REC in Spain also represent a very minor part of the market, still dominated by the five largest utilities, which represent 70 % of the electricity generation, 85 % of commercialisation and 95 % of distribution. In a market of slightly over 28 million domestic electricity consumers, La Solar cooperative has just 1608 electricity contracts and Som Energia 124,461.

In Italy, the electricity market is far more fragmented: 12 companies hold 60 % of the market and the former incumbent, Enel, only holds 16 % of the market share [47]. But according to Magnani and Osti [17], just 7 % of the 775 operators recognized as electric energy buyers or sellers in Italy in 2015 are cooperatives and Energia Positiva has just 811 contracts.

Competition from the large companies is seen as a hurdle by REC. Large companies have extensive resources to keep and expand their client base: advertising on television, telephone, social media and door-to-door campaigns, promotions, artificially low prices. These aggressive marketing strategies make consumers wary of change:

There is a certain fear of change in the electricity sector. People are afraid because we have not reached the level of awareness that exists in mobile phones, car insurance (you change insurance and there are no major problems). It is also true that the practices of the big companies make people afraid to change: "I'd rather stay in Guatemala than move to Guatepeor" [word play in Spanish between "mala" (bad) and "peor" (worse)].

(Interview - La Solar)

The four REC under study do not spend money in advertising, so they rely mainly on word-of-mouth, face-to-face events, webinars, social media, and agreements with other civil society organisations. This tends to limit their growth beyond the social networks of their members.

There is no constant, strong communication policy. There is no communication team. We do communication on the official website and blog and social networks, to communicate information about the cooperative's activities. (Interview - Energia Positiva)

Since large companies are RE producers, they also offer 100 % RE contracts to their clients: EDP's Green Electricity Plan and Packs Living, all of Iberdrola's plans for domestic consumers, GALP green electricity. In Spain Iberdrola's Plan Solar and Endesa's Tempo Solar offer special tariffs to clients with photovoltaic systems at home who are also

compensated for the energy they feed into the grid. In Italy, all three main operators offer several electricity and gas plans (e.g. Enel E-Light, Eni Plenitude Trend Casa, or Edison World Luce) that promise 100 % green energy. Companies are also acting as 'prosumer facilitators' [20], offering services for households and energy communities (financial support for installing solar panels, smart meters, software and hardware for managing shared consumption) and electric mobility (e-vehicles chargers) in what might have been a market niche for cooperatives, pushing back the scenario of an 'utility death spiral' [48]. EDP in Portugal, ENDESA in Spain and Ener Green Power in Italy sell and install solar panels to their clients for small monthly payments included in the electricity bill. Through the programme *Bairros Solares* (Solar Neighbourhoods), EDP provides services to energy communities. However, these services tend to be more expensive than the ones offered by cooperatives and do little to empower citizens or enhance their participation in energy systems. This is also seen by cooperative representatives as a form of 'greenwashing':

two years ago, we started to see advertising in the press [of green energy contracts] (...) That's a trap, because [name of company] pollutes a lot. "But if you want, we'll give you a certificate stating that the energy we produce is sustainable". That's a trap. They are doing it because they are being forced to do it.

(Interview - Som Energia local group)

Unlike the large companies, REC struggle with organisational and operational challenges, such as hiring and managing personnel or the technical upkeep of generation facilities:

It has a maintenance operation challenge, because being decentralised the travel costs are higher and having a power station in Mangualde that stops producing and having another one in the Algarve, you have to have local support

(Interview - Coopérnico)

Similar difficulties were also found in REC in the Netherlands [5] and in Germany [8,49], despite the fact that cooperatives are better represented in these energy markets. Nevertheless, as shall be seen below, REC can harness the support of their networks to overcome some of these obstacles.

5.1.3. Lack of civic culture of participation and trust

A history of political repression and lack of civic culture (see Section 3 above) is another hindering factor for the development of REC, particularly in Spain and Portugal. The testimonies from REC representatives attest that they face difficulties in mobilising new members and generating enough trust in consumers to lead them to leave traditional operators. The representative from Coopérnico mentioned the paucity of citizen support, which is attributed to cultural and historical reasons:

It seems to me that there is a mistrust, some distrust of the cooperative model, especially from people who have been through all those bankruptcies of the housing cooperatives, of the 25th of April [democratic revolution in 1974], etc.

(Interview - Coopérnico)

Spanish REC also experience difficulties in recruiting members and clients. Despite a lack of satisfaction with electrical companies, consumers are reluctant to trust cooperatives

When we signed the agreement with the environmental group [...], I was very excited because I imagined that a lot of contracts were going to come in, but they didn't, maybe twenty came in. I think there is a kind of fear or conformism or both. Everyone in Spain complains about the price of electricity and you are constantly bombarded with the news that we have the most expensive electricity in Europe (...) But I do not know why, for what strange reason, people do not take the plunge.

(Interview - Som Energia local group)

On the whole, the perceptions and experiences of REC representatives support the assertion that there are political, economic, and sociocultural factors in Portugal, Spain and, to a lesser degree, Italy that help explain the slow development of REC. These contextual factors pose barriers and difficulties to the emergence of cooperatives and to the expansion of their membership and client base. Despite the best intentions of European regulations, REC have yet to play a relevant part in energy transitions in these countries and governments show little interest in changing this state of affairs, by enacting legislation or devising support mechanisms that would level the playing field in the electricity sector. Far more difficult to change would be the negative public perceptions on REC and lack of trust that repel potential clients and members.

5.2. Benefits and opportunities for REC

In view of the unfavourable conditions REC in southern Europe face, it is worth examining whether they still provide distinct benefits and opportunities that make them worthwhile actors in energy systems. The next sub-sections will address their role in promoting environmental and social values, their local embeddedness, the value-added of the diversification of activities, their networks of mutual support, and the advantages of democratic governance.

5.2.1. Environmental and social values

As Cuesta-Fernandez et al. [24] state, the creation of REC in Spain in the last decade was mostly spurred by environmental and social values:

Founded from 2010 onward all over Spain by grassroots activists deeply distressed by the unsustainability and limited democracy of the electricity sector, they built their business model around retailing green-certified electricity to disoriented and politicised customers. [24]

Looking at the mission statements of the four REC (in documents and interviews), they all highlight environmental and social values: energy transition, renewable energies and citizen involvement. Coopérnico also includes the topic of energy efficiency, whereas La Solar and Energia Positiva mention economic dimensions (lower prices, opening the RE market to small investors).

Objectives: development, operation and consulting of renewable energy and energy efficiency projects; Vision: A renewable, fair and responsible energy model that contributes to a social, environmental and energy sustainable future. Mission: Involving citizens and companies in the creation of the new energy paradigm - renewable and decentralised - for the benefit of society and the environment.

(Coopérnico Charter, PT)

The ultimate goal of Som Energia is the transition of the energy model towards a 100 % renewable one. (Interview - Som Energia)

The aim was to be able to supply ourselves with clean, locally reduced energy at the lowest possible price. Our main objective was also to become a tool for social pressure, so that citizens could access the world of renewables without restrictions and then to be able to influence our policy makers, so that the issue of renewables would have the greatest possible penetration.

(Interview - La Solar)

[Our objective is] Open the electricity market to small Italian investors, connecting citizens to renewable energies and involve citizens in the energy transition.

(Interview - Energia Positiva)

The local group of Som Energia in a town near Seville emerged from an environmental protest action (in defence of a contaminated river) and its members are active in other environmental and social causes. Coopérnico also has strong ties with the Environmental NGO Zero. Many

of its members belong to the two organisations and even occupy positions in the governing bodies of both.

Some interviewees believe that REC have played an important role in pressuring electricity companies to make a bigger push for sustainability, including the above mentioned 100 % RE contracts:

There is one thing that shows us the important role that sustainable energy cooperatives are playing: when I joined this cooperative in November 2014, I think, nobody knew anything about sustainable energy. And suddenly, two years ago, we started to see advertising in the press [of green energy contracts].

(Interview - Som Energia local group)

In short, REC are attractive to citizens who share the environmental and social values that are upheld by the cooperatives. Membership can be expanded on the basis of these shared values more than on economic benefits [9,22].

5.2.2. Local embeddedness

Even though only La Solar has a regional scope (most of its members are located in the Autonomous Community of Murcia, South-Eastern Spain), both Energia Positiva and Som Energia started out as regional cooperatives (the former in Piemonte, northwest Italy, the latter in Catalonia, northeast Spain) that later attained national scope. Som Energia was also a pioneer in setting up local groups (currently 18 disseminated all over Spain), that have their own activities (including owning RE infrastructures), a model later adopted by Coopérnico (10 local groups). Som Energia also provides support to the creation of regional REC, such as Candela, in Andalusia, by motivating its members in the region to join the new cooperative.

Therefore, it can be said that all four cooperatives have strong local ties and geographical proximity to their members.

Concomitantly, REC tend to develop smaller scale RE projects, mostly, but not exclusively, photovoltaic, in selected locations with less environmental impacts, and to engage more closely with local communities, taking the time to explain and discuss RE implementation:

The fact of considering that energy production centres can (and should) be in the hands of citizens brings renewables closer to and promotes them, increasing their social acceptance. Moreover, as the aspect of economic profitability is not the main or only factor to be taken into account, the projects incorporate a local perspective, the concern to minimise the effects on the environment or the territory, etc., which reduces the reluctance of the people affected by the new installation.

(Interview - Som Energia)

Cooperative representatives also believe that they bring benefits for local economies. Coopérnico's representative stated that its projects help reduce the electricity bill of third sector organisations and local authorities. La Solar's stressed it buys its energy from local small-scale producers:

When a client buys energy through us; for the moment our energy purchases are made in the Region of Murcia. We do it in solar fields that belong to farmers (...). So, the purchase of energy is done in the Region and supports small producers who participate in a social economy. It is an economy much more based on buying from small producers and not from energy multinationals.

(Interview - La Solar)

In the interview with Som Energia, the benefits for local economy in terms of employment (construction, maintenance, security, and training) and local investment were highlighted:

As a distributed resource, it allows for a higher return to the local economy (depending on the scale of the project) because it requires people for construction, security, maintenance, training, etc. And if the participation in the investment has also taken place among the people nearby, the economic returns also return to the local level. And it is conceivable that if

the production system is distributed and not centralised, this benefit will be passed on to more people.

(Interview - Som Energia)

Finally, Energia Positiva's representative underlined its potential to link local actors:

cooperatives have great potential to get the most out of the local area from an energy point of view. Thanks to the cooperative model, it is possible to close the triangle between the local community, administrative entities and cooperatives offering technical support.

(Interview – Energia Positiva)

Most REC also have closer ties with local government. Coopérnico has several agreements with municipalities to set up solar panels in the rooftops of public buildings. Som Energia receives support from the regional government of Catalonia. And La Solar also cooperates with municipalities:

with some municipalities, yes, at the level of working and informing on self-consumption, or the possibility of developing new lines of public sector contracts.

(Interview – La Solar)

Energia Positiva participates in the Regional Council and as part of *Confooperative* it has contributed to the new legislation related to energy communities and collective self-consumption. It also provides services to local authorities:

There was a public call for tenders on lighting efficiency and boilers in a municipality: 20 years of lighting services, such as changing public lamps or replacement for LED lamps and maintenance of 5 heating plants (...) This has raised great acceptance by members in the general meeting and interest in doing similar interventions in other municipalities.

(Interview – Energia Positiva)

In short, even national REC tend to have strong local ties, that, on the one hand, make them more aware of local sensitivities when placing RE facilities, and, on the other, bring positive impacts to the local economy, by generating connections with local actors (municipalities, civil society organisations, companies) [5,13,15,17,18]. This in turn contributes to enhancing the public perception and acceptance of renewable energies.

5.2.3. Diversification of activities

One opportunity for REC to strengthen their position in the energy market is to diversify the types of activities they develop and the services they render their members. Besides RE commercialisation, the four cooperatives also provide supplementary services to their members, such as energy efficiency services, support to energy prosumption (e.g., bulk buy of solar panels for roofs of members' houses) and energy communities, training in energy literacy, information provision for families living in energy poverty, lectures and debates.

We operate in the prosumption model for customer installations (...) We make a little bit of money with the self-consumption installations we do, but it is a minor line of business. Above all, what we are looking for is for people to be able to enter the prosumption market. (...) We spend a lot of time with our customers on the ideology of prosumption, which is the fundamental issue that for legal reasons cannot be done in Spain. But as people don't know the details, we spend a lot of time explaining to people what is real, what is not real, how it really works and the advantages of renewables.

(Interview – La Solar)

Coopérnico, Som Energia and Energia Positiva provide opportunities for their members to invest in RE projects and obtain revenue from them. The cooperatives have developed innovative methods of participation and investment, such as crowdfunding (for the financing of shared prosumption infrastructures) or the creation of platforms for the promotion of self-consumption among cooperative members.

In Italy, REC were able to anticipate the market, to innovate and provide new services before for-profit companies [27]. They also provide employment (including for disabled workers) and training (development of industrial skills) for their members, in activities such as setting up solar panels and other power generation devices or building energy efficient housing. Energia Positiva develops energy efficiency projects for apartment buildings and municipalities:

The cooperative has developed energy efficiency measures, with the support of other technical companies, for apartment blocks (residential buildings) and municipalities. In addition, the cooperative is responsible for the maintenance of purchased generation plants. An example of an efficiency intervention is, in an apartment building in Turin, the replacement of a boiler and installing heat consumption monitoring devices.

(Interview – Energia Positiva)

This diversification of the types of activities REC develop and of the services they render to their members has occurred also in Northern Europe and is seen a key opportunity to attract and retain new members and clients [5,8,15].

5.2.4. Networks and mutual support

One of the key aspects on REC, that distinguishes them from other market operators, is the collaborations among them, with national and supranational federations of cooperatives, and with other organisations of the third sector that operate in the field of sustainability and social and environmental justice.

In the early stages of Coopérnico, the cooperative received financial support (loans) from Som Energia and another RE cooperative from the Netherlands. Som Energia has extensive connections with other energy cooperatives in Europe, such as Enercoop (France), Ecopower (Belgium), and Enostra (Italy). La Solar works in partnership with a network of REC and has a close connection to a RE cooperative in a nearby region of Spain, EnerCoop (Creventillat, Alicante):

They were willing to provide us with the capacity to purchase energy, invoicing, solve problems with the distribution company, etc. So that was a great help, because we were able to start trading with the support of a partner of interest, experienced (...) and which allows us to guarantee one hundred percent renewable energy (...) without the difficulties involved in purchasing energy and again having to implement an administration system from scratch.

(Interview - La Solar)

Energia Positiva engages with other national energy cooperatives and re-sells some of the electricity it produces to other cooperatives. Coopérnico is a member of APREN, the Portuguese Association of Renewable Energies, and La Solar and Som Energia are members of the Spanish national federation of REC (Unión de Renovables). Som Energia is also a member of the Network of Social Economy, Anpier (the association of photovoltaic energy producers), and Px1nmE (Platform for a New Energy Model, a Madrid based citizen initiative). Coopérnico, Som Energia and Energia Positiva are members of the European federation RESCOOP, which provides them with support, information, and participation in networks and projects.

Coopérnico has particularly strong ties to other third sector organisations. It collaborates with welfare and education organisations to install solar panels on their rooftops and among its collective members are organic food bakeries, supermarkets and restaurants. It also has connections with SMEs working in energy efficiency and domestic solar power.

La Solar benefited from the help of another cooperative in the Region of Murcia, which assisted in drafting the statutes and registering the cooperative in accordance to the regional law of cooperatives. Som Energia has agreements with environmental organisations, social economy organisations, and clean energy organisation for mutual benefits to members (discounts, access to electricity contracts without being

members).

These links are justified “with the aim of nurturing the social and solidarity economy of the territory” (Interview – Som Energia). Local groups sometimes share their offices with other civil society organisations, not exclusively in the environmental sector, but also working on gender issues, support to refugees and other minorities. Energia Positiva supports other initiatives related to ‘sustainable living’; for instance, they participated in a fundraising to create a bike path in the North of Italy.

To sum up, REC tend to have strong ties among themselves and with other civil society organisations, that share the same environment and social values and enhance their embeddedness in the local community. This helps them survive and develop in a hostile context.

5.2.5. Governance and participation

One of the most touted characteristics of REC is their democratic governance and the opportunities for citizen participation they provide. According to cooperative representatives, REC also tend to offer dedicated benefits for consumers: lower prices, no hidden costs or conditions (transparency and security), as well as investment opportunities and access to information and support about RE, prosumption and energy efficiency. According to representatives, all this leads to higher consumer satisfaction:

There have been many cases of dissatisfaction on the part of customers with the large suppliers, so being able to place their trust in a structure (...) they have the option of owning, as a member, their own energy cooperative, we understand that this generates much greater confidence. Any kind of dissatisfaction has a forum to be addressed, which is their own cooperative. Our main objective is to defend the interests of our customers. That's why we don't have any kind of restrictive attitude in the contracts, no permanence commitments, the prices are quite good (our margin is small).

(Interview - La Solar)

However, it should be noted that high consumer satisfaction so far has hardly contributed to widening the membership base of REC. This may be due to the difficulties highlighted above concerning lack of resources (and motivation) to advertise and the pressure from large utility companies.

Other cooperatives stress the participatory dimension, through collective ownership and democratic management of the cooperative:

[cooperatives are run] through democratic management, i.e. they are not for profit, so if you want a vote on your energy bill, you can go to a general meeting and have your say, you can contribute to the growth of your energy supplier. We have a motto that is: here we are the owners of our energy, that is, each one of us can contribute to the success of this project within the sector. So, in fact, here there is no CEO, there is no owner of the company, there are 1,200 owners of the company.

(Interview - Coopérnico)

Som Energia is particularly committed to an approach based in citizen engagement and participation [1,18,23,24]. It holds an annual training event called Escuela SomEnergia, with lectures, debates, innovation competitions (“Germinador Social”). It has a “Participa” tool, a virtual space where members access participation tools for information, debate and decision. It has a ‘democratic calendar’, where all public events are listed, and hosts Comunidad SomLab HackaSom, to which members contribute voluntarily with their computer and programming skills.

Thus, one of the most important characteristics of these cooperatives is the development of social innovation processes carried out through groups of volunteers who are responsible for promoting and disseminating the values of these cooperatives, in addition to the organisation of conferences or training activities that raise awareness for the need of a new energy transition model.

Nevertheless, it should be pointed out that participation in REC is not

evenly distributed across social strata. According to the interviews, most members of the cooperatives are men, with high levels of educational attainment and with an above average income. Membership fees may deter less affluent citizens (though some cooperatives do not require clients to be members) and since recruitment is often based on word of mouth and personal networks, cooperatives struggle with widening their membership base.

In short, southern European REC do exhibit many of the beneficial traits of their northern counterparts, despite operating in a mostly unfavourable context. They play a valuable role in strengthening environmental and social values, enhancing social acceptance of renewables by developing relations of proximity and support with local actors and communities, providing innovative services to members and clients, consolidating networks between civil society organisations (cooperatives and other types), and fostering civic participation in energy issues by enacting good practices of democratic governance.

The challenge is to scale up the participation of cooperatives in the energy sector, extending these benefits and opportunities to a wider part of the population in these countries.

6. Conclusions

REC remain actors with a minority role in the energy systems of Portugal, Spain and Italy, Davids against the Goliaths of energy companies. They are few, have a small number of members, and hold a trifling market share in electricity commercialisation. They struggle to survive in a hostile political and economic context that openly favours large operators and in a social and cultural context characterised by low civic participation and where cooperatives are viewed with mistrust.

However, REC do offer an alternative that may help mobilise citizens for energy transitions. They are steered by social and philosophical aims rather than by profits and economic benefits. Despite some differences in their legal definitions across the countries, the sense of collectivism, self-help, mutual responsibility, co-management, transparency and equality and a less vertical hierarchy are common characteristics identified in the case studies.

They have robust ties among themselves and with other third sector organisations. One of the most remarkable attributes of cooperatives are the social innovations that they adopt to fulfil their goals. For example, new methods of participation and investment, such as crowdfunding (for the financing of shared self-consumption installations whose investment subsequently affects electricity bill savings) or the creation of platforms for the promotion of self-consumption among cooperative members.

On the side of advantages that cooperatives offer, research results identify direct benefits for consumers and the positive social, economic, and environmental impacts. Cooperative representatives point out lower prices, no hidden costs or conditions (transparency and security), investment opportunities, access to information and support about RE and energy efficiency. Cooperatives also generate confidence by giving the option of owning the cooperative as a member. Interviewees consider that cooperatives contribute to the increase of social acceptance of RE and highlight the benefits for local economies in terms of employment and local investment. Furthermore, they underline their potential to link local communities, public administration and technical teams, representing an entirely different option concerning the RE generation and commercialisation model dominated up to now by large companies. REC create social and human capital related to RE knowledge and perform an inclusive role when integrating local communities in the decision-making process in the energy transition. Cooperatives empower prosumers and contribute to creating social networks, which in turn boost territorial cohesion.

The difficulty entering the energy commercialisation market is among the specific hindrances that the cooperatives face. The interviews give substance to the claims that electricity markets are dominated by large companies that benefit from more favourable regulations and government support. Unstable regulations and policy U-turns are other

difficulties to contend with. Cooperatives' governance and management issues, resulting from an increase in size and technical complexity, are also hurdles to be overcome.

Cooperatives need energy policies that are friendlier to small operators, as has been done, for instance, in Germany and Denmark [4,6,8–11]. These policies should include more flexible legislation, that takes into account different kinds of energy operators; less bureaucratic hurdles for setting up small-scale RE infrastructures and RE communities; specific conditions for entering energy auctions (admissibility of smaller tenders from non-profit organisations); and access to financial and other types of support (management, professionalised human resources, training).

Overall, Southern European REC would benefit from energy policies that are more transparent, more equitable and more inclusive, built open a wider consultation of diversified stakeholders and a greater concern with citizen engagement and participation. In a market of Goliaths, Davids do have a role to play in enhancing participation and acceptance in the energy transition.

How to scale up the role of REC in Southern European energy systems, along with the impacts that recent policies promoting community energy may have constitute promising topics for future research.

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Data availability

Data is qualitative: interview transcripts and documents. It is not anonymised, confidentiality issues arise.

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