



Renewable energy cooperatives: Facilitating the energy transition at the Port of Rotterdam

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ABSTRACT

Renewable energy cooperatives (RECs) are an important element of the European energy transition. Allowing citizens and companies to invest in renewable energy and thereby become independent power producers has advanced the acceptance of renewable energy among the population, accelerating the move toward a more decentralized and sustainable power supply. We investigate how a REC could be designed to increase renewable energy deployment at the Port of Rotterdam. Based on a progressive case study conducted among a wide array of stakeholders at the Port and across Europe, we have found 14 specific characteristics a REC should embody to facilitate the energy transition at the Port. Based on these results, we present an action plan with concrete recommendations on how a successful cooperative could be launched at the Port. The results of this research can serve as a guide for stakeholders in any industrial cluster interested in driving the energy transition through a REC.

1. Introduction

The beginning of the energy transition from unsustainable to renewable energy sources can be seen as one of the most promising global developments in recent history that is solving the wicked problem of sustainable energy supply (Ketter et al., 2016a). Renewable energies offer two major benefits. First, they are relatively clean; second, they can be used in a decentralized manner (Robyns et al., 2012). While the first benefit is widely known, the latter rarely receives the attention it deserves. In fact, decentralization has played a crucial role in the energy transition, as private households and companies invested in solar systems for self-consumption to decrease their energy bills (Braun et al., 2009). This is leading to a more diverse energy industry and to a “democratization” of energy supply (Kaphengst and Velten, 2014). This democratization brings new players to energy markets, in addition to the conventional energy corporations. One of the most visible ongoing developments is the emergence of Renewable Energy Cooperatives (RECs) (Fridgen et al., 2018). Based on the well-known concept of cooperatives, which emerged in Europe in the 19th century (Bonus, 1994), RECs give individual citizens and companies outside the energy industry the opportunity to on the one hand bundle resources and become renewable power producers, and on the other hand participate in

cooperative energy consumption. Through the increasing international acceptance of renewable energy resources, RECs have gained ground in many countries. For instance, the European Federation of Renewable Energy Cooperatives (Rescoop) currently counts 1240 RECs within its federation and a total of 650,000 European citizens as members.¹

Given the remarkable success of this phenomenon in driving the energy transition, it is expedient to find out how to expand RECs to industrial zones. Hence, in this paper we focus on the following research question:

What are the critical success factors in setting up an industrial REC so that it can have a significant impact in reducing CO₂ emissions and energy costs? Therefore, together with the Center for Future Energy Business of Erasmus University Rotterdam, we analyze what characteristics such a cooperative would have to contain to help the Port of Rotterdam, one of Europe's major industrial clusters and a macro-economic power house, in achieving its own energy transition. Based on these results, we give practical recommendations of how a REC should be set up in order to facilitate the energy transition at the port.

The reason why the Port of Rotterdam - the largest port in Europe - was chosen as research setting, is that the companies located there have an immense combined electricity demand, which according to the port authorities sums up to approximately 10–20% of the entire Dutch

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¹ <https://www.rescoop.eu/> (accessed 07.02.2018).

electricity consumption. Energy is the main cost factor for many companies at the Port, which is why the port community is looking for ways to decrease energy costs. An important challenge the Port is facing with regards to energy, is to make better use of synergies and common interests of companies located within its industrial park. For instance, while installing more decentralized and renewable power plants could be beneficial for the port community, their full benefit can only be harvested if companies aggregate their resources and better coordinate their energy consumption patterns. Our research intends to lay out guidelines to set up a REC as an entity that can help addressing the challenge of making better use of synergies regarding energy within an industrial cluster.

This paper is organized as follows. In [Section 2](#) we present relevant literature. [Section 3](#) outlines the methodology of the research this publication is based on. [Section 4](#) presents the results that have been generated. In [Section 5](#) we lay out a possible plan of action for building, managing, and sustaining a REC at the Port. Finally, in [Section 6](#) we summarize and suggest ideas for future research.

2. Related work

2.1. (Renewable energy) cooperatives

Cooperatives are organizations enabling economic collaboration among individual actors. Some authors define the founding of the Rochdale Equitable Pioneers Society in England in 1844 as the birth of modern cooperatives (Pezzini and Ambiorix, 2006). Subsequently, the International Cooperative Alliance has evolved as the predominant authority on the matter. According to this non-governmental organization, a cooperative should be defined as follows:

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.

Interestingly, most recent publications on cooperatives refer to renewable energy cooperatives. To understand why energy cooperatives are gaining in importance and why this refers mainly to RECs, it is useful to look at the history of German energy cooperatives, whose origins trace back to the end of the 19th century (Stier, 1999). In that time, due to insufficient grid infrastructure, local actors formed energy cooperatives to organize electricity production and distribution networks (Holstenkamp, 2012; Flieger, 2012). This shows that, while energy cooperatives were already partly investing in renewable energies (hydropower), they originally emerged mainly out of the desire to provide basic energy infrastructure.

After the Second World War, extended economic growth led to a dramatic increase in electricity demand. Since individual energy cooperatives often lacked the resources to meet this demand, they declined in importance and gave way to bigger, national energy companies (Stier, 1999). Another reason was that the public administration favored a centralized approach to energy supply (Holstenkamp and Radtke, 2017). Consequently, the dominant energy infrastructure in Germany (and globally), has been organized in a central manner, often through state owned companies (Stier, 1999)

However, since decentralized energy systems offer several important economic and technical advantages over centralized systems, a decentralized energy supply emerged over the last decades. Among other things, this led to more active participation of individual energy consumers and to the development of the now highly popular term “prosumer” (Luo et al., 2014), a neologism composed of the words consumer and producer (of energy).

The rising popularity of energy cooperatives and their strong association with renewable energies can thus be explained by two factors: first, renewable sources such as solar and wind are diffuse – it is difficult to concentrate them into large power plants. This leads to

decentralization and to active involvement of property owners who are willing to invest in these resources. Second, small producers of sustainable energy have no market power, and may find the cost of installing and maintaining the necessary equipment burdensome. A cooperative can increase the value and reduce the cost of renewable resources for individual producers, aside from the social benefits that may accrue.

RECs are often classified by their purpose (Yildiz, 2013):

- *Energy consumption cooperatives* help organizing bundled and well-coordinated energy purchases for its members. Through such cooperatives, peak demand can be optimized and better prices on the spot market due to larger purchase quantities can be achieved.
- *Energy production cooperatives*, the most common form of RECs, enable a group of persons to produce and sell energy together.
- *Energy service provider cooperatives* act as service providers for a group of already existing energy providers and cooperatives. Their purpose is to bundle resources for activities such as energy purchase and sales. Energy related service providers often also offer consultancy services.

2.2. How RECs facilitate the deployment of renewable energies

Walker (2008) suggests several reasons why RECs facilitate the deployment of renewable energies: first, they lead to a higher local acceptance of the technical installations. Second, RECs lead to lower energy costs and in some cases a more reliable energy supply for their members. Third, Walker argues that RECs help their members achieve ethical and environmental commitments, since it allows them to invest in a more sustainable energy supply, often by procuring sustainable electricity for their own consumption. Finally, RECs enable its members to perform load management (coordinating energy demand and supply), which can lead to significant cost benefits as well (Rieger et al., 2016). Other authors mention the benefit that financial barriers to the deployment of renewables can be overcome through RECs (Morris and Pehnt, 2012). Furthermore, Yildiz (2013) names lower danger of opportunistic behavior as one of the main benefits offered by RECs. The author argues that by giving ownership of their business activities to their members, cooperatives can be a beneficial organizational structure, since they reduce opportunistic behavior of the agents and thereby transaction costs.

As a community of energy consumers and producers, RECs can also facilitate the energy transition through their capability to act as power brokers among their members (Mono, 2018). In fact, in countries where the energy transition has already profoundly shifted the energy landscape, integrating renewables into the existing energy system has become a bigger challenge than increasing the amount of renewable power plants (Brunns et al., 2012). The current system design of “central power stations serving large populations of customers is breaking down” (Collins and Ketter, 2014), which is why the research community is busy developing means to create “smart markets” (Bichler et al., 2010). Meeting this task will require large scale measures that include providing “efficient price signals that motivate sustainable energy consumption as well as a better real-time alignment of energy demand and supply” (Ketter et al., 2013).

2.3. RECs as strategic alliances

The concept of cooperative organizations can be linked to the concept of strategic alliances, which offers interesting implications for the theory on RECs. Varadarajan and Cunningham (1995) define strategic alliances as a “manifestation of interorganizational cooperative strategies [which] entails the pooling of specific resources [...] in order to achieve common goals as well as goals specific to the individual partners.” In fact, RECs composed of companies can also be seen as interorganizational endeavors aiming to pool resources. In most cases, an industrial cooperative would not lead to an all-inclusive cooperative

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