Collective Action in the Energy Sector in the European Union and the United States

A comparison between the EU and the US and the potential for scaling up to impact the energy transition

G. Winston Gilcrease
Network for the Advancement of Social and Political Studies (NASP)
University of Milan

Advisor: Prof. Dario Padovan, University of Turin
Tutor: Prof. Luca Storti, University of Turin

There's no topic on the planet more important right now than democratizing energy—that's the precondition for the massive buildout of renewable energy that should be the chief occupation of a warming planet for decades to come.

Bill McKibben, author, educator, environmentalist, and co-founder of 350.org

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CHAPTER 1

INTRODUCTION

1.1 The Rationale

As climate disruption intensifies worldwide, and energy demand and carbon emissions continue to rise, the immediate scaling up of a sustainable energy transition is critical. The International Energy Agency (IEA) reported that worldwide energy demand is increasing faster than renewables deployment while still propelling fossil fuel production. The IEA also estimates world primary energy demand will increase by 30 percent by 2040 (IEA, 2017), meanwhile the IEA declared that carbon dioxide levels reached 412.5 ppm in 2020, the highest average annual concentration and 50% more than at the beginning of the industrial revolution (IEA, 2021).

Although there are a number of international and national environmental targets that lay out ambitious energy consumption and renewable energy goals, they still do not measure up to the scale of the challenges associated with the climate crisis. The majority of large incumbent players in the energy markets, i.e. utility companies, are still lagging behind in their efforts for an impactful energy transition to renewables. Many existing environmental and socioeconomic concerns highlight the need to reconsider our global energy systems, demanding enormous renewable energy deployment to stay within a safe 1.5 Celsius global temperature rise (IPCC, 2021). Thus, galvanizing citizen-led collective action at the local and municipal levels has been seen as a key step to achieving widespread sustainable energy deployment for generations to come.

A new IEA energy pathway[1] determined wind and solar energy must quadruple by 2030, necessitating a dramatic transition in just a few years. This energy transition affects how individuals and companies consume energy and adapt to new resources and

[1] International Energy Agency. Net Zero by 2050: A Roadmap for the Global Energy Sector https://www.iea.org/reports/net-zero-by-2050

stakeholders. Government and corporate leaders in the European Union (EU) and the United States (US) have frequently neglected the value of citizen participation for the energy transition. Addressing environmental and social challenges, as well as scaling up renewable energy deployment, is strengthened by empowering individuals to participate in the transition. Citizen participation also addresses Energy Democracy's key environmental justice challenges, which includes the lack of equal access to renewable energy sources and energy poverty (Fairchild & Weinrub, 2017).

The prevailing paradigm of global energy infrastructure has been centralized, employing carbon-intensive sources with minimal participation from citizens and communities in production or distribution. The low-carbon energy transition is progressing, and, at the same time, centralized actors are losing public trust (Mumford & Gray, 2010). Thus, a number of experts, citizens, and policymakers are advocating for a decentralized structure (Bauwens et al., 2016). This includes small-scale power generation near customers and a shift from an individualistic to a cooperating, group-oriented, 'commons' mindset. Decentralized energy at the community level is viewed as an effective way to move to low-carbon energy systems that has potential to disrupt global energy regimes (Seyfang et al., 2014).

A just energy transition requires innovative social, economic, and technological advances. Therefore, this dissertation demonstrates how citizens are reimagining our global energy systems to provide energy access to everybody, particularly in marginalized communities, that, in turn, helps to stable markets while responding to climate change.

Collective Action Initiatives (CAIs) have diverse goals, but they always aim to balance economic, social, and environmental demands (all components related to sustainable development), both locally and globally. Measurement of social innovative CAIs in the energy transition extends beyond individual CAIs. The objective is to establish a strong qualitative and quantitative measure of their collective contribution to the energy transition. This empirical investigation in this dissertation is reinforced with qualitative 'frontier' case study data from the EU and US.

Frontier case studies (see Chapter 6) attempt to emphasize elements that go beyond standard energy CAI development, which focuses on wind, solar, biomass, and energy efficiency implementation. These cases involve socially and structurally innovative CAI concepts, which includes the deployment of low-carbon transportation services and crowdfunding opportunities.

Frontier case studies are energy CAIs with unique and novel features or unusual mixes of existing collective action elements. Therefore, Chapter 6 highlights initiatives that might be considered difficult to categorize, which can help plant seeds for the development of future niche-level initiatives. This dissertation's value is the data analyses in Chapters 4 and 5, which are complimented by frontier case study results and key takeaways in Chapter 6.

1.2 The motivation

For this dissertation, I am investigating the different typologies of institutions (macro level) in relation to action (micro level) through a framework of perspectives that demonstrate how bottom-up (niche-to-regime) and top-down interactions produce "windows of opportunity" (Klein & Coffey, 2016) in order to advance social innovations that can drive forward the energy transition.

Shedding light on collective action in the energy transition requires a sound conceptual and theoretical foundation that includes an understanding of motivations, rural-urban dimensions and socio-technical issues through quantitative and qualitative analyses, to guide this dissertation research. Additionally, for the past three years, the European Commission-funded project, COMETS (Collective Action Models for the Energy Transition and Social Innovation), has been aligned with the research path for this dissertation, especially in the contributions of investigating energy Collective Action Initiatives (CAIs) in Europe.

Therefore, this research quantitatively and qualitatively investigates energy CAIs in the energy transition in Europe[2] and the United States and their typologies as so-called democratic and participatory organizations, while investigating their potential for establishing equity and democratic processes by considering communities' energy justice and environmental stewardship concerns. Energy CAIs are considered to be agents for empowering local communities and fostering behaviors that will affect the energy transition and social innovations. They are often assessed on the core *sustainable development* concepts of economic, environmental, and social indicators (UN ECOSOC, 2021). Most case studies show that energy CAIs function under sustainable development standards that apply to social responsibility and advocating for one's community, as well as promoting the social, economic, and environmental wellbeing of members.

A number of studies have highlighted the democratic characteristics of energy CAIs, which provide legitimacy to the principles of increasing individuals' influence over their energy provider (Van der Schoor et al., 2016). The Institute for Local Self-Reliance defines energy democracy as "an energy system that is democratic, where decisions are made by the users of energy" (Farrell et al., 2016). The concept of 'energy democracy' is grounded in social and environmental justice movements, which go beyond only transitioning to clean, affordable, renewable energy, but to give a greater understanding of the political, cultural, and socioeconomic components of the climate change crisis (Fairchild & Weinrub, 2017). Barr and Devine-Wright (2012) found that energy CAIs projects helped to stimulate a more "sustainable and resilient society while offering communities legitimacy, consensus, and voice" (Barr & Devine-Wright, 2012).

From a regulatory standpoint, the citizen engagement issue in the energy field is also at the center of the European Commission's low carbon development goals. This is acknowledged in the EU's Internal Market and Renewables Directives under the Clean Energy Package ("Clean energy for all Europeans") enacted by the European Parliament and Council in 2019, representing the most clear and far-reaching policy goals on empowering and engaging individual and collective consumers, putting citizens at the

[2] Note that this investigation of European Union energy initiatives started before the UK's official exit out of the EU ("Brexit"), therefore when referring to the UK, I will be using Europe instead of EU

center of the sustainable energy transition (European Commission, 2021). The EU's Clean Energy Package gives consumers the same rights as established market actors to engage in energy markets and outlines "enabling frameworks" for energy CAIs (COMETs D5.2, 2021).

In the US, apart from the New Deal support for rural electric cooperatives, no supportive national level policy has existed until the recently enacted Inflation Reduction Act in 2022. This national law provides more than $12 billion to “partner with rural and Tribal communities to help them access more clean energy, make their energy systems more reliable and resilient, and lower their electricity costs.” (see *section 3.7.6 US. History - The 1970s to Today* for more details.) One such attempt is the Department of Energy’s 2012 guide to enabling community energy around the country (Coughlin et al., 2012). This guide, however, is not consistent with the principles of community-led, democratic ownership and management, instead it encourages large utilities to take the lead in developing community projects. The DOE’s guide also fails to emphasize support for marginalized communities that have historically been impacted by fossil fuel development (Baker, 2021). However, almost half of the country (twenty-three states and Washington DC) have adopted some form of supportive community energy policies. (See *Chapter 4* for more details.)

In the coming years, the transition to sustainable energy will have an impact on societies and people’s daily lives. To achieve this transition in a legitimate way, collaboration between citizens, institutions and incumbent energy players are shown to be crucial conditions (Campos & Marín-González, 2020). There are a number of cases showing the social, economic, and technological advantages that decentralized systems have over centralized ones. Advantages include the strengthening of cooperation in communities, grid power disruptions, reduced transmission and distribution costs, and a larger share of low-carbon technologies that are tested and implemented at economies of scale (Bauwens et al., 2016).

A number of research investigations have devoted attention to sociological and economic aspects of collective action and social innovation for the energy transition, from population attitudes and motivations for adopting innovative ownership business models (Gorroño-Albizu, 2019) to how they mobilize within energy markets (Gregg et al., 2020). In fact, from 1990 to 2021, there have been around 4,300 academic articles indexed in the Web of Science database, retrieved using the following keywords-string: ((collective action OR social innovation) AND (energy)). Since 2005, there has been a significant increase of interest in research and publications in this subject (Figure 1.1).

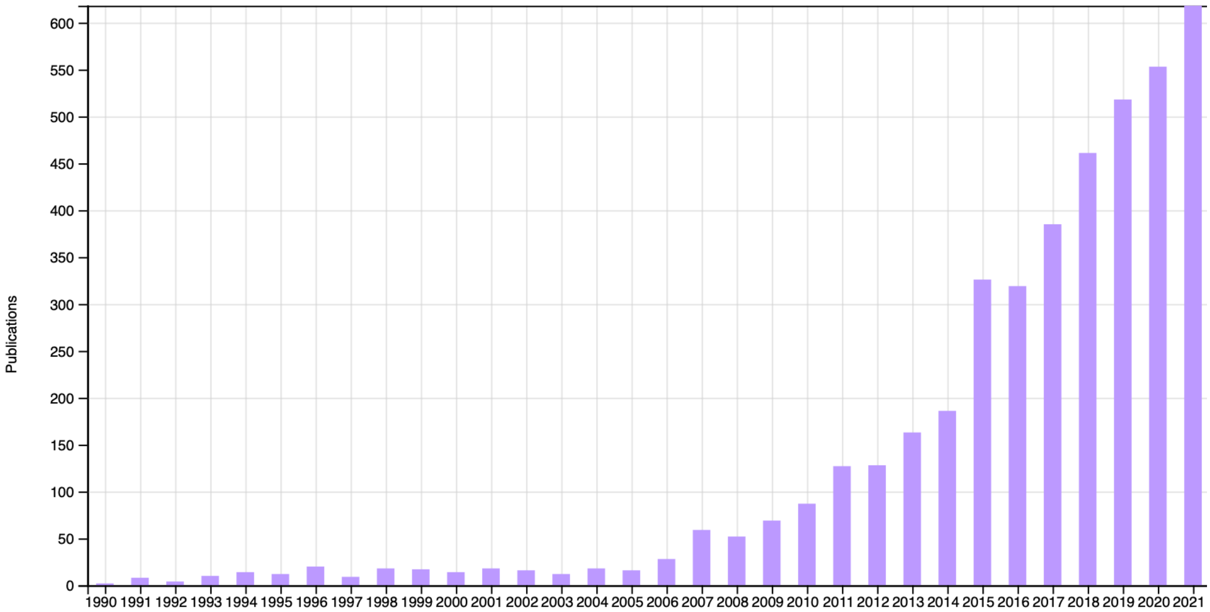


Fig. 1.1: No. of publications indexed (1990 to 2021) in Web of Science retrieved under keywords-string: ((collective action OR social innovation) AND (energy)). Date of search: March 2022

The arguments of collective goods emerging from collective action are introduced by Olson and Ostrom. When managed by a form of collective action, energy emerges as a collective good from both processes and outcomes (Gregg et al., 2020). Other leading scholars, such as Mark Granovetter and James Coleman, advanced the concepts of social capital, trust and embeddedness in the energy system. In fact, a number of scholars underscore the concept of 'social capital' as an essential contribution to foster a community's potential to manage environmental and societal challenges with collective action (Minard, 2009).

For this to be realized, trust among community members, as well as trust between members and institutions, needs to be established (see section *2.3 Social Capital* and its fostering of cooperation and trust), thus brining more opportunities to continue mutually beneficial social transactions, regardless of individual sacrifices. (Bowles & Gintis, 2002; Ostrom, 2003). Such theoretical analyses have extended merits that help to shine light on the social limits and potential of the energy transition (Bauwens et al., 2016).

There is huge potential for decentralized energy in the energy transition, using collaborative approaches to produce sustainable energy technologies (Bauwens et al., 2016). In the EU and US, a variety of energy CAIs - from electric cooperatives to eco-villages - have evolved in diverse forms for over a century to challenge centralized energy sources and support a low carbon energy system. The energy services they offer are varied and include anything from district heating, IT solutions, and energy efficiency consultancy to the provision of power (Wierling et al., 2018). Energy cooperatives, for example, enable and engage citizens with democratic ownership of their energy and to consume energy with more awareness and responsibility.

In the EU and the US, energy CAIs also have certain challenges that may limit their potential. Energy CAIs, particularly cooperatives, have a legitimacy challenge since they are seen as "hybrid organizations" that don't fall within the established organizational categories (Huybrechts et al., 2020). It is anticipated that widespread citizen engagement in the energy transition would enhance energy CAIs, including the cooperative mode, and have a bigger impact on the wider community.

This research focuses on the experience from both regional perspectives. In addition to a data analysis, the investigation uses qualitative case study research from both regions. This, in turn, deepens the investigation into how varying regulatory systems, credibility perceptions in energy communities and energy regimes, key financial mechanisms, and other variables can support or hinder local, citizen-led energy projects.

1.3 Research Hypotheses

This dissertation research path started with a core set of research hypotheses, namely:

- Collective action is a key way to trigger the energy transition and social innovation.
- Collective Action Initiatives (CAIs) are an existing reality in the U.S. and Europe.
    - *thus, they must be mapped.*
- CAIs present different features when comparing Europe and the US.
    - *A comparison of CAIs between the EU and US can help the understanding of their historical dynamics.*
- CAIs can drive the energy transition further when scaled up.
    - *The future scaling up might present new features and challenges, for example in the relations between CAIs, the market, and the public rule.*

1.4 Research Questions (RQs)

The research that was conducted for this dissertation was guided by a series of research questions:

1. **Why is collective action so crucial for the energy transition? (theoretical)**
    - *What are the primary motivators for community involvement in the field of renewable energy?*
2. **What are Collective Action Initiatives (CAIs) in the energy sector? (definition)**
    - *Based on the literature, how can we characterize citizen-led renewable energy efforts and set them apart from both private and commercial initiatives?*
3. **Where are energy CAIs located? (mapping)**
    - *Are we able to find a distinct rural-urban relationship?*
4. **What are their typologies and how do they work? (descriptive)**
    - *What are the social and economic mechanisms that promote the creation and scaling up of CAIs in the energy sector and what are the barriers?*
    - *What fosters cooperation in the form of collective action in energy? (formal –institutionalized-- and informal)?*

- *Core social dynamics: Similar affiliations, cultural backgrounds, behavioral features and other factors?*

5. **Can CAIs in the energy sector support the energy transition in future landscapes? (future roadmap)**
    - *What are the actual and potential determinants by various types of CAIs in the energy sector, especially in the EU and the US, for the potential, scalability, and capability of locally driven renewable energy production?*

1.5 The structure of this dissertation

Chapter 2 provides a dynamic conceptual foundation that assists in defining collective action and the energy transition, which leads to a theoretical framework that forms the lens through how I contextualize and interpret energy CAIs. Of course, not one single theory can adequately describe all of the processes involved, but by integrating six prominent theories, the research hones a more comprehensive perspective of the structure. Chapter 2 corresponds with **RQ1 and RQ2.**

Chapter 3 presents an in-depth historical analysis of both the EU and the US, which demonstrates how citizen-led energy initiatives were established in both regions with similar and different developments since their beginnings in the early 1880s. This chapter also compares and contrasts the two regions. Chapter 3 corresponds with **RQ2.**

Both Chapter 4 and Chapter 5 go further into the data that is currently available in order to comprehend and contextualize the overall scenario in the EU and the US. Chapters 4 and 5 correspond with **RQ3 & RQ4.**

Chapter 6 provides several innovative case studies, or so-called “frontier” cases, that provide key takeaways for innovative models that can be adopted to scale up collective action in the energy field. Chapter 6 corresponds with **RQ5.**

Lastly, this dissertation is summarized in Chapter 7, which concentrates on the most important takeaways.

Chapter 2

CONCEPTUAL FOUNDATION & THEORETICAL FRAMEWORK

Collective Action, Social Capital, Social Innovation, and the Energy Transition

Background

Research into the energy transition takes into account not only technical, material, and organizational perspectives, but also political, economic, and sociological ones. Several studies contend that we need to have a more holistic view and synthesize different perspectives in order to fully understand the interplay of power in societies (Newell, 2019; Husu, 2022).

Thus, Chapter 2 is split into two parts: **Part I. Conceptual Foundations of collective action for the energy transition.** This first part provides a systematic description of key concepts focusing on the aim to describe a multi-faceted framework in analysing the energy transition that promotes energy democracy. **Part II. Theoretical framework of collective action to contextualize the energy transition.** This second part supports Part 1 by weaving leading theories of collective action and transition studies to create an overall framework to support the dissertation's research.

Collective Action has been a fundamental part of sociology and economics in their examination of social phenomena, from social change to movement mobilization. There are several theoretical models presented in literature that offer explanations about people's motivations for engaging in collective action – from Mancur Olson's *The Logic of Collective Action* (1965) and Charles Tilly's mobilization model (1978) to Elinore Ostrom'*s theory on collective action* (2009) – that present key insights to understanding how individuals are addressing large, complex problems, such as climate change and the energy transition to renewables, with collective action. Certainly, this requires filling several knowledge gaps. This chapter provides both a conceptual foundation and theoretical framework that will help contextualize the accompanying chapters in an effort to compare Europe and the United States in collective action for the energy transition.

In its simplest description, collective action is "a solution that humans embrace to cope with problems that are individually unsolvable" (Rosenthal, 1998). While this is a great starting point and provides a good foundation, it doesn't quite encapsulate all the nuances of collective action in the energy field. Collective action in the energy field has been supporting the growth of a decentralized energy market and overall system change for a number of decades, shifting from a traditionally centralized energy market controlled by large, incumbent actors (utility companies). The evolution of a decentralized energy system in both the European Union (EU) and the United States (US) has included many individuals who are collectively engaging to implement innovative solutions that address traditional fossil-fuel based energy markets. **More specifically, so-called Collective Action Initiatives (CAIs) in the energy sector, which include energy cooperatives, producer-consumers ('prosumers'), solar communities, purchasing groups, eco-villages, renewable energy communities (RECs), and other community-led projects, have been gaining relevance as an innovative actor of the energy system.**

Energy CAIs is a term used throughout this dissertation. They are seen as a form of social innovation with the aim of transformational change from a variety of social, cultural, and technical perspectives. The core values enacted by energy CAIs are socially innovative in how they organize and empower citizens through a social movement mechanism, combining local action related to energy justice, equity and inclusion (Gregg et al., 2020).

Additionally, this research investigates how CAIs are a form of social innovation that aims to stimulate institutional change, thus the concept of Transformative Social Innovation (Bauler et al., 2017), which stems from an integration of *sustainability transitions* with *social innovation theory,* will be applied by combining knowledge from social innovation theory and sustainability transitions (see *section 2.7, Second Wave of Collective Action Scholarship*).

PART I:

CONCEPTUAL FOUNDATIONS OF COLLECTIVE ACTION FOR THE ENERGY TRANSITION

2.1 What is the energy transition to renewables?

The energy transition is the shift from producing energy primarily from heat-trapping fossil fuels to clean, renewable sources. According to sustainability transition scholars, the energy transition is complex by technical, organizational, institutional, and social factors (Sovacool, 2016; Markard et al., 2012; Acosta et al., 2018; Baker, 2021; Seyfang & Haxeltine, 2012). Furthermore, Markard and colleagues summarize sustainability transitions, which is aligned with the energy sector, as

> "long-term, multi-dimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard et al., 2012).

The international community has identified the low carbon energy transition as one of the key factors to mitigate climate change and foster sustainable development (see 2015 UN Sustainable Development Goals[3] and 2015 Paris Agreement[4]). Additionally, the UN Earth Charter[5] also implores an energy transition while at the same time promoting energy democracy and community development in Principle 7 of the renowned Charter:

> "Principle 7. Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being […] b. Act with restraint and efficiency when using energy and rely

[3] UN Sustainable Development Goals: https://sdgs.un.org/goals
[4] UNPCC Paris Agreement: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[5] UN Earth Charter: https://earthcharter.org

increasingly on renewable energy sources such as solar and wind." (UN Earth Charter)

Energy Communities (i.e. energy CAIs) are making a significant contribution to the mitigation efforts of climate change by reimagining how energy can be produced, distributed and used. It is for this reason that citizens and communities must be recognized internationally as fundamental to achieving the objectives of the 2015 Paris Agreement. The UN General Assembly has also established a *Global Action Plan for Decentralized Renewable Energy*, placing decentralized energy systems as a key target to accomplish the Sustainable Development Goal 7, "energy access to all" (United Nations SDGs, 2021). However, while current international climate agreements have ambitious energy consumption and renewable energy targets, they do not aim high enough to strengthen community mobilization to target the environmental challenges we are facing.

The organization of the energy sector and its embedding into society is complex; we know little about how to steer the energy transition effectively and lack an understanding of its likely speed (Riahi et al. 2012, Sovacool, 2016; Miller et al., 2013). Research on the energy transition has primarily concentrated on market-based, technology-driven transformations, while social components are generally characterized as "social acceptance" (Gregg et al., 2020). Large knowledge gaps still remain around the enabling of an energy transition in a smooth and participative way – a way that empowers citizens to engage at the center of this transformation (Lennon et al., 2019). Without the consideration of their needs, concerns, and abilities, the success of this fundamental transition is at risk. What we do know is that the answers will reflect the contributions of different actors, the influence of various institutional structures and the complexity of the energy system itself (Geels & Schot, 2007).

The world's energy infrastructure has historically been highly centralized and mostly sourced from heat-trapping fossil-fuels, with minimal citizen engagement in energy production or distribution. The centralized, incumbent actors (utility companies) have lost trust from the public in the speed and management of the energy transition (Walker et al., 2010). Thus, a more decentralized structure of the energy system is being advocated by a growing number of scholars, citizens and policy-makers (Bauwens et al., 2016). Through collective action involving diverse stakeholders, energy CAIs aim to transform the centralized energy regime into a decentralized and democratic alternative (Campos & Marín-González, 2020).

Richard Heinberg, a journalist and educator writing about climate change and oil depletion, describes how energy CAIs, especially in the cooperatives model, address the climate crisis:

> "Energy cooperatives put ownership of energy infrastructure in the hands of the people actually using the energy produced. Unlike publicly traded corporations, cooperatives don't have to pursue increased shareholder value above all; they can strive for other goals, like sustainability and equity. Energy cooperatives are vital for the transition to renewable energy and to be successful, they will have to move faster than the market." (Fairchild & Weinrub, 2017)

Small-scale generating units near customers are needed to build a decentralized system. This also includes building trust and reciprocity among community members and between institutions (Bauwens et al., 2016). Implementing a community-level, decentralized system requires a variety of democratic ways for organizing and managing the processes and overall system.

Energy CAIs aid in achieving "energy independence" from incumbent utility companies by transforming energy systems using locally available energy sources. Through collaborative, open, and participatory decision-making at various levels of governance, these models seek to empower people and build "community power" (Campos & Marín -González, 2020), which, in turn, creates potential for disrupting the global energy regime (Seyfang et al., 2014).

2.2 Defining Collective Action and its relation to the Energy Transition

Collective Action Initiatives (CAIs) are already engaging in the sustainable energy transition and impacting energy systems in the European Union and the United States (Wierling et al., 2018; Gilcrease et al., 2022). Therefore, it is necessary to recognize the numerous facets of mobilization and citizen participation in the transition to renewable energy sources in the energy regime.

A significant role of energy CAIs is transforming passive energy consumers into active, participating end-users at a community level. Instead of acting as passive energy consumers, members of a CAI might take part in a variety of functions inside the energy system. (ILO, 2013; DECC, 2014). The majority of energy CAIs are aware of their potential and impact on the production, distribution, consumption, and distribution of energy, and hence how they can contribute to the transition to sustainable energy (Sciullo et al., 2020).

The importance of communities in transforming energy systems is increasingly receiving more attention from researchers and scholars (Alvial-Palavicino et al., 2011; Dóci et al., 2015; van der Schoor et al., 2016; Bauwens, et al., 2016; Burchell et al., 2016; Olson-Hazboun et al., 2016). Some of the services documented in literature that these collective action, community-based initiatives include producing energy, 'prosumerism' (produce and consume), installing innovative energy use technologies, managing energy demand, and purchasing energy.

Doci and colleagues view energy CAIs as "social niches" capable of "introducing social innovations in the electricity market resulting in new forms of organizations, business models and institutions" (Dóci et al., 2015). Several established social advantages of energy CAIs include alleviating energy poverty, fostering local economies, advancing energy justice, developing local skills and promoting social cohesion, and raising awareness about sustainable energy (COMETS D4.2, 2021).

The lack of knowledge about the decentralized energy paradigm is seen to be a key impediment to the scaling up of energy CAIs (i.e., collective action in the energy field) among key stakeholders (public sector officials, financiers, and the general public) (Huybrechts & Mertens, 2014). Thus, having familiarity and awareness of energy CAIs can play an important role in their success and growth. This knowledge might potentially lead to the development of a so-called "cognitive barrier" in countries where a variety of stakeholders (from citizens to industry leaders and policy makers) are less familiarized with the collective approach to the energy sector (Bauwens et al., 2016).

Energy CAIs contribute to building knowledge and raising the collective consciousness of the energy transition, especially of renewable energy as a 'common good' (Huybrechts & Mertens, 2014). Once awareness and recognition about the cooperative model and the challenges that it addresses has been established, opportunities for expanding energy CAIs can increase throughout a society (Huybrechts et al., 2014). Therefore, energy CAIs are a tool that can change citizens from being passive consumers (who simply pay their electricity bills while also feeling powerless in the face of environmental challenges) to engaged citizens who lead the way in collectively and democratically solving local energy and environmental issues (COMETS D4.2, 2021).

Energy CAIs may be related to issues like energy democracy and energy justice within the framework of **new social movements theory** (*see section 2.7.4*), since these efforts are often highlighted by an emphasis on open and voluntary participation, democratic governance, autonomy, and independence. (ICA, 2021). In-depth case study research on community-based projects from a number of European countries as well as the United States has further shown how they may help people to significantly reduce their energy footprint (see chapter 6 on 'frontier' case studies).

2.2.1 Preliminary definition of Collective Action Initiatives in the energy field

The concept of Collective Action Initiatives (CAIs) developed by COMETS (Collective Action Models for the Energy Transition and Social Innovation),[6] a European Commission

[6] COMETS Project website: http://www.comets-project.eu

Horizon2020 project, incorporates a number of literary precursors. These include community-based projects, social innovation, and sustainability transitions. Each of them, in line with CAIs, has particular manifestations in the realm of energy and is pertinent to many different action domains**. It is important to note that the term *Collective Action Initiative* is a more recently coined term by the COMETS project (COMETS D2.1, 2019) to encompass all the variety of community engagement that contributes to the energy transition.**

In both Europe and the United States, the forms of energy CAIs can be considered as cooperatives, purchasing groups, prosumers, solar communities, to name the most common forms (Sciullo et al., 2020). The organizational structure of decentralized initiatives is often examined to see if they are generated and managed top-down or bottom-up (Welch & Yates, 2018).

Members of an energy CAI might take on a variety of tasks within the energy system as opposed to taking part as passive energy consumers. There are several interpretations of the concept of collective action in the energy transition in the academic literature, and the methods in which civil society interacts with the energy market might differ (ILO, 2013; DECC, 2014). They can be referred to by some as any sustainable energy initiative that is neither governmental nor profit-oriented (Walker & Devine-Wright, 2008, Hall et al., 2016), or community energy initiatives driven by social and/or environmental demands, civil society activists, and grassroots innovation (Seyfang et al., 2014). They all have the ability to affect how and to what a degree energy is produced, distributed, and consumed (COMETS D2.1, 2019).

The term "Collective Action Initiative" or "community energy" is not used consistently across literature, and various researchers propose distinct categories. For example, the *Guide to Developing a Community Renewable Energy Project in North America* (Secretariat, 2010) defines community renewable energy as:

> "locally owned, locally sited renewable energy (electricity and/or heat)" with a community participation component that "reaches beyond a simple investment of shareholding relation." (Secretariat, 2010)

Hoffman and High-Pippert also broaden the definition of "community energy" to include projects as varied as individual residential photovoltaic (PV) solar adoption, small landowner groups engaged in significant wind turbine projects, and urban cooperatives providing neighborhood heating and cooling services (Hoffman & High-Pippert, 2010). They suggest that a variety of socio-technical characteristics may be used to identify a "community energy initiative" or "energy CAI," which may include a “degree of public participation, methods of governance, proportion of locally generated energy that is consumed locally, ownership structure, and the technology adopted” (Hoffman & High-Pippert, 2010).

The concept of collective action for the energy transition is defined in several ways in academic literature, including but not limited to:

> “any sustainable energy initiative led by nonprofit organizations, not commercially driven or government led” (Walker & Devine-Wright, 2008; Hall et al., 2016).

Walker and Devine-Wright also divide many of these factors into two categories: **process and outcome.** Process refers to the individuals who plan and manage the initiative. Outcome pertains to the individuals who benefit from the initiative. According to Walker and Devine-Wright’s definition, the "ideal" community project is one that is managed and operated by a group of locals who also gain from it (Walker & Devine-Wright, 2008).

The ideal energy CAI or community energy project therefore involves a transparent and inclusive approach with benefits for the community at large (Klein & Coffey, 2016). Several of these positions are synthesized by Klein and Coffey (2016) in a comprehensive description that stresses the bottom-up approach to community energy:

> “a project or program initiated by a group of people united by a common local geographic location (town level or smaller) and/or set of common interests; in which some or all of the benefits and costs of the initiative are applied to this same group of people; and which incorporates a distributed energy generation

technology (for electricity ,heat, or transportation) based on renewable energy resources (solar, wind, water, biomass, geothermal) and/or energy conservation/efficiency methods/technologies” (Klein & Coffey, 2016).

The energy transition is thus considered to be a transition to a more just, equitable, and strong society. This also includes the sense of solidarity that exists across initiatives that communicates collective action (Campos & Marín-González, 2020). Thus, it is often seen that energy CAIs are founded by members of civil society in order to meet social and/or environmental objectives (Seyfang et al., 2014).

2.2.2 Collectively defining Collective Action Initiatives (CAIs)

In the COMETS project, the consortium members (8 different EU countries, 6 Academic bodies, 3 EU level organizations, 1 Energy agency, 2 Research centers) set out over the span of three years to define all aspects of what energy Collective Action Initiatives (CAIs) are by defining a broader definition that encompasses all social-technical and market-based innovation.

A focus group of academic and industry experts was brought together by the COMETS project in May 2019 to work on laying the groundwork for defining CAIs. This included defining boundaries that set one collective experience apart from other comparable collective experiences. Going beyond a thorough literature analysis previously completed, the following information highlights the major conclusions of the small group conversations, which I helped to organize and facilitate.

Participants agreed on characteristics for energy CAIs' organizational structure and context — from requirements for appropriate contextual data for performance to a quantitative contribution towards the energy transition (See *Chapter’s 4 and 5 for the data analyses*). Prior to this activity, the majority of definitions of CAIs were heterogeneous: they may be either too wide or too restricted, or they could result in definitions that are mutually exclusive and difficult to understand (COMETS D2.1, 2019).

Thus, a first set of dimensions were identified (COMETS D2.1, 2019):

- **Size and location (urban/rural dimension, economic and social environment)**
- **Technologies invested/adopted/diffused**
- **Mission statements and co-benefits expressed**
- **Business models developed/deployed**
- **Types and scales of energy services provided**
- **Organizational models chosen**
- **Decision-making processes**

In general, a significant heterogeneity across initiatives can be observed. CAIs often emerge as localized businesses, generally specializing in a particular form of renewable technology (solar, wind, hydro, or biogas), or in energy conservation, independently from one another. Additionally, this could include a specific kind of collective action through manufacturing, distribution, investment, education, or a particular emphasis on off-grid solutions (COMETS D2.1, 2019).

Establishing and scaling up energy CAIs is a challenge since their growth is context-specific and depends on a variety of variables, including social capital, organizational dimensions, regulatory obstacles, local and regional political and economic conditions, to name a few. Thus, they cannot scale up and expand with a one-size-fits-all strategy (COMETS D2.1, 2019).

From this capacity, the COMETS project consortium defined Collective Action Initiatives as:

> "an integration of all these strands: undertaking social innovation aimed at transformative change – social, cultural and technological – in dominant regimes through a combination of predominantly local action and participation in trans-local networks that enact – either consciously and involuntarily – core values relating to sustainability and/or social justice and inclusion." (COMETS D2.1, 2019)

2.2.3 Boundaries of collective action in the energy field

Scholars struggle to identify the boundaries of collective action since they're never clear. Communities self-define their borders based on **location, identity, and interest**. More specifically, Tarhan (2015) defines "communities-of-location" (or “place”) as those developed in geographic-specific areas that focus on generating electricity for local consumption, whereas "communities-of-interest" are established by individuals "assembled around a topic of common interest" and are not limited by geographic location (Tarhan, 2015).

Understanding various phenomena and behaviors, such as the conduct of a group of people who collectively make choices, can help to untangle the various agencies sometimes assembled under the banner of "collective action" (COMETS D2.1, 2019). Heiskanen and colleagues go further by differentiating between communities that are geographically local, sector-based, interest-based, and virtual communities in their investigation of renewable energy communities (Heiskanen, 2010; Klein & Coffey, 2016).

Part of the boundaries in community-led energy initiatives are in a gray area when determining whether or not to be considered an energy CAI, either because it was initiated by a top-down process or an incumbent actor (i.e. utility companies), or initiated by citizens but later evidence showed they were not interested in being part of an energy community. Not all projects may be called collaborative action, according to a COMETS survey conducted in 2020 (COMETS 3.3, 2021). For example, a Danish energy research lab was founded by the commercial sector, research institutions, and universities, and not by citizens per se (COMETS D3.3, 2021). These initiatives need additional investigation to establish whether they're energy CAIs.

This dissertation focuses on the heterogeneous, and often disorganized, social behavior in the energy sector that leads to spontaneous and unforeseen innovation, rather than its institutional and bureaucratic expression. This distinction might help include collective actors within grassroots movements or groups that make choices democratically, choosing a horizontal, bottom-up method over a top-down paradigm as with bureaucratic actors (Welch & Yates, 2018).

Feed-in tariffs and green certificate funding are being phased out as wind turbines and rooftop solar mature in energy markets, thus energy CAIs must now compete with large, commercial actors for investment subsidies via auctioning or tendering (Wierling et al., 2018). Some commercial actors provide "turn-key" green community energy solutions without consumer social capital contribution (see *section 2.3 below*). This is a fundamental boundary to collective action in the energy area since it undermines social inclusion (COMETS D4.2, 2021).

By cooperating and pooling resources, energy CAIs remain competitive by expanding their network to hire professional expertise and to have greater influence on local permitting authorities. A great strength of CAIs is having customers at the core, something unique that commercial actors can't provide. Certainly, more innovative financing models and social acceptance are needed for energy CAIs to continue maintaining legitimacy in the energy regime (Hoicka et al., 2021). Without it, energy CAIs will find it difficult to compete with private actors and to recruit members from a variety of socioeconomic backgrounds (Hoicka et al., 2021). Since this has an effect on the long-term viability of these community-led initiatives, more needs to be done to address the social characteristics of CAIs that may limit the degree of citizen engagement, especially in cases when participating in an energy CAI entails a higher personal risk (financial or other barriers to entry).

2.3 Social Capital

Social capital has been used widely in sociology and economics to shed light on areas of economic development (Putnam, 1993), social networks and their influence on the utility of individuals (Becker, 1996; Coleman, 1988-1990), as well as community values (Fukuyama, 1995, 1999), and the relationship between trust in society and with how government institutions operate (Rothstein, 2001; Ferragina, 2010). The theories from James Coleman on individual interests of collective action, especially social capital, including his model for collective decisions, also contributes to this framework. According to Coleman (1988), social capital is:

> “not a single entity but a variety of different entities[…] they all consist of some aspect of social structures, and they facilitate certain actions of actors-whether persons or corporate actors-within the structure.” (Coleman, 1988)

Putnam shares Coleman's premise that social capital is a feature that might encourage interpersonal cooperation. According to Putnam, social capital entails:

> “features of social organizations, such as networks, norms and trust that facilitate action and cooperation for mutual benefit.” (Putnam, 1993)

There is no commonly agreed definition of social capital, although most scholars acknowledge that it involves elements of trust, cooperation, and a sense of responsibility to one’s community (Coleman, 1988; Putnam, 1993; Fukuyama, 1995, 1999; Bauwens et al., 2016). These concepts are all innovative to the energy field and are necessary for the energy transition.

Several studies utilize social capital as a major argument in explaining why grassroots-based social innovation arises and how energy transition communities are developed (Jansma et al., 2023: Süsser et al., 2019). Moreover, Süsser and colleagues maintained that local social and cultural capitals are fundamental aspects of collective experiences that communities experience while engaging in the energy transition:

> “a high social and cultural capital structuring the system as a whole: collective engagement and individual participation are the only possible context of this prerequisite and consequently bear a considerable impact on the acceptance of renewable energy technologies” (Süsser et al., 2019)

The inherent multidimensionality of this kind of capital provides an opportunity to extend the social capital idea to energy CAIs, among many other social phenomena (Putnam, 1993). Coleman's definition of social capital is simplified as: "People's capacity for working together to achieve a shared objective" (Coleman, 1988). According to Ostrom, social capital is present across the social sciences, with scholars looking at a broad range of issues including the connection between social and personal networks, as well as political engagement (Lake & Huckfeldt, 1998; Ostrom, 2007).

Energy CAIs have exemplified interest in increasing their social capital. In terms of social identity, trust, and network model, most energy CAIs have some form of social capital, according to Bauwens and Defourny's 2017 study (Bauwens & Defourney, 2017). Furthermore, Ornetzeder and Rohracher (2013) draw a variety of findings on how social capital issues and energy CAIs are linked. Their research in Belgium suggests that "innovation culture" based on values of democracy, transparency, and diversity is something that people are willing to share. It is based on case studies in Austria (solar PV), Denmark (wind), and Switzerland (community vehicle sharing) (Ornetzeder & Rohracher, 2013).

According to Rogers and colleagues (2012) energy CAIs rely on local networks and expertise to promote cohesiveness and locally suitable solutions (Rogers et al., 2012). Additionally, in the COMETS project, an extensive survey researching six European countries found that Spain and Belgium's energy CAIs participate in a variety of initiatives that aim to further social inclusion and women's empowerment (COMETS D3.3, 2021).

Scholars emphasize 'social capital' as essential to a community's ability to tackle environmental and societal concerns collectively (Bauwens & Defourney, 2017; Ornetzeder & Rohracher, 2013). To achieve this, it is essential to foster trust among community members as well as between individuals and institutions. This ultimately increases the opportunities for social interactions that are mutually beneficial, even if at an individual cost (Bowles & Gintis, 2002; Ostrom, 2003). Such theoretical analyses help illuminate the energy transition's societal boundaries and potential (Bauwens et al., 2016).

The idea of social capital has been explored for many years in an effort to combine the individuality recognized by "Rational Choice Theory" with the virtues found in collective action approaches (Ostrom & Ahn, 2002). This also stimulates the question of how social capital is generated and destroyed. Approaching this requires an interdisciplinary approach combining political science, economics, sociology and history (Ostrom & Ahn, 2002).

A number of studies have shown that social capital can only be created collectively because of the existence of communities or specific networks. They also highlight that both individuals and group initiatives can access it. (Fukuyama, 1995; Lake & Huckfeldt, 1998; Rothstein, 2001; Bowles & Gintis, 2002; Keefer & Knack, 2003; Ferragina, 2010; Bauwens & Defourny, 2017). Individuals might use social capital of their networks to achieve "private" or "individualist" aims, while initiatives or organizations may use it to enforce a given set of norms or behaviors (Ferragina, 2010). In this way, social capital bridges the divide between "communitarianism" and "individualism," since it is created collectively but may also be utilized individually (Ferragina, 2010; Berka, 2012).

2.3.1 Social capital throughout history

From Ancient times until the 18th century, thinkers from Aristotle to Thomas Aquinas and Edmund Burke discussed 'community governance' and its influence on society (Bowles & Gintis, 2002; Ferragina, 2010). In the 19th century, Alexis de Tocqueville said in his book, *Democracy in America*, that social capital is as essential as financial capital. Tocqueville summarized that it is not about rigidity of laws, rather it is about **public trust** that creates greater participation from people, thus improving democracy (Ferragina, 2010).

Tönnies (1887) distinguishes between the historic form of community and contemporary society through the difference between ‘Gemeinschaft’ and ‘Gesellschaft’. The ‘Gemeinschaft’ is German for “Community; personal and family ties” and ‘Gesellschaft’ is German for “Company; social relations based on impersonal ties, social duty”. Gemeinschaft's qualities vary from Gesellschaft, the paradigm of contemporary society (Waters, 2016). Modern social capital analysis uses this difference. For example, Putnam compares social capital to Tönnies' bonding (Gemeinschaft) and bridging (Gesellschaft) (Putnam, 1993). Furthermore, Granovetter's seminal research on embeddedness, which is used by numerous social capital economists, is used to illustrate the distinction between bonding and bridging forms of social capital (Granovetter 1973; 1985).

By investigating a 'social order of markets', Beckert (2009) highlighted that market sociology investigates how social networks, social norms, cognitive processes, and formal institutions diminish vulnerability. For markets to function, social macrostructures must lead to steady expectations about the anticipated behavior of other market participants, thus market actors are confident enough to engage in risky market transactions. To obtain legitimacy, market exchange must provide normatively acceptable distributional outcomes. Only then can stable market role frameworks and societal order arise (Beckert, 2009).

According to Elinor Ostrom, collective action frameworks often include types of social capital, such as **networks and trust** (Ostrom, 2009). (see the following sections on *Networks, Embeddedness, Cooperation and Trust.*). This dissertation intends to incorporate both the qualitative narratives and quantitative data analyses of social capital in the following chapters.

2.3.2 Networks and embeddedness

The concept of "embeddedness" has been widely accepted in economic sociology over the past several decades as a categorical tool for identifying those ordering mechanisms that reduce ambiguity in a given action situation as well as the social structuring of decisions in market situations (Granovetter, 1985; Becker, 1993).

This makes a substantial contribution to the development and/or mobilization of social capital in sustainability transitions given the considerable roles that interpersonal connections and social networks play in the business models of energy CAIs (Bauwens et al., 2016). Thus, networks can be influential. Participating in a larger network locally, nationally, or worldwide might provide useful resources and assistance.

In this dissertation's case studies (see *Chapter 6*), we see a common thread of CAIs being connected through large, umbrella networks, helping the community-led energy initiatives to overcome challenges related to the ‘David and Goliath’ power struggles. In other words, numerous smaller energy CAIs must contend with the powerful, "Goliath" energy giants (incumbent utility companies). Being a member of a network reduces the impact of these large issues and provides communities with more resources and assistance.

Embeddedness expresses the idea that the economy is not autonomous, as some economic theories would propose it to be. Instead, economic systems are integrated with politics, religion, and social-cultural relations. Polanyi’s work on embeddedness (Polanyi,1944;1957;2001) underscores the socioeconomic realities of causal relationships between markets, institutions and communities, where economic systems, including energy regimes, are embedded in political, social and cultural contexts, or as he declared:

> “Instead of the economy being embedded in social relations, social relations are embedded in the economic system." (Polanyi,1944;1957;2001)

The word "embeddedness," as used by Polanyi, implies that the market and the economy have a direct impact on how individuals connect to one another and, as a result, on the level and usage of social capital that they have (Minard, 2009). This interdependent relationship requires trust, reciprocity, mutual understanding, and legal enforcement of contracts (Polanyi,1944;1957;2001). Accordingly, the link between one-sided economic operations and the impact that the social network of relationships has on specific people are the major indicators of embeddedness (Granovetter, 1985).

Granovetter (1985) and Coleman (1988) underscore the potential advantages of networks and organizations for economic growth via social capital and embeddedness (Minard, 2009). Granovetter (1985) argues that the importance of personal relations and networks of relations, referring to "embeddedness", in generating trust and norms is often not recognized by institutional economics (Granovetter, 1985). Coleman (1988) emphasizes interpersonal trust, social networks, and social organization as being significantly important in the functioning of not only society at-large, but also of the economy (Coleman, 1988). Additionally, a number of sociologists and economists share a general consensus that the growth of social and informal institutions, including decentralized initiatives, as enhancing the development of public goods via the embedding of commercial actors in networks of interactions (Granovetter, 1985; Coleman, 1990; Minard, 2009).

Many energy CAIs get assistance from regional networks and umbrella organizations (see Co-op Power NYC case study and advantages of belonging to a network in *Chapter 6, section 6.4.1.)* Energy CAIs are also forming regional networks of other energy CAIs to strengthen their voice and promote common ideals of providing renewable energy as a public good. This also creates opportunities to enhance the complex ties between government and businesses/social enterprises (Coleman, 1988).

Regional and informal networks established on similar principles help energy CAIs advance their social goals, such as energy poverty, equity, and access to renewable technology for marginalized communities. Energy CAIs that are just getting started in the energy field can benefit from collaborating with each other and in broader umbrella organizations. The umbrella structures provide a "strength in numbers" force to organize activities and provide know-how and access to financial schemes, thereby saving costs to smaller CAIs (COMETS D4.2, 2019).

The social embeddedness of market participants is highlighted by the network approach, which is particularly connected with the work of Granovetter (1985). The method bases its explanation of economic outcomes on the organization of social networks and the positions that different nodes occupy within those networks. Network analysts contend that social interactions' structures are more useful for describing how market actors behave than ethical attitudes or institutional structures (Granovetter, 1985; Beckert, 2009).

Energy CAIs and other Informal networks often serve as the engines and motivators to realize social movements' goals of discovering sustainable and inclusive development that can enhance economic systems (Ooms et al., 2017). The issues caused by economic systems that lack a genuine commitment to sustainability, for example from large energy providers, often lead to social movements and network activities in this area (De Moor, 2013). Thus, networks of social cooperation and umbrella organizations can provide an “institutional exoskeleton” for behavior that can be favorable to entrepreneurship and social innovation (Dees, 2001; Minard, 2009). Particularly, these informal networks often transform into organized forms of social movements, cooperatives, and neighborhood associations—all of which are essential for the formation of CAIs for the energy transition.

2.3.3 Cooperation and Trust

Cooperation between people is extensive and diverse. It is a key component to community-led energy management. People are prone to cooperate, even with strangers, but not everyone cooperates. Cooperation is contingent on many things and has a number of features in need of explanation.

Numerous collective action models are grounded on the paradox that each person's tendency to cooperate depends directly on the number of others who are already acting. One such seminal study was from Granovetter (1978) where he supposed that individuals have a threshold percentage to participate before he or she participates. Granovetter discovered that individuals who are eager to engage have thresholds of 0%, while those who will never participate have thresholds of 100% by employing a constant group size (Granovetter, 1978; Oliver, 1993).

As a result, even under similar environmental circumstances, people's propensity to collaborate varies widely. Several scientific studies correspond to this assertion:

- Commons management depends on resource size, exclusion technology, and exploitation (Ostrom, 1990);
- In public goods experiments, people tend to cooperate when engaged in anonymous prisoner’s dilemma games, especially for people playing the game for the first time, or after a previous experience (Marwell & Ames, 1981), and successful cooperation arises when they can discuss teamwork strategy before the game (Dawes et al., 1990; Nat’l Research Council, 2002).

In all these circumstances, collaboration requires trust. Trust in others and engagement willingness are well-documented (Latusek & Cook, 2012). Putnam (1993) noted that "cooperation breeds trust" is a cyclical, self-reinforcing dynamic (Putnam, 1993). Trust is the expectation that people and institutions will act in an honest and reliable way (Keefer & Knack, 2003). This is essential for communities to flourish, especially for energy CAIs to overcome some of their development barriers through establishing trust from citizens and other local stakeholders.

Trust, connected to reciprocity and civic participation, permits individuals to collaborate and flourish in a community (Keefer & Knack, 2003). A number of studies have demonstrated that members of community-led projects are more likely to have trust in such initiatives because their efforts are not controlled by distant, centralized systems (Cook et al., 2005; Dwyer & Bidwell, 2019; Latusek & Cook, 2012; Marlin-Tackie et al., 2020; Walker et al., 2010).

Rose (2000) capsulizes the discussion on trust in relation to social capital:

> “The appearance of modern social capital conceptualization is, in fact, a new way to look at this debate, keeping together the importance of community to build generalized trust and, at the same time, the importance of individual free choice, in order to create a more cohesive society. It is for this reason that social capital generated so much interest in the academic and political world.” (Rose, 2000)

Trust in institutions is a condition for collective action. Therefore, trust in institutions to act in an honest and reliable way is essential for energy communities to thrive. In the context of dissatisfaction with the performance of institutions, Albert Hirschman identified three potential consumer-member responses: **exit, voice, and loyalty** (Hirschman, 1970). To put this into context of energy regimes, citizens often decide to participate in collective action when they are dissatisfied with the actions of their energy supplier and choose to go in a different direction. It is a clear example of **exit** when consumers choose to try out different procedures and tactics for the supply of products rather than criticize (use their **voices**) or remaining **loyal** to their supplier. In other words, collective action is when all or most people choose a course of action that results in the anticipated best outcome as a group when acting in a cooperative way. (Hirschman, 1970; Elster, 1985).

With regard to generating trust, Cook and colleagues (2005) observed that:

> "although we know something about the conditions under which trust declines, we are only just beginning to systematize knowledge about how to build trust where it does not exist and how to reconstruct it when it dissolves—or, what is more likely, *how to look for alternative bases for cooperation.*" (Cook et al., 2005)

The trust that is fostered in communities has positive ripple effects (Fukuyama, 1999; Putnam, 1993). Members of grassroots energy initiatives build trust amongst each other, and trust that the information received in the community will provide a benefit to themselves, the community, and the overall environment (Huybrechts & Mertens, 2014). Community engagement in the energy transition builds trust and collaboration across communities and supports more inclusive regulatory regimes (Dwyer & Bidwell, 2019). Trust also reduces opportunistic behavior by increasing the risks of free-riding (Minard, 2009). (see more on free riding in *section 2.7.1.1)*

As owners of renewable energy facilities, people tend to live near their systems, thus energy CAIs interact with the local community considerably differently than the conventional, incumbent utilities (Huybrechts & Mertens, 2014). Studies have shown that people participate in collective action for the energy transition not just because of job creation and for local economic stimulation, they want to mitigate climate change and foster neighborly trust and collaboration (Vansintjan, 2017). In other words, participating in an energy CAI can foster solidarity in relationship to his or her community, moving from extreme individualism towards what Zygmunt Bauman describes in his book, *Community*, as one "which we would dearly love to inhabit and which we hope to repossess" (Bauman, 2001) that moves towards a sense of working together to make positive social change.

2.4 Energy Democracy

Energy democracy and the emergence of energy CAIs demonstrate a growing interest in participatory, voluntary, collaborative creation of the future energy system (Seyfang et al., 2013; DECC, 2014; Bauwens et al., 2016). The Institute for Local Self-Reliance defines energy democracy as "an energy system that is democratic, where decisions are made by the users of energy" (Farrell et al., 2016). In their book, *Energy Democracy*, Denise Fairchild and Al Weinrub underscore energy democracy as representing a new economic paradigm, specifically:

> "A paradigm shift represented by energy democracy is more than a new set of values and principles to guide our energy system […] one that calls for a new energy model, in sync with the environmental, social justice, and new economy paradigms […]" They continue by saying, "In a democratic society, people should be in control of all the major aspects of their lives, and nothing is more major or more fundamental to modern living than electricity." (Fairchild & Weinrub, 2017)

The Energy Democracy lens applied to this dissertation research applies to Social Movements Theory (see *section 2.7.4*) which promotes the role of individuals' active participation in the democratic governance structure of most energy CAIs, giving them "power" (in terms of both empowerment and electricity) or control over their energy generation and transmission (Fairchild & Weinrub, 2017).

Hess (2018) uses the Social Movements Theory (see *Chapter 2, section 2.7.4*) to construct "energy-transition policy coalitions" to explore how energy democracy movements actively disrupt incumbent industry actors (Hess, 2018; Campos & Marín-González, 2020). The term, "Power to the People", has often been cited to describe the decentralized and democratic nature of the participatory model of energy CAIs. People have an opportunity to be active and engaged in the democratization of their energy regimes, by either becoming "prosumers", or other community-led energy activities, while "exiting" (Hirschman, 1970) from centralized energy markets controlled by large, incumbent utilities (Burke & Stephens, 2018).

Energy regimes are becoming more democratic, opening up new pathways that support sustainable development principles as well as concepts of energy independence and community development (McMurtry & Tarhan, 2016). Energy democracy provides a deeper, more comprehensive awareness of the climate emergency's economic, political, and social embedded aspects, and how mobilizing citizens is key to mitigating these challenges (Fairchild & Weinrub, 2017). Recent studies on the energy transition have underscored the many types of governance, with energy democracy emerging as the most prevalent due to the multiple strong ties made by the various stakeholders participating in citizen-led energy projects (Van Veelen & van der Horst, 2018; Campos & Marín-González, 2020).

In an energy democracy, citizens have the ability to mobilize sustainable sources of production and distribution to meet local demands, thus facilitating financial stability through job creation and economic stimulation (Fairchild & Weinrub, 2017). To measure the democratizing of energy regimes, public knowledge is a fundamental component to how advanced citizen participation will play in the overall energy regime, but this can be challenging to generalize and apply to other contexts (Seyfang et al., 2014). A society's familiarity and awareness of collective action for the energy transition, especially among key stakeholders (public officials, bankers, citizen groups, etc.) is considered a major factor towards accessibility and creating a just and democratic transition (Huybrechts & Mertens, 2014).

Thus, it is important for the general public to be aware of how local community-led energy initiatives (i.e. CAIs) represent a significant economic growth accelerator due to the ability for member-owners of energy CAIs to address the "historical, systemic economic insecurity and persistent poverty by reframing how economic growth and innovation take place, at both the level of individual households and the level of community agency" (Fairchild & Weinrub, 2017).

In countries and communities where the general public may lack awareness, or a what Bauwens and colleagues refer to as a "cognitive barrier", about the energy democracy model, this may reflect on deeper cultural aspects (Bauwens et al., 2016). For instance, in a number of Eastern European countries, the issue is beyond a cognitive barrier, where the notion of “collectivism” and participating in energy cooperation has been linked to memories of top-down collectivism from the cold war era. Additionally, the lack of awareness of renewable energy as a ‘common good’ can result in limiting the involvement in community initiatives (Huybrechts & Mertens, 2014). Consequently, energy democracy faces issues of awareness and recognition, which can hinder opportunities for expanding energy initiatives throughout a society (Huybrechts & Mertens, 2014).

Amory Lovins' "soft energy path", a term that refers to the cogeneration of energy efficiency, a variety of energy production techniques, and a particular focus on "soft energy technologies" deployment at a decentralized level (i.e. renewables), has long served as environmental justifications for localized energy systems. “Soft energy paths” (as opposed to centralized, fossil fuel-based “hard energy paths”) focuses on diversified distributed renewable energy generation that is both scaled and of high quality (Lovins, 1978; Berka, 2012). Lovins urges us to follow the “soft path” where the decentralization of energy services makes them democratically self-governing voluntary groups, contending that these initiatives are the most crucial level for democratic development (Morrison & Lodwick, 1981).

The historical pathway noted in Chapter 3 will highlight how forms of Energy Democracy have developed in both the EU and US. The advantages of the energy transformation have been widely distributed among consumers thanks to energy democracy. It implies that customers have a significant influence over the energy economies of both themselves and their communities. It implies that all utility users, particularly those who have fallen into the hands of the grid's externalities by paying disproportionately more than their fair share, will have access to ownership and authority (Farrell, 2014).

In some conceptions of energy democracy, participation is supposed to enhance collaboration by helping participants recognize and act for the common good (Walker et al., 2015). Energy democracy has regard for the struggles of marginalized and low-income communities to achieve equity through ownership in the energy regime's renewable resources and use such resources to empower people politically and economically. This is a crucial aspect for achieving climate justice and is also a necessary first step in creating an economy that is more "just, equitable, sustainable, and resilient" (Fairchild and Weinrub, 2017).

The promotion of communal participation techniques, whether centered on control or ownership, demonstrates a vision to transform the current regulatory and energy systems (Van Veelen & Van der Horst, 2018). Chavez (2015) has maintained that, as long as it is supported by increased public engagement, energy democracy is also about renationalization and remunicipilization. As a result, ideas of institutional democracy are evoked, in which the state owns the energy system but where people have direct influence over the state's institutions, including the power network (Chavez, 2015).

The current energy sources are oftentimes managed, controlled, and monopolized by large, incumbent utilities, with citizens taking a passive role. Energy democracy puts decision-making and innovation in the hands of energy users (Fairchild & Weinrub, 2017), thus energy democracy is an “ideal political goal, in which citizens are the recipients, stakeholders (as consumers/producers) and accountholders of the entire energy sector policy” (Campos & Marín-González, 2020).

McMurtry and Tarhan (2016) encapsulates energy democracy in their paper on the existing dynamic of energy resource control:

> “While the transition away from fossil-based resources is an important component of the fight against climate change, what is often overlooked is the centralized ownership and control of electricity generation by corporate and state actors. This ownership scheme overwhelmingly favors electricity generation for the sake of profit and growth instead of human and ecological realities […] those who are most directly impacted by the destructive elements of the electricity sector […] are excluded from ownership and circles of decision-making. This lack of democracy in the electricity sector is mutually reinforcing with a lack of democracy in the economic and political realms produced and reproduced daily by capitalistic social relations.” (McMurtry & Tarhan, 2016)

Energy democratization is a way to enhance civic involvement, energy equity, and community empowerment (Fairchild & Weinrub, 2017), as well as a driver of socio-technical innovation, underscoring the impact of innovative ways citizens are democratically organizing new forms of energy procurement. This includes energy justice and its ability to mobilize local community-owned energy projects (Forman, 2017).

2.5 Energy Justice

Energy justice is a conceptual tool that energy policy makers can use to guide their policy choices in a way that addresses key social inequalities (Sovacool et al., 2017). The energy justice concept is also a framework that a number of energy CAIs use to enable social evaluation, namely "(a) where injustices emerge, (b) which affected sections of society are ignored, and (c) which processes exist for their remediation" in order to "(i) reveal and (ii) reduce such injustices" (Jenkins et al., 2018).

The concept of energy justice, particularly the idea of citizens taking an active role in the energy transition (Devine-Wright, 2007), requires:

> "a view of the public that emphasizes awareness of responsibility for climate change, equity and justice […] and the potential for (collective) energy actions." (Devine-Wright, 2007)

Energy citizenship, a term used in energy justice research, provides a context for discussing the various ways that citizens are participating democratically and actively influencing the energy transition, whether as prosumers, consumers, or members of protest and support movements (Spaargaren & Oosterveer, 2010; Hoppe et al., 2015; Kotilainen & Saari, 2018; Campos & Marín-González, 2020).

Examples of energy injustices include:

- Inequality between genders, often leaving women out of leadership roles in energy CAIs (Feenstra & Özerol, 2021);
- Inequality in power distributions inhibiting access to relevant decision-making process that, in turn, deteriorates trust (Marlin-Tackie et al., 2020);
- Inequality in the ability to access energy services, also known as 'energy poverty' (Bouzarovski & Thomson, 2018).

Energy poverty entails a type of energy injustice, which is rooted in the distribution of three primary resources: income, energy efficiency, and energy pricing (Walker & Day, 2012). All people are encouraged to become involved in energy decision-making through an energy justice lens while gaining knowledge on energy solutions, costs, and policies. Developing energy CAIs in low-income communities, for example, has many challenges that are not just financial. There are issues of trust, for example, when an outsider or large institution comes in to provide services (Van Veelen & van der Horst, 2018). When decision-making actors (e.g. local authorities, governments) are able to enhance procedural justice (e.g. by providing all citizens with opportunities for inputs, by enabling them to affect final decisions, by creating a sense of ownership, etc.) stakeholder perceptions of trust are reinforced (Dwyer & Bidwell, 2019).

When communities have control of their energy, in forms such as prosumers (producer-consumers) or purchasers, they tend to use it to address the environmental, economic, and social dilemmas they are facing. The benefits of a collective energy project include:

- Community shared revenue
- Increase in "energy literacy" in the community, encouraging smarter use of resources
- A microgrid connecting community households
- A number of shared benefits, including streetlights, shared EV charging stations controlled by the community (PPSC, 2021)

In present society, citizens are facing large democratic deficits, with few opportunities for civic engagement, a decline that Hirst (2001) posits is due to current public and private hierarchical governance frameworks (Bader, 2001; Berka, 2012).

At the same time, when citizens are provided with opportunities to take part in energy co-ownership and prosumer initiatives, they can actively change power relationships underlying the energy system and promote a decentralized and more democratic energy model (Campos & Marín-González, 2020). Electrical power is important, but it can be the start of something more—building economic and political power for communities who have been historically excluded is just as crucial (PPSC, 2021).

PART II:

THEORETICAL FRAMEWORK OF COLLECTIVE ACTION TO CONTEXTUALIZE THE ENERGY TRANSITION

The theoretical framework of this dissertation research stems from several leading arguments in sociology and economics for collective action. Each of the scholars support the investigation of the heterogeneity of CAIs though their different theoretical perspectives. The prerequisites for social capital and energy democracy, such as trust, reciprocity, cooperation, and creativity, are established via networks, community-led initiatives, and institutions (Polanyi, 1944/1957/2001; Olson, 1965; Ostrom, 1990). This connects individuals with governmental and commercial institutions. In his Nobel Prize lecture, renowned economist, Gary Becker, summarizes collective action as:

> "Actions are constrained by income, time, imperfect memory and calculating capacities, and other limited resources, and also by the available opportunities in the economy and elsewhere. These opportunities are largely determined by the private and collective actions of other individuals and organizations." (Becker, 1992)

In investigating the interaction between individual, community, and institution, renowned political economist, Elinor Ostrom helps establish the context for this theoretical framework:

> "What one can observe in the world […] is neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource systems […] Communities of individuals have relied on institutions resembling neither the state nor the market to govern some resource systems with reasonable degrees of success over long periods of time." (Ostrom, 1990)

In the exploration of collective action in the energy transition, especially the nexus of individuals and institutions, this chapter explores leading scholars from sociology and economics in the frame of two waves, all of which help to shed light on this topic and refine the theoretical framework.

Wave 1:	Wave 2:
Historic to modern approaches to Mobilization	*Energy as a collective good*
Briefly explains earlier approaches of Marx, Durkheim, Mill and Weber to Tilly that focuses on individual and collective ontologies leading to mobilization	Explores the more recent, leading scholars and their work on common goods, social movements, sustainability transitions and cooperation

Using these two waves provides the foundational lens for how I hone unique perspectives and contextualize energy Collective Action Initiatives (CAIs) in the energy transition. Of course, none of these theoretical approaches alone can completely explain the whole processes, but combined they provide a valuable perspective of the structure, for example why CAIs are located in heterogenous areas and their motivations for establishing and scaling up.

2.6 FIRST WAVE OF COLLECTIVE ACTION SCHOLARSHIP

Historic to modern approaches to Mobilization

Collective action is a recurring issue in social and economic sciences, and its origins in social thought require a broader approach. Collective action was a sensible strategy to avoid disputes and wars in Hobbes' social contract era (Sciullo et al., 2020). Spinoza later explored collective action as a kind of human rationality in the Ethics and the Theological-Political Treatise (TTP), arguing for Hobbesian social contract theory (Rosenthal, 1998). Spinoza's theory of rational human nature included a solution to collective action problems. The rational person knows his or her nature can only be realized in society, leading to a rational sense of cooperation with others (Rosenthal, 1998).

In a broad sense, collective action is how people solve individually unsolvable issues (Rosenthal, 1998). The social preconditions for establishing market relations were already covered by classical sociological theory, which also rejected an economic solution to the disorder problem based on the self-interest of market actors (Beckert, 2009).

Charles Tilly, a prominent sociologist, historian, and political scientist, studied how a variety of aspects of collective action affect history with aims to improve communities' and individual wellbeing. His approach to individual and collective ontologies, including his seminal work on mobilization, greatly influences this first wave. Tilly explored **four** forms of collective action through the perspectives of Durkheim (structuralist), Marx, Mill (utilitarian), and Weber (Tilly, 1978).

Tilly's study examined the role of actors' shared presumptions and meanings in comprehending events and solving problems using the Framing model, a collection of ideas and theoretical viewpoints on how people, organizations, and society organize (Benford & Snow, 2000). Thus, explaining collective behavior in terms of the motivations, convictions, and discourses that actors exhibit. Adapting Tilly's use of Durkheimian, Marxian, Millian and Weberian traditions, this section briefly lays out the foundation of their approaches to collective action (*in alphabetical order):*

- **The Durkheimian** analysis regarded collective action as a direct reaction to processes involving dual forces of disintegration and integration (new or renewed commitment to common beliefs), in addition to processes involving innovation and tradition (Segre, 2016). Emile Durkheim argued collective actions and social intelligence are linked (Segre, 2016). By operating together, individuals gathering for a shared goal perceive society as a collective force, boosting social cohesiveness (Beckert, 2009). Collective consciousness makes social bonds feasible, but the issue of "a certain type of stability" does not necessitate "throwing the collectivity into a normless condition" (Ruggero &

Montagna, 2008). If social labor is divided, certain professional subgroups may develop a separate collective consciousness beyond the typical social norms (Segre, 2016).

- **The Marxian** common stance in the structuring of the production and consumption system is the source of shared interests. This approach links collective action to group solidarity and conflicts of interest, which reinforce each other. A class is any group of individuals who have a connection with the means of production and consumption, yet classes differ widely in their internal structures and shared awareness (COMETS D2.1, 2019). Furthermore, the sort of workplace community within a firm (i.e. the factory described by Karl Marx) had the strong likelihood of solidarity and collective action as he predicted (Shorter & Tilly, 1974). In general, the more like a community the factory or workplace was, the greater the likelihood it would be organized (Sabia, 1988). Marx's theory stresses the social rationality of political action, yet mass-movement members often overlook their own interests (Tilly, 1978).

- **The Millian** and utilitarian schools of thought viewed collective action as a purposeful pursuit of personal advantage (Tilly, 1978). The logic of collective action is predicated on the strong premise that human behavior is driven by self-interest, or "limited rationality." The method used by John Stuart Mill analyzes the many decision-making processes that turn individual interests into individual behavior and group individual behavior into collective behavior (Tilly, 1978). This strategy underscores the need of a person adhering to a set of legally enforceable socio-political structures in order to ensure the long-term pursuit of such interests (the rule of law or some system of cooperation) (Brink, 2022). Models of collective choice explain the elements that influence distinct results when two or more participants make choices that affect outcomes.

- **The Weberian** concept of collective action proposes that groups commit to a common understanding of their environment and of themselves, often functioning in accordance with their historic roles, occasionally in accordance with their legal or logical identification as the group's actors (Tilly, 1978). A group's structure and outcome are significantly influenced by the foundations it adopts. According to Max Weber, the group's original adherence to a certain form of belief system largely determines its overall behavior and structure (Weber, 1978). In his analyses on religion and charisma, Weber depicted collective action as the result of adherence to particular belief systems, and he provided his explanation of how these basic ideas came to be (Weber, 1978; Tilly, 1978). Weber's explanation of the emergence of modern western capitalism's institutional foundations and human action dispositions is also founded on influential political processes and religious shifts. Thus, asymmetrical information and strategic action have significantly more important implications for understanding markets than economic models imply, because they undermine individualistic explanations of ordering processes using the rational actor model (Beckert, 2009).

There is a distinct split in the paths taken by the first-wave theories. Some of these statements are concerned with a collective ontology, while others are more concerned with an individual's own ontology. As it turns out, the distinctively diverse worldviews of Durkheim, Marx, Mill, and Weber are mirrored by even more divergent theories of collective action: While theories of collective choice are useful when there are few and well-defined options available, theories of collective action focus on what occurs when normative decision-making processes are disrupted.

These perspectives are significant to this dissertation because they draw attention to the shortcomings in the current global energy system and the rising interest in new social models for organizing the energy sector. The adaptation strategies might vary greatly, for instance, concentrating on individual choice differs from focusing on action.

2.6.1 The Mobilization Model

The mobilization model was developed to comprehend how individuals engage to establish collective action that mobilize and disrupt established regimes. "Collective action is a collaborative effort in pursuit of shared aims," contends Charles Tilly (Tilly, 1978). Consequently, energy CAIs' viability may center on the group's cohesiveness, sense of purpose, and capacity to mobilize resources to achieve their goals (Gregg et al., 2020).

To investigate collective action, the mobilization model is a suitable start to understand dynamics of energy CAIs that are different from other social science investigations, such as uprisings, riots, and revolutions, and explore the unassertive attempts to break away from large, incumbent energy suppliers while managing the threats of global climate change (COMETS D2.1, 2019). Tilly developed the Mobilization Model in 1978 to describe political revolutions and labor strikes. A simplified version of the concept for energy CAIs is shown in Figure 2.1.

Figure 2.1 depicts Tilly's mobilization model for energy CAIs, which Gregg and colleagues (of whom I am a co-author) recently adapted to capture CAIs interaction among four major variable features of important energy-related components, namely:

1. Interest connects the benefits and risks that result from a group's interactions with other entities;

2. Organization is the structure and **resources** that directly influences a group's ability to achieve its goals;

3. Mobilization is the process of managing more resources collectively and in larger quantity;

4. Opportunity is the link between an energy CAI and its environment. This dimension encompasses **power**, which includes relationships to other actors including local and national governments. Opportunity involves facilitation or repression of energy CAIs, which impacts its cost-benefit ratio. Changing ties may threaten or advance a group's goals.

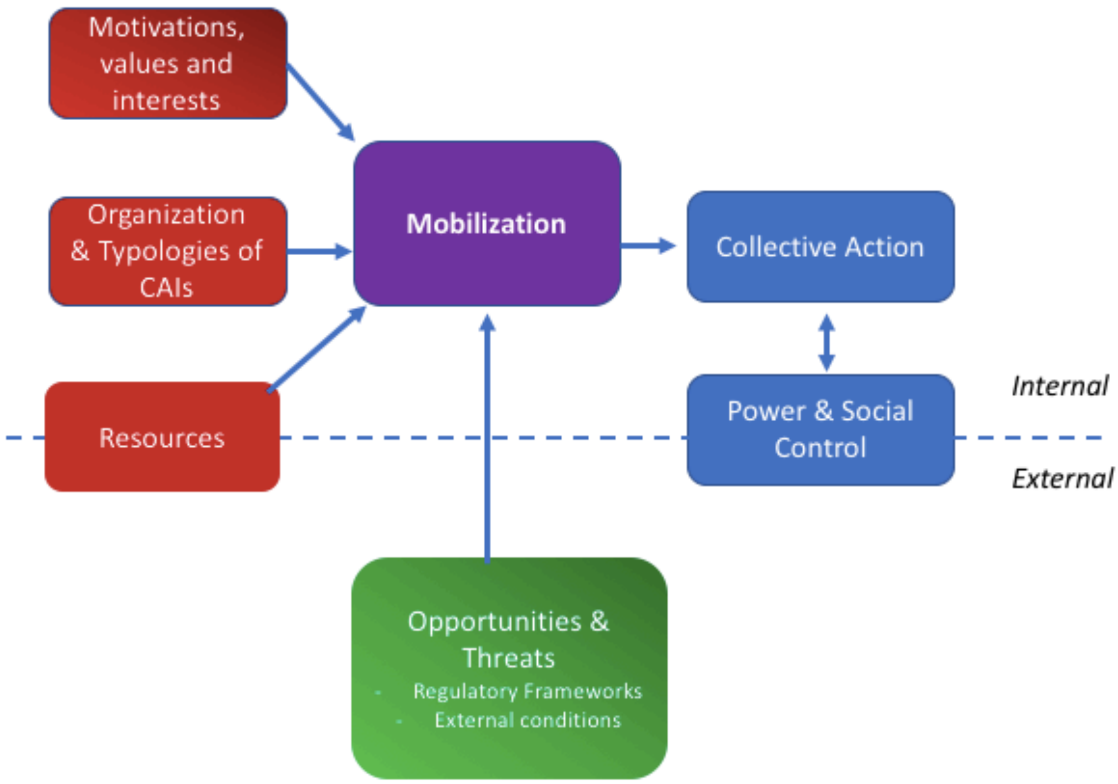


Fig.2.1: The Mobilization Model for energy CAIs,

adapted from Tilly (1978) and Gregg et al. (2020)

Despite not being a formal part of Tilly's mobilization model, the resources involved in energy CAIs are crucial and span both the internal and the exterior domains. Compared to Tilly's model, which has been used for everything from political revolutions to labor strikes, this model more specifically defines power. In order to enhance societal wellbeing, an energy CAI seeks to govern the local energy system with goals of solidifying trust, cohesion, and identity. The energy CAI internal power impacts its exterior power, and vice versa. The links between them are simplified in this model, but the processes are obviously complex, especially with secondary and tertiary ties possible.

Collectives mobilize in a number of different ways. Tilly makes distinctions among mobilization that produce different future horizons based on the strategy and threats. We can see how energy CAIs mobilize their members contingent on the local circumstances, aligned in one (or more) of the defensive, alternative, and preparatory mobilizations (Tilly, 1978).

- **Defensive mobilization** is a response to an outside danger that causes a group to aggregate its resources to prevent harm. For example, individuals might cooperate to avoid dangers like rising costs.
- **Alternative mobilization** is when a group combines resources to accomplish their goals differently from the established system. This mobilization often involves deploying a new organizational approach.
- **Preparatory mobilization** is when a group prepares for future possibilities and hazards by pooling resources. For example, energy cooperatives can maintain a financial reserve to buffer adversity, such as future unemployment, salary loss, or a scarcity of renewable energy and predevelopment funding. This sort of mobilization pools knowledge and organizational abilities, as with CAIs and the energy supply chain. (COMETS D2.1, 2019)

Alternative and Preparatory approaches are comparable except that one responds to current situations and the other predicts future scenarios, respectably. Defensive and Alternative mobilization have differing future perspectives, with Defensive being more moderate (COMETS D2.1, 2019). By keeping in mind the three mobilization strategies, energy CAIs have the potential to empower its members to take concerted action in order to make collective goals and identify solutions to problems confronting the commons (see more about the commons in *section 2.7.2*) and create future innovative alternatives.

2.7 SECOND WAVE OF COLLECTIVE ACTION SCHOLARSHIP

Energy as a collective good

When combined, the following six theories in Figure 2.2 provide a deeper contextualization for this dissertation. Similar to the first wave, none of these theories alone can explain the entire scenario, but when combined they provide a clearer lens for approaching collective action. The first two of the six theories (Collective Action Theory and Common Pool Resource Theory) complement each other as collective action is critical for managing common pool resources, such as renewable energy sources. All 6 theories are supported by the concepts from the previous wave, such as social capital, the commons, and energy democracy.

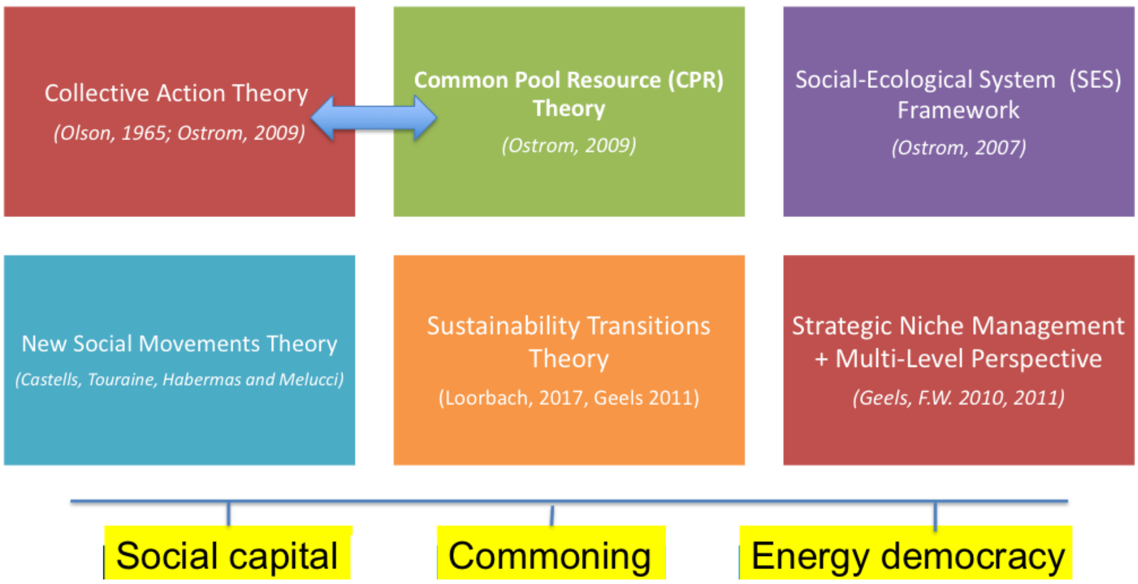


Fig 2.2. Six theories used in the second wave of collective action scholarship

Fred Hirsch, Mancur Olson, and Elinor Ostrom provide valuable perspectives that serve as a foundation for investigating collective goods (considered as renewable energy for this research) that are generated and managed by collective action. Furthermore, Oliver (1993) argues that any type of collective action produces collective goods (Oliver, 1993). Thus, a collective good is:

> "one which, if provided to one member of a group, cannot be withheld from any other member (called non-excludability or "impossibility of exclusion") (Olson, 1965; Hardin, 1982).

When one or a few people have a strong interest in obtaining a public good, Olson (1965) said, the likelihood of a group attaining that good increases, even if the good is still certain to be underprovided (Olson, 1965). Olson's concept emphasizes the individual supply of collective goods, although most scholars also pay attention to collective behavior (Oliver, 1993). Additionally, individuals may use public goods without affecting the availability for others, but when common-pool resources are used improperly, they reduce the resources available for others (Ostrom, 2010).

In terms of renewable energy sources, when managed by a group that takes collective action, energy becomes a collective good. A collective good is one whose prospective consumption by one person does not exclude the possibility of being consumed by other individuals. This is in contrast with an individual good, which excludes the notion of consumption by others (Oliver, 1993). A relevant difference that also pertains to renewable energy is between common and public goods. Both goods are common resources that people manage via social or cultural norms (COMETS D2.1, 2019).

2.7.1 Collective Action Theory

(Olson, 1965; Ostrom, 2009)

Collective Action Theory asks why people cooperate when they could easily free-ride on others' efforts (Ostrom, 2009). The theory examines whether individuals with a common interest are willing to take on organizational costs for the greater effort. When individuals face social dilemmas and choose short-term self-benefit strategies, they are more likely to take actions that reduce collective outcomes. According to Ostrom, if all engaged "cooperated" by using tactics different than those suggested by game theory, where no one is driven to alter their choice considering what others are likely to prefer, "the socially optimum result" may be attained (Ostrom, 2009).

The majority of organizations produce "public goods"—goods or services that are accessible to all members—according to collective action theory. Depending on Olson's main finding on the group size impact, which states that larger groups would fail while smaller groups may succeed (Reisman, 1990). Discussion of the "group size" effect suggests a general idea. Ostrom goes beyond the idea that the size of a group affects cooperation, claiming that it also affects other structural factors (Ostrom, 2001).

When it comes to public goods, expanding the number of participants often results in the availability of more resources that may be used to create a benefit that will be shared by everyone. Oliver (1993) came to the conclusion that group size has a beneficial impact on the likelihood that a public good would be supplied when it has "pure jointness of supply" because of the additional resources made accessible to a larger population and the quality of public goods is not diminishing (Oliver, 1993; Ostrom, 2010).

Ostrom focuses on structural factors that enable collective action, such as:

- the number of participants;
- the extent to which benefits are shared or subtractive (e.g. common-pool resources compared to public goods);
- the diversity of users. (Ostrom, 2010)

Collective action is nuanced but not a unique occurrence. Social scientists rarely make easy generalizations regarding collective action's origins, consequences, or dynamics due to its complexity (Oliver, 1993).

Klandermans (1984) identifies three collective action motives: collective, normative, and reward:

- **The collective motivate** indicates the individual's anticipation that collective action would accomplish the objective (e.g. joining an energy CAI will reduce local carbon emissions);
- **The normative motivate** is an individual's assessment of how others perceive collective action and his or her expectation that others would accept or disapprove of joining in the collective (e.g., concern of judgement by family or acquaintances);

- **The reward motive** provides a “reward” to individuals for the advantages and expenses of group activity (e.g., choosing between staying home or networking with colleagues).

  (Klandermans, 1984)

Stürmer and Simon (2004) offer empirical evidence for the distinct contributions of each of the three motives to the prediction of involvement in collective action (Stürmer & Simon, 2004; Bamberg, 2014). Social movement research often draws on the collective, normative, and reward motives, which support the predictive value of affiliation with a recognized social movement. **The normative motive was the most foretelling of the three motives** (Stürmer & Simon, 2004)

2.7.1.1 Collective Action Theory and the issue of Free Riding

Olson argued that rational people would free ride on others' contributions if nonparticipants can't be excluded from a collective good's benefits. He claimed that this temptation would be higher in bigger groups, since an individual's contribution would have less of an impact since the benefits of that action would be shared among more people. Thus, Olson states that collective action is "irrational" (Oliver, 1993). Olson claims that "rational, self-interested individuals will not act to achieve their common or group interests" and presents mathematical "evidence"[7] in a chapter on the "free rider dilemma" (Olson, 1965; Oliver, 1993). Overall, people will only join an initiative if the advantages outweigh the costs (Hardin, 1982).

Questions such as "Do individuals free ride?" and "Is collective action rational or irrational?" are too broad and general to support research, according to Oliver (1993). Instead, Oliver suggests asking questions pertaining to **when** people free ride, **how** do people coordinate collective action, **what** elements impact collective interactions? (Oliver, 1993)

[7] This is beyond the scope of this dissertation. More information on mathematical models on free riding can be found in Oliver, 1993

From a micro level perspective, collective action is a method that fosters individualistic behavior, which is demonstrated by the free rider concept. The free-rider approach is still more likely for individuals if, as Olson argued (Olson, 1965), people would only opt to join a group if the private advantages provided outweigh the cost of their own commitment. Olson (1965) assumed that individuals analyze the benefits and costs of an action and then optimize their subjective utility (value or happiness in economic terms). Individuals must bear the personal risks of involvement in effective collective action where a group may gain from the benefits (e.g., reducing local carbon emissions). A rational actor might decide to do nothing and wait for others to act, thus "free-riding." According to Olson (1965), active engagement in collective action is more probable when linked to exclusive rewards. (Olson, 1965; Bamberg, 2014).

At a macro level, an example of addressing a common pool resource issue, in accordance to Garrett Hardin's seminal work, *Tragedy of the Commons* (Hardin, 1968), would be sovereign countries not being incentivized to voluntarily adopt and implement strict environmental policies to mitigate climate change. As a result of the perception that a country's individual contribution to addressing the climate emergency is less substantial when acting alone, sovereign countries may seek to free ride on other countries' efforts to reduce carbon emissions in this case (Yi et al., 2017). **As noted by Olson (1982), it is important to emphasize how collective action, in all of its forms, may influence a community's or country's development, determining whether it will flourish or collapse** (Olson, 1982).

Collective Action Theory is a key contributor to the theoretical framework as it **provides a deeper understanding for how people can cooperate around a resource to produce a public good. This investigation on various management characteristics and motivators for how people organize themselves while managing commons is an important addition to the research on Collective Action Initiatives (CAIs) for the energy transition.** (see more about the commons in *section 2.7.2*)

2.7.2 Common Pool Resource (CPR) Theory

(Ostrom)

In addition to *Collective Action Theory,* Ostrom showed that people who share a resource can regulate themselves, which is a valuable aspect contributing to studies on Collective Action Initiatives (CAIs) in the energy sector, especially on how individuals organize themselves when managing commons. Ostrom highlights issues with crowding and overharvesting across significant categories of common pool resources (CPR), such as forests, water systems, and pastures (Ostrom, 2009).

Here I attribute renewable energy technology as a CPR and complement the theory with *Collective Action Theory* because collective action contributes to the commons. In fact, the approach for the future of collective action is to build up the commons. Renewable energy is a natural good that is mediated by the socio-technical system, in contrast to the conventional paradigm of a CPR. As a result, it may be considered a hybrid that has elements of both CPRs and public and collective goods. Public goods and CPRs cannot be restricted by definition (Künneke & Finger, 2009).

2.7.2.1 What are the commons?

Collective action is represented by the commons. No common, including a nature reserve or any other common good, can be maintained individually. A common, according to Bollier (2014), comprises "a resource, a community and a set of social protocols" (Bollier, 2014).

A common is characterized by circumstances including a social dilemma (Ostrom, 2009) or the need for collective action, which Darnton refers to as a "tyranny of small decisions whereby the outcome of millions of individual decisions is in conflict with what people collectively want” (Darnton, 2008).

The development and protection of the commons as a structure that is both democratic and effective that transcends the constraints of both market and state forces is a central tenet of a growing body of adaptive management for sustainability, especially:

- **For the markets** to adopt sustainability requirements that go against to their core approaches;
- **For the state** to properly enact and enforce such regulation without resorting to authoritarianism.
  (Bollier & Helfrich, 2012).

2.7.2.2 Energy as a common

A common in the energy field can be defined as "a resource which is owned and managed by a community, with a system of rules for production and consumption of the resource." (Melville et al., 2017). In the energy field, community ownership offers an alternate route to sustainable production together with modified patterns of supply and consumption that are required to balance sustainability and equity (Blanchet, 2019). Thus, the members of energy CAIs can be defined as:

> "those who seek to create new commons based on linked principles of sustainability and social justice as complements or alternatives to the actions of state and for-profit business" (COMETS D2.1, 2019)**.**

No one individual owns the wind or the sun (as absurd as that statement sounds), therefore, positive social and economic externalities are associated with increasing access to renewable energy sources (RES) for the general public. Given that everyone could have access to energy that is produced either directly or indirectly by the wind or the sun and since these resources could be shared by everyone, **by definition, renewable energy is a common resource** (COMETS D2.1, 2019). Energy systems and infrastructure, according to scholars Künneke and Finger (2009) and Frischmann (2012), should also be considered commons. This is due to the negative climate externalities caused by carbon emissions as well as the inherent monopolistic tendencies of energy regime actors.

New energy commons are being established by the various energy CAIs. Energy CAIs have the potential to generate new organizational structures, commons ecologies, and collectively based forms of collaboration (Acosta et al., 2018). A common is also characterized by the collaborative production and consumption (prosumerism) of groups. Agricultural communities are one example of this, and this idea is now being revived in a contemporary setting with the notion of "prosumerism" (Ritzer & Jurgenson, 2010), particularly in terms of energy CAIs prosumerism (Karnouskos, 2011).

The free rider issue is a challenge for the commons. When free riding exists among members of a collective, then the commons will be threatened. Thus, the free rider issue needs to be contained. The tragedy of the commons is evident despite the fact that many resources have been maintained as commons for centuries, including forests, lakes, and fisheries, as well as the significant declines in biodiversity (Hardin, 1968).

2.7.2.3 Example of commons in the energy sector

CPR Theory is valuable to the theoretical framework because it provides an important lens for how we see renewable energy resources. Reflecting on Bollier's (2014) definition of a common, comprising of "a resource, a community and a set of social protocols", we see this applied to a number of energy CAIs in this research. In the COMETS H2020 project, there have been a number of investigations into cases that refer to themselves as a commons. For example, the People's Power Solar Cooperative (PPSC) in Oakland, California (see *Chapter 6, section 6.4.2*). The Cooperative asserts their primary model for community solar ownership as a "Commons Model" because it operates by "putting privately-owned roofs into the commons" (PPSC, 2021). They have managed to implement this despite the fact that California, a state known for their progressive social and environmental policies, does not have viable shared solar policy. The pioneering Commons Model used by PPSC demonstrates that it is feasible to separate the ownership of property from the ownership of power production in a society. The model can serve as a tool for the community to organize, building on resources that may already exist there (PPSC, 2021).

There are three models, or "states-of-mind" in society that the PPSC highlights. The Commons state-of-mind is where the People Power Solar Cooperative operates under (see *Chapter 6, section 6.4.2*).

- **The Market state-of-mind** wants to sell the energy project to the highest bidder possible. This means if one cannot afford to pay, he or she doesn't get access to energy, even if that person needs power to live.
- **The Charity state-of-mind** is often well-intentioned with the goal to give the community free or cheaper energy. However, this perpetuates dependency that does not enable the community to participate in the process to establish self-determination.
- **The Commons state-of-mind** is unique and different. This structure enables people in the community to come together to gain control of their own energy while building their collective "power" (PPSC, 2021). Crystal Huang, co-founder and member-owner of PPSC, noted in our interview that the PPSC operates in the commons state-of-mind.

2.7.3 Social-Ecological System (SES) Framework

(McGinnis & Ostrom, 2014)

The Social-Ecological System (SES) Framework takes into account the interdependent relationships that exist between social and environmental challenges, as well as the ways in which these challenges influence sustainability goals across systems. The SES framework combines institutional economics and political philosophy (Partelow, 2018). The framework offers a systematic technique to investigate the self-organization of common-pool resource consumers and to successfully manage those resources for the common good over the long term (Ostrom, 2007).

Socio-technical systems, like energy CAIs, lack research on common-goods-focused system governance. The SES framework is therefore important for studying the governance of shared technology resources in socio-technical systems (Acosta et al., 2018), especially from what the case studies in Chapter 6 demonstrate.

The SES framework (Ostrom, 2007) lists variables that may interact and effect social-ecological system outcomes. Research conducted over many years on institutions, commons and collective action has been essential for the development of the framework (Poteete et al., 2010). The SES is also used as a method for evaluating social-ecological system sustainability, in addition to being a framework for research (Ostrom, 2009; Partelow, 2018). Some energy CAIs research used the SES framework for a commons approach. Bauwens and colleagues (2016) used the SES framework to assess wind power cooperatives in four European countries (Bauwens et a, 2016). Additionally, Melville and colleagues (2017) analyze obstacles and potential in UK local energy systems using Ostrom's design principles (Melville et al., 2017; Acosta et al., 2018).

Following the publication of her book, *Governing the Commons* (1990), Ostrom and a large number of her colleagues started to compile empirical data on the factors and institutional configurations that had the highest probability of enabling actors to collaborate and find solutions to social issues in systems with public goods and common-pool resources (CPR) (Ostrom et al., 1994; Partelow, 2018).

McGinnis and Ostrom compel scholars to employ a variety of scientific disciplines, each with its own terminology, to understand how different kinds of governance influence resource users of different dimensions and backgrounds and resource systems with varied characteristics (McGinnis & Ostrom, 2014).

Figure 2.3 shows multiple first-tier components in a revised SES framework. First-tier categories are solid. The SESF is divided into tiers of layered and connected variables and concepts (Fig. 2.3). *Resource Units (RU), Resource System (RS), Actors (A) and Governance System (Gov)* are the highest-level variables that also contain lower-level variables. *Interactions (I), Social, Economic and Political Settings (S), External Ecosystems (Eco), and Outcomes (O)* are all part of the first tiers (Partelow, 2018).

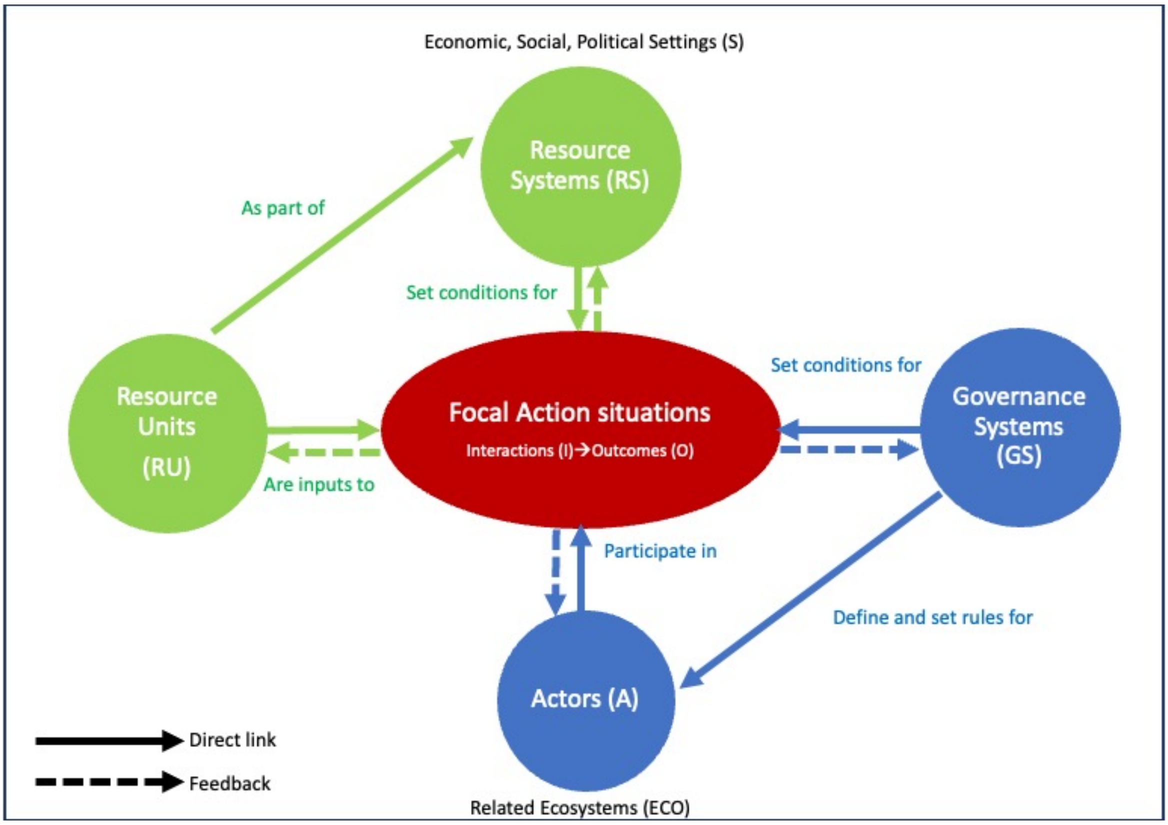


Fig. 2.3. Conceptualization of the social-ecological systems (SES) framework, adapted from McGinnis & Ostrom (2014).

Action situations feed each top-tier category. Feedback from action settings to each of the top-tier categories is shown by dashed arrows. The internal elements of the figure are surrounded by a dotted-and-dashed line, suggesting that the focal SES can be thought of as a logical whole, but any part of the SES may be subject to external influences from related natural systems or socioeconomic-political circumstances. These exogenous impacts may arise from larger or smaller processes than the focal SES (McGinnis & Ostrom, 2014).

2.7.4 New Social Movements Theory

(Castells, Touraine, Habermas and Melucci)

We obtain a deeper knowledge of how social movements affect collectivism and prosumerism in energy systems by using Social Movements Theory to investigate the underlying processes of energy CAIs in the energy transition (Campos & Marín-

González, 2020). Social Movements Theory provides a lens that "humanizes" the energy transition by addressing socio-political factors via a number of newly growing research fields, such as energy democracy (Szulecki, 2018; Van Veelen & Van der Horst, 2018), **prosumerism** (Campos & Marín-González, 2020), and **energy justice** (Forman, 2017; Sovacool et al., 2017). (see sections 2.*4 Energy Democracy and 2.5 Energy Justice* for more on these aligned research areas.)

Prosumer groups are growing constantly in the energy field and are supported by several energy regulations (Sciullo et al., 2020). The prosumer groups pool together funds, skills and resources, which helps to reduce economic and social risks, and, in turn, increases the normalization of collective prosumers (Ford et al., 2016). As participants who take an active role in social movements, energy prosumers produce and use renewable energy on their own and/or participate in energy markets, offering services like aggregation across several energy sectors (Campos & Marín-González, 2020).

Knowledge-sharing and socio-cultural learning are important aspects of social movements (Benford & Snow, 2000), which include people developing new technology, new forms of governance, or new economic structures and business models, among other types of knowledge-making (Jamison, 2010). New socio-cultural practices are incorporated into collective learning when new kinds of information are introduced via the advancement of scientific and technical knowledge (Jamison, 2006; Campos & Marín-González, 2020). This doctoral research on energy CAIs shows how new socio-cultural practices are being developed at the local, communal level.

The New Social Movement Theory, largely developed in the 1980s by Castells, Touraine, Habermas, and Melucci, shifts our understanding of social movements from their traditional political context (Tilly & Wood, 2015) to their more nuanced function as a type of collective action where conflict between rival actors is carried out (Buechler, 1995; Campos & Marín-González, 2020). These conflicts involve power and control over resource development, including cultural and political discussions about existing social ties, ecological degradation, and new technology (Buechler, 1995; Campos & Marín-González, 2020). Energy CAIs as prosumer collectives are gaining momentum and align with New Social Movement Theory. The move from individualism to collectivism necessitates **social cohesion** (as seen in the intersection of Figure 2.4), thus it is crucial to understand which **drivers, barriers and enablers of social movements** contribute to prosumer CAIs to achieve this goal (Ford et al., 2016; Sciullo et al., 2020).

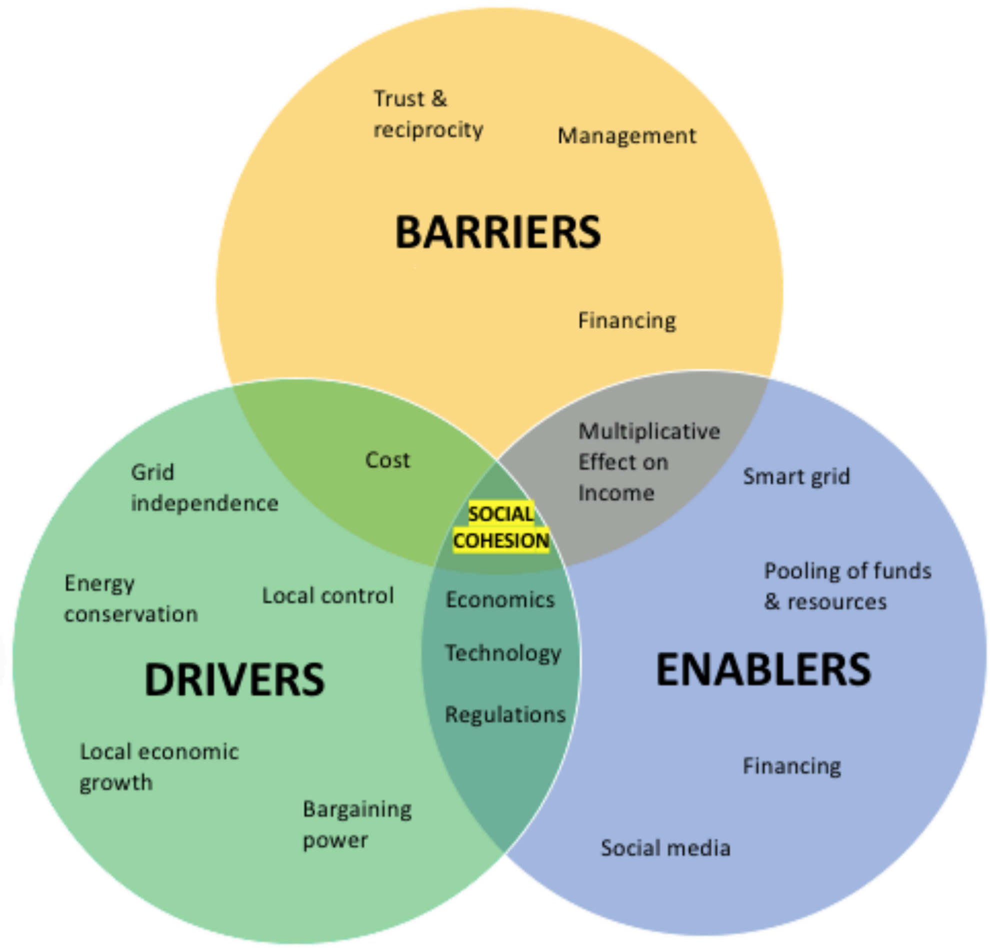


Fig. 2.4. Social Cohesion. Overview of drivers, barriers, and enablers of social movements, especially for citizen-led energy projects (Adapted from Ford et al., 2016)

Recent studies point to prosumerism as a major part of collective action framed by energy justice (Fuller & McCauley, 2016). This illustrates the nuanced characteristics of bottom-up, local community engagement (Fig. 2.4), in addition to new actors striving to promote energy access and affordability (Forman, 2017).

2.7.5 Sustainability Transitions Theory

(Loorbach; Geels)

The study of Sustainability Transitions has been a multidisciplinary response to the obstacles of coordinating the growing number of socio-technical transitions required to enable sustainable development during the last three decades (Loorbach et al. 2017). "Regimes and niches" are among its main themes:

- **Regimes** are the dominating socio-technical system, as seen in incumbent utility companies;
- **Niches** are innovation settings insulated from incumbent regime constraints, offering opportunities to investigate different socio-technical systems and confront the power relationships that obstruct sustainable transitions.
  (Avelino, 2017)

Sustainability Transitions can be described as an "empowered niche" (or niche-regime) threatening to destabilize or supersede the dominant, incumbent regime (Haxeltine et al., 2008). Niches may also be attributed to so-called "grassroots innovations," which are often initiated as sites for experimenting inside already-established regimes. All types of community energy, including energy CAIs, have been recognized as specific examples of grassroots innovation (Seyfang et al., 2014) as their values and approaches to adopting sustainability measures are at the core ethos instead of just secondary concerns (Seyfang & Smith, 2007).

Research on sustainability transitions indicates that for niche-level efforts to provide long-lasting results, they need a strategic vision. When communities engage in collective action with a strategic vision, this can help to challenge non-democratic regimes (Proka et al., 2018). For example, recent studies have shown an absence of consistency in the direction, strategy, and content of the UK's emerging community-led energy market (Seyfang et al., 2014). Similar to this, certain community energy initiatives in the Netherlands are not intentionally working to broaden outside of their area and engage with the regime (Proka et al., 2018). In fact, some initiatives decide to remain small so they may concentrate on providing local solutions to local challenges (Seyfang et al., 2013).

Sustainability transitions vary from many (but not all) historical transitions in a few key ways attributable to a number of unique traits. Sustainability transitions are purposeful or goal-oriented, as opposed to many historical shifts that were "emergent" (Smith et al., 2005) with common aims of solving ongoing environmental issues. Citizens working together to reform and decarbonize their energy systems in a participatory way are an example of this, as are social entrepreneurs looking into development potential tied to innovative renewable energy technologies and business models (Geels, 2011).

Although political processes have been intimately linked to studies on sustainability transitions, the contributions of social movements in promoting transition paths are still largely ignored (Hess, 2018). Social movements are more pertinent in circumstances of regime transition because they are involved in political and cultural processes that have the capacity to disrupt current socio-technical regimes (Turnheim & Geels, 2012).

2.7.5.1 Transformative Social Innovation

By combining concepts from **sustainability transitions with social innovation theory**, Transformative Social Innovation (TSI) has the capacity to "challenge, alter and/or replace existing (and/or dominating) institutions in (parts of) the socio-material context" (Haxeltine et al., 2016). Therefore, energy CAIs could be viewed as TSI initiatives and serve as innovation niches. However, not all energy CAIs explicitly state that this is their primary goal. Instead, some energy CAIs aim to transform their larger environment through inciting institutional change (Bauler et al., 2017).

Some studies have observed more action toward specific environmental and/or social objectives when combining grassroots innovation with TSI, regardless of whether the specific energy CAIs are linked to a specific location (as a community of place) or a shared interest (a community of practice) (Henfrey et al., 2017). This gives community-led energy CAIs the ability to successfully disrupt dominant regimes because they are grounded in shared narratives and values that are strengthened by involvement in trans-local networks (Henfrey & Ford, 2018). (See more about networks and social capital in *section 2.3*)

In both theory and practice, energy CAIs as a form of TSI have the potential to go beyond niche level and marginal action. Additionally, such localized energy projects may result in dramatic change at larger scales because to the social, cultural, and technical innovation they foster (Henfrey et al., 2017).

2.7.6 Strategic Niche Management + Multi-Level Perspective

(Geels)

For investigating the nuanced complexity of changes in energy CAIs and their socio-technical systems, the Multi-Level Perspective (MLP) is valuable to the theoretical framework applied here for understanding sustainability transitions by taking one step beyond niches and regimes and distinguishing between three analytical levels:

1. **niches**
2. **socio-technical regimes**
3. **an exogenous socio-technical landscape**

The MLP suggests that transitions, which are referred to as regime shifts, emerge when systems are interacting between these three levels (Geels, 2002). All stakeholders (institutions, niche CAIs, etc.) need to work together in a process of convergence. Investigations into "socio-technical" systems include innovative technology, but they also involve modifications to markets, user behaviors, policies, and culture (Geels, 2005). Additionally, as existing energy systems remain stabilized by embedded lock-in mechanisms, the socio-technical transitions are not easily realized (Geels, 2005).

By integrating MLP with Strategic Niche Management (SNM), which focuses on grassroots innovations, we obtain additional contextual framing of the typologies of energy CAIs, including **individual factors** (i.e. socioeconomic position, technological know-how) and **shared factors** (i.e. regulations, market actors, technology, social interactions and norms, supply chain) (Klein & Coffey, 2016).

SNM theories concentrate on grassroots innovations and claim that niche-level activities could operate as a basis for broad societal changes that drive forward sustainable development (Klein & Coffey, 2016). MLP, which has its roots in sociology, enhances SNM by offering evidence showing behavioral forces operating at different levels, where more altruistic behavior is based on a collective level and selfish behavior is based on an individual level (Wilson, et al., 2008). As a number of energy CAIs investigated in the COMETS project reveal, an individual's action based on altruistic values is a rational choice aimed at bringing collective well-being that addresses climate issues, such as engaging in low carbon development. This is aligned with the structural variables for having collective action, as postulated by Ostrom and Olson (Ostrom, 2010; Olson, 1965).

Geels (2002) examines social networks and technological advancements in agreement with the SNM-MLP paradigm. Organizational levels are classified as niches, regimes, and landscapes, whereas the technology transitions are a result of multiple-level actor development. Niche markets are first-applied technologies. Regimes, such as the energy sector, also have niches, such as local-level energy CAIs. A regime consists of actors, social groupings, regulations, sector-specific infrastructure, and machines. Aspects of landscapes include urban spaces, modes of mobility, institutions of economic and political power, and cultural norms. Geels (2002) argues that the landscape level is harder to modify than the regime level. Unlike regimes, landscapes change slowly. Electric lights, batteries, and photovoltaics are types of niche implementations (Geels, 2002).

The SNM-MLP framework is important for understanding collective action in the energy transition as it reveals how bottom-up (niche-to-regime) and top-down (socio-technical landscape-to-regime) interactions may create new pathways that drive social innovation. These pathways are open when socio-technical settings disrupt the incumbent regime (top-down) and niche-innovations (bottom-up) capitalize on this pressure (Klein & Coffey, 2016).

Chapter 3

Historical Analysis of the EU and US Systems

Background

The European Union (EU) and the United States (US) have unique similarities and differences in their historical development and socio-political contexts that have supported collective action in the energy sector over time. This chapter provides an in-depth analysis of the historical and socio-political contexts of each regions’ energy landscapes.

To contextualize and comprehend the current energy system, one must understand how historical circumstances affected the formation of collective action initiatives (CAIs) in the energy sector. Through the study of historical energy transitions, we are able to gain knowledge on the dynamics of the energy system transformations over time, which can then be applied to our present energy scenario (O’Connor & Cleveland, 2014). Thus, this analysis will put the current regional conditions into context with the aim of explaining the dimensions in how energy CAIs are created and developed across different countries.

Geels (2002) asserts that the historical development of a particular energy system, or "energy regime," has significantly influenced the establishment of energy CAIs (Geels, 2002). There are a number of potential reasons for this distinction, and the processes detailed in this chapter demonstrate how energy communities have been and continue to develop heterogeneously throughout the EU and US, albeit with some distinct similarities.

Historically, both regions' energy infrastructures have been heavily centralized with community level prosumerism (producer-consumer) at a niche level. An increasing number of scholars, citizens, and policymakers are in favor of moving to a more decentralized system that comprises more compact, widely spaced-out generation units that are close to consumers (Bauwens et al., 2016).

The importance of citizen participation in the EU and US energy systems is underscored through a number of energy CAIs. These collective actions depend on how much the community participates in decision-making and benefit sharing (Caramizaru & Uihlein, 2020; Walker & Devine-Wright, 2008). There are numerous and varied contextual variables that might affect how energy CAIs are established and developed (Verde & Rossetto, 2020).

For instance, energy cooperatives, which are a common form of energy CAI, were designed to be more than just energy suppliers, and they were meant to function according to seven key tenets (see section *3.7.4 Organizational structure of rural electric cooperatives,* for more details):

> (1) voluntary and open membership; (2) democratic member control; (3) members' economic participation; (4) autonomy and independence; (5) education, training, and information; (6) cooperation among citizens; and (7) care for the community (America’s Electric Cooperatives, 2021).

In the US, for example, it is important to note the prolonged battle for rural electrification as well as the unique method by which the countryside was connected: through member-owned and managed energy cooperatives. This especially continues in the middle of today's struggle for decentralized forms of Energy Democracy during the transition to renewable energy (Dawson, 2022).

3.1 Brief comparative overview of the EU and US systems

The development of energy CAIs differs significantly from one another, particularly with cooperatives, and between European countries and the United States. There are several possible explanations for this disparity. Locally owned energy has been connected to cultural norms such as attitudes toward the cooperative model and attitudes for local energy activism in addition to formal institutional regulations such as support for renewable energy (Bolinger, 2001). Furthermore, it has lately been claimed that rather than analyzing these elements separately, it is important to look at how they interact systemically (Oteman, 2014). Elinor Ostrom's 'Social-Ecological System' Framework is useful in its application for this endeavor (see *Chapter 2, section 2.7.3, Social-Ecological System Framework*, for more details).

Although the average Europeans and Americans have similar living standards, the EU and the US have several notable differences[8]:

- **Geo-political**: The US has 50 states under one country, whereas the EU is a union among 27 sovereign countries.
- **Geographic**: The US landmass (9,826,630 km2 / 3,794,080 sq mi) is larger than the EU (4,233,262 km2 / 1,634,472 sq mi).
- **Economic**: the US in 2020 had a GDP (PPP) of 21,440 trillion dollars ($67,426 per capita), while the EU had a GDP of 20,366 trillion dollars ($45,541 per capita).

Table 3.1: Comparison – Energy Cooperatives (as a form of energy CAIs) in the European Union and United States

Country/Region	European Union	United States
Total Population	447,007,596 (2021)	336,997,624 (2021)
% of energy produced by co-ops	6%	12%
Number of co-ops	1500	906
Density according to population (# of co-ops/total population/million inhabitants)	3.36	2.69
Approx. amount of renewable energy generated	1 GWh	873 MW

[8] Differences between the United States and Europe mapped: https://vividmaps.com/us-vs-europe/

% of energy produced by renewable sources (share of national production)	1-15%[9]	13%
Level of regulation	Member state	State
Representation by association	European Federation of Renewable Energy Cooperatives (REScoop)	National Rural Electric Cooperative Association (NRECA)

Source: updated from Gilcrease, 2018

Renewable energy sources (RES) have steadily increased in gross power consumption in EU nations as they strive toward renewable energy and decarbonization objectives, reaching 37% in 2020 from 34% in 2019. (Eurostat, 2022). Oil consumption has stagnated while wind and solar energy is rapidly growing, and natural gas is replacing coal as the primary energy source. However, RES energy supply changes still tend to be slow (O'Connor & Cleveland, 2014). For example, fossil fuels provided 86% of the U.S.'s main energy in 1990 and 80% in 2019 (EIA, 2020). Thus, RES deployment has been slow over the last 30 years in the US and more needs to be done to achieve decarbonation targets.

The context of development will be given in this chapter, along with some comparisons and contrasts. Then, we'll explore more deeply into both the EU and the US to examine how they both evolved during the nineteenth century and up to the present, both differently and similarly. The chapter's conclusion will provide a comparison of these differences and similarities overall.

3.2 Methodology

Recent studies on energy CAIs explores their definition in the energy sector and their various ownership arrangements (Gorroño-Albizu, 2019), as well as how they mobilize and challenge the incumbent energy actors (Gregg, JS, et al., 2020). Other studies focus

[9] Varies by country to country of EU member states.

on how they have developed through time in certain environments or locations and how national energy policy affects or is affected by them (Wierling et al., 2018). Furthermore, the historical evolution of energy CAIs is often examined in research through the lens of organizational and institutional theory (Mey & Diesendorf, 2018). However, in order to contextualize the macro-level processes of collective action phenomena in the energy sector in this EU and US, this research uses the Comparative Historical Analysis (CHA) and Theory of Fields (partially strategic action fields).

3.2.1 Comparative Historical Analysis (CHA)

In order to explain major large-scale outcomes, the comparative historical analysis (CHA) employs systematic and contextualized comparisons as well as causal analysis of processes over a period of time (Mahoney & Rueschemeyer, 2003). The CHA differs from other historical sociology methodologies like interpretative analysis and rational choice analysis (Mahoney & Rueschemeyer, 2003) as there is a primary focus on historically contextualized comparisons across countries (Collier, 1998).
Thus, CHA deals with:

> “a sustained focus on a well-defined set of national cases, a concern with a substantial time frame and with the unfolding of causal processes over time and the use of systematic comparison to generate and/or evaluate explanations of outcomes at the level of national politics” (Collier, 1998; Ohemeng, 2020)

The CHA's history in the social sciences is long and illustrious. All classical social scientists -- from Adam Smith and Alexis de Tocqueville to Karl Marx and Max Weber -- have used CHA as their primary method of inquiry. Additionally, CHA presently works in a variety of social scientific disciplines, such as public administration, economics, and sociology (Lange, 2013; Thelen & Mahoney, 2015). Many present-day conditions seem to have their roots in several generations or even centuries old constellations (Rueschemeyer & Stephens, 1997).

CHA is intended to produce causal arguments regarding a macro-sociological phenomenon, particularly on social movements (Mahoney and Rueschemeyer, 2003).

CHA has been criticized for remaining at the meso-macro level and failing to truly reach the micro level despite being widely used (Ohemeng, 2020). Nevertheless, as this chapter does not concentrate solely on micro-level processes (see *chapters 4 and 5* for more in-depth micro-meso level data analysis), this is not seen as a barrier to the analyses.

Macro level CHA is used by historians to describe the evolution and consistency of national systems. The theories of CHA take into account how events unfold over time. For example, when examining why European city-states and federations gave way to modern nations at various speeds, Charles Tilly (1990) makes the case that an event's effect is affected by its length. Another example of using CHA at a multilateral level is Rueschemeyer's study (1973) on the legal professions in Germany and the US and how they were affected by the differential timing of capitalist expansion and bureaucratic rationalization (Mahoney & Rueschemeyer, 2003).

As demonstrated by the situations of Austria, Denmark, Germany, and the United Kingdom, as well as some states in the US, are focusing on a small number of cases, allowing scholars to thoroughly examine them and analyze causal inferences and other explanatory variables. (Ohemeng, 2020). How a phenomenon can be examined is one of the key concerns that underlies CHA. Ritter (2014) claims that CHA is "one of the oldest methods in the social sciences" and that its practitioners must adhere to a number of methodological requirements (Ritter, 2014). Regardless of the study's specific emphasis, CHA is fundamentally guided by three key characteristics:

1) concern with the explanation objective;
2) the concept of causality;
3) the procedure for evaluating hypotheses.

(Mahoney & Terrie, 2008; Ohemeng 2020)

Despite existing for many decades in social sciences, CHA has only lately drawn much attention, as evidenced by the number of books and journal publications that have written about it in the last 30 years or so (Mahoney & Rueschemeyer, 2003). CHA researchers are able to identify the start of significant change brought about by events.

This perspective is often referred to as the "**crucial juncture**" perspective. A critical juncture is:

> "a period of significant change, which typically occurs in distinct ways in different countries (or in other units of analysis) and which is hypothesized to produce distinct legacies" (Collier & Collier, 1991; Ohemeng, 2020)

Boas (2017) asserts that locating a pivotal moment results in a causal hypothesis connecting a social transition to a distant dependent variable over time. For instance, in the EU and US, the 1973 oil embargo pushed local communities to investigate sustainable alternatives (Boas, 2017). The dependent variable should be a changing process, not a random event (Ohemeng, 2020). Complexity in system assessments arises from uncontrolled factors. Selection and interpretation are challenged by how to distinguish this from a simple tale. This may be qualitative or quantitative, therefore the causal link should include more circumstances (Mahoney & Rueschemeyer, 2003).

3.2.2 Theory of Fields (Strategic Action Fields)

Social science requires understanding social change and order, from political upheavals to financial meltdowns. The Theory of Fields integrates economic sociology with social movement theory and organizational theory to explain social organization and strategic action. Fligstein and McAdam's bottom-up approach emphasizes actors' strategic action without methodological individualism or rational choice theory by focusing on field position (incumbents or challengers) as the driver of action. According to Fligstein and McAdam (2012), "fundamental units of collective action in society" can also be considered as fields. This offers analytical resources for examining the dynamics and challenges of a particular field throughout the energy transition. (Fligstein & McAdam, 2012; Husu, 2022).

Numerous studies have used Pierre Bourdieu's master concepts of capital (economic, cultural, social, and symbolic resources), field (social spaces of objective relations between positions), and habitus (internalized dispositions) to shed light on social processes. In this context, I refer to Bourdieu's idea of the field of power, which is described by the "social space in which elite actors at the pinnacle of diverse fields form coalitions to promote significant changes in laws, rules, regulations, practices, and societal resource flows" (Harvey et al, 2020).

Therefore, **strategic action fields** are used with Fligstein and McAdam's "Theory of Fields" to explain collective action across time (Fligstein & McAdam, 2012). Strategic action fields are meso-level social structures in which actors interact while conforming to specified goals, relationships, rules, and objectives. These hierarchies have been called "sectors" (Scott, 1987) and "networks" (Powell et al., 2005). In other words, strategic action fields are collective action's building blocks (Fligstein & McAdam, 2012).

Focusing on **critical junctures** throughout the phases of development, establishment, and decline enables us to follow the historical trajectory of energy CAIs using the strategic action fields framework. For instance, Mey and Diesendorf (2018) studied the Danish community energy field's origins, evolution, and lessons that can be applied to other countries (Mey & Diesendorf, 2018).

The bottom-up method focuses on field position as the foundation of action, beyond issues of individualism or rational choice theory. With fields separated between **incumbents** (groups with authority and other advantages) and **challengers** (groups attempting to disrupt fields to progress up the order), the "rules of the game" are devised to reduce antagonism and welcome competition (Fligstein & McAdam, 2012).

Embedded or overlapping strategic action domains represent transformational processes. Changes outside a well-established field might trigger internal disagreements. Fligstein and McAdam term significant pressure on fields "episodes of contention," when players battle to maintain or change the existing quo (Fligstein & McAdam, 2012). Internal governance groups maintain field stability and resolve conflicts. Actors need skills, resources, and ability to activate creative collective action. The state contributes substantially here. Modern fields depend on government support to maintain stability. Fligstein and McAdam note that government interventions favor incumbent players (Fligstein & McAdam, 2012), as seen by the historical steps of energy CAIs in the EU and US.

3.3 The early development of energy CAIs in the EU and US

The heterogenous development of energy CAIs was influenced by historical events, and knowing those impacts is essential to understanding the present-day scenario. Energy transitions are widely known to cause significant changes in the economy, society, technology, and environment (Grubler, 2012; O'Connor & Cleveland, 2014).

Communities have continued to establish CAIs overtime, even if the political field is often uninformed about them. Social initiatives that aim to provide alternatives to the sociopolitical landscape (e.g., anti-nuclear movements) were some of the first to organize energy CAIs, especially in the cooperative model, in European countries (Wierling et al., 2018). Additionally, it's significant that many energy CAIs are addressing issues of a 'just transition' which includes supporting provisions that create access to traditionally marginalized groups (e.g., low income communities) (Forman, A. (2017).

Energy CAIs were established towards the end of the nineteenth century and in the first part of the twentieth century. These communities ranged from cooperatives and RECs to eco-villages and purchasing groups (see *Chapter 2*). These collective action initiatives were originally established primarily to support rural electrification and/or to offer power at a lower cost in these regions (ILO, 2013). In those early years, rural electrification faced significant difficulties. Cooperatives, for example, were frequently the first and only suppliers of electrical services in rural regions since for-profit businesses typically deemed the investment to be too expensive or the enterprise unsuccessful. For instance, 453 of Austria's 710 electricity-generating facilities in 1911 were operated by cooperatives or other private business owners (Schmidt, 2008).

The cooperative model is embedded in many sectors, including the production and distribution of energy, where they often develop as a result of market failure. The US and EU have many examples of energy cooperatives cited by many academics and professionals of effective rural electrification. Additionally, in the US, investor-owned or municipally owned utilities still require more subsidies than rural power cooperatives (Yadoo & Cruickshank, 2010).

Few market incentives exist for the profit-seeking companies involved in rural electrification (Haanyika, 2006). According to research conducted by the World Bank, rural electrification occasionally crosses the line between market efficiency and sustainability, especially in cases involving the poorest and most remote communities. In many instances, the initial expenditures or predevelopment funds must be covered by subsidies, and it is debatable whether communities can finance maintenance and running costs on their own (ILO, 2013). Wierling and colleagues (2018) underscore how important CAIs are for reducing the price of renewable energy and serving as catalysts for renewable energy solutions (Wierling et al., 2018).

Geographical isolation, distant users, increased maintenance costs, and the limited financial capacity of potential consumers are some additional factors contributing to these problems (Reiche et al., 2000). The World Bank study also revealed that in countries with weak institutions, cooperatives have been successful in supplying energy to rural regions. Thus, showing the importance of considering alternative energy distribution methods and ownership models than to only expand the country's electrical infrastructure (ILO, 2013).

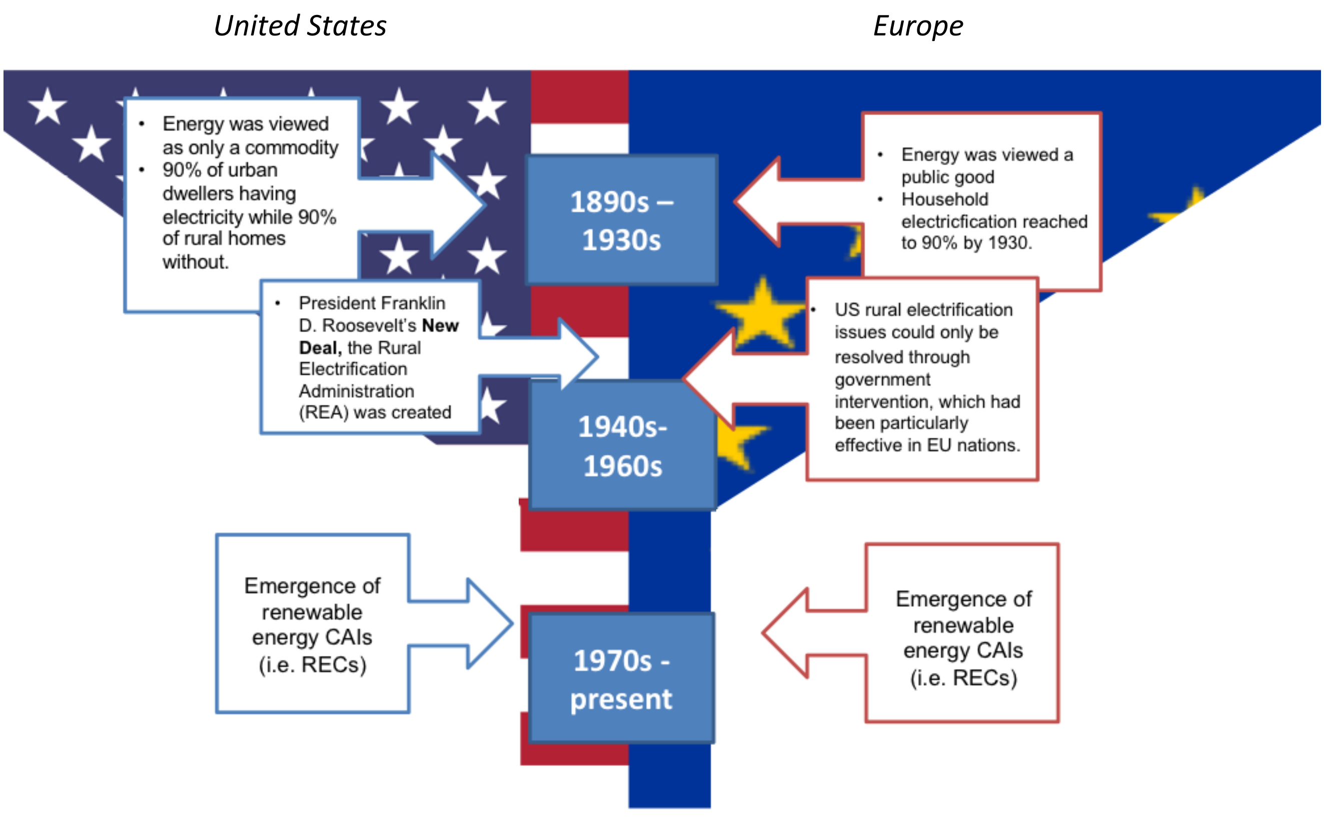


Fig. 3.1 Historical context overview

From the 1890s until the 1970s, the development of electricity was developed with very heterogenous aims (see figure 3.1). For instance, in the US, Americans viewed electrification as a business rather than as an essential social service, which was the case for most EU countries.

3.3.1 Electricity as a commodity, not a public good

Historically, power in the US was privately financed and required a profit. In Europe, electricity was often generated within a welfare state. Ownership and goals affected development. In Europe, particularly Scandinavian nations, the state generally owned utilities and utilized them as social initiatives (Nye, 1997). In the US, home electrification started as a conspicuous consumption for the wealthy and moved slowly to the rest of society. US streetlights rapidly evolved into commercial and advertising displays (i.e. neon signs, billboards, etc.). In Europe, notably Scandinavia, Germany, and Holland, such spectacular lighting for advertising took longer to emerge, although 90% of homes in those European countries were electrified by 1930 (Nye, 1997). This shows where electrification priorities were in those early years.

Private US utilities couldn't match European service standards. Most farmers obtained services via state and federal programs. For example, private ownership of streetcars in the US meant rapid growth in the 1890s until their rapid decline after 1920. Municipal governments in Europe ran streetcars at a loss since they were a public benefit. After 1920, US streetcar networks disintegrated, revealing another disparity between Europe and the US (Cochrane, 1985).

Americans typically considered electricity a business, not a social service. Electricity was a commodity for private firms. After the 1929 stock market crisis, US utilities continued to develop rural lines, although slowly. 11% of US farms had electricity in 1935, compared to 95% in Holland, 85% in Denmark, and 90% in France and Germany. Even New Zealand and Tasmania even had higher rates than in the US (Nye, 1997). The US still employs the 1940s-era electrical infrastructure, which was built by political and economic pressures, not technology (Nye, 1997).

In contrast to Europe's almost universal energy service, it was politically difficult for Roosevelt's New Deal to ignore the disparity between urban and rural electrification. The New Deal's Rural Electrification Administration (REA) addressed this imbalance. (Brown, 1980).

3.4 European History

Between 1895 and 1932, Europe witnessed the emergence of collective action in the energy sector. In Germany, for example, approximately 6,000 energy cooperatives were established in this period, the majority of which were established during the unstable years after World War I (1918-1925). Most of these energy CAIs in rural regions managed their own electrical grids (Caramizaru & Uihlein, 2020). In Europe, the most notable change in energy CAIs occurred between after the 1930s. A number of key events, such as World War II, the energy market liberalization, and amendments to the legal status of energy cooperatives, among others, had influence on challenging the growth of energy CAIs (Holstenkamp, 2012).

Every European country has its unique history of the energy community sector, which has been affected by certain contextual elements throughout its lengthy and mostly successful history. Despite differences in size, performance, and methods, the cross-country study clearly demonstrates that European energy CAIs have a number of common characteristics. This section describes some evidence that has been emphasized in the literature in order to give specific instances that demonstrate the significance of several of these contextual aspects.

To realize this, focus is placed on Austria, Denmark, Germany, and the United Kingdom—four counties with some of the longest history of community energy. Other European nations with a lengthy history of community energy initiatives include Belgium, the Netherlands and Sweden, where citizen engagement has been gaining traction in society for several years. The history of energy CAIs is much shorter in southern and eastern Europe, where the word "collectivism" has long been associated with a socialist past (Verde & Rosetto, 2020).

Energy cooperatives grew particularly in Denmark and Germany, both starting with the development of wind power. Since the 1970s, Denmark has been considered to be a pioneer in the emergence of wind cooperatives. The 1973 oil crisis stimulated the growth of wind cooperatives and forced people to reassess their reliance on oil. Communities in nations including Belgium, Denmark, Germany, and the Netherlands started building wind turbines. After the Fukushima accident in 2011, the number of energy cooperatives in Germany increased dramatically. In both countries, local communities' control more than 50% of the renewable energy systems (European Commission, 2015). Additionally, Denmark and Germany are home to more than 80% of the 3,000 renewable energy cooperatives that are known to exist in Europe (Wierling et al., 2018).

In the mid-1970s, Denmark built the first "renewable energy communities," or "RECs," as they are more widely known. However, it wasn't until the 2000s that the general public started to take notice of their spread in Northern Europe. The popularity of energy cooperatives in Denmark and Germany may be attributed to favorable national energy policy frameworks and a public awareness of the advantages of local management of renewable energy projects (EEA, 2017). In particular, both countries have put in place significant support systems like feed-in-tariffs (FiTs), which inspired citizen cooperative organizations to participate in energy production (REScoop, 2015).

Since 2000, the majority of western Europe has seen a surge of grassroots efforts by individuals trying to take advantage of the energy transition, giving them a chance to participate in energy production, distribution, and transportation. The amount of renewable energy generated by communities, however, varies greatly across Europe. For instance, between 1% and 2% of the renewable energy generated in Southern and Eastern Europe, 6% in Belgium and France, and an estimated 15% in Scandinavian countries comes from energy cooperatives (Huybrechts & Mertens, 2014).

One of Europe's most significant sources of collective energy is unquestionably the cooperative model, which is the only one that is represented by a federation called REScoop. In fact, 2 billion euros have been invested in renewable energy production installations by REScoop members collectively. These facilities are capable of producing 1 GWh, or around 725,000 houses' worth of electricity (REScoop, 2015).

The cooperative model is widely used in some countries, but it is still a minor contributor in others, notably in Southern and Eastern Europe. Interestingly, more than 77 active cooperatives in the Italian Alps region of South Tirol, where the cooperative concept has been successful for more than a century, provide renewable energy for 80,000 residents in 110 small communities (European Commission, 2015). The rest of Italy is slowly catching on to the cooperative model for its energy field. Some countries with long histories of cooperatives, like Denmark and Germany, are seeing the emergence of more promising projects (COMETS D4.2, 2021).

The growth of the field of study and the body of literature on RES communities in Europe reflects the interest in them and their perceived or actual significance (Verde & Rossetto, 2020). (See *Chapter 1, Introduction*, on growth of this research interest.)

The organizational structures of energy CAIs differ across Europe due to regional demands and national legal systems. However, they may be easily identified apart from commercial energy market players, such as large utilities, by a few shared traits. Common traits include the intention to drive forward the transition to renewable energy sources, as well as citizen participation (allowing members to actively participate and control the project), and the desire to accomplish non-commercial goals, such as building trust among community members (Wierling et al., 2018).

3.5 Comparison of EU countries

(in alphabetical order)

AUSTRIA

DENMARK

GERMANY

UNITED KINGDOM

3.5.1 Austria

Hydropower has historically served as the foundation of Austria's electrical grid. Around 75% of domestic generation in 1970 came from hydroelectric facilities (Schreuer, 2016). In Austria’s rural regions, energy cooperatives were crucial facilitators. Nine historical cooperatives are still in operation today and are listed in the COMETS database for Austria (Wierling et al., 2018). (see *Chapter 5* for more EU data information.)

Around 25% of Austria's electricity today is still produced from fossil fuels in thermal power plants utilizing gas, oil and coal (Schreuer, 2016). The energy system still primarily depends on hydropower, accounting for 65% of domestic generation, while the remaining 10% comes from biomass, wind, solar, and geothermal energy (Schreuer, 2016).

The 1970s environmental movement had a favorable cultural impact, like in other EU nations. Despite the Austrian government's claim that it wouldn't pursue wind energy owing to low yields in the country, these collective action movements supported wind and solar, helping to drive forward their deployment over time (Wierling et al., 2018). Construction of a hydropower project that would have significantly damaged local wetlands as well as nuclear power development were both controversial throughout the 1970s and 1980s (Lauber, 1996). Those "critical juncture" scenarios led to regulatory shifts in the early 1990s. Support mechanisms for renewable energy sources outside large-scale hydropower began to take shape and in 1991 the Electricity-Feed-in Law was enacted, similar to the one implemented in Germany (Lauber, 1996).

Community involvement in the energy field resulted in a significant rise in wind power from 200–600 kW in the middle of the 1990s to around 1000 MW today (Wierling et al., 2018). In the middle of the 1990s, energy CAIs controlled close to 80% of Austria's installed wind power capacity. In 2010, citizens collectively owned between 40–50% of the installed capacity of wind farms (Schreuer, 2012). The majority of community projects, or "Bürgerkraftwerk" as they are known in Austria, operate in the wind sector and are either seen as shareholder organizations or as working with incumbent utilities. Nonetheless, just 4.8% of Austria's renewable energy comes from wind (Wierling et al., 2018). According to analysts, individuals held 80% of Austria's installed wind generating capacity in the latter years of the 1990s. In less than two decades, 40–50% of the installed capacity of wind farms were owned collectively by citizens in 2010 (IG Windkraft, 2014).

Wood is the second-most significant renewable fuel at 29.6% of the total share after hydro power (36.5%) (Statistics Austria, 2021). Due to its extensive wooded land, Austria has one of the highest biomass percentages in all of Europe. This was accomplished by a significant expansion of district heating powered by biomass in the 1990s and 2000s. For instance, between 1999 and 2010 the quantity of installed plants rose fourfold (Statistics Austria, 2021). These plants supplied 45% of the total district heating output and cooperatives played a significant role in the scaling up (Statistics Austria, 2021). In 2010, farmers' cooperatives managed 66% of the plants (ILO, 2013). Future trends suggest that district heating's importance will only grow. The Austrian government intends to increase district heating by a factor of five, according to Austria's Renewable Energy Action Plan (Wierling et al., 2018).

Feed-in tariffs for power generated from biomass were ensured by the Green Electricity Law, which was established in 2002. However, district heating facilities were built before 2005 without taking into account local demand or even the most fundamental network links. The Austrian government introduced efficiency goals for district heating plants of 60% in 2006. This was done as a remedial measure. In the years that followed, the quantity of newly established energy cooperatives leveled down as a result of this.

District heating, which is often used in rural areas, is used by 95% of the registered energy cooperatives. Sawmill owners started specific projects for district heating using biomass in the 1990s, which then increased as a result of farmers seizing the opportunity to use byproducts from the wood industry to generate additional revenue (Seiwald, 2014). They banded together and established cooperatives to split the costs. Additionally, these cooperatives qualified for capital grants and interest-free loans that allowed them to pay up to 50% of the investment expenditures (Madlener, 2007).

In Austria, citizen-led solar PV plants are only beginning to emerge; a more recent development than wind farms (Reinsberger & Posch, 2014). The Austrian solar industry came from modest beginnings, primarily as a self-organized community education campaign among a small group of Do-It-Yourself (DYI) enthusiasts in rural areas. Today, Austria's solar industry holds a significant position in the global manufacturing industry despite its early days (Ornetzeder, 2001; Ornetzeder & Rohracher, 2006). There were scattered initiatives to jointly fund PV installations as early as the mid-1990s, but few were built until 2010. Feed-in tariffs and solar costs had adjusted favorably and contributed to their proliferation (Schreuer, 2016).

3.5.2 Denmark

The foundations of electricity in Denmark provides a striking contrast to how individualism and dependence on the market shaped growth in the US, where private utilities predominated. The ethnic and cultural homogeneity of Danish society and its dedication to social services that are widely accessible are the roots of Denmark’s technical approach (Nye, 1997).

The majority of Danish cities constructed sizable power plants that generate energy using steam turbines to heat houses and businesses with the resultant boiling water via underground pipelines. In addition to being more affordable and environmentally friendly than installing ineffective furnaces in every home, this "cogeneration" also strengthens community ties (Rüdiger, 2014).

Local governments have always played a part in Denmark's highly decentralized energy sector. Local governments and communities cooperated together to build wind farms, which are frequently small in size, situated in rural areas, and usually owned by farmers, homes, and local businesses (Verde & Rossetto, 2020).

Cooperatives in a variety of sectors have a long history in Denmark. The earliest cooperatives were founded in the agricultural industry, and throughout the first part of the 19th century, they expanded widely throughout the country. Cooperatives are still a significant aspect of Danish culture and are present in a variety of industries, including the food industry, retail, as well as public services like consumer-owned energy utilities. Despite the fact that many rural cooperative initiatives suffered losses in the 1970s, the ideas of resolving disputes collectively at the local level and the creation of cooperatives as platforms for cooperation have remained in Danish society. Nevertheless, when wind power technology became economically viable in the 1970s, the cooperative model was able to flourish (Bauwens et al., 2016).

Due to the oil crises of the 1970s, Denmark, like the United States, sought to increase its energy independence. However, in Denmark, a strong domestic antinuclear movement ensured that government plans for local alternatives to imported oil skewed more toward renewable energy than nuclear power plants (IRENA, 2013). Due to the high cost of the enormous wind turbines being manufactured in Denmark in the middle of the 1980s, communities there started pooling their money to buy wind turbines through regional wind cooperatives. Legislation required that any extra power generated by these cooperatives may be sold back to the grid or fed back into the system, **much like in the US. As a result, the wind turbine sector has flourished thanks to new, decentralized energy democracy** (Dawson, 2022).

In terms of wind energy, Denmark was a pioneer and continues to be a global leader. Danish wind cooperatives have been effective in lowering the cost of turbines and creating a culture of support for renewable energy since Denmark has an abundance of wind resources (Mey & Diesendorf, 2018).

Similar to the United States, energy CAIs began to focus only on renewable energy in the mid-1970s, which was prompted by the oil crisis. In that time, Danish society considered nuclear energy but ultimately decided against it and never implemented it. Before the oil crisis of the 1970s, nearly 80% of Denmark's energy demands were met by petroleum imports (Krohn, 2002).

Denmark started moving away from fossil fuels after the embargo in an effort to strengthen energy security (Rüdiger, 2014). Thus, more recent cooperatives were built on a foundation of collective anti-nuclear networks (Mey & Diesendorf, 2018). The country's abundant wind resources and the need for nuclear power alternatives led to initiatives for the exploitation of wind energy. An ambitious civil society played a critical role in these experiments, especially in the beginning of the wind market (Verde & Rossetto, 2020).

The following two decades saw an unprecedented growth of cooperatives focused on wind energy procurement. These cooperatives and social entrepreneurs ran modest initiatives by the late 1990s reportedly deployed around 2000 turbines in Denmark (Oteman et al., 2014). Thus, the growth of the domestic wind sector, which was a goal of industrial strategy and received a variety of forms of financial assistance, including as investment grants and feed-in tariffs, may be attributed with the success of wind cooperatives (Bauwens et al., 2016; Verde & Rossetto, 2020).

Wind turbines were scattered throughout the terrain during the 1980s and early 1990s, not always in places with the best wind potential. Due to the proliferation of smaller turbines in subpar locations for wind potential, the landscape was significantly altered in terms of aesthetics. To stop this tendency, wind planning zones were created in 1995, putting municipalities in charge of organizing the placement of wind turbines by 2001 (DEA, 2015).

3.5.2.1 Denmark's feed-in tariff

The expansion of wind turbines has benefited greatly from the involvement of the public in the legal arrangements known as general partnerships with the intention of operating them and selling the power produced. The community ownership model's influence was waning by the 1990s as more private ownership, mainly held by farmers, took its place (Hvelplund, 2006). A wind feed-in tariff program established in 1992 made this feasible by guaranteeing connections and power purchases at a "fair price" of 85% of retail rates (Farrell, J., 2009). Because wind projects qualified for rebates from both the Danish carbon tax and the energy tax, the compensation for wind energy was nearly doubled (Bolinger, 2001). The Energy Supply Act, which was approved by the Danish parliament in 1999, included provisions allowing customers to pick their power supplier and promoting a certificate-based quota system for renewable energy. For the market to grow, users were compelled to buy a specific amount of renewable energy (Orcana et al., 1999).

In 2002, more than 150,000 citizens owned shares in wind power cooperatives. The cooperatives collectively owned around 40% of the 6,300 erected turbines in Denmark, underscoring their significance for the Danish energy transition. The majority of the owners of the remaining turbines—about 40%—were farmers, and 20% of them belonged to utilities (Krohn, 2002).

In 2002, wind feed-in tariffs were eliminated by Denmark's newly elected center-right parliament. They promoted market liberalization and market deregulation in an effort to boost competition and bring down electricity prices for customers, contending that wind technology had reached a point of maturity at economies of scale that did not require additional government assistance. The number of wind energy cooperatives significantly decreased once the tariff was phased out in 2004 (Wierling et al., 2018). Larger businesses, such energy service providers, were able to enter the market more competitively as a result. For the already established energy cooperatives, who controlled fewer turbines, this was not the case (Wierling et al., 2018). The number of households with energy cooperative shares decreased to 100,000 by 2004 and to 50,000 by 2009 (Mignon & Rüdinger, 2016). (see Germany's impact of phasing out their feed-in tariff scheme in *section 3.5.3.2 below*.)

It is difficult to quantify how many new wind cooperatives were established after 2009, (see *Chapter 5* on the data for Denmark) despite the fact that utilities and project developers constructed and owned the majority of new wind power projects. In 2010, 15% of all Danish wind turbines were owned by cooperatives, according to the Danish Wind Turbine Owners Association (DK VIND) (Skotte, 2010). Over 6,000 wind turbines were in service as of April 2018; by 2017, wind energy accounted for 49% of Denmark's electricity generation (DEA, 2021).

The early energy transition pioneers in Denmark are expected to play a smaller role going forward. Onshore wind farms of all sizes will be subject to tendering procedures starting in 2019, which would further disadvantage cooperatives in comparison to big developers (Wierling et al., 2018).

3.5.3 Germany

German energy CAIs, particularly those that take the form of cooperatives, have a long history that can be traced back to the beginning of the 20th century, when they were first created to guarantee the provision of electricity in rural regions, particularly in the Bavarian region (Flieger & Klemisch, 2008).

Germany is a pioneer in renewable energy projects in Europe and internationally, similar to Denmark. Although there is a variety of renewable technologies deployed, wind and solar power are particularly significant. Oteman and colleagues (2014) claim that the decentralization of the German renewable energy policy framework is only marginal (Oteman et al. 2014). Additionally impressive is the distinctive contribution made by citizens and communities via cooperatives (Yildiz et al., 2019; Verde & Rossetto, 2020).

The majority of the recently formed energy CAIs are engaged in producing electricity from solar power. Certainly, other energy CAIs produce energy from solar PV, as well as other renewable sources, such as wind, hydro, biogas, and regional district heating systems (biomass) (Schreuer, 2012).

Energy cooperatives especially have grown significantly during the past several years in the German energy market. There are 973 energy cooperatives in existence right now, 82 of which operate with wind energy, whereas **the majority of cooperatives concentrate on solar PV generation since it has a better rate of return than other forms of energy** (Bauwens et al., 2016).

Germany's renewable energy sector continues to grow. In spring 2019, renewables generated 65% of Germany's electricity, with wind turbines providing roughly 50% of the total mix (Yildiz et al., 2019). In the early 2000s, less than 10% of the country's power came from renewable sources, therefore the transition to clean energy was rapid (Dawson, 2022). Onshore wind accounts for roughly 50% of renewable energy sources, while 20% is owned and managed by CAIs (Bauwens et al., 2016).

In addition to energy prosumerism (production-consumerism), a number of energy cooperatives trade renewable energy products including PV panels, power supplies, energy-saving contracts, educational materials, to name a few. Sometimes cooperatives begin with a solar PV project before expanding into other areas (Schreuer, 2012). In Germany, for example, EWS-Schönau overcame strong resistance from the incumbent utility to transform a local energy CAI into a regional network operator that delivers renewable energy nationwide without jeopardizing its core values by mobilizing public commitment to the goal of a more inclusive, democratic, and decentralized energy system (COMETS D2.1, 2019). The work of Ursula Sladek, founder of EWS and winner of the 2011 Goldman Prize for Climate & Energy, and her community in Schönau shows how social entrepreneurship and environmental stewardship may interact to address two of the most pressing concerns confronting the international community today: energy security and climate change (Goldman Prize, 2011).

Germany's energy cooperatives have a long history. Similar to the US, energy cooperatives helped electrify rural regions at the turn of the century (Wierling et al., 2018). Energy cooperatives historically accounted for the second-largest category in the German Rural Cooperative Association in 1930, with more than 6000 projects. Approximately 40 of these energy cooperatives were still in existence when the energy markets were deregulated in 1998 (Yildiz et al., 2015). Overall, German energy cooperatives have received less attention in academic literature compared to the US (Wolman, 2007).

The German states decide how to carry out energy programs, such as wind zoning plans and subsidy schemes, while the federal level establishes policy goals and priorities (Yildiz et al., 2019; Verde & Rossetto, 2020). Between 1970 and 1985, a low percentage of energy cooperatives have been established, most of which processed biomass for energy. From 1985 to 1995, renewable energy pilot programs prevailed. Renewable energy generating cooperatives and "bioenergy villages" revived the cooperative concept in the energy industry into the 2000s (Yildiz et al., 2015).

3.5.3.1 Germany's Energiewende

Similar to the other countries discussed in this dissertation, the idea of the energy transition (or "energiewende" in German) first emerged in the anti-nuclear movement in the 1970s (Verde & Rossetto, 2020). Germany's shift to renewable energy has been aided by grassroots movements for energy democracy (Morris & Jungjohann, 2016). Germany's planned "energiewende" has gained international interest and is recognized in literature that the renewable energy industry has developed within the energiewende framework as a long-term political plan (Dawson, 2022).

The energiewende also represents 'people power' in the form of empowering communities to go up against the status quo. In a sense, this is related to forms of **energy democracy** (see *Chapter 2, section 2.4*). For example, a conservative German rural town erupted against government plans to "develop" the area by constructing a nuclear power plant and enticing new businesses to consume all the extra electricity (Morris & Jungjohann, 2016). The community called for increased democracy in the energy industry and a significant role for residents in energy planning. This was in opposition to social and environmental transformations that would benefit major incumbent companies and industrial interests while leaving people to endure the dangers of nuclear power (Dawson, 2022).

Similar to the US system, Germany's grid is based around publicly operated regional power companies that generate and distribute electricity (Morris & Jungjohann, 2016). In fact, US regulatory reform influenced Germany's demand for greater local energy control (Dawson, 2022). President Jimmy Carter addressed the United States' energy situation, encouraging residents to decrease thermostats, to "live frugally," and to enhance energy efficiency. President Carter said energy policy was the "moral equivalent of war" (Dawson, 2022).

The 1970s and 1980s protests in Germany against the nuclear industry was also pushing against the centralized structure that was built during the Nazi authoritarian period. The system's monopolistic character highlights the challenges of the free market doctrine, since uncontrolled market forces had not resulted in new and competitive energy businesses. Instead, the system consolidated the dominance of fossil fuel and nuclear utilities (Dawson, 2022). That energy transition was accompanied by flexibility, sector coupling, and market reform, which transformed the transportation, heating, and industrial sectors' access to energy (Rechsteiner, 2021).

Austria, Belgium, Denmark, and Italy have nuclear phaseout plans with comparable percentages of wind and solar power in their grids (Morris & Jungjohann, 2016). Many local and national governments won majorities of strong opponents of nuclear power after 1970. In fact, their efforts created a foundation for climate policy (Rechsteiner, 2021). The energiewende later became an official government initiative in 2010, just before the Fukushima nuclear tragedy. After the catastrophe at Fukushima in 2011, Germany made the bold choice to shut down all of its nuclear power units (Dawson, 2022). The energiewende plan is popular due to people's and communities' engagement (Verde & Rossetto, 2020).

After 1974, OECD research expenditures for nuclear power dropped from 75% to 25%; the share of renewable energy in research funds is below 20% (IEA, 2019). Even with minimal expenditures, renewable energy generation has been successful. Science, industry, and citizen engagement fueled these accomplishments (Rechsteiner, 2021). Active population engagement is an important feature of the Energiewende agenda (Morris & Jungjohann, 2016).

Bundestag resolutions, a robust industry, dedicated research institutes in Germany and globally, and a large number of individuals embraced decentralized energy generation before it was widespread (Rechsteiner, 2021). Due to the energiewende's long time horizon and broad support, a strong legal and regulatory framework has been created for renewable energy. Thus, energy CAIs have symbiotically benefited and contributed to it (Verde & Rossetto, 2020).

3.5.3.2 Germany's feed-in tariff

Germany is an example of how policy-level indirect approaches have increased energy CAIs. A key motivator was the Act on the Sale of Electricity to the Grid (Stromeinspeisungsgesetz) , which was subsequently revised by the Renewable Energy Sources Act (ILO, 2013). The Stromeinspeisungsgesetz provided "feed-in" financial incentives in 1990, while the RESA expanded and strengthened the Act on April 1, 2000. The RESA is significantly responsible for the expansion of Germany's dynamic electricity market and is a successful financial mechanism for achieving renewable energy growth goals (ILO, 2013).

The RESA feed-in tariff allowed small energy producers in Germany to connect to the electric utility network, hence supporting energy CAIs to join Germany's national grid by not needing a high minimum input level (Nolden, 2013). A quota system wouldn't have helped solar PV and other new technologies. The feed-in tariff helped drive the large-scale installation of solar systems in Germany (Strunz, 2014).

The German feed-in tariff was also seen as a model that was adopted by several countries. In fact, it was so successful that the EU pushed the German feed-In tariff scheme as a model for deploying renewable energy in Europe. Between 2004 and 2011, EU clean energy investments grew 600% (Dawson, 2022; Sweeney & Treat, 2017). The feed-in tariff was vital for wind and solar PV energy CAIs to expand (ILO, 2013).

The term "feed-in tariff" was coined from the German Act's translation. According to the US Department of Energy, a feed-in tariff is:

> “a publicly available, legal document, promulgated by a state utility regulatory commission or through legislation, which obligates an electric distribution utility to purchase electricity from an eligible renewable energy seller at specified prices (set sufficiently high to attract to the state the types and quantities of renewable energy desired by the state) for a specified duration; and which, conversely, entitles the seller to sell to the utility, at those prices for that duration, without the seller needing to obtain additional regulatory permission.” (Hempling, 2010)

A feed-in tariff typically comprises guaranteed access to the grid, long-term power purchase agreements (PPAs), and purchasing prices that vary according to the price of producing renewable energy (Mendonça, 2007). The Feed-In Act required grid operators to connect renewable electricity plants. Also, the 20-year power purchase agreements (PPAs) assured renewable energy producers a set pricing for their electricity. The law led to the rapid spread of wind generation in Germany, while early solar deployment was minimal owing to low compensation levels. Once the plan was updated in 2000 by a Green Party-led coalition, renewable energy installations grew quickly (Dawson, 2022).

When the Cooperatives Act was updated in 2006, this legislation boosted interest in creating new energy CAIs (ILO, 2013). However, this all changed in 2014 when the RESA underwent a major revision by replacing the feed-in tariff program with a market premium program (see section below).

State laws have also enhanced this national legal framework. In 2008, for example, Baden-Württemberg became the first German state to require renewable energy in new residential construction. Since 2010, the state's Renewable Heat Act (Erneuerbare-Wärme-Gesetz) extends to already-built homes (Klinge, 2018).

3.5.3.3 Germany Today

Most citizen-led energy CAIs in Germany are considered to be "small cooperatives" with 130 members on average. The partially "re-municipalized" energy market liberalization created opportunities for local grassroots projects. The German renewable energy industry grew from 160,000 to 340,000 jobs between 2004 and 2009 (German Environment Ministry, Bundesministerium für Umwelt, 2010).

Due to the original feed-in tariff program, wind cooperatives have a longer history and bigger generating capacity. In recent years, the percentage of total wind capacity that is managed by people and energy CAIs has decreased to 20% as a direct result of growing levels of both professionalization and commercialization (Bauwens et al., 2016). Solar cooperatives, on the other hand, are a new concept that often include government and citizen cooperation. During the 2008–2009 financial crisis and the search for alternative business models, energy CAIs grew by 4 in 2007 to 200 in 2010 with a new generation of solar cooperatives having emerged (Oteman et al., 2014; Verde & Rossetto, 2020).

The curve for Germany (Figure 3.2) clearly reflects the expansion of solar cooperatives; it rises strongly in 2008 and flattens after 2014. The Renewable Energy Act was modified in 2014, and the feed-in tariff model was replaced with a market premium program that severely hurt small energy prosumers since they are often less competitive. In 2016, vital assistance measures changed to a bidding process (Wierling et al., 2018).

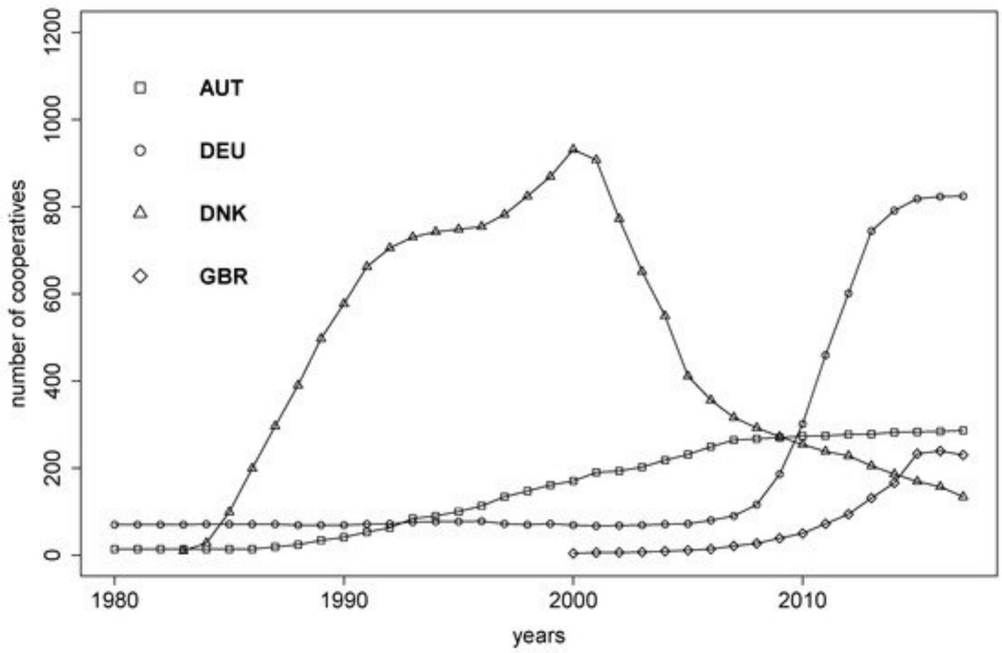


Fig 3.2. Growth of Germany's solar cooperatives. Extracted from Wierling et al., (2018) where I served as co-author: Statistical Evidence on the Role of Energy Cooperatives for the Energy Transition in European Countries

Statistics show that just 12% of the 1109 cooperatives are currently active.[10] Energy cooperatives that are smaller and medium-sized 'exited' (see section *2.3.3 on Exit, voice, and loyalty)* wind energy due to increased market competition and less government support (Wierling et al., 2018).

The COMETS' database includes 72 energy cooperatives founded before 1950. 70% of 1920s-era initiatives still exist (Wierling et al., 2018). Nevertheless, for onshore wind and solar PV auctions, "citizen energy initiatives" and energy cooperatives continue to be involved (Yildiz et al., 2019; Verde & Rossetto, 2020).

[10] See EU inventory here: https://dataverse.no/dataset.xhtml?persistentId=doi:10.18710/2CPQHQ

3.5.4 United Kingdom

The United Kingdom (UK) was one of the first countries in Europe where the idea of community renewable energy began to catch on, after Denmark and Germany. But even after many decades later, only a small percentage of energy CAIS are used in the British electrical grid. In a rigorous historical analysis of the growth of community renewable energy in the UK, Berka (2017) underscores that in the early 1990s, major multinational organizations controlled the electricity market, leaving local public utilities behind. This was not the best place to start seeking local renewable energy initiatives (Berka et al, 2017; Wierling et al, 2018).

In the UK, the energy sector supports extensive infrastructure and corporate dominance. The majority of the nation's energy supply is under the hands of six major energy companies. Only 0.3% of the energy generated is derived from sources beyond these utilities. Since the size of offshore wind suggests that large, incumbent utilities, instead of individuals or communities, are concentrating on their growth, this probably explains why the UK plays a significant role in offshore wind power generation (Nolden, 2013). Community-owned offshore wind still has a long way to go.

Beginning in the 1990s, the UK adopted a renewable energy strategy that placed the private sector at the core of the energy transition. Community and public participation in renewable energy production was first discussed in UK policy in 2000. It was prompted by normative and practical concerns. These comprised concepts and social attitudes for developing environmental and renewable energy initiatives, stressing localism, social cohesion, teamwork, cooperative ownership and investment, and environmental stewardship (Walker et al, 2007).

The first prospects for energy CAIs started to emerge around year 2000 with the implementation of renewables support programs, aside from a few experiences with community initiatives, which were primarily located in Scotland. The principal policy was a market-based approach that was ineffective for small-scale initiatives. In the beginning, only projects larger than 5MW were eligible for the Renewables Obligation program (also known as a renewable portfolio standard), which ultimately hindered support for local energy initiatives (Nolden, 2013).

Following that, in 2004, eligibility for the Renewables Obligation program was increased to encompass smaller plants (>50kW), but without technological advancements. Nevertheless, energy CAIs were often uncompetitive. Throughout those years, community-led renewable energy development was mostly focused on rural regions and community enterprises. During this time, the Scottish government also began to stand out from the UK government by aggressively promoting energy CAIs as a way to advance general goals related to rural development and community empowerment (Hall et al, 2016).

Prior to Scotland's autonomy under the Scotland Act (1998), all constitutional and legislative authority over energy and environmental matters remained with the UK. Since the late 1980s, when state-controlled energy firms were privatized, UK energy policy has been restricted to influencing how the energy market functions. The Office of Gas and Electricity Market Regulation is responsible for regulating the gas and electricity markets (Ohemeng, 2020).

In contrast to Denmark and Austria, the UK's energy strategy did not feature cooperative localized models for energy production until the late 1990s. Instead, the UK's energy technologies and infrastructure were centrally planned on a massive scale, with minimal to no consideration of social or environmental objectives or community engagement (Smith, 2007). Walker and colleagues (2007) note that cooperative localized power production models similar to Lovins' "soft energy path" (see *Chapter 2, section 2.4, Energy Democracy* for more on this concept) had only ever been considered in the past via demonstration projects outside of the existing energy distribution system, all without government assistance (Walker et al., 2007).

Similar to Denmark, the UK is one of the world's top geographical landscapes for wind power. However, the cooperative energy sector is undeveloped in comparison to Denmark and Germany despite this advantageous endowment of wind resources. By investing in bigger, commercial projects, 19 energy cooperatives had part ownership in an additional 1.22 GW of generation capacity in 2011, in addition to 19.6 MW of capacity that they held outright (Willis & Wills, 2011).

3.5.4.1 The UK's feed-in tariff

Since the UK's feed-in tariff program for renewable energy was launched in 2010, a "critical juncture" has developed for community renewable energy. In a similar way to Germany, the effort was effective in promoting investment in renewable energy, particularly community-led renewable energy initiatives. The total installed capacity of community-owned electricity between 2009 and 2014 was increased by more than three-fold, from 28 MW to 105 MW, in only five years (Berka & Creamer, 2018).

The growth of community-led energy was accelerated through the feed-in tariff programs, just like in Germany. Urban renewable energy cooperatives and innovative shared ownership structures started to emerge (see the case study of *Bristol Energy Network* in *Chapter 6, part 6.4.3*), in large part due to the reduced investment risk of the feed-in tariff. The government's ambitious Community Energy Strategy, which was released in 2014 and based on Bristol Energy Network's original energy strategy wheel *(in Chapter 6, part 6.4(c)),* further attests to the significance placed on energy CAIs (DECC, 2014).

The usage of the feed-in tariff was restricted by a new conservative administration in 2015, which favored alternative approaches (such as contracts for difference and renewable standards) that were ideal for large-scale, for-profit projects (Bauwens et al., 2016). The period of tremendous expansion in community renewable energy came to an end with this change. Although its future in the UK is still uncertain, Scotland continues to embrace community-led renewable energy (Wierling et al., 2018).

Although residential energy costs and energy poverty are closely scrutinized in the UK, very little has been done to study how energy CAIs affect these costs or other relevant indicators include disposable income, thermal comfort of dwellings, or the physical and mental well-being of initiative participants (Berka & Creamer, 2018).

Today there are 387 energy CAIs in the UK, of which are producing 235 MW of renewable energy (see *Chapter 5 on the EU data per each country*).

3.6 EU Policy and Regulatory Frameworks

The EU's enabling policy measures highlight the rising concern about the climate emergency and its acknowledgment as a top policy priority. These regulations also acknowledge the role that social and local government actors may play to speed up participation in the energy transition and open up new pathways for previously passive consumers to engage (Hoicka et al., 2021). Additionally, these have benefits related to energy security, employment development, and local economic and social advantages (Berka, 2012).

Energy CAIs, which has taken several legal forms, has not had a distinct legal standing under national and EU legislation until recently (Caramizaru & Uihlein*,* 2020). Now local energy communities must be able to:

> "own, establish or lease community networks and to autonomously manage them, and that these communities can access all organized markets either directly or through aggregators or suppliers," according to the European Commission's requirement for Member States to adopt.
> (Hancher & Winters, 2017)

Previously, energy legislation in at the Europe Union level did not include community involvement in energy production, thereby putting energy CAIs subject to the same regulations as centralized systems (Hancher & Winters, 2017).

The European Commission started thinking about ways to integrate the energy sector, notably the transmission of electricity and gas, in the Single European Act of 1986, which helped to create the European Single Market, in 1988. This began a long process to liberalize trade and competition in the single market area's wholesale and retail electricity and gas sectors (Goldthau, 2014).

The EU has mostly utilized legislation to effect this change, passing three electricity market regulations in 1996 (96/92/EC), 2003 (03/54/EC), and 2009 (09/72/EC). These directives created pan-European policy and required all single energy market participants, including Norway, a non-EU state, to comply with certain domestic legal requirements. The degree of decoupling (both horizontally and vertically in all aspects of the energy value chain - from generation and transmission to distribution) has an effect on each part of the chain of the power sector: generation, distribution, retail suppliers, and customers who choose their suppliers (COMETS D4.1, 2020).

Several single market nations, including the UK, liberalized their energy sectors in the early 1990s to establish wholesale power markets and encourage competition. This occurred prior to the 1996 directive. Additionally, there was a tendency toward liberalization in Central and Eastern Europe's once centrally planned economy. For instance, the once-state-owned vertically integrated monopoly in Hungary was divided into 8 manufacturing and 6 distribution enterprises in 1992. The state energy monopoly in Poland in 1995 gave rise to 33 distribution businesses, one transmission company, and 34 producing firms (Huybrechts & Mertens, 2014; COMETS D4.1, 2020).

However, domestic monopolists who controlled generation, transmission, distribution, and retail supply, notably EdF in France or ENEL in Italy, predominated in the most of Europe. With their activities dominating throughout production, transmission, distribution, and retail, established monopolists historically served as a stabilizing force throughout national energy systems. Since there was no major competition, horizontal bundling was the norm. Additionally, they possessed unique market access and displayed extensive vertical asset bundling (Oteman et al, 2014).

3.6.1 Today's EU regulations

There have been several planned and formally adopted amendments that are favorable. The EU's "winter package," a collection of proposals by the European Commission to restructure the energy market, was released on November 30, 2016. Energy communities and consumers were highlighted in this policy package as being at the core of Europe's energy market (Hancher & Winters, 2017).

The proposed regulation entitled, *European Parliament and of the Council on the Internal Market for Electricity*, declares:

> “Local energy communities can be an efficient way of managing energy at community level by consuming the electricity they generate either directly for power or for (district) heating and cooling, with or without a connection to distribution systems. To ensure that such initiatives can freely develop, the new market design requires Member States to put in place appropriate legal frameworks to enable their activities.” (Mengolini, 2017)

This proposal is useful because it provides a strategy for establishing a certain legislative framework that would let communities to engage in the energy system without becoming constrained by outdated regulations that were mainly designed for centralized systems (Vansintjan, 2017).

In the European Union, citizen engagement in the energy field is at the center of several unprecedented EU directives in recent years. For example, the EU’s “White Paper on the future of Europe: Avenues for unity for the EU at 27”, as well as the COM (2016)763 “Accelerating Clean Energy Innovation” and the “Accelerating the clean energy innovation” Resolution of the European Parliament adopted on the 6th of February 2018, which led to the adoption of the RED II (EU Renewable Energy Directive as part of the 2016 “Clean Energy of all Europeans” initiative, directive 2018/2001/EU). The RED II directive promotes citizens' and communities' rights to generate, store, use, and sell renewable energy, as well as additional rights including consumer protection and direct or indirect access to all energy markets (COMETS D4.1, 2020).

Following the supportive European legislation passed at the end of 2018, most European countries transposed and adopted the new legislation at the national level to varying degrees (Kotilainen & Saari, 2018). The most current and comprehensive policy goals on facilitating the empowerment and involvement of individual and collective consumers were charted in the Internal Market and Renewables Directives under the Clean Energy Package, which were enacted by the European Parliament and the Council in 2019. Therefore, recognizing citizens' active involvement in the energy transition (Hoicka et al, 2021). The Clean Energy Package of the EU defines "enabling frameworks" for energy

CAIs and grants consumers the same rights to engage in the energy markets as established market actors (Hoicka et al., 2021).

The transition to clean technologies has coexisted with the deregulation and liberalization of the energy markets during the last three decades, opening up new doors for the inclusion of new actors in the energy sector (Berka et al., 2017).

In Europe, community-based energy has advanced significantly and is now at a **critical juncture** to promote a more democratic Energy Union with strong citizen engagement. The Renewable Energy Directive (RED II) and the Clean Energy Package, in particular, both provide enabling frameworks that enable energy CAIs to take an active and unconstrained part in the energy markets. In 2019, the EU formally adopted the Clean Energy Package, a set of governing declarations that acknowledge energy communities as unique participants in the European energy system. **This has, in turn, increased the recognition of energy CAIs**. Regarding historical examples, Denmark's development as a pioneer in the installation of RECs, as well as the production of wind turbines from the 1970s onward, came about as a consequence of integrating wind power into an established culture of shared infrastructure ownership (van Est, 1999).

Because not all Member States are motivated to transpose these policies, this process is proving difficult. It demonstrates the competing interests of decision-makers, market regulators, energy suppliers, and other market participants as well as a range of variables (COME RES project, D2.1, 2021).

The number of energy CAIs has been rising steadily in Western European countries. In fact, they are also growing in importance as a rising player in the energy markets in some European countries (Herbes et al., 2017). Eastern Europe as a whole is still lagging behind, though. This isn't because the locals don't want to start initiatives; rather, the policy frameworks play a significant influence in either enabling or assisting them (Vansintjan, 2017).

After a long period of state monopoly, the electricity market was liberalized, which led to the emergence of the majority of European energy cooperatives (Huybrechts &

Mertens, 2014). In some nations, liberalization had the reverse effect and turned monopolies into oligopolies, which had little impact on prices and options for customers. As a result, customer discontent and a desire for more control over the source of their energy (production), its price (supply), and general transparency facilitated the deployment of energy cooperatives (Huybrechts & Mertens, 2014).

Specifically in accordance with the updated Renewable Energy Directive of the Clean Energy Package (RED II), community energy and communal self-consumption should now be well-positioned to experience further growth. The Internal Electricity Market Directive (IEMD) and its accompanying requirements for energy CAIs were to be implemented by December 2020, while the EU Member States had until June 2021 to transpose European policy for Renewable Energy Communities (COMETS D4.1, 2020).

3.7 The United States History

Prior to the electrification of industries, private homes were unappealing as a market in the US. As a result, electrification did not occur across the country at the same time. The electrical infrastructure in the US was mostly concentrated in big towns and cities prior to the 1930s, with 90% of urban households having access to electricity and 90% of rural homes being without it (Lewis & Severnini, 2017).

In rural areas, energy CAIs, namely electric cooperatives, have a long history of fostering regional businesses (Bilek, 2012). The large, centralized grid was largely used to support urban residents when the US was electrified. As shown in timeline (Figure 3.3), after 1910, a significant portion of US urban homes and businesses were wired into the electricity grid, while rural regions lacked access (ILO, 2013).

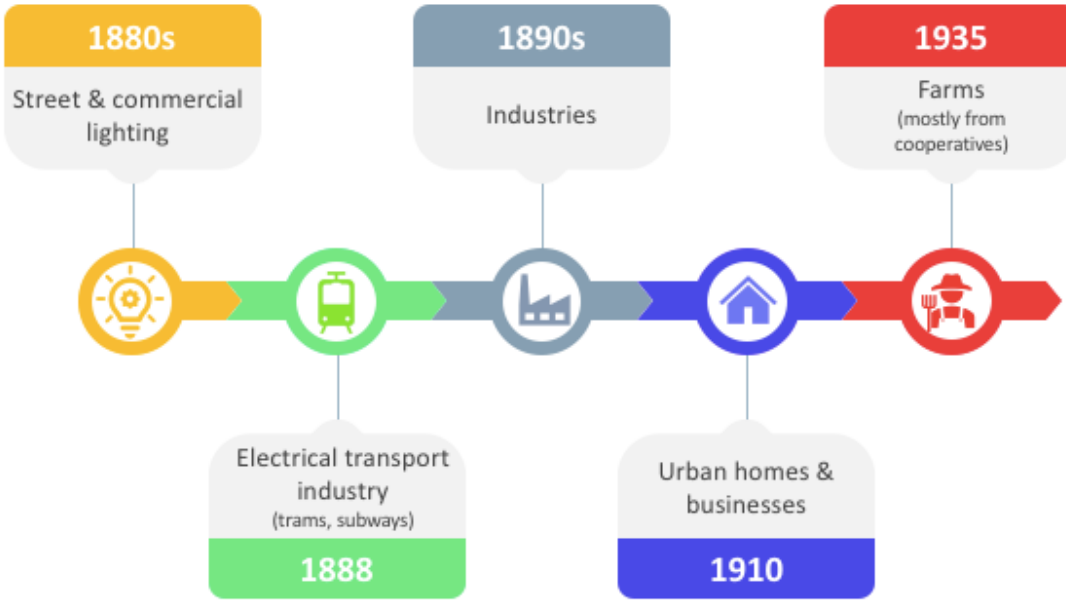


Fig 3.3. Timeline of electrification in the US. Adapted from Nye, 1997

Due to expensive construction and investment expenditures, as well as low profit margins, rural populations were frequently left in the dark. Rural customers of the incumbent utility companies typically had to pay the expenses of extending the lines during construction, and if they could afford energy, the rural customers paid far higher prices than urban consumers. Farmers and towns had to pay significantly more for service once these lines were turned over to the company as "company property". Due to substantial network infrastructure costs and the prospect of very small near-term revenues, rural markets lost their appeal (Malone, 2008).

3.7.1 Early days of electrification – boundaries and social networks

Granovetter and colleagues studied the history of the US utilities industry, especially the boundaries (see section *2.2.3 Boundaries of collective action in the energy field* for more details), demographics, and its dynamics. They noted that in those beginning years, the system was shaped by specific social networks of 80 central station companies, mostly operating in urban settings. In their study, Granovetter and colleagues examined the career histories of more than 200 former Thomas Edison workers, and more than 300 secondary and archive sources. They demonstrated how and why these networks acted in specific ways to influence and control industry growth, some of which are still in existence today (Granovetter & McGuire, 1998).

Friendships, familial ties, and social network engagement served as the foundation for this system of industrial self-governance, which was later strengthened by the acts of formal organizations. Through the official organizations that already existed, these relationships and choices spread across the industry. The social network of the inner circle, which was supported by their company's employees, finally came to rule these organizations (Granovetter, M. & McGuire, 1998).

The first boundaries of division between the various electric industries were being drawn by Edison. They achieved this by pooling the resources of himself, his friends, and their families as well as separating the production of electric light from that of other electric devices, such as telephones, electric trolleys, and other items that preceded the incandescent lighting system (Bright, 1972).

Employees who rejected the leaders' organizational and technological policies as well as the concept of industry self-governance were replaced by workers and leaders of other companies who supported that system. These elements of the ideal pattern for business relationships were **institutionally embedded** (Nye, 1997).

Electrification was a social construction that developed as a result of interactions between several distinct organizations in various parts of the US. It included cultural, economic, and technological variables. There were several levels of **key stakeholders** in this energy mix (Nye, 1997):

1. **Street railway and trolley** frequently served as the largest local electric company in many towns.
2. **Large, national companies like General Electric and Westinghouse**, which indirectly owned the private power company, provided equipment to the transmission operators and offered a wide range of consumer goods to consumers.

3. **Local industry** also joined the appliance market and embraced electrical production methods.
4. **State and federal governments**, which oversaw utility regulation and promoted electrical cooperatives to service rural regions, as well as the local government, which occasionally held ownership of lighting firms.
5. **Citizen engagement** was equally significant. As demonstrated at the local level, the story of electricity is one of growing technological potentialities woven with social processes. They saw electrification as a sequence of options rather than an intangible process.

Other neighborhood systems sold "surplus" electricity to other adjacent consumers after beginning at a "base" factory or trolley company (Granovetter & McGuire, 1998). For instance, 330 street trolley companies sold 44.9% of the total amount of electricity supplied to the general public in the US in 1907 (USDCL, 1910; Granovetter & McGuire, 1998).

Another common decentralized scheme at the time was to separate the activities of the conventional vertically integrated central station firms. Different groups may perform the functions of generation, transmission, and distribution separately, which might result in the formation of autonomous businesses. For instance, in New York State, the Niagara, Lockport and Ontario Electric Company only engaged in transmission business (USDCL, 1910; Granovetter & McGuire, 1998). A jointly-owned electric firm purchased these factory-based generation systems and later resold the power (Horn, 1973).

There are instances of a city-owned generating and transmission companies from this period that solely supplied electricity to companies and street rail businesses (Granovetter & McGuire, 1998). As a result of its widespread use, bulk sales—the transfer of current from one utility to another—were referred to as "a particular branch of the electric industry" by 1907. Some of these transfers included integrated corporations, while others involved non-integrated enterprises (USDCL, 1910; Granovetter & McGuire, 1998).

From 1930 until present day, energy cooperatives under the U.S. Rural Electrification Administration evolved similar divisions between generating, transmission, and distributing enterprises in a variety of configurations (Doyle & Reinemer, 1979; Hannah, 1979). Such alternative conceptions have technical strengths and limitations that are diverse, regionally-specific, and controversial. They were frequently cost-effective and occasionally technically and energy-efficient, particularly when coupled with new investment in generating technologies (Granovetter & McGuire, 1998).

3.7.2 The New Deal and the rise of rural electric cooperatives

The rural electrification issues could only begin to be resolved through government intervention, which had been particularly effective in European nations (Nye, 1997). To solve this unequal scenario, federal administrators turned to a rural electrification scheme that had previously been successfully implemented in Europe and tested in a few sites in the US: non-profit cooperatives owned by its customers seemed to be an ideal solution (Haanyika, 2006).

In the 1930s, the rural electric cooperatives began to rise; the majority of US farms and rural businesses could only get electricity through cooperatives. One of the first states to launch a rural electrification program was Indiana. In the lengthy period of poor farm prices that followed World War I and grew worse during the Depression, Indiana General Service, a utility company, like the majority of other private businesses, saw little financial benefit in reaching out to farmers. For example, only 4% of Indiana General Service subscribers lived in the rural areas in 1931 (Nye, 1997). On May 22, 1936, the first sixty miles of lines were implemented into operation in Boone County, Indiana, making it the first state to electrify a farm under the Rural Electrification Administration (REA) (Cochrane, 1985). Those without electricity in other counties in Indiana, such as Delaware County, were dispersed too widely to be effectively included in a single system. Therefore, they were absorbed into cooperatives in neighboring counties (Cochrane, 1985).

While the federal government implemented regulations to encourage greater access to electricity in underserved areas in the 1930s, the federal government continues to enact policies that favor energy CAIs, especially cooperatives, by exempting them from federal income taxes. This is only feasible if at least 85% of their revenue comes from member-owners and is used primarily to offset losses and service-related costs (Paredes & Loveridge, 2018).

Insofar as they were a byproduct of direct democracy, surviving alongside the state rather than being totally consumed by top-down, technocratic control, energy cooperatives have been a notable example of the energy commons (Dawson, 2022). (see more on commons theory in *section 2.7.2.)*

The separation between rural and urban life had significantly grown by 1930 as a result of electrification. The vast majority of urban dwellers had electric lights and modern appliances (an iron, vacuum cleaner, for example), but the rural family had none of these and could not foresee to obtain them any time soon (Nye, 1997). In the 1930s, as urban dwellers' per-household electricity usage increased quickly, farmers continued to use outhouses, read by kerosene lamps, and cooled themselves with palm-leaf fans, highlighting the stark contrast between the two regions. Such anachronisms gave the image of rural backwardness to urban dwellers (Nye, 1997).

At the same time, the one equalizer between urban and rural was the radio. The radio was the only electrical appliance that was used in both farms and cities. It was first sold as a battery-operated device that could be heard through headphones rather than as a plug-in electrical device. **Thus, farmers might often hear news from the city, including commercials for enticing electrical goods that they couldn't afford or use.** But farmers found the radio to be quite helpful as well. In fact, by 1930, the U.S. Department of Agriculture established a broadcast program that collaborated with local stations to deliver real-time market updates, weather predictions, and other agricultural information (Nye, 1997; Emerson Markham, 1930).

The Tennessee Valley Authority was given permission by the federal government to start constructing the system required to provide power to rural residences in Tennessee in 1933 (Fairchild & Weinrub, 2017). In March 1935, the Indiana State Legislature overwhelmingly approved a bill to reach the poorest and more isolated farmers. President Franklin D. Roosevelt signed the national bill creating the Rural Electrification Administration two months later as part of the New Deal (REA). The REA wanted to fund local cooperatives that provide services in areas that for-profit electrical companies avoided. The loans, which had a low interest rate and a flexible return plan, were insured by the federal government (Joskow & Schmalensee, 1988).

The REA believed it was viable to support grassroots organizations that would build their transmission lines and run an electrical service themselves after surveying models from both Europe and some cases in the US. Additionally, groups in support of decentralization favored the strategy (Nye, 1997). Private utilities opposed the REA's founding, although they quickly benefited from it. Since the government merely assisted in establishing distribution networks and left the majority of production in the hands of the private sector, they made profits by selling power wholesale to local cooperatives (Slauter, 1973).

In addition to supporting local electric cooperatives with low-interest, long-term credit programs, the REA also offered vital development tools, including technical, administrative, and instructional support. The primary function of REA's Washington office was to provide loans for the construction of distribution lines. In order to increase the risk of these loans, it also provided assistance with land surveying, engineering counsel, and legal support for the creation of cooperative bylaws (Brown, 1980). Cooperatives and publicly-owned utilities were given precedence over for-profit utilities (or IOUs) under a newly established federal financing program, which also assisted rural towns in forming cooperatives (Brown, 1980).

Undoubtedly, the establishment of rural cooperatives, which are financially backed by government loans through the REA program, is the primary cause of the electrification of rural America (Brown, 1980). The cooperatives would not have existed without the federal government's various measures of economic and political empowerment, which made it feasible for them to expand in the face of resistance from powerful, incumbent actors. Nevertheless, despite their relative independence from the federal government, they were nevertheless receptive to the local needs of rural residents (Dawson, 2022).

The REA boosted local economies by creating jobs and increasing demand for appliances and electrical generating equipment. As soon as the program got underway, it became very popular among lawmakers, who all wanted to highlight the concrete advantages they had brought to their respective congressional districts. More than 300,000 farms were reached by the 73,000 miles of electrical lines built by the new agency in 1936 and 1937. It achieved this by developing its own engineering expertise and disseminating it to regional organizations all over the nation (Nye, 1997).

By the mid-1950s, almost every farm in America had access to electricity, mainly due to locally controlled rural electric cooperatives that took out loans from the REA to construct lines and offer services on a nonprofit basis (Brown, 1980). The energy cooperatives campaign provided rural homes with power and, more recently, internet services. Rural waste and water disposal systems have also utilized electricity from the cooperatives (Malone, 2008).

Even though the ultimate goal was to develop a decentralized system of cooperatives that were democratically administered at the local level, the national REA office often had to support local groups in conflicts with private utilities. A few private utilities also disseminated misleading information, persuading farmers, for example, that joining a local cooperative would make them fully responsible for its loan debts. (Nye, 1997; Brown, 1980). The private utilities commonly used scare tactics such as saying that Washington DC wanted to impose its policies on cooperatives and that national-level bureaucrats were trying to erode local authority; all while government planners' main intentions were to foster local democracy (Brown, 1980).

3.7.3 US Electric Cooperatives overview

(This section is adapted from my published paper, Gilcrease et al., 2022)

Ever since their introduction into the energy sector before World War II, and supported by President Roosevelt's New Deal, electric cooperatives were a niche part of the energy market. However, in recent decades they have increasingly become bigger players, especially in certain areas of the US, serving around 13 percent of total utility customers. By comparison, publicly owned utilities (federal, state, and municipal-run) serve around 16 percent of utility customers, whereas the investor-owned utilities (private) serve the highest amount with 72 percent of the total utility customers in the country (Baker, 2021).

Over 90 percent of electric cooperative customers are residential, with only a few commercial and industrial members (University of Wisconsin, 2021). Additionally, members of a cooperative do not need to own property to participate (ICA, 2021). There are two leading forms of electric cooperatives in the United States:

1. *Distribution cooperatives* serve end-users (residences and businesses) within their membership;
2. *Generation and Transmission (G&T) cooperatives* sell wholesale power to distribution cooperatives and are usually part of larger cooperative federations (Lowery, 2009).

3.7.4 Organizational structure of rural electric cooperatives

(This section is adapted from my published paper, Gilcrease et al., 2022)

A common definition of a cooperative is:

> "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise"(Kim & Lim, 2017)

Furthermore, cooperatives are aligned with the basic conditions in the definition of cooperation, namely "cooperation is the process by which the individuals or groups combine their effort, in a more or less organized way for the attainment of common objective"(Fairchild, 1944). Cooperatives have a strategic democratic organizational structure where decisions are made democratically, which empowers people and supports equal participation (ICA, 2018). Cooperatives are considered both a social *and* economic enterprise because they don't aim for profit maximization, but instead they try to advance social and economic objectives (NRECA, 2021).

Electric cooperatives have a unique model of ownership compared to the public and investor-owned utilities. One major difference is a cooperative's "double quality", being both members and users of the utility (Huybrechts & Mertens, 2014). Additionally, their democratic ownership structure has a distinctive configuration as it is controlled by users with all voting rights based on “one member, one vote” (Huybrechts & Mertens, 2014). Additionally, as there is an obligation for the cooperative to be user-owner financed, the return of margins is distributed among users on the basis of use and the volume of transactions (ICA, 2021).

Similar to cooperatives in Europe and around the world, US electric cooperatives conform to a set of seven core principles and values. As cooperatives aim to put the needs of their members first, the seven principles are a primary example of what distinguishes electric cooperatives from other types of utilities (AEC, 2021; Greer, 2008):

1. *Open and Voluntary Membership.* There is no discrimination of who can join;
2. *Democratic Member Control.* Democratically controlled by members who engage in all forms of decision-making, including equal voting rights (one member, one vote);
3. *Members' Economic Participation.* Members contribute equitably to the capital of their cooperative;
4. *Autonomy and Independence.* Members control the cooperative autonomously;
5. *Education, Training, and Information.* Going beyond providing electricity, cooperatives provide education and training for members. This, in turn, encourages active participation in the development of their cooperatives;
6. *Cooperation Among Cooperatives.* Cooperatives can engage through local, national, and international networks to improve services, strengthen local economies and support social needs (see *section 2.3 Social Capital* and its fostering of cooperation and trust);
7. *Concern for Community.* Addressing local needs is supported by the community development of cooperative members.

   (AEC, 2021; Greer, 2008)

3.7.5 The 1930s to the 1970s

As suburban areas spread inside its boundaries and farm involvement fell, the cooperative lost much of its vibrancy, and most of its members no longer felt a communal connection to it and rarely attended its meetings (Nye, 1997). (See section

3.7.4 Organizational structure of rural electric cooperatives, for the 7 principles.) As the 7 guiding principles show, electric cooperatives were intended to be democratic organizations from the beginning. Many of the electric cooperatives, which originally intended to compete with distant corporate, for-profit utilities, started acting more like them over time, rather than serving as tools for empowering communities. In one study, for instance, "excessive rates, ineffective operations, severe collection methods, high CEO compensation, and prejudice in coop investments and employment" were consistently discovered (Fairchild & Weinrub, 2017).

3.7.6 The 1970s to Today

The 1930s rural electric cooperatives show how representative democracy and citizen self-management may coexist. Unfortunately, many of these historic cooperatives have been accused of being controlled in the same opaque, top-down manner as for-profit utilities. Additionally, m any cooperatives still depend on New Deal-era dams and coal-fired power plants. Nevertheless, decentralized, democratically controlled renewable energy production has inspired many cooperative members to regain public power and break utilities' fossil fuel dependency (Dawson, 2022; Schneider, 2017).

The 1973 oil embargo and subsequent national energy policy measures led cooperatives in the US to look into alternative energy projects, much like what happened in the European Union. Nuclear power stations included participation from a number of generating and transmission (G&T) cooperatives. However, following significant nuclear mishaps and expanding anti-nuclear activities, cooperatives postponed the construction of reactors; some even declared bankruptcy (University of Wisconsin, 2021).

The Carter administration applied pressure on Congress to pass the National Energy Act in 1978 as a solution to the energy crisis. The Act included a relatively unnoticed provision requiring the country's utilities to purchase and move electricity produced by any facility with an output of less than 80 MW to the market, giving a chance to small prosumers and producers, such as energy CAIs (Dawson, 2022).

The Rural Utilities Service (RUS) replaced the REA in 1994 and maintains its collaboration with rural electric cooperatives in order to continue enhancing infrastructure and energy services (University of Wisconsin, 2021). The RUS is also part of the US Department of Agriculture (NRECA, 2021). After almost a century of reliance on centralized power infrastructure, the energy system in the US is now more connected with decentralized entities thereby upending the conventional utility business model. These decentralized initiatives (i.e. energy CAIs) deliver electricity and other services to the grid (Fairchild & Weinrub, 2017).

There were 930 electric cooperatives in the US in 2015. Nearly all rural communities have access to electricity, with the great majority being supplied by locally operated electric cooperatives (University of Wisconsin, 2021). **Additionally, over 90% of the counties with chronic poverty in the country were served by these 930 cooperatives** (AEC, 2022).

Out of the 930 electric cooperatives, 864 distribution cooperatives provide 10% of the nation's annual energy usage in kilowatt hours. Despite owning and maintaining 42% of the country's electric distribution lines, which span 75% of the nation's land area, they only supply electricity to 42 million people (roughly 12% of the population) in 47 states (University of Wisconsin, 2021).

The three main types of electric utilities in the US today are investor-owned utilities, publicly-owned utilities, and electric cooperatives (Baker, 2021). With private companies selling 80% of the country's energy, municipal systems, cooperatives, and federal initiatives share the rest. Generation and transmission (G&T) cooperatives are the remaining 66 cooperatives. The G&T cooperatives either purchase and supply power from investor- or publicly-owned utilities, or they generate their own energy, in order to provide wholesale power to their member-owners (Baker, 2021). The 66 G&T cooperatives currently control 6% of the transmission line miles across the country. Additionally, 45% own generation facilities that provide around 5% of the nation's total power (NRECA, 2021). In total, there are 18 million homes, companies, schools, farms, and other facilities spread throughout 2,500 of the country's 3,141 counties (ILO, 2013).

The distribution electric cooperatives don't often create the power they sell to members. The majority get it through federal power companies or Generation & Transmission (G&T) cooperatives that are operated by distribution cooperatives. (Farrell et al., 2016). A major issue pertaining to G&T cooperatives today is that they are the 7th most carbon-intensive electric utility in the nation, obtaining 75% of their electricity from coal. This is also in opposition to the energy transition (Breakman, 2013).

The role of rural electric cooperatives remains significant especially for marginalized and low-income communities. For example, nearly half of the state's power was delivered by Mississippi's 25 distribution cooperatives and one G&T cooperative in 2015, and 98% of the state's counties with chronic poverty were serviced by these cooperatives (Fairchild & Weinrub, 2017; AEC, 2022).

Recently, the Inflation Reduction Act, enacted in August 2022, provides more than $12 billion to collaborate with rural and Tribal communities to support them in efforts to access more renewables, as well as make their energy infrastructure more reliable and resilient, and reduce their energy bills. This comprises billions of dollars in grants and loans to finance and deploy new clean energy projects that minimize greenhouse gas emissions and other pollutants, with a priority on projects in marginalized areas, energy communities, and other disadvantaged communities (White House, 2023).

For instance, $9.7 billion will go towards the U.S. Department of Agriculture's (USDA) loan and loan guarantee program for rural electric cooperatives' electric infrastructure. This funding is aimed at assisting rural electric cooperatives decrease greenhouse gas emissions from their electric producing and transmission networks by investing in and using sustainable energy and carbon capture and storage technology (White House, 2023).

3.8 The US Policy and Regulatory framework

With so many farm-related cultural customs, it became obvious that cooperatives were the greatest route to rural electrification. This information prompted the Rural Electrification Administration (REA) to provide the foundation for the 1937 enactment of the Electric Cooperative Corporation Act, which provided a legal foundation for states to implement their own laws for forming and regulating the growth of member-owned electric cooperatives (AEC, 2022; Fairchild & Weinrub, 2017). Two years after the REA program's launch, by the end of 1938, 1.5 million farmers were receiving power from 350 cooperative projects spread throughout 18 states (and in 45 states just a few years later) (Schurr et al, 1990).

The effects were remarkable and apparent right away. According to America's Electric Cooperatives, the number of rural electric cooperatives quadrupled, In the four years that followed the end of World War II, the number of members joining the electric grid more than quadrupled, and the number of miles of electric lines increased by more than fivefold. **Remarkably, by 1953, more than 90% of American farms had access to electricity** (AEC, 2022; Fairchild & Weinrub, 2017).

The majority of electrical suppliers ran monopolies until the 1990s. The 1990s saw a significant deregulation effort that increased competition in the electricity markets (Borenstein & Bushnell, 2015). Community-owned rural electric cooperatives that were established by borrowing money from the RUS to fund the construction of lines and the provision of service on a nonprofit basis are responsible for the bulk of rural electrification (NRECA, 2021).

Through the loan programs created in the New Deal, the government has provided substantial support for rural electric cooperatives. Federal financing has reduced some of its support over time, but it is still a significant part of the loan portfolio for the cooperative sector (University of Wisconsin, 2021). Approximately 30% of the loan funds authorized by the RUS were used to purchase equipment for electric distribution, including poles, wires, transformers, meters, vehicles, and office buildings. Construction of infrastructure for generation and transmission has accounted for 60% (NRECA, 2021).

The smallest Federal subsidy per user is provided via the RUS loans to electric cooperatives, which today accounts for less than 40% of overall funding (NRECA, 2021). Around 60% derives from private sector sources including the National Cooperative Services Corporation (NCSC) (SELC, 2019). In contrast to other organizational forms of electric utilities, Yadoo and Cruickshank (2010) note that cooperatives receive less federal funding than other kinds of utilities in rural areas of the US. As a result, the rural cooperatives might not differ all that much in terms of the percentage of revenues that are subsidized (Yadoo & Cruickshank, 2010). Ownership is probably one of the more significant factors that sets cooperatives apart. Since ratepayers own the cooperatives, any income that are in excess of expenditures are returned to consumers (Paredes & Loveridge, 2018).

A robust network facilitates a higher proportion of US electric cooperatives, similar to REScoop in Europe. In order to provide cooperatives a cohesive voice in Washington, DC, and to advance their interests, the National Rural Electric Cooperative Association (NRECA) was established in 1942. Over 900 (nearly all) member-owned, nonprofit electric cooperatives, public power districts, and public utility districts are presently represented by NRECA in the US. Additionally, 2.6 million miles, or 42%, of the country's electric distribution lines are owned and operated by NRECA electric cooperatives (NRECA, 2021).

3.8.1 Regulatory distinctions

(This section is adapted from my published paper, Gilcrease et al., 2022)

The most heavily regulated industries in the US is the energy sector, divided between state and federal levels. This division of regulation was established due to monopoly pricing and expanded to contain oversight over resource planning. Because there is no profit motivation, electric cooperatives and their supporters at the Rural Electrification Administration (REA) did not see the need for such regulations, advocating for exemption from both state and federal regulation. Many states have followed this path (NRECA, 2021).

The regulatory distinctions for cooperatives vary among states. Unlike the regulations for investor-owned utilities (IOUs), electric cooperatives are usually exempt from federal and state economic regulations. Currently, only 14 states have regulatory jurisdiction over the rates that cooperatives can charge their members (Jang, 2020). Some state laws allow cooperatives the option to withdraw from utility regulatory commission jurisdiction, i.e. Indiana, Minnesota and Texas. This inconsistency creates a special challenge for federal policy makers in the US, whose objective is to require that all transmission-owning entities join a Region Transmission Organization (RTO) to facilitate competition in the industry (Greer, 2008).

For example, Dakota Electric in Minnesota is currently the only electric cooperative that exercised the option and is regulated by the state's Public Utilities Commission (Jang, 2020). Cooperatives often avoid regulation because they have been perceived as largely self-regulating since they emerged in the early days of utility regulation. Additionally, electric cooperatives have traditionally been under the REA's oversight role (Pacyniak, 2020).

Despite following some regulatory exemptions, electric cooperatives operate within three different models of electricity regulation in the United States:

- *Traditional regulated monopoly:* This model is dominant with no organized wholesale electricity markets. Mostly seen in the West and Southeast;
- *The competitive model:* This is mostly in organized wholesale markets and gives states power to authorize retail competition. This model is predominately in Texas, Northeastern states, and some Midwestern states;
- *A combination of monopoly and competitive:* This model is the nexus of organized wholesale markets and traditional monopoly regulation at the retail level (Pacyniak, 2020).

3.8.2 Regulating the energy transition: The Renewable Portfolio Standard (RPS)

(This section is adapted from my published paper, Gilcrease et al., 2022)

States have been adopting renewable energy mandates, or Renewable Portfolio Standards (RPS), since the 1980s, starting with Iowa. The RPS has been regarded as a key driver of renewable energy deployment in the United States (Lyon & Yin, 2010). RPS and other mandates have obliged utilities to improve their business models and initiatives for renewable energy procurement. It has been shown that when utilities follow the state's clean energy mandates, they benefit from electricity at lower costs partially due to decreasing prices of renewable energy (Lyon & Yin, 2010).

Despite the decarbonizing energy initiatives, the larger electric cooperatives have largely opposed ambitious state and federal clean energy policies, demanding to be exempted from the mandates, including the RPS (Pacyniak, 2020). Some differences in policy exist. It is interesting to highlight that Georgia and Indiana, which are among the states with the highest number of cooperatives, don't have an RPS, but they have some of the highest percentages Renewable Energy Source/Total Capacity among cooperatives (see *Chapter 4, tables 4.2 and 4.2.1*). Additionally, although Nebraska has not adopted an RPS, the state's cooperatives produce more electricity from renewable sources (46%) than in California (32%), which adopted an RPS in 2002 (EIA, 2018). (see *Chapter 4, tables 4.1 and 4.1.1*.)

3.8.3 US energy CAIs contribution to the energy transition

(This section is adapted from my published paper, Gilcrease et al., 2022)

The US still relies heavily on fossil fuels, totaling almost 80% of its energy needs in 2019 (EIA, 2020). Although the U.S. energy mix has been dominated by fossil fuels, this has started to change in the past three decades. Both production and consumption of renewable energy reached record highs in 2019, around 11.6 and 11.5 quads, respectively (EIA, 2020). This is around 12% of the total domestic energy production. 2019 was also the first-time renewables surpassed coal consumption (EIA, 2020).

In 2019, the following renewable energy consumption by source (EIA, 2021a):

- Wind energy (24%)
- Biomass, wood and waste energy (24%)
- Hydroelectric power (22%)
- Biofuels, ethanol, biodiesel (20%)
- Solar energy (9%)[11]

The US energy sector is responsible for over 20% of global greenhouse gas emissions, with more than 70% connected to electricity, transportation, and heating

[11] Although the lowest percentage of renewable energy consumption, solar had the largest percentage growth among renewable sources in 2019.

services (Seyfang et al., 2014). In fact, more than 20,000 premature deaths from accidents and air pollution are connected to the energy sector (Velaga et al., 2019). Energy policy implementation today will have long-lasting effects on social and ecological systems (Jang, 2020). As a result, modernizing and innovating policies are essential to supporting options that encourage public participation and understanding in a future powered by sustainable energy (Klein & Coffey, 2016).

Electric cooperatives in the US are contributing to the transition to renewable energy with more than 80% of all electric cooperatives selling power derived from renewable sources in 2018 (NRECA, 2021). In contrast to 2010, when just 13% of electric cooperative power sales were made using renewable energy, this represents a significant shift (ILO, 2013). This demonstrates how, since 2010, the overall solar energy capacity of US electric cooperatives increased by 13 times (NRECA, 2017). Additionally, Cooperatives have expanded their solar footprint from 34 to 44 states in recent years (NRECA, 2017). Georgia tops the list of states where cooperatives are actively pursuing solar development, followed by Arizona, Colorado, Hawaii, Maryland, New Mexico and North Carolina (NRECA, 2017).

From 2010 to 2019, cooperatives increased their renewable energy capacity by 151 percent (EIA, 2020). According to the National Rural Electric Cooperative Association (NRECA), there is also increasing investments in renewables among electric cooperatives in the U.S. “More than 95 percent of co-ops provide electricity generated by renewable energy resources”(EIA, 2021a).

Just within two years (2016-2018), electric cooperatives expanded their solar footprint from 34 states to 44 states (NRECA, 2019). Additionally, cooperatives have contributed significantly to community shared solar projects. As cooperatives are mostly servicing rural areas, the vast land resources are ideal for large scale solar PV installations. Thus, cooperatives will continue to play a key role in scaling up community solar in the near- and long-term future (NRECA, 2019).

3.8.4 Locked into long-term Power Purchase Agreements connected to non-renewables sources

(This section is adapted from my published paper, Gilcrease et al., 2022)

Since their founding, electric cooperatives have had strong Federal government support through the lending programs established in Roosevelt's New Deal. While the lending has declined over the past decades, the support remains a significant part of a cooperative's financial portfolio (University of Wisconsin, 2021). Alternatively, in recent years, federal tax credits have been helping to scale up renewable energy deployment (NRECA, 2016). Some examples include the Production Tax Credit ("PTC"), providing 2.3 cents per kilowatt hour credit for wind electricity, and the solar Investment Tax Credit ("ITC"), providing credit for up to 30% of capital costs in solar projects (NRECA, 2016). However, since electric cooperatives are non-profit and are exempt from federal income tax, they do not have the possibility to access these benefits (Velaga et al., 2019).

There is one incentivizing method that electric cooperatives have used to bypass this issue. Through long-term power purchase agreements (PPAs), an electric cooperative can contract with a for-profit entity that can share some of the benefits listed above (NRECA, 2016). PPAs are contracts signed by electric cooperatives (also by municipal or investor-owned utilities) to purchase electricity from generating companies at a fixed price for a certain number of years (NRECA, 2016). Contracting through PPAs is advantageous for a cooperative because it reduces costs of owning renewable sources. However, the potential problem with PPAs is when a cooperative sign a long-term PPA (20+ year) with a generating company that is primarily coal sourced, the cooperative is locked into a situation where their members cannot renegotiate for decades (CRS, 2020). (see *Minnesota in Tables 4.2 and 4.2.1 for a real-world example.)*

Chapter 4

The US experience:
Trends of Energy Cooperatives in the United States from 1990-2019: An Empirical Analysis[12]

Background

The energy sector in the United States has historically been very centralized, producing most of its electricity from carbon intensive sources. This is still an embedded reality, where large, investor-owned utilities (IOUs) serve 72% of U.S. electricity customers (EIA, 2019). Although there are more public utilities and cooperatives than investor-owned utilities in the overall energy system, the IOUs tend to be much larger. In fact, IOUs serve three out of every four utility customers nationwide (EIA, 2019).

As the low carbon energy transition continues, the cooperative model is seen as an effective structure to support the transition with potential to influence wider transitions in global energy systems (Seyfang et al, 2014). Because they are democratically organized, energy cooperatives give communities ownership of their energy, as well as empower and educate individuals to be more responsible with energy consumption.

The rural electric cooperatives do not have one-size-fits-all characteristics. Instead they have diverse features and perform many different functions in every state. Various literature has often put rural electric cooperatives into one large group, but they vary widely in size, energy usage, number of customers, territories, assets and in many other functions (Velaga, 2013). For example, in the aggregate, cooperatives buy much more than they generate. Additionally, regulation of cooperatives is also heterogenous among states, as see in the last chapter (Jang, 2020). (see *Chapter 3, section 3.8, US policy and regulatory framework.*) Furthermore, some are acting as umbrella companies for many small ones, and they will buy or generate all the energy and then sell it to their smaller

[12] This chapter is adapted from a paper I published in this dissertation journey: Gilcrease et al., 2022

groups (EIA, 2021b). By comparison, investor-owned utilities are more homogenous in their dimensions and act more similar to each other and can be more easily associated.

Rural electric cooperatives provide a different way of engaging with local communities, especially with citizens participating as owners of their local energy provider (Huybrechts & Mertens, 2014). Literature has pointed out that people join electric cooperatives not just because of competitive energy prices and investment returns, but also their desire to promote community development, trust and reciprocity, and revitalization projects. In other words, cooperatives provide an added value of community projects towards the local economy (Vansintjan, 2017). They go beyond electricity service by providing opportunities for small businesses, delivering broadband internet connections, improving water and sewer systems, as well as educational services (Velaga et al., 2019).

The U.S. Energy Information Administration's (EIA) Form EIA-861 database was used for this analysis. The Form EIA-861 collects information on the status of electric power industry participants involved in the generation, transmission, distribution, and sale of electric energy in the United States and its territories (EIA, 2020a).

In the past three decades, we see from EIA data on cooperatives that there has been a constant and gradual growth in terms of consumers and revenue. This chapter focuses on the experience of US rural electric cooperatives from an empirical assessment of all registered cooperatives from 1990 - 2019.

From this perspective, while the EIA data set has been already used in several analyses investigating different aspects of the energy sector in the US (Bin & Dowlatabadi, 2005; Spang et al., 2014; Che, 2011; Grubert, 2020; Lin & Hong, 2013), so far no specific study focused on analyzing the temporal and geographical evolution of the rural electric cooperatives when using data collected by the EIA.

Several dimensions are explored -- from density and number of consumers, to state distribution and institutions – to describe their trends and development, revealing how they vary across the US (excluding US territories). The chapter has the ultimate goal of deepening the knowledge of rural electric cooperatives by mapping them and investigating several states in-depth based on geographical significance and interesting characteristics highlighted by the data analysis.

Overall, cooperatives represented 28% of the total utilities from 1990-1995, progressively reaching 38% from 2016-2019. As a whole group, cooperatives share some similarities and, at the same time, a large degree of heterogeneity across cooperatives.

4.1 Methods

The data in this analysis comes from the U.S. Energy Information Administration's Form EIA-861. Descriptive data on each rural electric cooperative were retrieved. Data are collected yearly and publicly available since 1990 from the Form EIA-861 collection. Information is collected for Form EIA-861 based on the status of electric power industry participants involved in the generation, transmission, distribution, and sale of electric energy in the United States and its territories (EIA, 2018).

For the purpose of this investigation, an ad hoc database is created by mining the annual form EIA-861 database, namely historical development of utilities, state distribution with geographical coverage comparison (including each state distribution by years of formation of existing energy cooperatives), ownership, number of consumers, renewable sources use, and total capacity.

4.2 Results and Data Analysis

The following figures provide a visual representation of the Form EIA-861 data, including the distribution of the types of utilities in the past three decades to show how cooperatives are represented in the overall energy system in the US. In the attempt to observe the temporal and geographical evolution of rural electric cooperatives when using data collected by the EIA over the last three decades, different descriptive variables have been analyzed.

4.2.1 The dimensions of rural electric cooperatives compared to the overall energy producers

In deepening the investigation of electric cooperatives, we show electric cooperatives total number have steadily grown from 1990 to 2019, paralleled with total revenues in the same 30-year span. In detail, the number of total utilities was overall stable from 1990 until 2011-2015, when they dropped more than 33% (mean of evaluated utilities per year: 3,183 in 1990-1995, mean 3,185 in 1996-2000, 3,129 in 2001-2005, 3,206 in 2006-2010, 2,090 in 2011-2015 and 2,245 in 2016-2019).

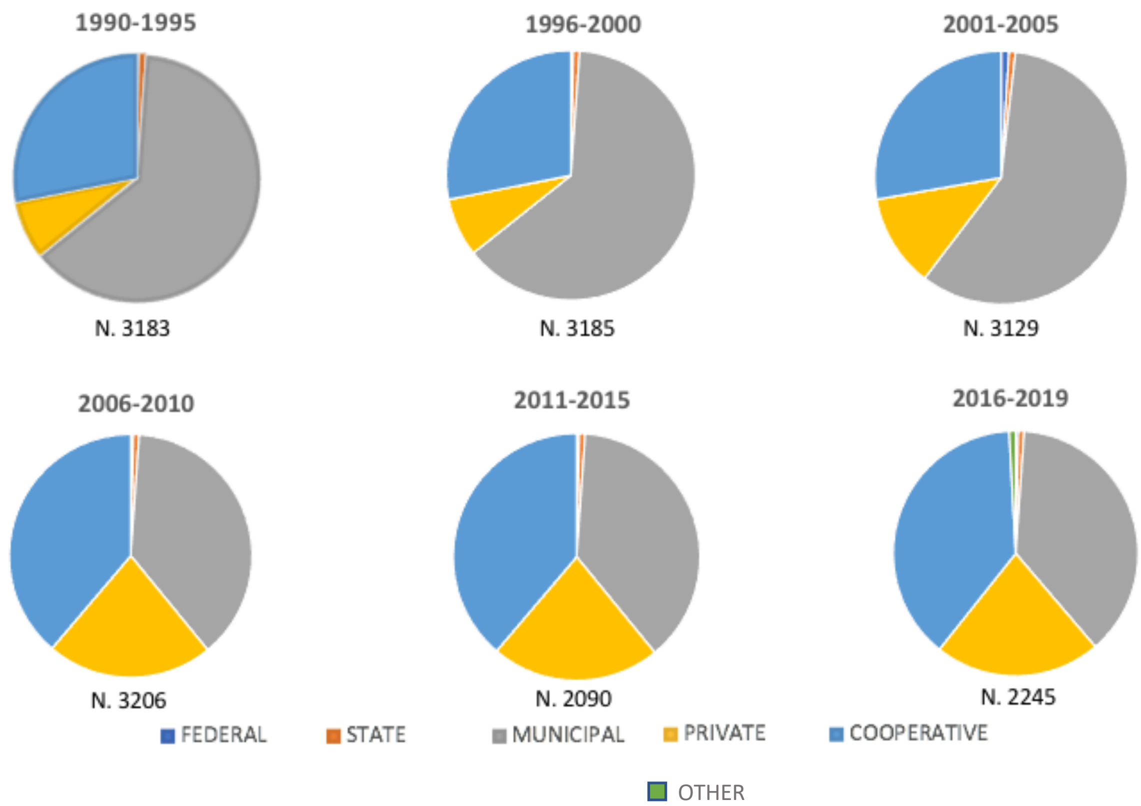


Fig. 4.1: Number distribution of US utilities from 1990-2019 (by type of utility)

The percentage of Federal and State-owned utilities remain stable over the years (less than 1%). The rate of municipally owned utilities progressively decreased from the 63% of the total from 1990-1995 to 37% in the recent years. Conversely, private utilities increased from 7.5% to 22%. Cooperatives represented 28% of the total utilities from 1990-1995, progressively reaching 38% in the 2016-2019.

The growth observed in the number of rural cooperatives has been paralleled by the number of consumers in registered electric cooperatives in the United States from 1990 to 2019 (Figure 4.2).

The increase of rural cooperatives also parallels the timing of the launch of Touchstone Energy in 1998, the national alliance for electric cooperatives. Majority of the cooperatives (over 750 out of 856) are under the Touchstone Energy alliance umbrella. Since this alliance was established, their territories have expanded into suburban and some urban areas, making electric cooperatives the largest electric utility network in the nation. The cooperatives that are part of Touchstone Energy are still owned and operated by the members it serves (Touchstone Energy, 2021).

Additionally, this growth trend in the late 1990s (figure 4.2) also mimics major regulatory reform aimed at introducing wholesale market competition, known as “restructuring”. This created changes in states with traditionally regulated and vertically integrated utilities and replacing them with a variety of actors including independent power producers (IPPs), wholesale markets, and competitive retail services (Bushnell et al., 2017). Most of these jurisdictions exempted electric cooperatives from “customer choice” regulations (Cooperative.com, 2016). Many states ended up abandoning the restructuring and returned to the traditional regulation. Distribution markets have remained largely unchanged during the restructuring era. The restructuring also left cooperatives unchanged (Jang, 2020).

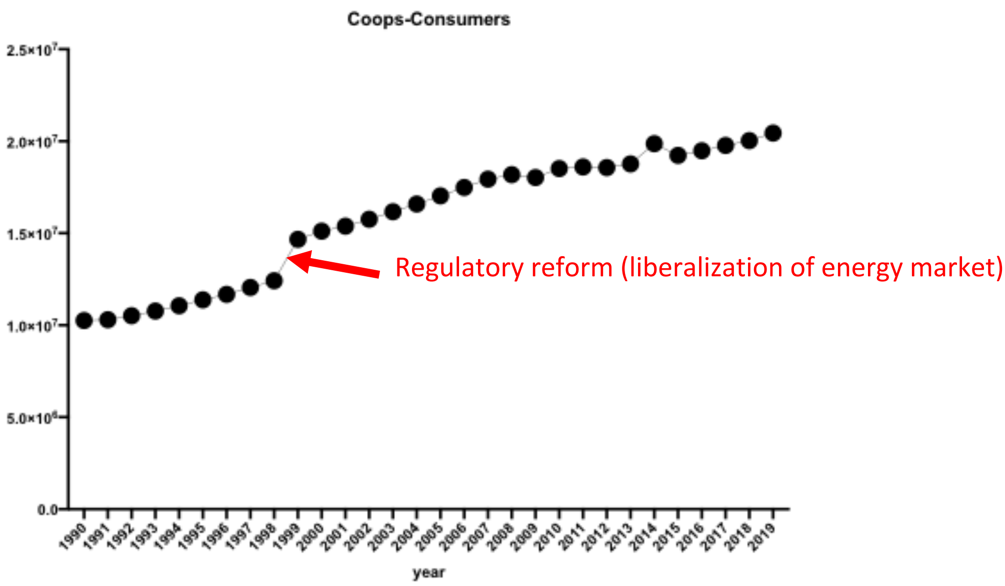


Fig. 4.2: Number of consumers in registered electric cooperatives in the US: 1990-2019

The trends observed in the revenue level mirror the number of total cooperative consumers. From 1990 to 2019, the steady growth in electric cooperative revenue was paralleled by the increase in consumers.

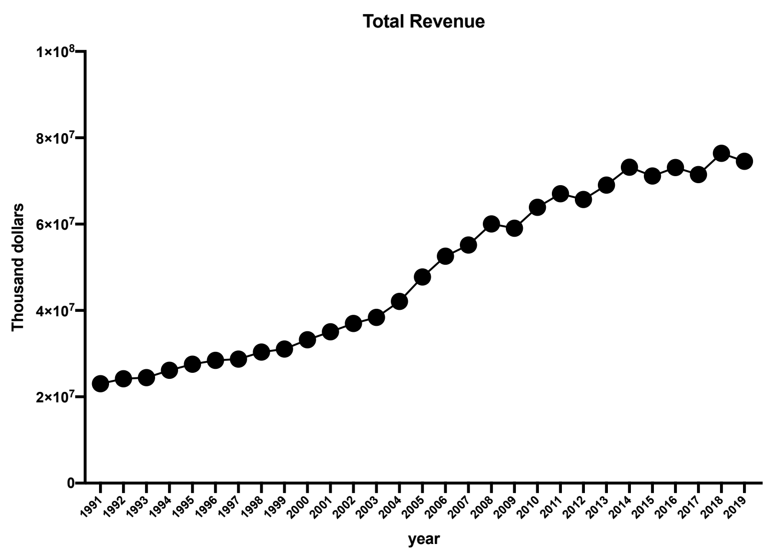


Fig.4.3: Total Revenue of Electric Cooperatives in the US: 1990-2019

Total revenue (thousands of dollars) progressively increased from 1990 to 2019. A marked increase from 2003 to 2019 was observed.

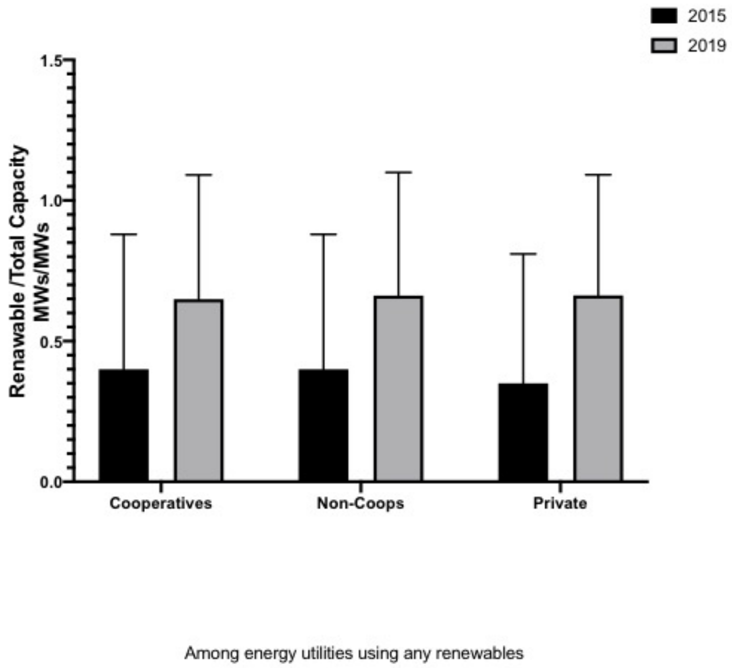


Fig. 4.4: Renewables total capacity of utilities in the US: 2015 and 2019

22% and 28% of the total utilities were using renewable sources in 2015 and 2019, respectively. Among those utilities, when adjusting for total capacity, we observed an increase of renewable energy use comparing 2015 and 2019. A similar trend is in the cooperatives, public owned utilities (federal, municipal, state) and private.

See more about renewable energy sources in electric cooperatives in Chapter 3, sections *3.8.2 Regulating the energy transition* and *3.8.3 US energy CAIs contribution to the energy transition.*

4.3 The geographical distribution of rural electric cooperatives

To the best of our knowledge, this is the first attempt at mapping the rural electric cooperatives when using the EIA data source, the Form EIA-861. The geographical distribution of registered cooperatives in the United States is heterogenous and varied over the years.

Higher numbers of cooperatives are predominately located in the Midwest and South (highlighted in purple). This geographical significance is aligned with the rural cooperative electrification movement that jump started in the 1930s with Roosevelt's New Deal.

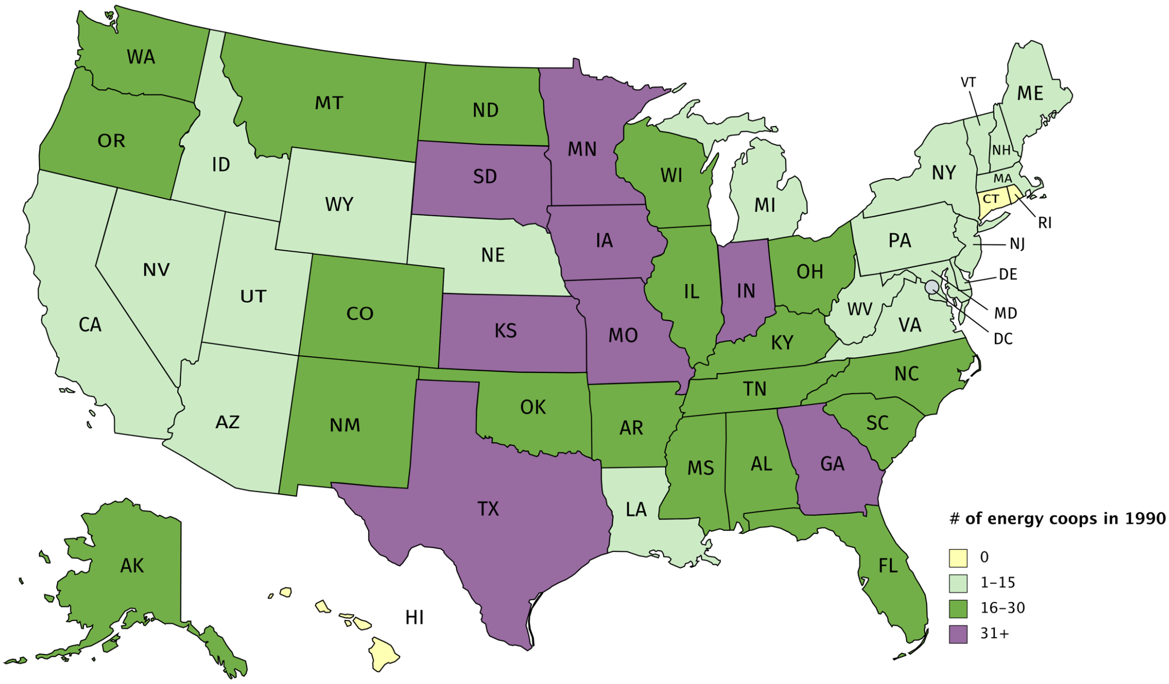


Fig. 4.5: Number of registered Cooperatives in the US (1990)

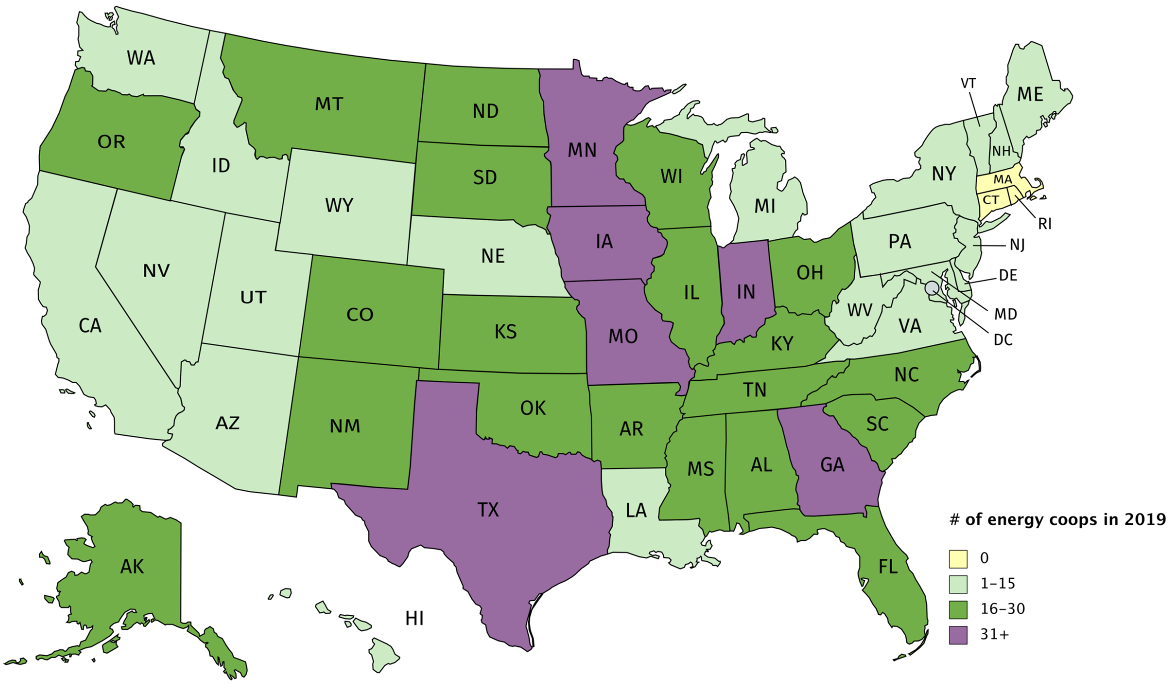


Fig. 4.6: Number of registered Cooperatives in the US (2019)

4.4 From mapping to comparability

When trying to identify some trends over the past decades, some considerations are worth noting. The number of registered electric cooperatives experienced some changes in the past three decades. For instance, in 1990 there were 8 states that had over 31 cooperatives. This was reduced to only 6 states in 2019. Within the three decades, Washington state lost 2 cooperatives. Two Midwestern states, South Dakoda and Kansas, both states that had over 31 cooperatives in 1990, lost 6 cooperatives. Also, in the Midwest, both Nebraska and Louisiana have less that 16 cooperatives, but are surrounded by states with a significant higher number of cooperatives.

All in all, while analyzing these fluctuations can be of informative when focusing separately on each state, a direct comparison can be limited by the heterogeneity of the different settings. To improve comparability, we limited our subsequent analysis on states with the highest and lowest number of registered cooperatives.

As previously mentioned, electric cooperatives are heterogenous and vary widely in size, energy usage, number of customers, and geography. It is impossible to lump them into one type of group. Nevertheless, we selected some descriptors (e.g., density (n. coop/population), number of cooperatives, geography) to allow some comparison among the dimensions of rural electric cooperatives across the selected states.

Four states (Louisiana, Nebraska, California, New York) all have less than 16 cooperatives and represent significant geographical regions of the United States. Details are provided in Table 4.1. Interestingly, Louisiana (Southern state) and Nebraska (Midwestern state) are both surrounded by states that have many cooperatives (over 16). Louisiana neighbors Texas, which has the highest number of cooperatives out of all states in the U.S. by a wide margin (80 in 1990 to 69 in 2019).

The density for cooperatives of Louisiana and Nebraska are almost identical ($2.1/10^6$ inhabitants) and are both much higher than California and New York by at least 10-fold ($0.07/10^6$ inhabitants and $0.2/10^6$ inhabitants, respectively). Both Louisiana and Nebraska state legislatures and leadership have been predominately Republican when compared to California and New York, both long-term democratic strongholds. Louisiana and Nebraska are also more aligned in physical geography, with mostly flat plains, whereas California and New York are much more diverse with mountains and flatlands.

Conversely, California has the highest population in the United States and ranks second only to Texas in total energy consumption (EIA, 2017). However, California and Texas (see Table 4.2) have a significant difference in the number of registered cooperatives. Texas has the most cooperatives in the country while California has one of the lowest numbers. Table 4.2 provides details of states with the highest representation of rural cooperatives (over 31).

4.5 What can we learn from these comparisons?

A direct comparison among states in terms of number of electric cooperatives might be challenging due to intrinsic differences in social, economic, geographical dimensions. However, some considerations are worth mentioning.

Firstly, states with the highest number of cooperatives share some similarities. From the institutional/political perspective, they are all Republican. Although looking into why predominately Republican states have a larger number of cooperatives, this exploration is beyond the scope of this paper and can guide the design of future investigations. Additionally, when looking at their physical geography, they mostly present flat lands, except for Georgia with some mountainous areas. Third, most of them experienced an increase in the number of customers from 2015-2019. Two of those states, Texas and Georgia, also have the largest electric cooperatives in the United States. For example, Pedernales Electric Co-op in Johnson City, Texas, has 333,809 customers. Remarkably, this is almost 50% more than the second-largest electric cooperative, Jackson Electric Member Corporation, in Jefferson, Georgia.

Pedernales Electric Cooperative in Texas, the largest distribution electric cooperative in the United States, also has a goal to have a 100% renewable energy portfolio. They signed a 15-year Power Purchase Agreement (PPA) for a 100-megawatt (MW) share of the King Creek 1 Wind Project in 2020 (EDF Renewables, 2020).

Similarly, Vermont Electric Cooperative, the state's largest member-owned electric utility, has committed to transitioning to a carbon-free energy supply by 2023. Renewable sources such as wind, solar, hydro, and nuclear, already provide around three-quarters of the utility's power. The rest is made up of natural gas and other fossil fuels. The cooperative plans to make the change by prioritizing carbon-free energy in all new contracts (VT digger, 2021).

When comparing Missouri and Minnesota, as shown in Table 4.2, we can observe that both have similar industry markets (based on top 3: Management, Agriculture and Manufacturing). Both states have adopted Renewable Portfolio Standards. They are similar in population (5,988,928 and 5,679,718, respectively) and density (7.3/106 and 7.5/106, respectively), but differ in number of consumers (757,992 and 852,860, respectively).

On the other side, a marked degree of heterogeneity exists. For instance, despite Texas and Louisiana sharing several similarities, they have very different numbers of electric cooperatives. They are neighboring states, both with the largest oil, gas and mining industries in the U.S., and both are Republican controlled state and house legislatures.
However, when we compare the density of cooperatives (coops/population) we observe a similar figure. The observation might suggest that further indicators beyond the total numbers of cooperatives should be considered when analyzing the spread of cooperatives in a certain territory. Similarly, regardless Iowa has a 10-fold smaller population than Texas, a ten times higher density of cooperatives is found in Iowa.

These considerations might guide the design of future indicators to evaluate the impact on electric cooperatives in a more accurate way.

4.6 Discussion

In the United States there are over 800 electric cooperatives in 47 states. Altogether, electric cooperatives deliver service to more than half (56%) of the nation's landmass (Velaga, 2019). Only Massachusetts, Connecticut, and Rhode Island don't have registered electric cooperatives with the EIA (as of 2019). These three states without registered electric cooperatives have experienced this for several decades, with the exception of Massachusetts, which had only 1 registered rural electric cooperative in 1990.

Back in 1921, the state with the highest percentage of electrified households was Massachusetts, with 97.8 percent. This is more than New York City (Touchstone Energy, 2021). As rural electrification had largely been accomplished in Massachusetts by the time REA came along in the 1930s, this might be one of the reasons why Massachusetts never had an electric cooperative, except for one, but only for a few years. This could be a similar explanation for its neighbors, Rhode Island and Connecticut, both of which always had just a few registered cooperatives or none at all (NRECA, 2021).

This study aimed to provide a first quantification and mapping of electric cooperatives in the US over the last three decades and to delineate some dimensions of the phenomena.

Over the last three decades we have observed an increase in rural electric cooperatives and their consumers in the US. Total revenue (thousands of dollars) progressively increased from 1990 to 2019. These trends should be compared to the number of total utilities that was overall stable from 1990 until 2011-2015, when they dropped more than 33%.

Electric cooperatives face diverse challenges, from their power sources to member engagement. While they represent some form of energy democracy (see section *2.4 Energy Democracy* for more details), rural electric cooperatives in the US can also experience member disengagement. Low member engagement persists despite rising customer numbers. In fact 70% of US energy cooperatives have fewer than 10% of voters engaged in elections, further disconnecting any democratic engagement from its members (Farrell et al., 2016). The low voting turnout at many rural electric cooperatives is an indication of the member-owners' disenfranchisement and apathy. Members typically struggle to overcome hurdles such long-distance to reach in-person meetings , complicated elections, and stringent voting protocols (Farrell et al., 2016). According to the National Rural Electric Cooperative Association (NRECA),

> “the electric cooperative is not defined by its products and services. Its “bottom line” is the empowerment of its member-owners. How it engages its membership to deal with the problems of the 21st century will define its success or failure.” (NRECA, 2019).

With that in mind, it should be noted that not all electric cooperatives are managed in the same way, and several cooperatives in the US have reformed their ways through member-focused efforts (Farrell et al., 2016).

Overall, cooperatives represented 28% of the total utilities from 1990-1995, progressively reaching 38% from 2016-2019. Growing as a whole group, cooperatives share some similarities. For example, they are predominantly in the Midwest region and have higher numbers in Republican states that all have common economic activities of Management, Agriculture and Manufacturing.

At the same time, a large degree of heterogeneity exists across cooperatives. A comparison can be challenging. Novel indicators are needed to assess the potential impact of cooperatives. The total number of cooperatives could be, for instance, replaced by the concept of density (no. of coops/population).

Electric cooperatives have been playing a key role in transforming the electric sector. However, the energy sector is still reliant on fossil fuels. A number of individual cooperatives are making the switch towards renewables. Interestingly, the map of the areas where cooperatives are denser (no. of coops/population) and where the use of renewables are more advanced don’t necessarily overlap.

4.6.1 Moving forward

The EIA produces its annual report showing different aspects of energy producers but is limited in that it is voluntary for cooperatives to provide this data. While the inclusion of data from cooperatives in the annual reports identifies them as players in the energy sector, still a specific focus is needed to understand their effective role. Analysis provided in this study might help to contextualize changes in the cooperative sector in the past 3 decades and help to understand the evolving scenario.

In order to realize the magnitude of their role, further investigations are needed that go beyond the larger rural electric cooperatives listed in the EIA databases to include smaller, grassroots initiatives. For example, there is a Community Renewable Energy Database in the US built by Professor Sharon Klein and her team that provides a classification system for community renewable energy projects across the country (Klein & Coffey, 2016).

Increased efforts into mapping all community-based energy CAIs, including cooperatives, need to be performed. Additionally, the economic aspects as well as the impact of current energy policies and regulations will deserve further investigations to have a more comprehensive analysis of the situation.

4.6.2 Solar communities in the US

Aligned with this growth of cooperatives in the US energy field is the rapid expansion of community solar, which often develops without following official restrictions and by-passing the established utility programs. In the US, community solar is expanding mostly because of operational assistance from established electric cooperative utilities (Michaud, 2020).

Community solar refers to solar installations that are shared by residents who, in return for their share of the electricity produced by the community, get credits on their energy bills (SEIA, 2022) (see example case study NYC-CEC in *Ch.6, section 6.4.1*) This is a strategy for enabling access to individuals who would otherwise be excluded from the energy transition and for establishing paths for residents to produce, own, and manage their own renewable energy resources (Baker, 2021). This is crucial for marginalized, low-income or mostly renter-populated areas to be able to access the renewable energy market, invest in, and run their own solar installation. In response to this lack of local access to sustainable energy, community solar projects have evolved, helping to drive forward the energy transition (Baker, 2021).

Over the last decade, federal and state governments released a number of manuals, pamphlets, and fact sheets about residential and community solar energy (DOE, 2014). In fact, the Department of Energy (DOE) publication, *Solar Powering Your Community: A Guide for Local Government,* contains best practices from the DOE25 Solar America Cities program which was created to:

> “assist local governments and stakeholders in designing and implementing a strategic local solar plan […] using examples and models that have been field-tested in cities and counties around the country […] that can help stimulate ideas or provide a framework for a comprehensive solar plan for a community […] to complement top-down federal policy approaches with federal-local partnerships that are helping to build a robust U.S. solar market" (DOE, 2011).

The successful communities studied for the DOE's solar projects demonstrate a growth in community-based renewable energy initiatives in the US outside of the typical electric cooperatives (Klein & Coffey, 2016).

There is a different distribution for the number of electric cooperatives when mapping and comparing state-by-state community solar regulations implemented throughout the US. The absence of community solar legislation in Midwestern states is a particularly clear example of this (Figure 4.7). One study found that while utilities were helpful throughout the regulatory process, they also posed significant barriers to community shared solar in certain states that had put in place statewide policies for the technology (Michaud, 2020).

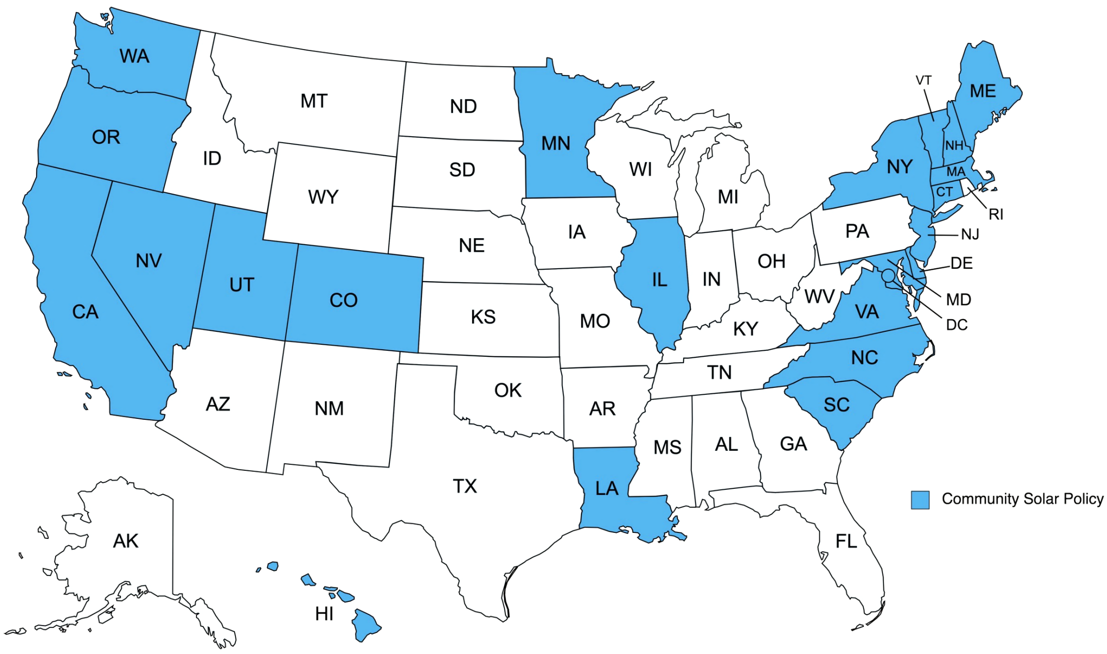


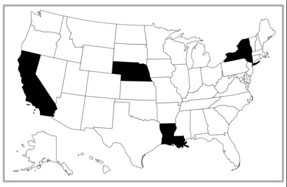
Fig. 4.7. States in the US that have enacted community solar policies (2020)[13]

Community solar policy and the number of electric cooperatives partially overlap when compared to the 2019 map of the distribution of cooperatives (Figure 4.6). Interesting to note, Louisiana, California and New York all have adopted a solar policy, while they are some of the few states with only a small number of registered electric cooperatives. Future studies may explore how these two variables interact and how much more participation of the wider population there is in community solar when compared to cooperatives.

The scaling of community solar is immediately assisted by electric cooperatives. The projects are often situated in states with officially established community shared solar policies (as well as in some states without). However, the majority of the projects are located in states with supportive regulation, notably Massachusetts (MA) and Minnesota (MN). In fact, Minnesota is the state with the most community solar systems installed. According to a recent study, the U.S. market for community solar will grow seven times in the next years (Honeyman, 2015).

[13] Adopted from NC Clean Energy Technology Center (2020), *The 50 States of Solar: 2019 Policy Review and Q4 Quarterly Report*

Table 4.1: Profiles of Louisiana, Nebraska, California, New York

	LOUISIANA	NEBRASKA	CALIFORNIA	NEW YORK
Population (2018)	4,659,978	1,845,525	39,557,045	19,453,561
Size (km²)	135,382	200,520	423,970	141,300
N. Cooperatives/n. of total utilities 2019 (%)	10/36 (27)	4/147 (3)	3/100 (3)	4/120 (3)
Density (n. coops/population)	0,21/10^5 inhabitants	0,21/10^5 inhabitants	0.007/10^5 inhabitants	0.02/10^5 inhabitants
Number of Consumers (total) 2015 2019	 369,745 425,524	 23,166 24,345	 16,646 16,718	 6,271 18,333
n. coops/consumers (2019)	2.4/10^5	16/10^5	18/10^5	22/10^5
Total Revenue Coops/ Total Revenue Energy Sector (1000$) % 2015 2019	2015: 973,923/7,178,849 (13.5%) 2019: 873,923/7,099,874 (12%)	2015: 299,513/4,077,009 (7%) 2019: 284,442/4,185,569 (7%)	2015: 41,834/40,284,580 (0.1%) 2019: 44,793/42,290,064 (0.1%)	2015: 10,783/32,459,111 (0.03%) 2019: 25,587/31,152,478 (0.08%)
Renewable Source/Total Capacity (mean)* 2019	N/A	46%	32%	41%
Drivers and Determinants				
	LOUISIANA	NEBRASKA	CALIFORNIA	NEW YORK
Regulatory	The Louisiana Public Service Commission regulates all electricity and natural gas IOUs and electric cooperatives in the state.	Nebraska Power Review Board regulates the state’s publicly owned electrical utility industry. These utilities electric cooperatives,	The California Public Utilities Commission (CPUC) regulates privately-owned utilities in the state of California, including cooperatives.	the New York Public Service Commission (PSC) regulates the state's electric, gas, steam, telecommunications, and water utilities. The only exception is State Electric Cooperatives, The PSC is also responsible for setting rates and ensuring adequate service by all utilities.

Adopted renewable portfolio standard (RPS)?	No	No	Yes	Yes
Institutional [i]	*Republican*: Every statewide office is held by a Republican, except the governor, Senate: 1991- 2011 Democrat control, 2012- 2019 Republican control House: 1991 to 2010 Democrat control 2011-2019 Republican control	*Republican*: Democratic trifecta +*: 1992-1998 Republican trifecta +*: 1999-2021. Nebraska only state legislature in the country that is unicameral. The state legislature is also unique in that it is the only state legislature that is entirely nonpartisan.	*Democrat*: State Senate: From 1992 to 2020, Democratic control. From 1992 to 2020, the California Assembly Democratic control, except in 1994 with Republican control.	*Democrat*: State Senate: 1992 - 2020, primarily held by Republicans. House: 1992-2013, Democratic control. State Assembly: 1992 - 2020, Democratic control
Physical Geography	Mostly flat: the Mississippi Flo od Plain; the Coastal Marsh; the Red River Valley; the Terraces; and the Hills.	Mostly Flat: The great plains and farmlands.	Diverse: cliffs, beaches, fertile river valleys, mountains and deserts.	Diverse: farms, forests, rivers, mountains, and lakes.
Industry (top 3 sectors)**	Oil, Gas, and Mining (477%); Construction (28%); Utilities (22%)	Agriculture (224%); Utilities (34%); Finance & Insurance (31%)	Agriculture (64%); Information (38%); Entertainment (23%)	Information (39%); Finance & Insurance (24%); Real estate (20%)

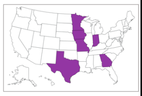
* among the cooperative using any Renewable Source (Hydroelectric, Wind, Photovoltaic)
** Percentage of employment common in each State compared to the rest of the United States (among the civilian employed population aged 16 and older).[ii]
*** renewable portfolio standard (RPS) provides states a requirement for a certain amount of electricity coming from renewables
+* state government trifecta is when one party holds the governor’s office and majorities in both state legislative chambers

Table 4.1.1 Additional details about each of the four states

State	Details
Louisiana	Louisiana is the only state in the south with under 16 registered cooperatives (see Fig. 6). Louisiana ranks third for highest per capita energy consumption and total energy consumption, mostly due to the state's chemical, petroleum, and natural gas industries.[iii] Louisiana (2nd) and Texas (1st) are the two states with the highest industrial sector energy consumption.[iv] Both states also have similar density levels (no. of coops/population) of electric cooperatives: $2.1/10^6$ and $2.43/10^6$ inhabitants, respectively. Louisiana's energy market is regulated and gives utilities ownership of electricity in their service territories and can decide electricity prices.[v]
Nebraska	With only 4 registered cooperatives (in 2019), Nebraska is mostly surrounded by most states with the highest number of electric cooperatives in the Midwest (see Figure 4.6). Nebraska is mostly flat prairie lands with fertile soils, making it one of the leading agricultural states.[vi] The agricultural industry is the leading energy end-use consumer in Nebraska, accounting for almost half of the state's end-use energy consumption.[vii] Although Nebraska does not have a renewable portfolio standard (RPS),[viii] its physical geography provides some of the best wind energy resources in the U.S.[ix]
California	California is an economic powerhouse being ranked as the world's fifth-largest economy. At the same time, the state boasts one of the lowest levels of per capita energy consumption in the nation, despite having many energy-intensive industries.[x] This phenomenon is mostly attributed to the state's long-term contributions to increasing energy efficiency and deploying energy demand technologies.[xi] California is also one of the top producers of conventional hydroelectric power in the US. It is only second to Texas in other renewable-sourced electricity generation.[xii] However, comparing California and Texas in renewable-sourced generation among cooperatives (Hydroelectric, Wind, Photovoltaic), California lags behind Texas, 32% and 48% respectively. Also, California has the lowest retail sales per capita in the U.S. but ranks second after Texas in electricity retail sales.[xiii] Additionally, California is the largest net importer of electricity in the US, receiving about 28% of its electricity supply from neighboring states.[xiv]

New York	New York's economy ranks third in the United States, after California and Texas.[xv] Additionally, both California and New York have the most energy efficient economies in the U.S. New York's total energy per capita is the lowest compared to any other state, except Rhode Island.[xvi] It also helps that New York's largest industries, finance and real estate, are not energy intensive. New York is also one of the top producers of hydroelectricity in the US, producing more utility-scale hydroelectric power than all states, except for California and Washington.[xvii] However, New York's electric cooperatives produced more electricity from renewable sources than California, 41% and 32%, respectively. After hydropower, wind is the second-largest renewable source in New York. In fact, wind has almost doubled in one decade (from 2009 to 2019) in the state, accounting for almost 4% of all utility-scale net generation.[xviii] New York also has an ambitious renewable energy and climate plan. The state's Clean Energy Standard (CES) became the renewable portfolio standard. The CES was updated in 2019 to require 100% carbon-free electricity by 2040 as well as transform the state's economy to net-zero carbon emissions by 2050.[xix]

Table 4.2: States with the highest number of electric cooperatives (2019)

	MISSOURI	TEXAS	GEORGIA	INDIANA	MINNESOTA	IOWA
Population (2019)	5,988,928	28,701,845	9,687,653	6,732,219	5,679,718	3,107,124
Size (km²)	180,639	696,241	153,909	94,321	225,181	145,743
N. Cooperatives/ n. of total utilities 2019 (%)	44/133 (35)	70/257 (27)	43/96 (45)	39/112 (35)	43/168 (26)	37/172 (22)
Density (n coops/population)	$0,73/10^5$ inhabitants	$0,243/10^5$ inhabitants	$0,44/10^5$ inhabitants	$0,57/10^5$ inhabitants	$0,75/10^5$ inhabitants	$1.1/10^5$ inhabitants
Number of Consumers (total) 2015 2019	738,445 757,992	2,036,126 2,321,288	1,995,385 2,102,775	539,289 336,865	811,702 852,860	227,339 233,992
N. of coops/consumers (2019)	$5.8/10^5$	$3.0/10^5$	$20/10^5$	$16/10^5$	$5.0/10^5$	$16/10^5$

Total Revenue Coops/ Total Revenue Energy Sector (1000$) % 2015 2019	2015: 2,658,967/13,346,755 (19%) 2019: 2,182,958/13,130,180 (17%)	2015: 4,604,207/24,530,923 (18%) 2019: 5,315,020/36,910,421 (14%)	2015: 4,160,268/13,069,829 (31%) 2019: 4,536,371/13,739,612 (33%)	2015: 1,433,115/9,399,292 (15%) 2019: 1,546,813/10,133,764 (15%)	2015: 1,622,414/6,289,992 (25%) 2019: 1,827,460/6,915,058 (26%)	2015: 2,278,267/13,935,801 (16%) 2019: 729,905/4,635,849 (15%)
Renewable Source/ Total Capacity (mean)* 2019	--%	48%	100%	75%	29.5%	94.1%
Drivers and Determinants						
	MISSOURI	TEXAS	GEORGIA	INDIANA	MINNESOTA	IOWA
Regulatory [xx]	the Missouri Public Service Commission (PSC) regulates the operational safety of the electric cooperatives	Public Utilities Commission of Texas (PUC). Electric cooperatives have the right to choose to participate in Texas' retail electric market. All cooperatives set their own retail rates through its board of directors. Most co-ops have been setting their own retail rates. Wholesale transmission rates for cooperatives are set by the PUC.	The Georgia Public Service Commission The Commission has limited authority with respect to cooperative, but are required to file their rates with the Commission [xxi]	Indiana Utility Regulatory Commission (IURC). Rates and charges of all coops are regulated at the local level instead of the state level. State law allows coops to withdraw from IURC jurisdiction for purposes of setting rates and charges and obtaining financing. All Indiana coops have withdrawn from state oversight.	Minnesota Public Utilities Commission (PUC). Regulation of cooperatives by the PUC is deemed unnecessary. The state legislature determined that due to coops being non-profit utilities, they are “effectively regulated” by other entities. Electric cooperatives can elect to be subject to comprehensive oversight by the PUC.[xxii]	the Iowa Utilities Board (IUB). The IUB authority is mostly limited to service, safety, and engineering issues for the electric cooperatives.[xxiii]
Adopted renewable portfolio	Yes	Yes	No	No	Yes	Yes

standard (RPS)?***						*first state to do so in 1983*
Institutional[xxiv]	Republican: state government trifecta. +* 1992 - 1998, Democratic control 2001-2020 Republican control	Republican: state government trifecta. +* Senate: 1992-1996 Democrat control. 1996-2020 Republican control. House: 1992-2002 Democrat control; 2002-2020 Republican control	Republican: state government trifecta. +* Senate: 1992-2013, Democrat control. House: 1992-2013 Democrat control.	Republican: state government trifecta. +* Senate: 1992-2020, Republican control. House: 1992-2010, partisan control changed five times. 2010 -2020 Republican control with strong majority.	Republican: divided state government, no political party holds a state government trifecta. Senate & House: 1992 - 2013, Democrat control House: 2013-2019, Republican control	Republican: state government trifecta. +* Senate: 1992 - 2020, competitive between the Democratic and Republican parties. House: 1992 - 2020, mostly controlled by Republicans.
Physical Geography	Mostly flat: Prairies, floodplains forested hills and low mountains. Lowlands farmlands[xxv]	Mostly flat: Gulf Coastal Plains, Interior Lowlands, Plains and Prairie [xxvi]	Diverse: Blue Ridge Mountains, the Piedmont plateau, Coastal Plains . [xxvii]	Mostly flat: The Great Lakes Plains, the Till Plains and the Southern Plains; Lowlands. [xxviii]	Mostly flat: woodlands, prairies, and 12,000 lakes[xxix]	Mostly flat: Rolling hills and flat plains. Iowa is one of the leading U.S. states in number of farms.
Industry (top 3)**	Management (14%); Agriculture (13%); Manufacturing (11%)	Oil, Gas & Mining (312%); Management (30%); Construction (28%)	Transportation (23%); Information (16%); Utilities (11%)	Manufacturing (82%); Transportation (5%); Healthcare (0.4%)	Management (61%); Agriculture (55%); Manufacturing (31%)	Agriculture (182%); Manufacturing (47%); Finance & Insurance (39%)

* among the cooperative using any Renewable Source (Hydroelectric, Wind, Photovoltaic)
** Percentage of employment common in each State compared to the rest of the United States (among the civilian employed population aged 16 and older).[xxx]
*** renewable portfolio standard (RPS) provides states a requirement for a certain amount of electricity coming from renewables
+* state government trifecta is when one party holds the governor's office and majorities in both state legislative chambers

Table 4.2.1: Additional details about the 6 states with the highest number of electric cooperatives (2019)

State	Details
Iowa	Iowa's flat plains provide ample space for significant renewable energy resources, especially solar and wind.[xxxi] In fact, around 2/5 of Iowa's electricity net generation derives from renewable sources, mostly wind.[xxxii] The state ranks third in wind power production, after Texas and Oklahoma.[xxxiii] Iowa adopted a renewable portfolio standard (RPS) in 1983, the first state in the U.S. to do so. Since then, **c**apacity from renewable resources has surpassed all RPS goals. In 2020, Iowa generated about 10,400 megawatts of renewable energy at utility-scale power facilities.[xxxiv]
Missouri	Missouri has around 40 distribution cooperatives**,** providing electricity to homes, farms and businesses. They vary in size--from just over 2,000 member-owners to more than 40,000 members. Some cooperatives might serve just one county whereas larger ones might span across larger territories.[xxxv] Similar to Iowa, Missouri's primary source of renewable electricity is wind, accounting for 2/3 of the state's renewable generation.[xxxvi] In 2019, the state's total electricity net generation included 6% of renewable sources. In the same year, the state's 500 turbines produced around 1,000 MW of wind power generating capacity.[xxxvii] Missouri adopted a mandatory renewable portfolio standard (RPS) in 2008, replacing the state's previous voluntary goal. The RPS mandates for the state's total retail electricity sales derive from at least 0.3% of solar PV by 2021.[xxxviii]
Texas	Texas ranks second in both population and economy in the US, both after California.[xxxix] The state's energy sector relates to the common expression, 'Everything is bigger in Texas'. The state is the top energy producer in the U.S, by a wide margin, generating almost twice as much as Florida, the second-highest energy-producing state.[xl] At the same time, Texas consumes the most electricity than any other state, accounting for almost 1/7 of the U.S. total consumption. The largest share of the state's electricity retail sales comes from the residential sector.[xli] Out of all 50 states, Texas is the only one with an isolated state grid.[xlii] There are four electricity grids in the state. The main grid, which serves ¾ of the state, is operated by the Electricity Reliability Council of Texas (ERCOT). Because the grid is largely isolated from the rest of the country, Texas avoids federal oversight and is dependent on its own resources.[xliii] The state's wind generation has significantly increased during the past two decades, providing more than 1/6 of Texas' generation.[xliv] Since 2010, most of the renewable capacity has been fueled by natural gas or wind.[xlv]

	Installed solar capacity has also been rapidly increasing in Texas, doubling between 2017 and 2019.[xlvi]
Georgia	Renewable energy sources account for 9% of Georgia's electricity generation. Half of the state's renewable generation is sourced from biomass (mostly wood-derived fuels), ranking Georgia in second after California in generation from all biomass resources.[xlvii] Georgia is one of the top 10 states in the U.S. for total energy consumption. The state's transportation sector is the largest end-use energy consumer, especially given its large interstate highways and airport in Atlanta (one of the world's busiest).[xlviii] The state's per capita energy consumption is around 2/3.[xlix] As with most states in the Southeast, Georgia never adopted a renewable energy standard or a voluntary renewable energy target. Although it lacks specific mandates, Georgia's utilities offer financial incentives that promote renewable generation and energy efficiency.[l]
Indiana	Indiana's large industries (chemical, petroleum, and steel production) are the largest end-use energy consumer, accounting for almost 1/2 of the end-use energy consumption in the state.[li] Indiana continues to use a significant amount of coal in its energy mix, ranking top 10 in the U.S. for electricity generated from coal and ranks second after Texas in total coal consumption.[lii] Although there has been a significant decline in Indiana's coal-fired electricity total generation, from 90% in 2010 to 59% in 2019, the majority of the state's largest power plants (8 out of 10) are still coal-fired.[liii] Comparatively, the residential sector uses almost no coal with 0.1% of households get heat from coal sources.[liv] Meanwhile, Indiana is one of the leading states in biofuel production, especially with its abundant corn and soybean crops.[lv] Indiana's clean energy portfolio standard is voluntary, and no utility has chosen to participate (as of 2019).[lvi] However, if an electric utility chooses to participate, it agrees to acquire 10% of the electricity it sells from clean energy sources by 2025. Additionally, the utility receives financial incentives in return.[lvii]
Minnesota	Minnesota generates around ¼ of its electricity from renewable energy resources, ranking among the top 10 states for installed generating capacity and net generation from wind. The state's wind resources provide the majority of the renewable generation, accounting for about 1/5 of the state's generation from all sources.[lviii] The state's largest end-use energy consumer is the industrial sector (energy-intensive food processing, manufacturing, petroleum refining, agriculture) accounting for more than 1/3. The residential sector is around 1/5.[lix]

	Minnesota adopted a renewable portfolio standard (RPS), requiring that the state's utilities (except the state's largest utility) to generate or procure at least 25% of electricity retail sales from eligible renewable sources by 2025.[lx] Around 1/3 of Minnesota citizens are members of an electric cooperative, making it one of the leading states for cooperatives. There is one major barrier for the cooperatives in fulfilling the state's renewable energy goals: Many cooperatives are locked into purchasing power agreements with larger G&T cooperatives that own coal plants elsewhere and they intend to continue operating far into the future, even when many coal-fired power plants have been retired in Minnesota (see Ch. 3, section 3.8.2 for the discussion on being locked into long-term, non-renewable contracts).[lxi]

Chapter 5

The EU experience of collective action in the energy field

Background

In order to finance renewable energy initiatives, increase the capacity of renewable energy sources, or encourage and assist others in participating, citizens throughout Europe are organizing various kinds of collective action initiatives (CAIs). In this approach, citizens take the lead in identifying and exploring the required system modifications. They experiment for the local community's benefit, work with public authorities on transition programs, find new business models, and facilitate important conversations about the design of the future energy regime (COMETS D5.2, 2021). They also test the viability of technological and legal solutions (Viardot, 2013).

To better comprehend the mobilization potential and to offer more accurate projections on the expected pace of the energy transition—a subject that is now increasingly debated in the scientific community—such information is, nevertheless, essential. Aggregate estimates of energy CAIs' contribution to Europe's energy transition were limited until recently. Such aggregate estimated included the amount of energy savings, installed renewable capacity, the amount of low-carbon energy services provided, the number of people involved, or the amount of money invested, to name a few. Even a comprehensive list of citizen-led projects operating in the energy industry was limited (only a list related specifically to energy cooperatives exists in a few European countries, which has its own limitations).(EU Commission, 2018; Sovacool, 2016; Grubler et al*.,* 2016; Smil, 2016; Sovacool & Geels, 2016).

The COMETS research project, which I was a member of, intended to close the identified knowledge gaps by establishing the first EU-wide infrastructure for the systematic collection, archiving, and dissemination of information about the advancement of CAIs. Such an inventory is timely for the integration of aggregate energy system models.

The literature reveals only a small number of aggregate estimates for only a few European countries, the majority of which have been published in grey literature (DRGV, 2018; COOP.UK, 2018). As a result, the majority of the quality requirements for the collection and processing of data are not provided, and previous estimations are thus likely to be quite unreliable.

The new, extensive database[14] of energy CAIs offers a valuable insight for research into how the topology of these initiatives affects their development, as well as a solid foundation for further contextualizing the frontier case studies (see Chapter 6). Mapping the data also helps us understand where these initiatives are located and what local policies are supporting them.

5.1 Methodology

A multi-country database was created in the COMETS project (European Commission funded Horizon 2020) with the intention of mapping energy CAIs within the EU. The associated tasks were carried out as a part of a multidisciplinary effort within the COMETS project (Wierling et al., 2018). The database was created by accessing national official registries of energy CAIs, which frequently included information about the dates of founding (and decommissioning), public addresses, and sources for more information. To create a preliminary list, registered CAIs working in the renewable energy sector were screened. Entries were expanded when it was able to provide more details on member attributes.

Various key sources were used to identify CAIs. These comprised, among other things, official company registries, national energy agencies, power plants, and market data registry searches. Additional search results from the internet, personal websites, self-profiling websites, and newspaper articles expanded the information that was retrieved. Archived webpages from archive.org in cases with deleted CAIs were additionally accessed.

[14] Access to EU inventory: https://dataverse.no/dataset.xhtml?persistentId=doi:10.18710/2CPQHQ

When retrieved, manufacturers and energy CAIs development businesses' reference pamphlets were studied. For the purpose of data validation, cross-referencing between supplementary website information (for example, RESCOOP) and obtained data was attempted (see Table 5.1 for the descriptive analysis). Using the four eyes principle and cross-checks between several data sources, data collecting problems were detected.

The database building and efforts were led by COMETS partner, Western Norway University of Applied Sciences (HVL), and is accessible here:
https://dataverse.no/dataset.xhtml?persistentId=doi:10.18710/2CPQHQ

5.2 Main Findings

Table 5.1 provides aggregate data for each EU country. The reported figures of the included energy CAIs are meant to provide a comprehensive view at a time when each country is currently transposing and implementing European Union directives that seek to encourage citizen engagement by establishing legal grounds to get involved. (see *Ch. 3, section 3.6* on the current EU policies and directives.)

While most countries apply a definition of "energy community" that largely follows the current cooperative legal framework, several countries, like Poland and Greece, have taken distinctly divergent stances. Additionally, the term "energy communities" can refer to a variety of organizations in France as it is not always a specific legal structure. A definitional mosaic is created by overlapping borders and forms. Although the volume, scope, and degree of accessibility varied by country, a centralized national business registration provided access to certain administrative data (registration numbers and addresses).

Legally required annual reporting helps a small number of countries keep thorough, transparent, and current records on project financing and performance. Others have acquired data about these initiatives via their own online publications and websites, or through publicly available resources collated and managed by umbrella organizations.

Due to the high heterogeneity in the quality and sources of the data obtained, manual information collecting, and compilation were used to create the dataset from thousands of sources. An ontology and internal accounting standards were built up in an effort to improve comparability between countries. However, the heterogeneity of sources, data accessibility, and applied definitions—all of which were previously mentioned—limit the reuse of data for additional comparison (within EU or with the US).

It's critical to understand certain limitations. It was not feasible to collect the same quantity of information for all countries and all entries since the accessibility of open data on energy CAIs differs from country to country as a result of legislative changes and the level of voluntary information provided by each initiative. The bulk of the initiatives are very modest in scale and lack their own websites. As a result, information is frequently disseminated through reports from umbrella organizations or local newspapers. Finally, and perhaps most importantly, public access to data is severely constrained in both the REScoop and COMETS databases.

5.3 Descriptive analysis

The data that has been obtained about the distribution and mapping of energy CAIs inside the EU clearly supports the idea that these niche-level actors may have a central role to facilitate the energy transition. The energy saved, number of individuals participating, number of organizations formed in different legal forms, employment generated, and energy services are all promising indicators of energy CAIs' impact on the energy transition and contribution to energy democracy efforts (Wierling et al., 2018). See more about the energy transition in *section 2.1* and more about energy democracy in *section 2.4*.

However, the shortage of open source comparable data still represents a major constraint. The current situation can be improved through teamwork, the creation of a broader open source database that is shared among researchers, and the creation of a reliable approach that can fill in data gaps with accurate estimations.

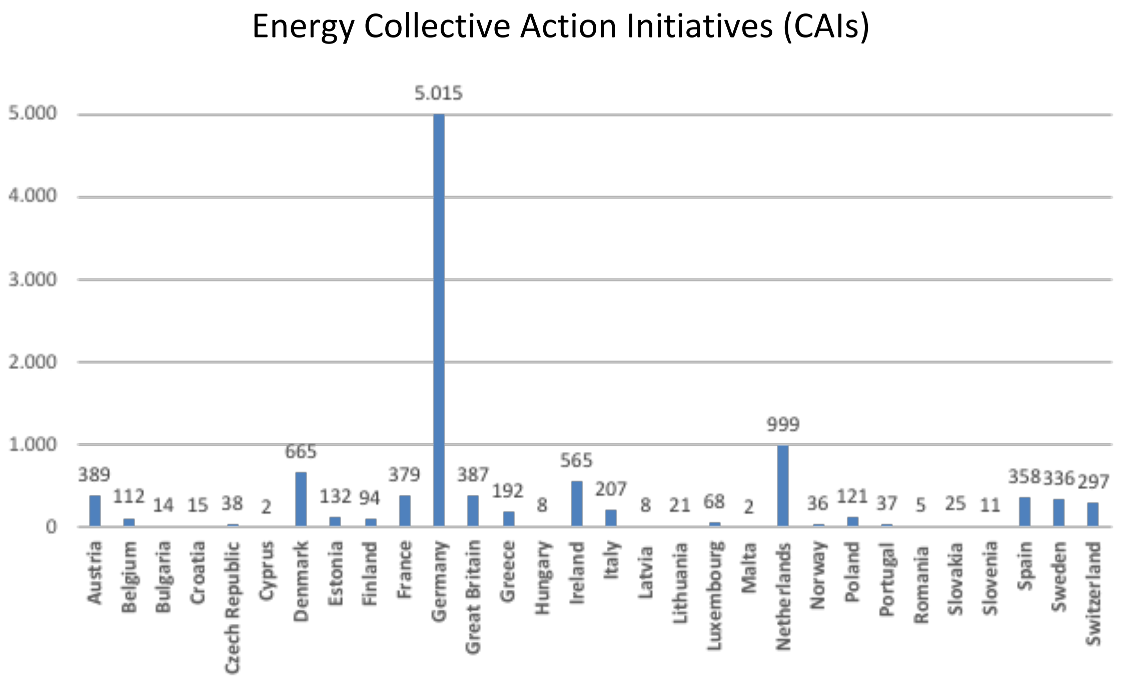


Fig. 5.1. Number of energy CAIs in the EU. Raw numbers of from the COMETS database

The magnitude of energy CAIs in the EU is given in Figure 5.1 when the raw number of CAIs is plotted on a graph. However, it is difficult to establish comparisons in this area as a result of the significant variance between the countries.

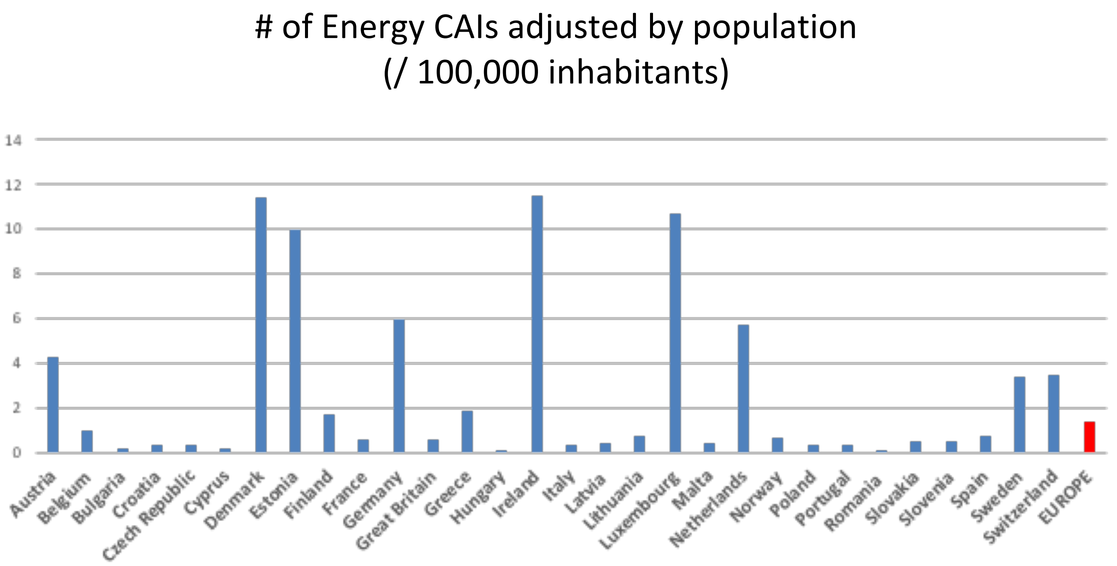


Fig. 5.2 Number of energy CAIs adjusted by population

As a result, when adjusting the distribution so that it takes into account the number of CAIs in relation to the total population (i.e. the density), we find that the distribution is more comparable (Figure 5.2). The average for Europe is shown in red, and this value can be used as a point of reference to determine which countries are higher or lower than the average for Europe (11 countries out of 30).

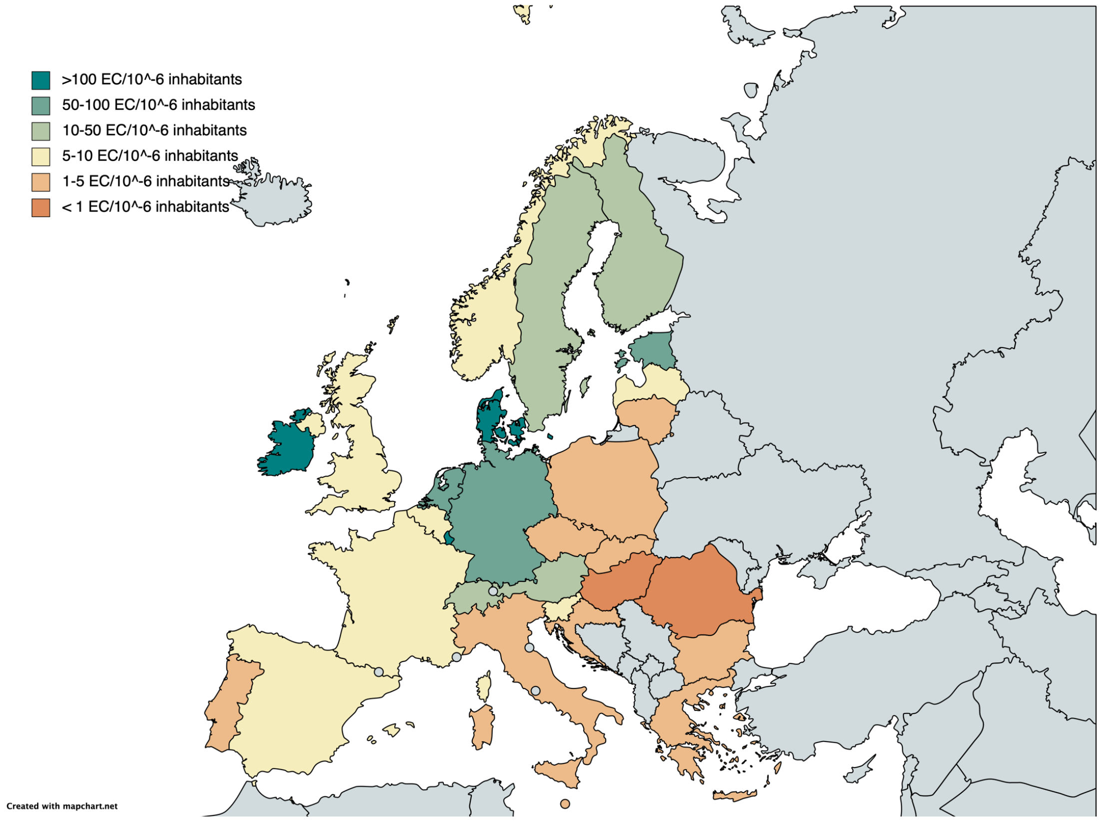


Fig. 5.3. Mapped data based on density of each European country

When we plot these observations on a map, we can see both clusters and a geographical dispersion of the locations where the observations were made (Figure 5.3). The density of collective action in each country is depicted on the map by the number of inhabitants per 100,000.

There are obviously certain distinctions to be made. For instance, Italy is a populous country; hence, the number after being adjusted for population might contribute to the low numbers in the end.

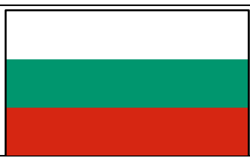
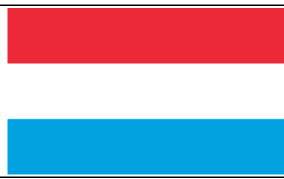
In addition to this, a significant portion of eastern Europe is underrepresented. Certainly, this might be for a variety of reasons, and the historical investigation can help shed light on some of those possibilities (see *Chapter 3, section 3.4 European History*). Countries that belonged to the former Soviet Union have the lowest numbers, which is likely due to cognitive barriers associated with the historical identity of cooperatives (i.e. top-down and forced collectivism). Thus, energy CAIs are not as developed in Eastern Europe as they are in Western Europe because of the possibly negative legacy of the socialist era as well as a population that is financially less well off (Bauwens et al., 2016).

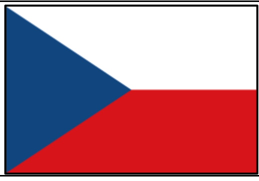
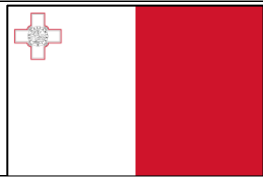
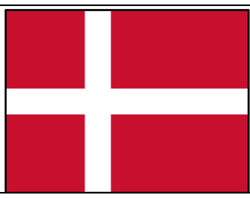
The history of community-led energy is unique to each EU country and has been significantly shaped by local environmental conditions. The darker-hued nations, particularly Germany and Denmark (see Figure 5.3), may be indicative of their extensive histories of citizen engagement. In contrast, there is little history of community-led energy development in southern Europe and even less in eastern Europe, where for a very long time, the term "collective" somehow evoked memories of the soviet past (Verde & Rossetto, 2020).

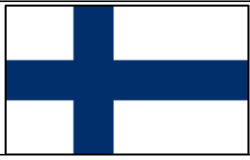
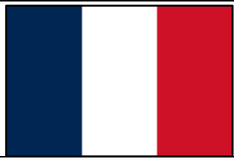
Modern renewable energy CAIs (or 'RES communities') often date back to the 1970s, when the first wind cooperatives were established, first in Denmark and later abroad. Beyond conventional mutual interest, energy CAIs often include participation from a variety of stakeholders (Huybrechts & Mertens, 2014; Yildiz et al., 2015; Lowitzsch & Hanke, 2019). In countries where cooperatives are increasingly integrated into society, renewable energy source (RES) cooperatives have become the most common type of energy CAIs (especially using solar PV). Additionally, energy CAIs, particularly RES cooperatives, are becoming a more significant player in the larger social enterprise landscape (European Commission, 2020). With just a few exceptions, RES communities are typically localized in small populations, with just a few cases of initiatives with over a thousand of members who generally work in the provision of energy (Verde & Rossetto, 2020).

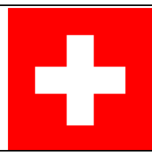
Germany's total renewable (RES) capacity was between 2,100 and 3,200 MW, the highest of all the countries in the database and a contribution to the overall energy transition (see *Ch. 3, section 3.5.3.1 for more on Germany's energiewende*). This gives a sense of their significance in terms of both the broader energy transition and the European electricity markets. With 2,600 MW of RES capacity, Denmark comes in second.

Table. 5.1 Descriptive analysis of energy CAIs in Europe (based COMETS database)

Austria		**Italy**	
Population	8,917 million	Population	60,285 milion
Area	83,879 km²	Area	302,068,26 km²
N. Energy Communities (EC)	389	N. Energy Communities (EC)	207
N. Cooperatives (ECoop)	383	N. Cooperatives (ECoop)	46
EC density	$4,3/10^5$ inhabitants	EC density	$0,34/10^5$ inhabitants
ECoop density	$4,3/10^5$ inhabitants	ECoop density	$0,071/10^5$ inhabitants
Renewable capacities estimates (MW)	352	Renewable capacities estimates (MW)	293-348
Belgium		**Latvia**	
Population	11,56 milion	Population	1,908 milion
Area	30,689 km²	Area	64,589 km²
N. Energy Communities (EC)	112	N. Energy Communities (EC)	8
N. Cooperatives (ECoop)	36	N. Cooperatives (ECoop)	N/A
EC density	$0,97/10^5$ inhabitants	EC density	$0,42/10^5$ inhabitants
ECoop density	$0,3/10^5$ inhabitants	ECoop density	N/A
Renewable capacities estimates (MW)	155.6- 565.5	Renewable capacities estimates (MW)	0,1-0,13
Bulgaria		**Lithuania**	
Population	6,98 milion	Population	2,793 milion
Area	110,994 km²	Area	65,200 km²
N. Energy Communities (EC)	14	N. Energy Communities (EC)	21
N. Cooperatives (ECoop)	1	N. Cooperatives (ECoop)	N/A
EC density	$0,2/10^5$ inhabitants	EC density	$0,75/10^5$ inhabitants
ECoop density	$0,01/10^5$ inhabitants	ECoop density	N/A
Renewable capacities estimates (MW)	N/A	Renewable capacities estimates (MW)	0,1-0,13
Croatia		**Luxembourg**	

Population	4,076 milion	Population	634 730
Area	56,594 km^2	Area	2,586 km^2
N. Energy Communities (EC)	14	N. Energy Communities (EC)	86
N. Cooperatives (ECoop)	2	N. Cooperatives (ECoop)	2
EC density	0,34/10^5 inhabitants	EC density	11/10^5 inhabitants
ECoop density	0,049*10^5 inhabitants	ECoop density	0,31/10^5 inhabitants
Renewable capacities estimates (MW)	10-60	Renewable capacities estimates (MW)	1
Czech Republic		**Malta**	
Population	10,554 milion	Population	525.825
Area	78,866 km^2	Area	316 km^2
N. Energy Communities (EC)	38	N. Energy Communities (EC)	2
N. Cooperatives (ECoop)	N/A	N. Cooperatives (ECoop)	N/A
EC density	0,36/1^5 inhabitants	EC density	0,38/10^5 inhabitants
ECoop density	N/A	ECoop density	N/A
Renewable capacities estimates (MW)	31	Renewable capacities estimates (MW)	1
Cyprus		**Netherlands**	
Population	1,141 milion	Population	17,550 milion
Area	9,250 km^2	Area	41,543 km^2
N. Energy Communities (EC)	2	N. Energy Communities (EC)	999
N. Cooperatives (ECoop)	N/A	N. Cooperatives (ECoop)	60
EC density	0,17/10^5 inhabitants	EC density	6,0/10^5 inhabitants
ECoop density	N/A	ECoop density	0,34/10^5 inhabitants
Renewable capacities estimates (MW)	N/A	Renewable capacities estimates (MW)	613-1.027
Denmark		**Norway**	
Population	5,840 milion	Population	5,425 milion
Area	43,094 km^2	Area	385,207 Km^2
N. Energy Communities (EC)	665	N. Energy Communities (EC)	36
N. Cooperatives (ECoop)	47	N. Cooperatives (ECoop)	N/A
EC density	11/10^5 inhabitants	EC density	0,66/10^5 inhabitants
ECoop density	0,80/10^5 inhabitants	ECoop density	N/A
Renewable capacities estimates (MW)	2.613	Renewable capacities estimates (MW)	2-14
Estonia		**Poland**	

Population	1,324 milion	Population	38,470 milion
Area	45,228 km^2	Area	312,696 km^2
N. Energy Communities (EC)	132	N. Energy Communities (EC)	121
N. Cooperatives (ECoop)	N/A	N. Cooperatives (ECoop)	48 (COMETS)
EC density	9,9/10^5 inhabitants	EC density	0,314/10^5 inhabitants
ECoop density	N/A	ECoop density	0,124/10^5 inhabitants
Renewable capacities estimates (MW)	13	Renewable capacities estimates (MW)	142-155
Finland		**Portugal**	
Population	5,536 milion	Population	10,344 milion
Area	338,424,38 km^2	Area	92,391 km^2
N. Energy Communities (EC)	94	N. Energy Communities (EC)	37
N. Cooperatives (ECoop)	2	N. Cooperatives (ECoop)	7 (RESCOOP)* 9 (COMETS)
EC density	1,7/10^5 inhabitants	EC density	0,35/10^5 inhabitants
ECoop density	0,036/10^5 inhabitants	ECoop density	0,067/10^5/inhabitants;0,087/10^{-5}/inhabitants
Renewable capacities estimates (MW)	87-172	Renewable capacities estimates (MW)	4,4
France		**Romania**	
Population	68,303 milion	Population	19,638 milion
Area	675,417 km^2	Area	238,391 km^2
N. Energy Communities (EC)	379	N. Energy Communities (EC)	5
N. Cooperatives (ECoop)	10	N. Cooperatives (ECoop)	2
EC density	0,55/10^5 inhabitants	EC density	0,025/10^5 inhabitants
ECoop density	0,015/10^5 inhabitants	ECoop density	0,01/10^5 inhabitants
Renewable capacities estimates (MW)	139-391	Renewable capacities estimates (MW)	5
Germany		**Slovakia**	
Population	83,996 milion	Population	5,449 milion
Area	357,582 km^2	Area	49,037,20 km^2
N. Energy Communities (EC)	5015	N. Energy Communities (EC)	25
N. Cooperatives (ECoop)	85 (RESCOOP)* 1424 (COMETS)	N. Cooperatives (ECoop)	N/A
EC density	6,0/10^5 inhabitants	EC density	0,45/10^5 inhabitants
ECoop density	0,1/10^5/inhabitants; 1,7/10^5/inhabitants	ECoop density	N/A
Renewable capacities estimates (MW)	2.157-3.279	Renewable capacities estimates (MW)	15
Great Britain		**Slovenia**	
Population	68,168 milion	Population	2, 111milion
Area	242,521 km^2	Area	20,273 km^2

N. Energy Communities (EC)	387	N. Energy Communities (EC)	11
N. Cooperatives (ECoop)	N/A	N. Cooperatives (ECoop)	1
EC density	0,57/10^5 inhabitants	EC density	0,52/10^5 inhabitants
ECoop density	N/A	ECoop density	0,047/10^5 inhabitants
Renewable capacities estimates (MW)	235	Renewable capacities estimates (MW)	0,3
Greece		**Spain**	
Population	10,320 milion	Population	46,770 milion
Area	131,940 km^2	Area	504,645 km^2
N. Energy Communities (EC)	192	N. Energy Communities (EC)	358
N. Cooperatives (ECoop)	13	N. Cooperatives (ECoop)	30 (RESCOOP)* 67 (COMETS)
EC density	1,9/10^5 inhabitants	EC density	0,76/10^5 inhabitants
ECoop density	0,12/10^5 inhabitants	ECoop density	0,064/10^5 inhabitants; 0,14/10^{-5} inhabitants
Renewable capacities estimates (MW)	86	Renewable capacities estimates (MW)	101-207
Hungary		**Sweden**	
Population	9,655 milion	Population	10,468 milion
Area	93,030 km^2	Area	450,295 km^2
N. Energy Communities (EC)	8	N. Energy Communities (EC)	336
N. Cooperatives (ECoop)	1	N. Cooperatives (ECoop)	83
EC density	0,082/10^5 inhabitants	EC density	3,5/10^5 inhabitants
ECoop density	0,010/10^5 inhabitants	ECoop density	0,78/10^5 inhabitants
Renewable capacities estimates (MW)	0.03	Renewable capacities estimates (MW)	170-265
Ireland		**Switzerland**	
Population	4,761 milion	Population	8,530 milion
Area	70,273 km^2	Area	41,285 km^2
N. Energy Communities (EC)	547	N. Energy Communities (EC)	297
N. Cooperatives (ECoop)	7 (RESCOOP)* 14 (COMETS)	N. Cooperatives (ECoop)	5 (RESCOOP)* 297 (COMETS)
EC density	11/10^5 inhabitants	EC density	3,5/10^5 inhabitants
ECoop density	0,15/10^5 inhabitants; 0,3/10^5 inhabitants	ECoop density	0,059/10^5 inhabitants;3,5/10^5 inhabitants
Renewable capacities estimates (MW)	9-14	Renewable capacities estimates (MW)	50-94

* Comparing statistical numbers of energy cooperatives from the EU REScoop database with the COMETS database

Chapter 6

A Possible Future: Frontier Case Studies

(This chapter is adapted from the COMETS project Deliverable 5.1 (Frontier Case Studies) where I served as work package leader, lead author and facilitator of interviews)

Background

Through a selection of innovative “frontier” case studies from Europe and the United States, and around the world, this investigation was established from surveying a group of experts in the energy CAIs research field (academic and non-profit networks within the COMETS H2020 project). I was the work package leader and lead author and conductor of interviews of the Deliverable 5.1 (*Frontier Case Studies*) and performed the series of interviews between March – June 2021. My aim was to gain a deeper knowledge about the experiences of communities that made energy accessible, affordable and contributed to the energy transition. This investigation provides a variety of insights into how energy CAIs are contributing to the energy transition in different areas of the world and their potential for scaling up. The more collective action there is for building movements, the more influence there can be on energy policies that can further support these initiatives.

This investigation focuses on exploring innovative “frontier” case studies that represent a particularly innovative contribution to the future of social innovation in the energy transition. Considering social innovation, I started with Hubert and colleagues’ definition of social innovation, representing “new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations” (Hubert et al., 2010). In other words, they are innovations that are not only good for society but also enhance society’s capacity to act. (Hubert et al., 2010) Even if not yet widely applied (i.e. niche level), the “frontier” cases represent a particularly innovative contribution to the future of social innovation in the energy transition.

Investigating innovative energy CAIs also means that we consider cases with the highest forward-looking content that are explored in-depth. All partners who assisted me in this effort (University of Turin, TECNALIA, Bocconi University, DTU, VITO, ECOLISE, TREA, and HVL) worked collaboratively to feed a list of around 40 potentially "innovative" cases. Subsequently through a voting exercise using the Delphi method, we narrowed down the list to provide a robust selection of around 20 backgrounds and experiences to investigate further and share their experiences and lessons learned. Based on the most recent debate on the potential innovations for energy CAIs, attention is focused on the 20 cases around the world to be investigated mainly through desktop methodologies and interviews with representatives. The interviews I conducted provide deeper qualitative knowledge on the nuances faced by energy CAIs in Europe and the US.

The "frontier" cases in this research offer insights into methods and efforts that may have worked successfully or proved futile in the process of community empowerment. In the end, the 20 cases reveal common challenges that many energy CAIs face in the energy field. In addition to the recent case studies developed in COMETS, both comparative and participatory cases, these "frontier" cases are an added value to the knowledge building that contributes to the knowledge commons for a more just and inclusive energy system.

Most of the information presented here can also be found in Deliverable 5.1
Frontier case studies (Exploring world-wide collective action initiatives at the frontier of social innovation in the energy field),[15] on which I served as lead author.

6.1 Methodology

The most interesting cases from Europe, the US, and around the world, were selected based on the following seven dimensions:

1. **Context of development** (motivations to organize, social movements engaged in, etc.);
2. **Organizational aspects** (decision making and governance, procedures, roles and functions);

[15] COMETS D5.1 Frontier Case Studies: http://www.comets-project.eu/images/deliverables/COMETS_D51_Frontier_CAIs_Report.pdf

3. **Social** (members profile, diversity/social inclusion, gender balance, social networks and community);
4. **Spatial** (rural-urban relationship, geographical coverage);
5. **Evolution** (scaling capacity, trajectories and strategies, diversification of services);
6. **Economic** (innovative business model, funding strategies, blockchain, etc.);
7. **Material** (technologies and energy sources).

6.1.1 Delphi method for Frontier case selection

The Delphi method is beneficial when the problem at hand can benefit from collective and subjective judgments or decisions, and when group dynamics do not allow for effective communication (e.g., time differences or distance) (Beiderbeck et al., 2021).

Phase I: Delphi Item Generation

- Survey: 24 panelists (from academic and research fields) were encouraged to share examples of energy CAIs of interest when referring to the selected seven dimensions of "innovation"
- During Phase I, Panelists used surveys and literature review to generate all potential candidate CAIs associated with dimensions of innovation.
- The 24 panelists were asked in an e-mailed survey I sent out on February 11, 2021 to list all CAIs that, in their experience, presented some degree of innovation and could represent examples of frontier case studies. The purpose of this preliminary exercise was to help identify potential candidates with ''positive weight''.
- The target number was 40 cases to be listed in a database. In the end, 40 examples were inputted for potential interest to be narrowed down in the next phase.

Phase II: Item Reduction

In the second phase, we aimed to have an item reduction guided by the following principles:

- the examples remaining after phase II should demonstrate good face, construct, and discriminant validity as examples of "innovation";

- items should cover the variety of dimensions attributed to “innovation”.

6.1.2 Voting: a collaborative action among partners

To achieve the item reduction, a second survey (survey II.A) was circulated aiming to assess each example generated in Phase I based on the Likert scale (-5 to +5), ranging from (-5) *extremely not innovative* to (+5) *extremely innovative.*

The concept of “innovative” is subjective by definition, thus each panelist was asked only to vote and range each energy CAI from (-5 to +5) and eventually add additional comments, if necessary.

Mean survey scores for each item (±SD) were calculated and energy CAIs were ranked from highest to lowest mean score. **The Top 20 Frontier CAIs** were selected for further investigation. The first four ranking Frontier CAIs were considered for an in-depth investigation through interviews.

- At least 1 person from each of the 8 Partner organizations (University of Turin, TECNALIA, Bocconi University, DTU, VITO, ECOLISE, TREA, and HVL) were expected to participate. In the end, we had 14 participants vote on the CAIs.
- Each of the partners reviewed every Frontier CAI on the list by reading each brief description and reviewing which of the 7 dimensions corresponded to each CAI (usually more than one).
- For example, for **Co-op Power in New York, US** (see *section 6.4.1*), partners read its brief description on the list and then saw it was aligned with 4 out of the 7 dimensions (organizational, social, special, and economic). In the end, this energy CAI scored the highest with a mean score of 3.9, showing high innovative potential.
- The estimated total time for the entire voting on the list was around 2 hours per partner.

6.2 Data analysis

Quantitative data were analyzed using SPSSv26 (IBM, NY, USA). I examined the data distribution of each score by calculating mean and standard deviation of overall scores for each dimension.

- CAIs scoring ≥2 overall were included in the list to be analyzed. (see **Table 6.2** for details on the list of information to be collected for each Frontier CAI);
- CAIs scoring ≥3 overall were included in the list to be interviewed (see **Table 6.2** for details on the selected questions presented).

6.3 Frontier CAIs identification

Phase I generated 40 candidate criteria, analyzed for 7 items of innovation dimensions. Using iterative item reduction techniques described in Phase II, the list was reduced to 20 potential candidate energy CAIs (Table 6.1). Subsequent item reduction methods resulted in 4 candidate CAIs for interviews and organized into seven domains of innovation (not based on any particular order):

1. Context of Development; 2. Organizational Aspects; 3. Social; 4. Spatial/Geographical; 5. Evolution; 6. Economic/Business Models; 7. Material/Technology.

Table 6.1: Final list of CAIs to be analyzed/interviewed

CAI name	Location	Delphi results	Delphi Score (mean±SD)	Dimension(s) of innovation *
Co-op Power	MA, USA	Interviewed	3.9±0.8	2,3,4,6
Bristol Energy Community Fund	Bristol, UK	Interviewed	3.3±1,8	2,3
People Power Solar Coop	Oakland, CA	Interviewed	3.0±1.0	2,3,4,6

Nørrekær Enges Vindmølleforening	Denmark	Interviewed	3.0±1.0	3,6
The Coastal Electrification and Women's Development Cooperative (CEWDC)	Bangladesh	Contacted for Interview, not reachable	3.8±1.4	1,2,3,4,6
AiPOWER/	Japan	Contacted for Interview, not reachable	3.7±1.1	1
Fairpla	Münster, Germany	Data collected	3.0±1.3	3,6
Windfang eG	Hamburg, Germany	Data collected	2.9±1.3	2,3
ACOPREV	France	Data collected	2.8±1.1	2,4,7
CoWatt	France	Data collected	2.7±1.0	1,2,3,6
ERE43	France	Data collected	2.6±0.7	2,6,7
Community Power	Co Tipperary, Ireland	Data collected	2.6±1.8	1,2,3,4,5,6
Middelgrunden wind farm	Denmark	Data collected	2.4±1.3	4,7
Cowichan biodiesel Co-op	Duncan, Canada	Data collected	2.3±0.6	1,7
EWS Schönau	Schönau, Germany	Data collected	2.2±0.7	1,3,4,5,6

Hepburn wind	Victoria, Australia	Data collected	2.2±1.5	5
Compile	Križevci, Croatia	Data collected	2.2±1.8	4,6
The Energy Self-Reliant Village Program	Seoul, South Korea	Data collected	2.1±1.9	1,3,4,6
Hackney Energy	Banister House estate, UK	Data collected	2.0±1.5	2,3,6
Conelectricas - Consorcio Nacional de Empresas de Electrificación de Costa Rica R.	Costa Rica	Data not available	3.0±1.6	1,2,3,4

** 1. Context of Development; 2. Organizational Aspects; 3. Social; 4. Spatial/Geographical; 5. Evolution; 6. Economic/Business Models; 7. Material/Technology.*

6.4 In-Depth Investigations: Interviews with Frontier Cases

The following four Frontier cases provide more in-depth real-world knowledge about the development of energy CAIs through interviews conducted with leaders from energy CAIS in Europe and the US. Through these interviews, this dissertation is able to contribute more understanding to the 'knowledge commons' of shared experiences that energy CAIs face, as well as unique challenges that might shed light on future intervention tools and policies to overcome potential obstacles. Table 6.2 provides the list of interview questions for the following in-depth investigation.

6.4.1 CO-OP POWER

Location: Incorporated in Massachusetts with projects in several northeastern states, US

Year of establishment: Incorporated in 2004, but started discussions in 1996

Number of members: 820 families and organizations in Massachusetts, Vermont, Connecticut, New Hampshire, and New York (soon to be 1250 for new NYC members)

Area of activity: Only community solar (had some wind projects in the past)

MWh/year produced: About 4.5 MW of solar under Co-op Power subscriptions. Helped put in 1000+ solar installations on rooftops, solar installation businesses, solar financial business, and a biodiesel plant (to be launched soon).

Which of the 7 dimensions are they aligned with?

Dimension	Alignment
Organizational Aspects	A federation (or network) of local energy cooperatives that uses one cooperative structure. This regional network is a *commons* - a shared resource where communities come together to make a difference.
Social	Prioritizes creating ownership of affordable solar energy for people in low income communities. Additionally, they provide job training/workforce development, community education, and community strategic planning. They make decisions by consent instead of by voting or using veto power, so that anyone who opposes a proposal has an opportunity to work with the group to address their concerns.
Spatial/Geographical	Based in Massachusetts with projects in several states in the northeast, US. Located in both rural and urban spaces.
Economic/Business Models	Created the **People's Solar Energy Fund** in order to provide access and predevelopment money and tax credits to move the projects into the pipeline.

Interview with Lynn Benander, President & CEO, Co-op Power
(conducted on June 18, 2021 via WebEx virtual conference platform)

Description

Co-op Power is a federation of local energy cooperatives that uses one cooperative structure. They are incorporated as a consumer-owned energy cooperative in Massachusetts and democratically controlled by its consumer members. Co-op Power members work locally through their energy cooperatives to bring energy efficiency and renewable energy resources to their communities (NYC-CEC, 2021).

All of the cooperatives in the Co-op Power federation are under the same network umbrella. In order to start an energy cooperative with Co-op Power, a prospective initiative would just need permission from the Board. One does not need to incorporate independently since any new initiative would be part of one shared structure.

Co-op Power is established as a Consumer Cooperative, and is structured around democratic participation in decision-making, joint purchasing, member-to-member installations, community-scale sustainable energy development, member education, and public outreach and policy advocacy (NYC-CEC, 2021).

Organizational Structure

In 2009, Co-op Power Members adopted a regional structure, organizing the cooperative as a decentralized network of Community Energy Co-ops (CECs). These CECs in Massachusetts, Vermont, Connecticut, New Hampshire, and New York are self-organizing and set their own agenda based on local energy priorities. They raise capital from their members and invest it in their own local energy projects. The CECs organize their own purchasing groups, contracting with local vendors to bring them the energy resources they need (NYC-CEC, 2021).

Co-op Power as a form of commons

According to Lynn, "this regional network is a *commons* - a shared resource where communities come together to make a difference." Co-op Power, as a decentralized network of local organizations and has CECs each playing the lead role in their regions. As a federation/network, Co-op Power's primary responsibility is to organize and educate people in their region and to facilitate the development of one or more community-owned, community-scale, clean energy businesses. (see more about commons theory in *section 2.7.2.*)

Governance

Each CEC has one member serve on the Co-op Power board. Additionally, Co-op Power delegates decisions regarding the activities within a region to the Community Energy Co-op board overseeing that region. Co-op Power also makes decisions by consent instead of by voting or using veto power, so that anyone who opposes a proposal has an opportunity to work with the group to address their concerns.

How did Co-op Power formalize?

Like many CAIs in the energy sector, there were several paths that brought Co-op Power together. In the 1990s, Lynn Benander, President & CEO of Co-op Power (who was interviewed for this research), was working at the Cooperative Development Institute, another federation of cooperatives in the Northeast and also a non-profit that helps with the development of new cooperatives. Lynn noted that around 1995, at the request of the public service commission in Vermont, which was looking at the impacts of deregulation of the energy industry, convened a group of people that looked into how to protect the needs of consumers in a deregulating energy industry. This included investigating the role cooperatives could play in the energy market.

This is a great example of how several key stakeholders from various backgrounds can collectively engage to effectively address sustainability and justice issues. Lynn's team secured grant money and brought in consultants with broad input from the national rural electric cooperative movement, as well as municipal utilities, nonprofits, the National Renewable Energy Laboratory, and a group of stakeholders that represented over 2 million people across New England and New York. They were tasked with exploring how energy cooperatives can move northeastern states towards a more sustainable and just energy system. Lynn noted that many talented consultants helped in finding solutions to the question of where communities can have the biggest impact, studying all kinds of technologies, including fuel cells, PV, biofuels, and energy efficiency.

In her earlier work in the 1990s, Lynn and colleagues were also looking into where citizen action can "create the most jobs while diminishing the reliance on fossil fuels". In other words, this group was aiming to create a "needed framework for people to transition off fossil fuels and reduce energy use while, at the same time, for communities learn to engage more and be committed to each other no matter what race and class". Lynn and colleagues were looking at stakeholders in a variety of lenses:

> "as citizens and residents in a political process; as volunteers and workers using life energy to make change; as investors putting money and time in; as consumers who can shape the way markets work and de-commodify the energy field that the communities are in […] viewing ourselves as whole people in whole communities addressing sustainability and justice issues."

The shift to prioritize access to solar for all

Several years later, in the early 2000s, the Co-op Power network was being formally established. In these earlier days, some members suggested for Co-op Power to focus mainly on rooftop solar. Lynn remembers the moment that shifted the course for Co-op Power. There was a meeting with stakeholders where there was a general feeling of unrest in the room and someone said,

> "I thought Co-Op Power would only do things that would benefit *everyone* and not just wealthy communities".

The stakeholders, mostly early founders of Co-op Power, at the meeting began shifting the discussion to address concerns of citizens who are renters (not landlords or homeowners) and can't participate in rooftop solar due to high upfront costs, which is why this technology was mostly installed in wealthier communities. From that moment on, Lynn remarked that this created a pivotal shift, or critical juncture, for Co-op Power overall, where people started to listen more to each other. Thus, they decided to not focus on rooftop solar until they could find a way for it to be accessible for everybody.

Inspired by ongoing conversations in the early 2000s, Co-op Power prioritized creating ownership of affordable solar energy for people in low income communities. They started investing more in community solar and worked with the State government of Massachusetts to provide a solar loan program that would monetize the tax credit, giving 30% off on the loan that was used to pay for the system. Lynn noted that this had a big impact on community solar in Massachusetts, especially for low income families.

Additionally, Co-op Power helped people with energy efficiency retrofits through insulation and other efficiency upgrades to their homes and apartments, whether they were homeowners or renters. Lynn noted that this helps to ensure all members have access to the products and services Co-op Power is investing in.

In recent years, the CECs in the Co-op Power regional network have supported the development of 12 enterprises in solar installation, solar finance, energy efficiency, thermal window fabrication, green plumbers and biodiesel manufacturing. They have created more than 400 reliable "green" jobs. The CEC's share business plans, staff, money, ideas and other resources with each other and are as committed to the success of the other CEC's in the Co-op Power Network as they are to their own success (NYC-CEC, 2021).

Below is an example of one of their urban projects, the New York City Community Energy Co-op. This is just one example of the many projects in the Co-op Power network.

New York City Community Energy Co-Op (NYC CEC)

Case study of a Community Energy Cooperative (CEC) in the Co-op Power network

Background

The New York City Community Energy Co-op (NYC CEC) is a multi-class, multi-race, urban cooperative working for energy justice and a just transition in Manhattan and the boroughs. The NYC CEC is part of the Co-op Power regional network of community energy co-ops (CECs). They also partner with other local organizations such as Solar One, UHAB, CUNY, UPROSE, WE ACT, Brooklyn Movement Center and Resonant Energy to develop affordable solar solutions in New York City (NYC-CEC, 2021).

In fact, the NYC CEC was created by a group from SolarOne, a non-profit. Noah Ginsberg, co-program director of SolarOne, met with one of the colleagues at Co-op Power, as well as with groups looking for community ownership in Brooklyn. Isaac Baker, the Community Solar Program Director at Co-op Power during that time, worked together with Ginsberg on early stage exploration with the local communities that wanted local ownership. They saw the value and joined Co-op Power, formed a board of directors, and oversaw 2MW of solar projects there.

Organizational structure

As an energy cooperative, they abide by the 7 international principals of cooperatives (see section *3.7.4 Organizational structure of rural electric cooperatives,* for list of principles). Their team consists of the Board Chair, Coordinator, Intern, and the CEC's Board of Directors. They work together with community solar project teams that oversee the development of their solar arrays. The NYC CEC also works with environmental justice organizations to empower community members, especially people of color and low-income communities, to build ownership and increase access to sustainable energy. The community solar arrays they are building provide a path to community ownership so that members not only have solar discounts on electric bills but have the jobs and the economic and political power that comes from owning the arrays (NYC-CEC, 2021).


Photo Credit: NYC Community Energy Co-op

The NYC CEC is owned by the people, the families, and the organizations that subscribe to the solar arrays and by others who join to access other benefits they are building together. They are working together to create solar arrays, green jobs, and enterprises that "will create a more just and equitable energy future in NYC - where everyone has access to affordable, clean, safe energy and has an equal voice in how our energy economy works" (NYC-CEC, 2021).

Members of the NYC CEC make decisions about what projects to get involved in, where to invest membership dollars, what community solar arrays to build, what benefits to develop for Members and what benefits to bring to their community.

They start by looking at what is needed in their community and choose the things they can do that will meet the community's needs, the organization's needs, and grow the cooperative. Benefits are created by members pooling their buying power, their investment dollars, their power as workers and volunteers, and their power as voters.

Business model

The NYC CEC operates on a not-for-profit basis, where any excess money collected is given back to Members based on how much they've invested into the Co-op. Owner-Members participate in the consent decisions of the NYC CEC. Together, they elect a board that makes decisions that they delegate to them between Member meetings (NYC-CEC, 2021).

In the US, solar arrays can only deliver credits to people in the same load zone and same utility. The energy cooperative can serve any region and develop projects in all the load zones in that region or just one load zone. All of it is delivered through the existing grid (no new grid construction needed). With the installation of solar arrays, the NYC CEC delivers solar credits to the grid and then gives ConEdison, the major utility of New York, a list of the CEC's members, who are also ConEdison customers, to deliver those credits. Then Co-op Power sends a bill to the member-owners asking to be paid 80-85% of the credits applied to their bill, depending on which program they are in, based on the price points on the projects.

According to Lynn, the large utilities are typically part of the legislative action that requires them to abide by this structure, even if not all utilities are supportive and compliant. Nevertheless, they don't have a choice as it is mandated by regulations.

Access to predevelopment funding

In the US, in order to build a solar project, one needs to pay for the design, interconnection agreement with utilities, permits, and other processes that need to be put together before building a solar array. Thus, no return on investment comes in until after the building process has begun and a loan can be secured. Lynn noted that most communities have to get a developer who is willing to provide the upfront money and then the project belongs to them, since they are the ones who accept the risk with the initial investment. Having the "risk money" to put into a project is very important in the predevelopment phase.

Additionally, people in the US build solar projects through access to tax credits, with a quarter of the project paid for by tax credits. If the tax credit incentive does not exist, then it is much harder for projects to develop or be viable.

To overcome these financial challenges, Co-op Power created the **People's Solar Energy Fund** in order to "get access and predevelopment money and tax credits to move the projects into the pipeline within a reasonable amount a time." The People Power Solar Cooperative in Oakland, California (see *section 6.4.2*) is also an active participant of the People's Solar Energy Fund.

Other activities of Co-op Power

- Job training/workforce development,
- Community education,
- Community strategic planning (looking at what is most urgent for creating a just and sustainable energy system).

What makes Co-op Power unique?

Lynn noted that Co-op Power does not want to be considered unique because

> "they aim to create symbiotic relationships with other sister and brother communities that lift each other up as part of a sharing economy."

Aligned with that aim, they share all their legal documents, notes, promotional materials to any like-minded community to help them seed and grow. Additionally, as part of a symbiotic relationship with other initiatives, Lynn said Co-op Power is also gaining significant knowledge from other sister groups.

Lynn emphasized her appreciation for the cooperative structure platform, which communities can access and start having an impact right away:

> "Even if it doesn't work 100% right away, communities are still finding their way in the middle of trying to lift the new economy in the old one and trying to help people learn the skills and approaches of cooperation in the midst of a competitive reality […] For some communities, this is an easier lift than for others. Just trying has been the exciting part."

Co-op Power and energy scenario in the near future

According to Lynn, Co-op Power's short-term goal is to have greater financial resources to make a difference and relieve stress for those involved in projects assembling the parts for scaling up community solar.

Additionally, Co-op Power would like to be able to aggregate, not just within network itself, but with all sister and brother energy cooperatives and municipal utilities across the country. In this way, Lynn said,

> "there would be more collaboration for providing consumers with options beyond the private Investor-Owned Utilities that allow them to build a local energy economy that is connected with other local energy economies in their state, region, country, or around the world. This includes being part of a bigger movement that brings back more sovereign control and benefit over energy."

Lynn expressed her pride in the notion that low-income communities not only have the ability to control the resources they rely on, like electricity, but also have the sovereign right to.

6.4.2 People Power Solar Cooperative

Location: Oakland, California, USA
Year of establishment: 2018
Number of members: over 100
Area of activity: community solar
MWh/year produced: *N/A*

Which of the 7 dimensions are they aligned with?

Dimension	Alignment
Organizational Aspects	Multi-stakeholder cooperative with hundreds of community members

Social	Actively helps their members to build a variety of skills, leadership, and people power necessary to overcome the barriers to energy constraints in their communities.
Spatial/Geographical	Urban area
Economic/Business Models	Community-owned and financed. Communities can access capital from diverse sources, including crowdsourced investments from community members.

Interview with Crystal Huang, Worker-Owner and Co-founder
(conducted on May 6, 2021 via WebEx virtual conference platform)

Background

People Power Solar Cooperative's ("People Power") efforts, like those of many other cooperative movements, are built upon the "shoulders of giants." In other words, People Power gives a great deal of credit to the movements and individuals who came before them and paved the path and developed the techniques that allowed them to reach their current position. Their objective is to build movements and be inclusive by "creating a just and inclusive transition to renewable energy and enabling everyone to own and shape our energy future" (PPSC, 2021).

People Power was incubated by a 501c3 non-profit in California called the Sustainable Economies Law Center ("The Law Center"), also based in Oakland. The Law Center has been trying to put energy into the hands of the people through community ownership in California since 2014. They work hard on trying to revise laws to allow communities to have solar ownership. According to Crystal Huang, Worker-Owner and Co-founder of People Power, "even in a so-called progressive state like California, passing policies to transition power away from corporate energy establishments and putting it into the hands of the people has proved to be particularly difficult."

The Law Center has been trying to figure out best ways to pass such laws that have been approved and successful in states like Massachusetts, New York, Minnesota and Colorado.

The lawyers at the Law Center decided climate change is an urgent issue and there is not much time to wait for laws to change; alternative paths are crucial, especially given all the regulatory barriers in California. By passing the **California Worker Cooperative Act** [16] in 2015, the Law Center saw an opportunity to create a model that pools resources among a community of people to build solar energy systems as "a wealth building machine for the community". This law allows individuals to join or purchase shares of a cooperative, which used to be capped at $300 per person, but now increased to $1000 per person. According to Crystal, the California Worker Cooperative Act of 2015 opened up opportunities for people to get together to pull resources in a meaningful way. For example, with only 100 people you can have $100,000 to invest in shared assets like clean energy projects.

A 'Movement' Cooperative

Photo credit: People Power Solar Cooperative

Crystal Huang recalls that the group asked themselves in 2018, "What if we let go of the idea that community-owned energy is about the community owning and consuming energy from a specific energy project? Since most people can't use their utility bills to subscribe to those solar

[16] California Worker Cooperative Act: https://www.theselc.org/ca-worker-cooperative-act

projects in California, People Power is not a cooperative with the primary purpose of letting people consume electricity."

Instead, its purpose is to let people participate actively in shaping the renewable energy economy. It is for that reason they call themselves a 'movement cooperative'. Many of the cooperative's member-owners won't use the cooperative to actively consume energy, but they and their investment will be a part of a movement to change the energy economy. Crystal noted that their model "allows anyone in the community to work with property owners to disconnect ownership of land from the ownership of power". This, in turn, would enable the community to get shared financial benefit on a privately-owned roof, in addition to collectively deciding and putting it into the commons as part of the cooperative. A pilot project was launched in 2019 to show how this could be feasible.

Since then, People Power has focused on "activating member-owners to see energy more than just the opportunity to decarbonize or have bill savings, but a tool to build community power" (PPSC, 2021).

As a multi-stakeholder cooperative with hundreds of community member-owners, Crystal emphasized that People Power is like:

> "a grid for the transmission and distribution of another type of power: it is a combined, connected and amplified potential of many people sharing resources, ideas, skills, connections, labor in infinitely creative ways to find ways together to change the conversation, solve the problem, and understand the history of the energy system."

In other words, People Power is not just functioning to build a traditional cooperative business model, which is certainly one part, but the bigger aim is to **build a movement.** People Power actively helps their members to build a variety of skills, leadership, and people power necessary to overcome the barriers to energy constraints in the communities. When people are tired of protesting and complaining about the current energy regime, Crystal said, "Join us! Let's build people power together."

How their cooperative structure works

As a multi-stakeholder cooperative, they have 4 different classes of member-owners:

- **Worker Owners:** the cooperative's staff, who provide the technical, operational, and organizing support to all other owners. They create the tools needed to support the member-owners and be the conduit. The asset is the more projects they build with member-owners in their communities, the more knowledge gained on how to do it.
- **Subscriber Owners (consumer-owned):** The members who get electrical power and other benefits or services from the cooperative.
- **General Owners:** members who purchase shares of the cooperative and provide support for projects. This was helped by the state law, California Consumer Cooperative Corporation Law, where people can come in and purchase shares and have capital up to $1000 and get a financial benefit.
- **Anchor Owners:** community members who provide leadership and spearhead the development of new projects. Everything is led by them. "They come together to talk about projects, educate others on energy history systems, talk about healing trauma to shift from the consumer mindset and come together as a village to talk about what 'energy' means", said Crystal. There are different things Anchor Owners can do to drive the direction of the cooperative.

A 'Commons' State of Mind

The People Power Solar Cooperative describes their work by reminding people that out of 3 'mindsets' that citizens are operating in but might not realize, People Power operates in the 3rd "commons state of mind". This is aligned with Ostrom's Common Pool Resource Theory (section 2.7.2):

- **Market state of mind**: where people buy and sell things like energy. In this framework, if one cannot afford energy, then it gets shut off.
- **Charity state of mind:** where people can get free or cheaper energy. Crystal noted that, "this is creating a system of reliance on the strangers who became wealthy from the market state of mind. Charity state of mind still creates a trap

in a system of treating energy as a commodity and not recognizing that energy is a human right -- people should never have their energy shut off (because they cannot afford it).” Instead, Crystal asked, “how do we enable everyone to have self-determination?”

- **Commons state of mind**: This is not about have vs. have nots. Crystal noted that “this is about everyone coming with a diverse pool of knowledge and working together to build the future that they want to see collectively.” In other words, the commons state of mind is about “getting together,” instead of just “getting by” or “getting ahead”, said Crystal.

The Commons state of mind is the center of everything People Power operates in because they “activate members of the community to get together and determine the wealth generated form the energy projects they build in the commons”(PPSC, 2021). However, this is just one model for community solar ownership that People Power member-owners are implementing to build a cooperative energy movement. As Hubert and colleagues defined social innovation as “new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations” (Hubert et al., 2010), thus People Power is a form of social innovation. It does this despite the fact that California does not have a viable shared solar policy (PPSC, 2021). (See more about commons theory in *section 2.7.2.*)

Qualities for success

According to Crystal Huang, People Power’s activities engage beyond the traditional energy grid of transmission and distribution by empowering member-owners and anyone in the community to be part of the movement and join together, connect and amplify what they know. This includes sharing resources, ideas, skills, and labor in a way that is cooperative. “The strength of people coming together is a key quality to the success”, said Crystal.

Challenges

- **Knowledge barriers about benefits of cooperatives:** As with many energy cooperatives, it is difficult to persuade people about the benefits of joining a cooperative, especially where the energy system is on a community member's roof, as in the case of People Power. Member-owners do not see it on their electricity bill.

- **Evolving from the market state of mind:** As noted by Crystal Huang, "the new energy paradigm is about shifting our understanding of what energy means because many people have been trained to only see electricity as a bill to pay or something that contributes to pollution in our communities. When things go wrong on the grid by utility mismanagement, such as the fires in California or the grid failure in Texas in early 2021, consumers are left powerless and accountable to pay for the infrastructure failures. When we are not paying attention, we are giving so much of our power away and not paying attention to the very thing that determines our survival."

  Crystal highlighted a study that was done in the United States that looked at how often Americans think about energy. An *Accenture* statistic showed that consumers spend around 10 minutes annually thinking about their electricity bill (Accenture, 2017). Thus, "when discussing a new energy paradigm when people only take 10 minutes on average per year to think about energy, it becomes extremely limited to build power when we don't take time to understand the very thing that we rely on," noted Crystal.

- **The narrative around power needs to shift:** The NAACP (National Association for the Advancement of Colored People) in the United States has an environmental and climate justice program that has already repeatedly pointed out that all the climate and health-related indicators tell us that a transition away from fossil fuels is happening way too slowly. They identified the primary cause as the Investor-Owned Utilities (IOUs) domination of the energy sector. According to the NAACP, the only way we can actually address the climate emergency is if we start to address the power dynamic in which energy is rested upon. Crystal highlights that "if we don't act now, we risk further consolidation of power by the for-profit fossil fuel companies, utilities, financiers, and developers that have been extracting wealth and health from our communities for decades."

Aiming for Energy Democracy

All the issues that People Power is focused on is aligned with the principles of Energy Democracy. (see Chapter 2, section *2.4 Energy Democracy* for more details.) When we talk about Energy Democracy, "it is important to recognize that it is a culmination of many movements in the past. For example, in the United States, Energy Democracy is the culmination of the Civil Rights Movement, the Indigenous Rights Movement, Women's Rights Movement, Labor Rights Movement, Environmental Movement-- all combined together is what Energy Democracy is about," declared Crystal. It's about people having power and having the ability to determine their own destiny.

In the discussion about power,

> "we are actually talking about recognizing what the system is doing to all citizens and how people can work together and start to build something that truly serves everybody and for future generations. Therefore, many of the conversations People Power has with its members and other stakeholders ends up centering around the discussion of power, and about trauma that the system has created in so many of the communities […] a system that created a situation where we are constantly pitted against each other, not just by racial identity, but not being able to trust each other to share."

It is critical to find resources that do not require dollar-to-dollar return in order for people to recognize the trauma in the communities and not be against each other in the commons state of mind, Crystal emphasized. Initiatives like People Power addresses that through building its local energy projects.

What makes People Power Solar Cooperative unique?

The People Power Solar Cooperative is "a laboratory for people who are trying to figure out how to address the liberation of all people around climate justice to build power in energy project development." Crystal said the diversity of strategy around Energy Democracy is important because it is not just about the energy sector, it is about liberation of the people in the sector that determines our economic system. See more about Energy Democracy in section 2.4.

People Power is working closely with many similar efforts in the Energy Democracy movement with practitioners like the Co-op Power network, Cooperative Energy Futures, NAACP, Emerald Cities Collaborative through initiatives like the **Energy Democracy Project**,[17] just to name a few.

Energy policies and regulations need to change

It is easy to look at energy cooperatives and think that they are all the same. There is obviously the historic Rural Electric Cooperatives in the U.S. established as part of the New Deal in the 1930's, but there are new types of clean energy cooperatives, like Co-op Power and Cooperative Energy Futures that can rely on community solar laws in their states.

Crystal noted that it is still a struggle in California. Thus, much of the activities at People Power is around education and activation of the member-owners so they can start to shift the narrative in the state, and in many others states that have such policies limiting communities to come together and benefit from collaborative, citizen-led energy.

Knowledge commons

When people come together to have conversations around Energy Democracy, Crystal said it is important to build a suite of resources that people can tap into and build a

[17] The Energy Democracy Project: https://energydemocracy.us

‘knowledge commons’ that people can share together and build faster. People Power’s model has been to work with the member-owners in their projects and their own local communities, talking about the political dynamic, power, and community ownership of energy as the solution. Community members can then rely on People Power for technical assistance and together they can start to build a wealth of knowledge to be shared with many other communities down the line.

Youth Resilience Hub

One of the biggest projects People Power is working on is supporting the implementation of a youth-led resilience hub in Richmond, California, a town near Oakland in the Bay Area that has one of the largest Chevron oil refineries, among many other refineries, in the state. *The Asian Pacific Environmental Network* and the *Communities for a Better Environment* have organized the communities there, especially young people, to gain deeper understanding of what it means to have a Just Transition from the current fossil fuel economy into a regenerative economy. Thus, Crystal noted, the community learns how to go from an extraction-based economy to a way that actually spreads wealth to the community. This goes beyond just the fuel source, but also looking at governance and the economy. People Power supports the youth-led resilience hub as a technical assistant to provide them with the knowledge needed to make critical decisions in project development to maximize community benefit, which has become increasingly important in the state of California.

6.4.3 Bristol Energy Network (BEN)

Location: Bristol, United Kingdom
Year of establishment: 2010
Number of members: a variety of projects operate with many citizens in the Bristol municipality. No specific number provided.
Area of activity: Solar, Wind, fuel poverty
MWh/year produced: N/A

Which of the 7 dimensions are they aligned with?

Dimension	Alignment
Organizational Aspects	Two types of members: 1) **Voting members** consist of community initiatives in Bristol and the surrounding area with an active interest in energy; 2) **Non-voting members** consist of individuals and organizations interested in the activities of the network.
Social	BEN is focused on getting everybody in the community involved, from engineers and roofers to students and healthcare practitioners. BEN is also focused on health and wellbeing of its members. They approach health and wellbeing through the lens of community energy, and thereby involving health practitioners in the energy sector, thus increasing recognition to the nexus of community energy and public health.

Interview with David Tudgey, Project Development Manager and founding member (conducted on June 22, 2021 via WebEx virtual conference platform)

Background

Bristol Energy Network (BEN) is an umbrella organization for individuals and community groups with an interest in renewable energy in Bristol and the surrounding area. BEN's vision is for a city "where clean, green, affordable energy is delivered to the community by the community." (BEN, 2021).

BEN's work is based on the foundation that, in order to build an energy system that works for *everyone*, citizens must be involved in the building process. In 2008, David Tudgey and friends started thinking more about solar PV electricity and, at that time, "it seemed like participating in sustainability activities was like an exclusive club and language, as if one needed a degree and money to participate", said David. After attending a Transition Town Cities meeting, David left inspired by their collective action efforts of going from neighbor to neighbor and talking about solutions to environmental and energy issues.

Together with a small group of friends, David focused on starting an organization that acts on climate change while addressing social justice needs, such as poor quality of homes. They did a community asset assessment (social and physical assets) and engaged with people, looking at everybody's skills and "what they can bring to the table". The aim of this community engagement was not to talk about climate change, but how to give people agency and to take action, based on the Transition Towns movement. Through this process, David said they found energy to be one of the most pressing issues.

How a small idea can be a city-wide realization (even with a small budget)

BEN began to develop by hosting open quarterly meetings every year. These meetings were open to all, no matter which background people came from. The aim of these preliminary meetings was to bring affordable energy to all. David and colleagues were looking for innovative solutions by having meetings for different energy projects to come together.

BEN was officially set up in 2010 to help community energy initiatives across the city share knowledge and ideas for a more sustainable energy future. The network was formed in response to a flourishing of grassroots energy activity and the perceived benefits of closer collaboration. BEN became, and continues to be, a connective tissue for different community energy projects around Bristol.

For the first four years, BEN was run by volunteers with support from the Centre for Sustainable Energy (CSE), Bristol City Council's Sustainability team and the University of Bristol, among others. During these formative years, people involved in the network supported the launch of Bristol Green Doors (their first event was held in September 2010) and the development and launch of the Bristol Energy Cooperative (launched to the public in 2011). In January 2012, as a result of the network's activity, 11 local energy initiatives won Local Energy Assessment Fund (LEAF) awards. The BEN network supported partnering between initiatives, communication between projects and dissemination of knowledge and results. As a result Bristol had the highest concentration of LEAF activity outside of London (BEN, 2021).

BEN emphasizes that in order to participate in the energy transition, one does not need to have technical and professional skills. Instead, they encourage people to ask themselves, “what can I do and be part of the solution?” and start collaborating.

When feed-in tariffs were available about a decade ago in the United Kingdom, BEN quickly tried to establish a working group to form an energy cooperative. David noted that they fostered relationships instead of competing with other groups. They also needed support at the local policy level, such a property services, finance and legal services. In the first few years, not everyone was onboard, but they now have valuable broad support and are entering into a Partnership Agreement with the local government.

The Bristol Community Strategy for Energy

Part of the formative years was developing a community energy strategy in 2013. This is when BEN hit a turning point. In the spring of 2013, BEN coordinated and led the development of the **Bristol Community Strategy for Energy**.[18] The Strategy lays out aims and steps for niche level action on energy and seeks to enable local community groups to work in collaboration with local authorities, the private sector and third sector organizations on sustainable energy issues (BEN, 2021).

At that time, BEN’s members were providing different perspectives on which direction to go: “energy efficiency is the solution”, “renewables are the solution”, and “addressing energy poverty issues is the solution”. David said they developed a community energy strategy, a so-called “Arthur’s Round Table”, where they gathered together everybody to understand and acknowledge all perspectives and their goals that can in turn support each other. From this strategy, they created the *Community Energy Strategy Wheel*

[18] Bristol Community Strategy for Energy: https://bristolenergynetwork.org/aboutus/community-strategy-for-energy/

(Figure 6.1). Over 50 people and organizations were involved in shaping its content and direction. It was officially launched by the Mayor of Bristol in June 2013.

Fig. 6.1 The Bristol Community Strategy for Energy

The Community Energy Strategy Wheel shows how different actors and their priorities fit in the wheel. This also includes the political level. In 2014, BEN was elected as the Energy Action Group and received a green capital award, and later offered a contract to promote community energy solutions. The coalition government at that time introduced the Community Energy Strategy Wheel (Figure 6.1) at the national level and later the wheel became part of the national policy to support community energy.

The Municipality (Council) of Bristol is a city and a county with around 400,000 inhabitants. The municipality also has one of the largest energy services in the country. In parallel to the community energy sector, the Bristol council received EU funding, ELENA (European Local ENergy Assistance), to borrow money where they needed to demonstrate the funding works as a multiplier. According to David, this ended up putting the local authority against community energy, so it didn't go as they imagined. Eventually, BEN worked with the local offices, and proved where engagement works, and the council received the fruits of the projects. “Now there is 3 years of funding between BEN and the council to come up with more innovative projects and to demonstrate unique innovations, which are now nationally recognized”, David noted.

Governance

BEN is registered with Companies House as a Community Interest Company (CIC) (no. 9077917) limited by guarantee with a large membership. The network has two types of members: voting and non-voting members (BEN, 2021):

- **Voting members** consist of community initiatives in Bristol and the surrounding area with an active interest in energy;
- **Non-voting members** consist of individuals and organizations interested in the activities of the network.

Membership is free and open to non-profit organizations in Bristol and the surrounding area that are running energy related projects or have an active interest in energy issues. Voting members are entitled to attend all meetings and to vote on BEN resolutions at the Annual General Meeting and to vote to appoint new directors. However, meetings are open to all, both individuals and non-member organizations, to take part in developing and implementing project ideas (BEN, 2021).

BEN is member-led; therefore the network’s activities are informed by the needs and views of its members, who are consulted via BEN meetings, online surveys and other means. Members commit to sharing information and ideas via BEN meetings, the members email list and monthly newsletter, and work together to achieve the network’s vision (BEN, 2021).

BEN has 9 Board members, many of whom are part of member organizations. The Board is responsible for the financial management of the organization, as well as staff supervision, and works collectively with the staff to develop and direct the work, including project development support, community outreach and member recruitment (BEN, 2021).

Values

BEN members are guided by the following values (BEN, 2021):

1. For everyone: actively working to create an energy movement that reflects the diversity of Bristol communities and ensuring everyone has a chance to play a part in designing and carrying out the work;
2. Transparent and honest: being accountable to those affected by our work by giving them the opportunity to be involved and openly sharing information about their activities;
3. Community-led: communities, rather than private interests, lead the work and benefit from it;
4. Sharing and supporting: working together, sharing knowledge and supporting each other to achieve shared goals (BEN, 2021).

Major near-term project

BEN just placed an order for a wind turbine, the largest onshore in the country. David noted how this is an example of working with the local authorities to get the land permits, even when the national government is making it harder for onshore wind projects. BEN is also collaborating with institutions, such as universities, to help bring policy changes.

Harnessing the skills of community members is a way BEN has fostered important conversations to happen, focused on empowering people to participate and connecting marginalized communities like Lawrence Weston (where the onshore wind turbine will be located).

Challenges

According to David, the first and foremost challenge is the knowledge building about community energy at both the policy and community level. The role of community energy is often not properly understood. In May 2021, BEN produced 10 'asks' that they would like to hear being asked of candidates in a recent election. Through the 10 asks, they present their contribution to a smart local energy agenda which they believe should be a strong focus in the near-term elections (BEN, 2021):

Q1. Community Energy: How can we grow and support our community energy sector to deliver a smart, local (community) energy system?
Q2. Renewable Energy: How can we ensure that more renewable energy is generated, and community owned in Bristol?
Q3. Sustainably Heated Homes and building efficiency: a) How can we encourage take-up of energy efficiency measures in our homes (existing and future) to reduce heat demand? b) How can our homes be supplied with heat from renewable energy sources?
Q4. Green Workforce & Green Recovery: a) How can we employ and train a green workforce to deliver a smart local (community) energy system? b) How can we ensure that the inequalities in our current energy system are addressed?
Q5. NetZero Transport system for all: How do we transition to a NetZero integrated transport system that is affordable and accessible for all?
Q6. Improved focus on Air Quality: How can we ensure that in the future energy system air quality emissions are prioritized alongside reducing carbon emissions?
Q7. Using the planning system to address NetZero: How can we ensure that climate change is addressed in new developments?
Q8. Alleviating fuel poverty: How can we eliminate fuel poverty in Bristol? a) What strategy and action plan should we follow? b) What is our timeline? c) What should be our initial actions over the next two years?
Q9.Engagement in energy issues: How can we increase opportunities to educate Bristol on energy issues, particularly in less affluent communities?
Q10. Reducing Consumption and Waste: How can we reduce consumption and waste across the city?

Current energy and social policies hostile towards community energy

David Tudgey noted that if BEN can get the conditions right for community energy, then it can thrive. The business models are not working properly at the moment “because the policies do not fit the purpose as they are designed around big institutions and investments”, said David. “Policies still do not support a decentralized energy system because the current centralized regime supports them at the moment." BEN is focused on getting everybody involved, from engineers and roofers to students and healthcare practitioners. As David stressed, "we can't just wait around for unicorn technology to solve the climate emergency, we need to use what we have and drive forward."

Community empowerment

Regarding community empowerment, David noted that communities know where their priorities are and that they have a sense of the climate emergency and the social injustice around fuel poverty. "Thus, supporting the communities to develop solutions is very important."

BEN wanted to create something that can be replicated anywhere. Community energy should be part of the roadmap to Net Zero energy and part of the conversation at the annual international environmental conferences because, as David said, "if you empower communities with information and resources, then amazing things can happen."

BEN supports any community that wants to build something around energy and fits within the Community Energy Strategy. There is no profit motivation, instead a motivation by community needs. BEN has expanded significantly in the surrounding areas of Bristol, often in marginalized and low-income communities that are forgotten by institutions and put into large council estates (public housing). David notes that services often don't reach residents in these areas, so BEN goes into these communities and engages to strategize their plans and host meetings in the communities. David also notes that rather than say that a community doesn't have skills to do x, y and z actions, BEN instead looks at what skills they already have and empower them to do more. "In turn, the communities don't rely on institutions to come in and do it for them, they look at how BEN can support them to be empowered to take action," David said.

Health and wellbeing

One of the most important aspects that David highlighted about BEN's work is their focus the health and wellbeing of its members. "Once we offer solutions that provide wellbeing, this in turn is offering solutions to climate change," David noted. "But if we only focus on air quality, clean vehicles, decarbonization, or on just one issue, then we miss the systems of how things work. We end up with siloed work and distorted outcomes."

David noted that BEN approaches health and wellbeing through the lens of community energy, and thereby involving health practitioners in the energy sector. This is bringing increasing recognition to the nexus of community energy and public health. BEN has been working with healthcare partners to put together the first ever chapter on Fuel Poverty for the Joint Strategic Needs Assessment (JSNA). The JSNA looks at the current and future healthcare needs of local populations to "inform and guide the planning and commissioning of health, well-being and social care services within a local authority area" (BEN, 2021). The published chapter can be found online[19] and information about the Joint Strategic Needs Assessment are also accessible online.[20]

Key Activities

BEN has a number of members (groups and individuals) involved in many different energy projects in Bristol, including (BEN, 2021):

- **Addressing fuel poverty**: Assisting people struggling to pay their fuel bills by advising them on how to deal with debts to energy companies, as well as finding the cheapest energy provider for their needs and accessing grants;
- **Behavioral change**: Advising people and community organizations on how to reduce their energy use, both by changing their behavior (e.g. not boiling more

[19] Bristol JSNA Chapter Fuel Poverty (2018) https://www.bristol.gov.uk/files/documents/1735-fuel-poverty-jsna-chapter-2018/file

[20] Joint Strategic Needs Assessment (JSNA) https://www.bristol.gov.uk/policies-plans-strategies/joint-strategic-needs-assessment

water than needed) and ensuring homes, community buildings, and council estates (public housing) are more energy efficient (e.g. improved insulation);

- **Clean energy diffusion:** Supporting the transition from fossil fuels to renewable energy through raising money and installing community-owned renewable energy projects (e.g. installing solar panels on community buildings);
- **Knowledge building**: Education, campaigning and lobbying to push for the social and political change needed to create a fair and sustainable energy system.

Qualities for success

According to David, having a *community energy strategy* (Figure 6.1) which lays out a round table for people to discuss and agree on ground rules for collaboration, provides the ethos of how to support one another. This has helped guide the narrative for the building of BEN: "A value added to the organizational strength of BEN is involving everybody and creating working groups for this to happen," David noted.

Creating access and helping to amplify people's voices

BEN is also broadening the conversation beyond just clean energy by also focusing on social justice issues. They are giving access for people to participate and amplify the voices of the communities often forgotten in the energy transition. David Tudgey notes that this is where education plays a key role, "especially creating information that is accessible and understandable for everyone – from an 8-year-old to an 80-year-old." This highlights the need for designing valuable information which, in turn, helps to amplify the voices of community members.

6.4.4 Nørrekær Enges Vindmølleforening

(Nørrekær Enges Wind Turbine cooperative)

Location: Nørrekær Enge in North Jutland, Denmark

Year of establishment: 2016

Number of members: 1000

Area of activity: wind

MWh/year produced: 120 MW - 150 MW expected (not yet in production)

Which of the 7 dimensions are they aligned with?

Dimension	Alignment
Social	Building trust and cooperation in the local area among community members and a large, incumbent energy company. Mobilized 1,000 community members in the local area to go up against the big "Goliath" energy company and make an agreement with them that is supported by the local municipality.
Economic/Business Models	Cooperation agreement with a large energy company which gives the citizens in and around Nørrekær Enge the opportunity for a local co-ownership of wind turbines in their community.

Interview with Daniel Leuchtmann, Developer and Advisor to the Nørrekær Enges Vindmølleforening project

(conducted on June 3, 2021 via WebEx virtual conference platform)

Background

Nørrekær Enges Vindmølleforening (Wind Turbine Cooperative) is a wind energy cooperative with around 1,000 members and 17 associations in the local area in and around Nørrekær Enge, located in North Jutland, Denmark. It was founded in August

2016 in response to Vattenfall's application to the municipalities of Aalborg and Vesthimmerland for permission to erect wind turbines in Nørrekær Enge. Vattenfall[21] is a Swedish company and one of Europe's largest producers and retailers of electricity and heat with main markets in Sweden, Germany, the Netherlands, Denmark, and the UK.

Since its founding, the Nørrekær Enges Vindmølleforening has worked to ensure locally anchored co-ownership of the wind turbines in the local meadow lands, with the aim of securing funds for local development with the wind turbines as leverage. After two years of negotiation, the Nørrekær Enges Vindmølleforening entered into a cooperation agreement with Vattenfall in November 2018, which allows for the purchase of a number of turbines in the park.

With this approach to the project, Nørrekær Enges Vindmølleforening has made a significant contribution to ensuring that there has been a great deal of trust and cooperation in the local area. Nørrekær Enges Vindmølleforening has therefore been met with great political backing from the municipalities of Aalborg and Vesthimmerland. However, like with any "David and Goliath" relationship, where small players are up against large, incumbent players, the challenges can sometimes be beyond expected.

Community response

Photo Credit: Nørrekær Enges Vindmølleforening

Wind turbines were established in the local area around a decade ago. A large, multinational company, Vattenfall, built and owns all turbines in the area. Daniel Leuchtmann says there is a lot of undisturbed wind in the area, even if it's not close to the seaside. The area doesn't have a large town, it is mostly just small villages.

[21] Vattenfall: https://group.vattenfall.com

At the early stages of the wind turbine implementation, the local people were positive about the project, but wanted to know how the project would benefit them. Now that there was a very big industrial player (Vattenfall) in their area, the local residents wanted to know if there would be any jobs for them or anything else that would benefit the local economy, especially because the turbines are far away from any of the villagers and farmers.

The challenge

A conflict developed between the large player and local interests. According to Daniel,

> "Vattenfall was focused on energy production without understanding that there could be other interests at a given site. Years ago, many of the big energy companies just made big coal and oil-fired production facilities and there were hundreds of MW, but nobody cared, and they continued with business as usual. The same company mindset is still the status quo today because when the energy transition started, it certainly didn't start with the big players. It started at the grassroots niche level, with single turbines dispersed from community to community."

That's where collective action among community members comes in (Nørrekær, 2021).

Regulation: Shifting to benefit the community

There was no direct connection between an energy producer like Vattenfall and Nørrekær Enges Vindmølleforening as a consumer. Daniel described it as "the consumers get their energy from the plug and that's it—they pay for it as they usually do in their monthly bills. This electricity is in no way directly delivered to an area, so the benefits to an area has to come from a different source. In Denmark, this is actually quite well regulated. The legislation has changed now, but if you wanted to construct a wind farm, you would have to divest 20% of that to local investors, helping to increase local acceptance of this kind of new energy production" (Nørrekær, 2021).

The regulation in Denmark is now distance-based, where a turbine company would have to pay anyone in an area of a circumference around the project within 2.5 kilometers, pay a tax-free bonus annually, “but this is a small amount”, according to Daniel. The majority of the money goes to the local government, the municipality, and they can use it however they want. The Nørrekær Enges project is located in two municipalities—the Aalborg and Vesthimmerlands municipalities, both over 30 kilometers from the site. Because of this distance, Daniel highlighted the local people’s concern that the money is not reaching the local area where the turbines exist around Nørrekær Enge and where the problems (noise, shadows, etc.) may be.

The community cannot bypass the Vattenfall because the company sits on the land lease agreements. One needs to secure land for that and you can’t bypass them. For that reason, there was a group of people who said they would like to benefit in a more direct way from this project. Daniel noted that the local people don't trust in the 20% divestment and want to have something more socioeconomically concrete. “Then Vattenfall offered 15000 Danish Krones (€2,000) per turbine per year for local development, which is an offer that has been seen in other places, as well.” Daniel noted that the offer was not bad as such, but the community said, “no, we want local ownership!”

This was the start of the Nørrekær Enge movement, where the group formed a local cooperative and gathered 1,000 members, corresponding to a large percentage of the local population over 18 years old.

Challenges

Funding

The question of funding is a crucial one: “how do you actually fund such an initiative/cooperative that is very professionally organized and has a strong relationship with the municipality?” asked Daniel.

One challenge that Daniel highlighted with the Nørrekær Enge cooperative is many people want to support it, but nobody wants to pay a membership fee. If they had taken a membership fee of 1000 Danish Krone (around €134) per year, for example, Daniel said they probably would have received a low membership rate. For the cooperative it was more important to get a critical mass activated, so they didn't require a fee, but that also means that they faced financial challenges. Daniel noted that "this is especially challenging when there are large players, such as Vattenfall, who have been creating obstacles to community ownership."

Political will

Daniel noted one of the biggest hurdles is the political system because there is an established way of requiring locally-owned projects to own 20% of the project value based on purchase of shares by individuals. Thus, the Nørrekær Enge approach is based on the local cooperative owning the shares. As highlighted by Daniel,

> "This is new and has been very difficult to sell to the to the national political system. Several attempts were made but were waved away by the minister of energy because he probably didn't understand the group's approach. Not so much the utilities, but the system in general is not prepared for this type of approach."

Ownership structure

The cooperative has a board where all decisions are made. There is an annual meeting, and their financials are audited like any other initiative. Normally for a local initiative of this kind, and there are many in Denmark, one would organize as a group of individuals who want to build this wind farm and finance it commonly. "This would also have been of interest for Nørrekær Enges, but as Vattenfall already had engaged with the established landowners, this was not possible," Daniel noted.

A new Nørrekær Enge Wind Farm

In March 2016, Vattenfall applied to the municipalities of Aalborg and Vesthimmerland for permission to erect 40 wind turbines in Nørrekær Enge (Project Nørrekær Enge II). At the final political decision in December 2018, the project was reduced to 36 turbines.

The work has so far included final agreements with the affected landowners, concluding a cooperation agreement with the local Nørrekær Enge cooperative and examining other possibilities for establishing a new wind farm in the area.

In addition, work was done to obtain the necessary regulatory approvals. According to a preliminary project plan from Vattenfall, the construction of the new park has been expected during 2020 and 2021 with anticipated grid connection during December 2021. Daniel noted that, "the work with authority approval, choice of turbine type and management of joint activities in Nørrekær Enge Wind Farm is carried out by Vattenfall, who makes the decisions about the park, but keeps the Nørrekær Enge cooperative engaged."

The new park is expected to include 36 new wind turbines, which together are expected to be approx. 120 MW - 150 MW in total, depending on the turbine type. Up to 13 out of these 36 turbines are labelled to be owned by the Nørrekær Enge cooperative. The rest of the turbines will be owned by Vattenfall. When Vattenfall selects the turbine type and make, the financial return is sought to be optimized, as well as legislation on noise and distance requirements (Nørrekær, 2021).

The cooperation agreement with Vattenfall

In November 2018, Nørrekær Enges Vindmølleforening entered into a cooperation agreement with Vattenfall which gives them, and thus the citizens in and around Nørrekær Enge, the opportunity for a local co-ownership of the turbines in the meadow (Nørrekær, 2021).

The main points of the agreement are the following (Nørrekær, 2021):

- The Nørrekær Enges wind turbine cooperative is offered to buy the share of the 20% that may not be sold to the neighbors. The number of turbines is rounded up;
- Landowners in the meadow have a pre-emptive right to 5 turbines agreed with Vattenfall;

- It has been agreed that the turbines offered to Nørrekær Enges will be transferred at cost price (RE price). Vattenfall thus has no profit on the sale of the wind turbine shares;
- The agreement ensures that the turbines offered to the Nørrekær Enges cooperative must have an average production that is the same as for the total number of turbines in the project.

Project halted

According to Daniel, the deadline of construction for the new park expected during 2020 and 2021 has not been met due to changes in the energy law, ongoing negotiations, EU-bidding rules and objections from the public to the environmental report.

The wind park has, hence, not been built and there is currently no updated time plan to the project. Another uncertainty is that Vattenfall has recently announced publicly that they are withdrawing from the onshore energy market. All the way through you have the "David and Goliath" issue, which is daunting and unsettling, especially for private citizens to whom it is the first time they engage in community energy.

Relationship building

Although the project has not been realized, some important takeaways has come out of it. Daniel notes that "throughout the process, the group has established important relationships with banks and financial institutions. This is encouraging because there is great will, especially from a local bank, to support this project."

There are no supporting governmental funds that could fund this, or at least provide the security for financing such a project. Daniel highlighted that the Nørrekær Enges cooperative has some excellent financial advisors, so they are surrounded by helpful and skillful people. "However, they can't engage in tough negotiations with the financial institutions until there's a specific project which can be negotiated. Ideally, they would have some government funds that could provide the security to such a project," Daniel noted.

Until 2017, there were subsidies, or a type of Feed-in tariff, of 10 Danish Krone cents per KWh which was almost 50% of the energy price on top. This was a good incentive; however this scheme no longer exists. Now it's all based on market prices and Purchasing Power Agreements (PPAs). “The securing of energy sales is a very important part of the job of the Nørrekær Enges cooperative. This includes meetings with energy traders who expressed willingness to support the project. Should this project become reality sometime in the near future, they have everything in place for it to become a successful reality,” Daniel remarked.

Social innovation potential

Although the project has not been completed, the Nørrekær Enges cooperative has managed to mobilize 1,000 members in the local area and has been able to go up against the big “Goliath” energy company and make an agreement with them that is supported by the local municipality.

Daniel highlighted that “the aim is to operate these turbines and generate benefits for the local communities, but the timeline is difficult at this point.” Having ownership of the turbines is the vision that drives the local citizens. The turbines will not be owned by a specific person or company, but by the citizens through the member-owned cooperative, generating consistent income year after year for the benefit of the local community.

6.5 Chapter Discussion

Although this chapter started with a standardized set of indicators to feed information to this dissertation, naturally, as all energy CAIs have unique attributes and nuanced approaches, some of the dimensions may not be synchronized with every Frontier energy CAI.

Some of the common key takeaways learned from the variety of Frontier cases include:

- **Social justice approach**: communities most impacted by the fossil fuel economy should be put at the forefront of the energy transformation;
- **The power of networks:** Collaborating in a broader network in one's region, country or internationally can provide valuable information and support (see *section 2.3 Social Capital* and its fostering of cooperation and trust);
- **Education and training**: many of the initiatives provide an added value to the communities they serve by having education and training for members;
- **the David and Goliath issue**: Many small players (community members, citizen groups, etc.) are burdened with going up against the large, "Goliath" energy players (incumbent utilities, energy companies, etc.).

An important lesson for future energy CAIs is the need to retain flexibility to bring on appropriate partners at different stages of project development as needs are further identified.

From the cases highlighted in the EU and US, a common theme is that these communities are building more than just energy projects. Instead, they are shifting the culture and the narrative around energy, recognizing that some of the deepest issues pertaining to scaling up community energy is the obstructive capitalistic structures in various municipalities, states and countries.

Capitalism faces an unparalleled social, ecological, moral, economic, and financial crisis. Reform and transformation efforts are emerging against this context. Some cases highlight the ability of capitalism to adapt to criticism by incorporating it (Boltanski &

Chiapello, 2005). Similarly, the energy and climate crisis are mitigated (in some way) through such decarbonizing strategies. Although innovative cases highlight important turning points, they reveal a potential to propose themselves as radically alternative and disruptive to the system. Thus, critical social movements, such as energy CAIs, some of which could be considered radical, are pressuring capitalism to change and model how to reform it.

Energy CAIs are enabling citizens, especially in low income communities, to be able to afford modern renewable energy by organizing, networking, and owning the renewable sources themselves. When focusing on a just transition where everyone could actually have a fair share and thrive in the energy regimes of tomorrow, we really are talking about an alternative energy paradigm where business models target socio-economic and environmental issues for increasing community wellbeing.

Table 6.2: Interview questions for in-depth investigation

Background Info:

- Name of initiative
- Location (*City, Country*)
- Year of establishment
- Number of members
- Area of activity (*Solar, Wind, Hydro, Trade, Production, Distribution, etc*.
- MW/year produced (*if available*)

In-depth description:

- History (*how it all got started*)
- Ownership structure (*cooperative? Solar community? Co-ownership? purchasing group? prosumer? etc.*) and how does it work?
- What is your business model?
- Qualities that help to be successful?
- Challenges faced?
- Other activities engaged in beyond energy?
- What makes your collective action initiative unique?
- What are you particularly proud of?
- How do you see your initiative and the energy scenario in 5 years?

Chapter 7

Conclusions

As energy demand continues to increase (by at least 30 percent in the next two decades (IEA, 2017)) the interest in finding alternate structures for managing energy regimes is reflected in community-led energy (Van Der Schoor et al., 2016). A rise in collective action initiatives (CAIs) for the energy transition is seen as a type of social movement that facilitates more democratic and participatory energy models that take on the incumbent players in the energy industry (*see social movement theory in Ch.2, section 2.7.4*).

The energy field in the EU and US has changed rapidly due to 1990s energy market liberalization and renewable energy integration. The International Energy Agency (IEA) highlights that a system change involves economic, technical, and institutional considerations to deploy intermittent renewable technologies into the electricity market (IEA, 2019). Managing the energy transition effectively requires public acceptance, support, and citizen engagement (Berka & Creamer, 2018), therefore this socio-technical system requires technical, institutional, and social cooperation (Smith et al., 2005). This, in turn, supports energy CAIS to fulfill objectives that provide new potential for intelligent, adaptable, localized, integrated energy systems.

Energy CAIs are becoming more widely acknowledged as a tool to assist in accomplishing national and local low-carbon energy targets as governments attempt to move to cleaner and sustainable sources of power. This is usually accomplished through generating renewable energy in places where local residents are positioned. The process of democratizing energy to a more decentralized form can seem intimidating since it entails overcoming the political, economic and financial forces of centralized and monopolized incumbent actors. Additionally, energy regulations are beginning to recognize the value of citizen participation for the energy transition, especially in Europe’s recent directives (Renewable Energy Directive (RED II), Internal Electricity Market Directive (IEMD)), as well as the Inflation Reduction Act, a recent landmark law enacted in 2022, that supports energy CAIs at the federal level through provisions for projects in low-income communities and other forms of energy communities (White House, 2023).

Bottom-up (niche-to-regime; regime-to-landscape) and top-down (socio-technical landscape-to-regime; regime-landscape) interactions are creating new "windows of opportunity" (Klein & Coffey, 2016) that have great potential to drive forward social innovations. These pathways become available when the top-down pressure of socio-technical landscapes on the current regime is combined with the bottom-up momentum of niche innovations (Klein & Coffey, 2016). (see *Chapter 2, section 2.7.6* for more info on the SNM-MLP framework.) The Strategic Niche Management **+** Multi-Level Perspective model is important for framing these collective action scenarios in the energy transition.

Although not all energy CAIs explicitly state this as their primary goal, some CAIs may be seen as driving forward Transformative Social Innovation efforts as a function of innovation niches. In addition, they strive to influence their larger environment by inciting institutional change (Bauler et al., 2017). Thus, it is argued for the creation of novel social innovation-producing mechanisms that enable citizens, whether they are formal citizens or not, to actively participate in collective decision-making while also addressing immediate local demands and opening up new opportunities for action.

According to a World Bank study, rural electrification sometimes crosses the line between market efficiency and sustainability, particularly in low-income, marginalized, and remote areas (ILO, 2013). This dissertation demonstrates that energy CAIs provide a benefit for communities' economies and environments. This may include enhancing trust and reciprocity, building commons (Ostrom, 2009) in the energy field, and providing innovative models to create market access that empowers marginalized communities to participate in the energy transition.

However, there are still some significant barriers to overcome. This is especially relevant to gaining access to important financial mechanisms, overcoming cognitive barriers (lack of knowledge) that keep CAIs at the niche level, as well as establishing wider supportive regulatory frameworks. The low carbon energy transition will gain more momentum when citizen involvement is a priority. As a result, more inclusive regulatory systems and increased trust and cooperation between communities will be supported. (see section *2.3 Social Capital* and its fostering of trust and cooperation.)

7.1 Comparing the EU and US through data

While there are clear similarities between the social and political environments of the EU and US that sustain energy CAIs, there are also some clear differences that take various shapes and are influenced by distinct forces. Despite different business models, the majority of energy CAIs aim to supply renewable energy to their communities. Many of the initiatives also address social concerns including building trust among community members and providing access to renewable sources for low-income and marginalized communities.

When attempting to compare the EU and US based on recent databases available, a direct **quantitative EU-US comparison** is not possible at the moment due to:

- Heterogeneity in data depository. The data collected per each CAI, the time span of data available, as well as the, volunteer-based vs externally sourced repositories;
- Lack of prospectively collected data. For example, there is no longitudinal data for the EU;
- Limited access to CAIs information as open source.

The US Energy Information Administration (EIA) data shows aggregately that cooperatives, used as a large example of energy CAIs, grew their renewable energy sources (RES), but we don’t know at the individual level. In the EU, this type of data does not currently exist. Thus, more mapping and longitudinal (especially whether the policies have impact or not) are needed.

More specifically, in order to make the EU and US comparable, the following are vital:

1. A core dataset to collect information;

2. Information to be open sourced and interoperable (FAIR practice standards);
3. Gain international consensus on a **core set of data** to be collected in a publicly available repository to foster further independent research in the field (e.g. for academia, public policy, industry);
4. Implement the **availability of information of** CAIs' energy sources (percentage using RES) to understand their contribution as a player in the energy transition;
5. Investigate the feasibility of scaling up innovative aspects of frontier cases;
6. A mapping endeavor for all community-based initiatives, including the existing registered cooperatives, ecovillages, solar communities, renewable energy communities (RECs), and similar initiatives, need to be performed;
7. The impact of policies and regulations, as well as economic and market aspects, deserve additional analysis.

This dissertation identifies a number findings related to the original hypotheses (see *section 1.3*) that can be further investigated using the specified quantitative technique to determine key dimensions that contribute to the energy transition and are also influenced by the literature review that demonstrates the possibilities and challenges to energy CAIs. Among them are:

- Given the improvement of human and resource capital, energy CAIs are more likely to contribute to the energy transition, yet marginalized and low-income communities still lack access;
- Where trust and reciprocity are highly valued, energy CAIs are more likely to thrive;
- The ability to influence energy policy to further support these projects will increase with the amount of collective action for creating movements.

In light of this, it is crucial for all stakeholders, particularly policymakers, financiers, and the general public, to be present in the discussions and gain knowledge from the experiences of current energy CAIs in the EU and US as another key way to address today's social and environmental concerns. Understanding the challenges and advantages of these collection action models will help such initiatives have a better chance of succeeding in the energy market and expanding into key areas that have been neglected throughout the energy transition.

Many of the Frontier cases in Chapter 6 include generating power with community members, networks, off-grid initiatives, as well as establishing economic and political power to disrupt and positively affect the current energy regime, comparable to the case of "People Power" in California, US (see *section 6.4.2*). The Frontier cases demonstrate that not everyone has access to renewable energy, thus equity is essential when scaling up community-led energy in a manner that prioritizes the populations who have been left out and/or deeply impacted by environmental injustices. This limitation is brought about not just by financial expenses but also by a lack of funding and political backing, including favorable legislation and energy regulation.

Concerning economic barriers, the Frontier cases also demonstrate that low-income populations are not always able to afford and acquire renewable energy. In order to provide marginalized communities with access to and control over their energy, it is necessary to reconsider and restructure current energy investments, based on an energy justice perspective.

7.2 Shared challenges to overcome in both regions

Energy CAIs still face a number of challenges while having the ability to provide a range of benefits that address social and environmental issues. Europe and the US have different impediments to supporting community energy initiatives, including grid access, restrictive regulations, access to supportive financial programs, and lengthy approval procedures. Supportive regulations and increased knowledge about the benefits of energy CAIs may eliminate these hurdles and enable communal energy to thrive. In addition to having a limited market share in both the EU and the US, the following obstacles make it challenging for them to scale-up in both regions:

Centralized systems still dominate

Large, centralized utilities, or incumbent actors, still control the electrical system and the market for renewable energy in every country. According to a European study, the behavior of these energy regimes limits the flexibility of energy CAIs, especially cooperatives (Proka et al., 2018). However, despite the large utilities' slow adoption of decarbonizing solutions, decentralized energy CAIs have seen an overall advancement in the energy field (Burke & Stephens, 2018).

Energy facilities often require appropriate acreage for solar fields or wind turbines; thus, the accessibility issues often benefit the large, incumbent actors that, in turn, promotes the retention of monopolistic or oligopolistic power. Most European energy markets, with the exceptions of Germany and Denmark, are characterized by such oligopolistic conditions (Huybrechts & Mertens, 2014).

Still using a large share of non-renewable sources

The long-term Power Purchase Agreements (PPAs) are one issue affecting energy CAIs, namely cooperatives, especially in Germany and the US. Through PPAs, energy CAIs, as well as municipal and private investor-owned utilities, buy electricity from generating companies for a set price over a predetermined period of time (Farrell et al., 2016). The potential limitation is that when an energy CAI signs a PPA with a coal power plant for 40 or 50 years, they are locked into the agreement and their members are unable to reevaluate a change in energy sources for decades. This is not in line with energy transition goals because members of an energy CAI will be forced to buy energy from non-renewable sources for a particularly long time (Spangher, 2017).

Staying at the niche level

Another significant obstacle that restricts the potential of energy CAIs to influence the larger energy transition is the one that keeps them at a specialized niche level (see *niche level management in Chapter 2, section 2.7.6*). According to transition studies, niche-level projects require a strategic vision that has potential to disrupt a non-democratic regime (Proka et al., 2018). For example, recent studies suggest that the UK's community energy market lacks a strategic vision and strategy (Seyfang et al., 2014). Similarly, a number of energy CAIs in the Netherlands aren't focused on growing beyond their specialty to connect with the regime (Proka et al., 2018). However, some initiatives choose to remain small so they may concentrate on solving local issues (Seyfang et al., 2013).

Policy and regulation

International climate accords provide recommendations for a sustainable future, but it is still up to national governments to decide what goes into energy systems and energy policy, who the key actors are, and how they are regulated (Proka et al., 2018). National regulators require a deeper grasp of the value of citizen engagement through energy CAIs since laws and economic structures are important indicators of why sometimes citizens are able to (or not) organize such initiatives. The development of national plans to accomplish national and international climate and energy goals can be further supported when energy CAIs are given a place at the table. While there is no set formula for effective policy, it is certain that to have citizen engagement for the energy transition, including the establishing of energy CAIs, a flexible regulatory framework must be incorporated at national and local levels (ILO, 2013).

Lack of knowledge and legitimacy

One of the biggest obstacles for energy CAIs is people's lack of knowledge of what they are, and the social innovation benefits they can provide. A lawmaker's or citizen's willingness to support an initiative they do not understand is likely to be low (Huybrechts & Mertens, 2014). Energy CAIs, especially in the cooperative model, are considered to be "hybrid organizations" that don't fit into the established organizational categories, which presents a significant legitimacy hurdle. This is often a result of energy CAIs' location at the unique intersection of two powerful economic sectors: (1) the private sector, which is connected with supporting social enterprises, and (2) the public welfare sector, which is associated with civil society well-being (Huybrechts & Mertens, 2014). It is anticipated that participation by a wide variety of citizens in energy CAIs will have a greater influence on the larger community and strengthen the democratic cooperative model.

Furthermore, public actors such as municipal governments could be reluctant to collaborate with other "outside organizations," especially if they are niche and unknown, because of the long-standing relationships that frequently exist between public authorities and the incumbent electrical providers (Huybrechts & Mertens, 2014).

The low level of member participation also creates a challenge. Less than 10% of voters participate in elections in 70% of US cooperatives, which diminishes the democratic aspects and further separates the cooperative from its members. The low voter participation at many rural electric cooperatives is a sign of the disenfranchisement and indifference of the member-owners; members frequently find it difficult to get over obstacles like difficult-to-access meetings, complex elections, and strict voting procedures (Farrell et al., 2016).

Financing

One of the most common challenges energy CAIs face is the complexity in acquiring funding. This is especially true for low-income communities and the broader renewable energy industry. One of the biggest challenges to establishing an energy cooperative, for example, appears to be the high cost and access to predevelopment funds, including the purchasing of renewable energy equipment, particularly wind turbines (Bauwens et al., 2016). Private, large investor-owned companies are usually more appealing to investors looking to get the best return on their investment (Huybrechts & Mertens, 2014). On the other hand, members of an energy CAI may be reluctant to accept the financial support of outside investors if the CAI desires to safeguard their shared democratic and cooperative goals against conventional profit-maximizing practices (Huybrechts & Mertens, 2014).

Governments also have a direct influence on the economic models of energy CAIs. One example is the major grant programs for renewable energy, which mostly helps the bigger energy regime actors, even if energy CAIs have also been successful in applying for funds (Proka et al., 2018). Due to these factors, capital for energy CAIs is typically restricted to grants from the government or funds earned by the members. This can prevent an initiative from accessing markets that need significant capital (Huybrechts & Mertens, 2014). However, there are additional funding sources for the development of renewable energy, such as feed-in tariffs, which were once successful supporting schemes for energy CAIs, especially in Germany and Denmark (Bauwens et al., 2016).

7.3 Summary

When more people are engaged in the low-carbon energy transition, it will progress more quickly, fostering community trust and collaboration as well as innovative methods of producing, distributing, and consuming renewable energy. This, in turn, can eventually enable a more inclusive energy regulatory system. “One thing is clear; energy cooperatives [CAIs] will continue to pave the way for the energy industry to become more democratic and advantageous for citizens,” noted Dirk Vansintjan, President of REScoop (Vansintjan, 2017).

Active involvement in the energy transition may include challenging the present energy regime with methods that reduce the monopolistic power of incumbent corporate actors and their technological systems. Limiting equity in the energy transition ultimately slows down a community's capacity to support and develop the required "collective power" to address enduring social and environmental justice concerns.

In both EU and US examples, communities are developing more than energy projects. Instead, they are changing the culture and narrative surrounding energy, realizing that obstructive capitalistic systems in municipalities, states, and nations are the biggest obstacles to scaling up community energy. Capitalism faces an unprecedented social, ecological, moral, economic, and financial crises. This is spurring reform and change. Several of the cases highlight the ability of capitalism to adapt to criticism by incorporating it (Boltanski & Chiapello, 2005). Such innovative cases may challenge the system and provide radical alternatives. Thus, critical social movements like energy CAIs, some of which are considered radical, are pressuring capitalism to shift and model its transformation.

Energy CAIs put consumers first, something commercial actors can't provide. Innovative funding approaches and societal acceptability are essential to sustain energy CAI validity. Without it, energy CAIs will find it challenging to outcompete the incumbent, powerful actors and attract a sizable membership. More efforts can be done to address the social components of CAIs that may restrict citizen involvement, particularly if there is a large personal financial risk (and other barriers to entry) to joining an energy CAI, which impacts the long-term sustainability of these community-led efforts.

This dissertation demonstrates how supporting energy CAIs and emphasizing key lessons learned from innovative Frontier cases may provide helpful guidance for navigating obstacles that are impeding marginalized communities' access to clean energy sources, allowing them to take control of and democratize their energy systems. As the cases and literature review showed, through cooperation, networking, and ownership of renewable resources, Energy CAIs enable low-income communities afford renewable energy.

Energy CAIs are significant to the energy systems of the EU and US. Their socioeconomic benefits are useful in the energy field because they provide communities with the tools needed to cooperate and counteract excessive individualism (Nye, 1997). Energy CAIs also aid their customers in reducing energy use and financial costs while hastening the switch to a low-carbon energy system by implementing renewable energy technology. Both are essential for society and the environment, especially helping to maintain global temperature warming within a safe 1.5C increase.

The shift to an alternative energy paradigm that focuses on a just transition where everyone can benefit from and have access to today's renewable energy systems requires innovative business models that address sustainable development issues (social, economic, and environmental) while championing a sense of community well-being.

Addressing the crisis in Ukraine

The current war in Ukraine and all of its devastation has shown a bigger influence on global energy markets, particularly the necessity for expediting the sustainable energy transition, maintaining energy security and affordability, as well as becoming independent from external sources. Since data was gathered prior to the present crisis unfolding, the altered geopolitical conditions have not yet been reflected in this dissertation. Certainly, it can be predicted that all the components of alternative energy systems are presently and will remain in the forefront in the near future. Citizens' knowledge of energy-related issues and their willingness to find community-led solutions are growing at the same time. May a peaceful, diplomatic solution soon bring an end to this war and foster new, innovative forms of cooperation for a just and healthy future.

If there is a reason for social movements to exist, it is not to accept dominant values as fixed and unchangeable but to offer other ways to live—to wage and win, a battle of cultural worldviews . . . laying out a vision that competes directly with the one on harrowing display, . . . one that resonates with the majority of people on the planet, that . . . ***we are not apart from nature but of it****.*

Naomi Klein, This Changes Everything: Capitalism vs. the Climate

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Chapter 4:

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