

Renewable energy cooperatives: main features and success factors in collectively implementing energy transition

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Abstract— Cooperatives for renewable energy are examples of proactive citizen initiatives aiming for implementation of alternative energy supply models. These initiatives not only result in higher shares of renewable energy, but at the same time represent alternative business models with the citizen as main actor and beneficiary, and in consequence challenge the predominant power of big companies active in the energy sector. This publication provides an overview on main characteristics of renewable energy cooperatives. Furthermore, it explores means to overcome key challenges and to implement such projects successfully. This is achieved by exemplifying the main factors in two selected contexts: (1) REScoop.eu, the federation of groups and cooperatives of citizens for renewable energy in Europe, and (2) bioenergy villages, which are among the best known examples of cooperative-based renewable energy systems. Community-based renewable energy projects clearly benefit from networks and in particular from facilitated exchange of experience.

Keywords- Renewable energy; sustainability; consumer engagement; cooperatives; bioenergy village; REScoop.eu; decentralised energy production

I. INTRODUCTION

Large companies and public entities still heavily dominate the energy sectors in Europe and beyond, and the centralised model based on exploitation of fossil energy carriers is today the predominant paradigm of energy systems. Energy from fossil fuel worldwide still covers a share of around 80 percent of the final energy consumption (REN21, 2014).

Energy transition refers to a shift from the predominantly centralised fossil fuels based energy system, which causes high greenhouse gas emissions and therefore is a main driver of climate change, to a more sustainable energy system, in particular a system without emission of carbon dioxide. Energy transition is not only a technical and economical challenge: it involves the necessity of changed behaviour of users regarding energy utilisation, thus moving away from wasting energy and to a more rational use.

Adoption of renewable energy schemes has a major role to play in the transition to more sustainable societies. Implementation of renewable energy projects contributes to reaching the objectives set by the Climate and Energy Package of the European Union. The Europe 20-20-20 objectives for 2020 are as follows: twenty percent less greenhouse gas

emissions compared to 1990, twenty percent of renewable energy, and twenty percent higher energy efficiency.

It is a key challenge and a unique opportunity to promote and establish community-based energy schemes based on utilisation of renewable resources as a technically and economically viable alternative to current energy supply. Cooperatively owned renewable energy facilities introduce an element of identification for the involved citizens and create motivating and rewarding community processes (Kusch and Beggio, 2015). This favourably contributes to sustainable development along the three core dimensions environment, society and economy. Active engagement of citizens represents a key element in the transition to sustainability, and economically viable community initiatives implementing renewable energy projects are particularly good examples of such engagement.

Community-based renewable energy source cooperatives have reached a considerable number worldwide. Throughout Europe alone, more than 2,400 such cooperatives exist (REScoop.eu, 2015). This is even more remarkable when considering that renewable energy projects often entail high overall investment (and operating) costs, and in consequence include many participants. In 2012, according to Wieg (2013) 700 renewable energy cooperatives in Germany engaged 150,000 members, 90 percent of which were private citizens, and most of them participating with small amounts (average shareholding of 3,000 EUR).

There is clear potential for more widespread uptake of the model throughout Europe and worldwide. Framing the success elements for community-based renewable energy projects is a complex challenge (Boon and Dieperink, 2014; van der Schoor and Scholtens, 2015; Walker et al., 2010; Wirth, 2014; Yildiz et al., 2015). Focusing on technical feasibility is clearly not enough.

The aim of this paper is to explore main characteristics of renewable energy cooperatives in Europe, and, by understanding central elements that contribute to success of the initiatives, to make a contribution to more widespread uptake of the model. The study is limited in scope in so far that it does not base its findings on structured data analysis or a comprehensive evaluation of individual cases following a detailed protocol. The paper reaches its aim by identifying and

describing main factors in two selected contexts, namely REScoop.eu and bioenergy villages. Making use of practice-based experiences of REScoop.eu, which is the federation of groups and cooperatives of citizens for renewable energy in Europe, enables to compile empirical results in a generalised form that will be directly beneficial for single initiatives. This approach is further applied to distil experiences from bioenergy villages. The findings therefore represent practice-evidenced understanding of main factors. In addition to compiling the information for the attention of the interested reader, the findings can also serve as basis to develop more comprehensive analytical research.

II. COOPERATIVES FOR RENEWABLE ENERGY

There is no standard definition of a renewable energy cooperative. Various organisational forms and financing models exist, but some common elements are present, namely a set of core principles and values.

The common elements can be illustrated by looking at the European network REScoop.eu (see Section IV for more details about background and operation of the organisation). Within the network, single renewable energy cooperatives are groups of citizens, in any legal form, which share a common long-term view on a sustainable future of energy and advance energy transition through active citizenship involvement (REScoop.eu, 2015). Being a member of the network means that every cooperative shall operate following the principles of the International Co-operative Alliance (ICA), which are (ICA, 2015; REScoop.eu, 2015; Viardot, 2013):

- 1) voluntary and open membership,
- 2) democratic member control,
- 3) economic participation by members (at least part of the capital is usually the common property of the cooperative),
- 4) autonomy and independence (cooperatives are autonomous, self-help organisations),
- 5) education, training and information (cooperatives provide education and training for their members and other stakeholders and provide information about the cooperative to the public),
- 6) cooperation among cooperatives (strengthening of the cooperative movement by working together through local, national, regional and international structures), and
- 7) concern for community (while focusing on member needs, cooperatives work for the sustainable development of their communities).

III. COORDINATED FRAMEWORKS

Single cooperatives often have a low level of coordination, in particular in acting externally, including for example efficiently communicating to public authorities or financial institutions such as banks. Single cooperatives are also in a generally weak position to influence relevant policy fields. Coordinated frameworks and networks of initiatives can not only facilitate implementation of new individual projects, but

they can improve general acceptance of the solutions by the wider public, and furthermore can increase impact on shaping favourable policies.

Among others, the presence of private and decentralised producers and consumers of renewable energies is still hindered by the lack of a wide social acceptance of these technologies. This small social acceptance comes from various types of barriers to a direct adoption of renewable energy sources. One barrier is the high costs associated with implementation of renewable energy technologies, and therefore the perceived need of wealthy investors as central actors. Another barrier is the NIMBY (not in my backyard) syndrome (Wieg, 2013), which refers to a situation that individuals are generally in favour of a technology or a development, but they oppose that it influences their own life.

From this perspective, renewable energy cooperatives propose an innovative form of organisation and a business model which mainly focuses on active participation of the local user citizenships in the decision making process of new renewable energy projects, from the siting to the implementation stage (REScoop.eu, 2015). Frameworks such as REScoop.eu (see Section IV) or SCO-RES (2015) therefore also act to foster social acceptance of renewables, and to speed up local and citizen-led renewable energy installations.

Among others, the framework of REScoop.eu facilitates bypassing obstacles to adoption of renewable energies, primarily by demonstrating to potential interested founders and communities that the concept is applied successfully elsewhere in Europe, and in addition by providing assistance and guidance at various stages. This is discussed further in Section IV.

Other coordinated frameworks or wider initiatives are not part of this study, but exist or are emerging. One highly promising example is the elaboration of protocols for community ownership of renewable energy systems which has recently been made available in the UK (SCO-RES, 2015). The platform SCO-RES also provides the possibility to search for partners to establish a new project or to search for opportunities to participate in initiatives.

IV. RESCOOP.EU

REScoop.eu is the federation of groups and cooperatives of citizens for renewable energy in Europe. The federation is exemplary in creating a supporting network and operating as an umbrella for individual renewable energy cooperatives, thus contributing to success of the existing initiatives and to more widespread implementation of such cooperatives throughout Europe. The federation is presented here to draw attention on a successful scheme that strengthens single renewable energy cooperatives. The authors of this publication are in no way involved in the federation and authors' sole interest is to present a best-case example of a scheme to overcome common problems of renewable energy cooperatives. The following presentation makes use of information provided by the federation REScoop.eu (2015).

The federation REScoop.eu acts as an institutionalised subject, representing the established alliance between various single renewable energy cooperatives, so-called REScoops

(Renewable Energy Source Cooperatives), across Europe. REScoop.eu was created in order to face common barriers to the running of decentralised renewable energy installations led by citizens and multiple stakeholders. REScoop.eu operates as a platform for the promotion of the idea of cooperative supply of renewable energy and proactively speeds up the implementation of REScoops through Europe. Communication between active members and the sharing of know-how and experience play a key role in ensuring a winning fate to the cooperative model.

REScoop.eu was founded as network in 2011, and was legally established as federation in 2013 under Belgian national law with a European scope. In addition to supporting renewable energy cooperatives by providing various tools and assistances, the federation officially represents its members in particular at the European level. This enables the federation to undertake lobbying actions at EU level, needed in order to guarantee a legal framework that does not discriminate its members within the European liberalised energy market.

According to the REScoop.eu vision, renewable energy sources are considered a common good. Citizenships should become involved in the process of buying, owning, exploiting and knowing technologies for the conversion and distribution of energy, as if it was a civic responsibility. This implies that citizens, as consumers, taxpayers and money savers, should pay energy transition in transparent modes. Moreover, a central assumption of the model is that a high share of decentralised facilities in a liberalised energy market context enables the presence of various renewable energy players, leading to competitive prices and increased energy independence.

REScoop map



Figure 1. Renewable energy cooperatives listed in the database of REScoop.eu (REScoop.eu, 2015)

In order to fulfil these aims, REScoop.eu provides to the audience a website (www.rescoop.eu) which represents a web container where basic information about the federation and the European network, together with further resources are freely available. As primary objective, the website intends to be an interactive platform where communication between various actors in the frameworks can occur. Interested organisations

can easily be registered as new REScoops, thus becoming new members of the network (Figure 1).

The REScoop.eu database on the website provides an inventory of existing REScoop initiatives across Europe; the database contains several hundred entries (more than three hundred in October 2015). The entries are classified into various categories, such as the energy sources used. Through the database, it is possible to obtain the website address of each REScoop and further information. Information is available how to contact the specific project in order to share experience, and to give and ask for advices.

REScoop.eu communication also focuses on arousing interests within a community about an existing REScoop or a new project. Bringing field-expertise and new REScoop players together among others means that already tested tools become available, which are capable of increasing the number of participants to each initiative. Furthermore, the network offers, through a section of the website, recommendations and communication means to engage higher numbers of participants (i.e. multimedia and graphic means to catch citizens' attention together with advices on how to create grassroots events).

Besides communication, REScoop.eu members concretely support cooperatives when they face economical, technical and bureaucratic challenges, thus easing the process of setting up and running a local, citizen controlled renewable energy installation. When new REScoops seek for specific advices on issues that are not covered by the general resources provided on the REScoop.eu platform, the network offers the possibility to get in contact with near and experienced mentors.

The network-organisation provides a practice-oriented action guide, which is intended to accompany the novice member through the process of building a REScoop. The action guide has a dedicated focus on maintaining concrete involvement of citizens and multiple stakeholders. Furthermore, on a website's section, a description is available of how existent projects overcame critical issues in a successful way. The collection of best practices from different European experiences builds on outcomes from the project REScoop 20-20-20. The project was launched in 2012 with funding from the Intelligent Energy Europe programme of the European Commission. REScoop.eu assumed the role of the advisory committee and provided their website as working platform.

Thirty best practice examples are documented in detail and provide references on how to overcome the most common challenges. Five criteria were identified as crucial factors (REScoop.eu, 2015):

- 1) speed in the authorisation process,
- 2) involvement of stakeholders and alignment of their interest,
- 3) technical and economic sustainability of the project,
- 4) financing schemes and participation of citizens as shareholders, and
- 5) grid connection and sale of energy.

V. BIOENERGY VILLAGES

The 'bioenergy village' is a model of cooperative-based energy system, born from the will of small rural municipalities to cover their entire energy demand with renewable resource-based technologies. Municipalities implementing this model decide to base their current and future electricity and heat supply primarily on biomass. Provision of biomass should be local or regional, thus originating mainly from agriculture or forestry in proximity to the bioenergy village. Biomass does not need to be the sole energy source, but it needs to be the main energy source in the energy system of a bioenergy village. Other energy sources, preferentially renewable sources, can be exploited additionally.

There is no consistent definition of the term 'bioenergy village', but depending on the context and purpose, precise definitions can be formulated, for example when specific funding programmes are defined. As one example, in order to be labelled as 'bioenergy village' by the German Federal Ministry for Food and Agriculture, at least 50 percent of heating demand and 50 percent of electricity coverage need to be ensured by energy based on locally sourced biomass (BMEL, 2015a).

In addition to fostering uptake of renewable energy, the bioenergy village concept aims to achieve communitarian self-management of both energy conversion facilities and energy distribution infrastructures. In its practical application, the bioenergy village functions in the form that local farmers and residents cooperate to establish and to operate the energy supply they require, meaning that the energy conversion and supply system becomes self-managed by the local communities. Energy consumers therefore change into main influential and centrally responsible actors of the energy system, including assuming the role of energy supplier and becoming decision-makers in cooperatively restructuring their own energy system.

It is a theoretical aim to be independent from external grids, although in practice feeding electricity into the general electricity grid can be economically particularly viable, for example if high feed in tariffs exist.

The success of the model 'bioenergy village' is pointed out by the numerous villages or municipalities, which have already become bioenergy villages in Germany and Austria. In Germany alone, 118 bioenergy villages are established up to date, while 54 other villages are on the way to be set as bioenergy villages (BMEL, 2015b).

Fulfilling the aims and objectives of a bioenergy village is well proven to be 'technically feasible' within the area of an average German village (Jenssen et al., 2015), and there is sufficient awareness and knowledge available on the fact that it requires implementation of mandatory equipment and construction of adapted infrastructures, which means significant initial investment costs.

Almost all German bioenergy villages implemented the following technical configuration (Bohnet, 2013): a biogas plant fed by locally sourced agricultural residues (where on average only 7 percent of used biomass derives from a distance beyond 20 km), a CHP facility, which provides electricity and

heat by biogas combustion, and a heating plant (boiler), fueled by wood chips. Furthermore, in order to distribute heat from the CHP plant, the construction of a district heating network is needed. Some cases record the use of fossil technologies for covering heat peak demand during winter (Bohnet, 2013).

As mentioned previously, technical feasibility is not enough. Implementing renewables-based energy systems comes with several challenges related to the nature of this energy source, including acceptance of the technologies (see Section III) – and those challenges also apply to bioenergy villages and affect the experiences of such projects. The establishment of local citizens cooperatives involved in the projects permitted to overcome these barriers.

Acceptance by resident citizenship is the key condition for the actual implementation of renewable energy projects; this was already achieved by promoting the involvement of cooperatives, which built trust among all actors involved (institutions and private enterprises) and contributed to the development of community-based renewable energy schemes (Viardot, 2013). Moreover, self-dynamics within communities involved in bioenergy villages occurred: citizens, prospecting a good opportunity, tried to convince other doubtful residents to connect to the district heating network, by their own initiative (Jenssen et al., 2015). This process resulted also in a strong economic citizen participation: while around three quarters of biogas plants are privately owned (mainly owned and operated by the local farmer), almost 50 percent of other facilities are characterised by collective ownerships (Bohnet, 2013).

In these terms, bioenergy village is identified as a practical implementation of cooperatively driven energy transition.

It is worth pointing out that in fact the choice to adopt this model is driven by the will to reach a dual objective (environmental benefit and socio-economic benefit), which represents also the key to success of these projects.

Utilisation of technologies based on local biomass is an environmentally sound alternative to conventional energy supply. The solutions allow the establishment of energy supply characterised by being carbon dioxide neutral. In addition, further environmental benefits result from reduced negative impact on climate by avoiding animal breeding related greenhouse gas emissions (when animal slurry is fed to a biogas plant), and the preservation of soil and groundwater health by using biogas residues as agriculture amendments (which leads to a minor usage of synthetic fertilisers). Rural areas provide advantages in biomass utilisation, since in these contexts much more biomass per capita is available if compared to more dense urban environments (Jenssen et al., 2015).

In addition to the environmental benefits, the locally provided biomass and the energy production schemes allow the possibility to create socio-economic benefits for rural areas (Von Bock et al., 2014). Building economies of scale on a regional base, reducing electricity and heating costs and increasing employment rates (64 percent of projects involved the creation of at least one new job, which in small rural community is considered a particularly favourable result (Bohnet, 2013)) are among these benefits.

VI. CONCLUSIONS

Renewable energy initiatives reduce the share of fossil-based energy and in consequence reduce emission of greenhouse gases. Community-based projects achieve active participation of the citizen, a vital element in sustainable development, and therefore have particularly high attractiveness (Kusch and Beggio, 2015). Citizens engaged in renewable energy cooperatives foster transition to more sustainable energy systems, based on utilisation of renewable resources and integration of decentralised energy conversion facilities as a viable option.

Cooperatives are not only relevant as business model for financial citizen participation within the energy sector, but for example in Germany constitute the organisational form that has become the most relevant regarding active participation in local energy policy (Yildiz et al., 2015).

Shining examples, which are successful projects, hold the potential to inspire and encourage initiation and implementation of new projects. Such projects do not need to be extraordinary, successful application in an average environment can be particularly beneficial in encouraging uptake by other communities. Bioenergy villages are among the best known examples of communities breaking dependency from existing energy supply markets and implementing their own systems. Potential replication throughout Europe and beyond certainly depends on favourable frameworks and suitable policies, but in particular on the decision of a community and individuals to get involved.

The aim of this study was to elaborate a practice-evidenced understanding of main factors which contribute to the success of community-based renewable energy initiatives. More detailed research, and a more structured methodological approach, would be necessary to advance towards a precise assessment of possible interplays of various factors. However, the study reveals that networks which foster exchange of information and experience, promote education and exchange of knowledge, and help to overcome financial and banking barriers are clearly highly valuable to support the creation of new and successful cooperatives.

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