THE IMPACT OF RENEWABLE ENERGY COOPERATIVES ON THE WELFARE OF LOCAL COMMUNITIES

Project Work

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List of abbreviations

REC – renewable energy cooperative
REScoop – renewable energy cooperative
CRE – community renewable energy
RE – renewable energy
RES – renewable energy sources
EFREC – European Federation of the Renewable Energy Cooperatives
RES-E - electricity generation from renewable energy sources
RES-H&C - heating and cooling energy generation from renewable energy sources
RES-T – transportation energy from renewable energy sources
HHs – households
PV – photovoltaic
CHP - combined heat and power installation
MCHP – micro combined heat and power installation
E-mobility – electric mobility
FiT – Feed-in- Tariff
FiP – Feed-in-Premium
DGRV - German Cooperative and Raiffeisen Association (ger. Deutscher Genossenschafts-
und Raiffeisenverband )
SEV – South Tyrol Energy Association (ger. Südtiroler Energieverband)
DSO – distribution system operator
TSO – transmission system operator
VPP – virtual power plant
GHG – greenhouse gases
NGO – non-governmental organization
Hydro – hydroelectric
S.r.L - limited liability company (it. Societá a responsabilità limitata)
S.p.A. - Public Limited Company (it. Societá per Azioni)
OTC - Over-The-Counter
VAT – value-added tax
R&D – Research and development
CO2 – carbon dioxide gas
MSD – dispatching market place
NIMBY – not in my back yard
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Abstract

In this project work, preconditions influencing the emergence of renewable energy cooperatives and the impact which RECs bring to the community were investigated. There were conducted 6 interviews: 4 interviews with vice-presidents and presidents of the RECs, 2 interviews with experts from the field. In Chapter 2 the table of deployment of RECs in the EU was elaborated, visualized and analyzed. A decent part of Chapter 2 was devoted to the analysis of the preconditions influencing RECs. Also, the impact assessment tool was designed. In Chapter 3 Italian experience in RECs was studied. In Chapter 4 four case studies were presented and analyzed. There were chosen: historical REC in Italian Alps, biogas CRE in Italy, new wave REC with an innovative business model in Italy, solar REC in Ukraine. Such a set was chosen to demonstrate a variety of types of energy communities, that were recently recognized in the EU law. The outcome of the impact assessment was presented in the visualized form and discussed. In Chapter 5 research questions were finally answered: the first hypothesis was partially accepted, second - fully.
Executive summary

Energy communities, which recently got recognition in the EU law, differ in its forms. In this project work, we concentrate on the cooperatives. In the EU there exist 2947 RECs with membership base about 800 000 citizens. Germany is a leader in the RECs movement. Netherlands and Switzerland hold the second and the third positions respectively. In Germany, new energy cooperatives started to emerge in 2007 with the introduction of the FiT. Despite Germany is a leader in a number of RECs in the EU, less populated countries like Netherlands, Belgium, Switzerland, Denmark, Finland have a higher density of citizens per one energy cooperative member ranging from 57 in Austria to 245 in the Netherlands, compared to Germany with much modest proportion number – 458. Netherlands and Denmark have the highest number of wind cooperatives, whereas Switzerland and Finland have a higher number of district heating biomass/biogas cooperatives.

Today in Italy exist 77 RECs with 42 346 citizens and firms being members, supplying on average 88 272 HHs. In the country, two types of cooperatives exist. First, historical RECs in Alpine regions. The average age of these cooperatives is 100 years. They were founded as the first suppliers of electricity in rural remote areas. All of them utilized hydro energy. In XXI century a lot of them introduced a change in the business model, adding biomass district heating plants and even the broadband Internet. These RECs usually control the entire chain: from generation to the final supply. Government introduces special preferences to them like an exemption from the system cost component in the energy price or an exemption from the unbundling requirements. Some of them show potential to close the factual energy loop - to become fully self-sufficient with the renewable energy produced locally, like an inspiring example of E-Werk Prad illustrates. These RECs foster social innovation by incorporating technological innovations like VPP or storage systems. Second, new RECs. There exist 67 historical RECs in Italy, and only 10 new RECs. These new cooperatives were mostly founded as the result of both: modern growth in environmental concerns, and policy incentives. They often utilize innovative business models like E’nostra, WeForGreen Sharing or Energia Positiva do. It was discovered that the economic benefit for the members is an utmost priority. An economic benefit is a reason why people participate in the new RECs mostly, with environmental concerns being the second main reason. Nonetheless, the actual impact is usually different from the motivations. Environmental benefits have the biggest impact. In historical RECs, the biggest impact is environmental,
with the social and psychological following. In Italy, historical cooperatives are based on the communities of place, while new RECs – mostly, on the communities of interest.

Policies incentivizing renewable energy in Italy are various. Some of them allow offering a respectful financial reward to the RECs’ members: Feed-in-Tariffs, green certificates. Some make the reward getting, reversely, more complicated, like Feed-in-Premiums based on the tendering mechanism. New installations in Italy can only benefit currently from the FiPs, as for 2019, that makes the RECs’ construction of new facilities unprofitable. Therefore, new RECs in Italy mostly purchase plants on the secondary market, that enable them to benefit from already terminated FiTs or green certificates. The second group of policies influencing RECs consists of those simplifying activities. In case these policies had not existed, the actual existence of the RECs in the country would have been at risk. This group includes simplified energy sale and purchase regime, system costs exemption, exemption from unbundling, tax reduction for the innovative start-ups, environmental regulation on manure. It is important to mention, that historical RECs benefit, predominantly, from the system costs and unbundling exemptions due to the nature of their business model. New RECs benefit more from the tax reduction for the innovative start-ups because they exploit innovative models.

The institutional framework supporting RECs is present internationally and nationally. On the international level, the European Federation of Renewable Energy Cooperatives is an important player: educator, lobbyist, and cooperative networker. Also, such programs launched by the EU as “REScoop 20-20-20” helped to establish RECs throughout the EU, like an example of the Italian E’nostra. Furthermore, within the Intelligent Energy Europe program, a crowdfunding platform “citizenenergy.eu” was created, utilizing which energy cooperatives get an additional way to collect funds and attract members. Another important financing method is engaging in the business the cooperative banks. There are different banks supporting cooperatives in the EU. In Italy, it is the Banka Etica. Speaking more about the Italian institutional design, associations like Confcooperative Consume e Utenza or SEV, assist cooperatives. SEV, for instance, lobbies interests of the historical and new biogas RECs in South Tyrol, offers billing and trading services that allow decreasing cooperatives’ transaction costs. In Italy, the overall dynamics of switching the supplier is positive, and this adds value to the future of new wave RECs. Though, absence
of policy incentives for the new RES installations is a negative factor. If nothing changes, rapid deployment of the small scale RE will be impossible in the country.

In the project work, we propose the policymakers to start an educational campaign about the opportunities that energy community projects can bring to citizens. Such an educational campaign should be designed accurately. Certain communities should be chosen to conduct the campaign because educational efforts in some of them could be more advantageous than in others. Also, awarding the possible incentives should be assisted by the analysis that will utilize the impact assessment methodology offered in this research. Such a methodological tool allows an assessment of the impact of a certain REC on the community, that in turn would help governments to distribute incentives more efficiently. Nevertheless, the methodology should be surely further developed.

To conclude, the emergence and impact of a REC on the welfare of the local community depends on a certain area’s historical background, institutional and market design, policy framework. The emergence of RECs depends on the motivations, though the impact on welfare has no direct connection with motivations. Impact on welfare depends on the business model choice, but the emergence of the REC – does not. Economic and environmental impacts on the welfare of local communities are possible to measure quantitatively. Social and psychological impacts on the welfare of local communities are possible to assess qualitatively. Comparison of different RECs impacts on their communities’ welfare is possible through elaborated calculation and visualization techniques.
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I want to thank a lot to the colleagues from the EURAC research institute in Bolzano, Italy. Adriano Bisello, a senior researcher, enlightened me with his discoveries about the energy communities and major members’ motivation to join such projects. Sonja Gantioler and Stefano Zambotti, senior researchers, informed me with some energy and environmental policies aspects. Daniele Vettorato, head of research group Regional and Urban Energy Systems, and Jessica Balest, researcher, expressed the initial interest in my topic and organized meetings with their colleagues.

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initial stage, that this topic is interesting and relevant, as her research interests include energy cooperatives as well. Prof. Magnani shared some contacts which later helped me.

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All mentioned above people made my project work for getting a Master Degree possible. An innovative topic that I have chosen could not be investigated without their motivating. Since their readiness to help, to talk, and to explain, I have not only finished this research but become inspired to proceed with the research on the energy transition. Without their responsiveness, it would not happen.

Finally, I want gratitude to my family and friends. They encouraged and supported me. I devote this project work to my grandfather who passed away during the final stage of my research. The great part of his life was related to electricity. He was an electric equipment specialist in coal mines of Donbas region, Ukraine. He always told me about the value of coal, benefits that this mineral brings, and how hard is the work of people extracting it. Today we move to the cleaner generation, but we need to thank our ancestors for the goods they created for us, for the benefits due to which we were raised and educated. Due to their hard work, we can move our society forward, to a brighter future.
1 Introduction

1.1 Relevance of the Project Work

The challenges of the 21st century require to transform our economies together with the lifestyles. Among the most threatening challenges is climate change caused by global warming, biodiversity loss, and poverty. We claim that this research contributes to the micro-level to the solution of the first and the third abovementioned challenges. A topic is dedicated to the investigating of the possibilities of such a new phenomenon as energy prosumers to influence local development. However, broader outcomes may be observed. With the diffusion of the energy prosumers (households which produce energy, community renewable energy projects) in the societies, local distributed energy generation could create new opportunities for the renewable energy deployment ubiquitously, together with other spillover effects which will be discussed later. Utilizing outcomes of research drawn at the micro-level, this Project Work could contribute also at the macro-level, particularly, to the tackling of the most provocative challenges which are mentioned in six United Nations Sustainable Development Goals. These are:

- Goal 7. Affordable and Clean Energy
- Goal 13 Climate Change
- Goal 8. Decent Work and Economic Growth
- Goal 9. Industries, Innovation, and Infrastructure
- Goal 16. Peace, Justice and Strong Institutions
- Goal 17. Partnerships for the Goals
1.2 Explanation of research agenda and hypotheses

In my project work, I make a comparative analysis of the Italian experiences in the energy cooperative’s impact on the welfare of local communities. The implications of this research will be analyzed in terms of the policy recommendations to Italy and Ukraine.

It is crucial for us to give a short definition of the "welfare" in order to explain which exact impacts we consider under this term. In Cambridge Dictionary we find that in Business English "welfare" means "the general state of health or degree of success of a person, business, country, etc." (Dictionary Cambridge, 2019). So, we consider the general degree of success of the local community as our target. For the measurement of the general degree of success of the community the author offers to use a definition of "wellbeing". Nobel Laurette Prize winner in economics, Amartya Sen (Sen, 2000), in his capabilities approach offers the definition of the "wellbeing" as the synergic measure of the human development which is not limited to the only measuring of the GDP per capita growth. General wellbeing is composed of such components:

- Psychological wellbeing
- Physical wellbeing
- Social wellbeing
- Environmental wellbeing
- Economic wellbeing

The measurement of the welfare of local communities in this research will be done by investigating the influence of the energy prosumers on economic wellbeing, social wellbeing, environmental wellbeing of the individuals. Particularly small attention will be devoted to psychological wellbeing. The author deliberately disregards physical wellbeing aspect in this research because consider that the energy prosumers influence this component poorly. The notion of the ‘welfare of local communities' instead of just ‘sustainable local development' was chosen to include the psychological aspect of the individuals who are energy prosumers.

Italy is the EU state which is a big consumer of the energy due to its population and economic development level. It is interesting to compare Italy with Germany, which is one of the leading counties in RE deployment in the EU.
Table 1. Comparison of RE deployment in Germany and Italy

<table>
<thead>
<tr>
<th>Energy Country</th>
<th>Generation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electricity</td>
<td>2004</td>
<td>2017</td>
<td>Change</td>
</tr>
<tr>
<td>Germany</td>
<td>9.37%</td>
<td>34.41%</td>
<td>25.04%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Italy</td>
<td>16.09%</td>
<td>34.41%</td>
<td>18%</td>
<td>5.7%</td>
</tr>
<tr>
<td></td>
<td>Heat&amp;Cool</td>
<td>2004</td>
<td>2017</td>
<td>Change</td>
</tr>
<tr>
<td>Germany</td>
<td>13.4%</td>
<td>13.4%</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>20.1%</td>
<td>20.1%</td>
<td>14.4%</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Eurostat, 2019)

Germany is one of the world's leaders in RE deployment. In 2017 the electricity generation from RES (later RES-E) was 34.41 percent of the total electricity generation, comparing to 2004 – 9.37 percent. The increase occurred to be 25.04 percentage points. Italy's generation RES-E was 34.1 percent of the total in 2017, comparing to 16.09 percentage points in 2004. The increase in Italy occurred to be 18 percent. The shares of the heating and cooling energy generation from RES (later RES-H&C) in Germany in 2017 and 2004 were 13.4 percentage points and 7.1 percentage points respectively, with the increase in 6.3 percentage points. In Italy in 2017 and 2004 shares of generation from RES-H&C were 20.1 percentage points and 5.7 percentage points respectively, hence the increase was 14.4 percentage points. RE consumption levels for both states are significantly lower than generation levels, which is the result of the nature of energy, because not all energy produced in the state would be consumed due to differences in unpredictable demand and offered supply. Demand can sometimes be lower than supply which leads to either energy plants export energy to the consumers outside of the country (if such a transmission grid is available) or dispatches its energy supply from the grid which leads to higher generation level than consumption as well. Therefore, a situation occurs when the consumption of a certain type of energy is lower than its generation.

This Project Work will concentrate on solar PV technology, hydro technology, biogas, and biomass technology, although some features of the other types of RES will be discussed in the theoretical part. The choice of PV is motivated by the wide distribution of this technology both in HHs and RECs due to its comparatively cheap cost. The choice of biogas/biomass technology is caused by the fact that Italy showed the significant increase in generation from RES-H&C which induce the motivation to discover the particular features of the biomass and biogas RECs in Italy.
The impact on the local communities is expressed in the direct and indirect benefits to the energy prosumers and to the community. We will concentrate research on the economic, social, ecological, psychological benefits for the individuals and locality where they live. However, in order to understand the different nature of the benefits which RECs bring and thus discover the reasons which led to the emerging of these benefits, there should be investigated in-depth nature of the RECs activities: historical background, motivations of RECs' initial leaders and members, institutional and market design, policy framework, business model.

It is important to discuss these five basic forming agendas because we can better recognize why there are differences in the impact of RECs on communities exist within the same country.

The analysis of the four preconditions and the business model choice will be conducted on the basis of theoretical research, descriptive statistics, semi-structured interviews. The tools to investigate the impact on local communities are the same as tools used to investigate preconditions. The conclusions would be drawn, once an analysis of the preconditions and impact of the energy prosumers will be conducted. Later comparison of case studies will be discussed and possible policy recommendations outlined. Two main hypotheses of Project Work are the following:

- Emergence and impact of a REC on the welfare of local community depend on a certain area’s historical background, institutional and market design, policy framework, as well as motivations and business model choice of a specific REC.
- It is possible to assess the impact of RECs on the welfare of local communities
2. General overview in the EU and Theoretical framework

2.1 Methodology

For successfully answering the hypotheses the selection of the right methodology is crucial. The author concluded few types of research methods that are simultaneously relevant for the current research agenda and correlate with the current time and financial limitations of this research.

Basically, research will be done by qualitative methods, and more precisely: literature survey, document analysis, case study research, semi-structured interviews with experts. However, the quantitative method will be applied in Chapter 2.

Descriptive statistics

Descriptive Statistics is used to present quantitative descriptions in a manageable form. Therefore this method will help us to understand the regional and country differences in RE deployment and thus later factors and outcomes of such differences on the RECs deployment.

Case study research

The strength of this type of research is that it captures “reality” in more detail since it allows for a larger number of variables to be analyzed (Ruddin, 2006), as well as for the use of multiple methods for the data collection (Neale et. al., 2006). According to Ruddin (2006, p798), “a case study is an in-depth

Case study research, however, has been criticized for being less rigorous than surveys and other methods (Neale et. al., 2006). It is also argued that it is not possible to make generalizations from single case studies (Neale et. al., 2006; Ruddin, 2006). However, (Ruddin, 2006) explains that criticism has been greatly misleading. “Although it is true that case studies provide a comprehensive review of a single case, it is untrue that the case study cannot contribute with trustworthy information about broader processes and patterns. In this sense, case study research is not presented as a replacement for the survey and experimental methods, but as a different form of inquiry which is not an inferior scientific method as such” (Ruddin, 2006). On the contrary, Ruddin emphasizes that the case study is probably the most basic method of science. A common criticism of case studies is their lack of generalizing power. It is for this reason that (Ruddin, 2006) explains that comparative case studies are a better option to avoid driving inferences that are unique for a single case.
Case study research allows the researcher to collect and present data through multiple methods, such as surveys, interviews, observations, or structured document analysis, which in turn make it possible to identify deeper insights from the object of study (Neale et. al., 2006).

The research proposes a comparison between case studies of Italian and German RECs to highlight the core research outcomes, emphasizing different experiences and processes under a common theme (Langford, 2012). As Herriot and Firestone (Yin, 1994) point out, the advantage of adopting comparative case studies to undertake a research is that the evidence is more compelling, providing, therefore, more robust results when compared to single case studies.

*Semi-structured interviews*

According to (Silverman, 2006), interviews are valid to explore with a certain level of depth and complexity aspects such as individuals’ attitudes and principles that cannot be grasped by other approaches. According to (Longhurst, 2010) the added value of semi-structured interviews relies on the fact that despite they present a certain predetermined order, they provide the participants with a certain flexibility to address the topics with their own words. Moreover, the same author claims that this method allows the combination with other methods in qualitative research.

The sampling procedure employed in the selection of the participants was the snowball or chain method. Widely used in qualitative sociological research, this method consists of asking the key players primarily contacted to provide contact referrals of participants that present some certain characteristics that are relevant for the research (Biernacki, P., & Waldorf, 1981).

Since this research employs a qualitative method and the interpretivism epistemology with an inductive approach, the interviews involved a small sample of study participants in order to collect in-depth information (Langford, 2012). Moreover, the information generated through interviews with the participants regarding the research topic will be presented textually.
2.2 Definition and classification of RECs in the EU

Classifying RECs is important for Project Work because the nature of RECs activities rely on their type. In order to further investigate preconditions to emerging as well as the organizational structure, we need to elaborate main types of RECs.

In EU RE Directive (EU, 2018) it is said that:

“renewable energy community’ means a legal entity: which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits”.

Community renewable energy projects (CRE) can acquire different legal forms. One of these forms is a cooperative form. Hence, it is the most widespread form of community renewable energy our research concentrates on it. According to the definition of the CRE in the EU RE Directive, not all types of RECs can be considered as CRE: precisely urban RECs, retail RECs, consumption-related services RECs, dividend pay-out RECs – cannot be considered as CRE. However, due to the objective of this research being on energy cooperatives, it is worth to consider all types of cooperatives, which have a connection with renewable energy, to understand its social phenomena in general without legal limitations. Yet types of RECs which do not match with EU legal definition cannot be ensured to utilize guarantees stated in Article 22 of the EU RE Directive.¹

A new European Parliament legislative resolution (EU, 2019) on common electricity market rules, which is not published yet but voted in EU, defines another entity “citizen energy communities”. A definition is very close to the “renewable energy communities” provided in the EU RE Directive (EU, 2018), but not identical:

“Citizen energy community’ means a legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources,

¹ Most important bullet points can be found in Chapter 2.4.2
distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders”.

According to the definition of renewable energy community such an entity should “be effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity”, however, this statement is absent in a definition of the citizen energy community. Moreover, citizen energy community “may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles”, which allows urban RECs, retail RECs, consumption-related services RECs and dividend pay-out RECs to be considered as citizen energy communities and enjoy guarantees stated in Article 16 of European Parliament legislative resolution 2019 on common electricity market rules. However, these guarantees which include also obligations, are directed explicitly to the retail and operational grid RECs. Certain guarantees which are present in EU RE Directive 2018 are present also in European Parliament legislative resolution 2019, although their main focus is on “energy sharing” obligations and rules. That is why from here it is possible to draw a conclusion that an absence of legal recognition and rights protection of certain types of RECs in EU RE Directive 2018 can be successfully completed by application of common electricity market rules, which are yet to be published and enforced in 2019. In this perspective energy cooperatives which do not fit the definition of “renewable energy community”, can fit the definition of “citizen energy communities”. Such a distinction also enables different types of RECs to have different levels of guarantees and right protection from the state. Purely generation RECs which fall under “renewable energy communities” enjoy a higher level of guarantees, whereas operational grid RECs, retail RECs, RECs with dividend pay-out revenue model, which fall under “citizen energy communities” – lower level of guarantees.

Classification according to the RES:

- **Solar.** Solar RECs utilize photovoltaic technology, so-called photovoltaics panels (later PV)

- **Wind.** Wind RECs utilize wind turbines technology respectively.
- **CHP** (combined heat and power). CHP RECs are cooperatives which utilize combined heat and power technology (frequently also cooling) at the same time, so-called cogeneration (or trigeneration if the plant produces cooling too). Micro CHP installations are predominantly have been used by the CHP RECs members. A 2013 UK report from Equity Consulting stated that MCHP is the most cost-effective method of utilizing gas to generate energy at the domestic level (Equity Consulting LLP, n.d.). CHP technology is applicable to energy cooperatives only when fuelled with biomass/biogas, but not with natural gas, which is a requirement coming up from definition of CRE in the EU RE Directive.

- **Biogas** *(solid biomass) heat/power*. Biogas/biomass RECs are utilizing technologies allowing the production of the heat or electricity from the solid or liquid waste and husbandry leftovers such as manure, as well as woodchip if the biomass power plant is established. Manure-based biogas production is the main type of RECs in the EU.

- **Hydro**. Hydro RECs relying on hydropower technology and small hydro technology. Wave energy converters and micro hydrokinetic generators are still not well exploited by RECs, although could be an interesting sustainable solution for hydro RECs to invest in order to minimize environmental impacts, especially in the coastal and mountain regions.

- **E-mobility**. E-mobility REC activities are still more like an innovation than something well distributed. However, for RECs e-mobility means utilizing storage devices as a source of distributed energy. Nowadays, several types of batteries exploiting various technologies are available as well as the future generation of electric vehicles will be connected to the grid which will enable electric cars to be an energy storage device themselves because vehicles stay parked an average of 95% of the time according to researches. According to (Herbes et. al., 2017) services, REC could offer for their customers regarding e-mobility are: rental service with a small fleet of the electric vehicle, establishing an infrastructure for electric bicycle, car-sharing service. However, for a lot of RECs as was mentioned by (Herbes et. al., 2017)e-mobility activities are in plans for the future.

*Classification according to the geographical context:*
- **Rural RECs.** Cooperatives established in rural areas, which members usually rural citizens. Cooperatives may be based on the community of space as well as the community of interest approaches. A community of space usually infers neighbors living in close proximity which are united by strong social ties and which REC goal, therefore, is more related to the social and environmental benefits for their community rather than only economic gains. The community of interest usually infers to the members of cooperative which participate in it because of rather only economic gains and in the lesser extent because of social/environmental intentions.

- **Urban RECs.** Cooperatives established in urban areas, which members usually urban citizens. (mostly big cities citizens). These cooperatives are based exclusively on the community of interest approach.

*Classification according to the revenue models:*

- **Feed-in-premia (FIP).** RECs relying on the selling to the grid and FIP provided by the governments to stimulate the deployment of renewable energy. In past, a lot of RECs were relying on the FIT (Feed-in-Tariff), however nowadays FIT is not allowed anymore in the EU according to the EU Court of Justice decision from 28.03.2019 (Court of Justice, 2019). Difference between FIT and FIP is explained in Chapter 2.4.2. While utilizing FIP revenue model, RECs should have a possibility to win auctions. This possibility is provided by the EU regulation in Article 22 of the EU RE Directive, where it is said that “Member States shall ensure that renewable energy communities are entitled to: (a) produce, consume, store and sell renewable energy, including through renewables power purchase agreements” and “access all suitable energy markets both directly or through aggregation in a non-discriminatory manner”. Thus renewables power purchase agreements as quota mechanisms should be established for a FIP revenue model to be functioning properly.\(^2\) Elimination of FIT which was a dominant revenue model in the past brings new challenges for RECs. It can already be observed in Germany, where RECs are struggling to adjust to the new policy. This legislative change is a considerable step back in the energy transition process.

- **Dividend pay-out.** Cooperatives which members invest in large-scale third-party projects, therefore not develop and operate plants by themselves, and just getting the

\(^2\) Quota mechanism is explained in Chapter 2.4.2
revenues as shareholders. It allows for higher income, albeit demanding closer management (Brummer, 2018).

- **Direct sale.** REC works as a utility selling energy to consumers directly and thus getting direct payments from them.

- **Participation in energy savings.** Consulting services to municipalities and HHs on energy efficiency topics could be an additional revenue stream.

- **Contracting.** RECs using besides other revenues in their business model also contracting. (Herbes et. al., 2017) states that revenue would be generated as part of the energy savings or as rental fees for the equipment. “Examples might be operating a CHP unit on the site of the customer or operating street lighting for municipalities or renting street lighting equipment to the municipality” (2017, p. 88). When premises are placed on the municipalities roofs it is a good example of a community advantageous public-private partnership.

- **Leasing.** When the revenues are coming from the leasing fee. REC leases, as a third party, equipment to the consumer. In Germany as (Herbes et. al., 2017) states cases where the consuming entity leases the equipment from a third party can qualify as self-consumption, thus making the leasing of a renewables facility a financially attractive option, because in German law is stated that ‘self-consumption’ consumers are exempt from certain levies.

A survey from 2014 (Klagge et al., 2016) showed that nearly 80% of all regional RECs and more than 80% of supra-regional RECs relied on the F.I.T. policy for their revenue stream.

*Classification according to the corporate purpose which is derived from the* (Herbes et. al., 2017) *research:*

- **Electricity generation.**

- **Operating grid: transmission and/or distribution.** Frequently such RECs provide balancing services owning biogas installations.

- **Retail.** Selling renewable energy to customers with certified pro-environmental effects.
- **Consumption related services** (consulting services, demand-side management, distributed storage, operating charging points for electric vehicles, energy efficiency models)

*Classification according to community engagement:*

- **Very small REC.** Less than 50 members
- **Small REC.** 50-200 members
- **Middle size REC.** 200 – 500 members
- **Big REC.** 500 – 2000 members
- **Very Big REC.** More than 2000 members

Such classification was elaborated by the author as a suitable average solution upon all literature and data sources studied for this Project Work.

Today the most widespread RECs are those based on the PV technology, relying on FIP/FIT, which the main purpose is electricity generation. Regarding the most common number of members, there does not exist reliable data for the EU generally, although some understanding can be derived from Table 1. Further researches on this topic should be done.
2.3 Deployment of RECs in the EU

In the EU distribution of energy, cooperatives are not homogenous. Such countries as Germany, the United Kingdom, Switzerland, Netherlands are leading the process, whereas in countries like Italy or Spain the processes started, however, the number of RECs is still very small. In other countries, we find RECs as only exceptional cases. European Federation for Renewable Energy Cooperatives (EFREC) includes REC federations in different countries, individual REC members, and associate members which are not RECs themselves. Relying on available data from the websites of EFREC and DGRV, reports of international/national/regional cooperation organizations, privately owned databases reports, most recent articles on the national and international CRE deployment, individual RECs websites - we build RECs distribution pattern which is depicted in Table in Annex 1, and on Pic.1 – Pic.5

![Number of RECs](image)

Pic. 1. Deployment of RECs in the EU.

Source: authors design based on data from Table in Appendix 1
Pic. 2. Map of RECs deployment in the EU.

Source: authors design based on data from Table in Appendix 1
Pic. 3. Membership and the average size of RECs in the EU countries with respect to the total population

Source: own design
As we see a leader in energy cooperatives total number is Germany. Second and third place holds Holland and Switzerland respectively. In Germany prevail type of RECs are
solar RECs, whereas in Holland wind cooperatives and biomass/biogas cooperatives dominate. In Switzerland and Austria, the biggest number of district heating biomass cooperatives exist. Usually, district heating biomass/biogas cooperatives involve a great number of citizens, more than solar or wind cooperatives. That is why the United Kingdom and France with their amount of cooperatives close to Austria and Switzerland’s nevertheless have more than two times smaller number of REC’s members; Holland having almost two times more RECs than Austria and Switzerland nevertheless have much modest number of citizens involved.

An average number of members per REC in EU countries can be observed on Pic.3. Spain and Belgium are the outliers with the average membership number of 2791 and 2147 respectively. Such a difference with other countries is caused by the presence of powerful retail RECs: Som Energia in Spain and Ecopower in Belgium, each of whom has around 50 000 members. Retail cooperatives’ members are simultaneously their customers. This type of RECs contract producers of RE dominantly in order to supply customers with clean energy. Social good and therefore decreased energy prices and sustainable energy provision is usually the main goal of such enterprises. Another cluster of countries with lower than Spain and Belgium but higher than in the rest of countries average number of members are Austria, Finland, Italy, Portugal, with numbers 538,338, 495 and 500 respectively. In the first two countries, district heating biomass/biogas cooperatives dominate. In Italy RECs in South Tyrol and Trentino provinces include biogas and hydro cooperatives and a big retail REC E’nostra, which in 2016 merged with Retenergie, composed by a high number of members too. In Portugal, REC Coopernico is a retail REC, which induces a high average number – 500 for Portugal.

On Pic.4 we can see that despite Germany is a leader in number of RECs in EU, less populated countries like Netherlands, Belgium, Switzerland, Denmark, Finland have higher density of citizens per one energy cooperative member ranging from 57 in Austria to 245 in the Netherlands, compared to Germany with much modest proportion – 458. Netherlands and Denmark have the highest number of wind cooperatives, whereas Switzerland and Finland have a higher number of district heating biomass/biogas cooperatives.

On Pic. 5 we see the data about the membership and consumption level only for those EU states where information about HHs consuming energy from RECs is available.
Germany and Netherlands have the highest membership and consumption level in the sample, whereas a huge difference in membership and consumption in the United Kingdom and Portugal is due to the retail RECs in these countries, Co-op Energy and Coopernico, supply a lot of customers without them being members of RECs.
2.4 Preconditions for emerging of RECs and business model choice

2.4.1 Historical background

In the beginning, decentralized energy experiments were carried out with tap water and hydraulic network back to 1880. However, these systems which could provide energy for equipment and machine movement were consuming precious tap water and thus disappeared in several years. At the end of 19th-century energy production was small scale and distributed locally. But with the emergence of economies of scale at the beginning of the 20th century, big companies invested in energy generation dominantly in big urbanized cities. Rural areas and middle-size settlements were left behind because big companies were not interested in the electrification of such places. Here local authorities and civic cooperatives had to bring “the light”. An interesting region which sheds the light on the roots of the generally cooperative movement and more precisely, energy cooperatives, is South Tyrol in Italy. To understand the processes which led citizens to cooperate institutionally, it will be very inspiring to consider the historic path of this Alpine Italian region.

South Tyrol province has a particularly high density of biogas cooperatives. Seven biogas cooperatives involve nearly 400 farmers and together process around 7660 livestock units of the total 9100 heavy livestock units processed in the Autonomous Province of South Tyrol in 2011 (Wirth, 2014). But how did they come to it?

In South Tyrol going back to the Middle Ages, and especially to the 18th century, the bequeathed property was often broken up because it was increasingly linked to an individual property rather than family property. This so-called “Realteilung” (a division of property into plots) led to the fragmentation of land (Leonardi B., 2009). Organizing agricultural work based on cooperatives helped to overcome this fragmentation (Wirth, 2014). Before cooperative principles (collaborative business operations, self- and co-responsibility, the principle of equality) devised by the German pioneers, Raiffeisen and H.Schulze-Delitzsch reached Tyrol, people had already gained useful experience of collective cooperation over hundreds of years: irrigation systems, guilds, brotherhoods (Alexander H., 2011). Back to 1925 in Prad in South Tyrol was organized first energy cooperative, EWP. It started with the hydropower plant and developed into a cooperative with a diverse energy mix (Dirk Vansintjta, 2015)
“In 1926, five ‘brave men’ from Prad decided to take matters into their own hands. They started the cooperative and collected enough money to secure a loan from the Raiffeisen Co-operative Bank to build their first hydropower plant. For many years the REC merely survived. Several setbacks such as the theft of electricity due to the lack of meters and the financial instability after World War II nearly brought them to bankruptcy. However, the members always managed to bring in enough equity to continue and sustain the REC and its electricity production. The REC stabilized and slowly expanded with three more hydro plants. The REC’s production has expanded extensively in recent years. It has added four biomass modules that produce electricity and heat, built two wind turbines and installed photovoltaic modules on the roofs of its members” (2015, p. 18).

After WWI demand for electricity significantly raised. Initiatives producing electricity locally became larger or merged with others. Such appliances were developed: driving machines with electric motors, radios, irons, etc. Energy technology progressed, and the systems became larger and more efficient. A change was made from direct current to alternating current, from steam engines to steam turbines, etc. (Dirk Vansintja, 2015). “Many public and cooperative initiators followed these increases in scale up to a point. Some continued to exist as producer and supplier. Others gradually limited themselves to the role of supplier of electricity that was generated centrally, often by private companies. Still, others merged into the larger public, private or mixed companies” (2015, p. 21).

WWII brought a lot of technological innovations as well as new social innovations of more effective and scaled production. Therefore, a higher demand to supply economies of scale emerged. Many monopolies, especially public monopolies, to supply large production factories were formed. All electricity network of distribution was adjusted to the needs of the big coal, gas, nuclear power plants (nuclear since the end of the 1950s). Small public players and cooperatives were able to survive only utilizing hydropower in remote rural areas. In 1960-1970 nuclear energy was conceived as the energy of the future.

Nuclear accidents at Three Mile Island in the USA, Chernobyl in Ukraine, Fukushima in Japan forced the public opinion that nuclear energy will not be our common future.

In Europe, the idea of industries that liberalization of the market could lower prices for energy and greater competition led to the European Commission directives in the late 1990s, in which unbundling rules were set for energy companies. Except for unbundling
rules barriers for the alternative suppliers to produce energy were removed, TSOs (transmission system operators) were obliged to ensure non-discriminative access to their networks for all willing suppliers. Production and distribution sector as by 2019 are considerably liberalized in EU. Transmission sector due to its nature is still monopolized although greatly regulated.

Geopolitical threats as a dependency from Russian gas and oil put energy transition agenda to the forefront of political life in EU as well.

All mentioned above regulations, special policies of leading EU countries like Germany and Denmark, geopolitical crises, led to the deployment of RE technologies on a massive scale by individual HHs and CRE/RECs. Solar PV has become more affordable globally, with module prices declining over 80% in seven years, spurred by 44% annual average compound deployment growth (International Renewable Energy Agency, 2017). Between 2010 and 2016, the global weighted average total installed cost, including all hardware and balance-of-system components, fell by 65% (International Renewable Energy Agency, 2017). Wind turbines become cheaper as well. It seems that RE technologies production lifecycle is approaching a period of the dramatic decrease in cost. This is a perfect opportunity for energy cooperatives as well as individual citizens to take a lead in the energy transition. However, big utility players still lobby significantly policymakers in all EU countries. This is a short review of the historical background which energy prosumers approached as for 2019.
2.4.2 Policy framework

In this section, we firstly, give a definition of the cooperative, define the internationally accepted requirement for establishing such an organization. Secondly, we describe briefly the EU Renewable Energy Directive in regards to CRE. Thirdly, we describe policy tools which are internationally used to promote RE, because the policy framework in which RECs operate is similar to that framework for the RES in general. Fourthly, we briefly speak about the best policy examples in EU countries aimed at RECs/CRE development. However, the specific policy framework in Italy would not be discussed in this subchapter but in more detail in Chapter 3.

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 (International Cooperative Alliance, 2015).

In order the cooperative being created it should follow some requirements, defined by International Cooperative Alliance (2015), which are also known as cooperative principles:

1. Voluntary and Open Membership
2. Democratic Member Control (in primary cooperative members should have equal voting rights: “one member, one vote”)
3. Member Economic Participation (members should contribute financially to the cooperative and may receive compensation on their contribution, surpluses are allocated to different cooperative purposes)
4. Autonomy and Independence (cooperatives cannot be sold etc.)
5. Education, Training, and Information (provide education and training for their members, inform the general public about the nature and benefits of co-operation)
6. Co-operation among Co-operatives (Co-work together through local, national, regional and international structures)
7. Concern for Community (work for the sustainable development of their communities)
By the lobbying efforts of EFREC and DGRV, the new European Union Renewable Energy Directive (EU, 2018) was enforced in December 2018. Energy cooperatives fall under the legally defined concept of the renewable energy communities ("renewable energy communities", Art. 22). In the Directive we find such crucial aspects which frame CRE activities and Member State obligations:

“2. Member States shall ensure that renewable energy communities are entitled to:

a. produce, consume, store and sell renewable energy, including through renewables power purchase agreements;
b. share, within the renewable energy community, renewable energy that is produced by the production units owned by that renewable energy community…
c. access all suitable energy markets both directly or through aggregation in a non-discriminatory manner.”

“Member States shall provide an enabling framework to promote and facilitate the development of renewable energy communities. That framework shall ensure, inter alia, that:

(a) unjustified regulatory and administrative barriers to renewable energy communities are removed;
(b) renewable energy communities that supply energy or provide aggregation or other commercial energy services are subject to the provisions relevant for such activities;
(c) the relevant distribution system operator cooperates with renewable energy communities to facilitate energy transfers within renewable energy communities;
(d) renewable energy communities are subject to fair, proportionate and transparent procedures, including registration and licensing procedures, and cost-reflective network charges, as well as relevant charges”

“(h) regulatory and capacity-building support is provided to public authorities in enabling and setting up renewable energy communities, and in helping authorities to participate directly”

“Measures to offset the disadvantages relating to the specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects include enabling renewable energy communities to operate in the energy system and easing their market integration. Renewable energy communities should be able to share between themselves energy that is produced by their community-owned installations.”

“Member States .. shall develop suitable information, awareness-raising, guidance or training programmes in order to inform citizens of how to exercise their rights as active customers, and of the benefits and practicalities, including … framework of renewable energy communities.”

Also yet not published, but voted in EU, European Parliament legislative resolution (EU, 2019) on common electricity market rules define citizen energy communities as a new type of entity. Their right to become a DSO (distribution system operator) is allowed and officially recognized: “This Directive empowers the Member States to allow citizen energy communities to become distribution system operators either under the general regime or as "closed distribution system operators" (2019, p. 30).
A common aim of CRE policy is to encourage community-led innovation around models of RE deployment and thereby contribute to national goals of RE uptake (Smith et al. 2016). Two policy tools considered as the most important for RE deployment: Feed-in-Tariffs and Quota obligations (Renewable Portfolio Standards). Emission Trading Schemes (ETS), tax incentives, Feed-in-Premiums, tenders and investment support are other policy tools used worldwide. These all tools enable to reflect in energy prices negative externalities of fossil fuel energy generation.

Feed-in tariffs (FIT) – fixed electricity price that is paid to RE energy producers by utilities/DSO/TSO for each unit of energy produced. Usually, the FIT price level is defined by national laws for a certain type of RES and is guaranteed. FIT electricity purchasing is usually organized in a form of power purchasing agreements (PPA) for 15-25 years (economic lifetime of RE project).

Quota obligations – is an obligation of utility companies/energy suppliers/big energy producers to buy a certain share of the RE from RES imposed by governments. Quota obligations are created for dissemination of RES. RE producers can thus sell their energy without discrimination from the utility side.

RE certificates market is another instrument which frequently assisted by quota obligations. RE certificates – are the documents which guarantee that a certain amount of RE was produced. On the RE certificate market these certificates can be traded: from RE producers to the DSO/TSO, from DSO/TSO to the utilities or big energy consumers, therefore utilities or big energy consumers can fulfill their quota obligations if they choose not to purchase directly RE or do not own the grid to do it (which is the result of the unbundling policy of the EU). RE certificates are the guaranteed revenue stream for the RE producers. Sometimes, the minimum limit for the certificate price is introduced to reduce the risks for the RE producers. RE certificate system allows fulfilling quota obligations in a most cost-efficient way because certificate price is usually defined by the market forces. This minimizes price burden on the final energy consumers.

There are two major disadvantages of quota and certificate systems. First, they tend to favor more big RE producers as they are able to produce more cheap RE, and thus big RE producers are better suited for the utilities to buy their energy. Second, the quota system does not favor diversification of RES, because only the cheapest RES will be profitable to install.
First problems can be solved by introducing a specific certificate market for small scale RES which is REC's and CRE projects. The second problem can be solved by the adoption of technology-specific sub-quotas.

Emission Trading Scheme (ETS) - a market-based tool with which energy producers or big energy consumers have two options to stay within CO2 emission cap imposed by government authorities: purchase a certain amount of CO2 emissions in the form of allowances on the ETS market or reduce their CO2 emissions by introducing energy efficiency measures. A standard amount of CO2 allowances has been allocated for each production or big consumption energy installation. If the energy producer or big consumer exceeds this amount (so-called, cap), it needs to purchase an additional amount on the ETS market or take measures to not exceed it, usually by increasing energy efficiency of the installations. ETS tool enables to reduce CO2 emissions in a most cost-efficient way. Those producers for whom energy efficiency measures are too expensive - can choose to buy allowances, whereas producers for which energy efficiency measures tend to be more beneficial - can simply introduce them in order to stay within the CO2 cap level.

Tax regulation mechanism when referring to RE deployment imply the tax reduction or the tax break for the RE producers or entities which adopt energy efficiency measures, such as purchasing an electric vehicle, for instance.

Feed-in-Premium (FIP) – a tool which award RE producers with a defined premium subsidy on the top of the electricity price for which they sold their energy on the market. DSOs/TSOs purchase the energy from RE producers paying a certain FIT price for a kWh of electricity, whereas FIP is applied when DSO/TSO have already bought the energy from RE producer with the market price and FIP is just remuneration on the top of the sold electricity. FIP allows RE producers being supported in a more cost-efficient way than FIT. This occurs because, when government utilizing a FIP tool, RE producers are obliged to find the seller for their energy by themselves on the market firstly, which in turn compel RE producers to react on the market prices, whereas utilizing FIT tool suppliers/utilities are obliged to purchase RE and thus RE producers do not react on the market prices which are determined by the demand and load of electricity. FIP is more likely applicable to the dispatchable technologies like biomass plant or geothermal plant as well as to the RES which could be combined with storage like hydro-power or CSP. Variable technologies like wind
or solar have very small possibilities to adjust to market demand and load. Thus for these technologies, FIP means additional costs to buy balancing services when they should sell their energy when the demand is low. RECs are mostly small scale projects and a lot of them exploit solar and wind technologies, therefore FIP is not a sufficient tool for their policy support. In a lot off the Member States in EU, both FIT and FIP tools were introduced simultaneously, so RE producers can choose which scheme is more benefitable for them.

Tenders – is a policy tool aimed at support of the RE deployment by allocating other tools such as feed-in-premiums, subsidies, RE certificates on the auction platform, where different eligible players can bid. European Commission (2013) guidance for the design of renewables support schemes argues that “well-designed auction can lead to significant competition between bids revealing the real costs of the individual projects, promoters, and technologies, thus leading to cost-efficient support levels, and limiting the support needed to the minimum”. “Auctioning systems may not be implemented easily in all cases [small scale, infant technologies, and administrative burden excluding small scale producers etc.] and thus any tendering process needs to be transparent, comparable, inclusive, applicable to the technologies and sectors capable of bearing the administrative burden, and also ensure that the desired capacity is actually built”(2013, p. 6). “Well-designed auctioning systems would allow new and dynamic market entrants, limit the cost of support and can help provide regulatory certainty about expansion of installed renewables capacity”(2013, p. 7). Despite benefits in terms of lowering of regulatory subsidies and cost-efficient RE capacity deployment, tenders are not appropriate for the delivering support to the small scale producers such as RECs or CRE, because they are barely able to overcome administrative costs of auctioning and market risk of the failure to win the tender, thus sell their electricity profitably.

Investment support – usually occurs in a form of grants or preferential loans to cover the capital costs, which make this tool different in nature from the tools subsidizing operational costs.

An extreme rise of the RECs last years in the Netherlands proves that appropriate conditions for it in the country exist. The evidence of such rise we can see on Pic.6
Obviously, multiple factors play a role in this process: a market with its institutional framework, motivations, path dependency. Nevertheless, policy tools chosen to support the local generation of distributed energy are critical to enabling all of those factors to play their role. According to Locale Energie Monitor (2018) three main policy schemes enacted by the national government in the Netherlands:

1. Net-metering. Using net-meters which can “countback”. The generated energy is deducted from the consumed energy in the HHs and building with rooftop solar or CSP installations. HHs and CRE projects pay less for energy because the bills for the energy they consumed are coming based on market price tariffs and since net-metering allows to decrease the quantity of consumed energy – the final bills are lower.

2. FIP.

3. “Zip Code” scheme. Members of RECs and CRE have a right to obtain energy tax discount in oppose to the other market players and big RE producers. Scheme was enforced since 2014.


4. Loans

Since 2014 experimenting in market models were allowed in Holland by exemption from the obligation of the Electricity Act 1998. A total of 12 exemptions have been granted, including 2 to RECs.
Despite it was concluded above that FIP is the less favorable tool for small RE producers, it was mentioned that it is mostly due to the administrative burden laying on RECs which need to find the seller of electricity by themselves. In the case of Holland, this flaw is compensated by the appropriate market framework which allows FIP and tax reduction scheme “Zip Code” to act in favorable for small RECs manner. Some energy suppliers start to deliver cooperative products. A good example is a sustainability sensitive supplier ”Greenchoice”. It offers resale contracts and purchases electricity from cooperatives paying them FIP. Except for FIP another tool plays a role in the success of the resale contracts. It is a “Zip Code” scheme. This service is especially valuable for newly created CRE projects which are weak in the expertise. Members of the RECs are direct customers of an energy supplier (in this case, of “Greenchoice”) and benefit from favorable prices. REC sells energy to the supplier, and later its members consume energy back, benefiting from the resale agreement with the supplier, because of “Zip Code” scheme tax discount: cost and thus price for energy which they sell to the supplier is lower due to the tax discount and therefore supplier which had purchased cheaper energy from REC – would sell to the REC’s members energy with the lower price too. Also in the Netherlands, cooperatives can operate themselves as energy suppliers on the market. As for today, there are two such suppliers. Both of them were formed by electricity generation RECs. Currently, 120 electricity generation RECs are shareholders of these 2 retail RECs. This is a so-called cooperative of cooperatives.

It is interesting to note that in Holland except everything exist also political will in the deployment of local distributed energy. This can be proved by the statement of the president of REC Netherlands National Federation: “Ziward Zomer on behalf of ODE Decentraal: ‘ We see that the cooperatives are closing the pioneering phase and are becoming increasingly professional. But there is also a lot of work to be done. The Climate Agreement [National Climate Agreement] includes the ambition, that 50% of all new wind and solar production must be owned by the local environment’. ”(“HIER Foundation 2019,” n.d.).

As we see in the example of Holland - net-metering, FIP and tax regulation mechanism benefit RECs due to the specific market conditions, their interplay with each other, available institutional conditions, and not solely due to these tools typical designation. That allows us to suppose that the successful combination of preconditions is important for the RECs deployment and not a single precondition is able to stimulate this process.
Another interesting case to see the impact of different policy tools on REC/CRE deployment is a case of Scotland. The CARES program offered by the Scottish government provides low-interest loans to local not-for-profits pursuing RE. According to EFREC (2014):

“The CARE Scheme has been set up by the Scottish Government in February 2011. The main objective of this scheme is to provide a system of loans to finance the pre-planning stage of local renewable energy projects. The particularity of this scheme is also that it supports exclusively projects which are driven by local groups and which bring benefits to the local community. This is therefore orientated towards the supports of projects such as RECs. Moreover, the dedicated organization, Local Energy Scotland, provides projects with technical guidance as well as the administration of the grants and/or loans of the CARE scheme.”

In this scheme, the Scottish government created not only fund for the support of CRE in the form of loans, but also a separate institution dealing with technical and administrative assistance. Such an approach is synergic.
2.3.3 Institutional and market design

In this subchapter, we elaborate on financial tools for RECs and best examples of the advantageous institutional context for RECs to develop in EU.

For RECs, a reduced need for any of the scarce resources – people, time and money – is an advantage (Brummer, 2018). “Were RECs to find a less time-consuming and faster alternative to formal decision making than uniting the members in person, that would represent an operational advantage to them. For RECs to compete in the market, they must find ways to offset these higher transaction costs by creating other values for their members making it worth to accept these costs.” Indeed, in some countries in the EU there are already in place particular services provided by the market institutions which allow reducing transaction costs. A good example is services of South Tyrolean Energy Federation (SEV) in Italy, German Cooperative Association (DGRV), or the German online platform which allows conducting cooperative meetings online instead of the physical presence. In Chapters 3.1.4 and 4.1.4 these services will be discussed in details.

Wierling et.al. (2018) argues that “as a reaction to the removal or tightening up of the incentives schemes, energy cooperatives responded with diversifying their portfolio or increasing the numbers of shares and members, as an alternative to completely terminating all activities.” “Energy cooperatives will have to face fierce competition when corporate actors finally enter the new promising markets, which were only opened by pioneering cooperatives. Larger energy cooperatives may provide a solution to this dilemma. Yet, it is important to keep the minimum financial engagement low enough to ensure the participation of diverse social groups (2018, p. 21).” That will increase further social acceptance of RE deployment.

In the previous subchapter, we mentioned about Local Energy Scotland public institution which assists CRE projects. However, this type of institutions could emerge due to the market forces too. “Energy2All” Cooperative Renewable Energy Developer in the United Kingdom is a bright example here. Cooperatives that have been created by this organization fund it. Energ4All finds communities willing to establish CRE project, helps them with the organization and raising capital for the planning and construction phase of the project. When the finance has been raised Energy4All takes a percentage of the project cost and further offers management services. Since the start of its activities “Energy4All” created
24 independent RECs\(^3\). Organizations like this are benefiting very much for the diffusion of REC social innovation in societies.

Another institutional framework that seems to benefit RECs can be observed in the Netherlands. Drastic deployment of RECs in the Netherlands since 2011, induced except other aspects by the relevant policies, has been the basis of the institutional framework to emerge in the field of RECs/CRE. An introduction of a certified quality label for decent CRE projects in the Netherlands is a good practice. Keurmerk Mienskips Energie serves as a quality guarantee for local and fair energy, for example, supported by and benefiting communities (HIER opgewekt, 2018). A separate institution was created for knowledge transfer and diffusion in the field of RECs and CRE – HIER Opgewert (HIER Foundation), which partners consist of municipalities, provinces, corporations, owners associations, service providers, RECs federation “ODE Decentraal”, grid operators. In turn, ODE-Decentraal was established by merging two organizations: ODE and Decentraal (which both started the promotion of sustainable energy in Holland back to 1980s). Such rapid growth of RECs in the Netherlands has been caused by the political will too. In previous subchapter policy tools targeting CRE in the Netherlands have already been mentioned. Also on the local level, a lot of Holland municipalities greened their procurement strategies and contracted cooperative suppliers for green and local energy.

A crucial aspect when elaborating on a market context in the field of energy cooperatives is the financing schemes for RECs. According to EFREC (2014), there have been several sources of financing for RECs:

1. Self-financing
2. Crowdfunding
3. Traditional bank loan
4. Joint ventures
5. Ethical or not traditional banks
6. Cooperative fund

\(^3\) Source: (“Energy4All website,” n.d.)
7. Leasing

8. Project financing


A matrix tool to choose among these options is depicted at Pic. 7

Pic. 7. Financing matrix for RECs.

Source: EFREC (2014)

According to this tool, RECs have been given a certain value from simple to complex projects and from completely collective to purely private. Calculation steps for project’s value can be seen in Table 2 and 3.
Table 2. Financing strategies: from simple to complex

<table>
<thead>
<tr>
<th></th>
<th>Low (1)</th>
<th>Medium (2)</th>
<th>Medium-High (3)</th>
<th>High (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size of the project</strong></td>
<td>&lt;200 kW</td>
<td>200-1000 kW</td>
<td>1000-5000 kW</td>
<td>&gt;5000 kW</td>
</tr>
<tr>
<td><strong>Type of RES</strong></td>
<td>Mini wind, PV</td>
<td>Mini hydro, Biogas</td>
<td>Wind on-shore, Solid biomass</td>
<td>Wind off-shore, Wind on-shore, Hydro</td>
</tr>
<tr>
<td><strong>Timing in the process (how difficult it is to collect financing according to different phases of the project?)</strong></td>
<td>Operating phase</td>
<td>Construction phase</td>
<td>Permitting phase</td>
<td>Planning phase</td>
</tr>
<tr>
<td><strong>Social acceptance of RES</strong></td>
<td>Social acceptance</td>
<td>Few opponents</td>
<td>Local scepticism</td>
<td>NIMBY (&quot;Not In My Back Yard&quot;)</td>
</tr>
<tr>
<td><strong>Geographical Scope</strong></td>
<td>Neighbourhood</td>
<td>Local/Municipal</td>
<td>Regional</td>
<td>National</td>
</tr>
<tr>
<td><strong>National RES tariffs</strong></td>
<td>High Feed in/premium tariff</td>
<td>Medium tariff</td>
<td>Low tariff</td>
<td>No tariff Selling to market</td>
</tr>
<tr>
<td><strong>Total Y</strong></td>
<td>Sum of row values (1-24)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EFREC (2014)

Table 3. Financing strategies: from collective to private

<table>
<thead>
<tr>
<th></th>
<th>Low (1)</th>
<th>Medium (2)</th>
<th>Medium-High (3)</th>
<th>High (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of citizens/actors</strong></td>
<td>&gt;500</td>
<td>100-500</td>
<td>30/09/00</td>
<td>01/10/14</td>
</tr>
<tr>
<td><strong>Nature of the actors involved in the project (citizens, public administrations, private investors, corporations)</strong></td>
<td>4 types</td>
<td>3 types</td>
<td>2 types</td>
<td>1 type of actors (i.e. corporation)</td>
</tr>
<tr>
<td><strong>Patrimonial guarantees of investors</strong></td>
<td>No guarantees</td>
<td>Few investors with patrimonial guarantees</td>
<td>Many investors with patrimonial guarantees</td>
<td>Patrimonial guarantees of all investors</td>
</tr>
<tr>
<td><strong>Willingness of people to invest (capital endowment and trust) into new RE:Scoop</strong></td>
<td>&gt;75% of engaged actors</td>
<td>50-75% of engaged actors</td>
<td>25-50% of engaged actors</td>
<td>&lt;25% of engaged actors</td>
</tr>
<tr>
<td><strong>Legal forms (limit and constraints)</strong></td>
<td>Cooperative</td>
<td>Community-owned company</td>
<td>Private company (Ltd)</td>
<td>Public company (Plc)</td>
</tr>
<tr>
<td><strong>Mutual objective</strong></td>
<td>Energy consumption</td>
<td>Capital remuneration and energy consumption</td>
<td>Low capital remuneration</td>
<td>High capital remuneration</td>
</tr>
<tr>
<td><strong>Total X</strong></td>
<td>Sum of row values (1-24)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EFREC (2014)

**Self-financing**

Typically, self-financing means when project funds have been raised from its members by offering shares, equity, bonds, etc. At the planning stage, it is harder to raise
funds by offering public shares. Thus, founders of the project may rely on their own money when the self-finance scheme has been chosen.

*Crowdfunding*

Crowdfunding refers to open calls to the wider public, typically through the internet, to finance projects that are directly chosen by the citizens who become involved as investors in the project development (EFREC, 2014). These calls usually state the funding needs and the purposes of the project, defining a limited funding period (EFREC, 2014). For RECs, the dominant scheme is when cooperative issues shares as a base for crowdfunding. Such crowdfunding platforms as Lumo-France or Citizenenergy.eu demonstrate successful crowdfunding examples which target specifically CRE projects. If Lumo-France is an example of a national crowdfunding platform, Citizenenergy.eu was created as an EU project that aims to develop energy transition at the local level internationally. Some European RECs develop two types of crowdfunding campaigns. A good example here is Som Energia cooperative in Spain and their crowdfunding campaigns. The first campaign was launched to publicly offer the shares. The second campaign was created only for internal usage of the shareholders. There was created a special crowdfunding website for this purpose. Funds were collected here in the form of a loan (so-called, “participation title” with a fixed interest rate of 5% and 5-year contract including withdrawal possibility). Funds acquired through this second crowdfunding scheme were more dedicated to finance new projects of REC, whereas the first crowdfunding scheme was launched to establish REC itself and build initial RE installations. Currently, Som Energia membership rate stands at 14000 members, thereby 1000 members have already invested in new projects through the second crowdfunding scheme. Here we see that wisely elaborated financing schemes, in our case, different level crowdfunding, can assure despite RECs creation, also growth and development.

*Traditional bank loan*

It is financing in debt which requires guarantees and the payment of interests. According to EFREC (2014), in comparison with an ethical bank, a traditional bank will:

- rarely accept small and medium loan (less than 500 k€/ 1M €) which are less profitable
• can require further due diligence to the project leaders (to check the guarantees and the ability to lead the project) - which can cost 20 to 30 000 euros

• maybe less willing to finance citizen projects whose governance is seen to be more complicated

*Joint ventures*

A joint venture refers to the creation of a partnership or conglomerate, in which 2 or more companies combine part of their assets (EFREC, 2014). It corresponds to a new legal entity and is often created to share risk or expertise on a temporary basis (EFREC, 2014). A Portugal REC “Coopernicus” is a perfect illustration for a joint venture.

“Boa Energia, a citizen RES initiative that provides citizens and organizations with investment opportunities in the renewable energy sector developed 4 PV projects that needed an investor before the deadline for the feed-in tariff application. Boa Energia offered the projects for different REScoops in Europe to invest. The REScoops that were interested in the projects decided amongst each other that it would be against their principles to be foreign investors without giving Portuguese citizens a chance to invest as well. Boa Energia agreed to set up a local REScoop which was named Coopernicus. The joint venture agreed to buy the projects and become owner of the PV installations. Coopernicus would get a 4% share in the joint venture with the possibility to buy back up to 100% shares of the joint venture, when their member base, and with it its social capital, would grow and in the end will end up becoming an autonomous REScoop” (2014, p. 56).

*Ethical or not traditional bank*

Most of the time they are cooperative banks: savers and borrowers are also members of the cooperative and have a right to vote each year during the general assembly (EFREC, 2014) “Most of the time the ethical banks will spend more time with the projects’ leaders and will be more attentive for small and cooperative projects than a traditional bank. The trust between the bank and the project’s managers is very important for the ethical bank: if the project’s managers share the same values as the ethical bank, the credit will be easier to implement” (2014, p. 21).

“Existing examples of an ethical or not traditional bank for financing RECs’ projects

• Banca Etica (Italy)
• GLS Bank (Germany)
• Triodos Bank (Netherlands, UK, Germany, Spain, Belgium)
• Merkur Bank (Denmark)
• la Nef (France)
• Crédal/Hefboom (Belgium)
• Ekobanken (Sweden)
• Faire (Spain)
• Cultura Bank (Norway)
• Alternative Bank (Switzerland)”(2014, p. 23).

Still, the loan when refers to interest rates or guarantees is usually similar to the ethical bank.

**Cooperative fund**

“Cooperative fund can be funded directly by individuals or by institutions. Contrary to crowdfunding, the risks are mutualized for:

- the shareholders that do not invest directly in a project, it is a more secure investment
- the project leader because even if he does not find the direct investors locally he can benefit from the funds

The “cooperative” character ensures that the fund is not speculative – the dividends distribution can be limited by the statutes or by law – and that it is managed collectively. It invests long term, “patient” capital and does not expect very high and rapid returns even if of course the projects financed have to be economically viable”(2014, p. 24). Usually when cooperative fund invests into capital, then they enter the board of the REC to assist with legal and economic questions.

**Leasing**

Leasing is a scheme by which a firm or an individual get the use of certain assets for which it should pay. When the contract expires, the user can become the owner of the used asset by paying fixed quota agreed before the signature of the contract. Leasing contract
between parties is similar to a mortgage. Leasing is obviously less capital demanding to compare to the purchase of the new RES plant. So, for RECs limited in financial capacity, leasing could be a tool to use RES installations. If no assets or patrimonial guarantees have been in RECs ownership yet – then this financial tool is harder to exploit to the new RECs.

*Project financing*

As EFREC (2014) defines

“project finance is provided by commercial banks as debt that is secured on the cash flow generated by the project, rather than a call on an asset owned by the company applying for the loan. It can also be called non-recourse debt and is always backed by equity, provided by the project’s parent company, shareholders or in the case of a cooperative its members”.

*European cooperative fund*

It is the same as a cooperative fund but at the European level. A good initiative is a TAMA online platform for raising funds for energy transition goals. On TAMA website (“TAMA website,” n.d.) a short description has been given: “First European Cooperative of social finance, TAMA aims to collect money from everyone in order to invest in emblematic projects of citizens' transition in Europe”. As EFREC (2014) concluded about TAMA: this European tool could add to the national and local networks as a third step of the cooperative financing model.

Other examples of the investment schemes are revolving funds like CARES in Scotland described in Chapter 2.3.2 or Seed Investment Tax Incentives, which are the tax reduction for the citizens and businesses who invest in CRE in the United Kingdom. French REC Enercoop⁴ was created by the cooperative between cooperatives. Enercoop could not capitalize enough their proposal for the call for bids to get the share of the electricity supply from the monopolistic utility EDF. French cooperative bank Credit Cooperatif which is the partner of Enercoop refused to guarantee for Enercoop bidding process, asking for counter guarantees. Enercoop gained counter guarantees initially from Belgian cooperative leader Ecopower, which in turn induced few other institutions to counter-guarantee Enercoop too. Eventually, Enercoop won a bidding process and got the share to supply with RE a certain

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⁴ Enercoop is a supplier REC
amount of the population in France. Later they contracted 100 small RE producers for this purpose. Thanks to successful tender Enercoop started its operational activities.
2.4.4 Motivations

For the organization of the renewable energy cooperative, the presence of the key committed individuals is crucial. The leader should organize initial processes and find people to involve as the shareholders, first. Sometimes it is easier to do, sometimes it is harder due to a not obvious need in creating new enterprise. When we speak about solar and wind cooperatives the need to establish a new structure has been born out of foresight of possible benefits. Whereas when we speak about biogas/biomass cooperatives the need has been born out of the request to utilize more efficiently leftovers in most of the cases. As we see the initial motives of individuals could vary according to the technology. In this subchapter, the personnel factor of establishing REC would be discussed more in detail.

RECs flourish in Italy most of all in Autonomous Provinces of Trentino and South Tyrol. They are looking to be autonomous even more from the central government. Independent energy production based on predominantly hydropower and biogas plays an important role in citizens’ motivation to participate in various forms of CRE. Magnani and Osti (2016) say that in Germany this cultural approach to the territory is even more developed. The Heimat concept indicates a feeling of attachment to a homeland, often identified with a small residential community, in which basic experiences of life have occurred. This feeling can foster the formation of energy communities, even if their membership is not limited to people living in a place where the energy source is developed (Blickle P., 2004).

As Magnani and Osti (2016) mentioned in their research, individuals who establish REC must have access to information, skills, and economic capital needed to start the project, as well as to form a supportive partnership. A leader who establishes REC is usually experienced in the energy field person, who have a strong wish to add transform the community to more “green” and self-sustainable. Researches in the literature typically call this type of individuals as “ecopreneurs”. Typically, the leader unites future shareholders based on similar values, mostly environmental, but also social. A good example that the initial leaders could be not only entrepreneurs but also a public representative we find in Susser (Süsser et al., 2017) work: “Looking back to the start of community-owned wind farms, the local council and the mayor have been found to be essential for planning the first wind farm. They dealt with procedures of approval, changes in land development plans, the establishment of development plans and initially adopted a collective approach.
Entrepreneurs were found to play an important role in advising the local council, if not even being part of it and managing the wind farms”. Local ecopreneurs as was revealed in Susser (2017) research might be able and willing to support CRE projects in other places where no local knowledge or leaders are present. This makes the role of the leader universal. One good example could be a case of “SoLe” cooperative in Italy. The role of the ecopreneur in the creation of the cooperative was played by the external expert, who was visiting Val di Ledro village in Dolomite Alps annually for the summer vacation. He got to know a lot of locals including the major. Ecopreneur realized a benefit which the sun could bring to this mountain village and as being an energy expert for a lot of years, he was able to provide both inspiring idea and precious organizational assistance to local citizens, because they did not have it by themselves.

Community spirit is an important factor allowing the ecopreneur to acquire needed support. What became apparent was that community collaboration appears to be important, but it requires locally emplaced innovators who discover and socially exploit these potentials (Süsser et al., 2017).

In research of Hicks et al. (2018) 25 CRE from EU, Australia, US, Canada were questioned in terms of their primary motivation. Motivations derived from Hicks et al. (2018) studies were categorized as you can see on Pic.8.
Motivations driving community renewable energy projects.

Source: Hicks et al. (2018)

Frequency of each motive was provided by Hicks et al. (2018) study too. For this project work, we can break motives into three groups: motives mentioned the most by CRE projects, motives mentioned less, and motives mentioned the least (leading, crucial, secondary). This will give us an understanding of the most influential ones. Later we can calculate an absolute weight value for each category (environmental, social, economic, technological, political) by adding all projects respective to the category and dividing it on the number of motives in each category. Eventually, we can claim which aspect is the most determinative in ecopreneurs’ and shareholders’ decision to establish CRE/REC.

Leading motives:

Environment – reduced GHG/pollution (20 projects)

Technology – renewable energy industry development (18 projects)

Social – local ownership and decision making (16 projects)

Crucial motives:
Social – regional development (12 projects), future “proofing” and resilience (12 projects)

Economic – shareholder income (13 projects), community income (12 projects)

Technology – energy self-sufficiency/security (12 projects)

Secondary motives:

Social – community-building/volunteering (7), empowerment and skills development (5), community asset (7), RE education and training (9)

Political – increased support to RE (9), create actors in renewable-powered future (9), political mobilization (2)

Environment – local environmental benefits (2), increased environmental values and behavior (6)

Technological – more appropriate local siting and scale of RE (8), increased energy efficiency [including line losses] (6)

Economic – local jobs and contracts (10), tourism (6), cheaper energy/energy savings (8)

<table>
<thead>
<tr>
<th>Category/Aspect</th>
<th>Number of motives</th>
<th>Number of projects in respect to the category</th>
<th>Aspects’ weighted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological</td>
<td>4</td>
<td>44</td>
<td>11</td>
</tr>
<tr>
<td>Economic</td>
<td>5</td>
<td>49</td>
<td>9,8</td>
</tr>
<tr>
<td>Social</td>
<td>7</td>
<td>68</td>
<td>9,7</td>
</tr>
<tr>
<td>Environmental</td>
<td>3</td>
<td>28</td>
<td>9,3</td>
</tr>
<tr>
<td>Political</td>
<td>3</td>
<td>20</td>
<td>6,6</td>
</tr>
</tbody>
</table>

Source: own design

The most important aspect when choosing to participate in CRE is technological. Individuals wish would develop a renewable energy industry because they consider that this development will lead to the positive consequences in terms of environmental and economic outcomes for society and therefore for them as part of society. Not unimportant is increased energy self-sufficiency which adds to the people’s sense of security. Individuals participating in CRE projects see themselves as drivers of the technology diffusion which would, therefore, indirectly influence the other aspects of their lives including social and environmental, that is why technological aspect happened to be the leading one.
People see direct and indirect economic benefits for them when participating in CRE as very important. The direct benefit is, first, shareholder income, whereas indirect benefits are community income, local jobs, and contracts, tourism, energy savings. Social benefits such as local ownership and regional development are perceived as important motives too. Although the most independently mentioned motive “reduced GHG/pollution” belongs to the environmental category, after weighting calculation was conducted we see that environmental concerns, in general, do not play a crucial role in motives. Possible political benefits almost do not play any role at all comparing to other aspects.

In the case of motivations, we can consider CRE being an analog of REC, even when only 8 out of 25 CRE projects were actual RECs. The author argues that all involved parties in the CRE project different in legal nature from the cooperative still would have the same motivation as REC members, because of the nature of the community project.

It is important to mention when we speak about motivations which activities may induce the actual act of the person to raise an idea for REC establishment or participation. The research of Korjonen (2017) gives an answer to it:

“the results of especially study 2 show that the emergence of grassroots innovation might be embedded in everyday life. Especially participation in the workshops and solar panel learning sites confirmed the idea how shared knowledge production and working together may lead to grassroots innovations”.

A quote is interesting to consider to track the flow of thoughts which lead people to grassroots energy innovations:

“Participant: ‘No. I just read a report [about produced solar power] myself and started to wonder about the extra energy we produce. It would be something for the neighbors as well. I think it is worth studying.’(2017, p. 27)”

It is worth in this subchapter to discover the roots of the motivations themselves to understand, besides economic and social gains, what induces motives existence in the people’s minds. Susser (2017) argues:

“people's place meanings and attachments are important ingredients that provoke or slow down the emergence of grassroots innovations, fuel or blight local entrepreneurship, and affect adoption or rejection of renewables. Furthermore, people's place meanings and attachments are closely connected to the socio-cultural context: the meanings ascribed to,

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5 Data from Hicks (2018) research
values nestling in and ‘histories’ associated with places help to better understand people's place-based bonds and their attitudes towards changes of their place”.

Therefore, the historical past of the community, shared knowledge production, working together are important preconditions of the personal motivation for the establishment or participation in REC to appear.
2.4.5 Business model choice

In this subchapter, we will outline the basic theory behind RECs organizational choice, German official requirements to cooperatives regarding their organizational structure, conflicts in the management of RECs and basic recommendations to resolve them. Finally, an inspiring case study organizational idea from Belgium is presented.

Ronald Coase (1937) noted that using market mechanisms involves costs other than production costs – transaction costs. Bonus (1986) argues that

“within this typology of transaction costs and governance structures, cooperatives are classified as hybrids within the spectrum of coordination mechanisms, ranging from market to hierarchical organization. On the one hand, members pool some (but not all) of their qualifications and resources in the cooperative enterprise’s business, and thus the use of the market is limited or even absent: hierarchy dominates. On the other hand, members of a cooperative remain economically independent, and they can use their qualifications and resources for other tasks, mostly for market transactions. In sum, the cooperative association possesses features that provide benefits in terms of integrating transactions into a collective organization, while allowing independence of other operational aspects”.

As identified in research by Hicks et.al. (2018), the main pillars of organizational structure choice to be made around: actors, voting, engagement with the community, financial benefit spectrum. This organizational structure choice influences directly the level of impact of REC on the welfare of local communities.

Departing from the analysis of cooperatives in the agricultural sector, various problems devolve from the division of residual claims and control rights, known as the free-rider problem; the horizon problem; the portfolio problem; the control problem; and the influence cost problem (Yildiz et al., 2015). For energy cooperatives, the control and influence cost problems are of importance. The control problem in REC is expressed as Yildiz (2015) claims: “by a lack of external competitive market pressures to discipline involved parties, particularly, the executing managers of a cooperative”. The influence costs are incumbent on all organizations where decisions affect wealth distribution among members (Sykuta & Cook, 2001).

Members of a cooperative might undertake efforts and bear costs to influence and control operative decisions, therewith reducing the transaction-cost efficiency of a hybrid organization (Yildiz et al., 2015).
“This problem may give rise to more hierarchical organization, especially in bio-energy cooperatives, where infrastructures at various stages are characterized by a complex value-addition process, including the energetic exploitation of raw materials and distribution of production output and waste. In con-trust, solar energy cooperatives are less prone to these problems, since the underlying technology does not rely on socially complex production processes, and therefore typically does not involve parties with heterogeneous interests. Consequently, the demo-critic organization of energy cooperatives and co-determination rights assigned to all members can generate extensive organizational costs, which may restrict their operational decision-making and management” (2015, p. 66).

The pooling of both resources and risk-sharing features are particularly relevant for citizens involved in generation cooperatives, since members can participate actively within local energy policy, without bearing extensive economic risks. However, contractual incompleteness within the institutional setting of relational contracting, as a regulating measure for the relationships among the involved parties can induce opportunistic behavior, resulting in significant risks that are likely to remain in cooperative organizations (Menard & Ménard, 2004). On an individual level, a member’s characteristics are the foundation of his or her abilities to contribute to the group’s actions. A member’s personality is crucial for positive participation in group decision-making. Empathy, the ability to work in group structures and the willingness and motivation to contribute to a common goal are requirements to be an active part of a functioning cooperative enterprise (Stevens & Campion, 1994). In executive work according to Brummer (2018), personal qualification plays a key role. Demands for a member of the board of directors of a REC include skills:

1. Understanding of the technical aspects of RE technology, market conditions, and regulative norms.

2. Member management, information politics and the ability to unite votes behind the goal are necessary skills for a REC director.

In Germany, the organization structure of all cooperatives is firmly defined by German Cooperative Law. It can be seen on Pic.9
Pic. 9. Structure of a registered cooperative under German Cooperative law

Source: Brummer (2018)

Brummer (2018) says that according to National Cooperative Law in Germany:

- Board members may take duties into their own hands or may employ a CEO, who is not required to be a member of the Board (or even the cooperative)

- Both Supervisory and Director Boards elected for a set period of time, which has to be specified in the bylaws, usually 4-5 years.

- Both bodies have to give account to the general meeting, which has to be held at least once a year.

- To become a registered cooperative in Germany, a group has to present a business plan to one of the approved audit organizations, which checks if the plan is viable and if the group includes people capable of handling the business.

- Every registered cooperative is subject to and audit once per year, where the financial situation, the functioning of the cooperative’s bodies and possible risks for the members’ deposits are reviewed.

- The bylaws must include the organization’s purpose of enterprise and the individual value of the shares. They also include the maximum of shares allowed by a single member.
• A clause regulating exit conditions states how long a member will wait after returning their shares to get their money back, usually about 2 years.

Brummer (2018) says that “current proliferation of RECs flourished because setting up a business made low demands for technical expertise and for financial expertise”. “Problems arise where RECs are dependent on external professionalism that is not being supplied free of cost, as typical German RECs rarely possess the means to hire external experts” (2018, p. 120).

In the same study (Brummer, 2018) we find that main occasions of the conflicts of legal provisions with social reality inside the RECs, which could bring negative implications for the functioning of the cooperative, frequently include:

1. When there were no known alternatives present. Members of the Board used for the general meeting presentation of limited options to avoid discussion of possible alternatives.
2. Short notice on the information in the decision-making process.
3. Low levels of information transfer to the members
4. Irregular vote count. For example, according to law, the general meeting is considered organized, when 1 member represents up to 2 other members on the meeting, although 1 physical person still counts as 1 vote. Despite this legal intervention, 1 member attending the General meeting can represent up to 7 other members.
5. Preference for risk aversion in the presence of complicated business opportunities. Risk assessment of new business activities requires expertise, in this case, legal expertise, which could not be among members. If the expertise were not provided on a pro bono basis, financial resources would need to be tapped. In this case, REC management often chooses to reject business opportunities. If the decisions made by the directors are not representing members’ interests, - according to the Law, - Board of Supervisors can call for a removal of the directors.

These main tensions can cause inefficient management of the REC as well as low benefits for the members and community as a whole. For instance, preference for risk aversion can lead REC not to invest in the expansion of its activities even when the financial situation allows. The same problem may stop REC from delivering community welfare project like cycling trails for a town or village because it will require additional communication with the municipality and certain skills. Low levels of information transfer
and short notice may spoil trust inside of the REC, which could lead to the members’ resignation from the structure. Also, Brummer (2018) noticed that some conflicts, like irregular vote count in some cooperatives, do not bother members very much, they do not even think that something is not right or should be changed. The fact that internal regulation has succeeded with RECs in Germany shows that operation of a REC is possible without strict adherence to regulatory procedure (Brummer, 2018). Nevertheless, new regulatory obstacles as the requirement for the German RECs to professionalize its directors or reduce of the FIT and FIP challenge cooperatives with a new force. According to Wierling et.al. (2018) research The number of terminated energy cooperatives in Germany amounts to 136 (14%) since 2006, the most of them were terminated after 2014, the year of change in supportive legislation. Also in the same study Wierling et. al. claim that despite financial problems and unfavorable legislative changes, “Management problems also contributed to cooperatives’ failure, such as disagreements between and within executive boards and members on the future of the cooperative, lack of management capacities or competencies as well as insufficient capacity to adapt to new situations”. These conclusions about termination reasons Wierling and colleagues drew upon the investigation of websites, reports and other sources. So, we clearly see that organizational conflicts are among the reasons for RECs failure. However, in a new study Brummer and Herbes (2019) revealed some recommendations to overcome the organizational conflicts:

- To look for forms to hedge their risks while applying their “House Rules”, for example, to put them in the bylaws.
- To adapt their business models so that management positions can be offered a salary to help them professionalize. This could also mean to look for a merger to unite resources.
- To take more care to implement legal cooperative governance structures. An umbrella organization with professionals as support can help.
- Reality shows that RECs work quite well with their own rules. Maybe some of them could be incorporated in the law.

An interesting organizational concept is Allon en Vec REC in Belgium concept, so-called “Children Windmill”. Here windmills are owned by children who will be the adults.
of tomorrow. Legal representatives of cooperative members are obviously adults, parents of the children, although once a kid becomes an adult – then he is a full right holder of his shares in REC. This concept is currently franchised by the NGO which pushed this idea initially and helped first Children Windmill REC, Allons en Vent, to be established. Such organizational concept helps to unite people around their children’s sustainable future and therefore is a popular scheme today in Belgium to replicate.
2.5 Possible benefits/detriments of RECs for the welfare of communities

In this subchapter, firstly, general advantages of RECs for society as a whole are discussed. Secondly, several benefits for local communities are discussed in the form of case studies for a description of the most common positive changes which RECs are able to bring. Thirdly, a general theory of all possible outcomes, positive and negative, is elaborated which in Chapter 4 would be used as a matrix tool to assess case studies.

Citizen participation in energy generation has been attributed with a number of positive effects on society and the proliferation of RE Technologies, which is in many cases hindered by the reaction to LULUs (Locally unwanted land uses), such as the NIMBY (Not in my backyard) effect (Devine-Wright, 2005). The participatory function of REC reduces these effects. Further effects can be educational and by supporting energy democracy (Brummer, 2018).

Regarding the discussion on the lack of legitimacy and short-comings of representative democracy, new forms of citizen involvement are a way to revitalize democracy (Yildiz et al., 2015). Decisions made in energy cooperatives resulting from collective action processes may find greater societal acceptance and may form a broader consensus, than decisions made by investor-oriented firms (Rosanvallon, 2011). Yildiz et al. (2015) point that although they lack the formal representation, legitimization, and control of public utilities, with these properties they have the potential to achieve a similar status by broad participation of local citizens, being open and accountable, and not discriminating against small investors.

As noted by Feldman and Kogler (2010) the greater the number of individuals who are able to participate in a creative endeavor, the higher the probability that a place [such as a community] is able to [assess and] capture the resulting benefits. This insight underlines the importance of two dimensions: the process dimension of who is involved in the project, and the outcome dimension that social, place-based and economic values are locally created (Walker, G., Devine-Wright, 2008). Engagement and participation have an essential influence on the acceptance of RE technologies as people develop individual and collective bonds to the technology and share the common purpose of renewable energy generation (Süsser et al., 2017).
It is interesting to see that participation in REC, except all goods, could bring detriments to the psychological wellbeing, as was investigated by Centgraf (2018) in her research on reflection of individual needs:

“Another internal challenge mentioned by members of all three RECs is the shortage of active members. The workshop participants assumed that there was a lack of interest among the REC’s passive members and attributed the lack of a shared identity to the different roles of the board and the members respectively”. “Sometimes the families of very active members feel neglected due to a family member’s dedication to the cooperative. Because of the shortage of active members, the emotional well-being of those members who are actively involved suffers: excessive demands, stress and a sense of frustration have a highly negative influence on people’s ability to fulfil their need for subsistence and protection, while active members additionally show signs of fatigue” (2018, p. 116).

Things which that impact in a bad way psychological wellbeing of the members, except of shortage of active members, include: “ambiguous short-term energy policies make it difficult for the cooperatives to act, as the policy framework might change quickly and make their earlier decisions void; the entrepreneurial risk contains external challenges in itself; and, last but not least, the conduct of other companies in the energy sector can pose a challenge by undermining confidence in RECs” (2018, p. 116). These things negatively impact the fulfillment of psychological needs of freedom, creation, security. Lack of active members and finances negative impact fulfilling of psychological needs of members of RECs. Human Resource Mobilization, as Brummer et al. (2017) call it, remains an important task for the continued existence and growth of RECs.

An interesting case to consider a general type of benefits which REC can bring is “Energyland” in Italy. After establishing the cooperative the willing members were supported to buy 1-6 kW shares. 1kW cost 3600 euros. The majority of cooperative’s members bought a 3kW share, investing the sum of about 10800 euros. According to Magnani & Osti (2016), to incentivize membership in cooperative and promote energy savings 2 tools were used:

1. 4% interest rate on part of the capital invested was granted to shareholders (dividend payout)

2. When shareholder consumed less kWs than it had invested in – the cooperative would buy non-consumed energy and sell it to the best buyer on the market.

Thus we can distinguish two main benefits:

- Individual shareholder regains some money invested
- Cooperative improves its economic surplus.
70% of its 100 members consumed less than 3000 kWh annually. On average a member of REC managed to repay its electricity bills and earn about 10% of the invested capital per year. Part of the cooperative’s surplus was decided for financing a project to devise and test smart meters for the constant real-time monitoring of energy consumption by the cooperative shareholders. It will increase the profits of shareholders in future even more: they will be more energy-efficient and thus the earnings from cooperative will boost. Obviously, employment opportunities were created too for local people servicing PV plant. As we see economic benefits for the members add additional value to the benefits for the environment, because except the PV RE plant itself energy-saving practices were stimulated by the wisely elaborated operational scheme.

Another interesting case from Italy is SoLe cooperative in the Trentino region. In Magnani et al. (2017) research we find the interview with the former director who describes: “The cooperative was founded with the intention of creating the conditions for sustainable local development. Our members do not have to give anything but they have to guarantee the cooperative financially. That means showing additional confidence[…]. Mutual trust is crucial for local development”. Funds for the construction of PV plant were borrowed from the bank, where members of the REC played the role of the guarantees only. Maximum share which was allowed to buy was 3kW, producing 3000 kWh of electricity covering HH’s average need. Shareholders got the return of 60/70 euros per 1 kW share per year. On average return per member is 90-100 euros/year. This saves 25% on a yearly electricity bill of the member. In addition, “together with retirees … there were young professionals who thanks to the cooperative’s action had been able to find jobs in the local green economy” (p.36). The Sole cooperative was able to finance a number of small local development initiatives: for instance, the recovery of a cycle path, the building of a small community biogas plant, and an exchange project between the University of Trento and the cooperative for young trainees in the energy sector (Magnani et al., 2016). In this case, we see that it is possible to create REC even without direct financial participation of the members, although economic gains have been found relatively modest. However, other benefits could be outlined of bigger importance in the case of the SoLe:

- Environmental benefits: new actor in the energy transition, increasing environmental values of community
• Social benefits: community asset, local ownership, and decision-making investing in other community projects, RE education and training
• Psychological benefits: participation experience satisfaction, the pride of being a member of REC.

It is worth to talk about one of the first examples of RECs in Europe – Samso energy island in Denmark. This cooperative was created by a top-down approach. Danish Ministry of Environment ordered to commit 20% reduction of CO2 emissions consumption back to 1990s. Minister hired Soren Hermansen to begin this process. His main initial target was to show to people the opportunities the green economy could bring. He started with Samso island, which was an island totally dependent on exports of the oil fuel. People established the first cooperative there, citizens bought 5% shares, they also met some private investors who have been invested in wind turbines too, because back to 90-s wind turbines were very expensive. Today Samso island brings 5000 energy tourists per year. Energy Academy was established on the island attracting inspired people in the energy transition from all over the world. Benefits for the local community thus range from economic to social and psychological improvements in the wellbeing of the people. RE boosted the island’s economy and continue to boost. Island transformed from being energy importer to being RE exporter to the mainland.

Examining the benefits of RECs to the local communities the discussion about the energy transition as a global process and role of the RECs in it is of high importance. The energy transition requires a transfer of society to exploiting clean energy technologies. Such technology as Carbon Capture and Storage (CCS) or low-energy nuclear reactions are still either too expensive or at the stage of research, therefore renewable energy seems like the best solution to tackle global warming challenge. In order to ensure it – several obstacles should be overcome. One of the biggest obstacles is a fluctuating nature of the RES which cannot provide stable load throughout a day. When various RES are working simultaneously – the problem is solvable, though two crucial preconditions must be in place. First, working storage systems. Second, smart grid with smart meters, smart appliances, Virtual Power Plants (VPP or also called aggregators) should be incorporated into the energy structure. Energy cooperatives seem to be a particularly advantageous socio-economic structure to introduce both storage capacities and a smart grid. Except for the physical infrastructure
needed for the smart grid, demand-response tariffs\(^6\) should be offered by utilities. Smart meters are able to not only send the information to the grid, like traditional meters but also take the information about current load and peak periods from the grid. This enables consumers to know current fluctuations, the market price of energy, etc. With demand-response tariffs, consumers pay less when the load is low and more during peak periods. This stimulates energy-saving practices by consumers as well as the introduction of smart appliances which operate on Internet-of-Things technologies. These smart appliances are able to react to load fluctuations in a way that they can regulate their working hours and power regimes according to smart meter signals. However, the introduction of smart meters requires the participation of consumers in it. RECs are the organizations owned by the consumers of energy thus are able to control an entire chain: from production to consumption. This makes them a perfect organization to manage smart grid projects, which enable complete elimination of fossil fuel power plants and full energy transition. One example could be that REC is able upon member decision to redirect dividend pay-outs in purchasing of smart meters. Traditional big utility companies are by their nature not interested in such investments. If it is not REC, then the local governments could provide such investments. In that case, energy transition remains the duty of a local/national government, which rarely is able to combat the influence of big utility lobby. That is why RECs are much more flexible and suitable organizations for such tasks. Example of REC’s investment in smart grid is Energyland REC in Italy, although many more around Europe could be found. Nevertheless, full implementing of smart grid and storage systems requires either strong collaboration of RECs with utilities and local governments or simply REC being an operating grid cooperative. As for available data (Wierling et al., 2018), only 31 RECs in Germany possess their own electricity distribution network, so-called operating grid RECs.

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\(^6\) Demand response is a change in the power consumption of an electric utility customer to better match the demand for power with the supply. Until recently electric energy could not be easily stored, so utilities have traditionally matched demand and supply by throttling the production rate of their power plants, taking generating units on or off line, or importing power from other utilities. Demand response seeks to adjust the demand for power instead of adjusting the supply. Utilities may signal demand requests to their customers in a variety of ways, including simple off-peak metering, in which power is cheaper at certain times of the day, and smart metering, in which explicit requests or changes in price can be communicated to customers. Source: [https://en.wikipedia.org/wiki/Demand_response](https://en.wikipedia.org/wiki/Demand_response)
Such storage devices as flywheels, pumped storage power plants, biogas storage, and accumulators in electric vehicles can be successfully integrated into smart grids. Moreover, exploiting vehicles for the needs of the grid – demands direct consumer participation. Energy cooperatives thus provide important educational and implementation platforms for electric cars being included in the smart grid. Another activity which is currently being invested in by a lot of RECs is car sharing research and practice, so-called e-mobility (electric cars utilization practices).

When REC becomes an operating grid REC and, simultaneously, retail REC - it could choose to invest into smart grid and later purchase electricity only from RES or expand activities into being a generation REC too. Community or region thus becomes energy circular, in terms of both energy and finances. Community/region would consume only locally produced and only RE energy thus.

REC is one of the most suitable social innovation, which enables full energy transition as well as local energy circular economy. Examples from Samso island in Denmark, Sifnos island in Greece, Gussing town in Austria, E-Werk Prad cooperative in Italy prove it. RECs in all these places successfully integrated smart grids partially, completely, or currently invest in its integrating. They all consume 100% RE, and all are net-exporters of clean energy to other regions/countries.

The assessment of the impact of RECs on the welfare of local communities, as has already been mentioned in Introduction, will be done through the assessment of the wellbeing of individuals: both members of the RECs and members of the community in general. In our research, we concentrate on four aspects of wellbeing: economic, environmental, social, psychological. Each aspect is divided into several benefits when assessing benefits, and detriments when assessing detriments. Results are depicted in Table 5.
Table 5. The wellbeing of individuals in the community with REC.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Economic       | • Cheaper energy  
                | • Tourism  
                | • Local jobs and contracts  
                | • Shareholder income  
                | • Community income |
| Environmental  | • Create actors in the energy transition  
                | • Increase environmental values and behavior  
                | • Reduce GHG/pollution  
                | • Energy savings |
| Social         | • Political mobilization  
                | • RE education and training  
                | • Community asset  
                | • Empowerment and skills development  
                | • Community volunteering/building  
                | • Local ownership and decision-making  
                | • Investing in other community projects (e.g. roads, kindergartens, etc.) |
| Psychological  | • Energy self-sufficiency/security  
                | • Participation experience satisfaction  
                | • Organized events for members  
                | • Friends in REC  
                | • Pride of being a member |

<table>
<thead>
<tr>
<th>Detriments</th>
</tr>
</thead>
</table>
| Economic       | • The additional burden on electricity bills since the new generation installation built  
                | • Contracting outside region companies for outsourcing services |
| Environmental  | • RE installation occupies valuable agricultural land  
                | • RE installation harms biodiversity  
                | • Retail REC contracting fossil fuel plants |
| Social         | • Tension among local actors  
                | • Complicating of the local energy system  
                | • Members withdraw their shares from REC |
| Psychological  | • Lack of active members  
                | • Policy changes leading to a decrease in profits or termination of REC  
                | • Conflicts in REC management |

Source: own design
Respondents in the interview would be given an additional questionnaire to grade each factor of benefits and detriments from 0 to 4, where 4 stands for the maximum possible factor influence according to what the REC of that type and with the particular country policy framework is able to bring, and 0 stands for minimum possible respectively. The personal respondent’s opinions would be given a priority to rather than merely quantitative expression, because all aspects, except economic, are hard for being quantitatively assessed. The average value for the aspect would be given after all factors have been graded. For the comparison reason, several RECs could be depicted on a single graph. The Pic.10 and 11 shows an outcome visual representation of the questionnaire results for a number of RECs. A questionnaire, ideally, should be given to the various stakeholders: RECs management, RECs members, citizens not participating in REC but aware of it, municipality, private companies in the community, NGOs in the community. Due to the time and financial limitations our research would be concentrated only on the first group – RECs management representatives.

![Graph of Wellbeing of individuals in the community due to REC. Benefits.](image)

**Pic. 10.** Wellbeing of individuals in the community due to REC. Benefits.

Source: own elaboration
Pic. 11. The wellbeing of individuals in the community due to REC. Detriments.

Source: own elaboration
3. Italian experience in RECs

3.1 Key figures

As it was mentioned in Table 1 in Introduction Chapter, Italian generation of electricity from RES equal to 34% in 2017, whereas the generation of heat & cool energy is equal to 20.1% of the total generation. Regional and provincial distribution of RE generation power is depicted on Pic.12.

![Regional distribution of installed power at the end of 2017](image1)

Pic. 12. Regional distribution of installed power at the end of 2017

Leading regions in RE generation are Lombardia and Puglia, 15.6 and 10.2 percent of the total Italian RE generation. Lombardy is developed in hydro, wind, biomass/biogas energy generation, whereas Puglia due to its sunny weather benefits from the solar energy generation the most. Piemonte and Veneto hold 3d and 4th place in energy generation with 8.8% and 6.4%, although on the map region of Trentino Alto-Adige is split into two autonomous provinces, which together hold 7.3% of total Italian generation. North of Italy
over all is more developed in RE generation. Nevertheless, generation does not show the overall progress in the country’s energy transition. Consumption level is much more representative in this case, because dynamics of the consumption level shows as well the progress in the energy efficiency measures and transportation sector, which is the important tool to end a demand growth thus have time for the energy transition to RES and, as a consequence mitigate the global climate change. In Italy was consumed 18,3% of energy in 2017 from RES. EU Directive 2009/28/EC set a goal for Italy to achieve 17% of energy from RES in 2020, which mean that Italy has already achieved it before the deadline. The consumption by type of energy and 2020 Italian targets are displayed in Table 6. Since in this Project Work we research the renewable energy cooperatives generally, operation grid together with retail RECs and e-mobility RECs could play an important direct role in increasing consumption from renewable energy sources. Current regional distribution of RE consumption level is depicted on Pic.13.

Table 6. Energy consumption level and targets achievement in Italy by type of energy

<table>
<thead>
<tr>
<th>Type of energy consumption</th>
<th>Consumption level in 2017</th>
<th>The target set by Directive 2009/28/EC for 2020</th>
<th>Difference, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>34,1%</td>
<td>26%</td>
<td>+8,1</td>
</tr>
<tr>
<td>Heat&amp;Cool</td>
<td>20,1%</td>
<td>17%</td>
<td>+2,9</td>
</tr>
<tr>
<td>Transportation</td>
<td>6,5%</td>
<td>10%</td>
<td>-3,5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,3%</strong></td>
<td><strong>17%</strong></td>
<td><strong>+1.3</strong></td>
</tr>
</tbody>
</table>

Source: own elaboration, data extracted from Eurostat (2019) and NREAP (2010)
Pic. 13. Regional distribution of derived heat consumption produced from renewable sources in 2017 (%)


Italy accomplished EU 2020 targets generally, in electricity and heat&cool, whereas in transportation goal has been still not reached. Eurostat says that in transportation, as for 2017, only Sweden and Finland reached the target. Speaking about regional distribution, the most RE consumed has been found in Lombardia and Piemonte, 30,7 and 14,3 percent respectively out of 100%. Also these Italian regions simultaneously the biggest in size, that is why we can see more modest numbers, for instance, for renewable developed provinces of Trentino and South Tyrol, 2,1 and 10,1 percent respectively.

In Table 7 we can see the Italian RECs membership data, supplying data, classification of RECs according to the typology elaborated in Chapter II, location information. There are 77 RECs in Italy with 42346 members. Historical RECs (which started back to XX century) are highlighted in brown color, whereas cooperatives of the 21st century (new cooperatives) are in green color. There are 10 new energy cooperatives and 67
old RECs in Italy. Historical cooperatives were founded mostly in the first half of the XX century in Alpine regions of Trentino Alto Adige region as hydropower plants on the small rivers owned by citizens. A great part of them still exists and extended its activities to the construction of district heating plants based on the biomass resources widely available in mountainous regions. A lot of them have already installed additional capacities of solar PV plants and provide to its members' energy efficiency, energy consulting and broadband internet services. Expansion of activities to the telecommunication sector frequently occurs due to the request from the municipalities, because existing underground distribution network and pipe routes provide an efficient way to connect the broadband internet to the homes. Some of the cooperatives in South Tyrol, like E-Werk Prad, expand its activities to the e-mobility sector. They build charging points for the electric vehicles and could purchase shared electric vehicles too. However, the greatest field of activity for the historical cooperatives is still hydro energy generation, distribution, and supply. Most installed power by RECs in South Tyrol, Trentino, Friuli, Piedmont, and Lombardia is coming from the small and medium hydropower plants.

New energy cooperatives in Italy appear in the Northern part mostly. Although a significant number of power plants owned by cooperatives is located in Puglia, these plants are owned by the cooperatives which are open to the Italian citizens nationwide. For instance, WeForGreen Sharing REC established 5 similar RECs, most of which capacity has been situated in Puglia, but the owners could be nationwide. Similar corporate purpose can be observed for the Energia Positiva REC. Italians willing to purchase a share in RE plants, which are currently situated in 5 different regions, could do it through the online platform. It is user-friendly and convenient. Shareholders later can also manage its activities through the personal Internet account as well. That is why these type of RECs are urban RECs according to the typology given in Chapter II. Urban RECs serve the community of interest more than a community of place. E’nostra REC started to own generation facilities only after they merged with another cooperative, Retenergie, in December 2018. Before that, they were only selling renewable energy to its members on the beneficial conditions and provided various energy services. That is why E’nostra activities are performed in almost all regions of Italy, although in Northern Italy there are more members comparing to the Southern.
Table 7. RECs in Italy: key figures, typology classification.\(^7\)

<table>
<thead>
<tr>
<th>RECs</th>
<th>Number</th>
<th>Members</th>
<th>HHs</th>
<th>Type of REC according to the corporate purpose</th>
<th>Type of REC according to the RES</th>
<th>Type of REC according to community engagement</th>
<th>Type of REC according to the geographical context</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole per tutti</td>
<td>1</td>
<td>62</td>
<td>-</td>
<td>Generation REC</td>
<td>Solar</td>
<td>Small</td>
<td>Rural</td>
<td>-</td>
</tr>
<tr>
<td>E'nostra (after merge with Retenergie)</td>
<td>1</td>
<td>4372</td>
<td>3271</td>
<td>Retail REC, generation REC (after merge with Retenergie), Consumption related services REC</td>
<td>-</td>
<td>Very Big</td>
<td>Urban</td>
<td>Lombardia, Veneto, Piemonte, Emilia-Romagna, Tuscany, Lazio, Liguria, Marche, Friuli Venezia Giulia, Puglia, Campania, Sicilia, Umbria, Sardegna, Basilicata, Calabria, Abruzzo, Val D'Aosta, Molise, Trentino Alto Adige</td>
</tr>
<tr>
<td>Melpignano</td>
<td>1</td>
<td>138</td>
<td>419</td>
<td>Generation REC</td>
<td>Solar</td>
<td>Small</td>
<td>Rural</td>
<td>Melpignano (Puglia)</td>
</tr>
<tr>
<td>WeForGreen Sharing Group</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energyland</td>
<td></td>
<td>123</td>
<td>460</td>
<td>Generation REC</td>
<td>Solar</td>
<td>Small</td>
<td>Urban</td>
<td>Verona and Orsara (Veneto)</td>
</tr>
<tr>
<td>Masseria del Sole</td>
<td></td>
<td>187</td>
<td>555</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lecce (Puglia)</td>
</tr>
<tr>
<td>Fattoria del Salento I</td>
<td></td>
<td>175</td>
<td>1115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Racale (Puglia)</td>
</tr>
<tr>
<td>Fattoria del Salento II</td>
<td></td>
<td>175</td>
<td>380</td>
<td>Consumption related services REC</td>
<td>Solar</td>
<td>Small</td>
<td>Urban</td>
<td>Ugento (Puglia)</td>
</tr>
<tr>
<td>Fattoria del Sole in Ugento</td>
<td></td>
<td>152</td>
<td>535</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ugento (Puglia)</td>
</tr>
<tr>
<td>So.Le. Societa Ledro Energia</td>
<td>1</td>
<td>200</td>
<td>90</td>
<td>Consumption related services REC</td>
<td>Middle size</td>
<td>Rural</td>
<td>Ledro</td>
<td>(Trentino)</td>
</tr>
<tr>
<td>Energia Positiva</td>
<td>1</td>
<td>280</td>
<td>310</td>
<td>Consumption related services REC</td>
<td>Solar, Wind</td>
<td>Middle size</td>
<td>Urban</td>
<td>Facilities are situated in 12 municipalities in Lombardia, Puglia, Abruzzo, Piemonte, Basilicata</td>
</tr>
</tbody>
</table>

\(^7\) Information about cooperatives ranges for the years 2016-2018
<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
<th>Generation</th>
<th>Operation</th>
<th>Retail</th>
<th>REC</th>
<th>Consumption related services</th>
<th>Hydro</th>
<th>Solar</th>
<th>Size</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIS (Consorzio Elettrico Industriale di Stenico)</td>
<td>1</td>
<td>3858</td>
<td>4630</td>
<td></td>
<td></td>
<td>Generation REC, Operation grid REC, Retail REC, Consumption related services</td>
<td>Hydro, Solar</td>
<td></td>
<td>Very Big</td>
<td>Rural</td>
</tr>
<tr>
<td>CEDIS (Consorzio Elettrico di Storo)</td>
<td>1</td>
<td>3252</td>
<td>4600</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro, Solar</td>
<td></td>
<td>Very Big</td>
<td>Rural</td>
</tr>
<tr>
<td>CEP (Electric Consortium of Pozza di Fassa)</td>
<td>1</td>
<td>3500</td>
<td>4000</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro</td>
<td></td>
<td>Very Big</td>
<td>Rural</td>
</tr>
<tr>
<td>SEM (Societa Elettrica in Morbegno)</td>
<td>1</td>
<td>550</td>
<td>13000</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro, biomass</td>
<td>Big</td>
<td>Rural</td>
<td>3 municipalities in Lombardy</td>
</tr>
<tr>
<td>CEG (Cooperativa elettrica Gignod)</td>
<td>1</td>
<td>3379</td>
<td>5979</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro, solar</td>
<td></td>
<td>Very Big</td>
<td>Rural</td>
</tr>
<tr>
<td>SECAB (Societa elettrica cooperativa dell’Alto But)</td>
<td>1</td>
<td>2970</td>
<td>5317</td>
<td></td>
<td></td>
<td>Generation REC, Operation grid REC, Retail REC, Civil lightening provider</td>
<td>Hydro</td>
<td></td>
<td>Very Big</td>
<td>Rural</td>
</tr>
<tr>
<td>Edolo-Mù Hydroelectric Consortium</td>
<td>1</td>
<td>No data</td>
<td>No data</td>
<td></td>
<td></td>
<td>Generation REC, Operation grid REC, Retail REC, Consumption related services</td>
<td>Hydro</td>
<td></td>
<td>Big</td>
<td>Rural</td>
</tr>
<tr>
<td>SIEC (Society for Electric Lighting in Chiavenna)</td>
<td>1</td>
<td>800</td>
<td>6700</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro</td>
<td></td>
<td>Big</td>
<td>Rural</td>
</tr>
<tr>
<td>Hydroelectric Cooperative di Forni di Sopra</td>
<td>1</td>
<td>No data</td>
<td>No data</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro</td>
<td></td>
<td>Big</td>
<td>Rural</td>
</tr>
<tr>
<td>Hydroelectric Cooperative Pro - Colloro</td>
<td>1</td>
<td>No data</td>
<td>No data</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro</td>
<td></td>
<td>Big</td>
<td>Rural</td>
</tr>
<tr>
<td>Cooperativa Forza e Luce di Aosta</td>
<td>1</td>
<td>582</td>
<td>4950</td>
<td></td>
<td></td>
<td>Same as above</td>
<td>Hydro</td>
<td></td>
<td>Big</td>
<td>Rural</td>
</tr>
<tr>
<td>RECs in South Tyrol</td>
<td>56</td>
<td>17591</td>
<td>31814</td>
<td>Predominantly RECs serving the whole community with all possible corporate purposes: Generation REC, Operation grid REC, Retail REC, Consumption related services</td>
<td>Predominantly hydro and biomas/s/biogas</td>
<td>Predominantly Big</td>
<td>Predominantly Rural</td>
<td>South Tyrol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
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<td>--------</td>
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<td>----------------------------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>42346</td>
<td>88272</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: authors design based on data from (Federazione Cooperative Raiffeisen Società cooperative, 2018), (Candelise & Ruggieri, 2017), (Cooperazione Trentina, 2019); individual websites of RECs; (Confcooperative Consume e Utanze, 2019);
3.2 Historical background

Energy cooperatives in Italy started to appear back to the beginning of the XX century in the Alpine regions of Trentino and South Tyrol. Although in Lombardy there is a REC founded in 1894. Until the 1918 great part of Alpine regions were a part of the Austro-Hungarian Empire. A lot of first energy cooperatives were found under the Austrian ruling. The territories of the South Tyrol and Trentino are situated in the mountains, therefore the region is predominantly rural. First centralized fossil-fuel electricity plants were usually established next to the big production centers – urban areas, where investment in a big facility has shown its return on investments. Big entrepreneurs or the central government in Wien thus had not had an emergency to electrify rural regions like South Tyrol. Hence citizens needed to take action by themselves in order to improve life in their communities. Small Alpine rivers happened to be a valuable and most affordable source of energy in South Tyrol and Trentino. Electricity was important for street lightening, sawmills, mills, woodworking. The first REC in the Trentino Alto-Adige is CEdiS (Consorzio Elettrico di Storo) which was found in Storo in 1904. A small hydropower plant of CEdiS cooperative of those years is depicted on the Pic.14.

![First hydropower plant and its cooperative society in Trentino Alto-Adige](image)

**Pic. 14.** First hydropower plant and its cooperative society in Trentino Alto-Adige

Source: (Angeli, 2011)

CEdiS REC has currently 3252 members and supplies the citizens with its service of 9 municipalities. Another very old cooperative is CEIS (Consorzio Elettrico Industriale di Stenico) which was founded in 1905. First hydropower plant there was activated in 1907.
In South Tyrol, first energy cooperative appeared in 1921 according to South Tyrolean Energy Association. It was a REC in the town of Stilfis\(^8\). The two initial leaders of the movement were a local church pastor and an engineer from the Haider Electricity Company. Overall, church priests played a crucial role in the development of the Northern Italy economy at the beginning of the XX century. The same year in the Vilnöss Valley three farmers and a craftsman in 1921 set up the “St. Magdalena Electricity Company” in order to produce and exploit electrical energy for lighting and power purposes and thus boost the local economy and promote the material welfare of its members (SEV website). One year later hydropower plant activated. One of the first REC in South Tyrol is E-Werk Prad, which was founded in 1926, and this REC is a case study of the Project Work too. It will be discussed in the following chapters. Speaking about the date when diversification of the cooperative’s activities started, we need to mention the begin of operation of the first district heating plant in 1995 in South Tyrol. District heating on the biomass was and continue to be a solution to eliminate dust from working on coal household furnaces, and also improve the air quality in the valley. Settlements in mountainous regions frequently placed inside of valleys, therefore they are prone to the suspension of emissions in the air space of the territory.

A new wave of cooperatives and community energy initiatives in Alpine regions of Italy occurred with the introduction of the manure output regulation in South Tyrol in 2002\(^9\) which was a consequence of the EU Nitrates Directive 91/676/EEC. This regulation required the farmers to decrease the soil exposure to nitrates, which are found in manure, in order to prevent ground water pollution due to the extensive dairy husbandry. In order to comply with the new regulation, farmers needed either to extend farmland area or simply decrease the number of cows which would lead to the economic losses and threaten the premium quality milk production in the region. Moreover, the regulation obliged farmers to build an obligatory storage capacity for the livestock unit. Farmers, however, discovered another solution to tackle new limitations – construction of the biogas plant which could serve all interested farmers from the territory. This solution would also contribute to the boost of tourism in the region since odor would be eliminated. Earlier odor had impeded tourism development in many rural areas of South Tyrol. First biogas cooperative and its biogas plant

\(^8\) Italian: Stelvio  
\(^9\) Regulation 1774/2002 on the use of animal by-products
had been activated in 2001 in Prad. E-Werk Prad REC assisted farmers in the construction and design of the plant. Later, E-Werk Prad joined some operational activities with biogas cooperative. Wirth (2014) says that there is 7 biogas RECs currently in South Tyrol: Biogas cooperative Prad, BioWatt Sand in Taufers, ALEG Aldein, Agrarenergie Terenten, Schluderns, Schlinig, St.Lorenzen. However, not all collectively owned biogas plants are organized in a form of cooperative. For example, Biogas Wipptal SrL10 is a collectively owned limited liability company. The shareholders of the Biogas Wipptal are 63 farmers in the area around the Wipptal town. Biogas Wipptal is a case study of this Project Work and will be discussed in the following chapters too. In Table 8 you can see the Italian RECs by year of foundation.

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10 SrL is an Italian abbreviation which stands for the limited liability company
Table 8. Foundation of RECs in Italy

<table>
<thead>
<tr>
<th>RECs</th>
<th>Year of foundation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energia Positiva</td>
<td>2015</td>
</tr>
<tr>
<td>Sole per tutti</td>
<td>-</td>
</tr>
<tr>
<td>E’nostra (after merge with Retenergie)</td>
<td>2013</td>
</tr>
<tr>
<td><strong>WeForGreen Sharing Group</strong></td>
<td></td>
</tr>
<tr>
<td>Fattoria del Sole in Ugento</td>
<td>2016</td>
</tr>
<tr>
<td>Energyland</td>
<td>2011</td>
</tr>
<tr>
<td>Masseria del Sole</td>
<td>2011</td>
</tr>
<tr>
<td>Fattoria del Salento I</td>
<td>2011</td>
</tr>
<tr>
<td>Fattoria del Salento II</td>
<td>2010</td>
</tr>
<tr>
<td>Melpignano</td>
<td>2011</td>
</tr>
<tr>
<td>So.Le. Societa Ledro Energia</td>
<td>2007</td>
</tr>
<tr>
<td>CEIS (Consorzio Elettrico Industriale di Stenico)</td>
<td>1905</td>
</tr>
<tr>
<td>CEDIS (Consorzio Elettrico di Storo)</td>
<td>1904</td>
</tr>
<tr>
<td>CEP (Electric Consortium of Pozza di Fassa)</td>
<td>1914</td>
</tr>
<tr>
<td>SEM (Societa Elettrica in Morbegno)</td>
<td>1897</td>
</tr>
<tr>
<td>CEG (Cooperativa Elettrica Gignod)</td>
<td>1927</td>
</tr>
<tr>
<td>SECAB (Societa elettrica cooperativa dell’Alto But)</td>
<td>1911</td>
</tr>
<tr>
<td>Edolo-Mù Hydroelectric Consortium</td>
<td>1921</td>
</tr>
<tr>
<td>SIEC (Society for Electric Lighting in Chiavenna)</td>
<td>1894</td>
</tr>
<tr>
<td>Cooperativa Forza e Luce di Aosta</td>
<td>1895</td>
</tr>
<tr>
<td>Hydroelectric Cooperative Procolloro</td>
<td>1919</td>
</tr>
<tr>
<td>Hydroelectric Cooperative di Forni di Sopra</td>
<td>1925</td>
</tr>
</tbody>
</table>

**RECs in South Tyrol**
- First historical REC: Società cooperativa azienda elettrica Stelvio: 1921
- First new wave biogas REC: Biogas cooperative Prad: 2001
- First new wave biomass district heating RECs: Bio-Energie-Genossenschaft Schlinig, Bioenergie Cooperativa St. Valentin: 2007

Source: own design

Except for 7 new biogas cooperatives which appeared at the beginning of the XXI century, there have been present new REC different from biogas type. It is a new district heating REC operating on the biomass. Totally this REC operates in 6 municipalities. They are situated in the north-western part of the province: municipalities of Graun, Mals and Schlanders, etc..\(^{11}\) This cooperative was founded in 2016. As for now, it does not own a

\(^{11}\) In Italian: Curon Venosta, Malles, Silandro

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distribution network. According to the typology offered by the author, it belongs to the generation and retail RECs only, whereas all historical RECs in Italy also own a distribution grid and thus are operational grid RECs too. Nevertheless, these new district heating REC operates a distribution network given as a concession right from the local government. The difference in owning and just operating lays in the different benefits for the members. Michael Wunderer, an officer at South Tyrolean Energy Association (SEV) and vice-president of E-Werk Prad told me, that RECs owning the distribution grid had a right to exempt their members from the system costs component in the final electricity bill, while RECs operating a grid as concession holders were not exempted from such burden. Therefore members of new district heating RECs do not have lower energy bills. Exemption from system costs in energy bills was granted to the historical cooperatives by ARERA, central energy regulation authority of Italy. According to Michael, SEV will try to lobby ARERA for this issue. The new Renewable Energy DIRECTIVE (EU) 2018/2001 and European Parliament legislative resolution from 2019 on common electricity market rules, where rights have been awarded to the renewable energy communities and citizen energy communities, could enhance lobbying efforts of SEV.

During my interview with Michael, it was clear that this young man is very much motivated by his job because his uncle was a cooperative’s director for more than 40 years as well as one of his ancestors, Alois Wunderer, was a founder of the E Werk Prad in 1926. That is how people’s heritage influence the modern development of the sector.

A good practice that has established in South Tyrol due to the significant amount of cooperatives in the region is a cooperative of cooperatives. RECs that have district heating plants purchase biomass from the suppliers in Austria, Germany, Italy with advantageous prices due to the collective bargaining power available when RECs cooperate.

New RECs in non-Alpine part of Italy emerged mostly since 2010. It is an outcome of bigger environmental concerns of the society and business sector. E’nostra cooperative was founded by the group of enthusiasts which had the background in energy and environment sectors. They benefited a lot from the funds of EU project REScoop 20-20-20. EU granted substantial financial and operational support to the 11 projects of new energy cooperatives in the European Union. One of such cooperatives was a retail REC E’nostra from Italy.
WeForGreen Sharing was founded by the ForGreen Group Spa and Energyland REC. ForGreen Group is a company whose aim is to develop innovative energy models. It was founded by the electricity professionals willing to contribute to the energy transition and climate change fight. Although before the foundation of the ForGreen SpA the same people started an Energyland REC in the Veneto region. Energyland was inspired by the historic hydro cooperative in Valpantena in Veneto, which was not existing anymore at the time. However, in 2016 WeForGreen Sharing and the financial investor Finval SpA launched a redevelopment project of the hydropower plant “La Lucense” in Valpantena. The same year plant restoration was completed and a new cooperative for local citizens was inaugurated. I think that a history of ForGreen Group initiative is a perfect case study of how historical background together with emerging environmental sensitivity can not only restore the successful past but also to create innovative 21st-century solutions. History reinforces modernity and vice versa. In Table 8 you can see that WeForGreen Sharing REC created as its spin-offs 5 RECs, shares for which are available to citizens nationwide, as well as cooperative restored the old “La Lucense” plant for the local citizens being its shareholders.

Cooperative So.Le. in Ledro in Trentino was basically the first new energy cooperative in Italy which utilized solar power as its production facility. Magnani (2017) says that the key role in the emergence of the project was played by an ecopreneur who came from outside the valley.

“He used to spend every summer in Val di Ledro as a tourist. He had the experience in creating energy cooperative and social cooperative before. The ecopreneur met with locals who had experiences in different institutions and were interested in RE, although lacked the vision, skills, and network to launch such an initiative on their own. ‘The objective was to create an organized collective structure that could support tourism, which is one of our valley's main resources. The focus on solar PV happened only by chance. The first and second energy bills had just been enacted, and we took this opportunity to create economic prosperity for the cooperative so that we could invest in other local development initiatives’.”(Magnani et al., 2017).

Cooperative Energia Positiva is a very new cooperative which utilizes also an innovative business model. The shares of the plants are offered for the purchase to the wide audience nationwide. All steps and needed information is available on the website. Energia Positiva has a very good elaborated web design of their online platform which allows them to attract also young people to participate. The REC’s team has many young people, including a president himself being born in 1990. Some of the team members are the serial startup developers, some have the technical background. One of the business developers,
Sergio Fedele, is originally from the South Tyrol and has worked in the local energy sector. Today Sergio is happy to work for the Energia Positiva which brings energy innovative model into life. Sergio’s homeland region has a particular amount of historical energy cooperatives. That is also an example of how historical background can contribute in terms of knowledge and value to the new energy cooperative models in Italy.

To summarize this section, historical background plays a key role in the preservation and development of the historical cooperatives. Example of the ForGreen Group shows how the past can reinforce future and future reinforce past. Example of new district heating cooperatives in South Tyrol is, obviously, an outcome of the presence of the historical RECs in the region, being them as a model to follow. Cooperative of cooperatives that RECs created to collectively bargain for the biomass supply is the direct result of historical background. Example of the E-Werk Prad successful growth, which would be discussed in details in the following chapter, is stimulated among other things by the social heritage that people value in Prad, as well as personal ancestry feeling of belonging. Such a feeling of belonging can be also traced in an example of the Energia Positiva REC with Sergio Fedele biography in particular. Such RECs as So.Le and E’nostra are not clearly influenced by the historical background. These RECs initiation seems like a modern contribution to the environmental and climate challenges, rather than initiatives induced by the glorious past. Nevertheless, the historical background does play an important role in the growth of the existing renewable energy cooperatives as well as in the emergence of new energy cooperatives which frequently have been built upon the innovative business models.
3.3 Institutional and market design

It is relevant to start this subchapter with the description of the national institutions created by the state to manage the Italian energy system. The key role to regulate the energy sector in Italy has been granted to the jointly formed authority - Regulatory Authority for Energy, Networks and the Environment (ARERA). It was founded in 1995. Authority’s board is appointed by the Ministry of Economic Development, jointly with the Ministry of the Environment and Protection of Land and Sea and approved by the Council of Ministers and later by the Parliament. Authority is independent and works according to the national and EU laws for the energy sector. Independence of energy regulatory authorities from any branch of state government is an obligatory requirement of the Third Energy Package. ARERA is not only responsible for the energy sector but as well for the water supply and waste management. ARERA has the following powers:

- Formulates observations and proposals to be transmitted to the Government and Parliament (advisory power);
- Has regulatory power (regulation);
- Determines the tariffs (in particular the component of the general system charges) and supervises the Fund for energy and environmental services;
- Ensures the publicity and transparency of the service conditions;
- Ensures equal conditions of access to energy networks;
- Has powers of quality control and supervision towards service providers;
- Evaluates complaints, requests, and reports presented by users or consumers.

Another important institutional player is the Ministry of Economy and Finance. In 1999 Ministry established GSE (Energy Service Agency), which is a public company fully owned by Ministry. Main functions of GSE are activities in renewable energy and energy efficiency sector. GSE works in accordance with guidelines given by the Ministry of Economic Development. GSE was appointed to implement policy incentive mechanisms, qualification of plants powered by renewable energy, plant inspections, forecast and monitoring of the power fed into the grid, promotion of RE. Agency founded 3 other public institutions which supplement GSE in its activities. They are AU, GME and RSE.
AU (Single Buyer) is a public company whose role in the energy literature is usually referred to as a "supplier of last resort". With the completion of the process of liberalization of retail electricity sales, AU continues to perform the procurement function for domestic customers and small businesses, which decide not to switch to the free market and are supplied under the protection regime established by law (AU, 2019). In order to enhance the transparency of supply offers, the internet portal where consumers could choose a retailer and access data regarding own consumption should be launched by 1 July 2019. AU is responsible for the creation and managing of the portal.

GME is an energy and environmental markets regulator. It manages the market online platforms. Among the markets that GME manages are IPEX (Italian wholesale electricity market), MTE (forward physical market), MPEG (a market for the trading of daily products), MGP (a day ahead auction market), MI (intraday auction market). It also operates on behalf of the Italian TSO Terna a platform for ancillary services (MSD), through which collects the bids and communicates the results, and a platform for the registration of OTC transactions (PCE). On this platform, parties that have concluded contracts outside IPEX, record their commercial obligations and nominate the related electricity injection and withdrawal schedules that they undertake to execute under the same contracts (GME, 2019). GME manages also natural gas markets: MGAS (wholesale gas market) and P-GAS (Gas Trading Platform). Responsibility of GME also includes Energy Efficiency Certificates Market, and the Guarantee-of-Origin Market (the market for green certificates policy incentive). GME works in accordance with guidelines given by the Ministry of Economic Development and regulatory provisions issued by ARERA.

RSE is a public research institution in the field of electric energy. ISPRA is a public research institution in the field of environmental protection. They both are important players. Results of their research influence activities of Italian and the EU energy sector authorities and market players.

On the Pic. 15 you can see the scheme of key authorities responsible for the energy sector in Italy.
There are 2 separate energy markets: gas and electricity. Major players are generators (producers of energy), TSO (transmission system operator), DSOs (distribution system operators), retailers (also called as suppliers or utilities). According to the Third Energy Package, activities of energy companies should be functionally unbundled. One single company neither can be both a DSO and utility simultaneously nor, for instance, own an energy plant and sell the energy to the final consumers at the same time. On Pic. 16 you can see the main actors of the Italian energy market.

In Italy, there presents a dominant public company which operates a transmission high voltage grid – TERNA Spa. It is in charge by means of Integrated Information System (SII) for the dispatching and transport services too. The number of smaller operators active
in the transmission grid include Agsm Transmission, Mincio Trasmissione, Edyna Transmission, Nord Energia, etc.

Speaking about utilities, in Italy there are 410 active retailers. The biggest retailers in terms of market share are ENEL, ENI, Edison, Dolomiti Energia. ENEL, for instance, in 2016 holds a market share of 37.5%. Top three retailers cover 45.9% of overall sales. Frequently, these retailers own also DSO companies, although they do not manage them directly because of functional unbundling. There are 133 different DSOs, but the market is extremely concentrated with ENEL through its subsidiary E-distribuzione operating 86% of the network. Despite ENEL, local municipalities are a second big group of DSOs.

In Trentino and South Tyrol, main retailers are ALPERIA and Dolomiti Energia. ALPERIA and Dolomiti Energia barely could be considered as competitors for the historical RECs, because historical RECs’ customers are stable and enjoy lesser energy prices. In addition, since these RECs own distribution network, ALPERIA and Dolomiti Energia have no chances of entering the market in these communities. Historical RECs are not obliged to be unbundled. Reasons for unbundling exemption are discussed in the following chapter. Traditional retailers like ENEL, Dolomiti Energia, ALPERIA could also beneficially cooperate with RECs, particularly, with generation RECs. A number of new RECs signed the agreements with retailers for energy delivering to the RECs’ members on the beneficial terms, allowing even rebates in their energy bills. One of such examples is Energia Positiva cooperative, that signed a partnership with Dolomiti Energia Spa. Cooperative offers -6% rebate (discount) on the gas price in final bills. Also, the agreement with Dolomiti Energia allows ensuring the supply to cooperative members of 100% certified renewable energy. In addition, Energia Positiva members cover partially their energy bills by economic returns from the shares in the cooperative, because cooperative owns some generation capacities. This set of benefits for cooperative’ members is closely interlinked with the supply services of Dolomiti Energia. Another example of REC’s cooperation with the retailer is WeForGreen Sharing REC. Cooperative signed an agreement with their founding company ForGreenGroup Spa. ForGreenGroup Spa is an energy retail company. ForGreenGroup Spa purchases energy from WeForGreen Sharing and sells it to both: members of WeForGreen

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12 Data source: Annual report of ARERA 2018
13 Data source: Deloitte 2015
Sharing and its non-member consumers. This example is quite different from the previous because a retailer is one of the founders of the cooperative. Nevertheless, we can conclude that in the case of the generation RECs, it is crucial to design a scheme of how their members would benefit from participation. Dividend pay-outs revenue scheme is almost absent in Italy. Usually, energy cooperatives major economic benefit for the members is a reduction in their bills. Hence it is crucial for REC to cooperate with a retail company to make this reduction possible.

RECs consumers that do not choose a retailer remain with a default retailer, the local DSO, which provides electricity according to a “standard offer”. In this case, the local DSOs buy electricity from the AU at the wholesale market price. According to ARERA (2018), in 2017 58.1% of customers were still supplied under standard offer, while 41.6% went over to the free market.

“In 2017, customer switching in the electricity market was greater than that of the previous year. Overall, almost 3.8 million customers (83,000 more than in 2016), i.e. 10.3%, changed supplier at least once during the year. In terms of volume, this corresponds to 33% of the total energy distributed”(ARERA, 2018). The Italian market is developing and consumers start to be aware of the possibilities to switch a supplier. This brings opportunities for growth to the new energy cooperatives in Italy, especially to the retail RECs, like E’nosra.

The average price for domestic consumers was 21,4 c€/kWh after taxes (ARERA, 2018). This is the price established for the consumers of the companies different from the energy cooperatives. Historical RECs have the benefit of exemption from the state system costs which make the bills for their members significantly lower. For instance, E-Werk Prad cooperative’s electricity tariff for their members in 2018 was 17.39 c€/kWh.

Italy is a country which does not have enough own energy resources. Italy’s main source of energy for production is natural gas. It imports huge amounts of it from Russia, Algeria, Norway, and Qatar. Gas is used for own heat&cool production, transport and electricity generation too. In the field of electricity, Italy imports an average of 43,181 GWh annually from its bordering countries, in particular, Switzerland and France, while exporting
an average of 6,154 GWh annually.\textsuperscript{14} This import dependency together with the climate concerns would boost policymakers for better strategies and support to renewable energy deployment. This gives hope for the rise of small distributed producers, among which energy communities can play a significant role. Moreover, with the new rights granted to RECs in the recent EU Directives\textsuperscript{15}, their growth is even more expected.

Other players worth to mention are banks. Many Italian RECs got the loans from a cooperative bank “Banka Popolare Etica” to fund the installation of the generation plants. Banka Popolare Etica is an Italian Ethical and Cooperative Bank, member of the European Federation of Ethical and Alternative Banks. Bank invests raised savings in initiatives pursuing both social and economic objectives with respect to the environment. EFREC (2014) says that Banca Etica developed within the “Progetto Energia” specific financing products for families and individuals mainly addressed to promote energy efficiency and RE production at a small scale. Retenergie REC\textsuperscript{16} borrowed money from Banca Etica. Funds were lent not with the full amount of interest and without patrimonial guarantees. The bank also offered special credit conditions to members of the REC in order to finance private energy efficiency measures. In return, Retenergie decided to deliver cheaper electricity to the members of the bank.

“The uncertainty of access to tariffs and the length of the authorization process negatively affect the willingness of traditional banks to give credit to RES developers. However many banks have developed specific products for renewable energy installations, but due to the transaction costs, they are mainly addressed to large RES projects. Specially for RECs, the main obstacle is related to the guarantees that the projects can give. Banks usually prefer to make business with companies which could demonstrate expertise in the field of RES (with a track record of projects) and with patrimonial guarantees. In general, the members (or only the administrators) of coop are asked to give some patrimonial guarantees in order to receive loans (or other financings) from banks. But in the energy sector, investments are relevant and members aren’t able to furnish enough guarantees for investments and the bank may also have some difficulties to collect and manage guarantees from all coop members”\textsuperscript{(EFREC, 2014)}.

Another institutional player in Italy is the Confcooperative\textsuperscript{17}(Italian Cooperative Confederation). It represents all cooperatives and social enterprises. Main activities are

\textsuperscript{14} Data source: Montella et.al. online review, 2018  
\textsuperscript{15} Those rights discussed in detail in Chapter 2.  
\textsuperscript{16} Now is not a separate energy cooperative, but merged with E’nostra  
\textsuperscript{17} Italian: Confederazione Cooperative Italiane
legislative representation and lobbying, legal, labor, tax, accounting, and training services. Also, the organization is a cooperatives’ auditor appointed by the state. Confederation provides trainings for the people willing to establish a cooperative. Energy cooperatives are represented by its sectoral federation Confcooperative Consume e Utenza.

Since a great part of the discussion in this Project Work is devoted to the historical cooperatives in the Alpine regions it is worth to describe specific details of the market context in South Tyrol. Regional production is concentrated on the electricity from hydropower and heat from biomass. South Tyrol is a region with the highest density of district heating plants in Europe (SEV, 2019). Speaking about electricity, in 2013 the share of the hydropower plants in South Tyrolean energy production was 92 percent\(^\text{18}\). Overall, there are 1072 small, medium, and big hydropower plants in the region. Today South Tyrol can cover its own electricity consumption with domestic hydropower (SEV, 2019). The region has a great number of DSOs. 56 out of 133 DSOs in Italy are situated in South Tyrol. Most of them are historical RECs. The dominant retailer is ALPERIA. The biggest DSO is EDYNA. The dominant energy producer is GreenPower. All these companies before the functional unbundling had been a single state-owned firm – SEL Group. Before unbundling and establishing of ALPERIA, SEL AG merged with Etschwerke AG, the oldest energy company in the region. Main shareholders of SEL Group were Autonomous Province of South Tyrol, municipalities of Bolzano and Merano. In 2013, the SEL share in the amount of electricity produced and distributed in South Tyrol amounted to 53.3 percent (SEV, 2019).

GreenPower manages 34 hydroelectric power stations in South Tyrol, producing an average of some 4,500 GWh of energy annually. EDYNA manages 8778 km of the electricity grid and 113 km gas network, public lightning in Merano and Bolzano, 24 charging points for electric vehicles. ALPERIA, EDYNA, GreenPower and some other associates have the same owners, although functionally they are unbundled.

Except for direct obedience of energy cooperatives in South Tyrol to the ARERA and GSE, they also interact with Terna when the excess of the energy has been produced or during peak demand periods. The part of the energy bills includes dispatching costs. Dispatching costs are included in the energy component of the price. These costs are paid to TSO, to Terna. In the case study of E-Werk Prad, we find that during winter cooperative

\(^\text{18}\) Data source: South Tyrol Energy Association website
has to buy energy from outside the municipality. Usually, REC purchases the needed amount from ALPERIA. Several big producers due to the capacity limitation of E-Werk Prad plants should be the customers of ALPERIA whole year. Therefore they pay more for the consumed energy. It occurs partially because ALPERIA must use the cooperative’s distribution network to supply these big producers. For its usage, ALPERIA pays the transportation costs to a cooperative. Eventually, these transportation costs end up in the bills of these big producers in Prad. In order to improve the situation of the big producers and include them into cooperative, new power plants should be constructed. This challenge and its solution are broader discussed in the next Chapter.

Another regional player with whom RECs tightly cooperate is a South Tyrolean Energy Association. SEV has more than 300 members: energy cooperatives, grid operators, municipalities, producers, etc. They are the service providers for all of them. Main functions of SEV include:

1. Lobbying (study regulations and proposals from the EU and Rome, analyze them and write position papers to protect small producers and distributors) The position papers are delivered usually to all state institutions dealing with the energy sector: ARERA, GSE, Terna, etc.

2. Providing background technical systems for grid operation and utility functioning. Usually, RECs should invest in them, but they are too expensive. Instead, RECs can pay some fee to SEV for a service providing and, therefore, get a job done. Most commonly used services are: calculating electricity bill, writing monthly reports that RECs later should submit to authorities.

3. Trading (SEV purchases energy when RECs have its excess and sell energy to RECs when they have a shortage). SEV is an accredited balancing partner, providing that they can trade on the energy market exchanges. For supplying RECs in the times of demand, SEV purchases often electricity from PV plants in Puglia.

Except for SEV, the accredited balancing partners in the region are ALPERIA, Energy Tiss and several others (much smaller in terms of trade volume). However, SEV is
only a trader assisting energy cooperatives. SEV started billing and trading services only three years ago with 100 GWT/hours. Now they trade 500 GWT/hours.

Except for services to the historical cooperatives in South Tyrol, SEV provides billing services also to E’nostra since 2018. As Michael Wunderer says: “They had some problems with their previous service provider. And they requested EFREC to help them. That is how we [SEV] started to be in touch with E’nostra”. Basically, the connection point between E’nostra which mainly specializes in the retail activities and SEV was a European Federation of Renewable Energy Cooperatives. Both organizations were members of the Federation, although they did not know about each other’s requests and, maybe, even existence despite being in one country. There were some contacts with other Italian RECs, like Energia Positiva, too. In the future, there might be born cooperation too. SEV also purchases biodiesel from Biogas Wipptal and sells it to the cooperatives which do not have enough plants to cover their demand. Initially, Biogas Wipptal produced electricity, but recently they decided to change the model and sell biofuel. Biogas Wipptal will be discussed in the following chapter more in detail. In these examples we can see how such a service provider with clear environmental concerns as SEV could help energy players, especially small, like energy cooperatives, to perform their operations at least transaction costs. Transaction costs burden is among the biggest threats for the energy cooperatives.

To conclude, market and institutional context do influence operations of RECs. In Italy we found several positive influence examples:

- Agreements between Energia Positiva and Dolomiti Energia
- SEV services to RECs simplify its operations
- SEV lobbying influence energy policy towards historical RECs
- Market players find service providers due to the activities of the EU Federation
- GME’s platforms allowing trade of green certificates and energy surpluses
- Switching rates are increasing due to the overall market dynamics
- Existence of the specialized bank.

Also, two negative influence of market context was discovered:
- limitation of some REC’s power generation capacities result in the exclusion from the membership certain high-demand consumers, which in turn leads to their higher electricity bills since they are supplied by the external player
- Functional unbundling of energy companies impedes competition perspectives of the RECs comparing to the ownership unbundling

Although, there may be more negative examples of market context on the performance of the RECs, those RECs which showed their livability – have already adjusted and benefited from the market. Potential obstacles for not yet created cooperatives are problematic to investigate. More light on the obstacles could be shed in the next section where we discuss a policy framework.
3.4 Policy framework

It is worth starting this section with the targets which Italy declared to achieve in terms of the RE deployment. Italy’s National Energy Strategy 2017 is based on the general EU Energy Roadmap 2050. Strategy set a goal to have a 28% share of energy consumption from the RES by 2030. A division of the goal for different types of energy will be as follows:

- 55% of RES-E
- 30% of RES-H&C
- 21% of RES-T

Regarding energy production Italian target is to achieve 50% by 2030. According to Michael Wunderer words, the country produces 22 TW/hours of PV energy and 18 TWh of wind. Italy needs to triple wind to get 50 TWh in order to achieve a 50% share of RE production by 2030 and to double PV to get 45 TWh.

Among other things, it is said in the strategy that diversification of support schemes for small-scale power generation and innovative technologies in the electricity sector should be enacted. The strategy envisages streamlining the permitting process for repowering wind and hydro plants, increasing hydropower generation with innovative projects in existing large-scale plants, promotion of self-consumption for small-scale power generation. Biomass facilities (traditionally very widespread in Italy) will have to mitigate their emissions and guarantee high environmental quality (Ministry, 2017). Furthermore, the potential of district heating in urban and non-urban areas will be harnessed in efficient ways (Ministry, 2017). In terms of energy efficiency, the EU Energy Efficiency Directive\(^\text{20}\) set a goal of energy consumption reduction by 1.5% per year. The goal of Italy in this field is to achieve 30% of energy savings by 2030 with respect to their trend in 2030. For that, an impetus should be given to the Italian energy efficiency industry (e.g. construction of energy-efficient buildings and installation of energy-efficient facilities). In the transport sector, among others, the support to the switch to smart mobility (car-sharing, carpooling, smart parking and bike-sharing), cycle and pedestrian mobility, as well as local public transport,

was established. As we will see in the next chapter, some RECs begin their activities in the e-mobility too.

In order to achieve its targets, special policies are elaborated in Italy. Some of them are in dynamic change, some are more stable over the years. One of the important policy tools which were supporting small scale producers during many years was Feed-in-Tariff. Now as it was mentioned in Chapter 2 it is not allowed in the EU. Indeed, the biggest deployment of the rooftop solar technology in Italy happened during FiT (tariffa omnicomprensiva) was in place. Also, green certificates assisted by the quota obligations was an important incentive. Green certificates policy was launched in 2003. However, after 2016 green certificates cannot be issued any more, but those issued last 20 years thus are still valid. Several RECs indicated on their website that they have benefited from the green certificates scheme. Among them biogas cooperatives and some historical. In particular, CEDIS REC in Trentino modernized its old hydropower plant; green certificates scheme made it possible. The cost of the reconstruction was 2,7 mln. euros. The power of the plant increased by 5% and all the facilities were renovated. Thanks to the incentive, investments would return in 10 years, otherwise making a project redeemable. Since 2016 green certificates were substituted with a Feed-in-Premium scheme. In order to benefit from FiP scheme, RE generators should sell their energy on the auctions/tenders. Tendering is a burden to the RECs because they do not have enough finances in order to participate in these processes constantly. That is why historical RECs in the Alps do not benefit from the FiP. When historical RECs need to purchase an energy shortage or sell the excess - they ask the service partner to assist them. In that case, they benefit, although most produced energy is usually consumed locally. In the case of South Tyrol, SEV participates in the tendering processes and trade energy for their clients – RECs. So, energy cooperatives benefit from FiP to a very limited extent.

The crucial policy which allows small scale generators to sell their energy in Italy is a simplified energy sale and purchase regime (ritiro dedicato). “This is managed by GSE and applies to plants below 10 MVA. Under agreements with the GSE, producers sell the electricity generated and to be injected into the grid to GSE, instead of selling it through bilateral contracts or directly on the power exchange market. GSE purchases and resells the electricity to be fed into the grid at the zonal price or at a minimum guaranteed price (for
plants below 100 kW only). On behalf of the producer, it transfers the fees for using the grid (dispatch and transmission fees) to distributors and to the Transmission Service Operator.

In Italy authorization of the RE plants is conducted through a single authorization regime (Autorizzazione Unica) granted by the relevant region or province. “The single authorization is issued after a local authority meets with all the relevant entities and examine the various public interests involved. The authorization is then granted within 90 days. Before this regime, several permits and authorizations had to be obtained to build a renewable energy plant” (Montella et.al., 2018). There is no authorization process to supply electricity to end consumers.

Electricity is traded between generator and suppliers on the Italian Power Exchange (IPEX) and related markets under the rules of the relevant market where the operator is active (Montella et.al., 2018). Also, they frequently enter into power purchase agreements which are not highly standardized (over-counter agreements) in Italy. Still, these over-counter agreements must be registered on the OTC Registration Platform. Reversely, between TSO and generator/trader should be signed a standard agreement. “Under the dispatching contract and the existing regulation, the dispatching user must send the TSO daily projections of the energy that is injected and withdrawn into and from the grid. This is to allow the TSO to effectively balance system demand and supply (Montella et.al., 2018).

Prices for electricity can be negotiated freely between parties since it is a market. However, HHs and small businesses have protection by law. Price for them could be only in a certain range and has been established by ARERA.

Except for the international and the national policy framework, cooperatives have been influenced by the regional policies. One of such examples is an environmentally induced policy of South Tyrol. This is a policy on manure output which has induced the emergence of biogas cooperatives and biogas plants of other organizational forms. It has already been discussed in Section 3.2 in detail. It is an example of the regional policy shaped by the local concerns and international regulations – a clear positive outcome of multi-level governance.
In order to continue a discussion, it is important to show the electricity bill composition scheme and shares of each component in the final HH’s bills. You can see it in Table 9 and on Pic.17.

Table 9. Electricity price bill composition

<table>
<thead>
<tr>
<th>Energy price</th>
<th>Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dispatching etc.</td>
</tr>
<tr>
<td>Transportation price</td>
<td>Transmission</td>
</tr>
<tr>
<td></td>
<td>Distribution</td>
</tr>
<tr>
<td>System costs</td>
<td>VAT</td>
</tr>
<tr>
<td>Taxes</td>
<td>Excise duty tax (State tax on electricity)</td>
</tr>
</tbody>
</table>

Source: own design

Pic. 17. Shares of components of electricity bills


Central authorities granted to historical RECs an exemption from system costs in 2008 as well as an exemption from the state tax on electricity but only for non-HHs members. Also in 2016-2017, there was a policy which granted an exemption from the unbundling requirement for the companies supplying less than 25 000 delivery points.21 Both exemption from system costs and exemption from the unbundling make historical RECs activities feasible and advantageous for their members. As we see on Pic. 17, the exemption from system charges allows reducing a final bill up to 19-20 percent, which is a very tangible

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21 Delivery point is a synonym to the connection point. We could say that it could generally mean 25 000 HHs
benefit for the historical RECs’ members. System costs component includes expenditures on state R&D in the energy field, costs for the promotion of RE, and the decommissioning of nuclear power plants. Michael Wunderer in his interview to the author mentioned that these preferences to historical RECs were lobbied by his uncle, Georg Wunderer, who was a chairman of the E-Werk Prad REC for the last 40 years. That shows us that special benefits to the RECs were not a top-down situation, but more as a bottom-up stimulation.

Also, Michael mentioned that the number of the following lobbying efforts would be proceeded by the SEV in order to benefit energy cooperatives. Among them is the exemption from the system costs for the new cooperatives, especially for the new RECs in the Alps, which operate as generators, grid concession holders and suppliers simultaneously. Another preference may be an exclusion from a dispatching component in the energy price for those RECs which have closed a nominal energy loop. Since there is no single definition of what is an energy loop, because energy transition area in social sciences is a new one, I elaborated it by myself. Moreover, I differentiated in between factual energy loop and nominal energy loop.

Nominal energy loop – is a closed energy system when demand for the energy in a certain community is fully covered throughout the year by its own local renewable energy production. The difference with a factual energy loop is in that balancing services in nominal energy loop are provided outside of the community, since excess of the energy production is dispatched into the transmission grid.

Factual energy loop – is a closed energy system in a certain community not only fully covered throughout the year by its own local renewable energy production, but also thanks to the virtual power plant (VPP) and energy storage systems, balancing services are provided locally and the energy system could be used without an excess dispatch into the transmission grid.

To conclude the section it is worth to design a summary table of the past and present policy tools benefiting RECs in Italy.
### Table 10. Summary of policy tools benefiting RECs in Italy

<table>
<thead>
<tr>
<th>Incentive scheme</th>
<th>Year of use</th>
<th>Type of REC benefiting</th>
<th>Level of actual benefiting</th>
</tr>
</thead>
<tbody>
<tr>
<td>FiT (Conto Energia)</td>
<td>2005–2013</td>
<td>Historical and new RECs</td>
<td>High</td>
</tr>
<tr>
<td>FiT (tariffa onnicomprensiva)</td>
<td>2007–2016</td>
<td>Historical and new RECs</td>
<td>High</td>
</tr>
<tr>
<td>Green certificates</td>
<td>2002–2016</td>
<td>Historical and new RECs</td>
<td>High</td>
</tr>
<tr>
<td>Simplified energy sale and purchase regime</td>
<td>2007–ongoing</td>
<td>Historical and new RECs</td>
<td>High</td>
</tr>
<tr>
<td>System costs exemption</td>
<td>2008–ongoing</td>
<td>Historical RECs</td>
<td>High</td>
</tr>
<tr>
<td>Exemption from unbundling</td>
<td>2016–ongoing</td>
<td>Historical RECs</td>
<td>High</td>
</tr>
<tr>
<td>Exemption from the carbon-tax on heat energy</td>
<td>2000–ongoing</td>
<td>Historical and new RECs</td>
<td>High</td>
</tr>
<tr>
<td>IRPEF (income tax) reduction for innovative start-ups</td>
<td>2017–ongoing</td>
<td>New RECs</td>
<td>High</td>
</tr>
<tr>
<td>Environmental regulations on manure</td>
<td>2001–ongoing</td>
<td>New RECs</td>
<td>Low</td>
</tr>
<tr>
<td>FiP (GRIN)</td>
<td>2016–ongoing</td>
<td>Historical and new RECs</td>
<td>Low</td>
</tr>
<tr>
<td>Exemption of non-HHs users from the state tax on electricity</td>
<td>No data–ongoing</td>
<td>Historical and new RECs</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: own design

In Table 10 we see policy tools grouping. Those incentives highlighted by yellow indicate that their period of operation has already been ended. However, green certificates when were issued could be used during 20 years from the date of issue, which means that some energy producers still benefit from its sale on the market or to the GSE. The same situation is with FiT tariffs. Energia Positiva REC, for instance, benefits from FiT (Conto Energia), because most of the plants, that they had acquired on the secondary market, were built before 2013. Dark green color refers to the incentives which are still working and mitigate either the operation complexity (simplified energy sale and purchase regime, exemption from unbundling) or they reduce the bills of RECs’ members (system costs.

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22 The difference with the Conto Energia is that this incentive applies only to the small plants with capacity less than 1MW (200 kW for wind farms) and for 15 years whereas Conto Energia for 20 years
23 Sale to GSE applies when a producer had not sold it on the market
exemption, exemption from the carbon-tax on heat energy). Light green refers to the policy tools that are still in operation, though benefiting RECs very less.

There are some other RE incentives which do not impact energy cooperatives at all or to a very limited extent, depending on the specificity of activities which REC performs. Among them are net metering service (scambio sul posto) and energy efficiency certificates (EECs).
4. Case studies from Italy and Ukraine: business models, motivations, benefits/detriments for the community

4.1 Biogas Wipptal

Biogas Wipptal Srl has 63 farmers as its shareholders. Although plant’s idea was born in 2002 and the company was launched in 2008, it started production only in June 2016. The cost of one share is 250 euros. Currently, 63 farmers from the territory are shareholders. Though enterprise holds not an organizational form of cooperative, it is still a renewable energy community, because of the community members being shareholders and the motivations being not only economic. Enterprise collects the manure that farmers should get rid in order to comply with the environmental regulations. After manure and slurry collection from the shareholders, the company manufactures the biogas from which electricity had been produced - 22 500 kW/h per day and heat about the same. Except for electricity and heat, another outcome is the fermentation residue in a form of fertilizer pellets. It has been produced by the belt dryer. Fertilizer pellets have been being returned back to farmers. The company takes from its farmers only the excess of the manure, which farmers cannot use according to the regulation. The left-overs of their operational activities are the concentrate - 35%, and the purified water – 65%. The former is transformed into the fertilizer pellets, and the latter is returned into the river. Plant cost is 12 million euros. The EU gave 1.9 mln. The construction was supported by the Italian Ministry of Environment.

Currently, the company changes its business model: from electricity & heat generation and return of pellets to the biogas sales as fuel and return of pellets. This sale has been assisted by the SEV as it was mentioned previously.

In the future enterprise plans again to transform its activities into the biomethane fuel production. Biomethane fuel is more expensive than biogas, which allows a higher margin. Nevertheless, the transformation of production into biomethane is very expensive nowadays. Biogas Wipptal still has not returned project’s costs. As for now, farmers do not receive dividend pay-outs thus. Also if the municipality buys buses working on the biofuel or farmers acquire such tractors or other vehicles, the company could supply them with the biofuel directly, without a need to sell it on the external market, thereby reducing transaction costs and benefiting the community more.
Joseph Mayr and three other co-founders started an initiative in 2002 after new regulation had been enforced. He says: “I got an idea. Then we were three. At first, we had 25 people, then we went to 42 partners, and then to 63”. Joseph Mayr is an agricultural engineer by education. And he worked in this field for many years prior to starting Biogas Wipptal. We asked the question about possible things which can negatively influence the operations of the company in the future. For that, Mr. Mayr responded: “Affect? Nothing. I mean, because it is a project of renewable energy for environment protection, I think there is a genuinely advantageous project”.

It is worth to mention that an important partner of the project was a University of Turin, which helped to elaborate the technical part of the plant. Also, the company does not operate the plant by itself. It hires the other firm for the operation and maintenance, as well as for the transportation of the manure from the farms to the facility.

According to the words of Joseph Mayr, cooperative’s vice-president and co-founder, Biogas Wipptal create such main benefits for the community:

1. Economical:
   - Farmers do not need either cut their livestock population nor expand their land property nor eliminate the exceeded manure by sale to the outside the region. In that way they keep their economic profits complying with environmental regulation.

2. Environmental:
   - Groundwaters are not spoiled by the nitrates contained in the manure and slurry
   - Less CO2 and no methane gases release into the atmosphere

3. Social:
   - The odor is eliminated in the villages, where farmers store the manure, transport it, and scatter on the soil. These things boost in return the tourist attraction to the territory
   - Farmers cooperate that enhance their feeling of belonging, mutual help, and trust
4. Psychological

- Farmers acquire a sense of economic security and environmental contribution

Mr. Mayr reported that still, the main advantage is the farmers’ compliance with the environmental rules.

Two graphs based on the filled questionnaire were elaborated in order to visualize benefits and detriments level with respect to the ideal type of the CRE of this business model.24

![Graph showing benefits of Biogas Wipptal](image)

Pic. 18. The wellbeing of individuals in the community due to Biogas Wipptal. Benefits.

Source: own design

It is clear that the strongest benefits of Biogas Wipptal according to the vice-president assessment are environmental and psychological.

![Graph showing detriments of Biogas Wipptal](image)

Pic. 19. The wellbeing of individuals in the community due to Biogas Wipptal. Detriments.

Source: own design

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24 Questionnaire example as well as filled questionnaire can be found in the Annexes; theoretical argumentation of the assessment framework was argued in the Chapter 2
The psychological detriment that could be considered for the members is that due to the management conflicts could emerge, although it is a usual working process. Economic detriment influencing the community, in addition, is that contracted facility’s operation and transportation companies are hired from outside of the community. Moreover, since the plant produces electricity and biofuel from RES – the higher price that the company receives from the utility lays eventually in the bills of the end consumers as a system cost component. Ecological detriment is expressed in terms that the plant occupies land which under other circumstances could be used for agricultural purposes.

The weighted measures were used to assess the overall impact of Biogas Wipptal on the wellbeing of individuals. The measure of impact was calculated as a difference between benefits and detriments. You can see it on the Pic. 20

![Wellbeing of individuals in the community due to Biogas Wipptal. Impact. Source: own design](image)

The range of impact aspects is the same as it is for the benefits: environmental, psychological, social, economic. However, economic overall impact reduced considerably in comparison with the economic benefits.
4.2 E-Werk Prad

E-Werk Prad (EWP) cooperative is one of the oldest in Europe. It is a historical cooperative in the Alpine region of Italy. It was founded in 1926. REC owns:

- 4 hydropower plants with 8 turbines of total power 4 MWT
- 2 district heating plants on the biomass with installed CHP engines which has a total power of 7.4 MWT of thermal energy and 1.6 of electric
- 100 kW power PV plant
- Electricity, heat and broadband Internet distribution systems
- 2 e-mobility charging stations and 1 citizen sharing the electric car.

One of the biomass district heating plants has a vegetable oil generation facility to produce energy during the peak periods and a biogas generation facility. The same plant has a heat pump allowing to take the surplus of energy to produce more heat. The second district heating plant is purely on the biomass. The third district heating plant works on the diesel, but today is used just for emergencies. It had been being exploited until 2002 before completion of the biomass plants. The newest PV plant of the 103 kW power was built in 2009. Next year REC starts the renovation of one of the old hydropower plants, which will enable to increase electricity output to cover the full year energy need. Current dynamics of energy production vs consumption of the cooperative members, which constitute 90% of Prad citizens, is depicted on Pic.21

![Pic. 21. EWP production vs consumption by months in 2018](source: EWP (2018))
On the Pic.21 we see that cooperative sustains its members with own energy from April to November, exporting excess to the outside of the municipality. In December, January, February and March EWP should purchase an additional quantity to cover consumption. In 2022, after reconstruction, EWP will self-sustain itself with RE, thus closing the nominal energy loop of the Prad community. Today that 10% of the community citizens, who are not members of the EWP, are mostly big producers. Big producers cannot join the REC because their inclusion will mean a price increase in the energy bills for the current members. Higher consumption during months when a shortage already exists - will force cooperative to purchase even more electricity. As for now cooperative buys winter shortage from APERIA. Since ALPERIA’s price for energy does not have preferences like an exemption from system costs, all EWP’s members will get higher bills. This problem stops the inclusion of big consumers, mostly industrial producers, from participating in the EWP, thus they pay more being supplied by ALPERIA instead of EWP. On the Pic. 22 we see the difference in the price which EWP’s members pay and price for non-members.

Pic. 22. Electricity price for members vs non-members of EWP by categories of consumers
Source: EWP (2018)

For HHs, the difference is almost 4 cents/kWh. HH’s electricity consumption in Prad in 2018 was 2432 kWh/year. It means that 97,3 euros per year one HH is able to save due to the lower electricity bill. Regarding the membership composition: 10% are the producers and commercials, 90% - HHs. There are 1442 members, which represent 3200 citizens out
of 3566 Prad’s total. In Table 11 and 12 we see the bill reduction component of economic benefit that EWP brings to the community.

Table 11. Electricity Bill Reduction Component of Economic Benefit to the Community

<table>
<thead>
<tr>
<th>Variable</th>
<th>Members</th>
<th>Non-members</th>
<th>Savings for members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, cents per kWt/hour</td>
<td>17.39</td>
<td>21.35</td>
<td>3.96</td>
</tr>
<tr>
<td>Annual expenditure per one HH, euros</td>
<td>422</td>
<td>519</td>
<td>97.3</td>
</tr>
<tr>
<td>Annual expenditure per community, euros</td>
<td>608 329</td>
<td>750 742</td>
<td>142 413</td>
</tr>
<tr>
<td>Non-Households (industrial and commercial consumers, farmers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, cents per kWt/hour</td>
<td>13.86</td>
<td>20.75</td>
<td>6.89</td>
</tr>
<tr>
<td>Annual expenditure per community, euros</td>
<td>1 688 897</td>
<td>2 528 471</td>
<td>899 574</td>
</tr>
<tr>
<td>Public lightening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, cents per kWt/hour</td>
<td>12.52</td>
<td>19.01</td>
<td>6.49</td>
</tr>
<tr>
<td>Annual expenditure per community, euros</td>
<td>26 058</td>
<td>39 566</td>
<td>13 507</td>
</tr>
<tr>
<td>Total, euros</td>
<td>2 322 284</td>
<td>3 318 729</td>
<td>995 494</td>
</tr>
</tbody>
</table>

Source: own design based on data from EWP (2018)

As we observe, the electricity bill reduction benefit for the community is almost 1 million euros. For the town of 3566 people, it is a good advantage. The heat bill reduction benefit comparing to the oil-based heat energy is almost 590 000 euros. In Table 13 you can see the summarized benefit for the community, which include also other components as

Table 12. Heat Bill Reduction Component of Economic Benefit to the Community

<table>
<thead>
<tr>
<th>Variable</th>
<th>Members</th>
<th>Equivalent for oil-based generation</th>
<th>Savings for members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, cents per kWt/hour</td>
<td>9.53</td>
<td>16.1</td>
<td>6.57</td>
</tr>
<tr>
<td>Non-Households (industrial and commercial consumers, farmers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, cents per kWt/hour</td>
<td>8.66</td>
<td>11.7</td>
<td>3.04</td>
</tr>
<tr>
<td>Total, euros</td>
<td>-</td>
<td>-</td>
<td>589 145</td>
</tr>
</tbody>
</table>

Source: own design based on data from EWP (2018)

As we observe, the electricity bill reduction benefit for the community is almost 1 million euros. For the town of 3566 people, it is a good advantage. The heat bill reduction benefit comparing to the oil-based heat energy is almost 590 000 euros. In Table 13 you can see the summarized benefit for the community, which include also other components as

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25 Prices are given without VAT
26 Total savings were extracted from the source without author’s calculation
employees’ salaries, local contractors payments, own profit reinvested in further community energy projects.

Another service that EWP provides for the community is a broadband Internet. Since the REC has all the heat distribution system underground, it was economically justified for the municipality to ask EWP for this service provision. EWP agreed and since 2000 provides this service to the community. In 2010-2011 the costs for the project had already been returned.

Table 13. Summarized Economic Benefit to the Community in 2018

<table>
<thead>
<tr>
<th>Variable</th>
<th>Benefit, euros</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity bill reduction</td>
<td>995 494</td>
</tr>
<tr>
<td>Heat bill reduction</td>
<td>589 145</td>
</tr>
<tr>
<td>Broadband Internet bill reduction</td>
<td>27 853</td>
</tr>
<tr>
<td>Employees’ salaries &amp; social security contribution (10 employees)</td>
<td>501 672</td>
</tr>
<tr>
<td>Payments to local contractors</td>
<td>517 425</td>
</tr>
<tr>
<td>Own profit reinvested in future energy projects</td>
<td>355 038</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2 986 627</strong></td>
</tr>
</tbody>
</table>

Source: Table 1, Table 2, EWP (2018)

The basic cost to become a member is 305 euros. The cost for the electricity kW power share is 41 euros for HHs, non-HHs pay 35 euros per kW. Michael Wunderer says:

“HHs on average have 3-5 kW. So, they pay around 430 euros for the membership - the cost of 1 full share, we can say, because each member gets 1 share. If members quit cooperative, they get back this money. Companies buy also 10 kW, 16 kW, depending on their needs. The cost for the heat power share is 80 euros per kW for HHs, while non-HHs pay more. The HH can be a member for heat and broadband together, but not for electricity. For electricity, HH should acquire another membership. For non-HHs, the cost of broadband internet membership in cooperative is higher, because they usually use only a single cable but connect a lot of PCs with a WI-Fi”.

EWP developed its business model in the new directions, more precisely in the e-mobility. It allows for increasing environmental and social benefits for Prad. There is evidence from vice-president:

“Now we are starting with e-mobility. Now 2 months ago we installed a high speed charging stations for electric vehicles, 75 kW. In 10-15 min it will be charged. I see many electric cars in ST. Since we installed charging stations 2 months ago [before there were no charging stations in Prad], each day there are 3 or 4 charges. And this is a good number. Also, we
decided to buy a citizen sharing electric car. We bought the first one, and then with the car-sharing platform of South Tyrol, we can share the car with all citizens. We cooperate with this platform. Each company or citizen have free access to this system. This will make people also more sensitive to electric vehicles.”

Another social benefit that EWP will soon bring is a construction of a new bicycle trail along the pipeline leading to the modernized hydropower plant. The bicycle route will be very beneficial at the place, because famous tourist attraction, Stelvio high altitude hiking path, is passing nearby. Construction of the pipeline as a part of the hydropower plant renovation thereafter allows building the bicycle route at a cheaper cost than if to do 2 projects separately. The initiative came from the EWP, but it will be funded by the provincial government. EWP will just be an operator of the works.

Also, EWP assisted local biogas cooperative in the construction of their plant. EWP agreed to attach the pipeline for biogas transportation to their own district heating plant. District heating plant nowadays uses biogas from neighboring cooperative as the resource for heat and electricity production. In this respect, EWP added more social and environmental long term benefits to the community, as well as helped to improve a sense of security for the local farmers, because they would not need to cut the livestock due to regulations discussed earlier in this project work.

It is important to mention that the cooperative did not develop always without problems. One recent issue happened with wind farm where REC holds 30% of shares. The farm started in 1999, later increasing its power. Wind park was situated near to Prad but in other municipality. Park helped to cover Prad’s winter demand in energy. However, in 2013 the park was dismantled. The main reason for that was the lack of citizen support. Michael says:

“Citizens did not want to have a wind park in Backyards, so-called, NIMBY effect27. I do not think it was due to the sound - next village was pretty far away, but visually it disturbed them. … The local government had done a survey, and after it, they suspended the permits of the company owning the windmills. The company could not operate anymore in the territory of this municipality. 40% of citizens said wind park is good and 60% - did not want. It was in 2013. Now, maybe, they might decide to remain it, because people become more educated and environmentally conscious.”

27 Not in my back yard
Environmental impact of EWP is worth a short description too. Reduction of emissions in the electricity sector is 9375 tons, heat – 4033 tons, the total is 13409 tons of CO2. That is a good figure highlighting not only Prad being an example of the renewable energy community, but also an example of the historical environmental sensitivity of the local population. Construction of district heating plants on the biomass in the 2000s was promoted by the locals. It allowed getting rid of things which spoiled the air constantly. The most population had used personal CHP facilities or furnaces which worked frequently on coal or gas before the construction of centralized heating plants. It had been making the air polluted and the harmful dust being scattered everywhere. Environmental sensitivity of locals is also visible in the density of PV plants. Except for the EWP, there are 157 other PV plants in the municipality. Total installed capacity is 7MWT. It is one of the highest density in Italy. This capacity is owned by private big companies as well as small enterprises and individual HHs.

The plans for the future is to further develop a business model. There is a plan to start individual PV plants installation for HHs and companies. REC will deliver the whole system to the prosumers: rooftop solar, battery. For cooperative, it can be interesting to take all the HHs produced energy from the batteries and locally distribute it. Michael says that in SEV they research a system to reach this goal, to create an intelligent system: to distribute this produced by HHs additional energy saved in batteries in the times of higher demand. Then, they need for this purpose to design a VPP (virtual power plant). With this, EWP could participate also on the dispatching market place (MSD market), so cooperative could own and operate transmission grid too. I that case the factual energy loop can be closed. Thereafter cooperative could self-sustain itself without delivering the excess to the TERNA since the excess could be stored and then used by its own consumption or sold on the MSD market. However, these plans could be realized if cooperative would acquire a big 1 MWT energy storage capacity in the form of a hydro pump or a battery. With it, they can regulate easily energy system, in addition to the HHs batteries, which they will supply together with rooftop solar as a service package. In order to obtain the needed capital for the purchase of an expensive storage system, EWP has been assisted by SEV services. SEV plans to lobby ARERA with an exemption from dispatching cost component in energy price for those energy cooperatives which had closed the nominal energy loop. Michael says that it can greatly help to collect funds for the new project of 1 MWT storage:
“In Prad, we distribute 20 000 MWt/hours per year per. With a dispatching cost 10 euro per 1 MWt, we can save, in case we would be exempted, 200 000 euros per year. This amount of money we could invest, for example, in a 1 MWT battery storage, which costs 1 mln euros. So, with dispatching costs exemption we could collect needed funds in 5 years for the 1MWT storage purchase.”

All these plans of E-Werk Prad if realized would allow the community to be factually self-sustained throughout the year, maximizing the advantages of all types for the citizens. On the Pic. 23, 24 and 25 you can see the assessment of benefits, detriments and overall impact of the REC on the wellbeing of individuals.

Pic. 23. Wellbeing of individuals in the community due to EWP. Benefits.
Source: own design

Pic. 24. Wellbeing of individuals in the community due to EWP. Detriments.
Source: own design

Presence of economic detriments is stipulated by the contracting some companies from outside the region for the outsourcing works. Insignificant psychological detriment is induced by the individuals’ understanding that policy change can weaken their energy-autonomous status. For instance, the dismantling of the wind farm where REC had the shares
was caused not just by the NIMBY effect, but also by the end of policy incentive for wind farms.

Pic. 25. Wellbeing of individuals in the community due to EWP. Impact.
Source: own design

People in Prad benefit from the cooperative, having the strongest impact on the environmental and social wellbeing with psychological and economic wellbeing play an important role too.
4.3 Energia Positiva

Energia Positiva is a new REC in Italy, that was founded in 2015. It is a generation REC utilizing solar (90%) and wind (10%) energy. REC owns 12 PV plants, 2 windmills, runs 2 energy efficiency projects. Plants are distributed in 5 regions, whereas the membership base is distributed in 14 regions. Cooperative had 231 members in 2018, in 2019 the number accounts to 280. It is also a community of interest REC. Members should not obligatory be from the community of installation placement; all people living in Italy can participate. Most members live in Piemonte – 130. The cooperative base is situated in Torino, the main city of Piemonte region.

Energia Positiva offers to its members a reduction of the bill, but not in a form of the smaller price for electricity or heat like it is done at E-Werk Prad, but in a form of the rebate of the dividends earned. The annual estimated dividend is 5% of the shares purchased. If a member buys 6 shares, then he will save 30% of its final bill; if 13 shares – 60%, etc. In Table 14 we can see the economic benefit for the members. Except for the bills rebate, the economic benefit also lays in the possibility to decrease the members’ income tax due to the participation in the innovative startup (it. PMI), being Energia Positiva as such. IRPEF tax credit stands at 30% in 2018.
Table 14. Economic benefit for members in Energia Positiva

<table>
<thead>
<tr>
<th>Variable</th>
<th>Economic benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The estimated annual benefit for 1 member</strong></td>
<td></td>
</tr>
<tr>
<td>Number of shares</td>
<td>1</td>
</tr>
<tr>
<td>Cost of shares, euros</td>
<td>500</td>
</tr>
<tr>
<td>Bill reduction annual</td>
<td>5%</td>
</tr>
<tr>
<td>Average electricity expenditures per HH, euros</td>
<td>525</td>
</tr>
<tr>
<td>Savings due to the bill reduction, euros</td>
<td>26.25</td>
</tr>
<tr>
<td>Savings due to the 30% IRPEF tax annual credit, euros</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total benefit for 1 member, euros</strong></td>
<td><strong>176.25</strong></td>
</tr>
</tbody>
</table>

| Benefit for all members in 2018 | |
| Number of shares in 2018 | 5338 |
| Cost of shares | 2 669 000 |
| Number of members | 231 |
| The average number of shares acquired | 23.3 |
| Production of electricity by REC, kWh | 751 987 |
| REC revenue, euros | 304 438 |
| Members' consumption of electricity, kWh | 484 000 |
| Members consumption of heat, m³ | 73 800 |
| Electricity expenditures, euros | 107 527 |
| Savings due to the bill reduction, euros | **88 244.5** |
| Actual bill reduction | **86%** |
| Savings due to the 30% IRPEF tax annual credit, euros | **800 700** |
| Total benefit, euros | **888 945** |

Source: own design based on data from Energia Positiva (2018)

In Table 14 we observe that the return on investments is possible in 2.8 years. The average number of shares acquired by one member is 23. Members’ economic benefit mostly occurs due to the personal income tax credit. Energy bill rebate depends on the generation output in a certain year and the FiT which amount differs yearly too. Bill rebate is possible due to the agreement signed with Dolomiti Energia, that was discussed in Chapter 3.3. The number of shares is limited to 120 % of the actual energy consumption of the individual member. It can lead to having a dividend 20% higher than the annual electricity bill. In this case, cooperative will pay out the earned money directly to the member. When the capacity

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28In 2019 IRPEF tax credit is 40%, thereby the return on investments speeds up.
of the RE facility has already been covered by the acquired shares, new members cannot enter anymore.

The business model is based on favorable market design available in Italy. Cooperative benefits from two policy incentives. First is the IRPEF tax credit and second is a FiT Conto Energia. Benefiting from FiT became possible because REC purchases RE plants on the secondary market (installed before 2013), thus are applicable to receive advantageous FiT during 20 years, that for Energia Positiva stands for mostly 15 years due to the purchase on the secondary market.

Process of becoming a member of cooperative and getting a benefit is very simple and it well proceeds through the website and online payments. Moreover, the administrative procedure to change the supplier to partner, Dolomiti Energia, is carried by the REC. Members are allowed to withdraw their shares after 3 years in a full amount, also they are allowed to buy more shares, sell the excess, exchange, etc. All processes are virtualized maximally, making easier to join a cooperative and understand its business model. This adds a competitive advantage to the REC, as well as could attract young people to the membership. However, President in the interview mentioned that the membership base consists of the people with the average age 35 and older. Some of them even struggle with the online application procedure. New marketing efforts could be interesting to think in order to attract young people, though there are some natural obstacles for this since most young Italian people are not settled in their life and therefore are not interested to reduce the energy bills, etc.

Alberto Gastaldo, REC’s President, told that governing structure is composed by the Board of Directors with 7 members, represented by a President and two specialized committees (made of different members of the board) dedicated to the evaluation of the renewable energy production plants, and another one dedicated to the evaluation of membership applications. There are also three people responsible for the territorial business development in the regions different from the core.

President mentioned that the main benefit for the members to participate is the economic one, with environmental concerns playing a significant role too. Except for GHG emissions reduction due to the RES, the environmental benefit of REC is also in its energy efficiency projects. These projects will be sponsored through the crowdfunding campaign,
that is the same as for the RE plants. Energia Positiva’s social benefit is obviously lesser than in the community of place RECs. However, members can choose via website types of RE installation they want to invest in (customize their investments), therefore increasing a role of the member in decision making, in addition to the Assembly meetings voting. People can thus decide which RES is better to invest in and deploy in society. On the Pic. 24, 25 and 26 you can see the assessment of benefits, detriments and overall impact of the REC on the wellbeing of individuals.

In the future, REC will grow. First of all, new RES plants are planned to be bought in 2019-2020: one solar plant in Lombardia and one in Puglia (has already been acquired as for July 2019), several hydroelectric plants. Secondly, energy efficiency projects in two municipalities of Lombardia and Piemonte will be implemented. These actions will further increase the membership base. Also, many promotion activities are planned in the following years. Alberto Gastaldo says:

“We want to increase environmental concerns of the population through their initial engaging into the energy transition based on the economic motives. They start to participate and their environmental sensibility grows as a consequence.”

In addition, the new cooperative “EPCO” on the basis of Energia Positiva is planned to be launched. Its actions will be aimed at particular companies (SMEs), associations and NGOs, that intend to reduce the cost of the bills and want to become RE producers.


Source: own design
Pic. 27. The wellbeing of individuals in the community due to Energia Positiva. 
Detriments.

Source: own design

Pic. 28. The wellbeing of individuals in the community due to Energia Positiva. Impact.

Source: own design

As we see on Pic. 26, Energia Positiva impacts the most environmental and economic aspects, with social and psychological less influentially. These results coincide with the witnesses of the President reported during the interview. Existence of the psychological detrimental impact caused by the lack of active members and a great dependence of the business model from the policy changes. To compare, lack of active members is a phenomenon rarely observed in historical RECs of Italy, that are the communities of place rather than that of interest.
4.4 Solar Town

Solar Town is a first solar energy cooperative in Ukraine in the town of Slavutich. It is crucial to mention that this town is new. It was built in 1986 as a consequence of the Chornobyl nuclear station catastrophe for the workers of the power plant which were resettled from the dangerous currently inhabitant city of Pripyat. Currently, there are 25,000 people living in the town. “Earlier, 85 percent of the city budget was filled due to the nuclear power plant. In order to attract new investors to the city, it has been granted special economic zone status. A re-training program for former station staff is also being carried out. However, despite these measures, the city has already left 1500 inhabitants (Wikipedia, 2019).” Despite these problems, there is a great share of young inhabitants. More than a third of the citizens are kids.

Solar Town is still not operating physically. As for July 2019, all needed documents from local authorities to launch the activities are acquired, the agreement for the municipality roofs rental has also been signed. The same month a crowdfunding campaign should start to involve first member-investors.

According to the typology given in Chapter 2, Solar Town is:

- Solar REC
- Electricity generation REC
- Based on the Feed-in-Tariff revenue model
- Urban REC

REC plans to construct a 300 kW power station on 3 municipal roofs in the city center. Cost of one share is 400 euros. Andrij Zinchenko, the cooperative founder, says:

“We took a German model of cooperation. For us, the word - society, this is not an empty word. This model has such a principle that firstly members of the community invest, then people from the region, and only after - everyone. We will have a simpler model, that is, at first months we will only be invested by the Slavutich citizens, after that - everyone can join”.

This model allows all willing citizens of the town to participate, and only later if there is a shortage of funds – people and organizations from outside the community can
invest. Maximization of the community benefit, therefore, is possible. Such a REC is predominantly place-based and not fully interest-based.

Currently, there are 4 members of the cooperative: Andrij Zinchenko, 2 of his peer co-founders, and the Regional Development Agency of the Slavutich city. In plans, crowdfunding campaign should collect around 200,000 USD to install the panels and begin the electricity generation. Main policy incentive is a FiT which is currently in place in Ukraine and should last until 2030. As for today, 1 kW of solar energy produced by non-HHs can be sold to the national utility company by 16 euro cents/kWh. With this FiT (although according to the law it will gradually decrease during years), REC can return the investments to each member in about 5 years, and until 2030 the return will be 150%, with 50% net income. It is very good profitability for members. However, certain risks exist in terms of policy instability in Ukraine. For example, a recent situation when legislator made changes in the regulation on the solar green tariff for HHs. Legislators suspended the green tariff for HHs where the installations are settled on the land but not on the roofs. This measure was caused by the recently developed fraud when private investors built solar stations claiming them being owned by HHs to acquire higher tariff. However, the current policy change does not solve the issue, but only restrict those fair HHs which have installed their stations on the land. Moreover, legislator includes the definition of “capital construction” into the regulation without giving a description of the term. In the absence of the term description, HHs could not prove even their rooftop solar installations can obtain a FiT. Currently, lobbying efforts have been made by the Association of the Active Prosumers to amend the bad-designed regulation and efforts seem successful. Though, the uncertainty of the Ukrainian legislator shows some risks to the REC’s future investors too, even that the cooperative is not a household.
Except for the members’ dividends and clear environmental benefits, REC adds several direct social benefits. It is written in the cooperative’s bylaw that 5% of the profits will be directed to the community. The money will not go to the budget, because in the budget they will disappear and there would be no clear benefit, but instead, a special committee will gather and decide what for these funds will be used. In addition, the city is a member of the Majors Agreement international society. Such an instrument as “The Sustainable Energy Plan” is a part of this agreement. Andrij Zinchenko says that the emergence of the energy cooperative which is, moreover, first in Ukraine, will allow the city to claim it as one of the results of the Energy Plan implementation. Indeed, in return, the city helps a lot to the cooperative. Firstly, they provided a renting space for 30 years with a good price. Secondly, Major himself and the Reginal Development Agency have assisted cooperative in acquiring all permissions in an efficient and, as fast as possible, way. Another important social benefit is that REC can show to the citizens of the town, where many engineers and technicians live (because a lot of past and current workers of Chornobyl power plant lives there), that there exist other possibilities to utilize energy, as well as related knowledge and skills to make it. In addition to it, citizens will obtain an additional earning opportunity. Solar Town can be not even such an economically beneficially enterprise but have a much higher role in the community spirit building. Andrij Zinchenko says that town needs rebranding: from the city attached to the nuclear power station to green energy and innovative city confidently looking into the future. There are enough specialists and knowledge. The thing which lack is a proper example and motivation. REC can play a role here.
Speaking about the future plans, REC’s founder mentioned that he and his colleagues have recently created another educational organization aimed at the promotion of renewable energy cooperatives. Strictly speaking, ideally, it would duplicate the successful example of the Solar Town in other Ukrainian cities. Later, the organization can provide services to RECs as legal advice or accounting on beneficial terms. These type of services will make newly created cooperatives better sustained. It can stimulate the growth of local distributed energy and energy communities. Later, it could lead to the spillover effects in the energy transition. Nowadays, FiT is very beneficial for solar RECs to emerge not as an exceptional phenomenon, but nationwide.

Among hypothetical detriments or negative externalities, according to the founder opinion, there might be the capsulation of experiences and knowledge in a single town. People might not pay attention to the bigger energy problems like power plants decommissioning or energy balancing issues.

The founder saw examples of RECs in the EU and USA, therefore his main wish and motivation were to make it in Ukraine. Andrij Zinchenko also says that the main motivation of the REC’s members is that they see it as a new way to invest, first of all, despite all other types of benefits REC carries.

To conclude, Solar Town is an example of the influence of all, discussed in this Project Work, preconditions on the emergence of the REC. Historical background in terms that Slavutich was chosen as the place where energy sector knowledge exists. Institutional and market design in terms that municipality and Reginal Development Agency help REC, as well as that their actions partially are induced by the Majors Agreement international tool. The policy framework has a direct influence on making the business model profitable by granting FiT. Motivations influence impact on the welfare in the form of REC’s decision to direct 5% of the profits to fund community needs. Business model influence welfare in terms that such a model could be easily deployed in the same community further or in other cities. Solar Town, if successfully developed, would be a good illustration of a sustainable local development project.
5. Research outcomes and policy recommendations

5.1 Discussion related to the first hypothesis

It was proved that historical background plays a role in the emergence of many RECs in the EU. Countries from western, northern and central Europe like Germany, Denmark, Sweden, Great Britain, Netherlands, France, Austria, and Switzerland have a long history of cooperation movement under capitalist regimes. For instance, initiation of the cooperative movement in Germany in the middle of the XIX century is clear evidence that German people are aware of such organizational form. Since the German-speaking population is living in Austria and Switzerland, these countries have a long cooperative history too. Moreover, Austria, Switzerland and the Alpine provinces of modern Italy have a lot of cooperatives too. The first energy community on mainland Europe that closed factual energy loop is a town of Güssing in Austria. Availability of rich biomass resources induced its utilization by means of the cooperative enterprise, because of the historical background. Also, energy cooperatives have particularly old roots in Alpine regions of Italy, with some RECs establishment dating to the end of the XIX century. A significant number of the new district heating biomass RECs in Austria, Switzerland and South Tyrol is caused by the presence of the strong cooperative spirit among mountainous inhabitants, which in case of South Tyrol had emerged much earlier than Fridrich Raiffeisen launched the first cooperative bank. This spirit dates back to the Middle Ages “Realteilung” processes. Therefore, it is not a surprise that when hydropower technology had emerged in Europe, rural Alpine regions chose to electrify itself by means of the cooperative organization. The past reinforced itself creating spillover effects as it was described in the example of WeForGreen Sharing cooperative in Italy. Although today this REC operates in not only northern regions of Italy, but on the whole country’s territory, still the initial idea was born looking at the glorious past of the historical energy cooperative in Veneto region. So, examples exist when not only historical RECs directly is influenced by its own history, but also new XXI century RECs. Environmental concerns of Alpine inhabitants are very keen due to the sensitive mountain ecosystem that these people value as a part of their heritage and thereby identity. In my interview with Adriano Bisello, the energy community expert from EURAC research institution, he mentioned that while traveling to Slovenia he talked to people who were interested in the energy transition, but mostly they were not understanding why should the energy communities be organized as cooperatives. He was
quite surprised to see such thinking. He considered that since it is a post-communist country, people would be prone to cooperate. Reality occurred to be different. Absence of such a cooperative spirit in the South-Eastern and Eastern Europe countries is even evident on the Pic.2 with these countries do not have energy cooperatives at all. Adriano expressed an idea that CRE may develop in South-Eastern and Eastern Europe in different organizational forms than cooperatives. This causes the need for these Member States to shape their legislation in order to benefit, for example, profit-based distributed energy or CRE organized as a public-private partnership. Another important evidence of the historical background is the Solar Town REC in Ukraine. Founders chose exactly town with nuclear past to place first REC because there is a presence of “sticky knowledge” in the community.  Cooperative of cooperatives in South Tyrol purchases biomass for district heating plants with advantageous prices. It became possible because a positive attitude exists in the region to the cooperation. That is due to the history too. To sum up, path dependency affects the emergence and impact that RECs brings.

Since RECs are social enterprises they need certain functions to be outsourced on the beneficial terms, because of the transaction cost burden to which cooperatives are prone. Availability of the special institutions serving needs of RECs was found in many countries. A particularly developed design is in the Netherlands with HIER Foundation and special Federation serving RECs - ODE Decentraal. In the Netherlands, the special positive institutional context is enforced by many municipalities greening their strategies. In Scotland, a special public institution was found to support CRE - Local Energy Scotland, while in the United Kingdom and Italy private companies, which the main goal is being a developer of the RECs, operate. Energy4All in the UK created 24 independent RECs, whereas WeForGreen Sharing REC in Italy established 5 other cooperatives, though they are not fully independent because service provision is tied with the founding REC. In many countries, the associations assist RECs, like DGRV in Germany or SEV and Confcooperative in Italy. However, these associations are not purely devoted to CRE. Confcooperative and its branch that serve RECs, “Consume e Utenze”, provide services to all cooperatives, and SEV provides services to all energy players of the South Tyrolean community. The only country, that has federations which concentrate purely on the RECs, is Belgium. They are REScoop Flandria and REScoop Wallonia federations. As their continuation, the European Federation of RECs was founded. EFREC has an official name,
“REScoop.eu”, that indicate its relation to the Belgian initiators. A positive influence of the international “umbrella” institution was discovered in the cases of lobbying efforts at the EU level, leading to the inclusion of the energy community concept in the EU regulatory framework. The first legal definition was designed and certain rights were granted. EFREC also introduced the SEV to E’nostra that brought a fruitful outcome for both Italian organization. There are a lot of other examples when EFREC was an interlink between RECs in different countries. Annual meetings and conferences organized by the EFREC make possible to distribute knowledge internationally. For instance, the founder of Solar Town, Andrij Zinchenko said me that he was attending these meetings and got acquainted with lots of colleagues throughout Europe as well as informed himself with the freshest news in the sector. Availability of specialized banks which are willing to borrow to the CRE projects like GLS Bank in Germany or Banka Etica in Italy makes initiation of the RECs easier. Other methods of fundraising are still fresh and not very developed. Such examples are specialized crowdfunding platforms as Lumo-France or Citizenenergy.eu. However, many RECs individually develop their online crowdfunding platforms as Som Energia in Spain or Energia Positiva in Italy did. Market design derived from the unbundling regulations allow small distributed energy producers to find suppliers for their produced energy or the renewable energy generators for their supply. It allows them to utilize their competitive advantage of offering clean energy to the market, although certain policy incentives and simplifications are crucial for RECs’ successful offering and existence. To sum up, the emergence and successful operation of RECs depends on the institutional and market design of a certain country and region.

Incentives like FiT or the simplification of the sales and purchase regime for the CRE projects present the utmost importance of the policy attention to the distributed energy that is happening already. An in-depth analysis of the Italian policy framework allowed us to recognize that the development of the distributed small-scale energy projects has already been written in energy strategies. Tools promoting RECs were grouped to those affording simplification of the activities, and those affording respectful financial reward. Both groups can consist of multiple instruments: from simplified energy sale and purchase regime to the green certificates mechanism, and etc. Another discussion, that has already been raised in the EU, concerns defining energy communities for shaping their activities. Adriano Bisello and Andrij Zinchenko mentioned in their interviews that energy communities concept has
been tried to be put in a certain frame in recent EU directives. It can hinder the development of distributed local energy since even today a variety of business models applied in the sector is impressive. Shaping policy framework around energy communities as it would not hinder the development of the variety – will stimulate the deployment of the sector. In Chapter 2.4.2, I analyzed two legislative records in the EU law concerning energy communities. The outcome of analysis shows that international legislator understands the importance of the policies which would shape a variety of the organizational forms and models. As far as I am aware, the development of the thought in the EU institutions was directed, except other things, by the EFREC lobbying. Nonetheless, further theoretical discussion of how to allow a variety of forms to flourish, and how to incentives this variety – is crucial. To sum up, emergence and the impact of RECs on the welfare of communities directly depends on the policy framework in the country.

The analysis in Chapter 2.4.4 based on data from Hicks et. al. (2012) research showed that technological motives (RE industry development, energy self-sufficiency, increased energy efficiency, etc.) are the biggest stimulators of the CRE projects. The second group of motives is economic (shareholder income, reduced energy bills, local jobs, and contracts). The third important group of motives is social with environmental and political motives lagging behind. Adriano Bisello said that in his personal perspective even him being a sensitive person to the environmental issues, because despite other things, renewables are his job, he was still induced to change a supplier of the green energy when they had notified him about not a significant but an increase in the energy price. Andriy Zinchenko mentioned that the preliminary meeting of the future Solar Town’s members had revealed that people, first of all, look for the opportunity to invest. These qualitative witnesses affirm that economic motives are most important. Technological motives are very general, and I consider that those technological motives in the Hicks et.al. (2012) research should be regrouped into the other categories. Michael Wunderer in his interview mentioned about the cruciality of environmental motives of the Prad citizens. This makes us suppose that in the historical RECs in the Alps the environmental motives are stronger than economic or social. This statement requires further investigation. The analysis of the exact benefits for the welfare of the communities that was performed in Chapter 4 showed that almost all RECs influence positively the environmental wellbeing of individuals the most. The psychological and social wellbeing had been influenced a little bit less, and economic wellbeing had been
influenced by the RECs the least. However, Energia Positiva showed that the economic impact is the second after environmental for their members' wellbeing. So, the main motivation of the REC initiation and becoming a member is economic, while the main outcome of the project is environmental. The same insight was discovered by J. Hicks and N. Ison in their research. This difference in expectations and the results might be interesting to research further because it can help to create effective policies: utilizing quality designed business models, where members could see clearly their profit, will impact instead more the countries’ environmental goals. To sum up, the emergence of the RECs depends on the motivations of initial leaders and members, although impact does not directly depend on the motivation. Simply, members would like to get higher shareholder incomes, whereas the highest impact on the wellbeing is usually environmental.

The business model choice was analyzed by proposing, first of all, classification in Chapter 2.2. As it was revealed by the case study analysis it is possible to apply the elaborated classification to the description of the business model. Variety of RES, revenue models, size, organizational form choice, a corporate purpose which CRE utilize, suggests that it results in a different impact on the welfare. Indeed, E-Werk Prad, for instance, being generator REC at the same time with operating the grid and being a supplier, bring more social benefit than a Biogas Wipptal, that is a company generating but not supplying the local community with energy yet. Solar Town REC having FiT revenue model could bring higher economic benefit, while E-Werk Prad having a direct sale revenue model brings higher environmental and social benefit for the community. E-Werk Prad being the rural big REC impact more environmentally and socially, while urban middle size Solar Town and Energia Positiva RECs impact more economically. Some organizational problems, like transaction cost problem or the conflicts in the management, influence on operations cooperative performs: which outsource, and which operations REC does not do at all. For instance, it was revealed that almost all new RECs in Italy are either only generator RECs or retail RECs, whereas historical RECs except generation and supply also operates a grid and have lesser transaction cost and management problems. In case when new RECs have own generation and simultaneously provide some benefits in terms of the bill reduction like it is done by Energia Positiva, they rely on the market agreements with other players. However, E’Nostra after the merge with Retenergie became both generator and supplier REC at the same time. Still, their business model is very different from historical RECs in
the Alps, therefore social and environmental impacts are different. Variety of RES which cooperatives rely on cause different impact on the welfare of communities too. For instance, biogas and biomass district heating cooperatives in Alpine regions of Italy impact local environment very significantly, because biogas RECs prevent groundwater contamination and biomass RECs prevent air dust pollution of the sensitive valley ecosystem since personal furnaces on coal and gas are not in operation anymore. On the contrary, solar RECs impact local environment less by simply reducing CO2 emissions, but they could impact economic welfare more. In addition, historical RECs and biogas RECs in Italy have a strong impact on the psychological wellbeing of people, while new RECs does not have such a strong impact. To sum up, impact on the welfare depends on the business model chosen, but emergence does not depend on the business model since the business model is usually born as an outcome of policy, market design and/or historical background.

The first hypothesis is partially accepted:

- Emergence and impact of a REC on the welfare of the local community depends on a certain area’s historical background, institutional and market design, policy framework.
- The emergence of RECs depends on the motivations, though the impact on welfare has no direct connection with motivations.
- Impact on welfare depends on the business model choice, but the emergence of the REC – does not.
5.2 Discussion related to the second hypothesis

The economic aspect of the impact of RECs is possible to assess quantitatively. It was proved by the economic assessment of the benefits which E-Werk Prad brings to the community: energy bill reduction, contracting local companies, salaries to employees. These benefits together with shareholder income and community income which we showed on the example of the Solar Town cooperative are the direct economic benefits. Energia Positiva allows its members to cut on average 86% of their bills. Furthermore, being an innovative start-up allows members to return investments in only 3 years. There is also an indirect economic advantage of RECs for the community. It is tourism development. Biogas Wipptal eliminating odor is a good illustration of how REC could improve tourism attraction.

The other aspects are much harder to assess quantitatively. It is possible to assess them qualitatively through questionnaires and semi-structured interviews. If questionnaires applied, it is worth them be filled by different community stakeholders like a representative of the management of the REC, several members of the REC, municipality officer, several private companies operating in the territory, etc. The qualitative assessment like this would give a correct picture of the impact of REC. Nonetheless, in our project work, we conducted the survey only with management representatives. We got data on the benefits, detriments, overall impact, which could be represented even visually. The results are not of the highest accuracy, but they show some trends that coincide with the interview-based evidence which had been discovered. This coincidence suggests that conducting a broader survey will make results even more accurate. The comparative matrix of the benefits is depicted on Pic. 30.
Pic. 30. The wellbeing of individuals in the community due to REC. Comparative matrix of benefits.

Source: own design

Such a matrix enables a comparative assessment of the benefits of different cooperatives. Here we see that Biogas Wipptal is more beneficial for the community in environmental and psychological aspects, whereas E-Werk Prad gives better social benefits and Energia Positiva – better economic. I am hesitating whether such a comparison is trustworthy because out of our interviews with RECs representatives and documents analysis we cannot claim that the economic benefit of Biogas Wipptal is higher than E-Werk Prad’s that we see on the matrix. Therefore, except for the benefit assessment, we have to assess the disadvantages of the cooperative in comparison with the ideal REC. Detriments assessment was conducted by the same methodology. The comparative matrix of detriments is depicted on the Pic.31
Pic. 31. The wellbeing of individuals in the community due to REC. Comparative matrix of detriments.
Source: own design

On this matrix, we see that economic and environmental disadvantages of Biogas Wipptal are higher than E-Werk Prad’s. It requires to make a balanced visualization of the overall impact. It is assessed by simply deducting detriments from benefits. You can see it on the Pic. 27.

Pic. 32. The wellbeing of individuals in the community due to REC. Comparative matrix of impact.
Source: own design

On the impact matrix situation with economic aspect slightly changed in comparison with the benefits matrix. Here we observe that E-Werk Prad impacts the economic aspect of the wellbeing considerably more than it does Biogas Wipptal, whereas psychological aspect is much higher for Biogas Wipptal. Energia Positiva impacts positively psychological
The social aspect is stronger for E-Werk Prad. These results coincide with the interview evidence of the REC’s representatives. Therefore, it is important not only to assess benefits but the overall impact that considers negative externalities. Our analysis shows that the impact is more representative than detriments or benefits separately. Comparison of a single matrix of the different RECs impact gives thus more correct picture.

New RECs implying innovative models have a potential of the higher economic benefits for its members, whereas historical RECs in Italy showed more impact on the environmental and social wellbeing of the members and community.

To sum up, the second hypothesis is accepted:

- Economic and environmental impacts on the welfare of local communities are possible to measure quantitatively
- Social and psychological impacts on the welfare of local communities are possible to assess qualitatively
- The visualization of the impact assessment is possible
- Comparison of different RECs impacts on their communities’ welfare is possible through elaborated calculation and visualization techniques
5.3 Policy recommendations

1. CRE projects should not be limited in a variety of organizational forms, business models, etc.

2. Prevalence of certain aspects of the impact on local community over others induces policymakers to design different policy tools also, in order to incentivize some of the aspects of the country’s target: economic, social, environmental, psychological. The prevalence can be discovered through the assessment utilizing methodology offered in this project work.

3. Policy tools should both: simplify RECs/CREs operations and make them profitable. For the majority of new energy cooperatives, the presence of profits is the main stimulator. Another powerful stimulator is a fear to lose your profits as we see in the example of South Tyrol biogas RECs. However, it is better to motivate people by the opportunity to earn than by fear to lose.

4. Expensive policy incentives (those which request big budget) are worth to be granted only after the examination of the project and its impacts on the welfare of community and project’s conformity with national targets. The case of the Ukrainian FiT, when it was exploited by unfair businessmen who used a fraud scheme, is evidence of the demand for such a preliminary assessment. Since energy community is a very broad concept and there is a need argued by academia and practitioners not to embed it very much into a certain policy frame/definition – more attention should be paid to the separate examination of the projects. In order to get the status of an energy community project – it must, indeed, benefit the community!

5. Educational campaigns are important to conduct to further deploy energy communities in the EU. Initiators of the educational campaign should be national governments. It is worth for them before the delegating the task to the local governments – to conduct an analysis of the historical background and market context in different regions. This could reveal that efforts in certain regions could be more promising, while at others could be useless. That is why, educational campaigns are worth conducting, first of all, only in promising communities. Distributed local energy generation should be incorporated in our society, albeit not at any cost. Funds must be invested smartly.
6. The campaign itself can be conducted by both local governments and the third sector. National governments delegate the task to local, local authorities can do it by themselves or outsource it further to NGOs. When done by themselves, local development agencies could be a suitable institution for this task.

Implementation plan to launch the deployment of CRE in the country is elaborated:

**Step 1.** Include to the national policy framework the definition of energy communities and the rights given by the EU.

**Step 2.** Make a preliminary assessment of the impact of the proposed policy tool.

**Step 3.** Design correct policy tools to simplify the operations of energy communities and to make them profitable and attractive to citizens.

**Step 4.** Create a project examination procedure and grant its performing to a certain institution. Expensive policy incentives should be only granted to the energy communities which examination had shown their alignment with crucial principles of cooperation and community benefits.

**Step 5.** Design an educational campaign

**Step 5.** Conduct an analysis of the historical background and market context in different regions

**Step 6.** Delegate local governments of the chosen regions/communities to conduct a campaign

**Step 7.** Local governments might conduct a campaign by themselves (might delegate it to the public local development agencies, if exist) or outsource it to the NGOs.
6. Conclusions and future research directions

Renewable energy cooperatives are the most spread organizational form of the community renewable energy. Majority of them own their small-scale production plants near the towns and villages, on the roofs of the public buildings, etc. Mostly, RECs began to appear in the EU after 2007. The model that a lot of countries try to copy is a German one. Renewable energy deployment in Germany initially was triggered by the small-scale community plants and individual rooftop solar installations. Germany’s “Energiewende” started from citizens, not from big companies. Big generators began to invest into renewables only after citizens had already been doing it. Even today 42.5 percent of all installed capacity in Germany is owned by citizens. There are 862 RECs operating today in the country. And in the EU there are 2947 energy cooperatives with 797 844 members, supplying 1 million people with clean energy. Are these numbers look incredible? German RECs relied on the generous FiT many years. Recently, the support in the form of FiT has finished due to technology maturity. Other policy incentives are being implemented internationally.

In such countries like Denmark, Belgium, Netherlands, and Great Britain, wind technology is very commonly utilized by the cooperatives. In Austria, Switzerland, Finland, Italy, and the Netherlands, district heating cooperatives on the biomass is a very popular solution. Many hydro RECs were founded at the end of XIX, beginning of XX century in Alpine regions of central Europe. A lot of them still exist. Some of them show potential to close factual energy loop, to become fully independent with renewable energy produced locally, like an inspiring example of E-Werk Prad illustrates to us. These RECs foster social innovation by incorporating technological innovations as VPP or storage systems. Communities that had first closed an energy loop, like Samso Island in Denmark or Gussing town in Austria, have different stories and motivations but the similar vision about the future. They became the lighthouses in the sea of our modern days. They show how our future will look like.

Energy communities are the best form to innovate energy system allowing it to be as cheap, green and human as possible. It can give new perspectives to the local development in rural areas and even in urban. Local distributed small-scale energy needs certain policies to be assisted by, as well as a deeper understanding of the phenomenon. I hope that I have contributed to this goal with my project work.
Future research directions in terms of the impact of RECs on the welfare of local communities should be done by more in-depth qualitative surveying. Various community stakeholders should be involved in questioning and interviewing. Comparative analysis should be conducted on the impact of cooperatives of the same type. This analysis will allow improving a survey. Later, comparison analysis of the cooperatives of different types thus would be more trustworthy, as well as between-nations analysis. Moreover, a quantitative analysis of the economic impact of different RECs on welfare should be done. In this project work, only the economic impact of one cooperative was assessed quantitatively.

I want to finish this project work with the words of a prominent American economist, sociologist, and visionary, Jeremy Rifkin:

“…each of us will be able to create our own green electricity and share it on the internet with people from other regions and other continents…”
## Appendix 1. Deployment of RECs in the EU in 2018

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated number of RECs</th>
<th>Members of RECs</th>
<th>Members per one REC (mean)</th>
<th>Estimated HHs number consuming energy from RECs</th>
<th>Country total population</th>
<th>The proportion of population per one REC</th>
<th>Proportion of population involved in RECs, citizens/REC member</th>
<th>Proportion of the population consuming RECs produced energy, citizens/consumer</th>
<th>National/regional federation of RECs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>862</td>
<td>180000</td>
<td>209</td>
<td>230000&lt;sup&gt;30&lt;/sup&gt;</td>
<td>82 439 639</td>
<td>95 638</td>
<td>458</td>
<td>119</td>
<td>DGRV</td>
</tr>
<tr>
<td>Netherlands</td>
<td>484&lt;sup&gt;31&lt;/sup&gt;</td>
<td>70000</td>
<td>145</td>
<td>140000</td>
<td>17 132 908</td>
<td>35 399</td>
<td>245</td>
<td>41</td>
<td>ODE Decentraal</td>
</tr>
<tr>
<td>Switzerland</td>
<td>292&lt;sup&gt;32&lt;/sup&gt;</td>
<td>68416&lt;sup&gt;33&lt;/sup&gt;</td>
<td>234</td>
<td>-</td>
<td>8 608 259</td>
<td>29 480</td>
<td>126</td>
<td>-</td>
<td>VESE (solar coops)</td>
</tr>
<tr>
<td>Austria</td>
<td>286</td>
<td>153797&lt;sup&gt;34&lt;/sup&gt;</td>
<td>538</td>
<td>-</td>
<td>8766201</td>
<td>30 651</td>
<td>57</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>247</td>
<td>33142</td>
<td>134</td>
<td>400000&lt;sup&gt;35&lt;/sup&gt;</td>
<td>66 959 016</td>
<td>271 089</td>
<td>2020</td>
<td>56</td>
<td>Community Energy England, Energy4All</td>
</tr>
<tr>
<td>France</td>
<td>193</td>
<td>27000&lt;sup&gt;36&lt;/sup&gt;</td>
<td>140</td>
<td>70000</td>
<td>65 480 710</td>
<td>339 278</td>
<td>2425</td>
<td>312</td>
<td>Energy Partagee</td>
</tr>
</tbody>
</table>

<sup>29</sup> Data collected from the website of EFREC may not include those RECs which did not report about its existence to the EFREC

<sup>30</sup> Data based on the estimated electricity generation from RECs which was 830 000 MWh in 2014

<sup>31</sup> 365 RECs and 119 CRE different in legal form from REC

<sup>32</sup> Data for 2015

<sup>33</sup> Data only for 129 RECs participated in the survey of Rivas et.al. (2018)

<sup>34</sup> Estimated number based on the calculation of the average members of RECs in EU countries (538 members). Number seems relevant because in Austria dominant type of RECs are biomass district heating RECs, where this type of RECs involve usually more members.

<sup>35</sup> Includes only HHs provided with electricity by “Co-op Energy” retail REC. Data source: www.thenews.coop

<sup>36</sup> Includes only Enercoop REC members which is a biggest country retail REC whose in turn 10 generation RECs and individual consumers are shareholders
<table>
<thead>
<tr>
<th>Country</th>
<th>Estimate</th>
<th>RECs</th>
<th>Members</th>
<th>Total Wind</th>
<th>Total Energy</th>
<th>Total Members</th>
<th>Data Source and Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>140</td>
<td>179</td>
<td></td>
<td>10 053 135</td>
<td>71 808</td>
<td>402</td>
<td>SEV (only for South Tyrol region), Confcooperative Consumo e Utenza</td>
</tr>
<tr>
<td>Finland</td>
<td>103</td>
<td>338</td>
<td></td>
<td>5 561 389</td>
<td>53 994</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>77</td>
<td>550</td>
<td>88272</td>
<td>59 216 525</td>
<td>769 046</td>
<td>1399</td>
<td>224 UNION RENOVABLES, FEDERATION OF ELECTRIC COOPERATIVES OF COMMUNITY OF VALENCIA</td>
</tr>
<tr>
<td>Belgium</td>
<td>29</td>
<td>2147</td>
<td></td>
<td>11 562 784</td>
<td>398 717</td>
<td>186</td>
<td>REScoop.Vlaanderen, REScoop.Wallonie</td>
</tr>
<tr>
<td>Spain</td>
<td>22</td>
<td>2791</td>
<td>93850</td>
<td>46 441 049</td>
<td>2 110 957</td>
<td>756</td>
<td>165 UNION RENOVABLES, FEDERATION OF ELECTRIC COOPERATIVES OF COMMUNITY OF VALENCIA</td>
</tr>
<tr>
<td>Croatia</td>
<td>10</td>
<td>11</td>
<td></td>
<td>4 140 148</td>
<td>414 015</td>
<td>39430</td>
<td></td>
</tr>
</tbody>
</table>

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37 Includes only wind RECs

38 Approximate estimation based on Wierling et.al. (2018) study

39 Including 32 eco-villages organizational form

40 Includes only the largest group (78 wind RECs) members

41 Data includes only 20 cooperatives: 15 RECs from Wallonia region and 5 from Flanders. Data was collected from website of REScoop Wallonia Federation and individual websites of RECs from Flanders region

42 Only members of EFREC
<table>
<thead>
<tr>
<th>Country</th>
<th>RECs</th>
<th>Population</th>
<th>Annual Revenue</th>
<th>Number of Members</th>
<th>Number of Cooperatives</th>
<th>Number of Nominated Directors</th>
<th>Total Endorsements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portugal</td>
<td>6</td>
<td>300043</td>
<td>500</td>
<td>11174</td>
<td>10 254 666</td>
<td>1 709 111</td>
<td>3418</td>
</tr>
<tr>
<td>Ireland</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>4 847 139</td>
<td>969 428</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Greece</td>
<td>3</td>
<td>45044</td>
<td>150</td>
<td>1000</td>
<td>11 124 603</td>
<td>3 708 201</td>
<td>24721</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2 081 900</td>
<td>2 081 900</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Poland</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>38 028 273</td>
<td>38 028 273</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL EU</td>
<td>2947</td>
<td>797 854</td>
<td>551</td>
<td>1 034 296</td>
<td>458 473</td>
<td>568</td>
<td>269 969</td>
</tr>
</tbody>
</table>

Source:
Sweden, Netherlands, Belgium, Portugal, Greece, Slovenia - (REScoop.eu, n.d.); Germany - (DGRV, n.d.);
Spain – Capellan-Perez et al. (2018);
Italy - (Federazione Cooperative Raiffeisen Società cooperative, 2018), (Candelise et al., 2017), (Cooperazione Trentina, n.d.), individual websites of RECs;
Austria, Denmark - database of Wierling et al., refer to (Wierling et al., 2018);
Poland – (“Website of CO-POWER project,” n.d.);
Croatia –(Carmen Quintana with Cooperative Europe’s team, 2015);
Finland - (Carmen Quintana with Cooperative Europe’s team, 2015), (K.Huntala, 2016);
Sweden – (Magnusson & Palm, 2019);
France - (Energie Partagee, n.d.);
UK –(Co-operative Economy 2018, 2018);
Switzerland - (Schmid & Seidl, 2017); Rivas et.al (2018)
Ireland - (“Energy Cooperatives Ireland website,” n.d.);

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43 Data available only for 3 out of 6 RECs
44 Data available only for 2 out of 3 RECs
Appendix 2. Questionnaire

General questions

1. Which year were you founded?
2. Which type of energy production do you have?
3. Which services except for energy production you provide to members?
4. Which services except for energy production you provide to the community?
5. How many members do you have?
6. What is a cost of one share?

Organizational structure and business model

7. What is the structure of members such as local businesses, farmers/agricultural holdings, communal authorities?
8. Are you open to new members?
9. How stable is your member base? Is there significant drop-outs or new memberships?
10. Is there a difference between membership and ownership in the cooperative?
11. What are the policy incentives from which cooperative benefit?
12. Has the “business model/cooperative model” changed in any way over time, in that case, how?
13. What questions are discussed most intensively at the cooperative’s meetings?
14. What are the governing structures? How many people are involved?

Benefits/detriments

15. How members benefit from participating in the cooperative?
16. What is an average profit for a member from participating in the cooperative?
17. Does the community benefit from participating in the cooperative? If yes, then how? (local contracts/jobs/tourism/education etc.)
18. Which other positive things your cooperative might do for the community?
19. Can you see any negative impact which your cooperative may bring to its members or to the community? Maybe even hypothetical.
20. Speaking about the benefits of your cooperative to members and community as a whole, could you assess from 0 to 4 next possible benefits? (0 - the complete absence of benefit, 4 - the biggest possible outcome that ideal cooperative of your type could bring)

<table>
<thead>
<tr>
<th>Please assess how strong were the following arguments for the initiative</th>
<th>Not relevant</th>
<th>Highly relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Producing cheap energy</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Fostering touristic activities through better sustainability image</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Creating local jobs and contract local suppliers</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ High shareholder income</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ High community income</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Increase environmental values and behavior</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Reduce GHG/pollution</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Increase amount of saved energy thorough more sustainable practices for the households</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Political mobilization as an outcome of participation in cooperative</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Provide renewable energy education and training</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>■ Renewable energy plant becomes a community asset</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Empowerment and skills development of members/community inhabitants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Members of cooperative volunteer or develop a community</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local ownership and decision-making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative invest in other community projects (e.g. roads, kindergartens, etc.)</td>
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<tr>
<td>Improve energy self-sufficiency/security</td>
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<tr>
<td>Members of cooperative enjoy their participation</td>
<td></td>
<td></td>
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<tr>
<td>Cooperative organizes events for members</td>
<td></td>
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<tr>
<td>Members have friends in cooperative</td>
<td></td>
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</tr>
<tr>
<td>Members are proud of being a part of the cooperative</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
21. Speaking about the negative impact of your cooperative to members and community as a whole, could you assess from 0 to 4 next possible disadvantages? (0 - the complete absence of negative things, 4 - the biggest possible negative impact that a cooperative of your type could bring)

<table>
<thead>
<tr>
<th>Argument</th>
<th>Not relevant</th>
<th>Highly relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>An additional burden on electricity bills since the new generation</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>generation installation built</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contracting outside region companies for outsourcing services</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Renewable energy installation occupies valuable agricultural land</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Renewable energy installation harms biodiversity</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Retail energy cooperative contracts fossil fuel plants (only for retail/</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>supplier or system operators cooperatives)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative creates tension among local actors</td>
<td>0 1 2 3 4</td>
<td></td>
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<tr>
<td>Cooperative makes the local energy system more complicated</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Members withdraw their shares from cooperative</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Lack of active members</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Policy changes lead to a decrease in profits or termination of energy</td>
<td>0 1 2 3 4</td>
<td></td>
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<tr>
<td>cooperative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflicts in management of cooperative occur</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
</tbody>
</table>
Motivations

22. What was the original motivation behind founding the cooperative?

23. What do you think is the main motivation for cooperative members?

24. What are the plans for the future for the cooperative?

25. What can influence in a bad way the future of cooperative?
Appendix 3. Photos
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