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Emergence and development factors of renewable energy cooperatives: A cross-country comparative study of Germany and Portugal

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Emergence and development factors of renewable energy cooperatives: A cross-country comparative study of Germany and Portugal

Master Dissertation in Energy for Sustainability, developed on the specialisation branch Energy Systems and Policy, presented to the Faculty of Science and Technology of the University of Coimbra, as part of the requirements for the award of the Master Degree.

Supervisor: Prof. Patrícia Pereira da Silva

Coimbra, May 2017

“Was dem Einzelnen nicht möglich ist, das Schaffen viele.”,

“What is not possible for an individual, that accomplish many.”,

“O que não é possível para um indivíduo, que realizam muitos.”,

Friedrich Wilhlem Raiffeisen

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Abstract

In recent years, various governments and organisations have encouraged the active participation of citizens in community energy projects. Especially renewable energy cooperatives (RE cooperatives) emerged and have contributed greatly to achieve national renewable energy targets. However, the existing research has focused mainly on the specific characteristics of countries, lacking a comprehensive scope and explanation for the unequal spatial distribution of RE cooperatives among countries.

Therefore, the purpose of this dissertation is to identify and assess the economic, organisational and regulatory emergence and development factors of RE cooperatives in a comparative cross-country analysis. The ultimate aim is to develop tailored policy recommendations and thereby realizing the full potential of citizen's engagement and positive environmental and societal impacts. Firstly for, Germany, where RE cooperatives are well established, but recent policy decisions lead to deteriorating conditions, and secondly, Portugal, where these organisations struggle to make a headway.

First of all, an overview of the RE cooperative movement and the role of citizens within the EU energy transition strategy outlines the current context. Thereafter, a literature analysis aims to develop a sound understanding of the influencing factors and gain required knowledge for the preparation of the experimental study. An online survey was conducted to acquire and examine data on RE cooperative activities, internal structures and external drivers and barriers, complemented by two qualitative interviews with RE cooperative experts.

Findings indicate that RE cooperative are exposed to a multitude of obstacles that can be lowered through a clear and stable framework, recognising their distinctive characteristics. Moreover, the engagement of local actors, the support of associations and availability of a well-developed knowledge infrastructure as well as local financial institutions constitute particularly influential factors.

Keywords

Renewable energy cooperatives, social economy, renewable energy policy,
EU directives, renewable energy, energy transition

Resumo

Nos últimos anos, vários governos e organizações incentivaram a participação ativa dos cidadãos em projetos comunitários de energia. Em particular, as cooperativas de energias renováveis surgiram e contribuem bastante para conseguir atingir os objetivos nacionais de energias renováveis. No entanto, a pesquisa existente focou-se principalmente nas condições de países específicos, sem uma explicação abrangente para a prevalente distribuição geográfica desigual das cooperativas de energias renováveis entre os países.

Portanto, a intenção da dissertação é examinar os fatores económicos, organizacionais e regulatórios de surgimento e desenvolvimento das cooperativas de energias renováveis. Finalmente, propõem-se recomendações de políticas, por um lado, para a Alemanha, onde apesar de terem sido criadas numerosas cooperativas, as recentes alterações legais levaram à deterioração das condições. Por outro lado, no caso de Portugal, avanço destas organizações socioeconómicas é ainda residual, apresando estádio muito embrionário quando comparado com o caso alemão.

Em primeiro lugar, apresentamos uma visão geral do movimento cooperativo e do papel dos cidadãos na estratégia de transição energética. Segue-se uma análise da literatura com o objetivo de desenvolver uma compreensão dos fatores influentes e de angariar o conhecimento necessário para a preparação do estudo experimental. Foi desenvolvido um questionário online para a aquisição e análise de dados sobre atividades de cooperativas estruturas internas e os facilitadores e obstáculos externos. Esta etapa foi complementada com duas entrevistas com líderes cooperativistas.

Os resultados indicam que as cooperativas de energias renováveis estão expostas aos inúmeros obstáculos que podem ser reduzidos através de um quadro claro e estável, reconhecendo as suas características distintivas. Além disso, fatores particularmente influentes apresentam o envolvimento de atores locais, o apoio das associações e disponibilização de uma infraestrutura de conhecimento e instituições financeiros locais.

Palavras-chave

Cooperativas de energias renováveis, economia social, política de energias renováveis, diretivas da UE, energias renováveis, transição energética

Zusammenfassung

Im den letzten Jahren unterstützen diverse Regierungen und Organisationen die aktive Einbindung der Bürger in regionale erneuerbare Energieprojekte. Insbesondere Energiegenossenschaften florierten und leisten einen enormen Beitrag zur Erreichung der nationalen Ausbauziele für erneuerbare Energien. Die über Energiegenossenschaften bestehende Forschung beschäftigt sich vor allem mit den Zusammenhängen und Bedingungen in einzelnen Ländern, jedoch liefert diese keine umfassende Erklärung der unterschiedliche Entwicklung und Verteilung über Ländergrenzen hinweg.

Das Ziel dieser Thesis ist es, die ökonomischen, organisatorischen und regulatorischen Entstehungs- und Entwicklungsfaktoren von Energiegenossenschaften zu untersuchen. Anschließend sollen passende politische Empfehlungen entwickeln werden, zum Einem für Deutschland, da die Energiegenossenschaften hier gut etabliert sind aber jüngste gesetzliche Änderungen unvorteilhafte Bedingungen geschaffen haben, und zum Anderen für Portugal, als ein Land in dem diese sozio-ökonomischen Organisationen Entwicklungsprobleme aufzeigen.

Zuerst umreißt die Thesis den derzeitigen Stand der Energiegenossenschaften und verdeutlicht die Rolle der Bürger innerhalb der Energiewendepolitik der EU. Anschließend folgt eine Literaturanalyse mit dem Ziel ein klares Verständnis über die Einflussfaktoren und benötigtes Wissens für das experimentelle Vorgehen zu entwickeln. Eine Online-Umfrage wurde durchgeführt um Daten von energiegenossenschaftlichen Aktivitäten, internen Strukturen und externen Treibern und Barrieren zu sammeln und diese anschließend zu analysieren, komplettiert wurde dies durch zwei Interviews mit Genossenschaftsexperten.

Die Ergebnisse weisen darauf hin das Energiegenossenschaften einer ganzen Reihe von Hindernissen ausgesetzt sind, welche durch klare und stabile Rahmenbedingungen die ihre charakteristischen Merkmale berücksichtigen gesenkt werden können. Darüber hinaus zählen zu den besonders stark beeinflussenden Faktoren das Engagement von lokalen Akteuren, die Unterstützung durch Verbände und Verfügbarkeit einer Wissensinfrastruktur sowie lokale Finanzinstitute.

Schlüsselwörter

Energiegenossenschaften, Sozialökonomie, erneuerbare Energien, erneuerbare Energiepolitik, EU Richtlinien, Energiewende

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List of Abbreviations & Acronyms

APREN	Associação Portuguesa de Energias Renováveis (Portuguese Renewable Energy Association)
BMU	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)
BMWi	Bundesministerium für Wirtschaft und Energie (Federal Ministry for Economic Affairs and Energy)
CC	Cooperative Code
CfD	Contract for Difference
CO_2	Carbon dioxide
ct/kWh	Cents per kilowatt hour
DES	Decentralised energy systems
DGRV	Deutscher Genossenschafts- und Raiffeisenverband (German Cooperative and Raiffeisen Confederation)
DL	Decree Law
DSO	Distribution system operator
EC	European Commission
EfS	Energy for Sustainability Initiative
EE	Energy Efficency
EEG	Erneuerbare Energien Gesetz (Renewable Energy Sources Act)
EU	European Union
EEWärmeG	Erneuerbare Energien Wärme Gesetz (Renewable Energy Heat Act)
FiP	Feed-in Premiums
FiT	Feed-in Tariffs
GBR	Gesellschaft bürgerlichen Rechts (Civil Law Partnerships)
GDP	Gross-Domestic Product
GenG	Genossenschaftsgesetz (Cooperative Act)
GER	Germany

German federal states:

BW	Baden-Württemberg
BY	Bayern
BE	Berlin
BB	Brandenburg
HB	Bremen
HH	Hamburg
HE	Hessen
MV	Mecklenburg-Vorpommern
NI	Niedersachsen
NW	Nordrhein-Westfalen
RP	Rheinland-Pfalz
SL	Saarland
SN	Sachsen
ST	Sachsen-Anhalt
SH	Schleswig-Holstein
TH	Thüringen

GHG	Greenhouse gas
GmbH & Co. KG	Gesellschaft mit beschränkter Haftung & Compagnie Kommanditgesellschaft (Limited Partnerships with Limited Liability Companies as General Partner)
ICA	International Co-operative Alliance
IEA	International Energy Agency
KG	Kapitalgesetzbuch (Capital Code)
kWh	Kilowatt hour
KWKG	Kraft-Wärme-Kopplungsgesetz (Combined Heat and Power Act)
MS	Member states
MWh	Megawatt hour
NUTS	Nomenclature of territorial units for statistics
n.s.	Not specified
PT	Portugal

PY	Publication year
RE	Renewable energies
RE cooperatives	Renewable energy cooperatives
RES	Renewable energy systems
SCE	Statute for a European Cooperative Society

1 Introduction

According to the International Energy Agency (IEA) electricity generation and heating account for around 42% of all CO_2 emissions and several other hazardous greenhouse gas emissions (IEA: CO2 emission report, 2015). The European Union (EU) and national governments acknowledged the need to take actions against the rapid climate change and established sustainability targets as an integral aspect of energy planning, and policy-making. In recent years, a certain progress has been noted, visible through the decreasing energy intensity in some countries, nevertheless, the pace of the much needed energy transition remains too slow, with the devastating result, the world remains off track to comply with international climate and decarbonisation targets (IEA: Track the energy transition, 2015).

In order to stabilise emissions, policy-makers, scholars and citizens aiming for a new paradigm of a sustainable energy supply, rely on low carbon electricity generation technologies, in particular renewable energies (RE). This long-term energy transition strategy entails innovations and technological development at all levels of the energy value chain, first and foremost, through the deployment of decentralised RE and the consequent restructuring towards a decentralised energy supply, while simultaneously taking advantage of the embedded benefits. The promotion of decentralised energy concepts and technologies enables society to harness several advantages, including reduced distribution and transmission costs, reduced grid power losses, more efficient data management systems and an eased implementation of a larger share of renewable energies (Bauwens et al., 2016). In turn, this structural reorganisation requires, in the most favourable case, an active role of energy consumers who shall evolve and become simultaneously consumers and producers of electric energy, referred to as “prosumers” (Kampman et al., 2016).

In this context, it is meaningful to study variables that foster citizen participation in energy projects. Community initiatives are increasingly perceived as key actors in the energy transition, while concurrently incumbent actors suffer increased competition and a lack of trust from the public (Kalkbrenner and Roosen, 2015).

Since mutual trust increases the willingness of citizen to adapt new technologies, the implementation should be steered by trustworthy individuals and organisations based in local communities. Furthermore, community participation schemes enhance social acceptance and awareness of energy issues (Mignon et al., 2016). Thus, the object of this study is to analyse the enabling conditions under which a specific form of community initiative – renewable energy cooperatives emerge and develop. RE cooperatives set themselves apart through their organisational forms, business models and core principles, like democratic governance. Instead of having the single aim of profit maximization, cooperatives aim for economic, social and cultural advancement of its members and therefore take part in the social economy (Draheim, 1952). These goals make cooperatives particularly compatible with the energy transition goal of a sustainable energy system in the EU.

Still, there is an unequal geographical distribution of RE cooperatives across Europe with almost 80% being based in Austria, Denmark and Germany (F&F, 2016). Conversely, in other EU countries, including Portugal, the development process of RE cooperatives has been slower and research on such organisation schemes remains scarce. Various studies were carried out to assess the conditions of RE cooperatives in a single country but just a few use a comparative approach across countries. This dissertation intends to bridge this research gap within the scope of analysis, comprising Germany and Portugal for several reasons.

Firstly, both countries are committed to a low carbon energy future and perform as role models for others countries. Secondly, until recently both countries had similar regulations for incentivising renewable energy generation, thanks to which the renewable energy share in Portugal and Germany have experienced a strong increase. Thirdly, despite these similarities, both are characterised by major market disparities, namely the electricity market liberalisation process and current structure. Fourthly, the range of actors, varies greatly. In Germany, the energy transition involves a wide range of actors contributing to achieve a system change, in particular RE cooperatives, whereas in Portugal a couple of national champions seem to realize the energy transition alone, excluding citizen from taking advantage.

The primary objective of this dissertation is to conduct a quantitative and qualitative comparative cross-country analysis to acquire and examine data on the emergence and development factors of RE cooperatives. This aims to understand the regulatory, financial and organisational facilitators and barriers of RE cooperatives in both countries. Ultimately, the goal is to develop tailored policy recommendations, both for Portugal as a country with problems to establish RE cooperatives in the energy sector and for Germany as a country with a strong RE cooperative development, but where recent policy or regulatory trends seem to be particularly discouraging for the further development of this specific business model. Secondary objectives include, the identification of the standpoint and framework of the EU and national governments in regards to RE cooperatives as well as to gain an understanding about the motivations of cooperative members to join this kind of organisation. To be able to realize these goals and for knowledge building purposes, a systematic review of existing bibliographies was carried out to determine the appropriate methodological approach.

This document is organized through five chapters and the remainder of this dissertation is structured as follows:

Firstly, chapter two describes the general context and brief history of the cooperative movement as well as provides the current market data of RE cooperatives linked to RES shares in the electricity production mix. Furthermore, the interrelation between citizen empowerment in the energy sector and the energy transition itself is highlighted. Thereafter, we offer an overview of the legislative background for RES deployment at the supranational EU level, the targets and the most standard support measures implemented.

Chapter three embodies a summary of RE cooperative studies utilizing the survey methodology in a European context. The findings revealed are used to describe the emergence and development factors of RE cooperatives and subsequently discusses them with regards to the scope of analysis to clarify the socioeconomic connections within the market environment.

Chapter four discusses the development, implementation, and results of the *Renewable Energy Cooperative Survey* project. This chapter outlines the applied methodology and the survey preparation process, explains its structure and cooperation within the project. Furthermore, it describes the deployment method and presents the acquired data and results, and finally, discusses the outcomes in light of the findings gained throughout the deployment process, providing recommendations for future studies that will use surveys as a data collection method.

The concluding chapter summarises the main findings of the research and provides policy recommendations, and suggests future research paths assisting to realize higher RE deployment rates and greater involvement of citizens in Germany and Portugal.

2 The Energy Transition Strategy of the European Union and the Rise of the Cooperative Movement

Cooperative enterprises as a worldwide practiced business form have not enjoyed the same level of public attention and academic research as investor owned enterprises. Despite this lack of interest, cooperatives represent a major generator of economic wealth and jobs throughout the world. According to the International Co-operative Alliance (ICA), the cooperative movements brings together over 800 million people while employing more than 250 million people directly in 2015 (ICoop Alliance, 2016).

2.1 Concept of cooperatives

Cooperation among people can be found in every historic era in one form or another. Since the beginning of mankind groups have been formed, whenever a single person was not able to perform a task, to satisfy economic and other needs. The cooperative model exists in various businesses ranging from agricultural producers, grocery and financial institutions, hardware wholesale, worker unions as well as housing and building societies and, of course, RE cooperatives with a focus on energy production, distribution and trade (Zeuli; Cropp, 2004). The motivation to establish a cooperative varies and can, for instance, stem from the need to improve the negotiation power, cost reduction, access to products and services that would not be available otherwise, expansion to new market opportunities, and improvement of the individual income (Prüssing et al., 2015). As the first international organisation, the International Labour Organisation (ILO) defined cooperatives in their Recommendation No. 193. This definition has been adopted by the ICA as the nowadays leading non-governmental authority on cooperative definition and values, with over 230 member organisations in over 100 countries. These business enterprises are defined as:

"A co-operative 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." (ICoop Alliance, 2016).

Cooperatives should be run in compliance with the seven core principles, which are shown in the figure 1 below.

Figure 1: The seven cooperative principles (own elaboration, based on data from ICoop Alliance, 2016)

The ICA definition recognises the most vital element of cooperatives: voluntary membership. True cooperation with other persons arises from a belief in mutual help, so that nobody can be forced to engage in a cooperative. In a proper cooperative people can join voluntarily and have the choice to leave at any time, if they wish to do so. Cooperatives differentiate themselves through their business organisation due to a singular model of ownership. By definition, cooperatives as a business entity are owned by their users rather than their investors, as it is the case for capitalist business entities. Thus, cooperative members need to invest at least some of the cooperatives capital to perform business activities. With the outcome that members enjoy what is referred to as the "double quality", being both simultaneously members of the cooperative and users of the enterprise. The first intrinsic quality represents the member's earnings depending on their individual investment volume with net profits that have been generated and are distributed among them (Huybrechts and Mertens, 2014).

Cooperatives aim, like investor owned enterprises, for economic success. Yet, they focus on the enhancement of benefits for all their members instead of just maximizing the benefits for a small group of investors. Mazzarol (2009) has shown, that by doing so, they prevent economic privileges and enhance economic equity.

Collaborative decision-making, represents the second quality, and means that all members have full and equal voting rights, on a “one member, one vote” basis (Huybrechts and Mertens, 2014). Through democratic governance every member influences important and long-term business decisions either directly or indirectly through their representatives, which have been elected by the board of directors. Voting rights are tied to the membership status and the one member one vote principle - not to the level of investment or patronage of the cooperative. Therefore, cooperatives represent the most democratic legal form that exists and simultaneously prevents superiority of certain members.

Both the principle of voluntary open membership and democratic governance make cooperatives particularly suitable for the multidimensional goals of sustainability (Šahović and Silva, 2016). The shared ownership leads to a high degree of personal responsibility and dedication to the organisation, thereby the personal investment naturally plays a key role. Member’s personal contributions have the effect that they generally have a great interest to run the business without greater difficulties and excessive risk taking (Prüssing, 2015). Moreover, a feeling of identity evolves among members and a general strong member orientation due to the simultaneous owner and beneficiary role, this relates in particular to members of the board with the effect that all interests of members are focused and supported by the cooperative (Vogt, 2010). Additionally, cooperatives tend to remove monopolies within a market, distribute earnings locally and frequently operate most successfully in market niches, where investor owned enterprises are not viable or the profit margins remain too low. With the focus on member benefits, local supply and services as well as the concern for the local community, they proved to be an effective business model to support socially and economically disadvantaged regions (Mazzarol, 2009). Therefore, cooperatives are considered as great contributors to local economic development.

The first cooperative businesses were born in the 1840´s in underdeveloped mainly rural areas, back then as well as today they stabilize communities since they are community-based businesses and distribute, recycle, and multiply local expertise and capital within a community. They enable their members to generate earnings, create jobs, accumulate assets, provide affordable, quality goods or services and develop human as well as social capital (Nembhard, 2014).

To put it in a nutshell, cooperatives set themselves apart through their organisational forms, business models, core principles and in case of energy cooperatives a major reliance on RE generation technologies. Instead of having the only goal of profit maximization, cooperatives aim for economic, social and cultural advancement of their members and therefore take part in the social economy (Draheim, 1952; Mazzarol, 2009). RE cooperatives are entities that engage in activities along the energy value chain as shown in figure 2. They may produce electrical energy from renewable energy sources, operate as distributor and manage grid infrastructure, sell “green power” to customers or provide technical services, such as consultancy, legal services, engineering, and certification.

Figure 2: Activities of cooperatives (own elaboration)

2.2 Brief history of cooperative movement

In the beginning of the 19th century, cooperatives primarily emerged within the working class to improve the living conditions and offer better opportunities to workers. Consumer and producer cooperatives were also created to offer an alternative to dominant monopolists. The rise of cooperatives was deeply interconnected with the emergence of the “social question”. Thus, besides their economic function, cooperatives were particularly created as a part of a broader social movement, which had political ambitions to transform society, mainly due to unbearable living conditions and deep social divisions at that time (Huybrechts, Mertens, 2014; Brendel, 2016).

Energy cooperatives emerged in Europa and North America during the first decades of the 20th century where they played a key role in rural electrification (Zeuli et. al., 2004). Bauwens (2014) takes the US electricity sector as an example, where in the mid-1930s nearly 80% of rural farms and homes were not electrified. With the legislation of the Rural Electrification Act in 1936 the federal government provided loans, loan guarantees and other support measures to extend electric infrastructure and service into rural regions. "*Within four years…the number of rural electric systems in operation doubled, the number of consumer connected more than tripled and the miles of energized line grew more than five-fold. By 1953, more than 90% of U.S. farms had electricity*" (NRECA, 2016). Due to its success, similar programs have been successfully replicated in various countries around the world, including Bangladesh, Costa Rica and Nepal (NRECA, 2016; Mazzarol, 2009).

According to an analysis of Bauwens (2014), the two main drivers leading to the emergence of RE cooperatives are electrification and environmental concerns. Cooperatives emerge due to their way of doing business, which provides several advantages over other organisational and legal forms, in particular for local communities. Yildiz et al. (2015) identified four phases of energy cooperative development in Germany: a boom in the first half of the 20th century – rural electrification, an interim phase until the late 1980s - centralisation of electricity market, a pioneering renewable energy phase in the 1990s – pilot projects pioneering in the field of RE technologies, and a revival of the cooperative model in the energy sector in the 21st century with a major reliance on RE.

This new wave of formation of energy cooperatives has been witnessed in various industrialised countries, especially in Europe. The reason for the revival of this specific organisation primarily stems from pure environmental concerns (Sagebiel et al., 2014; Musall and Kuik 2011, Klagge et al., 2016).

The following chapter examines the current state and importance of the cooperative movement within the energy transition and additionally highlights the objectives as well as necessity of speeding up the process with the aim to meet the European emission reduction targets.

2.3 Cooperatives in the energy market

2.3.1 Evolution and current state

As mentioned in the previous chapters, energy cooperatives are far from being a new phenomenon. The first boom phase occurred in the first half of the 20th century, where cooperatives played a key role in rural electrification. After a policy shift towards centralisation most cooperatives disappeared (Sagebiel et al., 2014). Most modern recently established energy cooperatives can be considered as truly renewable energy cooperatives since they almost exclusively generate electricity from renewable energy sources. Policy and legal reforms as well as technological developments in the field of renewable energy influence the cooperative movements strongly. Thus, the European Commission (EC) supports and boosts renewable energies as well as energy cooperatives with different policies and legislatives instruments. With the adaption of the 20-20-20 targets the European Union committed to transform itself into a highly energy efficient and low carbon economy. As shown in figure 3, the renewable energy share has steadily increased in all 28 European Union member states (MS), including in Germany and Portugal.

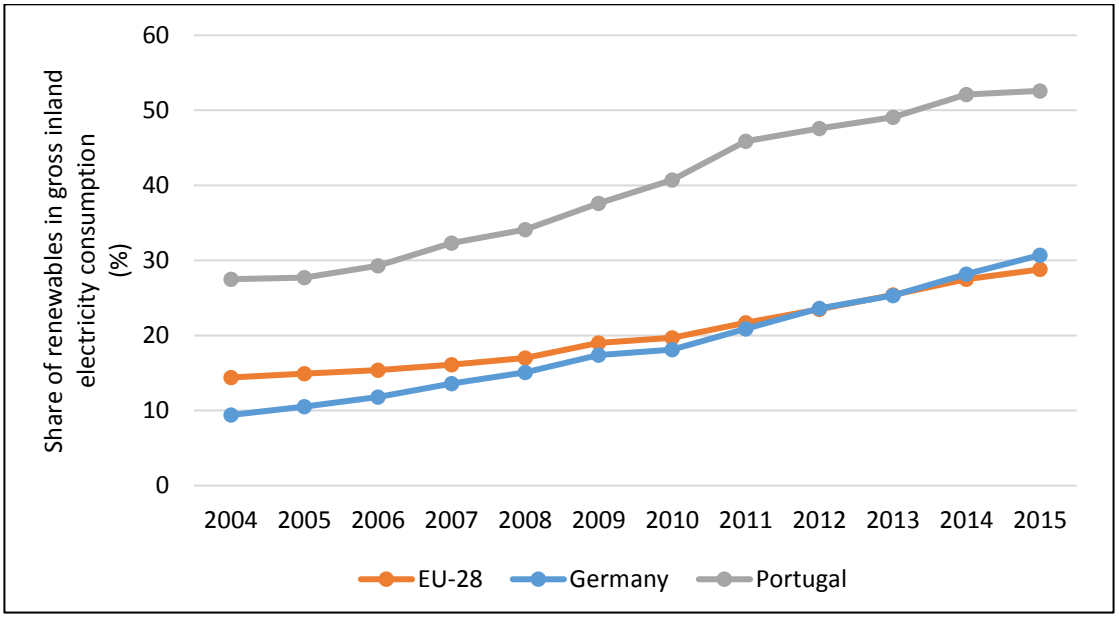

Figure 3: Proportion of electricity generated from renewable sources (own figure, based on data from Eurostat data, 2016)

Germany is one of the most active countries with regards to renewable energy installation and experienced a boom between 2005 and 2015 with annually increasing expansion rates (Sagebiel et al., 2014). In 2015, more than 30% of the total energy produced came from wind (12%), biomass (7,7%), solar (5,9%), and hydro (3%) plants. This represents a remarkable share for a country with such a large industrial sector, highlights the Agora, 2016 initiative. In the same year, Portugal accomplished a record share of 52,6% of the total electricity production and, moreover, ran in May 2016 an extraordinary four days (107 hours) straight on renewables. Most of the renewable electricity produced came from wind (22,5%), hydro (19%) and biomass (5,1%) (HBS, 2016; APREN, 2016).

Both Germany and Portugal achieved great results and are leading nations in providing clean and sustainable electricity. Nevertheless, the energy transition follows two completely different paths with regards to the empowerment of local citizen and the development of RE cooperatives.

There were 2.397 renewable energy cooperatives in Europe, according to the European Federation of Renewable Energy, in 2014. The overview of the cooperative membership structure reveals that the national distribution over the continent is disproportional. Almost 80% of all members are based in Germany, Austria and Denmark, whereas Portugal, UK and Spain altogether are represented by just 77 cooperatives (F&F, 2016). The relevance of this emerging business model becomes apparent by observing the extent to which cooperatives are responsible for the increase of renewable generation capacity in some European countries. The most prominent example is Germany where individuals, communities and cooperatives own between 40-50% of all installed renewable energy capacity, with a focus on solar, wind and biomass (Hall et al., 2015). A market study of the German-Renewable energy agency (Agentur für Erneuerbare Energien) reveals the extent of citizen investments in renewable generation capacity, as shown in figure 4. Almost half of all installed RE capacity belongs to citizens whereas traditional utilities own a mere share of 12%.

These figures demonstrate that the population shoulders the energy transition in Germany to a large extent. The citizen energy share is subdivided to roughly 52% individually owned and 48% owned by cooperatives (AEE-B, 2014).

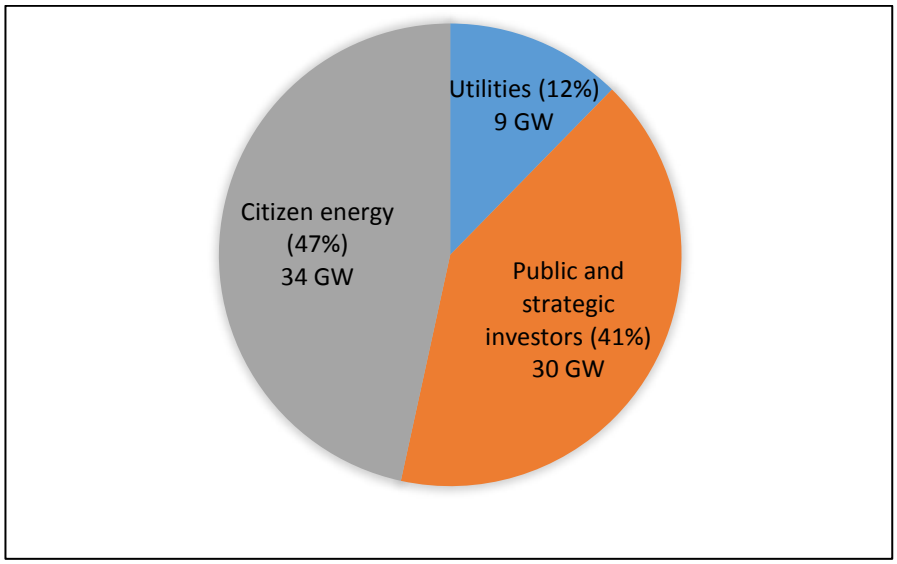

Figure 4: Installed renewable generation capacity in Germany by owner group in 2013 (own elaboration, based on data from AEE-B, 2014)

Denmark, another prominent example, generated 46,7% of the total electricity production from renewable sources in 2013, almost exclusively from wind power and biomass. By acknowledging that cooperatives and farmers represent a market share of over 50% of all installed wind power capacity, the enormous potential of citizen participation and investments volumes become apparent (Agora, 2015; HBS, 2015). However, Portugal with just one RE cooperative1 is a latecomer in this respect and is thus located exactly on the other side of the spectrum, since large investor owned enterprises own almost 100% of all wind farms and hydropower plants. (Graca and Gomes, 2016). Despite generating almost two-thirds of all its electricity from renewable energy sources and boosting the fifth highest renewable share of all IEA-members countries, Portugal's energy market remains in the hand of large centralised capital enterprises and excludes the citizens from taking advantage of the energy transition (IEA-Portugal, 2016).

[1] Additionally, five distribution cooperatives have been identified but since they distribute to a large extent electricity produced from fossil fuels, they aren´t considered as RE cooperatives.

Clearly, there is a significant growth potential in the number of individuals and RE cooperatives that could engage in activities along the energy value chain.

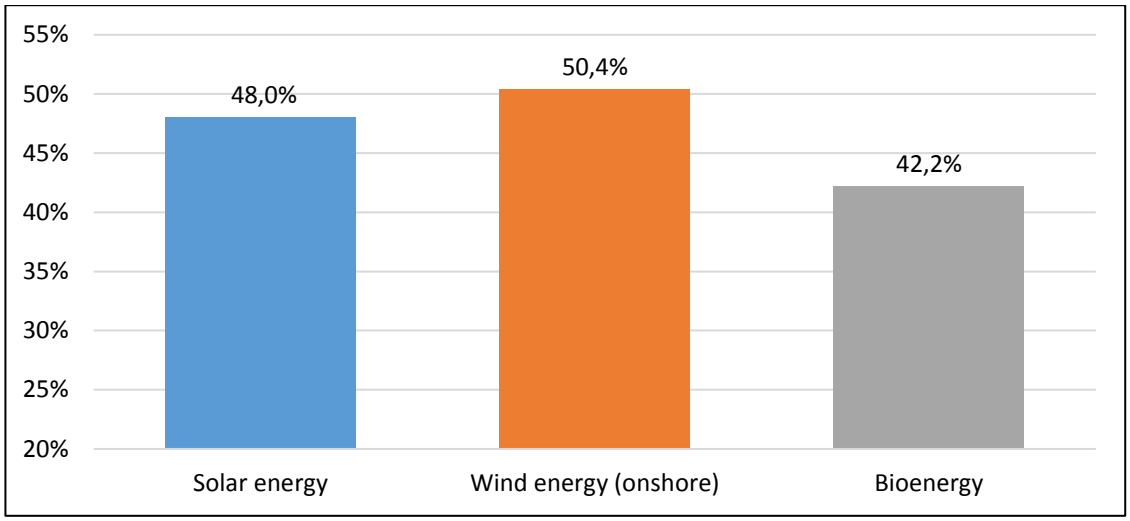

Figure 5: Ownership share of citizen ownership of the installed RE capacity in Germany, subdivided by technology in 2012 (own elaboration, based on data from Leuphana, 2013)

As mentioned earlier, the revival of the cooperative model in Germany became possible and was increased in tandem with the rise of renewable generation technology in the second half of the 2000s. Additionally, a legislative change in 2006 made it easier for citizens to establish cooperatives as a legal entity. Therefore, the number of cooperatives increased until 2010, as shown in figure 6. In 2011/2012 a peak in growth most likely indicates a saturation effect and marked a general policy shift away from generous support due to a sharply increasing RE surcharge, failed grid expansion and enormous pressure from utilities to slow down the transition (Morris, 2015; Leidreiter, 2014). Just 40 RE cooperatives were established in 2015, representing a decline of 25% compared to the previous year. The chairmen of the German Cooperative and Raiffeisen Confederation states: "*The boom years are over for the time being. Above all, it is the financial restrictions for new photovoltaic projects, which are seriously hampering the activities of energy cooperatives. The introduction of tendering sets up yet more barriers to citizens' energy.*" (DGRV, 2014). Cooperatives currently experience difficulties in developing new business models and numbers grow much slower. Further development depends on concrete changes of the legislative framework, as the German Renewable Energy Source Act (EEG) was recently under its fifth revision. Consequently, the future prospect remains uncertain (Morris, 2015).

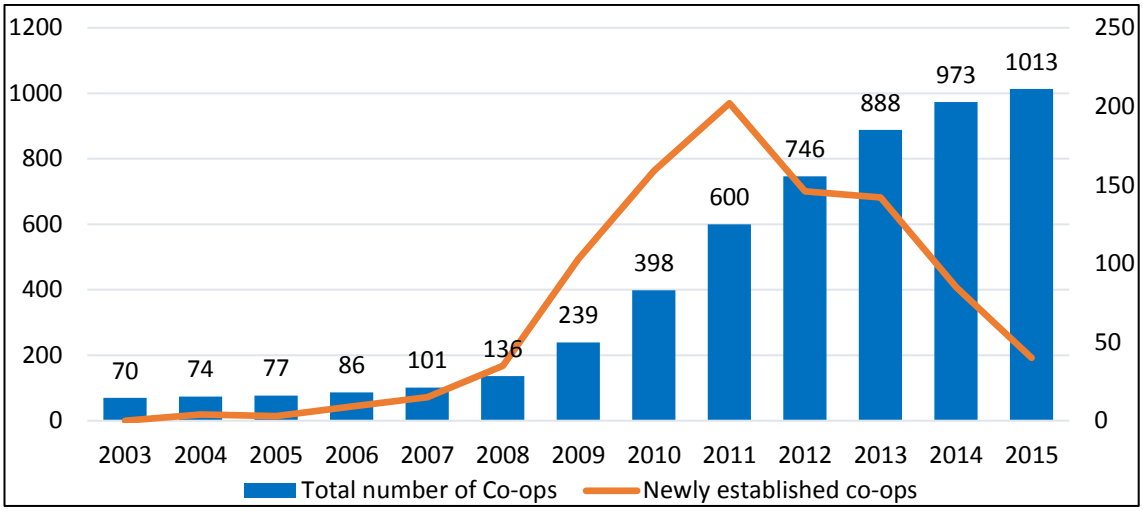

Figure 6: Development of cooperatives in Germany (own figure, based on data from Morris, 2015; Energiezukunft, 2016)

In 2012, Holstenkamp and Müller examine the incorporation of cooperatives in Germany where they found a clear decline in total numbers since 2011. Two years later Müller and Holstenkamp (2014) reviewed their results with updated numbers and development issues identifying four major factors. Firstly, a cut in subsidies decreased profitability and a new support scheme (tendering) increased the risks for investors. Secondly, investments conditions experienced legal uncertainties due to the implementation of the German Capital Investment Code (Kapitalgesetzbuch-KAGB). Thirdly, renewable energy projects compete with oil and gas, which currently have low prices. Finally, new business models require time and know-how, which most cooperatives may not have to a sufficient extent.

The repeated amendments of the *EEG* probably limit the rapid development of both the RE cooperative and RE deployment. This political shift comes at a time with worldwide skyrocketing RE investments leaving Germany behind and undermining the efforts of community initiatives. The policy change strengthens exactly these utilities, which have not participated in the energy transition away from harmful fossil fuels. Thus, it is doubtful if the amendments will lead the way towards an 80% share of renewables in 2050 but certainly will curb the diversity of actors (Leidreiter, 2014/2016; Müller and Holstenkamp, 2014; Prüssing et al., 2015). That Germany still serves as a role model for other countries, has become questionable. Consequently, a deeper understanding of the influence of political factors on the advancement of RE cooperatives needs to be developed.

2.3.2 Classification and distinction

Germany had taken a pioneer role in the process of the energy sector transition where RE cooperatives serve as an important building block with an impact on the whole electricity value chain (Prüssing et al., 2015). Nevertheless, a comprehensive theoretical classification of RE cooperatives in Germany and other countries was missing in literature. Yildiz, et al. (2014) identified the need of cooperative classification and distinction to enable academic research and strengthen the concept of RE cooperatives. This study adopts a comprehensive approach with three criteria: technology, level of value addition and regional distribution, used in a similar manner by various studies (Mignon et al., 2016; among other).

Following the proposed value chain classification approach, a brief explanation is presented below:[2]

- Generation/production (73%): Cooperatives mainly involved in running/owning power generation facilities or investing in firms that operate them. Generation includes apart from electricity also heat production.

- Distribution/Transmission (22%): Cooperatives that operate local electricity grids or heating networks. Frequently these cooperatives also own generation facilities, but their main business is concentrated in the network infrastructure.

- Trading (5%): Cooperatives with their main activities in buying and selling energy (or energy resources). Cooperatives that sell the energy generated are grouped as generation cooperatives.

As the first classification reveals, the majority of RE cooperatives engage in generation/production, thus a further technology-in use classification seems useful to differentiate within this large group. Most RE cooperatives utilize PV systems 77%, followed by biomass 31%, and wind with 12%.

[2] Shares illustrate the fields of activity of German RE cooperatives, data from Yildiz, et al., 2015.

Hydro-power with 5% plays a minor role as well as solar-thermal and geothermal electricity production both just over 1%.[3] As shown, cooperatives engage in activities all along the energy value chain and are spread throughout Germany, however, there persists an unequal spatial distribution across the country, as displayed in table 1. Bavaria is the federal state with the highest number of RE cooperatives, followed by Baden-Württemberg and Lower Saxony.

Region	BY	BW	NI	NRW	HE	SH	TH	RP	SN	ST	BE	MV	BB	SL	HB	HH
Nr. of coops	237	145	127	109	55	35	34	34	24	20	19	16	12	8	7	6

Table 1: Spatial distribution of RE cooperatives in Germany (own elaboration, based on data from AEE-A, 2014)

Apart from some exceptions, most German RE cooperatives use renewable energy sources that are promoted by feed-in tariff (Yildiz et al., 2015). As already mentioned, so far just one RE cooperative has been established in Portugal. It demonstrates similar characteristics as it engages in generation/production and also relies on the PV technology that is promoted by feed-in tariffs, like many of its German counterparts.[4]

The classifications are needed for the questionnaire design and analysis that will be carried out in this dissertation. It is clear that cooperatives focus on photovoltaics and biomass since the installation, operation and scalability are comparably simple. Cooperatives often use roofs of public buildings, like town halls, schools or indoor swimming halls, provided by municipalities or social institution like churches. Greater risks, higher upfront costs as well as land competition prevents RE cooperatives often from engaging in wind energy projects (Huybrechts, Mertens, 2014). Furthermore, in the search for new business models, a growing number of RE cooperatives engages in complementary business fields such as providing technical assistance or consultancy, legal services, engineering and certification as well as offering innovative e-car sharing models and EE-contracting (EA-RP, 2016).

[3] Shares illustrate the technologies used by German RE cooperatives, data from Yildiz, et al., 2015.
[4] Information retrieved from the official cooperative website, http://www.coopernico.org.

2.4 The role of energy citizen and cooperatives within the energy transition

An extensive literature in the field of energy transition addresses the triple challenge of sustainability, competitiveness and affordability, with a consensus that the transition must be cost-effective (Foxon, 2013; Nochevnik, 2014). Thus, researchers constantly try to identify the optimal measures to realise such a system. Through the transition towards a more decentralised and sustainable energy sector, existing traditional centralised network actors are increasingly challenged by new market players, especially community-based cooperatives. New technologies have triggered the entry of these new players creating an environment favourable to Research and Development (R&D). The participation of a broader range of actors has increased the public acceptance of the energy transition and as a direct result companies and policy makers push for greater changes (Fabra et al., 2015; Vergados et al., 2016).

Figure 7: Technology adaption process (own elaboration)

Main steps to tackle climate change and to increase the penetration of renewable energy systems have been initiated by the European Union as a first mover. The EU achieved a clear competitive advantage over other world regions that started pursuing climate actions at a later stage (Karkatsoulis et al., 2016). Seyfang et al. (2012) found that although Europe is the leading region in climate change mitigation, environmental NGOs and other civil society organizations ask for more ambitious targets in terms of renewable energy penetration, reduction of GHG emissions, and for a greater involvement of the community in achieving these goals, throughout the entire energy value chain.

Since the EU energy market has been liberalised, consumers cannot only choose their energy provider, but may become “prosumers” by producing energy with their own PV system, wind turbine or combined heat and power generation systems argue Van der Schoor and Scholtens (2015).

As the German Federal Ministry for Economic Affairs and Energy (BWMi) states:

"*The energy transition is putting an end to the old dichotomy between producers and consumers of electricity and heat. Instead, we now have prosumers who can do both."* (BMWi-prosumer, 2016)

This has become an attractive opportunity for a growing group of energy consumers and small to medium size enterprises. In light of these activities, we witness the expansion of social networks related to energy. This new wave of citizen engagement takes part in the social economy drawing its strength from a fundamental distrust, ideas about self-empowerment and autarky from large energy companies explain Bomberg and McEwen (2012). In this context, engaged "energy citizens"[5] scale up from the individual to the community level and thereby foster the development of a decentralised energy provision. Due to the institutionalization and incorporation of energy cooperatives, energy gets produced and distributed locally (Van der Schoor, Scholtens, 2015).

2.4.1 Involvement of consumers

An enhanced involvement of citizens is a necessity as opposed to a mere possibility. With increasing shares of RE in the EU, the consumer´s role changes inevitably and transforms them into: "energy citizens". Thus, consumers will become an active part of the energy system – as energy producers, suppliers of demand side flexibility as well as energy storage options, as witnessed in many European countries. Consumers become electricity producers by installing solar PV on their roofs or by participating in cooperatives for large scale PV, biomass or wind installations. Various cities and communities actively pursue the goal of becoming self-sufficient and abandon fossil fuels by implementing projects to use electric cars or battery centres as energy storage for locally produced renewable electricity, according to Vergados et al. (2016).

[5] The terms "energy citizen" and "prosumer" can be used interchangeably, both designate individuals, households, private- or public companies that move from being solely energy consumers to do both produce and consume energy (Kampman et al., 2016).

Kalkbrenner, Roosen (2015) express that energy citizen engaging in RE projects foster the psychological commitment and promote a way of responsible energy usage (energy responsibility), avoid or lower opposition and implementation problems, facilitate the energy transition and strengthen the local economy.

In Europe, the potential of energy citizens has been analysed by a research group around Kampman et al. (2016). They concluded that about half of all EU households could potentially become active participants producing energy either individually or in a cooperative by 2050. This implies that 45% of the electricity demand could be supplied though energy citizens involving roughly 264 million people all over Europe. However, costs and benefits depend on how authorities modify energy market framework.

Through the efforts to develop a modern smart grid across Europe - the consumer is expected to play a prominent role within the future energy system, on both the demand and supply side, highlight Stromback et al. (2011) and Goulden et al. (2014). In the old electricity system, the consumer is “managed”, whereas in the future vision of the electricity system the consumer becomes a “manager” himself, in the process of consumption and generation. Moreover, active participation of the demand-side is indispensable in achieving emission reduction target and realizing efficiency improvements.

There is however the problem that the common citizen rarely cares about his energy consumption, impact of personal behaviour patterns and resultant consequences due to a lack of information on their consumption and missing incentive schemes to modify them (Stromback et al., 2011). Therefore, consumers should be increasingly empowered by smart grid technologies, like for instance smart meters or in-home displays. These technologies can have an enabling function and raise the awareness about energy consumption through the visualisation of loads or personalised information of typical energy usage patterns. Consumer engagement usually develops in response to an economic signal. Thus, consumer demand response programs try to encourage customers to actively participate in programs modifying consumption in response to price signals. In time-of-use scheme for instance reduces the consumer loads during peak hours and shifts them to off peak hours receiving remuneration in return. Prosumers exhibit the highest degree of control over the personal energy usage.

By being aware of their energy consumption and patterns, they avoid using electricity from the grid in peak hours and thus mitigate the critical increase of energy demand during peak hours. In this context, demand response schemes allow and boost consumers to play an active role (D´Oca et al., 2015; Stromback et al., 2011).

A research group around Golden et al. (2014) found that consumers with a direct experience of community or personal energy systems have a higher awareness of energy´s role within their daily life. They engage as active consumers more quickly and demonstrate a greater openness towards new energy technologies. One has to note that community energy schemes make energy more salient through the "creation" of electricity. This engagement as part of a general reorientation towards energy, as an active component in life, instead of being something taken for granted, eases the transition to a lower carbon and sustainable lifestyle. Moreover, when a profit-seeking company asks consumers to consume less energy or to invest in more efficient appliances, the reaction is mostly distrust and a rejection of new technologies, resulting from the assumption that lower energy costs would not be passed on. Hence it is no surprise that Dotsen (2009) emphasizes the importance of familiarizing citizens with impacts of the energy sector on the quality of their life's. He further states that successful innovations have a certain goal – by influencing both the economy and society, they build social prosperity.
Community-based initiatives, such as cooperatives, where citizen take ownership invert the distrust in trust and spur willingness to go along with technological innovations, found Walker et al. (2010). Since generated profits remain within the community and fund further advancement locally. Therefore, the shared ownership model of community schemes supports both the energy citizen concept and the energy transition. Similar to that, Bonn and Dieperink (2014) summarise that involvement, participation and the possibility of co-ownership constitute important factors to gain the trust and support of the community. Moreover, these factors have a multiplier effect creating and intensifying positive outcomes, such as energy savings and a climate-friendly attitude. Dorniak and Lautermann (2016) argue that the energy transition in Germany depends on the actionability and engagement of local grassroots projects. They raise further the question to what extent the energy transition transforms the energy sector – Is it a technical infrastructure project or a cultural shift in terms of distribution of power and choice.

2.4.2 Political willingness

The challenge of a successful and in particular rapid energy transition can be achieved more easily by including many smaller community actors as they have proved to be more effective, flexible and trustworthy than large investor-owned corporations (Walker et al., 2010; among others). Simultaneously, energy citizens, in any form whatsoever, enable the possibility to take advantage of all the positive "side effects". Therefore, the EC and national governments should not safeguard and maintain the existing centralised system, but rather acknowledge the full potential of an active consumer and decentralised approach.

A first step was initiated in 2015 with the "*Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*". The EC moves the citizen to the core of the Energy Union revealing the vision of an electricity market where the citizen takes ownership of the energy transition benefiting from technological development and reduced energy bills. In other words: the concept of energy citizen as well as the formation of energy cooperatives are embraced and supported (EU, 2015). The vision of the future Energy Union has become widely accepted, however, it remains a pure vision and needs to be followed up by a serious political change.

Skillings (2016) describes the demand side of the energy market as a "sleeping giant" that has the power to transform the energy system. He further points out that the EU may be left behind by other major world regions, in the race to create an efficient, flexible and low carbon energy system, as the regulatory and market framework differ. A recently published IEA-market report (2016) reveals that the EU loses its position as a frontrunner, stating that China and the U.S. are racing ahead of the EU in the build-up of renewable capacities.

Imke Lübbeke, head of climate and energy at WWF's European policy office, comments on recent trends saying: "*The European Union is losing its leadership role to the U.S. and China. The global energy transition is accelerating, but the EU is asleep at the wheel, and missing out on the opportunities this could bring for our economy, job creation and health.*" (Lübbecke, 2016).

Securing Europe's leadership position and mastering this dramatic transformation requires a radical new thinking in the area of the market and regulatory framework. To actually place the citizen at the core of the Energy Union a shift must comprise – A move away from a centralised energy market design driven by fossil fuels and unlocking the full potential of RE. The implementation of the decentralised energy provision system and smart grid technologies, will replace centralised generation technologies and large economies of scale to a great extent. Through the enhanced interconnectivity, the electricity system becomes capable of dealing with a larger proportion of volatile RE sources and increases the efficiency through an optimised balance of generation and consumption. (Skillings, 2016; Goulden et al., 2014).

All this together will ultimately unleash the full potential of the new energy system and truly democratise the energy system and provide the most basic need of citizens – heat and electricity. RE and smart grid technologies are considered as the key drivers in making the decentralised energy system possible and feasible. An increasing number of citizens already does its part and contributes to this transition towards a sustainable electricity sector, irrespective of whether as an individual or in a RE cooperative or any other community initiative. It is worth mentioning again that community initiatives and decentralised energy concepts perfectly complement each other (Kampman et al., 2016; among others).

2.5 European Union Energy Strategy – Framework Amendment

2.5.1 Legislation and policy strategy

The European Commission supports and boosts the energy transition with different policies and legislative instruments. With the adaption of the 20-20-20 targets of the Climate and Energy Package in 2008, the European Union committed to transform itself into a highly energy efficient and low-carbon economy. Binding national targets for renewable generation share, which differentiate between countries have been set and were mainly stimulated by generous Feed-in tariffs (EC, 2007).

The "*EC Directive on the promotion of use of energy from renewable sources*", (EU, 2009) states that the expansion of energy production from renewable sources will be fundamental to foster technological development, innovation and regional development, especially in rural areas. They further point out that the RE deployment often depends on local or regional small and medium sized enterprises (SMEs) and independent energy producers. It is important to promote and recognise local initiatives as important actors that foster community development and cohesion by providing income sources and generating jobs locally.

In 2014, the EU set out future policy steps for climate and energy for the period from 2020 to 2030 and calls for a 40% reduction in GHG emissions together with binding national commitments and an EU-wide renewable target of 27% of total energy consumption (EC, 2014).

Name of Directive	Scope and timeframe	Targets	Legal status
Directive 2001/77/EC on the promtion of electricity produced from RES in the internal electricity market	Share of electricity in 2010	· 21% of electricity from RES from total European electricity consumption · 12% of gross domestic energy consumtion by 2010	Voluntary
Directive 2009/28/EC on the promotion of the use of energy from RES	Share of energy from RES consumed in transport, electricity and heating/cooling in 2020	· 20% of gross final energy consumtion at EU level, 10% for transport · National shares defined in NREAP	Binding at EU and national level
2030 Climate and energy Policy Framework	Share of energy from renewable energy sources in 2030, no target for transport and heat	· More as 27% of gross final energy consumption at EU level, · GHG reduction by 40%	Binding at EU but not on national level
2050 Energy Roadmap	Share of energy from renewable energy sources in 2050, econmy wide decarbonisation, Citizen participation	· At least 55% of gross energy consumption · 64-97% of gross final electricity consumption from RES · Citizen participation in community schemes · GHG reduction by 80-95%	No binding targets, pre-legislatives

Table 2: Evolution of the European Union´s Renewable Energy Targets (own table, based on data as indicated)

All these objectives are steps towards meeting the long-term decarbonisation targets with economy wide reductions of more than 80%, which describes the "*European Commission Energy Roadmap 2050"* (EC, 2011) for moving to a competitive low-carbon economy in 2050. Unlocking the investment potential of the private sector and individual consumers as well as creating the framework conditions for such investments presents a major challenge for the EC. Furthermore, the broad involvement of the social dimension in energy planning, lowers the risks of major social dispute and rejection of new technologies. Otherwise, the current pace of the technology deployment may causes serious problems for investors and delays the compliance with emission reduction targets. The greater inclusion of citizen in a transparent decision-making process might help to overcome these obstacles and effectively manage the change.

The "*European Parliament Resolution on the 2050 Energy Roadmap"* (EU, 2013) stresses that the energy transition to a low-carbon and energy efficient economy constitutes an opportunity for SMEs in the EU, operating in the energy production market. They can deliver an excellent impulse to the development of innovation and entrepreneurship and most likely provide jobs in rural and urban areas.

Moreover, the resolution welcomes the inclusion of the social component and "*emphasises the importance of transparency, democratic oversight and civil society involvement*" (EU, 2013), but highlights at the same time the importance to obtain constant progress reports on whether the challenging goals of the Roadmap can be achieved or may need adjustment due to a negative impact on the EU´s economy – related to global competitiveness, employment and social security.

In the newest *Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy* the European Commission moves electricity consumers to the focus of attention and reveals the vision of an Energy Union "*with citizens at its core, where citizens take ownership of the energy transition, benefit from new technologies to reduce their bills, participate actively in the market, and where vulnerable consumers are protected*" (EU, 2015). Furthermore, the EC pledges to provide secure, sustainable and affordable energy and proposes to completely integrate renewables into the energy market. This aims to remove the "old" unresponsive standard Feed-in tariffs (FiTs), and replace them by Feed-in premium tariffs (FiPs), which pay a premium on the market price but then require producers to take responsibility for selling and balancing power.

The new market design aims to deliver a "new deal" for energy consumers based on a three-pillar strategy (EC, 2015).

First pillar, *consumer empowerment* – Saving money and energy by enabling consumers to adapt consumption through access to real-time consumption data and the possibility to choose the energy supplier freely on an easily accessible, transparent and trustworthy market. As a result of the growth of volatile RE, the EC aims to realise the value of demand side flexibility with supply contracts based on dynamic pricing. The document explains further, that the trend of consumer participation- either in decentralised generation with RE or in providing energy storage options- on an individual or community bases, can help to reduce grid losses and congestion, which in turn leads to network cost savings.

Second pillar, *smart homes and networks* – Deployment of smart grid technologies should ease and automate consumer involvement. Therefore, technical interoperability should be guaranteed as well as consumer access to their consumption data. The realisation will be closely monitored by the EC. As network investment and operation management will be crucial, the document points out that distribution network operators should engage in innovative solutions as a neutral market facilitators.

Third pillar, *data management and protection* – A major concern in the new market design is keeping consumption/metering data under the control of the consumer and when access is granted to third parties, protection and security of consumer data must be guaranteed to gain the full support and trust of the end consumer.

The EC's plans for the Energy Union could offer new business opportunities for cooperatives, citizen engagement and boost the economy. The new EU Energy Market Design is currently being drafted, and will define the words "citizen involvement". The EC is aiming at a transparent and fair economic participation by all Europeans through democratically organised and jointly owned energy organisations in an energy market ensuring a level playing field for all market actors (EU, 2015).

2.5.2 RE support schemes

The European Union, as a supranational organisation, sets the framework conditions on how to achieve goals and targets for RE. Member states (MS) have to support and achieve mandatory RE targets but can choose among suitable support schemes. After adopting the *Renewable Energy Directive* (EU, 2009) all MS were obliged to submit *National Renewable Energy Actions Plans* (NREAP), stating sectorial targets, type of technology, growth trajectory, reforms and measures to develop RE. Currently, MS apply diverse instruments, whereby common support instruments in NREAP include:

- Feed-in tariffs (FiT);
- Feed-in premiums (FiP);
- Quota obligations;
- Loan guarantees;
- Soft loans;
- Investments grants;
- Tax incentives and
- Tendering (auction schemes)

Figure 8 presents the key support measures that are operating support instruments subdivided into quantity (quota obligations and tendering) and price based instruments (FiT and FiP). A further detailed explanation is provided in the Annex.

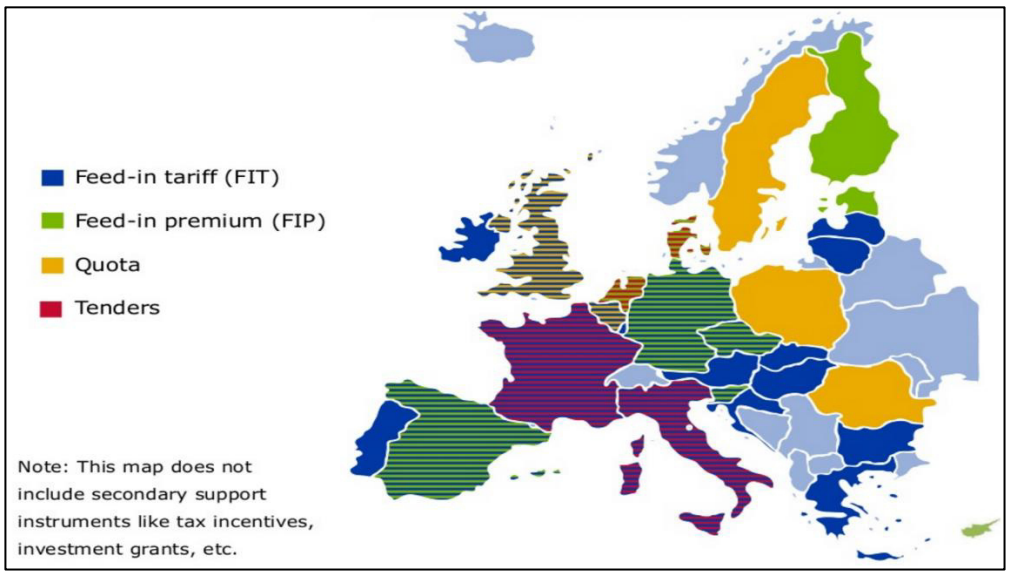

Figure 8: RE support schemes in the EU-28, in 2014 (based on data from Klessmann, 2014)

Every EU member state has to define the suitable support instruments, as the RE resource potential and technology costs differ among countries. Furthermore, is it noteworthy that a single support instrument rarely provides sufficient incentives to develop a versatile RE sector, consequently many countries adapt a variety of support schemes simultaneously (Ruska and Kiviluoma, 2011; CEER, 2016). Recent trends in national support schemes point in the direction of abandoning FiTs and quota instruments and introducing FiPs, tendering (auction schemes) as well as Contract for Difference (CfD)6. In some countries, a discontinuation of RE support can be observed owing to increasing electricity retail prices and general transition costs. Increasingly, MS rely on tendering, which appears to be the most cost effective instrument to deploy RE on a large scale. Various MS introduce tendering for one or more technologies, as shown in figure 9. However, the introduction of auction schemes is not entirely voluntary, since the EU adopted the *EU State Aid Guidelines* in 2014, forcing MS to establish tendering above a specific project size with effect from 2017 (ECC, 2014). Policy makers hope to allocate financial support in a more cost-effective way to the RE technologies due to eased cost and volume control.

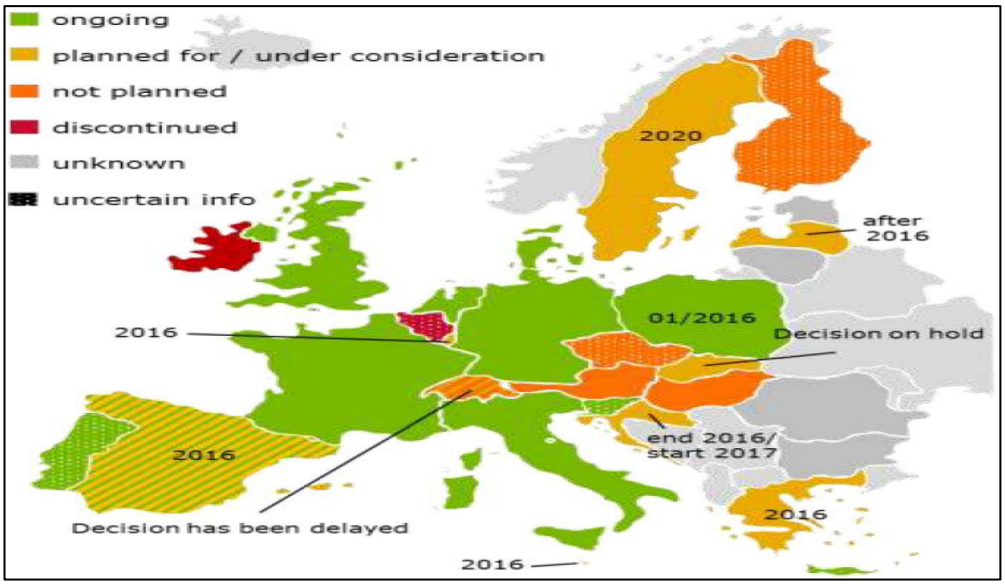

Figure 9: Changeover to tendering schemes in the EU, in 2016 (based on data from Klessmann, 2016)

[6] Private law contract between a producer and the government (CfD counterparty). Contract bases on the difference between the reference price and a pre-defined strike price. The "strike price" reflects the costs of investment and the "reference price" the average electricity retail price. Currently just in the UK but wider diffusion seems likely.

Opportunities	Obstacles
Control of max. volume and support cost	Challenge of ensuring high realisation rates/target fulfilment
Support level is determined by the market, not the administration	Higher risk for RES electricity producers than administrative FiT/FiPs, favouring bigger market actors
Competition between RES electricity producers could result in lower prices (compared to FiT/FiPs)	Risk of strategic behaviour (collusion) leading to higher prices and support costs as expected

Table 3: Potential effects of tendering (own elaboration)

However, countries with tendering in place have reported mixed experiences, as project realisation and prices depend on the auction design as well as the market environment. Creating competition represents one fundamental prerequisite to a high cost-effectiveness. Thereby arises the problem that tendering introduces additional elements of uncertainty for project developers, regarding their revenue and future commitment to project realisation, since planning new projects becomes more difficult, and may result in higher risk premiums. Moreover, the effectiveness hinges on both preventing a shortfall of the auctioned amount, primarily due to "underbidding", and resulting non-feasibility of projects, and the tender dates, which must be frequent and reliable as commitment for support is just granted on specific dates (Held et.al, 2014; CEER, 2016).

To conclude, RE support schemes need to be flexible to adjust to new market situations, and technological development. But at the same time entities need the schemes to be predictable and stable providing a certain revenue stream over a long-time horizon to attract investments. It remains to be seen how MS maintain their generous support levels and schemes, in times of austerity and budged cuts. Furthermore, the future development of RE deployment and framework conditions will be highly influenced by the follow up of the current RES directive, which is at the time of writing being revised by the EC.[7]

[7] Preparation and expected draft in late 2016, enact in summer 2017: https://ec.europa.eu/energy/en/consultations/preparation-new-renewable-energy-directive-period-after-2020

3 Factors Influencing the Emergence and Development of RE Cooperative

As previously mentioned, both Germany and Portugal experienced a strong growth of RES in the electricity sector over the past two decades. Certainly, major contributing factors are regulations that incentivised electricity generated from RE sources. Nevertheless, while in Germany RE cooperatives have contributed significantly to the increase of RES in generation capacity, in Portugal this has not happened. Hence, Germans have taken advantage of the energy transition and financial incentives, whereas in Portugal, cooperatives play an insignificant role in the energy sector, despite RES incentives. Therefore, the subsequent section examines the underlying reasons for this divergent development through a comprehensive analysis of the factors influencing the emergence and development of RE cooperatives, such as the regulatory framework, market actors or the reasons why citizens join a cooperative.

3.1 An overview of recent studies and their assessment methodologies

Despite the continuous growth of literature in the field of cooperatives, scientific research in the field emerged recently and is still regarded as quite limited. However, researchers have applied a variety of methodological approaches, including research interviews, surveys, economic modelling, input/output modelling, cost benefit analysis and econometric analysis (Sovacool, 2014).

Each type of assessment methodology has differences on its usage and obtained outcomes. While some provide wider results, others focus on specific projects or interactions among actors. The choice of a methodological model should be based on the goals of the research project and resources available, ensuring cost-effectiveness and result quality. Šahović and Silva (2016) identified that existing research most frequently addresses the cooperative issue through the application of theoretical models and to a lesser extent via empirical studies. Thus, omitting to explore in detail the social and human dimension in RE cooperative activities. The following table 4 aggregates the main outcomes and enables to compare different studies and their scope of analysis.

No	Study title	Author, PY	Country/ Region	Sample size	Business model	Technology	Method	Outcome and remarks
1.	Local acceptance of renewable energy—A case study from southeast Germany	Musall and Kuik, 2011	Germany	320 individuals from two communities in Saxony	Production	Wind	Comparative case study utilizing a questionnaire based survey among citizen of two small towns	Study of the effects of community ownership on local acceptance of RE. Findings indicate a higher acceptance of RE with community ownership models than with a private ownership model.
2.	Are consumers willing to pay more for electricity from cooperatives? Results from an online choice experiment in Germany	Sagebiel et al., 2014	Germany	287 complete questionnaires out of 886 respondents who opened the survey	n.s.	All RES	Choice experiment based on a survey under university students/staff using an online questionnaire	Investigate whether cooperative governance attributes to a greater willingness to pay more for electricity. Results indicate that consumers care about the energy source but to a lesser extent by whom the electricity has been produced.
3.	Energy cooperative survey	DGRV, 2014 (German Cooperative and Raiffeisen Confederation)	Germany	718 RE cooperative contacted, questionnaires returned 216	All across the energy value chain	All RES	Survey based on questionnaire	Analysis of economic, organisational, business models and outlook in the future. Solar most important technology. General business conditions deteriorate, main cause is the modification of legal framework.
4.	The relevance of the cooperative model in the field of renewable energy	Huybrechts and Mertens, 2014	Mainly Belgium	12 interviews (7 RE cooperatives, 3 network officials, 2 local government officials)	All across the energy value chain	All RES	Survey based on semi-structured interviews and secondary data	After analysing the assets and weaknesses of the cooperative model the authors highlight the potential of RE cooperatives for today's social and environmental problems and call for a more fine-grained analysis connecting RE cooperative development with the respective national context.

Table 4: Overview of studies that utilise either the survey methodology or a comparative approach (own elaboration)

No	Study title	Author, PY	Country/ Region	Sample size	Business model	Technology	Methodology	Outcome and remarks
5.	Citizens' willingness to participate in local renewable energy projects: The role of community and trust in Germany	Kalkbrenner and Roosen, 2015	Germany	780 individuals in charge of energy-related and financial decisions in their house-holds and 174 owners of renewable energy systems	n.s.	All RES	Case study utilizes a questionnaire based online survey among citizens	Study reveals the highest willingness to participate in cooperatives among individuals that own a RES and live in rural areas. Insights further emphasize the importance of social (namely social norms and trust) rather than just environmental motives as determining factors to take part in community energy.
6.	Local civil society based renewable energy organisations in the Netherlands: Exploring the factors that stimulate their emergence and development	Bonn and Dieperink, 2015	Netherlands	5 interviews with experts, 13 participants in both interviews and online survey	Production	Al RES (Key technologies: wind and solar)	Semi-structured interview and online questionnaire	Study explores the factors that stimulate and hamper the appearance and development of local RE organisations. Results show that municipalities/policy makers can ease the emergence by enabling the transfer of knowledge, lowering bureaucratic burdens and provide a consistent policy framework that reduces uncertainties. By involving locals, fair and equal distribution of benefits and the possibility of co-ownership local support for RE is ensured.
7.	The new 'civic' energy sector: civil society institutions and energy infrastructure transitions in Germany and the UK	Hall et al, 2015	Germany and UK	35 individuals from utilities, finance providers, project developers, etc.	n.s.	n.s.	Comparative case study utilizes in- depth-semi-structured interviews and secondary documentary	The analysis investigates the impact of civil society institutions on the energy sector and further demonstrates the strong links between forms of finance and forms of ownership. It is argued that expanding the civic energy sector underpins the energy transition by allowing new organisational forms and sources of capital to enter the sector.

Table 4: Overview of studies that utilise either the survey methodology or a comparative approach (own elaboration)

No	Study title	Author, PY	Country/ Region	Sample size	Business model	Technology	Method	Outcome and remarks
8.	Explaining the diversity of motivations behind community renewable energy	Bauwens, 2016	Belgium, Flanders	2 RE cooperatives members	Production and supply	Wind, Solar Biomass	Comparative case study approach utilizing a questionnaire based survey conducted among cooperative members	The study suggests that cooperative member's are not a homogenous group, e.g. motivation to join and level of engagement differ. Social/moral norms may be an effective way to stimulate investments and engagement levels.
9.	What drives the development of community energy in Europe? The case of wind power cooperatives	Bauwens et al., 2016	Multi-country - Denmark, Germany, Belgium	40 interviews with key actors	Production	Wind	Comparative case study based on semi-structured interviews, applying the Social-Ecological System Framework Model	Analysis highlights a double-edged phenomenon of prevailing and growing hostility towards cooperatives. Legislation and support schemes are described as major factors of influence. Cooperatives strategically react by developing new business models and forging inter-organisational cooperation.
10.	The impact of systemic factors on the deployment of cooperative projects within renewable electricity production – An international comparison	Mignon et al., 2016	Germany, France, Sweden	7 interviews with RE cooperatives (2 Germany, 3 France, 2 Sweden)	Production	All RES	Comparative study of three institutional contexts based on secondary data and qualitative interviews with RE cooperatives	Compare the development context in three countries in order to systematically identify the systematic factors that impact their deployment. Major impact of the legal framework to encourage and facilitate RE cooperative projects as well as a lack of financial and knowledge infrastructure. Additionally, incumbents utilize market power to influence legislation and lower support for community energy that leads to lowers engagement levels.

Table 4: Overview of studies that utilise either the survey methodology or a comparative approach (own elaboration)

Table 4 summarizes the most relevant research findings, with a focus, firstly, on empirical studies dealing with factors likely to explain why the cooperative sector exhibits different stages of development across regions, and secondly, on studies utilizing a questionnaire based survey as a method to acquire data on RE cooperatives. There is the further intention to demonstrate the applicability of the selected methodology for the *Renewable Energy Cooperative Survey* project that will be carried out as part of this dissertation. The entirety of factors impacting RE cooperatives are analysed throughout the rest of this chapter.

3.2 Planning policies and support schemes

RE cooperatives rely on RES technologies that under the current electricity market design in most cases are still not fully cost-competitive compared to fossil fuel based technologies. Therefore, support schemes have been implemented to deal with this problem making RES economically feasible and establish an equalized level playing field for all available technologies. Schreuer (2012) highlights the importance of stable financial incentives for facilitating the development of smaller actors. Small community initiatives benefit from those to a greater extent than larger market actors as they can distribute and cope better with certain project risks.

Bauwens et al. (2016) argue that RE cooperatives, owing to limited financial resources8, substantially benefit from risk-reducing support measures. Furthermore, most RE cooperatives focus on one or few local projects making them even more risk averse, as they lack the possibility of a broader distribution of risks9. Consequently, market-independent support instruments (e.g. FiTs) establish favourable risk-reduced conditions for smaller actors than market depended ones. The advantage results due to a fixed remuneration that doesn't depend on variable electricity spot market prices. This provides a higher investment security – predictable cash flows and low transaction costs for financing and operating RE projects. Therefore, for smaller actors, FiPs or quota obligations that require reactions to market price differences, can result in higher transaction costs for marketing electricity and thus lowered price competitiveness and revenues (Couture and Gagnon, 2010).

In this light, Negro et al. (2012) express that institutional characteristics constitute the most influential systematic factor, impacting the deployment of RE technologies, and subsequently the advancement of RE cooperatives. Legislators should establish consistent and continuous long-term policies and regulations with short bureaucratic procedures.

[8] Project financing via member's equity and external project financing e.g. bank loans.

[9] A focus on few local projects causes a higher risk in each project – constrains to hedge and distribute risk in a small portfolio.

Apart from these issues, governments can stimulate the emergence through facilitating the transfer of knowledge, providing preferential loans and subsidies. Paradoxically, a consequence of a lack of governmental actions to comply with environmental targets motivates citizens to take actions by themselves and engage in renewable projects (Bonn and Dieperink, 2014; Negro et al., 2012).

3.2.1 Legislative overview

Both Germany and Portugal are bound to the EU´s supranational policy strategy and legislative framework. Nevertheless, the formation and development of cooperatives has continued to follow extremely different paths: 1 RE cooperatives in Portugal and more than 1000 RE cooperatives in Germany. As mentioned, since the beginning of the 1990, the RE shares considerably increased in both countries. In 1988, the Portuguese government enacted the first law directed to the advancement and support of RE, whereas the German government enacted the *Electricity Feed-in Act* that obliged grid operators to feed-in electricity from renewable sources in 1991. In both countries, FiTs/FiPs represent the major financial instruments to support the market integration of RES. As scheduled in figure 10, these measures have been modified, broadened, tightened or otherwise changed several times since their establishment.

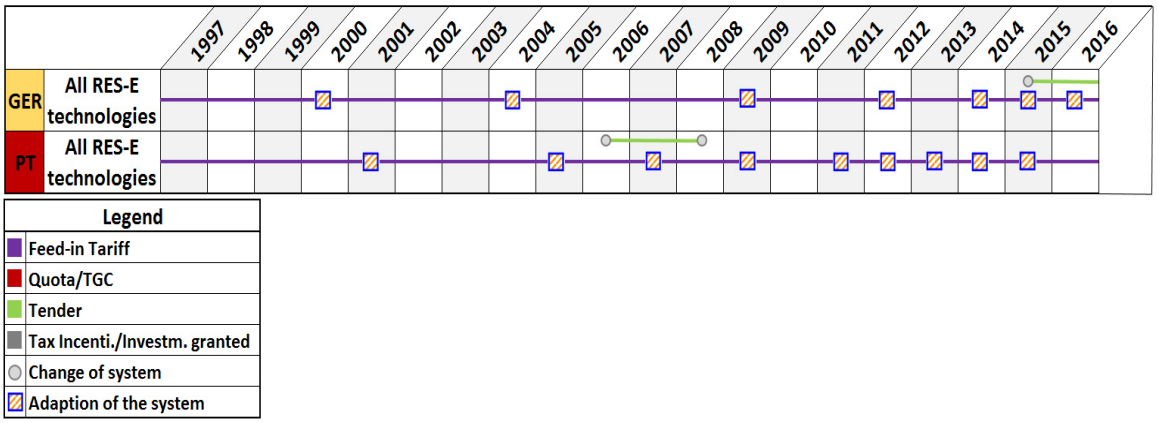

Figure 10: Evolution of German and Portuguese RE support policies, as of end 2016 (own elaboration)

The following tables 5 and 6 provide an overview on the German and Portuguese RE legislation.

Germany	Legislation	Status	Decree	Measures	Aim
	Electricity Feed-in Act	Superseded	1991	First obligation to grid operators to feed-in electricity from renewable sources, Grants priority dispatch to RE, guaranteed FiT over 20 years	All renewables, mainly wind
	100 Million Program	Ended	1995	Aims to increase the use of RE via capital subsides, in particular PV, Heat pumps, small hydro, wind	Multiple RE
	100 000 Roofs Solar Power Program	Superseded	1999	Support of small scale PV roof installations with beneficial loans, aims to develop up to 300 MW additional capacity.	PV
	Renewable Energy Sources Act 2000	Superseded	2000	Investment protection through guaranteed FiT, grid access granted to small and medium size enterprises, "degression"- decrease of FiT in regular intervals, specific tariffs depending on technology, scale and location, introduction of RE surcharge	All renewables
	Combined Heat and Power Act 2002	In force	2002	Increased deployment of cogeneration (CHP), surcharge of electricity produced by CHP plants, fix deployment targets	Multiple RE
	Law to Amend the Mineral Oil Tax Law and Renewable Energy Law	In force	2004	Raised the cap on total PV capacity that is eligible for premium payments. Biofuels tax exemptions until 2008.	Multiple RE
	Renewable Energy Sources Act 2004	Superseded	2004	Modified FiT tariff structure, PV/Biomass favoured, exemption of industry from RE surcharge	All renewables, mainly PV and Biomass
	Renewable Energies Heat Act 2008/2009	In force	2009	Setting market incentives, mandatory heat demand covered from RE for new buildings	CHP Fossil and multiple RE
	Renewable Energy Sources Act 2009	Superseded	2009	Extended industry privileges, flexible degression rate, reduction of PV tariffs, enhanced on-shore wind support, flexible compensation of wind turbine	All renewables
	Combined Heat and Power Act 2008 and 2009	Superseded	2008/ 2009	CHP electricity fed into the grid or used for self-supply subsidised	CHP Fossil and multiple RE
	PV Act 2010	Superseded	2010	Dramatic reduction of FiT for PV systems, FiT rate depends on project size	PV
	National Energy Action Plan (NREAP)	In force	2010	Sets RE share targets for 2020, 18% share of energy demand from RE in gross final energy consumption, 37% share of RE electricity demand, H&C 15,5% share of RE etc.	All renewables

	Energy Concept	In force	2010	Long- and mid-term energy transition targets and development pathways though the year 2050	Multiple RE
	Renewable Energy Sources Act 2012	Superseded	2012	Introduction of market premium scheme, support increase for on- and offshore wind, geothermal support increase, further industry exemptions from RE surcharge	All renewables
	PV Act 2013	In force	2013	Degression adjustment, changed market integration, FiT cuts	PV
	Renewable Energy Sources Act 2014	In force	2014	New operators need to market their electricity in return market premium, switch from specified FiT to a system of tendering, government fixes future deployment target for each RE technology, mandatory direct marketing, expansion of transmission grid	All renewables
	Renewable Energies Heat Act 2015	In force	2015	Including new technologies in support schemes, increased remuneration	Multiple RE
	Ground-mounted PV Auction Ordinance	In force	2015	Pilot auctions to ensure pre-defined deployment levels between 2015 and 2017	PV
	Combined Heat and Power Act 2016	In force	2016	CHP expansion targets lowered, more complex regulation, phase-out of support for CHP plants using coal, increased funding surcharge, mandatory direct marketing	CHP fossil and multiple RE
	Subsidy for solar PV with storage installations	In force	2016	Investment support for battery storage of electricity generated from PV (residential)	PV
	Renewable Energy Sources Act 2017	In force	2017	Decree on 01.01.2017, tendering introduced for biomass, PV and wind, Cooperatives enjoy special treatment, degression of PV tightened - flexible degression rate, Support for off and onshore wind and biomass increased, wind power can be limited in times of grid congestion, RE target increase to 35% by 2020, removes subsidies and exemptions for industry and prosumers	All renewables

Table 5: Most important German Renewable Energy legislation (own elaboration, based on data from IEA P&M database, 2016; RES legal, 2016; BMWI, 2016)

Portugal	Legislation	Status	Decree	Measures	Aim
	DL 189/88	Unknown	1988	FiT introduced, mainly for small hydro for an eight-year period	All renewables, mainly hydro
	Tax Reduction for RE Equipment	In force	1999	Purchase of RE equipment, VAT of 5%, investment costs in RE deductible	All renewables
	DL 168/99	Unknown	1999	Major FiT formula change - consist on the sum of three factors, FiT payment extension to a twelve-year period	All renewables
	E4 Program	Ended	2001	Energy Efficiency and endogenous energies program	Hydro, Wind, PV
	DL 312/2001 and D339/2011	Unknown	2001	FiT price guarantee, FiT differentiation between generation technologies, priority grid access for RE, grid connection licences	All renewables
	New Tariffs for RE	In force	2001	Tariffs for RE increased	All renewables
	DL 68/2002	Unknown	2002	Regulatory and administrative rules change	All renewables
	Resolution of the Council of Ministries - 63/2003	In force	2003	Main focus on liberalisation of the electricity market and the decrease of energy intensity	All renewables
	Resolution of the Council of Ministries - 171/2004	Unknown	2004	Proposes increase of RE and market liberalisation, new incentives to RE and CHP	All renewables
	DL 33A/2005 New FiTs for RE	Superseded	2005	FiT extension to 15-year period, changes in formula coefficient for remuneration, different scope	Multiple RE
	National Energy Strategy	Superseded	2005	Main policy guideline and measures	All renewables
	DL 172/2006	Unknown	2006	Connection to the grid shall be non-discriminating, priority for electricity from RE sources, except hydro above 30MW	All renewables
	DL 363/2007	Superseded	2007	Sets measures related with the RE as provided in the National Energy Strategy, establishes legal framework for el. Generation from microproduction units of up to 5,75 kW	Multiple RE
	DL 225/2007 Modified FiTs for RE	In force	2007	FiTs revised, new tariffs vary by source and by capacity, additional incentives for small production plants up 150 kW	Multiple RE
	Wave Energy Pilot Zone	In force	2008	Establishes a pilot zone for demonstration and R&D purposes	Wave
	Solar thermal incentive scheme	Ended	2009	Incentive program for solar thermal installations	Solar thermal

	National Energy Strategy (ENE)	Superseded	2010	Major points in the Portuguese energy plan/strategy - 31% of gross final energy consumption, 60% of the electricity produced, 10% of the transport energy consumption will come from RES in 2020, reduce energy imports, consolidate wind industry sector	All renewables
	Implementation of the CHP Directive	In force	2010	Establishes legal framework, remuneration and status of CHP units (promotion and development)	Multiple RE
	National Renewable Energy Action Plan(PNAER)	Superseded	2010	Pilot zone for wave energy projects, solar energy demonstration projects, installation of PV power stations	Multiple RE
	DL A118/2010 Microgeneration	In force	2010	Micro generation law - FiT granted, fiscal and financial incentives	Multiple RE
	DL 34/2011 Mini production	In force	2011	Sets legal framework for mini generation units of up to 250 kW, FiT extension to 20 years and agreement to extend FiT to all prior existing wind parks	Multiple RE
	DL 215-B2012	In Force	2012	Amendment of grid access scheme, obligation to purchase all electricity produced by sources benefiting from FiT	Multiple RE
	FiTs for micro and mini generation (Portarias 430/2012 and 431 /2012)	Superseded	2013	FiT for micro and mini generation, rates lowered substantially by 30%	PV, Solar thermal
	DL 35/2013	In force	2013	Alternative remuneration regime for wind parks	Wind
	Feed-in tariffs for micro and mini generation for 2014	Superseded	2014	Established FiTs for micro and minigeneration and deployment cap	Multiple RE
	DL 153/2014 Self-consumption	In force	2014	New regime for small production units and self-consumption, introduction of bidding scheme, set regime and tariffs for small production an self-consumption	Multiple RE
	Green Growth Commitment 2030	In Force	2015	11 quantifiable green targets, like boost of RE share, improve EE and air quality	Multiple RE

Table 6: Most important Portuguese Renewable Energy legislation (own elaboration, based on data from IEA P&M database, 2016; RES legal, 2016; IEA-Portugal, 2016)

3.2.2 German legislation

German RE legislation is constantly updated, as reflected in these regulations and corresponding amendments:

- *Renewable Energies Heat Act (EEWärmeG)*: The act intends to increase the renewable energy share in the heating and cooling of buildings, focusing on new buildings.
- *Combined Heat and Power Act (KWKG)*: The act supports the construction, modernisation and operation of CHP-cogeneration plants and local heating networks.
- *Renewable Energy Sources Act (EEG)*: The *EEG* was enacted in 2000 and is the successor of the *Electricity Feed-in Act* (1991-2000). It endorses the generation of electricity using RE sources and constitutes the cornerstone of Germany's RE policies. The act is constantly amended (2004, 2009, 2012, 2014, 2017) to achieve the most efficient and profitable conditions to market development in respect to the learning curve of renewable technologies.

The key elements in all three regulations present financial incentives, with separately specified targets. The *EEG*, as the cornerstone, has contributed greatly to the rapid RES deployment that Germany experienced in the last two decades. Four basic principles characterise the act and have contributed to its success (AEE, 2015):

a) The legislation guarantees grid connection and preferred dispatch of electricity produced from renewable sources regardless of the production volume or technology. Renewable power producers receive a fixed tariff for every kWh they feed-in the grid over a period of 20 years. With the amendment in 2012, the market premium scheme was introduced to encourage direct marketing, so that electricity producers sell their own production and do not receive the fixed FiT but can instead claim a market premium on top off the revenue obtained from the sale of the electricity at the spot price market. A further amendment in 2014 obligates all new installed renewable plant operators to market their electricity directly, either through a direct marketer or individually.

Two exemptions exist: First exemption, if direct marketing is currently not possible, the producer receives a tariff in the amount of 80% of the corresponding fixed tariff from the grid operator. Second exemption, small producers with an output power less than 100 kW. The latest amendments of the *EEG* came into force in January 2017, introducing a tender scheme for biomass, PV and wind, setting a cap on new installations eligible to receive support, exemptions exist for small plants.

b) A technology specific compensatory feed-in remuneration without cross subsidisation or state subsidies – consumers pay the costs through the *EEG* surcharge included in their electricity bill.
c) Pressure to be innovative, the level of remuneration for new installed plants will be reduced annually – degression. Underlying logic implies that technologies become more efficient and economical.
d) Protection of operator interests. Future amendments of the *EEG* do not modify conditions retroactively. This protection extends to prioritised dispatch, guaranteed level of remuneration as well as the payment period of 20 years.

These stable and clear regulations have a particular importance for facilitating the development of RE cooperatives (Schreuer, 2012). However, the newest amendment of the *EEG 2017* aims to increase the share of renewable energy in the annual gross electricity consumption from the current 33% to 40-45% in 2025, to 55-60% in 2035 and to at least 80% in 2050. An integral part of the amendment of RE subsides represents the introduction of a competitive tender scheme for biomass, PV and wind. Although community initiatives, including cooperatives, have been legally defined for the first time in the *EEG* and enjoy special treatment in the tender procedure, they have to deal with a new regime exposing them to a greater market risk. Nevertheless, RE cooperatives can already participate in a wind tender, if they have secured an installation site and obtained a wind appraisal, predicting the average wind speed and expected wind yield.

They benefit additionally from longer implementation time, increased by 24 months, and uniform pricing in which they receive the highest bid price granted in each tendering round. All other investors need to meet a set of additional and tightened requirements receiving support under a pay as bid scheme. Furthermore, for wind and solar power plants, the minimum threshold for the tender is set to 750 kW, i.e. all small scale wind and solar power installations of up to 750 kW receive FiT or FiP. For this reason, solar power plants become again particularly interesting for RE cooperatives, as the threshold had been set to 100 kW in the *EEG 2014*. The situation is somehow different for biomass installations, the legislator increased the deployment volume and includes existing plants into the tender scheme, whereby certain opportunities arise, especially through an extension of the remuneration time. However, the newly installed capacity won´t be sufficient to compensate the dismantling of old biomass plants in the foreseeable future leading to a loss in total installed capacity (Synopse EEG 2017, 2016).

Nevertheless, although RE cooperatives operate under favourable conditions, the amendments have introduced further obstacles and complicate the deployment procedure, and thus slow down the rapid development of both RE cooperative and RES deployment. It will take some time to evaluate whether community initiatives can actually compete with large market actors, especially with regards to wind plant tenders.

3.2.3 Portuguese legislation

In Portugal, the *Green Growth Commitment 2030* presents the most recent strategic policy document designed to guide the development of the entire economy until the year 2030. In the reform, Portugal recognised the importance of sustainable development and preservation of natural resources (such as drinking water preservation, among others) and determined thirteen quantifiable targets for 2020 and 2030. The eleventh goal established new RE targets from 25,7% of final energy consumption in 2013 to 31% in 2020 and 40% in 2030. The RE share for the electricity sector was set to reach 60% in 2020.

Through the introduction of measures aimed to encourage the use of RES, the number of RE generation plants has increased significantly. In the past, a strong focus and favourable natural conditions resulted in the installation of many hydroelectric plants. Nevertheless, since the early 2000s the growth was predominantly driven by the build-up of onshore wind turbine capacity. Between 2004 and 2014 wind power capacity increased by the factor of 14, stimulated by generous government incentives. During that period, solar power increased as well but hasn't reached a meaningful share, with just 1,2% in 2014 (IEA-Portugal, 2016). Therefore, solar power presents the technology expected to have the highest growth rate until 2020, including concentrated solar, solar thermal and PV, up to a share of 6% of total installed capacity (Amorium, 2014).

Major RE support legislation that came into force and made the development possible, include:

- *Decree Law 189/88* established the first FiT in the market, from the beginning on designed to relieve RES electricity producers of any financial risk. Between 1988 and 2001, the FiT payments were not technology related, i.e. all RES received the same FiT amount per MWh generated. The first remuneration amendment of the FiT scheme represented the introduction of variable factors for wind plants in 1999. From 2001 on, an additional factor distinguishes the amount of remuneration of different RE technologies, furthermore, a new grid connection procedure as well as priority grid access for electricity generated from RE sources were established. Moreover, municipalities receive payments for locally installed wind turbines to increase attractiveness and lower opposition from local citizens. In following years the amendments solar and especially wind diffusion kicked off. (*DL 312/2001 and 339/2001*) The FiT level continues to be relatively constant and a payment extension of FiTs to a twenty-year period in exchange for annually payments for eight-year period to cover grid operation costs has been agreed upon. *(DL 35/2011*)

  Several authors analysed the Portuguese FiT scheme and found that incentives were successful in promoting RES, in particular wind. Under the generous and stable legislative environment wind power capacity more than doubled and CHP

almost tripled in 14 years of subsidisation but was abolished due to a lack of technological progress in 2014.

However, findings indicate a heavy over-subsidisation of both technologies. Although wind turbine plants have demonstrated the most competitive cost-base of all RE technologies, the Portuguese FiT varied from approximately €74 per MWh to €104 per MWh with an average wholesale market price of around €50 MWh between 2005 and 2014. Due to the established framework, the Portuguese authorities are now obliged to pay the turbine owners the imbalance for a period of 15 years even though wind turbines reach cost competitiveness after a 7 year-subsidisation period. Similar to this, CHP installations receive an even higher premium of about 25 € to 50 € per MWh above the electricity wholesale market price. Initial promotions of both technologies proved to be effective to incentivise deployment but were heavily over-subsidized and ultimately caused a still growing electricity tariff deficit of the Portuguese electricity sector. All other RES in the special regime do not have a large impact since their share remains below 1 % (Peña, 2014; Withers, 2015).

- *Decree Law 313/95* guarantees grid access for Independent Power Producers of all RE (prior limited to small hydropower). The law has been reviewed and adapted several times to new market situations and paved the way for citizen engagement.
- Liberalisation of the electricity sector started in 1995 through the law package *DL 182/95 to 188/95,* representing an important modification to the energy sector, particularly in respect to generation, originating from having a high degree of centralisation to facilitating the entrance of new independent market actors. In the course of market liberalisation regulators grouped generation technologies into an ordinary regime, including thermal and large hydro power plants, and a special regime, comprising all kinds of renewable energy plants, each of which is entitled to receive guaranteed FiT. It took the legislator until 2000 to unbundle and restructure the business fields of generation and transmission and until 2007 to establish a fully operational wholesale market. This gap forced the legislator to guarantee revenues to all generation plants installed prior to 2007.

Both, the delayed market reform and RES premium payments contributed to an enormous €4 billion tariff deficit. So far, Portuguese authorities were not able to manage or lower the tariff deficit substantially, according to Withers, 2015. Moreover, the market concentration at generation level remains high. The market share of the three biggest enterprises (EDP, REN Trading and Iberdrola) stood at 65% in 2014, whereas EDP´s share, as the market leader, exceeds 47% of total generation capacity (RAP, 2015; Ghazvini et al., 2016).

Several factors opposed the entry of new independent market players, like RE cooperatives, in electricity generation: Firstly, household customers were unable to change the electricity supplier. Only from 2002 on, medium-voltage customers were eligible to choose a supplier freely on the market. This consequently had a significant impact on the market opportunities of newly build power plants through limited abilities to sell electricity. The implementation of the Iberian electricity wholesale market between 2003 and 2006 caused further regulatory uncertainties through an unstable legislative framework. Ultimately, this uncertain environment caused investors and interested entities to delay investments or stay away completely (ANNEX II, 2007).

Decentralised energy concepts and the importance of citizen participation schemes have been evolving over time. The government established the *Decree Law 68/2002* regulating a producer/consumer scheme for the first time. RES projects started to include micro- and mini-generation installations from 250 kW down to 5 kW and 3,78 kW of installed capacity, respectively. The mini-generation scheme was only enacted in 2011 (*DL 34/2011*). Support schemes became more sophisticated along the years and entailed a general and guaranteed price regime depending on the technology. The most recent amendment sets the legal regime applicable to small production units (UPP) of up to 250 kW (formerly known as micro/mini generation) and self-consumption units (UPAC) between 200 W and more than 1 MW.

The most important statutory changes relate to UPPs that are now supported through a bidding scheme and the fact that UPAC can connect to the national grid with the simultaneous option to sell the exceeding electricity to the market (*DL 153/2014*). This new scheme appeals much more to energy citizen, however, the primary goal is to meet local consumption needs. Consequently, community initiatives or the collective self-consumption still experience a lack of support in legislations.

As one example which kind of obstacles cooperatives and small developers face in Portugal serves the wind tender conducted in 2006 and 2007. Portuguese authorities organised, as one of the first worldwide, a multi-criteria tender where the price (pay-as bid) was one among several other award criteria. A bidder had to comply with a set of requirements, such as economic, financial and technical capabilities. The capabilities of the bidder were presumed sufficed, if the entity had installed a capacity of at least 30 MW at the time of submission. Another crucial prerequisite required the development of an industrial cluster producing wind turbines locally. These criteria's, in combination with the bid size (1200 MW, 400 MW, 200 MW), demonstrated the government's intention to favour large corporations. On these grounds, it is reasonable to assume that smaller market actors were systematically excluded since solely large corporations have the ability to comply with the tender conditions (Aures, 2016).

Furthermore, the entry of new market actors were further complicated due to market uncertainties, naturally impacting smaller actors to a greater extent. The mentioned delays throughout the liberalisation process posed major obstacles, like the customers' ability to change the electricity supplier and an unstable regulatory framework. Although it was strategically the right decision to allow the entry of new actors and to provide incentives to deploy certain technologies, the Portuguese experience suggests that simple liberalisation (ownership unbundling) is not sufficient to create competition. Moreover, regulatory uncertainties and government interventions aiming to maintain national champions can cause a contradictory effect on competition in the long run.

In Germany, support schemes have played an essential role in boosting the German RE market and high actors diversity. Both RE development and small actors were benefiting from stable and consistent support instrument in the last two decades, whereas the Portuguese electricity sector experienced more uncertainties, not in the context of RE development but all the more in regards to the entry of new market actors.
The *EEG* amendments in 2014 and 2017 with accompanying introductions of FiP remuneration, direct marketing and auctioning, resulted in deteriorating business conditions for RE cooperatives in Germany. The key obstacle for small actors represents the missing comprehensive portfolio permitting them to successfully operate in an electricity wholesale market dominated by a few large actors. Those incumbents can better spread the transaction costs and mitigate the inherent risks among the portfolio and in addition take advantage of economies of scale.

This section provided an overview of the main legislations and support instruments However, both governments support the energy transition with a variety of further support instruments, listed in the Annex.

3.3 Legal framework of cooperatives

With regards to cooperatives, almost every country in Europe adopted its own cooperative law. While in some countries, a general cooperative law applies to all business sectors, in others, each sector relies on a specific cooperative law. Regardless of differing national laws that developed on a different cultural, economic and historical backgrounds. What truly distinguishes cooperative enterprises from other legal forms are the cooperative values and principles, explained in chapter 2.1. (Cracogna et al., 2013).

At the EU level, cooperatives have not been recognised as an officially business form until recently. In 2003, the EC adopted the *Regulation on the Statute for the European Cooperative Society* (SCE) (EC, 2003), aiming to facilitate cross border and transnational activities of cooperatives and to build cooperatives capable of competing with success throughout Europe. The supranational SCE statute stresses that the legal framework in which the business is carried out still relies principally on national legislation and thus grants sufficient leeway. Therefore, the regulation does not represent a "real" European regulation, which can be considered as independent from national legislations but rather be seen as complementary on an international scope. The main characteristics of the SCE are presented in the Annex. By adopting the SCE statute, the European Union ultimately acknowledged that there are various business forms or ways of doing business, because of their different nature, a distinctive handling and specific legislative and policy framework were needed.

Citizens choose in most cases equity-financed based schemes to invest in renewable energy projects. However, business models vary considerable in the area of voting rights control and co-determination granted to members. Initiators of projects have to evaluate the limitations and advantages of a certain business model since this aspect has a decisive influence on the manageability of projects (Yildiz, 2014). Additionally, the question of liability and distribution of project risks most certainly influences the founding process (Brinkmann, Schulz, 2011).

3.3.1 German cooperative environment

In Germany, the most common legal forms of community initiatives engaging in RE projects are *cooperatives* and *GmbH & Co. KG* (Limited Partnerships with Limited Liability Companies as General Partner) and in some cases *GBR* (Civil Law Partnerships) (Yildiz, 2014).

GmbH & Co. KG.

Although this legal form is out of the scope of this dissertation, its importance for the citizen engagement in the energy sector, makes this legal form worth mentioning. Closed-end funds constitute the major capital source for project financing of this business form, especially in the wind sector. Similar to cooperatives, projects raise equity financed capital through a large number of investors. However, this legal model splits shareholders in two different groups, a limited liability company as a general partner that takes the responsibility of business management and limited partners that are liable only up to the invested amount. General partners are often corporate actors, like energy suppliers, project developers or holdings, whereas citizen participate financially as limited partners. Apart from the project initiators, none of the partners assumes full liability in case of project failure, otherwise project risks would be too great for small private investors. Furthermore, members have no impact on the decision-making process and cannot exercise control on management, which is a clear disadvantage for initiatives truly seeking local member control of the energy supply and therefore tend to choose a cooperative as the legal form of citizen participation. On the other hand, the missing co-determination positively affects the manageability of the entire endeavour (Yildiz, 2014; Brinkmann, Schulz, 2011).

Cooperatives

The German cooperative law „*Gesetz betreffend die Erwerbs- und Wirtschaftsgenossenschaften*“ (Genossenschaftsgesetz – GenG) is broadly in line with the definitions and values of the ICA (Chapter 2.1), but stresses the distinguished nature of the legal form. The cooperative law guarantees specific features including the easy change of members, limited liability up to the amount of capital brought in, and democratic-decision making, independent of the capital share.

It is another particularity of the business form that members are not entitled to the reserves or assets of the cooperative upon leaving the cooperative. That is why, cooperatives represent the most suitable community ownership model to actively involve a larger number of citizens in such an endeavour. (Brinkmann, Schulz, 2011).

Due to a compulsory membership in a review association (e.g. DGRV), cooperatives can benefit from assistance in certain consulting and advisory services. Furthermore, these associations monitor activities and financial performance of cooperatives in regular audits to prevent shareholders from incurring financial losses (Volz, 2012). As a direct result, cooperatives represent the best-protected and safest private legal form, when regarding to bankruptcy in Germany (BWE, 2012). RE cooperatives have been able to extend and spread their legal form throughout Germany. Their numbers have increased together with the share of RES in total energy consumption, as displayed in figure 11.

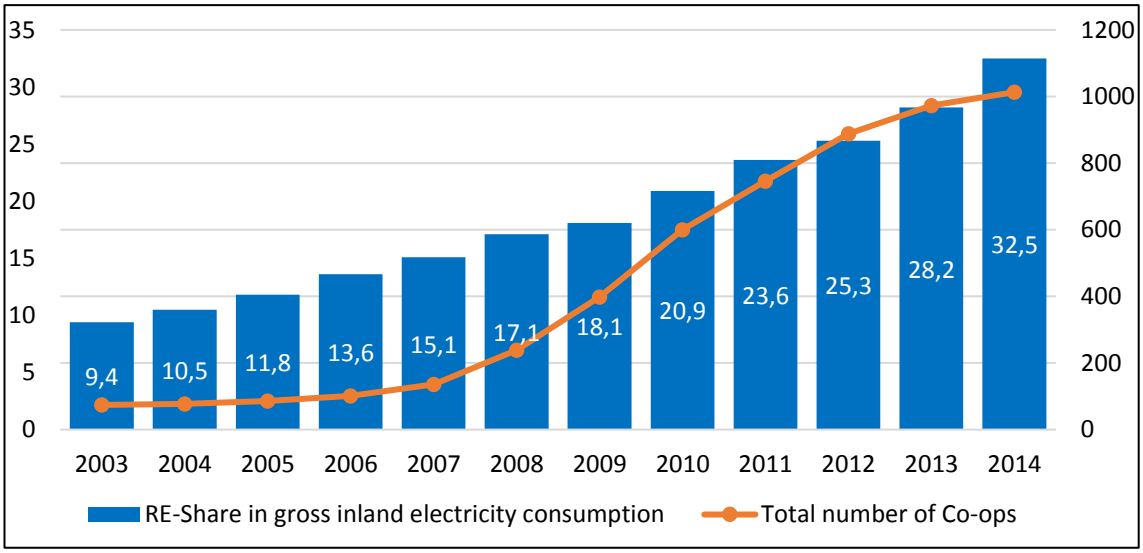

Figure 11: Growth concurrency of RE share and RE cooperative numbers in Germany (own figure; based on data from Morris, 2015; Energiezukunft, 2016; Eurostat data, 2016)

Apart from financial support established in the *EEG* to encourage RES installation, Schreuer (2012) highlights other factors that may have added to the large increase in the number of energy cooperatives:

- Cooperatives have been exempt from prospectus requirements;
- Assistance from specialised support organisations has become available. Auditing associations and federal states enhanced their support to establish more cooperatives;
- Many people consider cooperatives to be an attractive and safe form of investment and
- Amendments to the cooperatives law in 2006.

The first German cooperative act was established in 1889 and later subject to several amendments. The last amendment of the *GenG* in 2006 not only adjusted the German law to comply with the SCE regulations, but adopted the act to the needs of modern cooperatives by introducing the following provisions (Cracogna et al., 2013):

- Broadened the objects of cooperative societies to include the promotion of social and cultural aspiration of the members;
- Reduced the minimum of founding members from seven to three;
- Eased foundation of new cooperatives by allowing in-kind contributions;
- Reduced organisational costs by allowing cooperatives with less than 20 members to operate with just a one-person management board and without a supervisory board and
- Reduction of auditing costs for small cooperatives through simplified audits.

Brinkmann and Schulz (2011) analysed this business form and found that it possesses substantial advantages over other legal forms owing to a lower organisational effort, lower liability risk as well as democratic governance.

Since partners are generally not liable individually this legal form is attractive for small as well as large projects since the crucial question of liability is solved through the cooperative model, representing one major advantage over other common forms, like *GMBH & Ko. KG*. or *GBR* (Holstenkamp and Degenhart, 2013).

Furthermore, the cooperative business form explicitly links general social principles and values that go beyond profit maximization, including social responsibility, collaboration, communal self-help, the provision of quasi-public goods and the previously mentioned democratic - one member one vote principle (Flieger B., Klemisch, 2011). Despite more than 20,4 million cooperative members in Germany, the cooperative movement remains somehow unknown among other businesses and scholars but in truth constitutes a pillar of German society in general and of the energy transition in particular, express Cracogna et al. (2013). In a recent study dealing with the operation constrains of cooperatives, discovered the BWMi that 95 % of all cooperatives are satisfied with their legal form and regarding legislation, further 80 % of cooperatives welcome the obligatory membership in review association and corresponding annual audits. Cooperative founders even highlight the importance of these rules as an effective support instrument along the foundation process and as reason for the lowest insolvency rate of less than 0,1 % among all kinds of legal models (BMWI-GenG, 2015).

3.3.2 Portuguese cooperative environment

The first Portuguese cooperative law came into force in 1867. Despite the early implementation, the impact and actual effect of the law remained limited until 1974. In the course of the democratic transition cooperatives were freed from legal and political constrains that had bound them before. Probably one of the most noticeable features of the legal system regulating cooperatives in Portugal, presents the fact that the ICA cooperative principles have legal force.

In 1980, the *Cooperative Code* (CC) was enacted and applied to cooperatives as a whole. In the following years, several amendments and complementary laws, relating to different cooperative branches in the CC, have turned the legislation complex and inconsistent. Although the cooperative's foundation process was considerably simplified in 2006, a couple of years later in 2011, the cooperative fiscal statute changed significantly. Several tax benefits and exemptions enjoyed previously by cooperatives have been repealed. These amendments pose a problem, hampering most certainly the successful advancement of the cooperative business form (Cracogna et al., 2013).

The social economy law, established in 2013, integrates cooperatives among other organisations into the social economy with altruistic aims and respect of social principles. The law excludes more market-oriented enterprises of being part of the social economy, creating thereby two kinds of economic activities in the context of cooperatives, in the first situation, a "surplus"[10], generated due to economic activity among members of the cooperative, can be distributed among them. In the second situation, the "profit", generated due to economic activities among members and non-members, needs to be taxed (tax on profit). Furthermore, the law prohibits the distribution of "profit" among cooperative members, since the residuary "profit" after taxes is legally defined an inalienable collective asset.

[10] "Profit" of the cooperative must be called "surplus", if generated among members due to the law, prohibiting entities in the social economy to make a profit out of economic activity. Per definition, a cooperative satisfies the needs of its members and does not aim to make profits, as a primary target. In this case, the entity would be market-oriented and thus excluded from the beneficial social economy status.

Consequently, the cooperatives business form has not the same attractiveness than in other countries, as a citizen investment option, and ultimately the funding of RE projects becomes much more difficult. Many cooperatives and other social enterprises spend a significant amount of effort and time raising money focusing less on providing services or on project realisation (Social Invest. PT, 2015).

In a wider context of strategic planning and sustainability, explained Eslider in 2013, a social innovation network that the *"governance structures and strategic management plans are in dire need of reform. The role of the organisations' boards of directors and executive directors often mix and overlap, in an intrinsically inefficient structure, which fail to provide a long-term strategic plan or vision.*" (Paupério et al., 2013).

Furthermore, a EC report on "*Social enterprises and their eco-systems*" (ICF, 2014) identified a number of gaps and barriers opposing a smooth development of social enterprises, namely the government cuts in public funding, a missing clear legal framework and a clearly established concept of social enterprises. Especially the obscure and incomplete legal framework for social enterprises makes it difficult for them to be recognised as such. Consequently, these enterprises suffer from a limited access to external financial sources and long term sustainability.

However, a growing number of citizens shows interest in the social sector and cooperatives. New initiatives have emerged in recent years utilizing innovative new ways and ideas, e.g. to access capital via crowdfunding, stimulating growth and accelerating business activities, Coopérnico[11] represents a remarkable example. Nevertheless, the regulatory and legal frameworks need to be updated and support local grassroots initiatives (Rebelo and Caldas, 2015; ICF, 2014). It may have been the economic crisis that gave the needed momentum to start new social businesses. By approving the social economy law and due to the fact that Portugal is currently the only country worldwide mapping social innovation and entrepreneurship initiatives, the environment has improved providing improved conditions for cooperatives than in the past (Paupério et al., 2013).

[11] Coopérnico is the first and only RE cooperative in Portugal. Founded in 2013 by 16 people and already has more than 198 kW of installed PV capacity. www.coopernico.org/pt/projects

3.4 Structure of the energy market and variety of market actors

The rise of cooperatives in the energy sector correlates with the emergence of RES for electricity production. RE technologies had a hard time to break through an energy market dominated by fossil-fuel technologies benefiting from economies of scale, state support, strong market profile and institutional as well as organisational embedding. Under such circumstances, the incumbent utilities have been able to produce cheap electricity align to consumer and corporation preferences. Negro et al. (2012) stress that the incumbent technologies, actors and institutions are extremely powerful and well-organised. Owing to the fundamental interest of incumbents to not jeopardise their own core competency and profit, they hesitate to adopt and try to prevent the development of new technologies. Thus, these organisations either use their political leverage to prevent the large-scale diffusion or try to take ownership and control of the deployment process. By influencing the design of the regulatory and support framework, criteria for grid access or tendering procedures in a way to favour large scale projects, it is possible to undermine the business model of smaller actors, emphasise Mignon et al. (2016).

Bearing all of those facts in mind, table 7 provides valuable insights into the differing electricity market structure in both countries. The Portuguese energy market indicates a high degree of monopolistic centralisation, with the former state owned company EDP (Energias de Portugal) representing a 46,5% share of the total electricity production and a 46,9% market share in retail, in 2014 (Energy-EC, 2016; Paupério et al., 2016). Clearly, EDP represents the dominant utility exerting influence on the policy debate and energy legislation. It is thus not surprising that EDP has been able to take the lead in the business field of RE generation technologies (ERSE, 2016).

In 2013, the Portuguese regulator abolished, as part of the liberalisation process, the regulated electricity tariffs, previously offered by EDP. One would assume that Portuguese customers would change to another supplier but instead of switching and taking advantage of the liberalised market, most customers chose to stick with EDP as their supplier. Ghazvini et al. (2016) put it this way: "*electricity customers in Portugal have a long-established relationship…and therefore showed a great willingness to sign contracts with EDP".*

Mignon et al. (2016) found that in Germany, the exact opposite happened, instead of maintaining the contract with one of the dominant utilities German customers switched in large numbers to more than 800 newly formed green electricity suppliers. Nevertheless, through the integration of the Portuguese and Spanish energy market into the Iberian electricity market competition improved in both countries through cross-border entries at production and retail level. However, the incumbents have been able to maintain a dominant market position. In Portugal, both the transmission and distribution grid are managed as monopolies under an exclusive concession, whereas in Germany both grids are divided among multiple operators (RAP, 2015; Ghazvini et al., 2016). As illustrated in table 7, a few utilities dominate the electricity market in both countries, although to a different extent.

	Portugal	Germany
Producers (Representing 95% Total)	66	>1000
Main producers (>5% Total)	2	4
Cumulative market share producers, main entities	64,2%	59%
Market share largest producer	46,5% (EDP)	32% (RWE)
Retailers to final consumers	14	1226
Main retailers (Sales >5% Total)	4 retailers but high market concentration through EDP with a 46,9% share	4 main retailers with a total share of 45,5%
Cumulative Market Share, main retailers	87,47%	36%
Distribution grid operators	2 regional + 10 local operators (concession by EDP)	>900 local operators
Transmission grid operator	1 main operator (REN)	4 regional operators

Table 7: Overview of the electricity market structure of Portugal and Germany in 2014 (own table, based on data from Energy-EC, 2016; RAP, 2015; Ghazvini et al., 2016)

In contrast to Portugal, the liberalisation in Germany has led to more competition among electricity retailers with around 1200 electricity retailers in the market and four major electric utilities, the biggest being RWE (Rheinisch-Westfälisches Elektrizitätswerk) with a share of 32% of total electricity production, however, merely 4,8% are based on sustainable RE technologies in 2014 (Energy-EC, 2016; RAP, 2015; RWE, 2015).

In light of the last-mentioned fact, Šahović and Silva (2016) emphasize the capability of RE cooperatives to thrive in the context of market failures as a mechanism for self-development. From this perspective Mignon et al. (2016) highlight that the German utilities' initial lack of interest in RE technology investments created a market environment favourable for the entrance of new actors. The "green" niche market allowed the entrance of cooperatives and other new market actors. These pro-RE technology actors quickly gained momentum and managed to establish favourable conditions, which deteriorated however through increased counter pressure of utility lobbyists in recent years. In Portugal, the incumbents have prevented such a favourable market situation, which explains the undoubtedly hampered growth of RE cooperatives.

3.5 Attitude and knowledge of society

The attitude or degree of societal familiarity towards the cooperative model is likely to play a role. In countries with a well-established tradition and fostered cooperative movement the benefits of this legal form are well known, whereas in countries with a less developed cooperative sector, the lack of awareness could constitute a "cognitive barrier". Huybrecht and Mertens (2014) analyse this correlation relating a poor knowledge of RES and understanding of the cooperative business model to it. However, negative experiences in the past may result in a negative historical legacy and therefore pose an obstacle. A number of authors point out that in regions with a "culture of energy activism", especially anti-nuclear movement, a connection to local ownership of RES exists. As a matter of fact, the anti-nuclear movement's oppositional character certainly corresponds with interest in RE (Kalkbrenner, Roosen, 2015; Bauwens et al., 2016).

Consequently, if a society leans more towards a sustainable way of electricity production, it accumulates knowledge on the individual and collective bases. Therefore, Mignon et al. (2016) emphasize that the lack of capabilities, such as experience and knowledge of RE technologies in particular, constitute a major barrier. Since cooperative members are rarely professionals of RE technologies or project development, they generally lack the needed skill set on the individual level.

Thus, cooperatives need to interact with other actors to build-up a knowledge infrastructure, in which knowledge and expertise can be gathered and shared. Due to the shared interests and values a cooperative network or other public/private institutions can help to overcome this barrier. Besides that, the personnel of suppliers and installers in the RES industry enhance practical knowledge available and as a secondary effect, have an influence on the local perception of cooperatives. (Walker et al. 2010) According to Bonn and Dieperink (2014) the availability of advice and external knowledge enhances the vital support and acceptance in local communities.

In this context, Germany and Portugal have quite a different historical legacy. The overwhelming majority of Germans, some 84% of the population, supports the energy transition and favours citizen managed decentralised RE projects, an Emnid survey found in 2013. Research identified additionally, consumer's willingness to pay more for electricity produced from renewable sources on the one hand and for electricity produced by cooperatives on the other hand (Sagebiel et al., 2014). On the contrary, Portugal's high shares of RE´s correlate with the highest electricity household consumer prices (on a PPP basis) in Europe, aggravating the energy poverty problem among the poorer classes. Ultimately, this may result in a negative attitude towards the energy transition (Tran, 2016). In light of the public opinion in both countries, cooperatives have been regarded as "old-fashioned", causing a decline of available knowledge of this legal form. In Portugal, legislative articles have thinned down over time, in fact, a move in legislation seems to be directed at pushing long established cooperatives to privatisation (Fernandes, 2006).

As described in chapter 2.3, German RE cooperatives appeared in regions with a traditionally strong cooperatives movement, namely Bavaria, Lower Saxony and Baden Württemberg, whereas in the Eastern part of Germany, owing to the socialist era, a negative legacy persists. According to Yildiz et al. (2015) a lower disposable income and wealth hinders further the development in certain regions. Consequently, it is assumable that this might be a reinforcing factor for the different RE cooperative development in Portugal too.

Moreover, energy activism started in Germany from the beginning of the 1970s - the anti–nuclear movement, as a part of a broader democratic and environmental movement, strived to develop RE technologies expanding citizen participation. This grassroots movement showed how local protests initiate change, however, the differing distribution of RE cooperatives cannot be explained by these considerations (Milder, 2015). The results of Bauwens et al. (2016) show further stronger profitability expectations of the German "advocacy coalitions" of engineers, farmers and firms, in comparison to other countries. In Portugal, the anti-nuclear movements emerged in the aftermath of the government's decision to construct the first Portuguese nuclear power plant in Ferrel. Influent government ministers and strong local protest prevented the continuation of initial construction works on the plant in 1976. Barca and Delicado (2016) further stress the importance of Ferrel, as the birthplace of the Portuguese environmental movement drawing parallels to other Western European countries where the movements have appeared simultaneously.

However, after the Carnations Revolutions of 1974 the Portuguese legislation was set to encourage and support cooperatives. As time went by legislation changed, so that the business form became unappealing and unviable, thus Portugal has not experienced a larger trend towards cooperatives in the modern sense in the energy sector until today (Fernandes, 2006). The EC published reports on "*Social enterprises and their eco-systems*" for both countries, highlighting a number of gaps and barriers opposing a smooth cooperative development. In Portugal, where the concept of social enterprise is not yet full stabilised, the lack of knowledge on how to start and run an enterprise, draft business plans, attain sustainable incomes, monitor and evaluate projects represent some of the constraining factors. The lack of awareness poses a further problem, although business support and additional information exist, many entrepreneurs do not know how to find or gain access to them. In Germany, a lack of management skills, affordable support services as well as the unwillingness of some public-sector agents to innovate or establish partnerships constrain the development. However, barriers indicated are not regarded as insurmountable, owing to the existing social enterprise tradition, fully established knowledge ecosystem and supplementary business support (ICF-PT, 2014; ICF-GER, 2015).

Moreover, Yildiz et al. (2015) emphasize the significance of German umbrella organisations fostering the advancement of cooperatives. In conclusion, the missing knowledge ecosystem and national as well as local coordinating bodies assisting cooperatives may represent the basic causes behind the difficulties in Portugal.

3.6 Importance of local actors

Most RE cooperatives are owned by local citizens, nevertheless, a wide variety of actors contribute to their foundation. According to Dieperink et al (2004) the founding process encompasses four phases.

Figure 12: Foundation process of cooperatives (adapted from Dieperink et al. (2004))

Throughout the first three phases local actors play a vital role in delivering the ideas and motivating the founders. Furthermore, the various actors within the social network or direct surrounding influence the perception of the founders and the local community through highlighting the benefits of such an endeavour or features of RE technologies. Thus, Bonn and Dieperink (2014) conclusion is not surprising that local support and acceptance significantly increase the chances of actually establishing a cooperative.

Despite the general public´s support for RES, the picture is regularly different in the local context due to local resistance towards the installation of RES in proximity to people's residences, usually referred to as "NIMBY" (not in my backyard). The local acceptance problem can be circumvented or considerably decreased through co-ownership models and active inclusion of the local population, however, the development often hinges on three conditions: the dedication of certain individuals, local organisations and the reinvestment of the profits to the benefits of the local population, underline Musall and Kubik (2011).

In this matter, Germany serves as an example of good practice since many local rural credit cooperatives (Volks- und Raiffiesenbanken) provide incentives for the foundation. For instance, 60 % of the members of the Rheinisch-Westfälische cooperative association have been founded through the initiation of local cooperatives banks (Volz, 2012).

Since the banks are cooperative themselves they demonstrate a high degree of familiarity with the needs of the legal form. Additionally, their offer expertise in commercial matters and human resources for project initiation. The mutual interest stems from the "green" investment opportunity the banks can offer to their own customers (Walker, 2008). Furthermore, municipalities support the cooperative sector in various ways. As many municipalities do not have the necessary financial resources to invest in RES, they offer instead roof surfaces of schools, administrative buildings or swimming halls to cooperatives, thereby creating a win-win situation.

Beermann and Tews (2016) analysed this situation and highlight that rural regions in Germany, currently facing economic difficulties and lacking a larger industrial base, most embrace the installation of RES. On the one hand synergies and advantages for the municipality include an improved reputation and the generation of additional income (e.g. rents, tax revenue, local added value, employment) and on the other hand cooperatives receive spaces to install RES generating income for their members. The focus of local businesses and the close relationship among municipalities and municipal savings banks (Sparkassen) carries additional benefits for cooperatives, like legal advice or external financiers. Municipal energy supplier (Stadtwerke) constitute alternative local actors in the German cooperative environment, assisting with technical and economic expertise. In addition, local authorities provide further assistance in conducting feasibility studies or other preliminary requirements to participate in tenders, which lowers the transaction costs for cooperative projects.

3.7 Motivations to join a cooperative

RE cooperatives demonstrate a wide range of different members, including private individuals, farmers, churches, local businesses, authorities and cooperative banks. Debor (2014) emphasizes the feature of this business form to open up the possibility to all kinds of actors working together. Figure 13 reveals the heterogeneity among cooperative members in Germany.

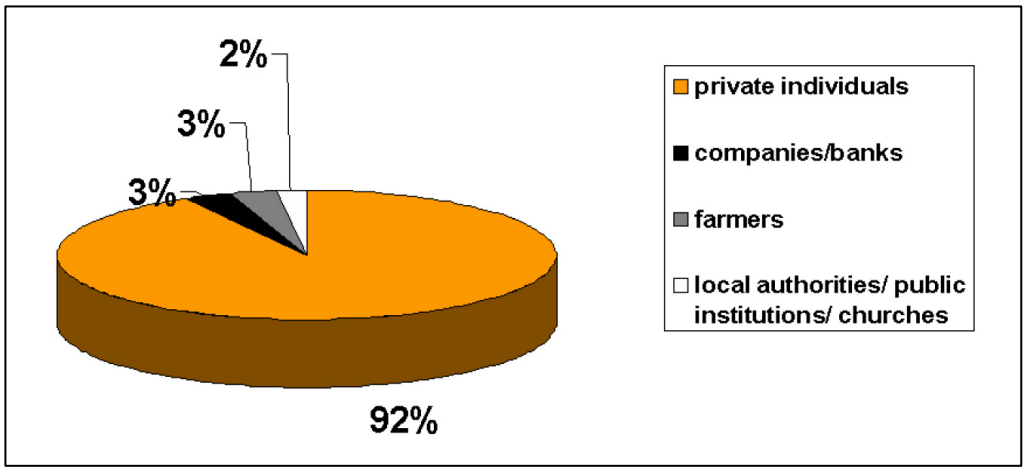

Figure 13: Membership structure of RE cooperatives in Germany, 2014 (based on data from DGRV, 2014)

Motivations to join a cooperative can be distinguished into two broad motivating categories: self-regarding motives and social or moral driven norms.

Self-regarding motives

Self-regarding motives refer to individuals who primarily care about their own payoff. Following this view, future cooperative members will invest solely, if they can expect a return on investment, in form of avoided or reduced electricity costs or income generation. Most cooperative members are at least partially driven by self-regarding motives (Bauwens, 2016). A case study performed by Wiersma and Devine-Wright (2014) revealed in five out of seven projects, the key drivers to join the initiate were the reduction of local poverty through reduced energy bills, and thus alleviating fuel poverty, improving housing quality standards, health and well-being. Additionally, the ease of investment and low financial barrier (minimal capital outlay) pose an attractive investment possibility for citizens, as shares are sold for less than 100 Euro (Prüssing, 2015).

It may also play a role decisive role in entry considerations that the individual's capital is invested locally, because the community generates income locally through returns on investment (Walker, 2008). Nevertheless, while most cooperatives require low investments volumes, a lower regional disposable income and wealth still might hinder the development (Yildiz et al, 2015). Šahović and Silva (2016) suggest, therefore, a comparison of per capita GDP across regions for the purpose of determining the correlation of citizen's regional wealth and emergence of RE cooperatives.

Social and moral norms

Recent research shows that a variety of social and moral norms play also an important role in citizen's investment decisions, contrarily to the standard economic perspective assuming pure material rationales. Four norms can be identified: environmental concern, interpersonal trust, social norms and social identity (community):

- Firstly, citizens may join a cooperative because they care for the environment and want to extend electricity generation from RE. Higher environmental concerns of people have a positive effect on pro-environmental behaviour and thus support for local energy projects (Kalkbrenner and Roosen, 2015; Prüssing, 2015). Following Musall and Kuik (2011) the participation in a RE cooperative expresses a general concern about the unsustainability of traditional generation technologies and willingness to support the energy transition.

- Secondly, an intrinsic characteristic of cooperatives is represented by a high level of interpersonal trust, since trust presents an essential precondition for economic decision making, e.g. financial investment (Kalkbrenner and Roosen, 2015). A higher level of mutual trust has been proven to raise citizen's willingness to participate in cooperatives. Therefore, trust can be seen as a prerequisite for the development of decentralised energy projects in citizen´s hands (Wiersma, Devine-Wright, 2014). Yildiz et al. (2015) analyse the relation between community organisation and trust. Their findings suggest that although trust represents a key component of successful community energy projects, it is not solely ensured by the community label, but rather depends on social dynamics of the projects and people involved.

- Thirdly, the social identity (community) increases the willingness to contribute to the community. A strong community identification and connection strengthens citizen's collaboration and dedication. The "sense of community" can even shift the entry motivation from self-oriented to community oriented leading to benefits like higher tolerance and trust on the individual level (Musall and Kuik 2011). Stürmer and Kampmeier (2003) further highlight the group identification as a determinant of community volunteerism and local participation through a perception of a shared collective identity fostering the willingness to engage in mutual social influence.

- Fourthly, social norms are "*actions or beliefs commonly accepted as normal behaviours by a group or society…most people tend to conform to social norms in most situations*", expresses Lundin (2013). Social norms perform a pressure on individuals to change certain behaviours and to adapt to these actions. Thus, a positive effect of social norms on cooperatives and environmentally related behaviour has been found by several authors (Huybrechts and Mertens, 2016). Bauwens (2016) highlights the example of a survey among members of the cooperative Ecopower, which finds that nearly 30% of all members got to know the organisation by word-of-mouth communication. He further points to the resulting social pressures leading to a higher level of energy related social norms and increased willingness to participate in local energy projects.

In a regression analysis on how community and trust influence the willingness to participate in RE projects in Germany, Kalkbrenner and Roosen (2015) exposed a positive attitude of large parts of the population towards community energy. However, the willingness to volunteer for a good cause is higher than the willingness to invest money. Results revealed that social norms and trust have the strongest influence, followed by environmental concerns and income generation. Community identity represents a lower influential factor. The authors conclude that a further increased share of renewables could be reached by sustaining participation, financial incentives, expertise as well as government support and especially taking advantage of social aspects by creating a "salient social pressure". These findings are of relevance for other countries than Germany aiming for similar community energy projects.

Align with these conclusions is Bauwens (2016), although he goes a bit further and empirically investigates the reasons why different types of members may have joined these initiatives. Indeed, the results show heterogeneity among members. Initially, cooperative members tend to be driven by social and environmental norms who join even without a clear material benefit and can thus be characterised as highly motivated individuals. In contrast to them, “late coming” cooperative members tend to be less active participants and more driven by material incentives attached to electricity supply - thus less norm driven. Additionally, a higher spatial member distribution lowers the direct social interaction and level of social norms in this group, thus, weakening the bond among members and identification with the organisation. Nevertheless, Smith et al. (2015) highlight that the entry of these members presents an essential step to mobilize more financial resources, increase the market share and organisational development.

3.8 Financial infrastructure

Several authors identified the mobilisation of sufficient capital for projects as a crucial precondition for the development of RE cooperatives. Huybrechts and Mertens (2014) refer to the gathering of sufficient capital as probably the most challenging barrier of entry, faced by cooperatives. Most entities rely predominantly on the shareholder equity to finance projects but due to enlarging investment volumes (e.g. through larger wind turbines - repowering) the availability of additional capital resources becomes an important factor in their successful development. Therefore, the need for loans granted under preferential conditions from local financial institutes, and furthermore, specific forms of co-ownership models among private investors and commercial actors can assist to raise the necessary funds (Enzensberger et al., 2003; Yildiz et al., 2015).

Hüfen et al. (2015) stressed the differing realities in terms of the access to financial resources. While cooperatives often suffer financial constraints, whereas large energy companies have almost unlimited access to capital and hence possess the ability to handle major capital expenditures. Large commercial banks are unlikely to finance small RE cooperatives, owing to several reasons: founders lack of experience, lack of confidence (volunteers run the entity), size of cooperative sector does not justify the effort to gain detailed knowledge, low rate of return, unstable support framework among others (Hall et al., 2015; among others). Some authors, nevertheless, revealed the particular suitability of cooperatives to operate in an unstable economic context, such as an economic crisis, because the additional equity source available increases the financial robustness (Enzensberger et al., 2003).

However, certain local institutions provide suitable financial assistance in Germany. Firstly, local municipalities and affiliated municipal savings banks provide financial support to cooperatives through loans, subsidies and by covering the costs for feasibility studies. Secondly, cooperative banks owing to their own business form exhibit a high degree of familiarity with cooperatives finance needs, and offer additional support which includes commercial expertise and human resources (Walker, 2008).

Prüssing (2015) stresses the function of local banks as multipliers and important partners providing valuable commercial skills. These institutions function in this regard as an incubator since proximity to local customers is of particular interest for local banks. Apart from this, RE cooperatives represent a solid and reputable investment opportunity for banks (Walker, 2008). Hall et al. (2015) examine, furthermore, whether and what impact financial institutions have on RE ownership models in Germany and the UK. They conclude that market based economies can foster the development of community initiatives by developing more local financial institutions. In contrast to commercial banks, regional or cooperative banks are better integrated in the local economy and therefore tend to support small or middle scale local businesses. This outcome presents an important condition to realize the full potential of public engagement in the energy sector to benefit from the investment advantages, which can be retained within local communities.

3.9 Summary

Based on the presented theoretical analysis of the business environment of RE cooperatives, it has been demonstrated that risk-reducing support schemes, a clear legislative cooperative framework, a well-developed local financial and knowledge infrastructure, support of local actors and well-established cooperative culture positively influence the emergence and development of these socioeconomic organisations. However, comprehensive empirical studies, analysing in depth the factors of cooperative growth based on first hand data are scarcely available and thus several gaps persist. In this context it is reasonable to perform a cross-country analysis on the scope of Germany and Portugal that sheds light on the extent to which the presented factors impact the overall development. The demonstrated review serves as the bases for the *Renewable Energy Cooperative Survey* and the subsequent attempt to develop tailored policy recommendation for countries aiming to either maintain or make headway for a stronger cooperative sector.

4 Cross-Country Survey under RE Cooperatives – Methodology, Methods and Results

Citizens have reintroduced the cooperative business model to the energy sector. Through the social and environmental advantages of these socio-economic organisations over the classical regime of energy provision, we witness an all-comprehensive energy transition. The most influential factors, outlaid throughout chapter 3, need further validation and verification with first hand data, to gain a deeper understanding of their impacts.

This chapter describes the development process of the applied methodology and presents the key results of the cross-country survey analysis conducted in Germany and Portugal. The *Renewable Energy Cooperative Survey* was conducted within the scope of the collaboration of the research project: *The Electricity Sector Transition – Transnational Experiences from DSOs and Cooperatives Models– A Portuguese-German Study* between the Energy for Sustainability Initiative (EfS) of the University of Coimbra, MIT Portugal Program and RWTH Aachen E-ON Energy Research Institute.

The experimental study was prepared and carried out in collaboration with:

- Faculty of Economics and EfS Faculty member at the University of Coimbra:
  Ms. Professor Patrícia Pereira da Silva Ph.D.
- PhD candidate of the EfS program of the University of Coimbra:
  Mr. Nikola Šahović

The motivation to collaborate and combine two similar research perspectives stems from the resulting synergy effect that we were able to exploit. Synergies include the following: discussion of the optimal methodological approach, divide work intensive tasks during the development process such as register check and peer-review of questionnaire and invitation letters.

4.1 Methodology

In order to understand the impact of different factors on the emergence and development of RE cooperatives, we conduct a quantitative and qualitative comparative analysis of two countries: Germany and Portugal. The experimental study aims to acquire the needed data predominantly using a questionnaire based online survey. Subsequently, the gathered data are analysed and evaluated with descriptive statistics. Finally, the results and outcomes are compiled in a project report.

The proposed methodology suits the project conditions in terms of the three selection criteria defined by Yin (2015) - Firstly, the form of research questions (e.g. who, what, how many), secondly, no control of behaviour events is needed and thirdly, the focus on contemporary events. Furthermore, the survey methodology is considered as resource intensive when compared to other methods, but provides more detailed information on the business environment of RE cooperatives (Yin, 2015). In Europe, this method has been used in similar studies analysing different aspects of RE cooperatives, as presented in table 4. The approach of conducting a survey in enterprises has been used frequently by researchers and represents a sound empirical method (Sovacool, 2014).

It is further evident, and already shown in chapter 3 that there is a lack of studies that apply a comparative approach to evaluate the reasons of the unequal distribution of RE cooperatives across countries. (Hall et al., 2010; Huybrechts and Mertens, 2014; Šahović and Silva, 2016). This dissertation follows the suggestions of Sovacool (2014) and applies a comparative cross-country approach since a comparative approach increases the applicability and robustness of results, when analysing interaction of society and energy sector related issues. Finally, following the example of previous studies, the survey project entailed a follow-up process. It consisted of interviews, intended to deliver further insights into the activities and conditions of RE cooperatives in both markets addressing prevailing gaps in knowledge. A further motivation stems from the lack of RE cooperatives in Portugal and the resultant shortcomings in terms of data variety and quantity.

Nevertheless, Germany and Portugal were selected on the basis of four characteristics described in chapter 1 of this thesis. These comprise the commitment to a low carbon energy future, similar regulations for incentivising renewable energy generation, different experience of electricity market liberalisation processes and current structure and, finally, the differing actor variability. Furthermore, a study contrasting Germany and Portugal has not been, to our knowledge, published so far and as such increased the appeal of the analysis. The survey was conducted solely under cooperatives for the purpose of setting limits to the scope of investigation although other organisational forms, chosen by community initiatives, may have a similar importance in terms of RES deployment or empowerment of local citizen.

4.2 Survey preparation

A precondition to develop the survey was to analyse existing studies and regulations, and review different methodological approaches and their findings. This was done through a systematic review of existing bibliographies on EU and national energy legislation, directives and policies; bibliographies on environmental and social science.

The goal was to identify and justify the survey methodology in terms of development and implementation in the cooperative environment, as outlined in chapter 3. The following step of the preparation process was to contact the identified researchers or organisations, which applied the survey methodology to obtain the original questionnaires. As already explained, six studies were found that applied the questionnaire based survey methodology in the cooperative context and could be used for comparative purposes and at a later stage for result verification. Consequently, an effort was made to obtain the original questionnaires to perform this comparative study. The contacted authors unfortunately replied saying that they could not forward the questionnaire and no valuable information could be obtained from them.

However, probably one of the most important steps was to design the questionnaire to obtain all required relevant data for the analysis. Thus, RE cooperative related surveys conducted in Europe served as a necessary baseline for the preparation of the questionnaire on the scope of the study.

Since no original questionnaire was obtained, we drew our own conclusions from the composition, formatting, and graphics of the published studies and review of relevant literature. By doing this, we were able to ensure that the questionnaire just contained science-based questions of paramount importance.

The questionnaire followed the form of a semi-structured survey. All in all, the questionnaire contained 45 items of which a majority could be answered by multiple choice. Moreover, for the main part of the questionnaire, seven-tier scales were used for the evaluation of the provided statements. The scales were endpoint designated and there was also the possibility to state "*Not relevant*" or in some questions the possibility was provided to develop or complement own thoughts in an open question field designated "*Other*".

The questionnaire composed five thematic sets of questions, displayed in figure 14.

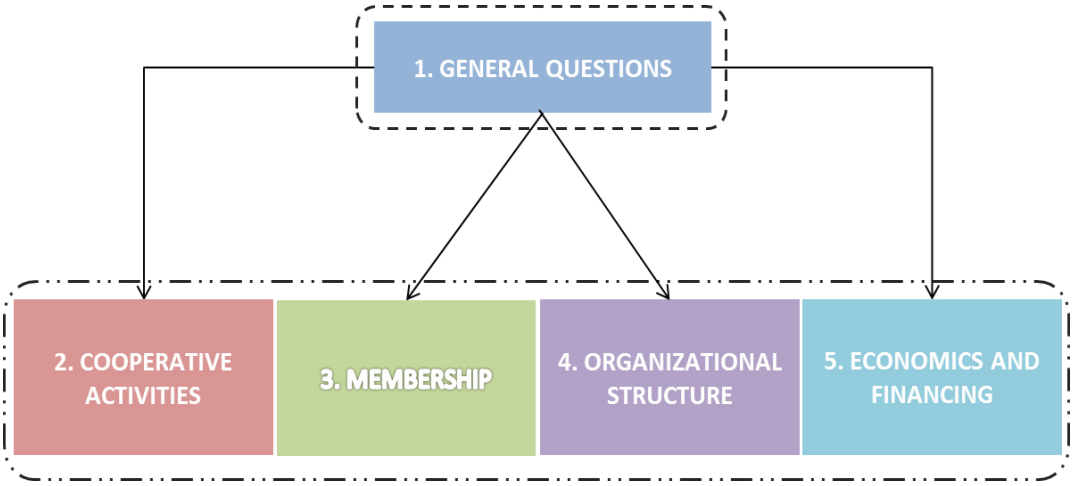

Figure 14: The structure of the RE cooperative survey (own elaboration)

A simple method for boosting the response rate of online surveys is to send a reminder e-mail to all organisations that had not replied at a specific date. The corresponding procedure is illustrated at the end of this chapter in table 9. Other measures to circumvent this problem include that the questionnaire should be as short as possible, is well-structured and easy to understand, since cooperate professionals are not willing to spend much time on answering an extensive and incomprehensible survey, especially considering the limited use for themselves. To raise the self-interest of cooperative officials and impel them to participate on our survey, we promised to deliver a compiled survey report to all participating entities (Groves et al., 2004; Wiersma, 2013).

The questionnaire, in the Annex, began with a brief introductory text. Next the respondents were asked the following questions sets structured in five different categories:

1. General Questions: general questions to gain information about the business entity.
2. Cooperative Activities: question regarding the field of activity, the technologies utilised and influencing factors such as FiTs or drivers and barriers to cooperative development.
3. Membership: to gain insights in membership structure, participation and motivations why members have joined the cooperative.
4. Organisational Structure: to get insights in internal administrative structure and compliance with cooperative rules.
5. Economics and Financing: financial issues like sources of financing, debt to equity ratio, shareholder structure and if the cooperative provides additional value to the local community or may receive assistance from local actors.

On most of the screen of the online survey, respondents could give feedback and further information or express doubts. The complete questionnaire can be viewed in the Annex. Since the scope of the survey stretched over two countries, the most economical way to conduct the survey was electronically, based on an online dissemination through mail contacts and a questionnaire built in an online platform[12].

The questionnaire was designed to adapt its logical flow depending on the answers given, so that participants just answer questions that correspond to their organisation and skip not relevant ones (skip logic).

[12] eSurvey Creator platform (see www.esurveycreator.com) was selected because a free student version is available, entailing a wide range of question types, unlimited amount of question as well as participants.

The next step in carrying out the survey was to identify active cooperatives in the relevant field to enable the dissemination of the questionnaire. RE cooperatives can be identified by examining membership lists of industry associations. Thus, questioned RE cooperatives were identified based either on their listing at the *European Federation of Renewable Energy Cooperatives* register or the *German Federation of Energy Cooperatives* register. The European federation register may not be exhaustive since the registration is not mandatory, nevertheless, it is probable that a vast majority of cooperatives should be listed, simply to enhance one´s own influence and for representational purposes. Precisely the opposite is the case for the German registry, as the *German Cooperative Act* obliges cooperatives to become members of a review association at the date of foundation. Both registers are accessible via internet either at *www.rescoop.eu* or *www.genossenschaften.de*.

The RE cooperatives were assessed as follows. First, access through the online registry list. Extracting the full list and converting into an excel sheet. In the next step, the organisation whose primary activity is along the energy value chain were identified as energy cooperatives. Three information sources were used: 1. The business name listed, if it indicates clearly the entity as cooperative, it is adopted. 2. The business model/information stated in the registry. 3. Information available online, such as official websites, naming in published articles, or municipal websites. In this manner, the proper RE cooperatives were identified and other organisations could be excluded, for instance, if social housing constitutes the primary activity and energy production represents just an auxiliary business. A similar empirical approach for identification purposes was used by Holstenkamp and Müller (2012) as well as Debor (2014).

Coming to the final step of the survey development process, the launch of the survey was performed on the 9th of January 2017. RE cooperatives were contacted three times: 1. survey invitation, 2. reminder of invitation, 3. final reminder to announce the closing of the survey. The final closure of the survey was set on the 10th of March 2017.

As stated initially, the survey makes part of a German-Portuguese research project and was carried out in collaboration with the Sustainability Initiative of the University of Coimbra, MIT Portugal Program, and RWTH Aachen E-ON Energy Research Institute. Securing and mentioning the partnerships with these institutes for representative purposes was a major concern in order to promote and attract more attention towards the survey.

Both of the complementary semi-structured interviews, follow a guideline defined beforehand, partly adapted to the country context. The interviews were conducted with experts in the field of RE cooperative, namely:

- Interviewee 1: Kay Voßhenrich (board member) of Energiegewinner eG[13] in Cologne, Germany
- Interviewee 2: Ana Rita Antunes (employee) of Coopérnico[14] in Lisbon, Portugal

Furthermore, both interviewees were contacted via e-mail shortly after the launch of the survey, however, the interviews themselves were conducted after the closing of the survey. This follow-up process intended to deliver more insights into areas that the survey was not able to cover to a sufficient extent. The interviews conducted followed the guideline but strayed and dived deeply into topical subjects.

4.3 Data collection and analysis

During the survey launch, our sample included a total of 696 cooperatives, of which 695 are located in Germany and 1 in Portugal. Since some mails were undeliverable, the sample size decreased by 37 RE cooperatives to a total of 659 RE cooperatives. Reasons for a lack of an e-mail address include: cooperative size makes a mail address unnecessary, no updated web presence and mail address, cooperatives business closure or merger.

[13] Energiegewinner eG, Lichtstaße 43b, 50825 Cologne, Germany, www.energiegewinner.de
[14] Coopérnico, Pra. Duque da Terceira, nº 24, 4º andar, 1200-161 Lisbon, Portugal, www.coopernico.org

The applied procedure and obtained response rate are illustrated in table 8.

	GER	PT		
Sample size - Nr. of cooperatives contacted	658	1		100 %
Answered questionnaires before the 1. reminder	36	0	=	5,5 %
Answered questionnaires after the 1. reminder	23	1	=	3,6 %
Answered questionnaires after the 2. reminder	4	0	=	0,6 %
Total response rate	63	1	=	9,7 %
Minus incomplete or non-evaluable questionnaires	6	0	=	0,9 %
Evaluable questionnaires	57	1	=	8,8 %

Table 8: Response rate of survey (own elaboration)

The approach to send reminders proved to be effective, as the response rate grew after both renewed contacts, almost doubling over time. After the final reminder and closure of the survey, an acceptable response rate of 9,7 % could be obtained. Of the total of obtained replies six have not been completed in an adequate manner or show other irregularities. After analysing the final number of replies, the evaluable number of questionnaires gives a rate of 8,8 %, which provides a just about acceptable amount of data for statistical analysis.

Moreover, in the course of the project, the decision to name the E.ON Energy Research Institute as a collaboration partner proved to be disadvantageous. Several cooperative officials contacted us expressing their distrust and concern about this kind of collaboration. Their motivation stems from the thought that a research project co-financed by a private company, which repeatedly has proven to use its market power to lobby against the development of decentralised energy systems and community participation schemes, cannot conduct independent research. This unfortunate aspect has most likely lowered the response rate significantly, however, the outcomes are analysed in the next chapter in-depth. Given the response rate obtained, the data aggregated were analysed using predominately IBM SPSS Software and Microsoft Excel software and its embedded data analysis features. The following two pages outline an overview of the entire RE cooperative survey project development process.

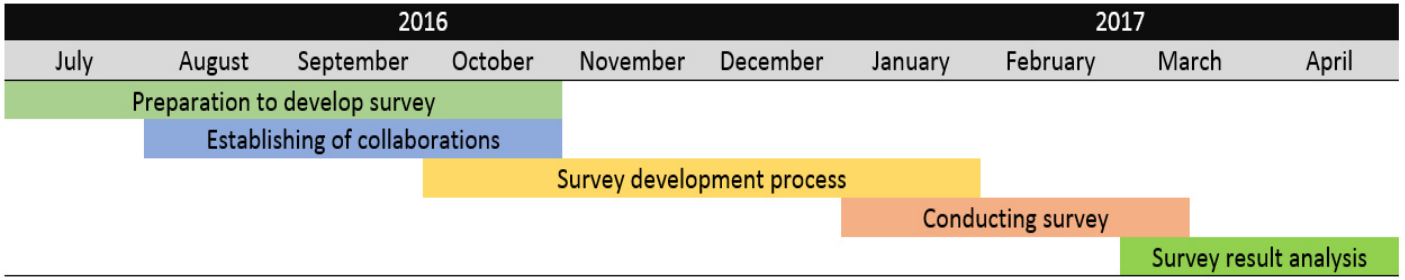

Table 9: RE cooperative survey project development timeline (own elaboration)

Preparation to develop survey
- Literature review based on various scientific sources - Identification of previously carried out surveys and studying their results and approaches - Defining an adequate research methodology based on previous case studies - Going through the acceptance process of the theme and methodology - Contacting researchers in order to obtain questionnaires for comparative/verification purposes
Establishing of collaborations
- Introduction into the project team - Establishing collaboration within the Portuguese project team - Informing RWTH E-ON Energy Research Center team about the upcoming research - Gather information and ideas about RE cooperative surveys and an appropriate approach

Survey development process
- Drafting a first offline questionnaire in Microsoft Excel - Continuous iterative improvement process by peer-reviewing the draft version - Sending the final draft to our supervisor and include proposed improvement suggestions - Searching for cooperatives contact details and compiling a contact database that allows the subsequent dissemination - Translate the questionnaire into German - Analysing available online based survey platforms and evaluate their pros and cons - Choose most appropriate solution and draft the online version of the questionnaire on the eSurvey Creator online platform - Create official project mail address: rescoop@inescc.pt - Writing the invitation letter in both English and German, emphasizing especially the importance of the project for the RE cooperative sector - Finalising invitation letter and online survey in consideration of final remarks from our supervisor - Drafting of the guideline for the complementary interviews
Conducting survey
- Survey launch of the English version on 03. January 2017, dissemination via the official projects mail address and launch of the German version on 09. January 2017, dissemination via the RWTH E-ON Energy Research Center - Entities received with the invitation mail an one-time link, which would take them directly to the surveys cover page and prevents a multiple access - Responding to questions and doubts of cooperative officials regarding the survey throughout the entire time period of the RE cooperative survey projects - Send out of the first reminder within 2 weeks after the publication date and an additional repeated reminder three weeks after - Within the second reminder mail the deadline was set to the 10. March 2017 and the access was closed accordingly - After the closing of the online platform adjusting the interview guideline to suit requirements - Scheduling of interviews and conducting accordingly via Skype
Survey result analysis
- Results were analysed in March and April 2017 - 58 completed questionnaires were analysed from a sample size of 659 – rate of 8,8% - Analysis of gathered data was realised predominantly in IBM SPSS and Microsoft Excel - Interpret and discus survey data results and interviews in light of the current business environment - Compile the outcomes of the RE cooperative survey project in a report and send to all participating entities

Table 10: Project phases and corresponding tasks of the *Renewable Energy Cooperative Survey* project (own elaboration)

4.4 Survey result analysis[15]

As mentioned in table 8, a total of 58 valid questionnaires were received from more than 650 RE cooperatives invited to take part in the survey. This represents a less than 10 % rate of return of valid responses, and thus the data gathered on the cooperatives sector in the energy market does not constitute a fully representative sample. Although the share of 8,8 % may not be ideal, it still represents a good overview of the RE cooperatives active in the energy market, hence, this section presents a summary of the data that have been received subdivided accordingly to the sections of the questionnaire. Nevertheless, the unequal geographical distribution of RE cooperatives across the scope of analysis affects the representativeness of results. This is particularly true for the cross-country comparison of Germany and Portugal. In this regard, the analysis suffers quality and robustness, however, the qualitative data obtained from the semi-structured interviews could equalize certain gaps and provide valuable additional information. Descriptive statistics were used to quantitatively describe and summarize the sample data in order to learn more about the RE cooperatives that the sample of data represents.

4.4.1 General Question – Entity Background Data

The survey required participants to identify their head office based on the Type 3 Nomenclature of territorial units for statistics (NUTS), however, due to the low response rate and practical reasons, the head office locations are presented on NUTS-2 region level, figure 15. By observing their locations and linking them to the Gross-Domestic Product (GDP) in corresponding regions of the scope of analysis, a relation becomes apparent. Most RE cooperatives are located within regions with a comparable high GDP, neglecting city states such as Hamburg, Bremen and Berlin. City states as urban areas exhibit a reduced density of RE cooperatives than more rural regions. The data gathered does not represent the scope properly, since a vast majority of the sample is based in Germany, except for one in Portugal.

[15] Unless otherwise stated, all figures, graphs and tables displayed in this chapter base on survey data gathered within the project.

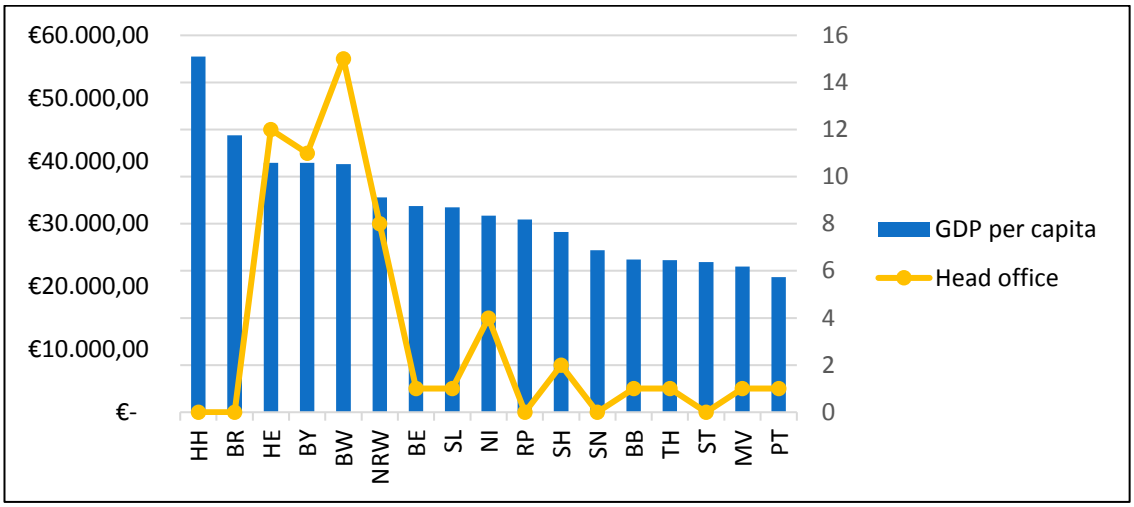

Figure 15: Relation between GDP per capita in NUT-2 region and location of cooperatives head office[16]

As expected, most participating RE cooperatives have been founded between 2006 and 2014, as displayed in figure 16. Causes for this development most likely include the generous and low-risk RE support schemes and legislative framework at that time (Klagge et al., 2016). In Germany, a certain saturation effect, rise of uncertainties and the transition of renewable production technologies towards a mass market set limits to the sectors growth. Since the peak in growth in 2011, numbers decline sharply in Germany, as similar results of the DGRV (2014) confirm. The first and only Portuguese RE cooperative has been established in 2013.

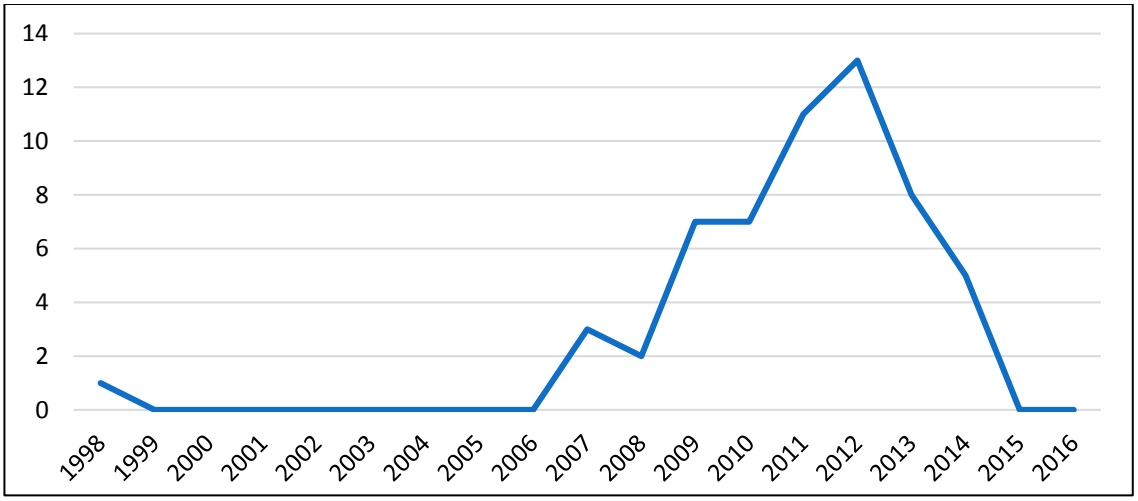

Figure 16: Development of RE cooperative foundation per year in Germany

[16] GDP data source: http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_at_regional_level/de

4.4.2 Cooperative Activities - Influencing Drivers and Barriers

47 out of 58 organisations that took part in the survey engage in electricity production, representing with a share of 81 % the main business field of RE cooperatives. 33 RE co-operatives established more than one business activity along the energy value chain, presented in figure 17. The combination of the business fields of Generation/Production and Distribution/Transmission appears most attractive, with eleven entities pursuing both. Six entities cover the entire energy value chain and none relies upon mere Trading/Green power purchasing. It seems that RE cooperatives emerge into new fields of business, a particular striking example represents the engagement in the field of electric mobility.

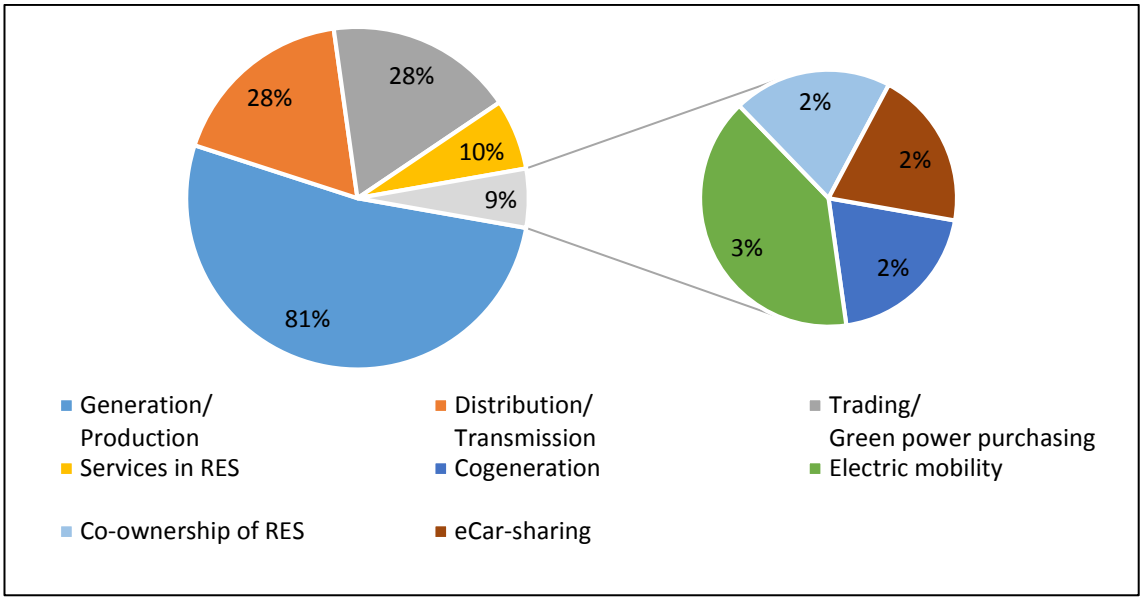

Figure 17: Share of RE cooperatives active in each business field

Subdividing the business field of Generation/Production participating co-operative harness the electricity mainly, to over 80%, with two technologies: wind turbines and solar PV systems. District heating networks represent the third largest installed capacity, with the purpose of heat production whereas electricity energy, so-to-say as a by-product, is also produced.

Technology	Installed capacity	in %
Hydro power	0,02 MW	0,02%
Wind power	39,5 MW	39,02%
Solar PV	40,78 MW	40,29%
Solar thermal	0,05 MW	0,05%
Biomass, Liquid biofuels	8,50 MW	8,40%
District heating	11,27 MW	11,13%
Biogas	1,10 MW	1,09%
Total inst. capacity	101,22 MW	100,00%

Table 11: Inst. production capacity per technology

Subsequently, RE cooperatives active in energy production were asked whether they benefit from Feed-in tariffs, where a quite uniform picture emerged. 84% of all business activities performed in the field of energy production benefit from Feed-in tariffs or Feed-in Premiums, with the remaining 16% represented by not eligible district heating networks[17], as presented in table 12. The subsequent responses are rather alarming, as merely 12% of the entities consider their business model viable after expiration of the current support scheme.

Technology	Total amount of activities per technology	Receive FiT/FiP	Viable without FiT/FiP
Hydro power	1	1	0
Wind power	8	8	0
Solar PV	36	36	5
Solar thermal	1	not eligible	not eligible
Biomass, Liquid biofuels	6	5	1
District heating	8	not eligible	not eligible
Biogas	1	1	0
Total values	61	51	6
Total in %	100%	84%	12%

Table 12: Business activities in the field of generation/production and corresponding viability

Introduced through continuous amendments of the legislative framework and support policies, additional uncertainties affect the cooperative business model. It is, therefore, all the more surprising that a majority of participants plans to continue to produce renewable electricity upon expiration of feed in contracts. Official's assessment of historical support policies tend to be interpreted as not satisfactory whereas recently established support schemes demonstrate even deteriorating conditions from a cooperatives perspective, as displayed in table 13.

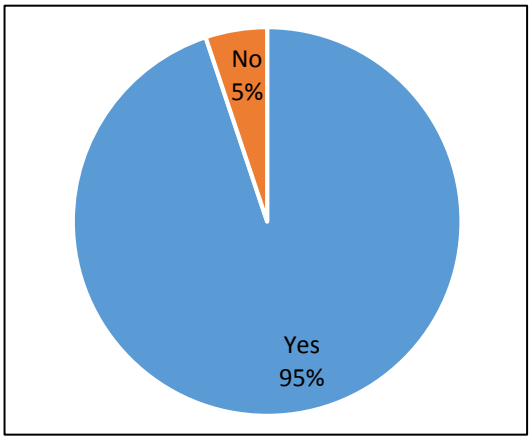

Figure 18: Will you continue to produce renewable electricity upon expiration of feed in contracts?

[17] District heating network without having a primary focus on el. production are not eligible to FiT/FiP.

	1=very negative; 7=very positive	
	ø Arithmetic average	
	± Standard deviation	
	ø	±
Satisfaction with historical support policies for RE	3,08	1,56
Impact of new support schemes on cooperative's activities	2,41	1,2

Table 13: Satisfaction and impact of support policies

The assessment of support polices casts an unfavourable light on recent legislative decisions. Interviewee 1 explained that in Germany, the established operating conditions deteriorate for years through the continuous amendments of the EEG and changed capital code. He acknowledged the progress made through the first-time naming of cooperatives in energy legislations and newly established special rules for cooperatives but, immediately after, stressed the negative consequences of the additional regulatory and administrative rules. Very similar obstacles were mentioned in Portugal (Interviewee 2).

Nevertheless, results show that roughly half of all participants plan to adjust or broaden their activities as a result of the changing framework, but two thirds of returned questionnaires left the field on how cooperatives might plan to react blank. However, one respondent replied to the challenge by suggesting that cooperatives should "*Move away from the support towards state independent alternatives, as they are too discontinuous and changeable.*" In fact, a number of entities stated that they will extend their activities or open up new fields of business, measures mentioned include the expansion of installed capacity, energy-efficiency-contracting, co-ownership of different RE technologies, development of eCar-sharing models, new contract models with clients as well as mobile-local-heating based on mobile heat storages. At this point the Portuguese cooperative differs as it has no current plans to open up auxiliary fields, however, it continues to develop further PV projects (Interviewee 2). One of the main reasons for this presents the continuation of the FiT remuneration model.

RE cooperatives act in spite of having to cope with a wide range of barriers. Most certainly, cooperative´s decision-makers would not seek new business models if their intrinsic field of activity would offer prospects for the future. As such, it is worth mentioning that more than 60 % of all participants expressed their opposition to the idea that support policies establish a level playing field for all actors in the energy sector.

Established policies favour large scale corporations and thus constitute a major barrier to small scale community solutions. When they were asked to indicate the main barrier for development in their regions, the non-supportive policy environment and unfavourable changes in the RE policy framework for the cooperative enterprise model have been identified. Furthermore, it is surprising that the market entry and network connection procedure to small generators is perceived as such a strong barrier, as shown in table 14, although the national legal requirement in both countries strictly prohibits any kind of discrimination in such a matter. Furthermore, experts point to further strong monopolistic tendencies in the energy market as well as political interference of multinational utilities preventing effective competition and undermining decentralisation efforts of local actors (Interviewees 1,2).

On the upside, a lack of local community support and familiarity with RE technologies were not considered as barriers. As results show, this applies particularly for the crucial precondition to gather sufficient capital to finance projects.

	1=Not a barrier; 7=Strong barrier	
	ø Arithmetic average	
	± Standard deviation	
	ø	±
Bad image due to harmful environmental impact (such as impact of wind turbines on bats and birds);	3,63	1,72
Barriers to market entry and network connection such as lack of incentive for network operators to connect to small generators	4,66	1,88
Difficulty to obtain bank loans	2,42	1,74
High operations and maintenance cost of employed technologies	2,88	1,4
High upfront costs, such as purchasing and installing RE generation facilities, licensing for RE generation, land use taxes, grid connection fees, etc.	4,24	1,87
Lack of familiarity with RE technology;	2,67	1,73
Lack of local participation in community groups	2,52	1,57
Land use conflicts (energy, agriculture, forestry)	3,14	1,7
Missing regional institutional support and networking	3,18	1,8
No feasible location to install systems.	4,29	2,04
Non-supportive policy environment	4,91	1,94
Unfavourable changes in RE policy framework for the cooperative enterprise model	5,7	1,82
Weak capacities of the community to persevere in carrying out the project and keep systems maintained and operating efficiently	3,84	1,99

Table 14: Impact assessment of identified barriers to RE cooperative development

Moreover, participants were able to further indicate barriers. 16 respondents took advantage of that possibility and highlighted further barriers, including:

- Impact of decreased Feed-in payments;
- Tendering also applies for small scale organisations, preliminary outlays required cannot be financed with available means;
- Conflict of interest between political leaders and utilities/municipal utilities (Stadtwerke);
- Increased regulations and ever more comprehensive legislation and;
- Local energy provision massively hampered through preferential treatment of large corporation by politics.

In terms of addressing the highlighted barriers, cooperatives pursue a number of strategies or implement measures to overcome them. Some try to minimise costs, expand on a slower pace or put their hope into a general framework that might improve business conditions in the future. Results show that most entities, however, evolve from a passive role as a niche player responding with an expansion of activities, mergers and increased networking in association. The increased collaboration between cooperative and collective lobbying efforts are used to influence political decisions on the regional, national and supranational level. Interestingly, participants seem to distinguish among the different political levels, as this participant described: "*Local politics support the decentralized energy supply to the best satisfaction. The federal politics in Berlin slows down a decentralized organization and aligns the laws with the interests of major enterprises.*"

As stated in the questionnaire, officials seek to raise the awareness in the community about their organization attempting to mobilize the general public for their cause through a variety of social marketing initiatives. Mentioned strategies include the establishment of a constant dialogue with the community and politicians and invitation of local organisations to participate and carry out information campaigns to inform about the benefits of a local energy supply in "citizens hands". These results correspond with the findings of Viardot (2013).

One respondent summarized his cooperative's strategy by mentioning five key words: "*Networking, Activism, Information, Innovation, Survive*", this statement concludes the actions pursued by cooperatives to overcome the barriers short and concise.

In terms of development drivers for RE cooperatives, roughly 70% of the entities agree with two major drivers: firstly, local investment and income generation and, secondly, ethical and environmental commitment. Interestingly, the drivers local investment and income generation represent the same approval rating across the scope of analysis regardless of the average income in the individual NUTS-2 region. As expected, and displayed in table 15, the replies demonstrate a negative attitude towards the support policy environment for cooperatives on the one hand and support policies for RES on the other, although the latter is substantially more effective. Both evaluations are an expression of the discontent and frustrations regarding the constantly deteriorating framework conditions in Germany. Respondents demonstrate an engrained distrust towards political actors as well as incumbents (Interviewee 1).

It must be noted that all those drivers linked to a certain locality were considered influential. Altogether, the local environment seems to have a major impact on the development of cooperatives, especially considering the fact that the influence of local public institutions was identified as beneficial, in contrast to superordinate governmental bodies.

	1=Not a driver; 7=Strong driver	
	ø Arithmetic average	
	± Standard deviation	
	ø	±
Ethical and environmental commitment	5,66	1,82
Influencing local energy policy	4,83	1,97
Local control of resources and load management	4,07	2,03
Local investment and income generation	5,72	1,54
Lower energy costs and reliable supply	4,83	1,76
Strong cooperative enterprise history and tradition in your region	4,15	1,7
Sufficient average regional personal income and/or wealth	4,18	1,6
Supportive policy environment for cooperative enterprise	3,62	1,98
Supportive policy environment for renewable energy systems deployment	3,26	1,81

Table 15: Impact assessment of identified drivers of RE cooperative development

A notable disparity exists between the assessment of the barriers and drivers impacting RE cooperative´s development. Results show that barriers were considered as less disruptive than drivers were considered beneficial. It is unclear whether the difference occurred due to logical reasons or the fact that people prefer to identify themselves with positive factors.

As before with the barriers, the questionnaire gave the possibility to indicate further drivers, unfortunately, only a total of nine replies were recorded. Additionally mentioned drivers include the aim to democratise the energy supply, to not compromise future generation's habitat, regional co-ownership, increase regional added value and reduce loads on grids through regional electricity generation and usage. Once again, it is obvious how often regional aspects play a role in the philosophy of individuals considering them as drivers.

4.4.3 Membership – Structure, Participation, Motivation

This section of the survey gathered interesting data on the membership characteristics and what motivated individuals to join the cooperative. In table 16, the average number of members in cooperatives demonstrates the relative small size of the member base, roughly 55% of the organisations have between 100 and 300 members and just 19% more than 300 members.

Number of members in cooperatives	
ø Arithmetic average	211,63
x̃ Median	186
± Standard deviation	159,18
Range	809
Minimum	11
Maximum	820

Table 16: Number of RE cooperative members per entity

However, RE cooperatives enable individuals of relative modest means to participate in the energy transition. As shares in many cooperatives can be obtained for not more than 100 €. Actually, over 50 % of the organisations sell shares for a price between 15€ and 200 €. The larger picture demonstrates that nearly three-quarters of the entities enable individuals to participate with a share size of less than 500 €. Still, the range of share prices offered differs enormously. Interestingly, 36 organisations out of the sample require just one share to be bought to become stakeholder and mere 12% more than five shares.

Therefore, though hard to imagine, no strong correlation could be found between the minimum share price and the number of cooperative members.

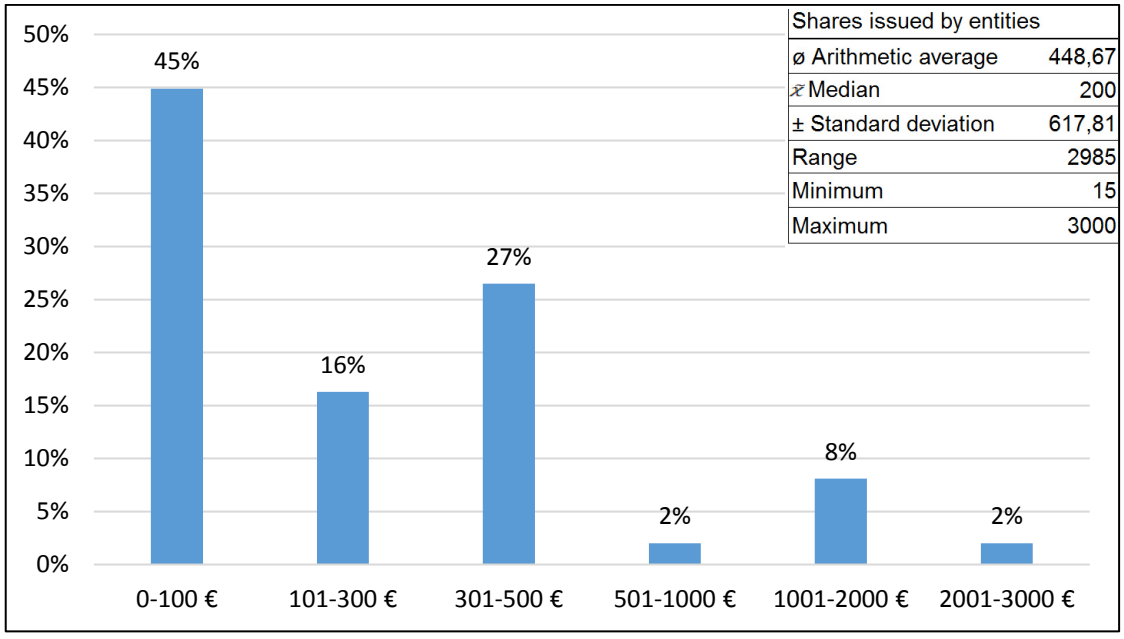

Figure 19: Distribution of share prices in €

One of the most intrinsic features that draws attention to the cooperative model, represents the democratic decision making, in other words: the one member one vote principle. According to the survey data, every organisation of the sample complies with this principle.

Hence, it is assumable that this way of decision making would be unappealing for investors other than regular citizen, since they cannot exercise control corresponding to their shareholding as the case in other legal forms. However, 72% of cooperatives themselves do not allow investor members, so that the question does not even arise.

Hereby most RE cooperative rely on other forms of financing, predominately on individual members. Respondents further highlight that investor members permitted to the cooperative do have the same rights and responsibilities as regular members and need the approval of the board of directors, in some entities. The assumption, therefore, seems reasonable that RE cooperative could try to expand their geographic reach for the purpose of attracting more people from a greater geographical region, as indicated by other authors (Yildiz et al., 2015; Bauwens, 2016). Results demonstrate, however, that the geographic reach of cooperative's membership in 85% of the cases remains at a regional level attracting a mere 4% of members on an international scale.

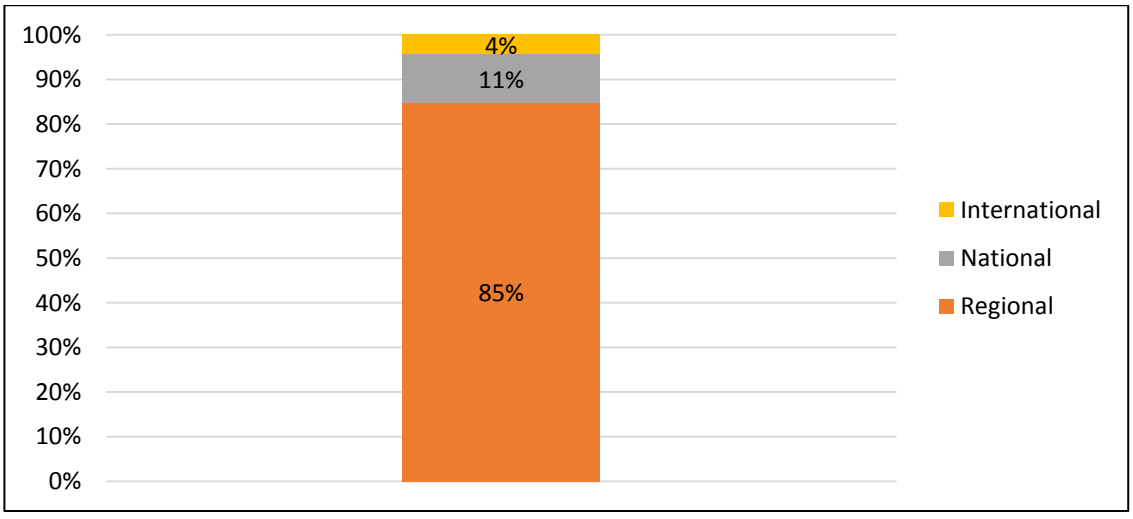

Figure 20: Geographic reach of cooperative's membership

Certainly one of the most important aspects for RE cooperatives is to gain the support of the local community and ideally persuade individuals of the good cause and entailed benefits of being a member. As the grounds of accession differ among cooperative members, respondents were asked what motivated their members to join this kind of organisation (Dieperink et al, 2004).

The results in table 17 reveal rather strong approval rating for all motives, most notably: the participation in the energy transition and the possibility of local investments. The latter fits well into previous questionnaire results, as this opportunity has been highlighted already as the second strongest driver of cooperative´s development, whereas one could assume that the energy transition itself might be to abstract to motivate a regular citizen to join. Therefore, it should be noted that the questionnaires, almost certainly, have been completed by long standing and strongly motivation cooperative members, who may identify themselves much more with the energy transition than other members (Bauwens, 2016).

Concerns about environmental and climate impacts of traditional electricity generation technologies seem to be a general public concern nowadays, which clearly motivates individuals. Results show that neither self-regarding motives nor social and moral norms were identified as predominant motivation, which complies with other studies such as the one by Kalkbrenner and Roosen (2015) and Bauwens (2016). Moreover, in both countries experts attribute to cooperative the inherent ability to remove income inequality and enhance social justice (Interviewee 1,2).

	1=Not important; 7=Very important	
	ø Arithmetic average	
	± Standard deviation	
	ø	±
Concerns about environmental and climate impacts of traditional energy technologies	5,64	1,47
Influence of the community and trust	5,26	1,45
Local income generation	5,26	1,47
Local investment	5,87	1,22
Lower energy costs	4,15	1,91
Participating in the energy transition	5,91	1,12
Reliable local energy supply	4,74	1,83

Table 17: Motivations to join a RE cooperative

Once again, responding entities added a couple of reasons to participate, including the support for the funding of local schools, strengthening of local economy and personal proximity. Surprisingly, 35% of cooperatives responded that their member's reasons for participating weren't different for founding and later coming members.
However, others highlighted prevailing differences, as appropriately described by this cooperative official: "*It seems to be the case that climate and energy policy motives have played a greater role for founding members than for later coming ones. In general, all members have a mixture of energy/climate/regional political motives and income expectations, with varying intensity*", in addition to that another respondent by saying that: "*In 2008, the euphoria and motivation to participate in the energy transition was considerably greater, than in 2017. This has been caused by the (misguided) development of energy policies.*" In addition, Portuguese members seem to be particularly suspicious before becoming a member exhibiting a higher degree of the "*fear of the unkno*wn" – they would like to see results before getting involved personally. This might stem from a negative historical legacy that the Portuguese population experienced after the Carnation revolution with cooperatives (Interviewee 2).

A more or less uniform picture emerges out of these results, implying that the founders were more socially and morally driven individuals taking part actively in the cooperative. In contrast to the more self-regarded late-coming members with a stronger focus on the possibility of a local investment and resulting rate of return. Additionally, late-coming members were described as a necessity of a viable operation and finance base for further projects.

4.4.4 Organisational structure

RE cooperatives were asked to identify the legal form they have adopted. All participating organisations identified themselves as registered cooperative companies. Survey results show that roughly 78% of them have no employees and just 8% employ more than two. Three entities employ their employees on a part-time bases. Thus, the crucial question of maintaining the motivation of volunteers in daily operations and missing professional knowledge of volunteers gain importance. In particular, paid professional managers are an exception, working in a mere 4% of the organisation.

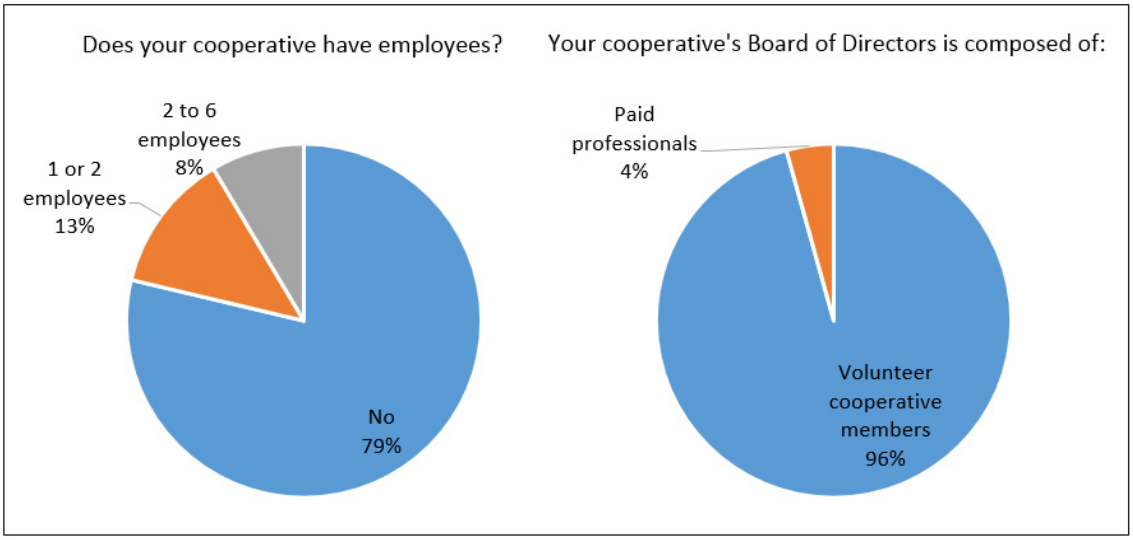

Figure 21: Extent of volunteers working in RE cooperatives

The influence of small organisations is typically constrained to the local level. It is therefore pleasing that survey data indicates the satisfaction of RE cooperatives with the support from the municipalities and other local actors. Nevertheless, to exert influence on the national or supranational level, organisations usually join associations or perform mergers to lobby jointly for their interests. RE cooperatives are no exception, so that already 32% have made such an endeavour. Figure 22 presents the share of RE cooperatives pursuing lobbying activities, almost half the respondents were engaged in such activities to influence institutional actors, such as regulators or the federal government. However, the cooperative movement has a limited influence, as mere one person lobbies on their behalf in Berlin, in contrast to the utilities employing entire department for this purpose (Interviewee 1).

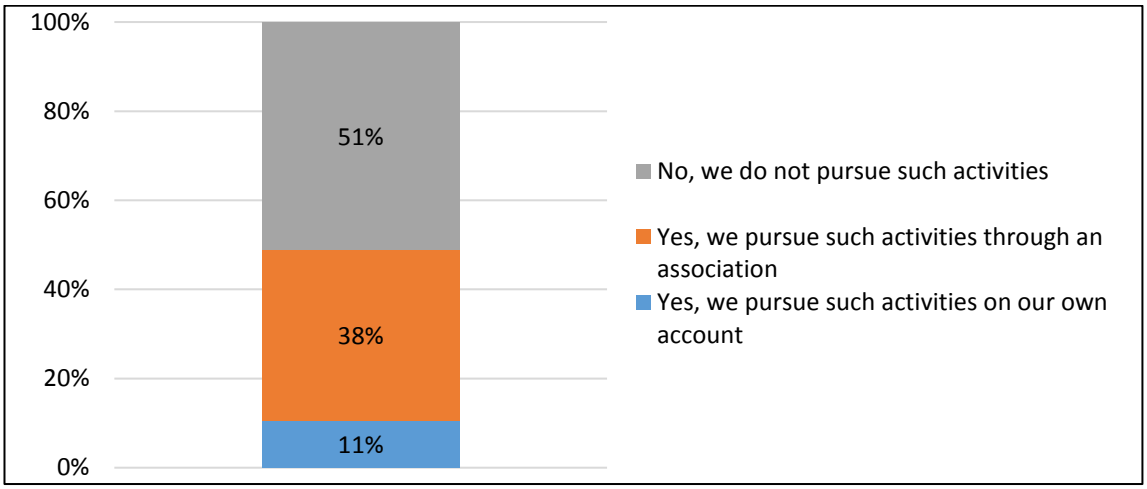

Figure 22: Share of RE cooperatives pursuing lobbying activities on local, national and supranational level

4.4.5 Economics and Financing

In terms of project financing several means are available, however, commercial banks are hesitant to provide loans for capital intensive RE projects owned by cooperatives since they are generally averse to restrains (Yildiz, 2014). Hence, cooperatives rely on other sources of capital than investor owned entities. Survey data revealed that two of the three most important financial project resources are generated internally. Firstly, more than 80% of the entities highlight member equity finance as their predominant source of finance. Secondly, earnings stem from their business activities. Both financial resources have a leading edge over other resources, as they entail no additional interest or transaction costs.

	1=Minor; 7=Major	
	ø Arithmetic average	
	± Standard deviation	
	ø	±
Commercial bank loans	3,44	2,23
Cooperative revenue	5,07	2,04
Cooperative bank loans	5,53	1,89
Ethical or green bank loans	3,79	2,37
Member equity financing	6,19	1,42
Other RE cooperatives	2,97	2,1
Public financing (e.g. municipal, national, EU project financing)	3,18	2,34

Table 18: Sources of finance of RE cooperatives

Having additional external financing needs, RE cooperatives rely mainly on cooperative banks to provide external capital. The uttermost importance of cooperative bank loans for cooperative development demonstrates figure 23. The large majority collaborates either with cooperatives or local banks. These findings were again confirmed in both interviews, however, the statements differ from one another primarily in one point: Whereas the German cooperative pointed out to a have a wide range of financial support institution at their disposal, the Portuguese cooperative states a general lack of suitable financial institutions, in particular as available banks lack ethical business practices (Interviewee 1,2).

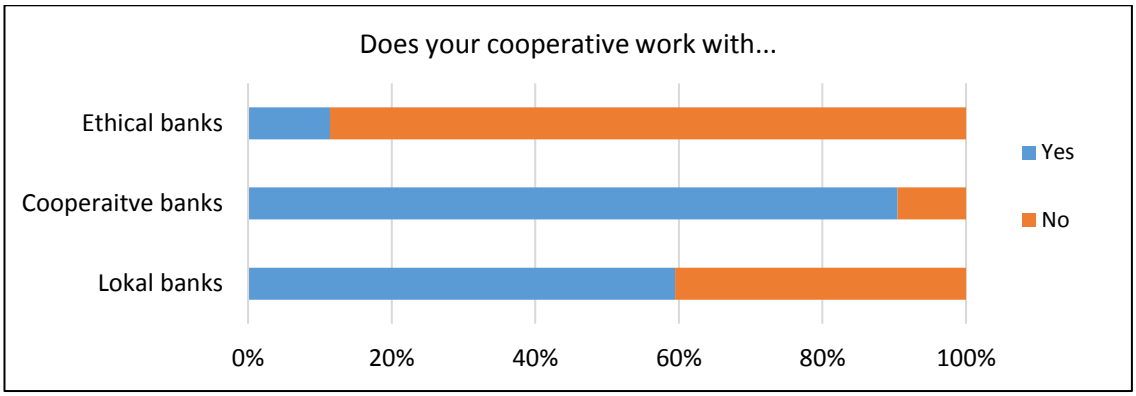

Figure 23: Established connections to external sources of finance

Furthermore, the following figure 24 highlights the debt to equity rate of participating cooperatives, although one has to note that only 20 replies were recorded. However, RE cooperatives have comparatively high proportion of equity of 49% on average. 15% of cooperatives invest no debt capital at all and a further 25% only to a negligible extent. These results approve the earlier mentioned findings about the differing way of project financing of cooperatives in comparison to investor owned enterprises. Moreover, most organisations remain fairly small entities as results on average revenue reveal. 51 % of RE cooperatives generated an annual revenue of less than 100.000 euro during the last three years, and a mere 2,3% more than one million euro.

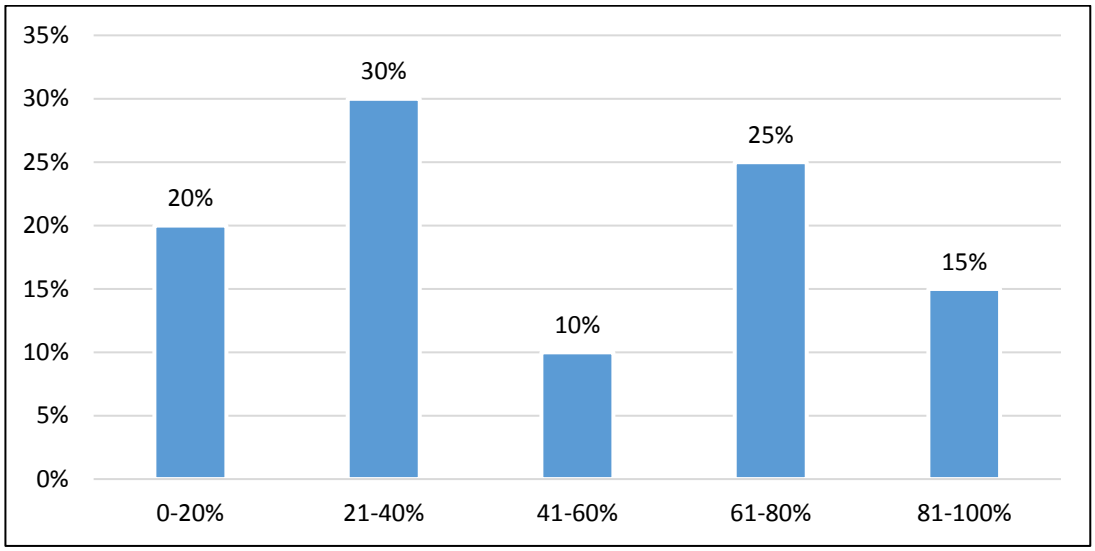

Figure 24: Debt to equity ratio of cooperatives

It should be stressed here that in the German banking system local banks are to a great extent municipal savings banks and thus linked to local governments (Beermann and Tews, 2016). This means, if municipalities or local governments lean towards the energy transition and are willing to support cooperatives, they could issue instructions to these banks, resulting in different advantages. Apart from the importance in terms of project financing, the partnership among local entities and cooperatives generates mutual benefits. To which extent cooperatives are embedded and impact the local economy is revealed by the following fact. When participants were asked with whom they have established local partnerships, more than 60% named community organisations, every second cooperative local businesses and slightly less was stated the local municipality. However, not every established partnership seems to be mutually beneficial or to lead to a long-term collaboration. Results reveal a certain lack of interest and excessive profit expectations of local municipalities in Portugal (Interviewee 2). On the contrary German municipalities have been pleased to receive the opportunity to enter into a partnership and consequently try to assist throughout the project realisation process (Interviewee 1).

The results further indicate the strength of the collaboration of the cooperatives and local actors, as 31 respondents stated joint activities, including:

- Municipalities lease roofs, land plots for RES installation or provide event venues;
- Joint RES projects with municipal utilities, installers, municipalities and community;
- Purchasing external services from regional partners – local value creation;
- Municipalities, local banks and local businesses join the cooperative as investors or initiate/support foundation;
- Municipalities offer legal advice and assistance in project realisation as well as public relations;
- Carry out joint climate protection campaigns with municipalities;
- Sell electricity generated directly to the city;
- Advice and assist the mayor in energy related topics and develop an energy transition roadmap with the county council and municipality and;
- Membership in various local and national associations.

93% of cooperatives state that they do not benefit from any preferential tax treatments, but at least partly they receive support on the local level, as previously mentioned. One reason for the support from local institutional actors may stem from the non-monetary added value to the local community. As results show, almost 2/3 of the entities believe to provide certain added value, for instance through the participation and joint responsibility in a common project, leading to a strengthened sense of community. Additionally stated were the increase of local energy independence, new car sharing or eCar offers that have been made available as well as lower CO_2 emission. Educational offers and heat supply for schools or community facilities complement and contribute to the positive image of these organisations.

4.5 Outcomes

The *Renewable Energy Cooperative Survey* project was not successful in mobilizing a fully representative sample of RE cooperatives active in the energy sector.
Therefore, one has to be careful to draw conclusions about the foundation and development factors of RE cooperatives business environment. It should be stressed here again that the analysis is based almost exclusively on data obtained from German RE cooperatives and thus further decreased the robustness of results regarding the Portuguese case. However, a number of lessons were learned for future research projects applying the survey methodology that might help to conduct such a project successfully.

- As mentioned in the dissertation, the literature rightfully states that the successful survey deployment demands a significant amount of time and resources throughout the entire process but in particular during the survey preparation. The survey launch had to be postponed several times, at first as a result of the extra effort, clearly surpassing the initially planned workload and later to avoid an unfortunate launch period, right before Christmas. In this light, the researchers experienced the effort it truly takes to realize such a project and also the need to consider the timing of the survey launch, when collaborating with third parties for data acquisition.

- The extent of the survey along with the academic character may not have offered sufficient motivation for respondents to participate. Although an attempt was made to additionally motivate respondents by the promise to make the compiled survey results available to all participants. On the basis of the quite broad questioning a single knowledgeable individual was certainly able to finish the survey without significant effort. However, a shorter and less detailed survey may increase the response rate but simultaneously decrease the obtained data quality. Unfortunately, literature does not provide further information on how comparable studies were able to perform the survey more successful. One could assume that these studies were governmentally backed or endorsed by a cooperatives association.

- The RWTH Aachen E-ON Energy Research Institute was mentioned among others as one of the inviting organisation to the *Renewable Energy Cooperative Survey* and undertook the responsibility to distribute the invitation letter in Germany. The intention behind this decision was motivated by the desire to increase the significance and impact of the survey for the cooperative sector. However, it soon turned out that the naming of the "E-ON Energy Research Institute" triggered a reaction of rejection and deep distrust by many respondents with regards to the research project leading to the accusation of not conducting independent research. Although several attempts were made to convince a couple of respondents otherwise, none took part in the survey at a later stage. With all this in mind, the researchers are convinced that this represents the major reason for the low response rate highlighting in an exemplary manner the engrained distrust of RE cooperatives towards utilities.

- Another weakness of the project resulted from the ownership of the distribution process. The RWTH Aachen E-ON Energy Research Institute forwarded the survey invitation letter by mail, including the link to access the online survey along with the project´s mail address. First of all, some confusion was created through the distribution via one mail address and stating another contact mail in the survey invitation letter. As a result of not being involved in the distribution, the researchers were not aware of any possible response to the distributing mail address, furthermore, it was later revealed that some mail addresses in the distribution list contained errors, hence not all organisation were contacted. Therefore, it is from uttermost importance in such studies that the researchers are involved in every aspect of the process.

- Finally, some respondents reported a great number of inquiries from other research projects in the field during the period of implementation and some others reported negative experiences with previous research groups. Clearly, these aspects present no direct link to the research team, however, whereas the first aspect represents an unfortunate fact, the latter should be avoided by all means, as a disturbed relationship between the research and cooperative community benefits neither of them.

It should be noted in this context that most surveys in literature entailed follow-up interviews that intend to bridge persisting knowledge gaps and deliver insights to a greater depth. As this project followed a similar approach and the survey was designed accordingly, participating organisation were asked to confirm their willingness to participate in the follow-up process. 32 organisations stated their contacts and responsible persons for future collaboration – representing 55% of the sample. However, the timeframe and scope constrained this endeavour to the conduction of two complementary interviews. Both interviews led to valuable insights increasing the representativeness of the data collected. The experience suggests a continuation of the follow-up process representing an excellent opportunity for future collaboration on supplementary studies.

In summary, the experience of the *Renewable Energy Cooperative Survey* project suggests that in order to perform a successful survey with a representative response rate, the following considerations should be met:

- Deployment effort should be evaluated and planned in a proper manner;
- Consider survey launch time of the year (e.g. public holiday, annual accounts, etc.);
- Target organisations need be strongly motivated to participate. Increased lobbing efforts, government backing, endorsement of association can help to raise the motivation level;
- Beneficial collaborations should be established, however, the reputation of partner organisations among the target group must be considered;
- Researcher must have full ownership of the survey deployment process to avoid shortcomings and misunderstandings and;
- Follow-up process represents a great opportunity to acquire additional qualitative data.

Some facts, regardless of the low response rate, worth empathizing include:

- The established collaboration framework made the implementation of the project possible;
- A complete survey was developed with detailed questions to acquire data across countries on RE cooperative activities, organizational models and membership characteristics as well as on the most influential drivers and barriers;
- A detailed database of contact information of cooperatives in the energy sector was compiled and;
- Provided contact information and the willingness of RE cooperatives for further collaboration could serve a base for future research and studies.

To conclude, besides the mentioned constrains, the project was successfully developed, comprising a detailed methodology and structure, even though lacking RE cooperatives engagement to a sufficient level. Consequently, improvements must be observed and put into practice before starting the next research projects of this kind.

5 Conclusion and policy recommendations

The main goal of this dissertation was to develop tailored policy recommendations for the advancement of RE cooperatives. Particularly by identifying and assessing the regulatory, economic and organisational emergence and development factors of this organisational model, since literature provided insufficient justifications for the different stages of development across countries. Secondary objectives included, revealing insights into the motives for entry of cooperative members and identification of the governmental standpoint towards citizen participation. The dissertation firstly provided an overview of the cooperative movement and contextualising the citizen´s role within the European energy transition. Secondly, an extensive literature review of RE cooperative studies along with corresponding legislation was presented, intending to identify the factors in the present state of knowledge, required for developing and carrying out the *Renewable Energy Cooperative Survey* in Germany and Portugal. Finally, the applied methodology, course of action and outcomes of the study were described in chapter 4.

Key conclusions drawn from the policy- and legislative overview in the EU indicate that recent amendments were directed at improving the EU´s compliance with RE targets and strengthening the active citizen participation in the governance of RES projects. Through this strategic reorientation on the supranational level, community initiatives may become an integral part in the decentralised energy provision. However, the ongoing Europe-wide implementation of tendering, as a measure to allocate financial support, introduces additional elements of uncertainty for project developers. Therewith, although aiming to establish a level playing field for all market actors, quite the contrary is true, resulting in a support framework favouring large incumbents and putting citizens at a disadvantage. In conclusion, a clear and stable legislative framework reducing complexity, risks and costs is needed for the purpose of unfolding the proven positive social and environmental impacts of community energy initiatives, like RE cooperatives.

Along the development process this dissertation predominantly suffered from two main shortcomings, namely the low survey response rate and the lack of RE cooperatives in the Portuguese market, causing serious data limitations in terms of quality and quantity. Both shortcomings should be kept in mind when drawing conclusions, therefore, the knowledge acquired from the survey project complemented with the interviews and profound insights of the theoretical analysis, revealed the following major outcomes:

In Germany, community energy organisations have largely contributed to the great increase in the share of RE with currently more than 1000 RE cooperatives. A number of possible causes for this development comprise the following: a relatively high ethical and environmental commitment of the population, the presence of a multitude of support organisations, the initial lack of interest of the incumbents and especially stable and most generous RE support schemes. Unlike other studies, the results indicate a particular high importance of local actors, as they often provide the incentives for the foundation and required expertise. Apart from that, the intensified lobbying efforts of the incumbents unfortunately resulted in a slowed pace of the energy transaction and unfavourable regulatory modification for RE cooperatives.

In Portugal, the deployment of RE plants has been most successful and resulted in one of the highest RE shares worldwide. However, in contrast to Germany, only a couple of RE generation plants are not owned by large utilities. In general, the activities along the energy value chain remain in the hands of large incumbent actors, with currently a single RE cooperative promoting citizen engagement. The cooperative model struggles to make a headway, resulting from a variety of barriers opposing their successful emergence, comprising: a missing clear legal cooperative framework, the political influence of dominant utilities that resulted in a market design favouring large entities and oligopoly structures, the insufficient institutional support and missing knowledge infrastructure, as well as scarce financial resources (lack of suitable local banks and low financial power of the population).

Both, the Portuguese and German government could adopt several measures to encourage the advancement of RE cooperatives in the electricity market. Thus, the succeeding table 19 presents the policy recommendations concluded from the theoretical analyses and experimental study.

No	Portugal	Germany
1.	Maintaining the incentives for municipality allowing wind plants on their territory (DL *339/2001)* and, if possible, expanding to PV installations	Fewer amendments of the legislative framework and support measures to provide a stable business environment
2.	Decreasing the complexity of administrative procedures and costs for grid connection/guarantees or building permits	Associations can provide business ideas or support to establish new activities
3.	Analysing and revising the social economy law (legal definitions) and cooperative code with the aim of adapting them to the activities and goals of community energy initiatives and reintroducing tax cuts as well as eased regulatory procedures	Extending specific rules for small actors within the current *EEG*, for instance, increase the minimum threshold for tender, eligible FiT payments, or eased conditions of participation in the tendering process
4.	Build-up of a network of partner institutions to provide additional technical capabilities, exchange experience (knowledge infrastructure) and offer training sessions	Analysing the possibility to introduce tax cuts for community energy organisations to equalize other disadvantages on the market
5.	Sensitising local actors for the benefits of community energy projects and provide information about mutual interests and profits	Decreasing the complexity of administrative procedures for grid connection or building permits
6.	Defining a specific financial envelope that incentivises the foundation of local green/ethical or cooperative banks with the aim to increase project funding or preferential lending terms to social organisations	

Table 19: Policy recommendations for the advancement of RE cooperatives, divided by country (own elaboration)

As the results of this dissertation indicate, there is a large potential for the design of new frameworks to encourage and facilitate the deployment of RE cooperatives. In that regard, the comparison between Germany and Portugal provides interesting solutions that could be used as a best practice example for policy makers or RE cooperatives willing to realize RE projects, one example represents the role of local actors.

Although some aspects can be generalised, the successful implementation depends on the development of a framework designed to meet the specific local circumstances. Furthermore, the Portuguese market environment demonstrates that certain barriers of cooperatives can be overcome by highly motivated individuals in cooperatives, however, a well-designed supportive framework is needed to realise the large-scale diffusion. The final learning relates to the recent electricity market reforms in Germany that may considerably limit the opportunities of projects deployment by RE cooperatives. Hence, nothing should be taken for granted, in terms of a well-functioning institutional context. On the contrary, a constant alertness is required and opposition from affected organisations.

Ultimately, the presented study provided incentives and ideas that contribute towards creating a truly sustainable transition of the energy supply. Government authorities have the right tools and knowledge available to establish a framework fostering the socio-economic inclusion of citizens.

Nevertheless, through the performance of the research project, different opportunities for further research were identified. A future research path can build on this dissertation performing the research in consideration of the shortcomings and in a broader scope comparing a wider array of national frameworks with each other. This could assist to increase the robustness and representativeness of results generating more appropriate recommendations. Another interesting approach could be to analyse the influences of certain factors in a more detailed manner, in particular, shedding light on the impacts of the human factor (mind-set, cultural background, habits, etc.). Finally, it is certainly worth exploring the long term-effects of RE cooperatives on the three dimension of the energy trilemma (energy security, energy equity, environmental sustainability), as cooperatives might be most beneficial for one dimension but unfavourable for the other.

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Annex

1 Main characteristics of the SCE

The main characteristics of the SCE at a glance:

- SCE follows the principle object to satisfy the needs of its members - the return of capital investment should not be the top priority;
- Members benefit proportionally to the profit, not to their invested capital and liability is limited to invested capital;
- SCE can be newly formed by five or more persons from more than one EU member country, by a merger of two or more existing cooperatives, by five or more persons and companies in or governed, by at least two different EU member states, by a conversion of an cooperative, pre-existing at least two years, that has a subsidy in another EU member country;
- Minimum capital requirement of 30.000€. Investor members are allowed but limited to a proportion of 25% of total voting rights;
- SCE must be registered in the EU member country where the head office is located;
- Voting on a “one member one vote” bases should be conducted. Some weighted votes may be permitted but must be determined by the degree of participation and;
- A general meeting must take place at least once a year. Decisions are taken by the simple majority of members participating or represented. Two third majority necessary for statutes changes.

2 Support Instruments

The following both tables present the support instruments of RES, aiming to enhance the deployment, in Portugal and Germany, as of end 2016 (own elaboration, based on data from RES legal, 2016; IEA-Portugal, 2016; BMWI, 2016).

	Support scheme	Description
Germany	Feed-in tariff (EEG feed-in tariff)	Power plants of up to 100kW receive FiTs, which are paid by the grid operator. FiTs are granted for a period of 20 years and the amount is set by law. Optional remuneration with FiP.
	Loan (KfW-Consortium Loan Energy and Environment)	Supports by providing a consortium loan of up to € 4 billion for on-shore wind farms and PV systems.
	Loan (KFW-Program Geothermal Exploration Risk)	Supports exploration activities by covering investment costs.
	Loan (KfW Renewable Energy Programme Premium)	Among others, provides low interest loans and grant repayment support for electricity generation in deep geothermal installations.
	Loan (KfW Program offshore wind energy)	Off-shore wind farm project receive support through loans and financing packages.
	Loan (Renewable Energy Program Storage)	Support measure to increase the amount of stationary battery storage system in connection with PV systems and grid connection.
	Loan (KfW Renewable Energy Program Standard)	Low interest loans with a fixed interest period of 10 years including a repayment-free start-up period for investments in systems for electricity productions.
	Premium tariff (Market Premium)	Every plant operator of RES with an installed capacity of 500 kW is supported by a market premium for the electricity sold to the grid. The market premium amount is calculated each month.
	Subsidy (Flexibility premium)	Biogas plants that became operational before 01.08.2014 can apply for additional support for providing capacity support for on-demand use.
	Subsidy (Flexibility surcharge)	Biogas plants that became operational after 01.08.2014 can apply for additional support for providing capacity support for on-demand use.
	Tenders (Auctioning the feed-in support for ground-mounted installations)	For groundmounted PV systems with an installed capacity between 100 kW and 10 MW the financial support is determined by auctioning.

Portugal	Support scheme	Description
	Feed-in tariff (Tarifas feed-in)	Most important support instrument. The FiT consists of two elements: A fixed payment rate and an amount calculated by a statutorily set formula. For new small scale generation installations, a bidding based remuneration scheme is in place, in which producers offer discounts to a reference price.
	Tender(Bidding the feed-in support for Small production units(UPP))	UPPs with a capacity of up to 250 kW and a cap of 20MW annually - Producers offer discounts on reference tariff, altered annually, Guaranteed remuneration period of 15 years,
	R&D subsidy (Fund)	Fund to support innovation in renewable generation technologies.
	Certification and Training of RES installers	Professional course/program of technician of RE

3 Interview Guideline

1. Market structure:
   1.1. Can you please describe market conditions for renewable energy cooperatives in Portugal?

   1.2. Do you feel that there are (hidden) monopolies in the Portuguese energy market structure that favourite incumbent large stakeholders, i.e. ineffective unbundling of generation, transmission, distribution and retail of electricity?

   1.3. Are these incumbent actors influencing national RE policies, targets and support schemes in a way that is unfavourable to small enterprise and individuals?

   1.4. How is this impacting your work (and how are you adjusting)?

2. Financing:
   2.1. How do you finance your projects?

   2.2. Are member contributions and the willingness of citizens to invest in cooperative projects sufficient for the development of a national niche of renewable energy cooperatives, or is financial support, through networks such as REScoop, banks, government grants (feed-in tariffs, crucial for starting an RE cooperative in Portugal?

   2.3. Where do you see the incumbent major advantage in terms of access to funding?

3. Institutions:
   3.1 Are you under Portuguese law considered as a part of the social economy? If not, why not and what are the consequences? If so, in which extent are you affected by the removal of tax benefits and exemptions for cooperatives?

   3.1. (Do Portuguese cooperative law and energy (electricity) market laws and rules have synergies that are supportive of the renewable energy cooperative model?)

   3.2. Coopernico is the only RE cooperative (in the modern sense) in Portugal as far as we know. Please give us your opinion as to why this is the case.

   3.3. Have people approached Coopernico to ask advice on how to set up their own RE cooperative and if so do you provide information and share your experiences with them?

3.4. Do cooperative may suffer due to a negative historical legacy in general?

3.5. From your point of view, is the cooperative model, as a legal form, attractive in Portugal?

3.6. What is you experience in cooperation with local governments/municipalities?

4. Knowledge, interaction, information sharing and capabilities

4.1. Is there a Portuguese or an Iberian platform that can assist new entrants in the same way?

4.2. How do you share knowledge with others or spread the idea of a decentralized and democratic energy system?

4.3. Would you say that there is a culture of energy activism in Portugal?

4.4. Public attitude towards RES?

4.5. Are there barriers in terms of willingness of citizens to uptake new technologies or new models of participation in electricity markets - i.e. prosumer concept through the cooperative model - such as "fear of the unknown", distrust in small ventures in the electricity market, lack of entrepreneurial spirit and cultural barriers?

4.6. Where do you see the main reason for the weak development of PV systems in Portugal, considering the enormous potential due to optimal environmental conditions?

If there is time:

5. Grid access - Are you satisfied with the established grid connection procedures and costs? What is their impact on your business decisions (e.g. on establishing new capacities, location of systems, lead-times)?

4 Explanation of key support instruments

All four key instruments are operating support instruments subdivided into quantity and price based instruments. Quota obligations and tendering schemes represent quantity based instruments fixing a quantity of renewable generation capacity to be deployed.

- *Quota obligations*: Under a quota obligation scheme, governments impose an obligation on producers, suppliers or consumers to source a definite part of their electricity from RE. Tradable green certificates can be used to facilitate the obligations. Producers sell the electricity at the market price, but they can also sell green certificates, which they receive for the production of renewable electricity.
- *Tendering schemes*: A tender is announced for a pre-defined amount of electric capacity for a certain technologies. Enterprises have to bid and the cheapest offer is accepted.

Price based instruments set a fixed price to be paid for electricity generated from renewable energy sources.

- *Feed-in tariffs*: Feed-in tariffs (as well as Feed-in premiums) are granted to renewable electricity generated for the electricity they feed into the grid. FiTs pay a fixed retail price per unit of electricity to the producer (minimum price system) FiTs get usually granted for a period of 10 to 20 years after installation. The major advantages of FiT schemes presents the predictability and stability for both the renewable energy landscape and especially for individual producers and investors with regard to their income generation. In addition to the fixed retail price, the long duration decreases the market risk faced by investors.
- *Feed-in premiums*: Unresponsive FiTs schemes become increasingly replaced by Feed-in premium schemes, which pay a premium on the market price but require producers to take responsibility for selling and balancing power. Like FiTs, FiPs are granted to RE plant operators for a fixed period but introduce competition among producers of electricity, in contrast to FiTs.

Additional instruments include fiscal incentives such as tax reductions or exemptions. Renewable electricity producers are exempted from paying specific taxes to provide equal conditions for all energy sources due to various external costs of fossil fuels.

5 Questionnaire

Renewable Energy Cooperatives Survey 2017

Welcome to our Renewable Energy Cooperative survey 2017!

The Energy for Sustainability Initiative at the University of Coimbra, the Institute for Systems Engineering and Computers at Coimbra (INESCC), the MIT Portugal Program and the RWTH Aachen E.ON Energy Research Center thank you for willingness to take part in our survey.

The data collected in this survey will only be used for academic research and any information that you provide us will not be disseminated further as such.

The questionnaire is divided into 5 thematic with a total of 40 questions. Most of the questions are multiple choice, while those that require a written input are simple questions, such as asking for the name of your cooperative or the number of members in it. Therefore, completing the survey should take no longer than 20-25 minutes of your time.

You may skip questions that you are not comfortable with answering. Do bare in mind though that the information that you can provide is very important, and that the aggregated results of this survey will be used to develop recommendations for advancing the EU and national policy environments and conditions for renewable energy cooperatives.

Should you have any questions or doubts, please do not hesitate to contact us at rescoop@inescc.pt.

By clicking on "Next" you will be redirected to the the questionnaire. Thank you very much and we wish you all the best in the New Year!

A) General questions

1. Organization Name *

2. Country *

Please choose...

A) General questions - Region (EU NUTS III)

Austria region

Please choose...

A) General questions

3. When was your cooperative established?

Year: [ ]

4. When did your cooperative initiate its primary activities?

Year: [ ]

B) Cooperative activities

1. To which of the following categories does your cooperative belong to (select multiple if applicable)? *

- [ ] Generation/production
- [ ] Distribution/transmission
- [ ] Trading/green power purchasing
- [ ] Services in RES (i.e. Consultancy, engineering, legal services, certification, etc)
- [ ] Other (please specify): [ ]

B) Cooperative activities

1.1 Which technologies does your cooperative employ for electricity generation?

- ☐ Hydro power
- ☐ Wind power
- ☐ Solar PV
- ☐ Solar thermal
- ☐ Geothermal
- ☐ Biomass, Liquid biofuels
- ☐ Wave/Tidal
- ☐ District heating cooperative
- ☐ Other (please specify): _____

B) Cooperative activities

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Hydro power			

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Wind power			

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Solar PV			

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Solar thermal			

Please provide further information about your renewable energy generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable energy generation economically viable without a feed-in contract? (please answer yes or no)
Geothermal			

Please provide further information about your renewable energy generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable energy generation economically viable without a feed-in contract? (please answer yes or no)
Biomass, Liquid biofuels			

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Wave/Tidal			

Please provide further information about your renewable energy generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no)	Is renewable energy generation economically viable without a feed-in contract? (please answer yes or no)
District heating cooperative			

Please provide further information about your renewable electricity generation

	What is your installed capacity? (please indicate in MW)	Do you benefit from feed-in contracts? (please answer yes or no?	Is renewable electricity generation economically viable without a feed-in contract? (please answer yes or no)
Other			

B) Cooperative activities - Renewable energy support policies

2. Have you been satisfied with historical support policies for renewable energy deployment in your country? (1=not satisfied at all; 7=absolutely satisfied)

Please choose...

3. Have support policies for renewable energy recently undergone changes in your country that impact your activities, or do you expect such adjustments in the policies to be enacted in the near future?

- ◯ yes
- ◯ no

B) Cooperative activities - Renewable energy support policies

3.1 How do you expect the new support schemes to impact your cooperative's activities? (1=very negatively; 7=very positively)

Please choose...

3.2 Have you, or do you plan to adjust, broaden or narrow your activities as a result of changes in the renewable support policies and general legislative environment for your field of activities?

- ◯ yes
- ◯ no

B) Cooperative activities - Renewable energy support policies

3.3 If you answered "Yes" to the the previous question (3.2), please provide a description of the actions you are taking or which you plan to take.

4. Do support policies in your country establish a level playing field for all actors in the renewable energy sector? (1= quite favorable for large scale corporate actors; 7= quite favorable for small scale community energy solutions, including cooperatives)

Please choose...

B) Cooperative activities - Drivers and barriers for renewable energy cooperatives

5. Please indicate the main barriers for development of Renewable Energy Cooperatives in your region and country by selecting one or more responses from the list below, and indicate in the adjacent field in the scale of 1 to 7 how important it is (1=not a barrier; 7=Strong barrier).

If not listed, please use the empty fields to indicate other barriers for renewable energy cooperatives that you are facing. You can add extra fields if necessary by clicking on "+1" at the bottom of the multiple choice list.

	1	2	3	4	5	6	7	Not relevant
Bad image due to harmful environmental impact (such as impact of wind turbines on bats and birds);	◯	◯	◯	◯	◯	◯	◯	◯
Barriers to market entry and network connection such as lack of incentive for network operators to connect to small generators	◯	◯	◯	◯	◯	◯	◯	◯
Difficulty to obtain bank loans	◯	◯	◯	◯	◯	◯	◯	◯
High operations and maintenance cost of employed technologies	◯	◯	◯	◯	◯	◯	◯	◯
High upfront costs, such as purchasing and installing RE generation facilities, licensing for RE generation, land use taxes, grid connection fees, etc.	◯	◯	◯	◯	◯	◯	◯	◯
Lack of familiarity with RE technology;	◯	◯	◯	◯	◯	◯	◯	◯
Lack of local participation in community groups	◯	◯	◯	◯	◯	◯	◯	◯
Land use conflicts (energy, agriculture, forestry)	◯	◯	◯	◯	◯	◯	◯	◯
Missing regional institutional support and networking	◯	◯	◯	◯	◯	◯	◯	◯
No feasible location to install systems	◯	◯	◯	◯	◯	◯	◯	◯
Non-supportive policy environment	◯	◯	◯	◯	◯	◯	◯	◯
Unfavorable changes in RE policy framework for the cooperative enterprise model	◯	◯	◯	◯	◯	◯	◯	◯
Weak capacities of the community to persevere in carrying out the project and keep systems maintained and operating efficiently	◯	◯	◯	◯	◯	◯	◯	◯
Other:	◯	◯	◯	◯	◯	◯	◯	◯

6. What measures, if any do you take towards addressing the barriers that you indicated as barriers in the previous question?

7. Please indicate the main drivers for development of Renewable Energy Cooperatives in your region and country by selecting one or more responses from the list below, and indicate in the adjacent field on the scale of 1 to 7 how important it is (1=not a driver; 7=Strong driver).

If not listed, please use the empty fields to indicate other conditions that you consider to be drivers for renewable energy cooperatives. You can add extra fields if necessary by clicking on "+1" at the bottom of the multiple choice list.

	1	2	3	4	5	6	7	Not relevant
Ethical and environmental commitment	◯	◯	◯	◯	◯	◯	◯	◯
Influencing local energy policy	◯	◯	◯	◯	◯	◯	◯	◯
Local control of resources and load management	◯	◯	◯	◯	◯	◯	◯	◯
Local investment and income generation	◯	◯	◯	◯	◯	◯	◯	◯
Lower energy costs and reliable supply	◯	◯	◯	◯	◯	◯	◯	◯
Strong cooperative enterprise history and tradition in your region	◯	◯	◯	◯	◯	◯	◯	◯
Suffucient average regional personal income and/or wealth	◯	◯	◯	◯	◯	◯	◯	◯
Supportive policy environment for cooperative enterprise	◯	◯	◯	◯	◯	◯	◯	◯
Supportive policy environment for renewable energy systems deployment	◯	◯	◯	◯	◯	◯	◯	◯
Other:	◯	◯	◯	◯	◯	◯	◯	◯

C) Cooperative membership

1. How many members does your cooperative have?

2. What is the value of a regular cooperative share, and the minimum number of shares that need to be purchased to become a member of the cooperative?

Price (€) (please indicate in local currency if your country is not in the Eurozone).

Number of shares

3. Does your cooperative observe the one member one vote principle?

◯ yes

◯ no

4. Does your cooperative issue different classes of membership shares, such as investor shares?

If share classes that you issue are not listed please indicate them in the "other" field. You may add as many as necessary by clicking on "+1" at the end of the multiple choice list.

	yes	no
Investor shares	◯	◯
Preferential shares	◯	◯
Other:	◯	◯

C) Cooperative membership

4.1 Please describe the rights and responsibilities of investor members, where they differ from regular members (share price and minimal volume, voting rights, etc.).

C) Cooperative membership

5. What is your cooperative's membership geographic reach?

Please choose...

6. What motivates your members to join the cooperative? Please select one or more responses from the list below, and indicate in the adjacent field the on the scale of 1 to 7 how important it is (1=not important; 7=very important).

If not listed, please indicate further reasons why your members join the cooperative in the empty field at the end of the question. You may add as many as necessary by clicking on "+1" at the end of the multiple choice list.

	1	2	3	4	5	6	7	Not relevant
Concerns about environmental and climate impacts of traditional energy technologies	◯	◯	◯	◯	◯	◯	◯	◯
Influence of the community and trust	◯	◯	◯	◯	◯	◯	◯	◯
Local income generation	◯	◯	◯	◯	◯	◯	◯	◯
Local investment	◯	◯	◯	◯	◯	◯	◯	◯
Lower energy costs	◯	◯	◯	◯	◯	◯	◯	◯
Participating in the energy transition	◯	◯	◯	◯	◯	◯	◯	◯
Reliable local energy supply	◯	◯	◯	◯	◯	◯	◯	◯
Other:	◯	◯	◯	◯	◯	◯	◯	◯

7. Would you say that the motivations to become a member of the cooperative were different for founding members compared to those joining later and new members, and if so how do they differ?

D) Cooperative legal and organisational structure

1. What is the exact legal person form of your cooperative, used in the appropriate national registry? Please provide the answer in your language.

2. Does your cooperative have employees?

◯ yes

◯ no

2.1 If you answered "Yes" to the previous question, please indicate how many.

3. Are all members present at the General Meeting meetings or are votes delegated?

Please tick applicable

☐ All members take part in the General Meeting

☐ Members are represented by delegates at the General Meeting

4. Your cooperative's Board of Directors is composed of:

◯ Volunteer cooperative members

◯ Paid professional managers

5. Do you incorporate the seven ICA cooperative principles in your activities?

Please select as applicable.

☐ Voluntary and Open Membership

☐ Democratic Member Control

☐ Member Economic Participation

☐ Autonomy and Independence

☐ Education, Training and Information

☐ Co-operation among Co-operatives

☐ Concern for Community

6. Is your cooperative a member of a second-tier cooperative or any other association of cooperatives or renewable energy support organizations (national, regional, European)?

◯ yes

◯ no

7. Does your cooperative actively pursue lobbying with local, national or supranational (e.g. European Commission) authorities?

◯ yes

◯ no

E) Cooperative economics and financing

1. Which of the following would you designate as your major sources of project financing? Please select from the list as many answers as necessary, and their indicate importance on a scale of 1 (minor) to 7 (major).

Please use the "other" field to add sources of financing that are not listed. You can add as many additional responses as necessary by clicking on "+1" at the bottom of the multiple choice list.

	1	2	3	4	5	6	7	Not relevant
Commercial bank loans	◯	◯	◯	◯	◯	◯	◯	◯
Cooperative revenue	◯	◯	◯	◯	◯	◯	◯	◯
Cooperative bank loans	◯	◯	◯	◯	◯	◯	◯	◯
Ethical or green bank loans	◯	◯	◯	◯	◯	◯	◯	◯
Member equity financing	◯	◯	◯	◯	◯	◯	◯	◯
Other renewable energy cooperatives	◯	◯	◯	◯	◯	◯	◯	◯
Public financing (e.g. municipal, national, EU project financing)	◯	◯	◯	◯	◯	◯	◯	◯
Other:	◯	◯	◯	◯	◯	◯	◯	◯

2. Does your cooperative work with local/cooperative/ethical banks?

	Yes	No
Local banks	◯	◯
Cooperative banks	◯	◯
Ethical banks	◯	◯

3. Do you establish partnerships with other local entities, private or public? (businesses, municipality, public services, etc.)

Please use the "other" field to add entities you establish partnerships with that are not listed. You can add as many additional responses as necessary by clicking on "+1" at the bottom of the multiple choice list.

	Yes	No
Local private businesses	◯	◯
Municipality	◯	◯
Local public utilities	◯	◯
Other:	◯	◯

4. What was your average revenue during the last three years?

Please choose...

5. What is the cooperatives debt to equity ratio?

This question is formulated because Cooperatives have been the organizational model that has been least exposed to debt and loan related challenges during the ongoing recession.

6. As a cooperative, does your national legislation allow preferential tax treatment steming from your activities and revenues? (thanks to regional or national laws on taxation of cooperatives)

◯ yes

◯ no

E) Cooperative economics and financing

6.1 Please indicate how important the preferential tax treatment is for your continued work and competitiveness with private and public energy producers.

	1	2	3	4	5	6	7
1=not important 7=highly important	◯	◯	◯	◯	◯	◯	◯

7. Does your cooperative provide non-monetary added value to your community? (region and members)

◯ yes

◯ no

E) Cooperative economics and financing

7.1 Please describe if and which kind of non-monetary added value your cooperative provides to your community? (region and members)

THANK YOU!

Thank you very much for dedicating your time to our complete our questionnaire. We appreciate it very much. Once again we assure you that the information which you provided be used solely for academic research purposes, will be kept confidential and will not be disseminated further. If you wish to contact us, or have questions or comments about the survey or the follow up process, please write to rescoop@inescc.pt. We wish you a successful, productive and sustainable 2017!

» **Redirection to final page of eSurvey Creator** (change)