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# The Socio-Economic Power of Renewable Energy Production Cooperatives in Germany

Results of an Empirical Assessment

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## **1 Abstract**

This paper reflects the socio-economic power of renewable energy production cooperatives for a wider energy system transformation in Germany. Energy cooperatives have turned into important supporters of renewable and decentralised energy structures, due to their strong growth since the year 2006, their participation in local renewable energy projects and their democratic awareness. The cooperative form of coordinating regional energy projects applies to a decentralised energy system that is managed by many smaller firms - a system concept that is preferred by the majority of German citizens. However, there is not enough knowledge to understand to what extent this organisational form is able to unify a broad group of actors in promoting a renewable energy system (societal power) and to gather capital for elaborating renewable energy supply structures (economic power).

The reflection is based on an empirical assessment of all energy cooperatives that were registered in Germany by 31<sup>st</sup> December 2013. Their growth dynamic and their business approaches are discussed. A special focus lies on renewable energy production cooperatives. The study presents the development of their members, their capital, their profit and loss, as well as their investment intensity over a timeframe of three years (2010-2012). The socio-economic potential of renewable energy production cooperatives for supporting a renewable energy system is discussed against the background of empirical results.

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## 2 Renewable Energy Cooperatives and the German ‘Energiewende’

Over the last decades, resource scarcity, increasing awareness of global climate change and negative events related to energy, such as the nuclear accident in Fukushima, have pressured Germany’s energy system towards developing more sustainable energy supply structures. However, the majority of energy continues to be produced with non-renewable resources. In 2012, 87% of Germany’s net energy demand was generated with conventional energy (Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) 2013, p. 5). Therefore, it is essential to observe not only technical but also societal models that foster the wider diffusion of new energy structures. Since renewable energy is predominantly decentralised in its production, regions are important fields of action. This focuses attention on recently emerging energy cooperatives. The majority of them has a special focus on local renewable energy production. Their open membership approach, their democratic decision-taking structure, as well as their focus on values beyond economic benefits, are core differences to other business forms. In this sense, energy cooperatives follow a different operational logic than conventional enterprises in the energy sector. The strong growth of renewable energy cooperatives during recent years shows that they seem to be particularly valuable for capturing social needs that are aligned to renewable energy technologies. In line with general cooperative principles, their business approaches are found to be closely connected to (a) an increasing interest in the local origin of energy production, (b) a rising demand for a closer relationship between energy users and producers, and (c) an increasing request for civil society participation in energy affairs, along with the aim of actively supporting the fight against climate change and energy resource scarcity (e.g. Müller, Rommel 2010, p. 191; Flieger 2011a, pp. 58ff., 2011b, pp. 50ff.; Maron, Maron 2012, p. 19; Klemisch, Boddenberg 2012, pp. 576ff.; Alber 2014). The majority of German citizens prefers a decentralised energy system that is managed by many smaller firms (Berlo, Wagner 2013, p. 23).

However, little knowledge exists about the socio-economic power of renewable energy cooperatives to shape a broader transition process of Germany’s energy system. Their socio-economic power can be described through (1) the ability to allocate capital for investing in e.g. energy production, (2) the ability to gather members that actively support the cooperative’s business goals and (3) the ability to achieve a robust operational basis (no membership decline, positive return on investments over the long term). It is thus essential to learn more about membership and capital structures of renewable energy cooperatives. Empirical results for both aspects will be presented below. A particular focus lies on cooperatives that produce renewable energy because they represent the biggest group among energy cooperatives.

The description of renewable energy cooperatives in general, and renewable energy production cooperatives in particular, is based on a full assessment of all officially operating energy cooperatives that were legally registered in Germany by 31<sup>st</sup> December 2013. Financial data and membership information are drawn from the analysis of annual financial statements that were published by renewable energy production cooperatives for the years 2010, 2011 and 2012. The acquired data

allowed a comprehensive analysis of the capital development, as well as the distribution of members over a timeframe of three years.

There is as yet no detailed socio-economic analysis of renewable energy production cooperatives over time. Other research that covered membership figures provided few single financial issues and were based on smaller surveys without specifically addressing renewable energy production cooperatives (e.g. Volz 2012; DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013a). Earlier works that conducted a full assessment of registered energy cooperatives have a different focus. Maron & Maron (2012) provided comprehensive information about the field of energy cooperatives with particular regard for geographical aspects. Holstenkamp & Müller (2013) provided a general business approach typology for energy cooperatives.

### 3 The Cooperative Business Form in the Energy Sector

Cooperatives represent a legal business form that exists in many different countries. According to the international cooperative alliance,

*“a cooperative is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise.” (The International Co-operative Alliance 2014)*

Core principles of cooperatives are self-help, self-responsibility and democracy, which are combined with concrete business activities (Klemisch, Vogt 2012, pp. 21ff.; The International Co-operative Alliance 2014; DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013b). Built on the idea of achieving goals with joint force, cooperatives empower single players to realise projects that they would not be able to realise by themselves. The organisational approach is driven by the interest and needs of its members. Business goals of cooperatives are thus balanced between achieving economic benefits on the one hand, and taking social responsibility on the other hand. Membership is open to persons, as well as to associations and firms (DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013b). Basic decisions are taken in general assemblies with equal voting rights. Each member has one vote independent from its financial involvement (*The International Co-operative Alliance 2014*). The fundamental principle ‘one person, one vote’ protects cooperatives from the dominance of single shareholders. Furthermore, it makes ‘hostile’ takeovers almost impossible (DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013b).

Energy cooperatives are organisations that manage activities along the energy value chain, as displayed in figure 1.



Figure 1: Energy value chain, (own source).

They may provide technological services, produce renewable energy, be in charge of its distribution, operate the respective infrastructure, market and sell renewable energy or offer renewable energy demand and supply services.

## 4 Methodological Approach

The empirical assessment of energy cooperatives involved three steps: (1) The identification of registered energy cooperatives at the German registry for cooperatives, (2) the identification of their primary business goals, and (3) the analysis of financial statements that were published by renewable energy production cooperatives for 2010, 2011 and 2012. Each step included extra reviews and checks in order to ensure high data quality.

### 4.1 Identification of Operating Energy Cooperatives

All officially operating energy cooperatives were identified based on their entries in the German registry for cooperatives. The register is administrated by the federal state and the German ‘Bundesländer’. It is accessible via internet at <https://www.handelsregister.de/>. The registry is a valid data source for identifying all operating energy cooperatives because it lists all cooperatives that are officially registered at the German registry courts. The registration is compulsory for each cooperative after its foundation (§10; §11 GenG). 942 energy cooperatives were identified that were registered by 31<sup>st</sup> December 2013.

The energy cooperatives were assessed as follows: Through the online registry access, registration lists were extracted for each register court. The lists contained all registered cooperatives. In the next step, those organisations whose primary business focus is realising activities along the energy value chain (displayed in figure 1) were identified as energy cooperatives. Three information sources were used in the following order for selecting cooperatives as energy cooperatives 1) the business name, if it provided a clear indication regarding the business approach, such as in the case of ‘Energiegenossenschaft’ (energy cooperative); 2) the business approach published in the registry; and 3) secondary information that is available online, such as business websites, press-releases or published articles. In this way, the business approach of all cooperatives was identifiable. There was

no cooperative for which the operating sector remained unclear. For each identified energy cooperative the business name, the registry number, the register court, the firm domicile and the registration date were extracted into an own data list.

The assessment of the German registry for cooperatives was conducted three times in order to ensure the identification of all energy cooperatives. The first full review was conducted between October and November 2013. The second full review was conducted in December 2013. Since registry announcements are usually published a couple of days after the day of the cooperative's official registration, a third review in February 2014 focussed on newly registered cooperatives. In this way, it was certain that energy cooperatives, whose registration was conducted at the very end of 2013, and published at the beginning of the year 2014, were also assessed.

Earlier assessments applied a similar empirical approach for identifying energy cooperatives, such as Maron & Maron (2012) and Holstenkamp & Müller (2013, pp. 5ff.). As stated before, they have a different research focus.

#### **4.2 Analysis of Core Business Goals**

In the second step, energy cooperatives were clustered according to their core business goals. Core business goals are those business activities or projects that are factually realised or actively planned. Official internet websites were the primary source of information for determining core business goals. 66% of registered energy cooperatives have a website that describes planned and implemented projects. Furthermore, most websites provide a link to the cooperatives' statutes, which have to contain a description of the business approach (§6 GenG). If no website was available, or if the website did not contain enough information about core business goals, other data sources were drawn upon, such as third party articles or third party websites. Only official and credible sources were used, e. g. press-releases, newspaper articles or information from municipalities. In some cases cooperatives were contacted by phone in order to determine their business approach. The identified business goals were reviewed twice, ensuring that the provided business goal information was correctly interpreted.

#### **4.3 Assessment of Balance Sheets**

The economic analysis, as well as the analysis of membership distribution, focussed on energy cooperatives that actively support renewable energy supply structures. Of 942 identified energy cooperatives, 690 produce renewable energy. Economic data and members' information were collected from annual financial statements. For each renewable energy production cooperative that was registered before the end of 2013, all financial statements that covered the business years 2010, 2011 and 2012 were analysed.



Financial statements describe the economic situation of a company. They are a valid source of financial and membership data of energy cooperatives. Their annual publication is mandatory for German cooperatives at the latest 12 months after the end of a business year (§325; §339 HGB). Accordingly, 2010, 2011 and 2012 are the most recent years for which financial statements are broadly available. They are accessible via the national electronic registry ‘bundesanzeiger’ ([www.bundesanzeiger.de](http://www.bundesanzeiger.de)) that is administrated by the German Federal Ministry of Justice and Consumer Protection. The assessment covered balance sheet figures and membership data. Of central interest were equity and borrowed capital, profit and loss, long-term invested capital, as well as number of members and number of members’ shares. From each financial statement the data was extracted into an own separate data list.

As of 13<sup>th</sup> April 2014, 1,021 financial statements for 2010, 2011 and 2012 were published by all renewable energy production cooperatives that were registered in or before the respective business year. The assessment included all 1,021 financial statements. Table 1 displays the number of published financial statements for each observation year in relation to the number of registered renewable energy production cooperatives. The table also shows how many financial statements included additional membership information.

Number of published financial statements, as well as number and share of renewable energy production cooperatives	Business year			
	2010	2011	2012	Total
Total number of renewable energy production cooperatives that were registered in or before the respective business year	249	407	541	
Total number of published financial statements from registered renewable energy production cooperatives	229	366	426	<b>1,021</b>
Respective share of renewable energy production cooperatives that published financial statements	92%	90%	79%	
Total number of published financial statements that included additional membership data	199	325	374	<b>898</b>
Respective share of renewable energy production cooperatives that provided additional membership figures	80%	80%	69%	

Table 1: Overview of financial statements from 2010, 2011 and 2012 that were published by registered renewable energy production cooperatives by 13<sup>th</sup> April 2014 and formed part of the assessment, (own source).

Between 79% and 92% of all renewable energy production cooperatives that were registered in or before the respective business year provided financial statements for 2010, 2011 and 2012. Accordingly, the majority of organisations followed the legal requirement of publishing their annual reports. Between 69% and 80% of all renewable energy production cooperatives that were registered in or before the respective business year provided additional membership information in their financial statements. Usually, cooperatives have to specify membership data in the appendix (§ 338 HGB).

The analysis of financial statements included two assessment rounds in order to prevent mistakes. The first assessment was executed between October 2013 and February 2014. The legal deadline for publishing financial statements for the business year 2012 was 31<sup>st</sup> December 2013. Some energy cooperatives tend to publish their financial statements after the deadline. In order to maximise the collection of 2012 publications, a second assessment round was conducted between 1<sup>st</sup> and 13<sup>th</sup> April 2014.

## 5 Growth Dynamic of Energy Cooperatives

In Germany, 942 energy cooperatives were officially registered by 31<sup>st</sup> December 2013<sup>1</sup>. Figure 2 displays annual registrations of energy cooperatives between 2000 and 2013. 91% of all organisations were registered from 2006 onwards. The highest number of registrations took place in 2011, with 203 cooperatives. In the following two years, annual registrations were slightly lower, with 175 foundations in 2012 and 177 foundations in 2013. Nevertheless, the share of registrations in 2012 and 2013 were still about 20% higher compared to registrations in 2010 and about 25 times higher compared to registrations in 2006.

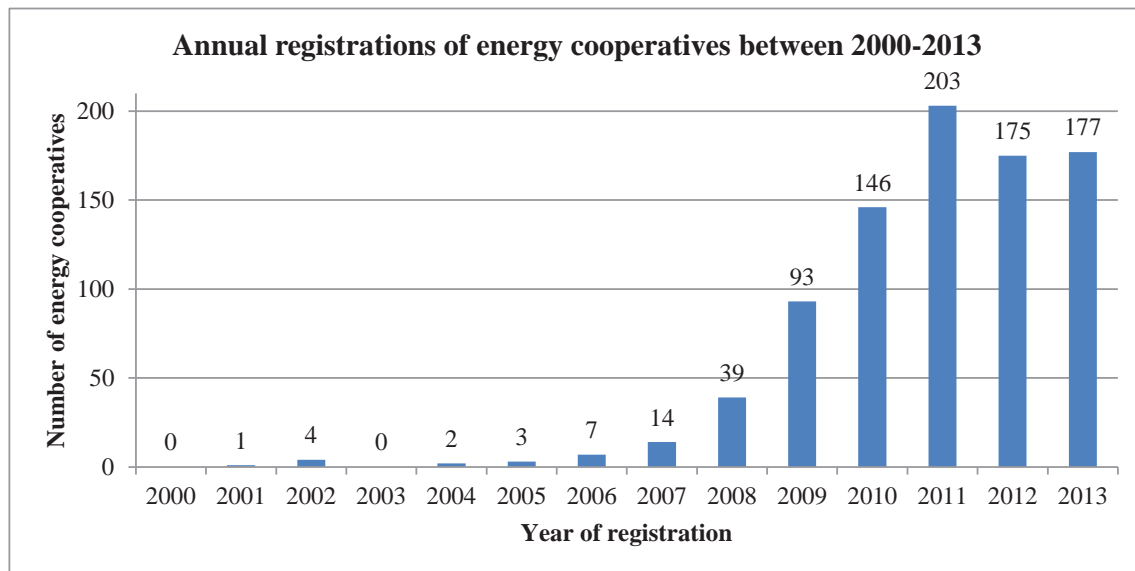


Figure 2: Annual registrations of energy cooperatives between 2000 and 2013 in Germany, (own source).

Two events predominantly triggered this growth dynamic of annual registrations between 2006 and 2013. The first event is the on-going transformation of Germany's energy system towards renewable energy structures. A significant number of recently emerging energy cooperatives is focused on

<sup>1</sup> Since there is no official definition for energy cooperatives, related empirical data, such as total numbers or annual registrations, might slightly deviate between other existing research works. The assessment that provides the basis for this paper identified all organisations whose business activities can be primarily associated to one of the sectors of the energy value chain (displayed in figure 1) as energy cooperatives.

renewable energy. Their activities will be further specified in the next section. The second event is the facilitation of cooperative foundations through several legal and operative amendments in the German cooperative act, which were introduced in 2006 (Bundesministerium der Justiz 2006; Schaffland, Korte 2006).

## 6 Business Goals of Energy Cooperatives

Energy cooperatives represent a heterogeneous group with a variety of different business approaches. However, 822 organisations out of all 942 registered energy cooperatives have a primary focus on renewable energy, representing a share of 87%. The range of their business goals will be described below. The overview is based on the general business approach classification, which has been elaborated for energy cooperatives by Holstenkamp & Müller (2013, p. 15). In their work, they presented business goals for all energy cooperatives that were registered by December 2012. The aim of this chapter is to point out the strong relationship between energy cooperatives and the elaboration of new renewable energy structures. Hence, the classification of Holstenkamp & Müller (2013, p. 15) has been slightly amended: (1) The number of energy cooperatives with business goals related to renewable energy is clearly specified, (2) the classification is extended by a few categories, such as e-mobility and (3) for several energy cooperatives more than one core business goal was identified because this seemed to better represent the reality<sup>2</sup>. Many energy cooperatives that manage a small district heating system also produce energy. Several energy cooperatives operating a conventional grid also market energy. Furthermore, an update of business approaches is provided for all cooperatives that were registered by December 2013.

Table 2 displays core business goals of energy cooperatives. For each category, the table lists the total number of energy cooperatives who apply the respective business goal. Also, the table presents the number of energy cooperatives that have a primary focus on renewable energy within the respective business goal category.

The overwhelming majority of energy cooperatives, in total 690, produces renewable energy or invests in renewable energy production (solar, wind, biomass or water). They represent 73% of all registered energy cooperatives. The second dominant group of energy cooperatives implements and operates small district heating systems, which are predominantly fed with biomass heat. With 148 organisations, they represent 16% of all energy cooperatives. 67 cooperatives market and trade energy. Out of this group, 19 organisations have a primary focus on marketing and trading renewable energy. 51 organisations market and install energy technology. 17 of them are specialised in renewable energy technology, such as in the installation of photovoltaic panels. 36 energy cooperatives are operators of

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<sup>2</sup> For 786 energy cooperatives one core business goal was identified. For 136 energy cooperatives two core business goals were identified and for 8 energy cooperatives three core business goals were identified. For 12 energy cooperatives the business goal could not be identified.

the local distribution electricity network or of the natural gas network. Most of these cooperatives also represent the general energy provider in that region<sup>3</sup>. 32 organisations were identified that offer energy services. Out of this group, 18 cooperatives claim to primarily support the change of energy structures by e.g. coordinating energy efficiency projects.

<b>Business goals of energy cooperatives</b>	<b>Total number of energy cooperatives</b>	<b>Number of energy cooperatives with a primary focus on renewable energy</b>
Energy production/investors in energy production	701	690
Implementation & operation of small district heating systems	148	148
Marketing & trading of energy	67	19
Marketing & installation of energy technology	51	17
Operation of electricity grid or natural gas network	36	
Energy services	32	18
Acquisition or marketing of biomass	16	16
Not possible to determine business goal	12	
Production & marketing of biofuel	10	10
E-mobility	6	6
Lobbying & networking	5	4
Operation of fuel station	4	
Research & development	3	3
Shareholder of municipal energy provider	3	3

Table 2: German energy cooperatives differentiated according to their core business goals as of April 2014 (more than one category per cooperative is possible), (own source).

Cooperatives with a focus on renewable energy operate in a variety of additional business areas. Their strong increase over the last ten years is thus accompanied by a diversification of business settings. Several cooperatives produce and market biofuel for the mobility sector. Others market biomass as an energy resource, e.g. they produce biomass but do not operate biomass plants. Some renewable energy cooperatives primarily acquire biomass. Most of them are networks of energy production organisations that have unified in order to achieve a better price for their needed energy resource. Several energy cooperatives aim to establish electro-mobility with a focus on renewable energy in their region. Other energy cooperatives focus on lobbying and networking for a new renewable energy structure. A few organisations exclusively support research and development projects for renewable energy technology. Another few cooperatives aim to become a shareholder of the local municipal energy provider (one of them has already achieved this goal). The core aim is to support the municipal provider in establishing renewable energy structures in the region. For 12 energy cooperatives, it was not possible to determine their core business goals.

<sup>3</sup> Organisations that operate a grid below a certain size are excluded from the requirement to separate their energy marketing and grid operation (unbundling) (§7 EnWG).

## 7 Development of Renewable Energy Production Cooperatives

As outlined in the previous chapter, renewable energy production cooperatives represent a share of 73% - the biggest group among German energy cooperatives. In figure 3, energy production cooperatives that were registered by December 2013 are differentiated according to their applied energy resources.

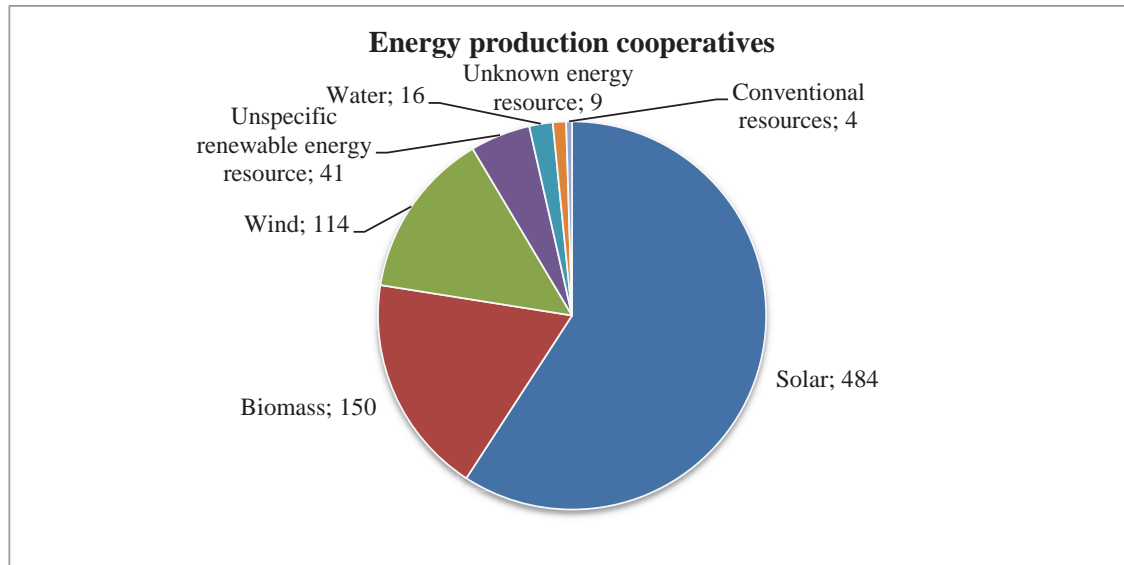


Figure 3: Energy production cooperatives differentiated according to energy resources as of April 2014 (more than one category per cooperative is possible), (own source).

484 cooperatives are focussed on photovoltaic, representing 69% of all energy production cooperatives. 150 cooperatives produce renewable energy with biomass, representing a share of 21%. 114 organisations produce wind power, making up 16% of all energy production cooperatives. A small fraction uses water for producing energy. With 16 organisations, they represent 2% of all energy production cooperatives. Only very few organisations use conventional resources<sup>4</sup>. 41 organisations could be identified as cooperatives that generate renewable energy but it was not possible to further specify their applied renewable resources. For 9 energy cooperatives the origin of the applied energy resource, whether it is renewable or non-renewable, remains unknown.

Figure 4 displays annual registrations of renewable energy production cooperatives differentiated according to the energy resources solar, wind and biomass.

<sup>4</sup> The category only includes organisations that use conventional resources on a standard basis. Several cooperatives may use conventional resources as a back-up source in peak times since energy demand can occasionally become very high. However, since such times are seen as exceptions, these cooperatives are not counted as organisations that regularly use conventional resources for producing energy.

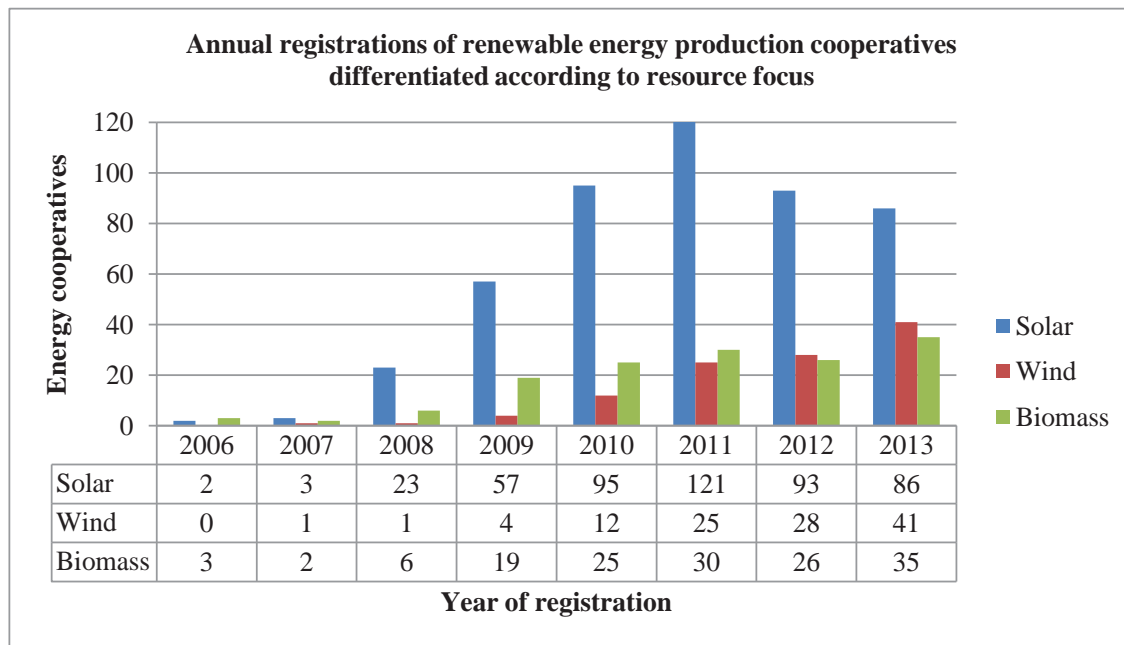


Figure 4: Annual registration of renewable energy production cooperatives according to resource focus, (own source).

Annual registrations of cooperatives that produce solar energy strongly increased between 2008 and 2011. Their high share indicates that the project character of solar energy production, e. g. project size and location, seemed to be especially suitable for renewable energy cooperatives. Since 2011, the number of newly registered photovoltaic cooperatives has been decreasing. In turn, the number of cooperatives that are engaged in biomass and wind energy production has been increasing. The decrease of annual foundations of photovoltaic cooperatives correlates with the point in time, at which the German renewable energy act was amended. Legal modifications were introduced in April 2012 (Bundesministerium der Justiz 2012). The decrease of the feed-in tariff for photovoltaic plants has made it more challenging for cooperatives (and other actors) to achieve return on investments with photovoltaic energy production. The increase in the generation of wind and biomass energy indicates that cooperatives may have started to look for alternative options to become engaged in renewable energy production. Furthermore, the start in more capital intensive operating areas, such as wind energy, has become easier for new cooperatives due to the experience and knowledge that has already been gathered by existing cooperatives. Nevertheless, the share of energy cooperatives that is engaged in wind or biomass energy production is still a lot smaller compared to the number of organisations focused on solar energy production.

Most cooperatives concentrate on one energy resource. Only about 13% of all renewable energy production cooperatives use more than one energy resource. For example, they may invest in photovoltaic and in wind energy production. Energy cooperatives can also have more than one business goal (see table 2). About 15% of renewable energy production cooperatives are active in other renewable energy areas. For example, 70 organisations were identified that produce biomass

energy and operate a small district heating system. Three energy cooperatives were found to produce, as well as market and sell renewable energy. Several organisations explicitly offer additional energy services. These examples reveal the diverse position of renewable energy production cooperatives in the energy sector.

The membership distribution and the economic development of renewable energy production cooperatives will be described below for the years 2010 to 2012.

### 7.1 Membership Development

Members of renewable energy production cooperatives directly support the elaboration of a renewable energy supply structure. It is thus of interest to assess how many actors generally join these cooperatives and to what extent the number of members can be increased. Figure 5 displays the membership distribution of renewable energy production cooperatives between 2010 and 2012.

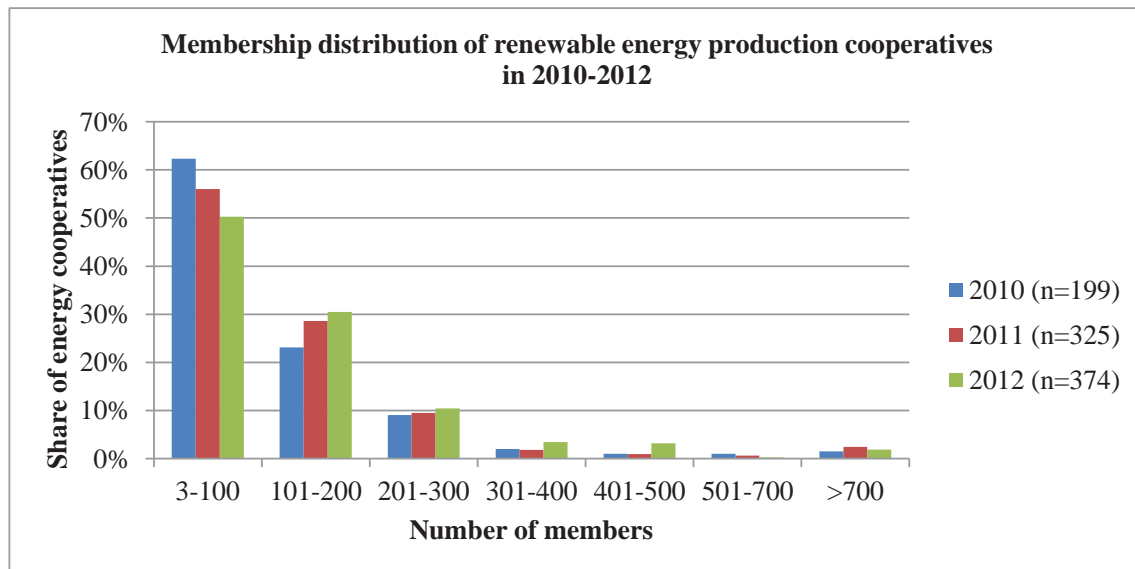


Figure 5: Membership distribution of renewable energy production cooperatives between 2010 and 2012, (own source).

The majority of renewable energy production cooperatives are rather small organisations in terms of membership size. More than 80% had 3 to 200 members between 2010 and 2012. However, a shift can be observed within this range towards cooperatives that had between 101 and 200 members. The number of analysed organisations with up to 100 members decreased from 62% in 2010 to 50% in 2012, whereas the share of surveyed renewable energy production cooperatives that gathered between 101 and 200 members increased from 23% in 2010 to 30% in 2012. The minority of surveyed organisations had more than 200 members. Nevertheless, their share increased from 15% in 2010 to 19% in 2012. Cooperatives that had more than 700 members remained at a share of 2% in the three observation years.

Figure 6 displays how many surveyed renewable energy production cooperatives generally increased, decreased or did not change the number of their members between 2010 and 2012<sup>5</sup>. The information shall complement the observation regarding their membership distribution. Not all renewable energy production cooperatives increased their membership size between 2010 and 2012. 65% of analysed organisations achieved an increase in the number of their members, 20% remained unchanged and 15% experienced a decrease in membership.

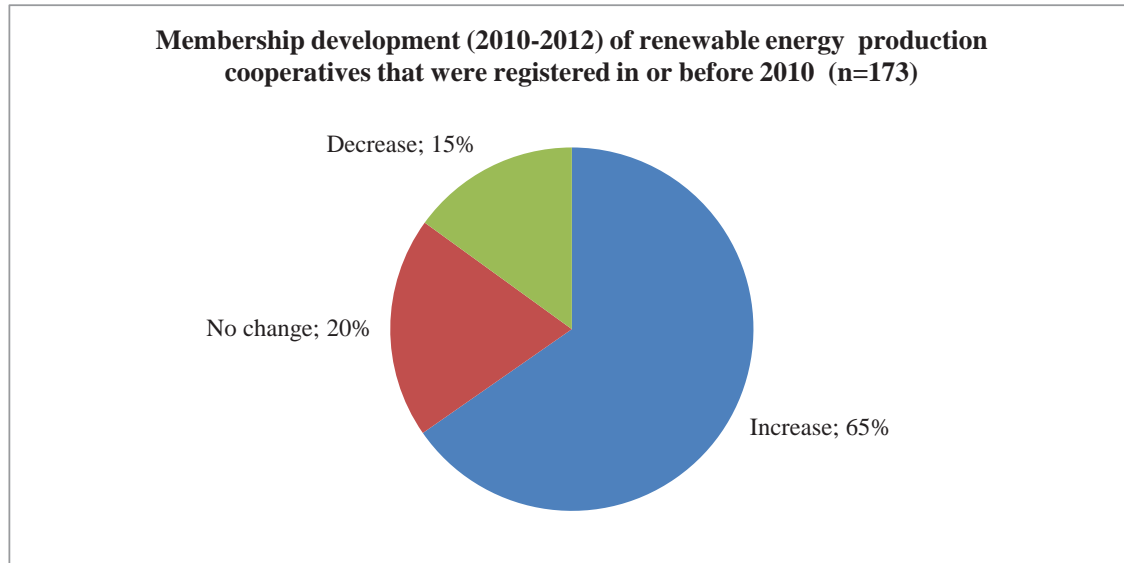


Figure 6: Membership development (2010-2012) of renewable energy production cooperatives that were registered in or before 2010, (own source).

Against the background of these results it can be said that renewable energy production cooperatives expanded their business activities to the extent that they were able to include new members. At the same time, business elaboration was positively noticed by a growing number of actors that also wanted to become a member. It appears that the support of a renewable energy system is a major motivation for joining energy cooperatives (trend:research GmbH 2014, p. 24). In total, all surveyed renewable energy production cooperatives already gathered about 76,500 members by 2012<sup>6</sup>.

However, the fact that most organisations include less than 200 members reveals that it has been challenging for these organisations to achieve higher membership growth rates. Energy cooperatives especially help to ensure a direct and democratic participation in local energy affairs if they gather a large number of actors. The increase in the number of organisations with more than 200 members reveals that business strategies exist, through which renewable energy production cooperatives are able to attract a large number of new actors. Accordingly, further membership growth may be possible.

<sup>5</sup> The observation concentrates on cooperatives that were registered in or before 2010. Of 249 cooperatives that were registered in or before 2010, 173 provided membership information for the years 2010, as well as for 2012, representing a share of 69%.

<sup>6</sup> They represent 69% of all renewable energy production cooperatives that were registered by 2012 (see table 1).



## 7.2 Total Capital Development

The total capital development of cooperatives with a focus on renewable energy production helps to understand to what extent these organisations are able to economically support the development of renewable energy supply structures. The total capital represents the sum of equity capital and borrowed capital, published in the annual balance sheets. Figure 7 displays the total capital of renewable energy production cooperatives between 2010 and 2012.

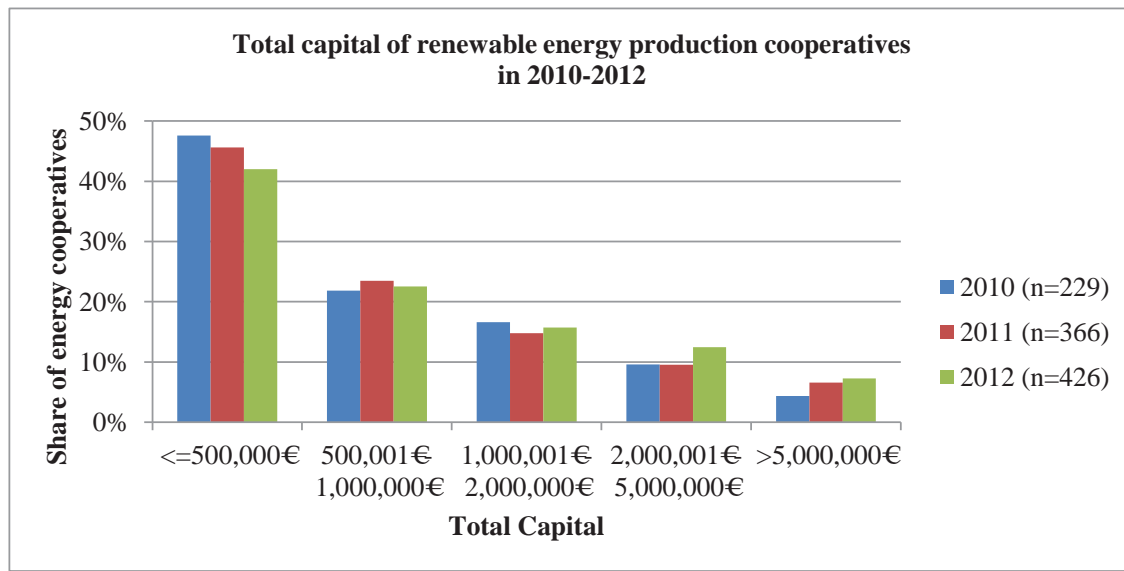


Figure 7: Total capital of renewable energy production cooperatives in 2010-2012, (own source).

The majority of renewable energy production cooperatives are, in terms of total capital, small to medium-sized organisations. These observations complement the results on their membership distribution that were presented in the previous section. Most surveyed organisations had up to 500,000 Euros at their disposal between 2010 and 2012, followed by cooperatives that had total capital of between 500,000 Euros and one million Euros. Between 2010 and 2012, a shift can be observed from low capital rates, that lay in the range of one Euro to 500,000 Euros, to higher capital rates that lay above two million Euros. The number of analysed renewable energy production cooperatives that had a total capital of up to 500,000 Euros decreased from 48% in 2010 to 42% in 2012. The share of surveyed organisations with a capital of between 500,000 Euros and two million Euros stayed the same between 2010 and 2012, at 38%. In turn, the number of analysed renewable energy production cooperatives with more than two million Euros total capital at their disposal increased from 14% in 2010 to 20% on 2012. The share of organisations that had more than 5 million Euros total capital almost doubled from 4% in 2010 to 7% in 2012.

The growth from low capital rates to comparably high capital rates reveals that a significant number of renewable energy production cooperatives intensified their investment activities by increasing the size or the number of their projects. The observation of higher investments is in line with a rising number of cooperatives that have turned their business focus from smaller photovoltaic projects to more

capital intensive wind power projects, as demonstrated in figure 4. In total, all surveyed renewable energy production cooperatives already gathered about 693 million Euros total capital by 2012<sup>7</sup>.

Despite the increase of cooperatives that have more than two million Euros capital, large organisations remain a minority. In 2012, 80% of surveyed cooperatives still had less than two million Euros total capital. However, those organisations that were able to achieve capital rates above two million Euros demonstrate that further growth rates are possible. In this sense, renewable energy production cooperatives may have the capacity to increase their economic power for supporting a renewable energy structure.

The next section analyses, in what way the development of membership size and total capital of renewable energy production cooperatives are related to each other.

### 7.3 Development of Equity Ratio

The equity ratio of renewable energy production cooperatives, which displays the share of equity capital from total capital (Heesen, Gruber 2011, p. 281), indicates to what extent business activities are financed with own financial resources. The growth of total capital being accompanied by a rising number of members may reveal that renewable energy production cooperatives primarily finance increasing investment activities with the shares of their members. Figure 8 displays the equity ratio of renewable energy production cooperatives between 2010 and 2012.

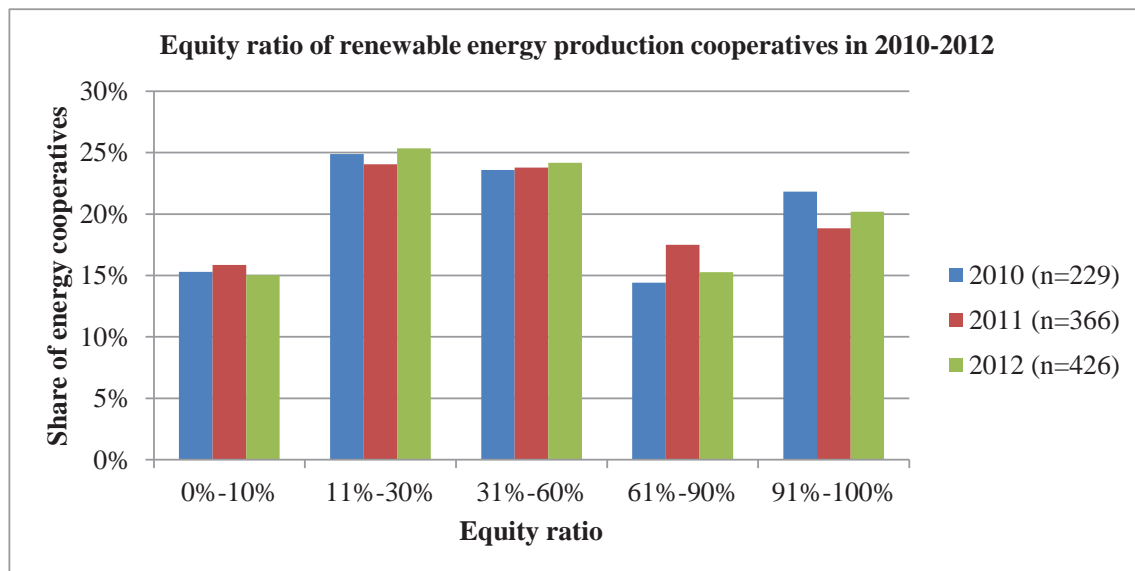


Figure 8: Equity ratio of renewable energy production cooperatives in 2010-2012, (own source).

The majority of surveyed renewable energy production cooperatives had a considerably high equity ratio between 2010 and 2012. Also, the range of equity ratios remained stable throughout the

<sup>7</sup> They represent 79% of all renewable energy production cooperatives that were registered by 2012 (see table 1).

observation period. 60% of surveyed cooperatives had an equity ratio between 31% and 100% in 2010, as well as in 2012. Accordingly, 40% of analysed organisations had an equity ratio below 30% in 2010 and 2012. In comparison, the average equity ratio of German small and medium sized firms<sup>8</sup> lay at about 23% in 2012; the average equity ratio of big companies lay at about 29% in 2012 (Deutsche Bundesbank 2013, p. 47). Based on these empirical results it can be said that despite increased investment volumes, financial requirements are still met to a great extent by members of renewable energy production cooperatives. Financing projects primarily through equity capital complies with fundamental cooperative principles. By collecting equity from members, cooperatives aim to support actors in the united development of self-defined goals without majorly drawing upon the support of third parties (Zerche et al. 1998, pp. 209ff.).

The share of analysed organisations that had very high equity ratios, lying above 90%, slightly decreased from 22% in 2010 to 20% in 2012. This shows that, even though renewable energy production cooperatives have a strong equity background, additional capital is needed to realize growing project goals. Capital loans for energy cooperatives are mainly provided by cooperative banks. Further financial support is offered by national aid programs (DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013a, p. 11).

#### *7.4 Development of Investment Intensity*

In the following section, total capital development of renewable energy production cooperatives is related to their long-term invested capital. The ratio visualises the investment intensity of organisations (Heesen, Gruber 2011, p. 279). The aim is to better understand to what extent energy cooperatives invest their capital in the elaboration of new energy structures. Figure 9 displays the relationship between total capital and long-term invested capital for renewable energy production cooperatives between 2010 and 2012.

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<sup>8</sup> Small and medium sized firms possess of sales volumes that lay below 50 million Euros (Deutsche Bundesbank 2013, p. 47).

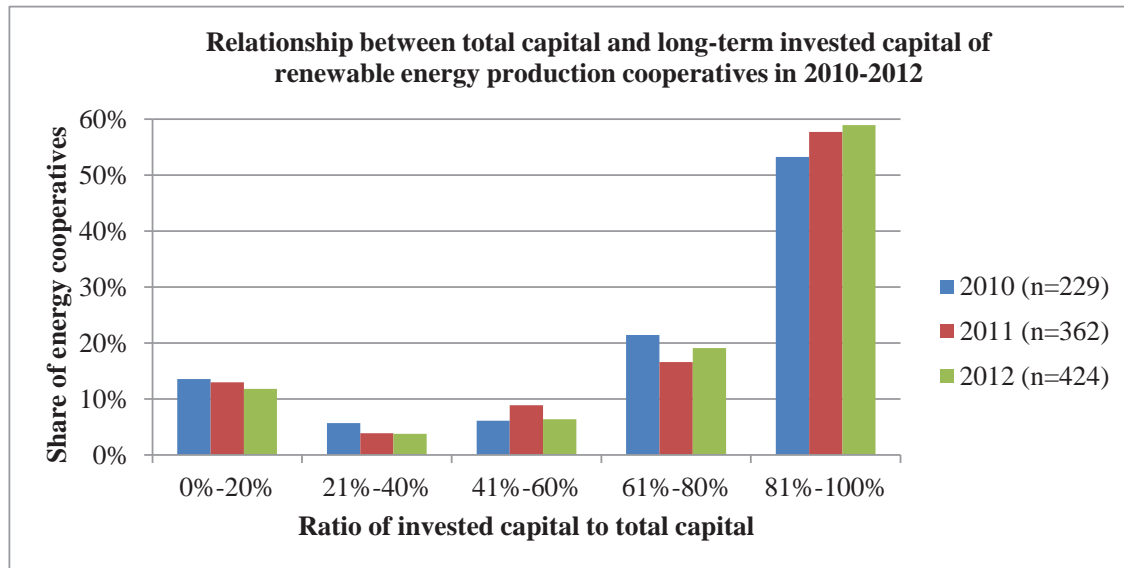


Figure 9: Relationship between invested and total capital of renewable energy production cooperatives in 2010-2012, (own source).

The majority of analysed renewable energy production cooperatives had high investment rates between 2010 and 2012. In the three observation years, most surveyed organisations invested 61% to 100% of their total capital in organisational assets. The share of analysed cooperatives with investment ratios that lay between 81% and 100% even increased from 53% in 2010 to 59% in 2012. Cooperatives with a focus on renewable energy production primarily invest in renewable energy technology and thus used the overwhelming majority of their capital in order to develop renewable energy supply structures. In 2010, 14% of analysed cooperatives had investment ratios that lay below 20%. In 2012, a share of 12% had a ratio that lay below 20%. Especially those cooperatives that were registered in the same year for which the ratio is calculated, showed such low equity shares. At that time, they were at the start of their operational activities. In many cases, planned investments were conducted in the years after registration.

The relation of total capital and invested capital also provides insights into the financial flexibility of organisations (Heesen, Gruber 2011, p. 279). Organisations that have invested a high share of their capital in organisational assets may have difficulties in adapting their business strategies to new market developments. A strategy change becomes necessary in case of the absence of profit. Since renewable energy production cooperatives receive a guaranteed compensation for producing renewable energy (Bundesministerium der Justiz 2010), such flexibility may not be as important as it is in other sectors who are more exposed to organisational competition. In the long-term future, the influence of high rates of long-term invested capital may have to be re-evaluated for renewable energy production cooperatives.

### 7.5 Profit and Loss Development

Central for cooperatives is not the maximisation of profit but the support of its members (Zerche et al. 1998, pp. 216ff.). In this respect, cooperatives follow a different operational logic than conventional organisations. However, the generation of profit or at least the avoidance of loss over the long term is necessary for robust business operations.

Figure 10 displays the profit and loss development of analysed renewable energy production cooperatives. Figure 11 displays the related return on equity that shows how much income after taxes could be achieved per Euro equity (Heesen, Gruber 2011, p. 285). The presented data only apply to organisations that were registered in 2010. This focus enables the reflection of the financial development of cooperatives between their registration year and the two following operating years. Out of 125 renewable energy production cooperatives that were registered in 2010, 80 organisations listed their annual profit or loss in the balance sheet for the business year 2010 (representing a share of 64%); 74 organisations provided profit and loss information for the business year 2011 (representing a share of 59%) and 59 cooperatives listed profit and loss data for the business year 2012 (representing a share of 47%)<sup>9</sup>.

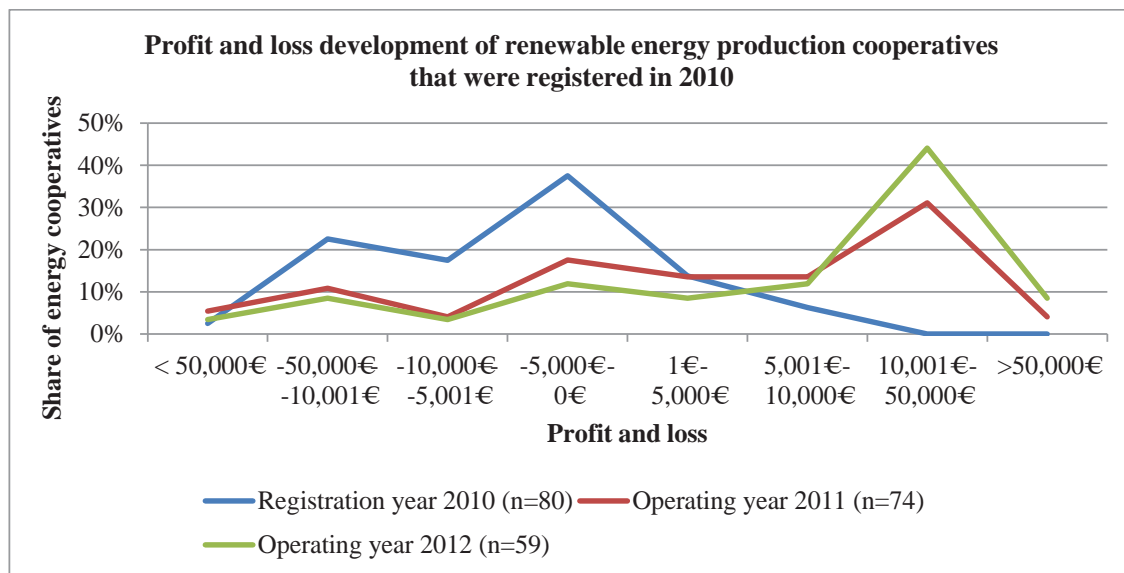


Figure 10: Profit and loss development of renewable energy production cooperatives that were registered in 2010, timeframe 2010-2012, (own source).

<sup>9</sup> Most energy cooperatives are as per definition of § 267 para. 1 HGB small corporate entities. Small organisations are not required to publish a separate income statement with detailed information about annual profit and loss (§ 339 HGB).

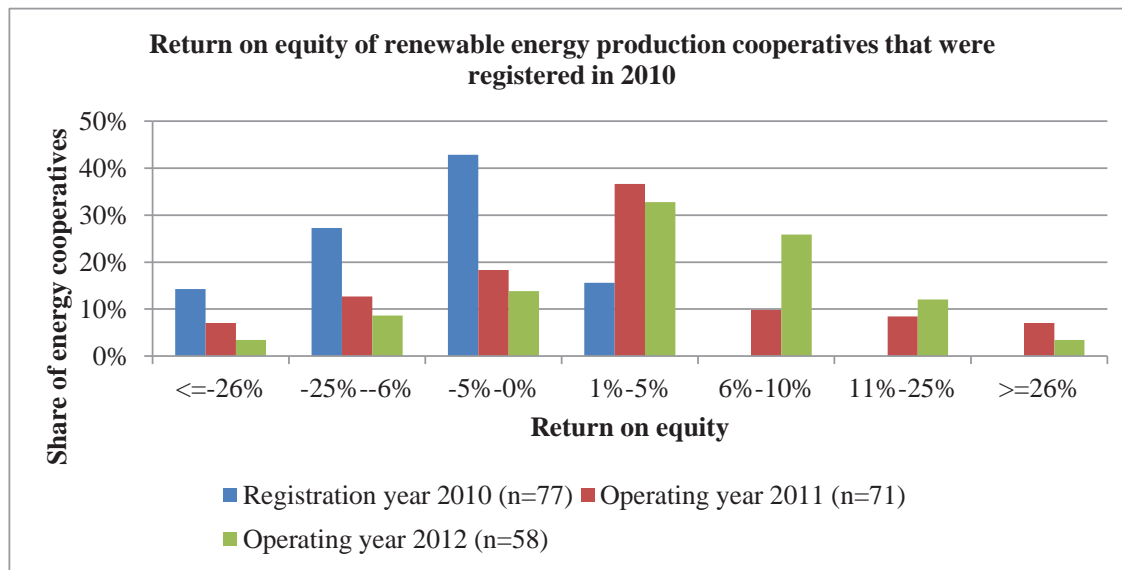


Figure 11: Return on equity of renewable energy production cooperatives that were registered in 2010, timeframe 2010-2012<sup>10</sup>, (own source).

55% of analysed renewable energy production cooperatives that were registered in 2010 made between 0 and -10,000 Euros loss in the year of their registration. A share of 25% of surveyed cooperatives made losses below -10,000 Euros. A minority of 20% made up to 10,000 Euros profit in their registration year. No cooperatives were identified that generated a profit of more than 10,000 Euros in their registration year. Accordingly, over 80% of analysed renewable energy production cooperatives had a negative return on equity in their first business year. This is not unusual since investments need to be conducted first before profit is generated. 43% had an equity ratio that lay between 0% and -5%. A share of 42% had an equity ratio that lay below -5%.

As displayed in figure 10, 73% of surveyed renewable energy production cooperatives that were registered in 2010 already generated revenues two years after their registration. A share of 20% made up to 10,000 Euros profit, 44% made profit that ranged between 10,001 Euros and 50,000 Euros. Accordingly, 59% of analysed organisations achieved a return on equity that lay between 1% - 10% in 2012. A share of 16% even achieved a return on equity that lay above 10%. Empirical results reveal that the majority of analysed renewable energy production cooperatives from 2010 was able to consolidate business operations within three years from the time of their registration. On the one hand such positive economic development may not be surprising, since all renewable cooperatives have been receiving a guaranteed feed-in tariff for investments in renewable energy production (Bundesministerium der Justiz 2010). 76% of analysed renewable energy production cooperatives that were registered in 2010 generate energy with photovoltaic projects, 10% generate wind power and 20% produce energy from biomass. On the other hand, the positive economic development

<sup>10</sup> The return on equity is not calculated for organisations that have no equity capital. Therefore, the number of organisations, for which the return on equity is provided, is slightly lower than the number of organisations, for which profit and loss figures are presented (see figure 9 and 10).

demonstrates that the innovative society focussed business structures of energy cooperatives are well suited for operating renewable energy projects on a professional basis. Energy production projects can be challenging and involve many project risks, such as technical problems. They must be well implemented and coordinated so that return on investments can be achieved. Energy cooperatives are generally operated by volunteering actors that are new in the energy business, such as private persons.

## 8 The Socio-Economic Potential of Renewable Energy Production Cooperatives

In total, surveyed renewable energy production cooperatives, for which data is available<sup>11</sup>, unified around 76,500 actors and had about 693 million Euros capital at their disposal by 2012. All in all it can be said that renewable energy cooperatives have already been able to gather a considerable number of actors, as well as a considerable amount of capital for the elaboration of a renewable energy system in Germany. It is likely that the actual number of members and the amount of capital for the business year 2013, including all renewable energy production cooperatives registered by December 2013, are higher<sup>12</sup>. However, the economic influence of energy cooperatives is still fairly small compared to total investments in renewable energy production in Germany, which lay around 19.5 billion Euros in 2012 (Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) 2013, p. 5).

The empirical assessment revealed that 20% of analysed renewable energy production cooperatives were able to gather more than 200 members or more than two million Euros total capital in 2012. In this sense, cooperatives with a focus on renewable energy generation may have further growth potential. Empirical data may also indicate that a number of existing cooperatives have not yet activated their full socio-economic potential. In order to identify factors that might be related to large renewable energy production cooperatives, a closer look was taken at organisations with more than 200 members *and* more than two million Euros total capital.

Since the socio-economic potential includes the activation of actors, as well as financial assets, this study especially reflected upon whether high membership numbers and a high amount of total capital are directly related to each other. Since high equity ratios indicate that most cooperatives receive their capital from their members, it could be assumed that large capital cooperatives also have many members. This is only true to some extent. Just half of those organisations that had more than two million Euros capital in 2012 also had more than 200 members. Hence, large financial renewable energy production cooperatives do not automatically have many members.

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<sup>11</sup> As stated in chapter 4.3, 79% of all renewable energy production cooperatives that were registered by December 2012 provided capital information. 69% of all renewable energy production cooperatives that were registered by December 2012 provided membership data (see table 1).

<sup>12</sup> According to a survey of the German cooperative association (DGRV), energy cooperatives unified about 136,000 members in 2013. However, since the figure is extrapolated from a small number of 213 cooperatives and since cooperatives show a broad range of member distribution, real figures might deviate (DGRV Deutscher Genossenschafts- und Raiffeisenverband e.V. 2013a).

It was further analysed whether large cooperatives can be related to certain types of energy production or to the application of additional business goals. 30% of large analysed renewable energy production cooperatives invest in more than one energy resource. For example, they produce photovoltaic, as well as wind or biomass power. This means that more cooperatives with many members and a high amount of total capital are focused on one energy resource. 46% of large analysed organisations solely focus on photovoltaic. This could show that energy production cooperatives that have increased in size, tend to produce solar energy. However, compared to all analysed solar energy production cooperatives, only 6% had more than 200 members and more than two million Euros capital in 2012. In this sense, solar production cooperatives are not automatically large. 11% of large analysed renewable energy production cooperatives solely focus on wind. Accordingly, a direct relationship between large energy production cooperatives and a certain energy resource cannot be identified. Neither is there a direct relationship between large membership number, a high amount of capital and the number of business activities. Only 19% of analysed organisations with more than 200 members and two million Euros total capital have more than one business goal (for example, they produce, as well as market and sell energy).

Other factors may exist that explicitly support an increase of the socio-economic power of renewable energy production cooperatives. More research on large cooperatives is necessary to better comprehend their general growth capacity. It is also crucial to analyse in what way a growth dynamic may affect the organisational self-understanding of energy cooperatives. Are they able to keep their democratic and participatory structures while growing in business size? Case studies on renewable energy production cooperatives with high total capital rates and many members would help to understand how they achieved a stronger increase in size compared to most other energy cooperatives, as well as to learn more about the consequences of growth.

## 9 Conclusion

The number of members demonstrates the societal power of renewable energy cooperatives to activate people and other organisations for promoting a renewable energy system. The development of total capital shows the economic power of renewable energy cooperatives to activate investments for renewable energy. Socio-economic power is further accompanied by robust operating structures.

Out of 942 energy cooperatives that were registered by December 2013, 822 are active in the renewable energy sector. 690 cooperatives produce renewable energy. Renewable energy production cooperatives make up 80% of new registrations since 2006. As a first conclusion it can be said that:

1. *Renewable energy production cooperatives have grown strongly in numbers since the year 2006.*



The majority of analysed renewable energy production cooperatives had between three and 200 members and had up to two million Euros total capital at their disposal in 2012. Organisational growth especially takes place within the smallest cooperatives with up to 100 members or up to 500,000 Euros capital. Organisations with more than 200 members or more than two million Euros capital remain an exception. As a second conclusion it can be said that:

*2. Renewable energy production cooperatives are small to medium sized organisations.*

In 2012, the majority of analysed renewable energy production cooperatives had an equity share above 30%. Most cooperatives that were registered in 2010 achieved a return on equity that lay between 1% and 10% and made a profit of between one and 50,000 Euros two years after their registration. Most capital is invested, predominantly in energy production technologies. The majority of analysed renewable energy production cooperatives that were registered in or by 2010 was able to increase the number of their members between 2010 and 2012. As a third conclusion it can be said that:

*3. Renewable energy production cooperatives provide robust organisational structures for diffusing renewable, regional and decentralised energy production.*

A share of 20% of surveyed cooperatives was able to gather more than 200 members or achieved more than two million Euros capital in 2012. This reveals that cooperatives with a focus on renewable energy production may have further potential to increase their socio-economic power. No direct relationship could be identified between many members and a high amount of total capital, or between large cooperatives and a resource focus or other business goals. In order to better understand the socio-economic growth potential of renewable energy production cooperatives, supporting, as well as challenging factors, have to be identified and analysed in more detail. As a fourth conclusion it can be said that:

*4. Renewable energy production cooperatives may not yet have activated their full socio-economic power for supporting a renewable energy structure. Further research on factors that foster and challenge their growth potential is necessary.*

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