SOCIAL ENTREPRENEURSHIP TO TACKLE ENERGY POVERTY: A SYSTEMATIC LITERATURE REVIEW

Abstract

Energy poverty still affects more than 50 million people in Europe. Due to COVID-19 crisis this number may increase significantly. However, efforts to tackle this complex problem by different actors appear to be insufficient. The intersection of domains from different disciplines is increasingly of relevance in energy social science. Social entrepreneurs have the mission to solve social problems and could coordinate the energy poverty network. Considering the network nature of the energy poverty problem, we examine the collective social entrepreneur as a potential space to address energy poverty.

A systematic literature review of the intersection among energy poverty, innovation and social entrepreneurship in developed countries can contribute to the discipline with a structure of the main concepts to assist all the actors involved. The discussion may analyse if the coordinated network will be able to mitigate the problem in a more effective (but not exclusive) way. Based on the outcomes of this systematic literature review potential new lines of research are identified within the intersection of the three domains.

Introduction

The pathways towards low-carbon energy transition are faced with the challenge of being inclusive of energy vulnerable households, an issue of growing interest, particularly in Europe (Hiteva, 2013). Energy poverty refers to the difficulty or inability of a household to maintain in an adequate temperature conditions, as well as other essential energy domestic services at a reasonable price.

Energy poverty has been dominantly attributed to the triad of insufficient income, high prices of energy and energy inefficiency, but other approaches see this delimitation as partial, since it ignores causes of a different nature, such as lack of information or building strategies. A delimitation is a partial approach that excludes other multiple factors with a more human-centered approach (Boni et al, 2016). Moreover, energy poverty can be characterized as a *wicked* problem given its complex, systemic, multidimensional, and frequently invisible nature, which requires the coordinated participation of multiple

interrelated actors. Therefore, approaches that bridge disciplines and domains are particularly appropriate to address energy poverty issues (Sovacool, 2019, 2014).

It is estimated that more than 50 million households in the European Union are experiencing energy poverty (Thomson and Bouzarovski, 2018). COVID`19 may cause the expansion of energy poverty (Sumner, et al, 2020). If not specifically addressed by all actors, the consequences of the COVID-19 could affect a greater number of vulnerable people, increasing energy poverty. Confinement measures exacerbate pre-existing energy poverty problems by increasing residential energy demand and reducing the incomes of small families. COVID`19 has a socioeconomic impact that aggravates energy poverty mainly due to two factors: the reduction of income, due to the total or partial loss of income of many households, and the increase in domestic energy consumption, due to the situation of confinement of the population. These two phenomena, aggravated by the low energy efficiency of the houses and the little knowledge of energy billing, have caused an increase in pollution situations (Barrella, 2020). Some progress has been made but there is not a unique solution despite all actors' efforts.

The dominance of partial approaches to complex problems calls for the need to adopt multilevel, multidimensional and multiactor approaches on energy poverty (Sovacool, 2014; Power, 2018). In this work, we focus on the emerging relevance of social innovation and social entrepreneurship issues within the field of energy social science to tackle energy poverty (Martiskainen, Heiskanen and Speciale, 2018). Social enterprise could be a productive space for building effective responses to the problem of energy vulnerability (Montgomery et al, 2012), as well as its capabilities for leveraging resources through the energy poverty social network (Dacin, Dacin, and Tracey, 2011). Potential contributions of social entrepreneurship to energy poverty might increase the number of innovative solutions for marginalized groups in energy transition from lenses of energy justice (Jenkins, Sovacool and McCauley, 2018).

A full understanding of this different lens of the problem of energy poverty is the first step required to provide alternatives to tackle such problem through social innovation and the coordination of the collective social entrepreneur (Okhuysen and Bonardi, 2011). As other researchers indicate, there are many social innovation initiatives in the field (like the Alliance against energy poverty in Barcelona) and the conceptualization of this research could provide an alternative approach to the problem (Moulaert and MacCallum, 2019). Social enterprise and social entrepreneurship are loosely defined constructs, but a

mission related to address social problems or to create social value is widely accepted as a central feature of these actors (Saebi et al., 2019). Therefore, several initiatives and business models are emerging with a mission to tackle the social problem of energy-deprived households, as illustrated by the accelerator created by Ashoka and Schneider Electric Foundation to support social innovations in energy poverty.[1]

Accordingly, research addressing the role of the social enterprise actor in domestic energy poverty is also emerging (see, for instance, the cases studied from lenses of energy justice by Hiteva and Sovacool, 2017). However, research contributions on social entrepreneurship for energy poverty are still scant, specifically concerning poverty in the global North (Bouzarovski and Petrova, 2015). In addition, Sovacool, Axsen and Sorrell (2018) defend the need for systematic literature reviews and interdisciplinary research in the field of energy social science.

In developed countries, the number of vulnerable people in energy is increasing despite the growing number of interventions from private and third sector. Though energy poverty is a global problem (Day et al, 2016; Osunmuyiwa and Ahlborg, 2019), it is also situational and varies with the geographical context (infrastructure, urbanisation, public policies, social, cultural…) (Bouzarouski and Petrova, 2015). The rationale for excluding developing countries in this selection and the focus on entrepreneurial solutions in Europe (local, national, and European level) is the need of contextualisation of energy poverty and social entrepreneurship.

It seemed necessary to draw a systematic literature review to assess the state of social innovation and entrepreneurship research in the domain of energy poverty with a cross-disciplinary view (Sovacool et al, 2019). The intersection as a new space to question conventional management practices that will also allow us to later change the lens from which we look at the problem (Okhuysen and Bonardi, 2011). The literature review serves to analyse the multidisciplinary nature of a given domain and the complexity of assembling a review in an interdisciplinary field (Webster et al, 2002).

The importance of interdisciplinarity in energy social science has been also raised by Sovacool (2014, 2019). It allows us to understand which authors, journals and topics are addressed and if there are gaps in the research which would entitle to make future contribute to the intersection. In energy poverty there is a perceived lack of coordination

[1] [1] https://tackleenergypoverty.ashoka.org/

among academy and practice in the interventions. The literature focuses excessively on identifying the problem (such as measuring and identifying vulnerable families) but little on how to develop solutions or structured interventions to it (Sovacool, 2014).

Through this review we aim to depict the state of research on social entrepreneurship to tackle energy poverty in the global North. This work allows to discuss the following findings: 1) Perspectives of energy poverty considered; 2) Roles and nature of social enterprises in the network of energy services in energy poverty; 3) Elements of the solutions offered by the interventions in energy poverty and, 4) Role of renewable energy and climate change in sustainable transition.

Additionally, this review may serve to answer the following research questions:

a) What does literature mean by innovation and social entrepreneurship in energy poverty? What are the main social innovation or private sector initiatives addressed?

b) What is the relationship between energy poverty and the clean energy transition?

By answering them, we first aim to determine the approaches that have already been adopted at the intersection through a comprehensive review of issues, methods, and topics (Webster and Watson, 2002). Second, to identify which topics can be categorized to obtain a more structured and comprehensive understanding of the private interventions to energy poverty. And third, to explore the role of social entrepreneurs in energy poverty considering the barriers and drivers that they face to achieve his social mission and develop their social impact.

Sovacool (2014) already indicated that social science journals constituted less than 5 percent of all those reviewed in the literature of the energy field. He recommended scholars to focus on issues such as human-centered studies, energy justice, innovation, financial incentives, and policies. He founded the Energy Research & Social Science journal to cover these gaps. This paper is inclined to *pre-search* (Sovacool et al, 2018) to get scientific utility that is needed as theoretical development, but also because of its applicability in practice.

Background

This section related to the general background on the rationale for social entrepreneurship in energy poverty. The literature in energy poverty looks at this problem with partial focus.

Boardman (1991) identified and made the energy poverty problem visible, considering the political skepticism at the time. She was interested in an inter-disciplinary approach (policy, technology, economics, sociology) and she gave the first definition of energy poverty to cover households whose fuel expenditure on energy services exceeded 10% of their income.

Today there is no consensus in the definition of energy poverty, but this work follows Day, Walker and Simcock (2016) that define energy poverty as

> *an inability to realise essential capabilities as a direct or indirect result of insufficient access to affordable, reliable, and safe energy services, and taking into account available reasonable alternative means of realising these capabilities*.

Energy services in households are tools required to develop secondary capabilities which in turn are needed to have basic or primary capabilities, that are essential for living, like good health or social respect. Secondary capabilities sometimes require energy services. It is widely recognized that energy as individual needs, such as heating, lighting, refrigerating food, telephone or watching TV, among others, are necessary for people's well-being, to be healthy or to achieve an effective participation in society. Researchers disagree about which specific services are considered basic. Thus, the lack of energy services feeds the vicious circles of energy vulnerability (Day, Walker and Simcock, 2016; Bouzarovski and Simcock, 2017).

Identification and information about energy services in relation with the energy vulnerability factors (Bouzaroski and Petrova, 2015) and invisibility and stigmatization have been widely addressed by the literature (Day et al, 2016; Bouzaroski and Simcock, 2017). The measurement of interventions in energy poverty in developed countries is very rarely approached in the literature.

Social entrepreneurship is also already a consolidated field as part of entrepreneurship, but there is no final definition of social entrepreneurship and a quite fuzzy notion of diversity in juridical forms. An actor with different names such as social innovator or social entrepreneur that does not need any legal entity to be encapsulated could embed many organisational forms. What is not under dispute is that the mission of social entrepreneur is related to disadvantaged groups (Mair and Marti, 2006). This work assumes that the heroic individual theory of the social entrepreneur (Bornstein, 2004) has been surpassed by the network view (Montgomery et al, 2012). Dacin et al (2011)

provided a network line of studies for social entrepreneurship drawing from the social entrepreneur increasing capacity for (i) leveraging resources through a network (Dacin et al, 2011; Short, Moss and Lunpkin, 2009) and (ii) identifying the most effective management strategies to catalyze innovative activities in the network of energy poverty.

This paper also acknowledges the existing literature about social entrepreneurship as a vehicle of neoliberalism to cover its wounds particularly when social entrepreneurs aim to provide public services corresponding to the State (Nichols and Teasdale, 2017) and about the need to balance the market and social service logic with skepticism about the social entrepreneurship organisation to serve collective interest (Dey et al, 2016). However, the scalability and growth of social entrepreneurship in a multilevel approach (Geels, 2012) may achieve the inclusion of all actors in the new ideas, guiding specifically policy makers views. Instead of social entrepreneur as substitute of State in provision of social services, a close collaboration and participation of all actors could be achieved with the integration of new and old logics (Dey et al, 2016). With this perspective, this study argues that the social enterprise is in a good position to approach social problems (Dacin et al, 2011).

Methodology: systematic literature review

The first step for the systematic search of articles was writing a protocol to ensure rigor and then identify the keywords. Based on previously reviewed literature and the deep look at the intersection among the three domains, the articles were selected through a keyword advanced search in the title and abstract and selected a database, the main collection of Web of Science, in more settings the first three databases appear only (SCI-EXPANDED, SSCI, A and HCI, ESCI) to not include communications from conferences or books. Doing this *practical* screen (Okoli, 2015) the filtering of only peer-review or highly rated journals was guaranteed.

The search string (Search 1) was: (fuel or energy) poverty AND (ENTREPRE* OR INNOVATION) finding 150 articles and a second search string (Search 2): (fuel OR energy) poverty) AND (social (innovat* OR entrepreneur*) finding 90 articles. After that, a comparison of the 240 articles was carried out and 68 were repeated and taken off. The use of these terms is justified by the intention of obtaining articles that focused on the intersection between entrepreneurship (or innovation) and energy poverty, which are the terms commonly used by academics and professionals.

In spite of the more accepted view that domestic energy deprivation could be seen as a global problem (with no division among Global South and North) and considering that all forms of energy poverty in developing and developed countries have a common condition that is the lack of capacity to achieve a social and material level of domestic energy services at different sizes (Day et al, 2016; Osunmuyiwa and Ahlborg, 2019), this systematic literature review is focused solely on developed countries. According to the author decision to focus in European interventions to understand the diversity of geographical context, to further select relevant articles, the author limited the results excluding the articles of developing countries with focus on access to energy and last mile electrification. Moreover, other not relevant articles dealing with other not related topics such as water, agriculture, health, etc.

The rationale for this *practical screen* or exclusion is to limit, restrict and specify the results as much as possible to articles whose main theme is related to entrepreneurial and/or innovative solutions and energy poverty in developed countries. This decision would allow the summary of the intersection to be solely explanatory to open new directions for research (Okoli, 2015).

After a careful reading the abstracts and full content of some of the discarded articles from developing countries, five articles were maintained because their focus was in topics that may enlighten the potential analysis of the solutions in developed countries and that were considered interesting for future contributions in the integration of fields and had theoretical relevance for the research questions. We finally obtained a customized data base of 42 articles for deeper review (see figure 1 below).

INSERT FIGURE 1 AROUND HERE

The citations of each article is relevant to classify the weight in the academia and identify seminal articles in the review, that is, *to identify the giants* (Okoli, 2015). Not many citations in any of the articles, 6 have more than 100, 11 among 20 and 100 and the rest (25) less than 10 (see Table 1. Methodology and citations). The conclusion may be that not much relevant literature is dealing with this intersection.

INSERT TABLE 1 AROUND HERE

The full protocol registration is in an excel sheet that can be requested from the author. The last day for the search was November 18th, 2019. Not all reviewed articles have

provided relevant information, but they have contributed to drawing the scope of the theoretical framework proposed at the end of this work (Okoli, 2015).

A time limitation to the search was not included since both domains together were relatively new as intersection, meaning that there is huge previous literature about innovation and energy poverty but not with the joint lens. We did not include either any limitation to conceptual or empirical articles, or any methodology. It is from the year 2000 when articles that mention social innovation oriented to this problem of energy poverty begin to proliferate. (See Table 2. Timing of publications of the articles selected in the review).

INSERT TABLE 2 AROUND HERE

Several factors motivated the review of the intersection: First, the aim to determine if interdisciplinary approaches were adopted by the three fields of study to better asses the state of research at the intersection with the challenge of the multidisciplinary nature (Webster et al, 2002). Second, the interest to understand how researchers raised social entrepreneurship in energy poverty and what innovative solutions were proposed (MacInnis, 2011). Third, Sovacool (2014) indicated that social science journals constituted only 5 percent of studies in the energy field. This review shows that the intersection seems understudied although the two literatures overlap in important ways.

Results

In this section we include the overall main findings from the review in relation to concepts, authors, journals, methodologies and the relatively few structured literature on energy poverty interventions. After the following identification of the main findings, the conceptualization will be developed in the subsequent subsections.

This paper first synthesizes several theoretical concepts and their relationships into a systematic approach. As Webster and Watson (2002) indicated, the literature review is key to consider broader issues, make new connections, and elaborate on the significance of the findings of the summary of what was published in an area. In the results four main categories derive from the final customized database of the 42 articles (see Table 3 below) after the selection process described above.

INSERT TABLE 3 AROUND HERE

Second, the main authors in energy poverty, with a few exceptions, are not reflected in the intersection which concerns this review, and normally focus on other themes such as identification, definition and policy making in energy poverty. There is a lack of social sciences or interdisciplinary background in the authors of the review and women authors are underrepresented (Sovacool, 2014).

Third, this paper examines the more appropriate type of journals for the intersection among energy poverty and management domains. Sovacool (2014) also indicated expressly that the three main journals of so-called *energy social science* are *Energy Policy*, *Energy Research and Social Science* and *Energy Journal*. *Energy Research and Social Science* is committed to human-centered approaches to problems, integrating methods and concepts from social science.

The fourth finding is related to methodologies. This review identifies mainly qualitative approaches such as case studies (Martiskainen, et al, 2018; Sovacool et al, 2019; Boerenfijn et al, 2018; Sovacool et al, 2019; Boerenfijn, 2019; Power, 2018) and semi-structured interviews (Patkos et al, 2019). Less examples of quantitative methods are found, except in the selected papers related to measurement of indicators (Dineen et al, 2015; Fu et al, 2014) (see Table 1. Methodologies and citations). On this regard, Sovacool (2014) raised the gap between what energy researchers consider it is important and what practitioners, utility commissioners, and politicians think and do. However, in energy poverty there is a lack of connections among academic literature and actions coordinated

by practitioners, and lack of structured solutions through scalable interventions. The literature focuses excessively on identifying the problem (such as measuring and identifying vulnerable families) but little on how to develop solutions to it.

Another finding is the relatively low number of articles found in the intersection in developed countries versus the intensive literature in each of the three separated domains. This can open a new line to research through the integration of domains (MacInnis, 2011) in a more structured way through inputs on how the collective social entrepreneur or innovator could coordinate energy poverty networks with measures to orient all actors efforts in a single direction with a single language. This coordination could increase the visibility of the problem. The adoption of more effective corporation management techniques in the third sector networks (Brugmann and Prahalad, 2007) and the visibility of the problem in the field of social entrepreneurship could improve the number of private initiatives.

From a careful examination of the selected articles, the results of the review are structured into four main themes or categories, including each the subtopics in table 3 below:

1. Perspectives of energy poverty considered.
2. Roles and nature of social enterprises in the network of energy services in energy poverty.
3. Elements of the solutions offered by the interventions in energy poverty.
4. Role of renewable energy and climate change in sustainable transition.

We draw on the literature in terms on how it informs the referred topics, and, in the meantime, we build the answers to the research questions. The method of the systematic literature review leads us to conceptualizing the findings in order to draw general conclusions from them (MacInnis, 2011) so we have tried to reflect the following groups of categories following a common driving thread that connects energy poverty and social entrepreneurship: the interventions. Also, this review allows to observe how those concepts relate to each other within its context (Okoli, 2015).

1. The perspectives of energy poverty considered

Energy poverty researchers adopt a partial vision separated from general research in poverty with the aim to go to the detail of the specific side of energy poverty. This partial approach follows the recommendation from Banerjee, Banerjee and Duflo (2011) to isolate and contextualize global problems into pieces to solve them. Most of the literature displays that although low income is assumed as the main cause of energy poverty, also energy inefficient homes, institutional political factors, and changes in the affordability of utility services should be considered (Bouzaroski and Petrova, 2014).

The literature approach to understanding energy needs and energy poverty is to have very wide applicability, so it cannot be linked to a fixed notion of necessary energy sources, amounts or even services, but rather relate to outcomes. Families do not need energy per se, but specific energy services. Capability theory offers a useful framework for this (Day, Walker and Simcock, 2016; Bouzarovsky and Simcock, 2017).

The review finds mostly followers of Day et al (2016) which definition is not limited to developed countries, allows global and climate change mitigation context. Schaffrin and Reibling (2015) previously built a model called *Energy Service Cascade* which definition of energy poverty is based on energy services. Private interventions of energy poverty, that are situated far from theory and closer to the vulnerable groups need a framework integrating theories that focus on the person.

Sovacool and Mukherjee (2011) spoke about the social energy science identifying the lack of rigor, innovative contributions, style, and excellence, as well as calling the need for systematic literature reviews and constant innovation in the sector. It is striking that Sovacool has five articles related to energy poverty, conceptualization, and transitions in the review. The reason could be that main authors didn´t fully focus on more practical solutions through interventions, and such research should be consolidated and systematized.

Energy justice intertwines with other social issues in the interventions (Sovacool et al, 2017; McCauley et al, 2019). Elia and Margherita (2018) also raise the challenge of complex problems that need complex solutions and the look through social justice in the energy transition which take us to the principles of energy justice(Jenkins et al, 2018).

The issues that seem to generate more interest in the energy poverty research are indicators, regionalization, definition and policies (Pye et al, 2015) but we don´t find in the review an structured approach to the final part of chain: the interventions, their measurement and their monitorization. The limitations in collecting reliable data on

energy poverty are highlighted to avoid errors of inclusion and exclusion (Dineen et al, 2015; Sovacool and Mukherjee, 2011; Boerenfijn et al, 2018; Nunes, 2018; O´Brien and Hope, 2018; Butler and Sherriff (2017).

2. Roles and nature of social enterprises in the network of energy services in energy poverty

In the review the social entrepreneur does not appear as a private company with social mission and economical income. It is difficult to generate income in the energy poverty field. However different associated and community entities try to tackle energy poverty with innovation, initiatives that this study assimilate to the collective social entrepreneur. Another finding is that large corporations do not appear in this review. The juridical organisation is not that relevant as the mission, understanding of the network and proximity to vulnerable groups. This research considers social entrepreneurship and innovation as the same reality within an encompassing research strategy.

Social entrepreneurship appears in the Energy Cafes (Martiskainen, et al, 2018). Community action has gained significance in the sustainability transition providing new spaces for technological and social innovations. Since the collective social entrepreneurship theory is still in the conceptualization stage (Sekliuckienea et al, 2015), this paper equate social entrepreneurship to other social innovation actions (Moulaert and MacCallum, 2019; Martiskainen et al, 2018; Dineenet al, 2015; Webb, 2015; Silvestre and Tirca, 2019; Boerenfijn et al, 2018; Claude, 2017; Sdei et al, 2015).

Social services assistance to implement palliative measures and isolated private interventions such as the Energy Cafes in the UK (Martiskainen et al, 2018) develop a critical role in energy poverty. Where public policies and social workers do not arrive then the private initiative could arrive, but income from vulnerable people is less apparent than in other traditional markets. Then the social mission could be the main incentive. Social services could be considered social entrepreneurs using private sector tools with a focus in a wider impact and a unique objective shared by the whole network to eradicate the energy poverty problem.

The literature agrees that innovation is an element of sustainable development and also is recurrent in all articles of the review. There are several examples of innovation in energy efficiency that can be illustrated by the Living Labs in Cahors (France) for retrofitting in urban centers (Claude et al, 2017). Innovation implies that significant changes must be

adopted by community networks (Silvestre and Tirca, 2019) to steadily allow the energy transition with new metrics, processes, and structures (Sovacool et al, 2019).

Social innovation is questioned and looked from different perspectives in the literature since again it might fail more often due to commercial uncertainties. The role of innovation in sustainable development requires action from all actors, given its complexity, dynamism, and uncertainty. Innovation should include the environmental and social dimension, but the understanding of each challenge is required, social innovations is questioned and looked from different perspectives since again it might fail more often due to commercial uncertainties (Silvestre and Tirca, 2019). In relation to the responsibility to foster the innovation, according to Karlsson (2016) rich countries should implement long term and green scalable technologies because innovation must be driven by the State and not only by the private sector. This paper defends and found also in the review numerous examples of bottom-up innovations that later have an impact and produce insights for the public policies (Dineen et al, 2015; Okonen and Letonen, 2016).

3.- Elements of the solutions offered by the interventions in energy poverty

This section identifies the main elements and characteristics found of the solutions in this review that social entrepreneurs usually develop in interventions in energy poverty.
Once the vulnerable households are identified and the data is duly analysed to have a clear understanding of the causes, then an efficient intervention should be designed. This intervention could be approached by the public or the private sector (and by the third sector and the social innovators, all of which we will include in the definition of collective social entrepreneurs due to the network nature of this problem). The reason not to find many pure social entrepreneurs in the more impoverished conditions groups could be explained by the existing barriers to formalization of entrepreneurship and lack of empowerment (Barrios and Blocker, 2015). However, increasing exchanges among private and third sector are expected (Prahalad and Brugmann, 2007).

Energy efficiency: the challenges of infrastructure, housing, and retrofitting

Energy poverty begins at home that is where most of the energy services are needed (O´Brien and Hope, 2018). Most of the articles deal with energy efficiency issues because it is the main tool to tackle energy poverty in both a palliative and structural way. There are interesting initiatives in social housing derived from information in smart meters, with

crowd-funding financing campaigns (Boerenfijn et al, 2018) or green retrofitting by the figures of *the green doctors* (Sdei et al, 2015). The value of the initiatives to reduce energy consumption through changes in behaviour patterns is not so obvious but could also address the inclusive energy transition if duly disseminated in a global scale. Consumption patterns can provide a lot of information about household time uses or lack of isolation, so studying these patterns could have social implications (Sahakian and Dobigny, 2019).

Training and knowledge dissemination in vulnerable households regarding passive and active energy efficiency technologies for social housing financed by public policies could minimize energy poverty (Sdei et al, 2015; O´Brian and Hope, 2010). The potential need of qualified labour to hold urgent need for energy retrofit of the old buildings is a space to be anticipated both from the private and public sector.

Energy efficiency in retrofitting is not only a legal obligation but an opportunity to introduce green and inclusive energy efficiency measures (O´Brien and Hope, 2018; Knuth, 2019; Sdei et al, 2015; Dineen et al, 2015; Bale et al, 2019; Streimikiene and Balezentis, 2019; Sahakian and Dobigny, 2019; Santamouris, 2016).

Social networks and energy communities

In the literature of social entrepreneurship there is a overcome line of study to abandon the vision of the social entrepreneur as a single individual or hero - the Ashoka approach - towards the research on the collective entrepreneur (Montgomery et al, 2012). In relation to social networks in energy poverty there are more and more collective initiatives permitting several actors in the network (see figure 1 below) join forces and align their interests towards the alleviation of energy poverty. The European Union Renewable Energy Directive (RED II) that entered into force in December 2018 and included a framework for energy communities. We therefore acknowledge the integrative approach of the social collective dimension often embedded in social entrepreneurship (Picciotti, 2017; Webb, 2015).

INSERT FIGURE 2 AROUND HERE

In line with this part of the literature, the collective dimension of the interventions is dominant along the review. Multiple examples of interventions, community action and/or co-creation with network perspective, are guided by collective social entrepreneurs.

To illustrate this social network approach, several examples are found in the review. The energy access innovation centers for clean energy impoverished communities show good community practices in the *base of the pyramid* in developing countries that could be transferred to developed countries (Nathwani and Kammen, 2019). The main goal of those centers is developing long-term strategies to mobilize networks. Multiactor and multilevel approaches are essential to tackle energy problem.

Energy poverty is often approached from local communities such as the English Energy Cafes (Martiskainen, 2018) bearing in mind that energy poverty is a poverty problem and is therefore very sensitive to fear of stigmatization. Social problems must be delicately treated from proximity (Bouzaroski, 2015). The just energy transition would be the result of changes in different areas by way of involvement and participation of all social actors (Jenkins et al, 2018).

The *Living Labs* in Cahors, France (Claude et al, 2017) offer an example of co-creation of innovation with vulnerable consumers, governance of collaborations and multidisciplinary work and the relevant role attain by University and municipality. The interventions with private financing must have the user vision for the non-commercialization (O'Brien and Hope, 2010).

The complexity of implementing renewable energy projects through local communities creates new ways for local development with a human-centered approach (Picciotti, 2017; O´Brian and Hope, 2018). Social entrepreneurship initiatives through collaborative networks could activate new paths to bottom-up development (Okkonen and Lehtonen, 2016).

The different actors forming the network should speak the same language and share the cultural lens. The same awareness and priority of the problem are challenges for all actors, including for the vulnerable groups (Butler and Sherriff, 2017). Together with network skills and learning capacity process, all actors needs to share common goals like sustainability or climate change (O´Brian and Hope, 2018) and formalization of the relationship among the members and empowerment of all parties should be enhanced (Barrios and Blocker, 2015).

The need for the holistic perception of the community in a just energy transition and how energy poverty may be reduced thanks also to the coordination of the collective social entrepreneur. We support Sovacool (2014) line of research related to the interactive and

collective processes to enhance innovation, commercialization, and business development in energy poverty issues.

Trust, coordination, and communication are required in relationships within the networks (Sahakian and Dobigny, 2019; Wu et al, 2018; Picciotti, 2017; Webb, 2015). Community initiatives have more visibility in promoting bottom up public policy creation (Piccioti, 2017) and have a greater effect for the better adoption of green energy technologies in neighborhood homes, while local authorities have a preponderant role in the promotion of energy efficiency measures, more feasible than from the State due to proximity (Bale et al, 2013).

Bottom up initiatives in the formation of public policies.

This section is related to the structured insights that interventions in energy poverty could provide to policy making. The final goal of the private interventions should be provoking bottom up integrated and better formed public policies. Such interventions could help partially eradicate the problem in a non-exclusive systematic and structured approach. Since energy sector is regulated the requirement of public intervention is clear. The question is how public administration should intervene (O´Brien and Hope, 2018). The level of public policies is different depending on the countries, for instance, in the UK fuel poverty policies started already in the 70s (Sovacool, Lipson and Chard, 2019).

Policy makers influence in solving energy poverty is reflected in the continuous references to insights to public policies (Sovacool and Mukherjee, 2011). Although there were a few isolated successful cases in top-down policies (Fu et al, 2014), a more accepted approach indicate that bottom-up public policies could promote innovation and energy efficiency in a more inclusive way with a more relevant human-centered approach (Okkonen and Lehtonen, 2016).

Karlson (2016) called the moral obligation of rich countries for global sustainable innovation policies. This obligation justifies the inclusive transition or the development of regional, local and rural renewable policies with the tensions that arise showing the lack of technical capacity to the local administration to face such complex problems that mix sustainability and energy poverty (Okkonen and Lehtonen, 2016).

There are multiple tensions between the division of state, regional and local competencies in the field or the lack of knowledge of public leaders to face problems of energy poverty and climate change. The policies should look at the long term and not allow the confusion among energy poverty and climate change policies (Webb, 2015). Policies should promote the reduction of energy consumption and renewables for sustainable transition. Politicians should be the leaders in the inclusive transition and responsible to develop good practices to be extrapolated to other countries (Power, 2018). Sovacool et al (2019) adds the need for the development of inclusive policies that do not leave anybody behind. It is not common that the role of project coordinator is held by local authorities and not by private entities, but it is a success factor if such leaders are fully trained in all technical and social skills, as was reflected in the wind projects of Northern Scotland (Okonen and Letonen, 2016).

Public policy on energy poverty and general poverty should co-evolve constantly with technical progress and with the social communities views, so future research could focus on how social entrepreneurs could be the bridge among vulnerable groups and politicians to make sure that all human-centered aspects are clearly transferred to the corresponding legislation. There are 7 articles in Energy Policy journal, which show significant of the relevance of public policies to tackle this problem.

4.- The role of the inclusive sustainable transition.

In this section we focus on the references to inclusive transition in this review that is reflected in most of the articles. Sustainability transition includes transition to renewable energy and fight against the climate change appearing transversally linked to energy poverty, so that vulnerable consumers are not left behind since they will more suffer the consequences of the climate change or the non-use of low carbon resources.

Social lens are required in the energy transition (Jenkins, Sovacool and McCauley, 2018). Imaz and Sheinbaum (2017) see the industrial energy transition to renewable energy more complicated due to the structural changes of infrastructures but they argue that the green transition in the domestic sphere would be possible. This study also found several approaches to intersections of domains like energy consumption of buildings, energy poverty and climate change. New schemes would allow that the global impact of each sector is diminished (Santamouris, 2016). Sovacool (2014) gives voice to the energy

poverty in this transition and raises the potential of energy studies to expand the qualitative methodologies highlighting the person.

In most of the articles energy efficiency objectives are more linked to the environmental causes than to the fight against energy poverty, and the same applies to the green taxation. Climate change effects are devastating on health and energy poverty, and we should move to positive actions (Costello et al, 2011). Knutt (2019) also mentions climate retrofitting in the US environment and that only sustainable policies should be considered in transitions. Silvestre and Tirca (2019) also talks about the tensions between innovation and sustainable, green, and social innovation defending the triple balance for sustainable innovation. The main finding is the prevalence of the sustainability discourse in the review since energy efficiency objectives seems more linked to the environmental cause than to the reduction of energy poverty.

Discussion and lines of research

After the conceptualization of this literature review, some drivers and challenges are identified for social entrepreneurs to activate their ideas and help them mobilize other actors. Acknowledging the presence of the networks and collective dimension through he review, the use of trust, communication, and coordination skills are required for the involvement of all players (Montgomery et al, 2012; Okonen and Letonen, 2016, Jenkins et al, 2018, Sahakian and Dobigny, 2019; Wu et al, 2018; Picciotti, 2017; Webb, 2015). Moreover, the proactive role of all sizes of companies to achieve it is facilitating the framing of Sustainable Development Goal 7 (Nathwani and Kammen, 2019; Liu, 2019; Wu, 2018). Training in both technical and sustainability issues and co-creation of private companies with third sector and exchanges of profiles between NGOs and companies should be promoted (Brugmann and Prahalad, 2007) to tackle energy poverty.

Energy efficiency and green retrofitting are source of new employment in the context of energy poverty (Osunmuyiwa, and Ahlborg, 2019; Dandara, Tabacaru, and Danila, 2017; O´Brien and Hope, 2018; Knuth, 2019; Sdei et al, 2015; Dineen et al, 2015; Bale et al, 2019; Streimikiene and Balezentis, 2019; Sahakian and Dobigny, 2019; Santamouris, 2016). The same would apply to social innovations in social housing (Sovacool, Lipson and Chard, 2019; Knuth, 2019; Streimikiene and Balezentis, 2019), user-centre

approaches, humanizing development, and co-innovation with vulnerable consumers (Claude et al, 2017; Boni et al, 2016¸ O'Brien and Hope, 2010).

The findings have also inspired the identification of several barriers to social innovation/entrepreneurship in energy poverty. There is not a widely adopted definition of collective social entrepreneur (Kalt, 2019), a fact that impairs the acceptance of leadership and coordination capabilities. The non- systematic application of energy justice principles in energy poverty initiatives may affect the non-inclusivity of the energy transition. Moreover, a lack of strong leadership by the State is perceived through frequent references to policy insights found in most of interventions of the review. The responsibility to tackle energy poverty seem to correspond to the public sector, but this transfer of responsibility may explain the isolation of community initiatives in promoting bottom up public policy creation (Piccioti, 2017). There is a lack of a clear global legal environment, mixture of competencies among several levels like regional and municipality policies in Europe to combat climate change and social inequalities (Patkos et al, 2019; Power, 2018; Okkonen, and Lehtonen, 2016; Karlsson, 2016; Sdei et al, 2015; Webb, 2015; Fu, Kelly, Clinch, 2014¸ Streimikiene, and Balezentis, 2019).
The network of energy poverty is key in the mitigation of energy poverty but seems not to be properly coordinated (Webb, 2015; Bale et al, 2013) since not all actors have adequate levels of information, awareness and training, especially the public administration (Butler and Sherriff, Martiskainen, Heiskanen, Speciale, 2018; Elia, and Margherita, Claude et al, 2018; Sahakian, and Dobigny, 2019) and the relationships between climate change issues and energy poverty are often misunderstood (Schaffrin, and Reibling, 2015; Santamouris, 2016). The overcome of those barriers could lead to more structured interventions to be carried out.

The present study offers some limitations which need to be mentioned: (i) the selection of the keywords might leave out other initiatives that may also respond to the same concept but do not appear in this research, (ii) this study has not intended to carry out quality appraisals of the articles reviewed provided its exploratory objective within the intersection, although the citation check has given a high level reference; and (iii) the exclusion of articles from non-impact journals, conference publications or languages other than English, could limit the inclusion of all relevant articles (Okoli, 2015)

Essentially, the purpose of this review is to provide a summary of the intersection of social entrepreneurship/innovation and energy poverty, stating new lines of research (MacInnis, 2011). One line of research could be the structural application of the collective dimensions of social entrepreneurs to energy poverty. The study of intra-organizational gains such as management, ownership and governance mechanisms that increase efficiency (Sovacool, 2014) could also be explored. Efficiency understood as fewer resources to achieve the objective of reducing energy poverty. The agency of the social entrepreneur as intermediary may help ensuring the involvement of human-centered aspects (Claude et al, 2017; Boni et al, 2016¸ O'Brien and Hope, 2010). More research could be done on new ways of organizing through sustainable business models and how such models may affect energy poverty.

The relationship within the social network around energy poverty could be a new line for research to deeply analyze the challenges of communication, listening, and awareness of social changes (Hu et al, 2016) or how to apply resource leveraging methods in those networks or social movements. There is an apparent lack of availability of funding to alleviate energy poverty (Martiskainen et al, 2018) and a lack of study of social aspects in energy communities, such as motivation or competitiveness versus sustainable values in energy communities (Okkonen and Lehtonen, 2016). The social entrepreneur could support and coordinate the network and promote policies that could finally solve the root cause of energy poverty, always taking into account that the energy transition must be inclusive and not leave behind the most vulnerable groups.

Additionally, much of the existing literature on energy poverty focuses on the early stages of the process (e.g. indicators, identification, smart meters) (Pye et al, 2015) so more research on interventions in energy poverty could pay attention to diffusion, tipping points, and to long-term innovations and not just emergence situations.

Last line of research could be how actors should be involved in transitions and provide insights to public policies so that policy makers understand integratedly the effects of interventions from social entrepreneurs. The identification of limits to collect reliable data could lead to avoiding errors of exclusion in political measures (Dineen et al, 2015; Sovacool and Mukherjee, 2011).

Also, the implementation of energy justice principles in energy social companies (Sovacool and Mukherjee, 2011, Jenkins et al, 2018; McCauley et al, 2019; O´Brien and

Hope, 2010) and the role of social innovation (pioneers and incumbents) in energy transitions (Silvestre and Tirca, 2019; Sovacool et al, 2019; Jenkins, Sovacool and McCauley, 2018).

This work would also have implications in practice since its final purpose is minimizing energy poverty in developed countries. This review leads to the pre-science from Corley and Gioia (2011) since (i) it pays attention to future emergent domains and complex problems; and (ii) it has the focus of improving the relationship and communication between academia and practitioners. Collective social entrepreneurship and innovation may be an alternative, partial, and non-exclusive solution to reduce energy vulnerability.

The number of energy vulnerable people is going to increase after the COVID-19 crisis. Therefore, exploring an actor like the social entrepreneur could provide non-exclusive solutions in this field given his or her hybrid character towards social and income generation could be a line of research which has still not been properly addressed to obtain a structured approach to all interventions.

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Figure 1. Prisma flow chart of the systematic literature review.

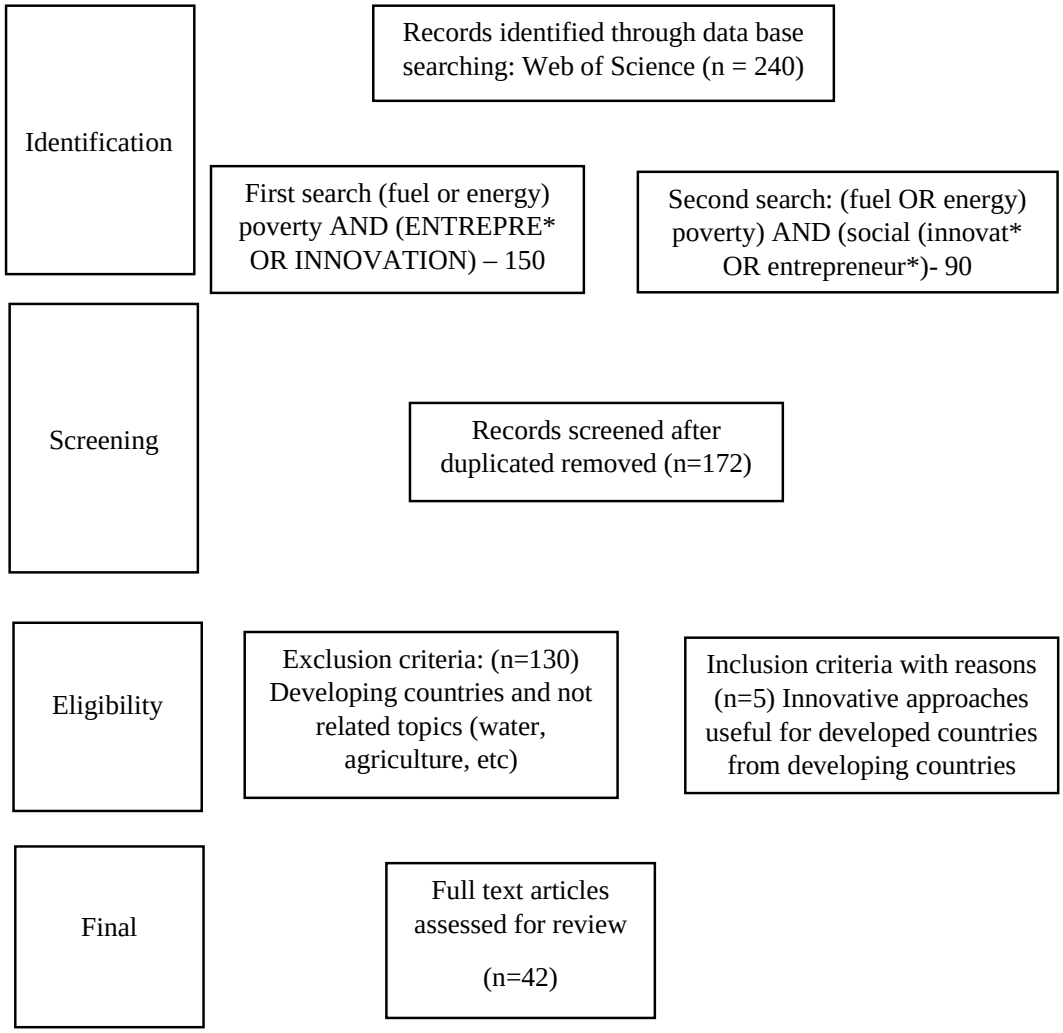


Table 1. Methodologies and citations in each article of the systematic literature review

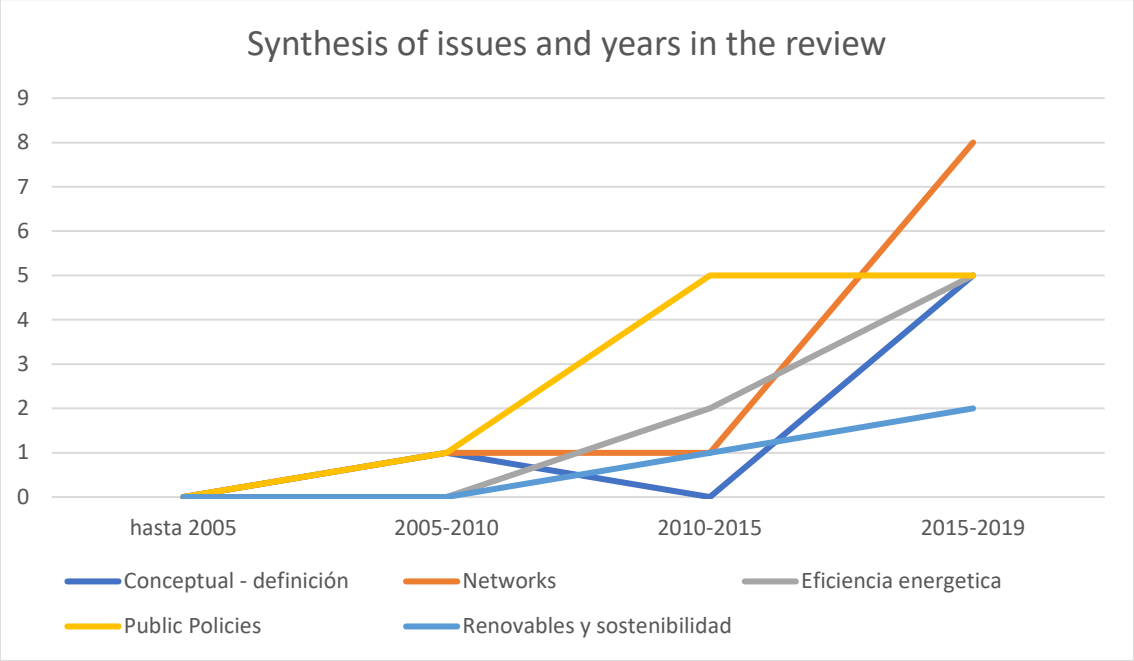
	Reference	Cites	Method	Summary
1	Nathwani & Kammen (2019)	2	Qualitative	Social Entrepreneurship, Clean centres for energy poverty, Networks
2	Patkos et al (2019)	1	Qualitative	Public policies, community innovations, Climate change
3	Kalt et al (2019)	7	Qualitative	Energy poverty, definition, energy services
4	Osunmuyiwa and Ahlborg (2019)	5	Quantitative	Entrepreneurship, employment, gender, and energy
5	Pueyo and Maestre (2019)	8	Both	Energy poverty conceptual definition, gender
6	Sovacool, Lipson & Chard (2019)	10	Qualitative	Energy justice in household low carbon, Retrofitting innovations
7	Knuth (2019)	8	Qualitative	Retrofitting, green growth
8	Silvestre & Tirca (2019)	43	Quantitative	Literature review of innovation, sustainability
9	Lu et al (2019)	4	Quantitative	CSR, companies, SDGs
10	McCauley et al (2019)	26	Quantitative	Energy justice, interdisciplinary energy research, low carbon
11	Power (2018)	1	Qualitative	Regional and municipality policies, climate change and social networks
12	Elia & Margherita (2018)	11	Quantitative	Conceptualization of complex problems
13	Jenkins, Sovacool & McCauley (2018)	63	Both	Energy justice and humanizing, transitions, invisibility
14	Boerenfijn et al (2018)	21	Qualitative	Innovations, energy efficiency, social housing, older adults
15	Martiskainen, Heiskanen & Speciale (2018)	16	Qualitative	Information, awareness, innovation
16	Claude et al (2017)	16	Qualitative	Energy efficiency, innovation, municipality and university role, user´s centre
17	Butler & Sherriff (2017)	14	Qualitative	Identification, young adults, awareness, and information
18	Picciotti (2017)	22	Qualitative	Social enterprises, sustainability, cooperatives, collaborative networks

19	Dandara, Tabacaru & Danila (2017)	3	Quantitative	Role of the financial system for social welfare
20	Imaz and Sheinbaum (2017)	17	Qualitative	Science and technology, SDGs, networks, research
21	Hu et al (2016)	0	Quantitative	Nigeria, discourse of energy poverty and social entrepreneurship
22	Boni, Leivas & De la Fuente (2016)	0	Qualitative	Innovation for human development, invisibility
23	Karlsson (2016)	10	Quantitative	Public policies, innovation, climate change
24	Okkonen & Letonen (2016)	59	Qualitative	Community wind power projects, rural public policies, social entrepreneurship
25	Sdei et al (2015)	14	Quantitative	Retrofitting, public policies, social housing
26	Dineen, Rogan & Gallachoir (2015)	32	Quantitative	Innovation centres, energy efficiency, limitations to data gathering
27	Barrios & Blocker (2015)	10	Qualitative	Community-centrist public policy, entrepreneurs of subsistence
28	Webb (2015)	29	Qualitative	Public policies, lack of coordination in networks, social innovation
29	Schaffrin & Reibling, 2015	32	Quantitative	Public policies, energy efficiency, climate change
30	Fu et al (2014)	11	Quantitative	Public policies, heating, climate change
31	Bale et al (2013)	53	Quantitative	Networks, energy technologies
32	Sovacool & Mukherjee (2011)	396	Both	Public policies, data gathering, energy security
33	Dyck (2006)	11	Quantitative	Planning, Networks
34	Sahakian & Dobigny (2019)	3	Qualitative – case studies	Public policies initiatives, awareness. communication in networks, energy transition, reduction of consumption
35	Streimikiene & Balezentis, (2019)	1	Quantitative	Public policies, retrofitting, Russia
36	Nunes (2018)	3	Both	Identification, older adults
37	Sovacool, Axsen & Sorrell (2018)	137	Both	Research in energy and science, excellency, energy social science
38	Wu et al (2018)	114	Qualitative	Networks, communication, SDGs
39	Santamouris (2016)	129	Qualitative	Innovating, energy efficiency, climate change

40	Costello et al (2011)	78	Qualitative	Climate change, positive action
41	O'Brien & Hope (2010)	120	Qualitative	Public policies, localism and centralism, private funding, user focus
42	Brugmann & Prahalad, 2007	488	Qualitative	Private sector and third sector. Networks relationship among NGOs and companies

Source: Elaborated by author

Table 2. Timing of publications of the articles selected in the review

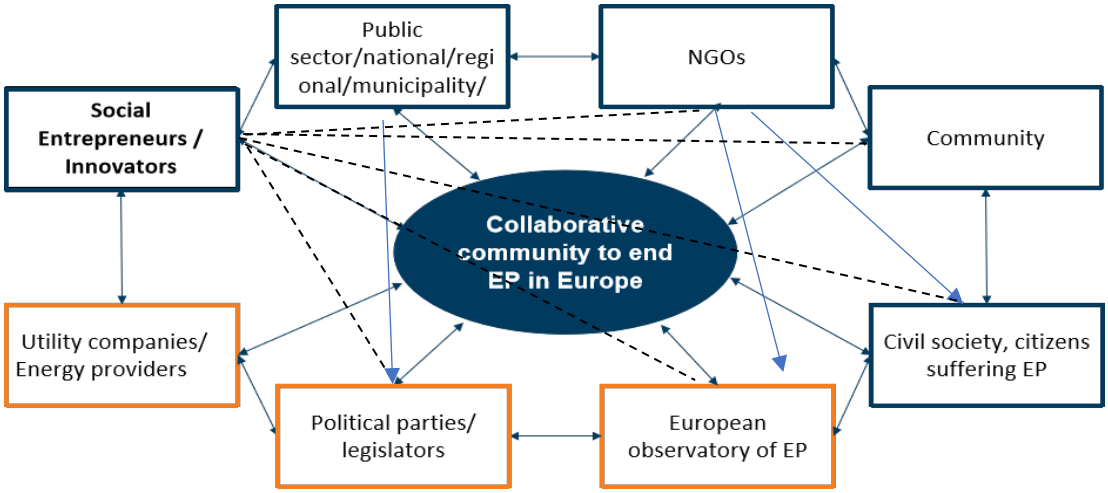


Source: Elaborated by author

Table 3. Categories found and subtopics in each category

	Categories found	Subtopics in each category
1	Perspectives of energy poverty considered	Concept of energy poverty, vulnerability, energy justice, invisibility, stigmatization, user behaviour, individual or household consumption patterns, energy security, social-political change.
2	Roles and nature of social enterprises in the network of energy services in energy poverty	Research development and demonstration, market diffusion, innovation, technological learning, trade, technology transfer, financing, network
3	Elements of the solutions offered by the interventions in energy poverty.	Role of infrastructure and housing: energy efficiency, retrofitting, economic development, energy consumption, spatial attributes, r&d, innovation, bottom up, public policies, tariffs, energy governance, institutions, organizations, investment, public policy, feed-in tariffs, urban and rural.
4	Role of renewable energy and climate change in sustainable transition.	Climate change, greenhouse emissions, mitigation, geo-engineering pollution urban planning, mining, land use planning, geography, industrial processes, manufacturing, geopolitics

Figure 2: Energy poverty network



Source: Prepared by the author