Co2mmunity Working Paper 2.3 - Developing a Joint Perspective on Community Energy: Best Practices and Challenges in the Baltic Sea Region

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Developing a Joint Perspective on Community Energy: Best Practices and Challenges in the Baltic Sea Region

Co2mmunity

Co-producing and co-financing renewable community energy projects

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Summary

Community energy (CE) generally refers to projects in which citizens own or participate in the production of renewable energy (RE). There are different ownership models that citizen use to manage RE projects including cooperatives, housing associations and SMEs. In Europe, CE has attracted the attention of both policymakers and researchers for the role it can have in accelerating the energy transition.

The aim of this working paper was to study CE in the Baltic Sea Region (BSR) to thus identify the main drivers, barriers, benefits, and best practices in CE development. To this end, 11 CE case studies were conducted in 7 countries. The results show that in Denmark, Finland, Germany, and Sweden sociocultural factors and the political economy structure of these countries are more conducive to CE development than in Estonia, Latvia, Lithuania, and Poland. In particular, Germany and Denmark have had most favorable contextual conditions and policies.

The study revealed that the ownership structure influences local acceptance. Community ownership, for example in the case of wind power, is strongly correlated with local acceptance. This is in line with a previous study conducted in Sweden which found that public support for wind farms increases when the wind turbines are fully or partly owned by the local people.

CE leaders have better chances to succeed in local RE projects if they involve the local people in their initiatives. Therefore, engaging early on with the local community is a way to reduce opposition and increase transparency and trust towards an initiative or technology. Community engagement implies constant and open communication, which is needed to generate trust and support. Talking face-to-face, organizing personal meetings and expert presentations to share technical information are good ways to communicate with local people. However, to succeed, it is important that CE leaders have a clear mandate to act on behalf of their community.

Collective decision-making and sharing of benefits are also important success factors. Local acceptance improves when benefits are shared with the members of the local community. This is usually the case with German and Danish CE cases. Often revenues from CE schemes are reinvested in reinforcing local infrastructures, creating new services for local people, or developing other sustainable development initiatives. In the case of Ærø in Denmark, this was organized through a local foundation, which holds shares in the island's wind park. The foundation reinvests its profits in local community projects.

The study also revealed that CE has numerous benefits which include energy costs reduction, financial gains from the energy sales and renting of land, creation of jobs in the construction and maintenance of RE infrastructures, and tax income for municipalities.

Despite the benefits provided by CE projects, they continue to face many challenges. Policy, regulatory, cultural, and financial barriers continue to hinder the diffusion of CE initiatives. A cultural change is also needed in the mindset of policymakers. CE is an expression of a different set of values and needs. Same policies employed to promote commercial projects might not work for RE projects set up by local communities. Moreover, **policymakers need to realize that without the participation of citizens in the energy transition - for example through RE investments - climate change mitigation goals may not be achieved due to local resistance to RE projects**.

Thereby, to promote the expansion of CE, the following actions are crucial:

1. **Provide long-term and low-interest investment funding schemes.** A main barrier is the lack of good financing mechanisms through which community groups can easily raise the needed capital to invest in RE and energy efficiency projects. Low-term and low-interest loans should be provided to RE projects that promote local economic development and social regeneration.

2. **Eliminate regulatory barriers**. For example, the cases from Finland, Estonia, and Poland show that current metering regulation prevent many residents of the housing associations from benefiting from the solar PV self-consumption in their apartments.
3. **Provide economic support.** CE projects are often considered as initiatives that depend on subsidies. Supporting CE projects should not be seen merely as an energy policy issue, but also as a matter of industrial policy. CE projects can provide numerous benefits in terms of job creation, tax income, and local socio-economic development. Investment grants should be provided to RE projects that promote local economic development and social regeneration. National or regional governments could also introduce dedicated finance support schemes for energy communities which helps them during the planning and project set-up phases.

4. **Create a stable policy framework for RE investments**. The citizens in many CE projects make investment decisions with a long term perspective in mind. Therefore, is essential that all investors can operate within a stable policy framework. For example, the community owned district-heating company in Marstal on Ærø in Denmark lost two million Danish crowns (DKK) overnight when a feed-in tariff for electricity from their bio-CHP plant was slashed.

5. **Promote training and access to information.** New competences are needed for energy advisors and experts to explain the possibilities and benefits of RE and retrofitting projects to local residents. It is crucial that citizens have access to technical information and guidance.

6. **Establish the right conditions for support organizations to operate**. The example of the community-owned wind farm in Ærø, Denmark, shows that a lot of CE projects can be made possible with the support of intermediary organization. People often have more trust in these knowledgeable actors when they are not directly involved to technology providers or authorities. Government funding is often needed to establish these kinds of actors.

1 Introduction

Citizen-driven renewable energy (RE) projects across Europe are attracting the attention of both policy makers and researchers' for the role they can play in the decentralization of our current energy system and transition towards a low-carbon society. Community energy (CE) refers to RE projects carried out by citizens for the benefit of a local community. There is a wide range of ownership models and RE technologies that citizens can employ to carry out local energy initiatives (Ruggiero et al., 2018). However, despite this heterogeneity, CE initiatives have one common denominator, which is citizens' interest and participation in local energy development (Hewitt et al., 2018).

Several benefits have been attributed to CE projects (for an in-depth review see Brummer, 2018 and Berka and Creamer, 2018). Two of the most eminently discussed advantages of CE projects are RE acceptance and economic opportunities for local communities. Numerous studies (e.g. Ruggiero et al., 2014; Warren and McFadyen, 2010; Zoellner et al., 2008; Barry and Chapman 2009; McLaren Loring, 2007; Boon and Dieperink, 2014; Wirth et al., 2018) have demonstrated that community ownership, especially in the case of wind power, is strongly associated with local acceptance of RE projects. For instance, in a survey carried out in Sweden, it was found that public support for wind farms grew when they were fully or partly owned by local communities. In addition, the study revealed that consumers (in Sweden) would be willing to pay more for electricity generated by wind power projects in which the local population participated in planning and situating of wind farms (Ek and Persson, 2014).

The economic benefits of CE projects have also been highlighted by several authors (e.g. Li et al. 2013; Phimister and Roberts 2012; Rogers et al. 2008; Okkonen and Lehtonen 2016; Ruggiero et al. 2014). These authors have showed that one of the main benefits of CE projects is economic regeneration. Large RE projects

are often situated in rural and marginalised areas with economic disadvantages. Hence, direct financial gains from the sale of RE, renting of land, and tax income, can contribute to local economic development. Moreover, CE projects can contribute to stimulate the regional economy by creating jobs through the construction and maintenance of RE infrastructures (Brummer, 2018).

Despite the considerable benefits of CE initiatives, especially in terms of reduced opposition to RE projects and the potential for accelerating the energy transition, citizens' renewable energy projects face numerous barriers. As Seyfang et al. (2014) noted, many times the main challenge for CE initiatives is "in simply surviving" (p. 2). In addition, while in some EU countries the role of citizen-driven RE initiatives is well embedded in the national energy policy and vision, in others, CE seems irrelevant.

When looking at the extant literature on CE, several studies have dealt with the factors that prevent the diffusion of CE initiatives (Busch et al., 2019). However, as showed by Busch et al. (2019), CE research builds on cases predominantly from the UK with contributions from a few other countries such as Germany and the Netherlands. Therefore, as Holstenkamp (2017) also pointed out, there is a need for more research on the drivers and barriers of CE in countries that have not been previously studied (e.g. the former communist countries of Central and Eastern Europe). Although several authors have discussed the barriers to the upscaling of CE projects, another limitation of the present literature on CE is the fact that it has not paid much attention to how CE leaders try to overcome such barriers.

Therefore, this working paper aims at studying CE in a new context, the Baltic Sea Region (BSR). To fulfil our research goal, we firstly explore the general situation of CE in the BSR, paying attention to those contextual conditions that can determine (or not) the diffusion of citizen-driven renewable energy initiatives. Subsequently, we identify: (a) the drivers, (b) the barriers (c) the ways in which barriers are overcome, (d) the project benefits, and (e) the best practices in CE development. We will then offer some policy recommendations based on the examined data.

The rest of this paper includes Section 2 that shows our adopted definition of CE, Section 3 and 4 describe our theoretical framework and methodological choices, Section 5 summarises the main findings, and Section 6 draws some conclusions and presents our policy recommendations.

2 Definition of Community Energy

One of our first tasks was to come up with an operative definition of CE. As we showed in a previous working paper (Busch et al., 2019) several definitions of CE can be found throughout the literature. However, one common aspect to all these definitions is the idea that citizens are the main actors behind CE projects. This is often demonstrated by the fact that they own the RE installations (Seyfang et al., 2014). In addition, CE is often understood as RE projects that aim at benefiting a local community (Walker and Divine-Wright, 2008). For all of these reasons, we found that the operational definition proposed by the EU Commission in an early draft of The Renewable Energy Directive for the promotion of RE sources was useful for our study.

However, we emended the fourth point in the original definition (EUR-Lex, 2016) of the EU Commission to highlight the participative nature of CE projects. Hence, we defined CE as any initiative that aims at "the generation, distribution, storage, or supply of energy from renewable energy sources" (EUR-Lex, 2016). Such initiatives can be carried out by various legal entities including SMEs cooperatives, and not for profit organizations. However, CE initiatives need to fulfil the following criteria:

1. The majority of the shareholders or members with voting rights of the entity running the project are natural persons
2. The majority of the shares or participation rights of the entity running the project are owned by citizens who live in the region

3. The majority of the seats in the board of directors or managing bodies of the entity running the project are reserved to citizens who live in the region
4. Participation of local community members, i.e. project outsiders, is made possible

The above definition implies two important things. Firstly, that CE projects are not initiatives run by private companies or municipalities although they may have some degree of citizens' participation. Secondly, that other actors can also be involved in CE projects, for example through co-ownership, but the key idea is that CE initiatives are controlled by private citizens.

3 Theoretical Underpinnings

3.1 Grassroot innovation

In line with Seyfang and Haxeltine (2012) and Hossain (2018), in this study we regard CE initiatives as examples of grassroots innovation for sustainable development. Grassroots innovation can be defined as:

> …innovative networks of activists and organizations that lead bottom-up solutions for sustainable development; solutions that respond to the local situation and the interests and values of the communities involved. In contrast to the greening of mainstream business, grassroots initiatives tend to operate in civil society arenas and involve committed activists who experiment with social innovations as well as using greener technologies and techniques" (Seyfang and Smith, 2007, p. 585).

According to Seyfang and Smith (2007), grassroots innovation has different characteristics compared to conventional market based innovation. In their views, grassroots innovation and market-based innovation belong in two different domains; social economy and market economy, respectively. The social economy gives more attention to the need, values, and interests of people whereas the market economy focuses on rent-seeking behavior. Therefore, in grassroots innovations profit making is subordinated to the fulfillment of social needs.

Seyfang and Smith (2007) believe that grassroots innovation is driven by social need and ideology. Ideologies promoted by grassroots innovators can often be in sharp contrast with established or mainstream views. This is because these views are supported by alternative values such as self-reliant economies rather than market growth (Seyfang and Smith, 2007).

Seyfang and Smith (2007) suggested that grassroots innovation is difficult to diffuse because of its geographical rootedness and the small scale. This point is also supported by Feola and Nunes (2014), Feola and Butt (2015), and Seyfang and Longhurst (2016). They found that the characteristics of the geographic location in which grassroots innovations take place are relevant to the diffusion process. For instance, Feola and Butt (2015) suggested that the long history of left-wing politics, the presence of social entrepreneurism and environmental awareness might have favored the diffusion of the Transition Towns Network and solidarity purchasing groups in central Italy.

Besides the issue of the geographic rootedness of grassroots innovation, another issue discussed in the literature is the way in which the success of grassroots innovations should be evaluated (Hossain, 2018). As grassroots innovations are aimed at the fulfillment of social needs and not rent-seeking, it is therefore difficult to measure their success with the same parameters employed for conventional market-based innovations. Another aspect regarding success in relation to grassroots innovations is the question of how we can learn from them. One way to learn from successful grassroots innovations can be through the extrapolation of best

practices. However, best practices imported by other regions may not work in all contexts (Hossain, 2018). To a large extent, this is because the success of CE initiatives is determined by a mix of favorable contextual factors and agency. As a result, learning from grassroots innovation cases needs to be situated, i.e. evaluated in relation to place and time. For this reason, in this study we consider best practices as general or holistic principles rather than specific procedures in carrying out CE initiatives.

3.2 Factors that contribute to the success of community energy initiatives

In order to understand the factors that play a role in the successful development of CE initiatives and compare countries in the BSR, we developed a theoretical framework based on CE literature (Figure 1). This framework highlights four categories of factors: 1) contextual factors, 2) energy policy, 3) project related factors and 4) actors' characteristics and role. The first category, contextual factors, includes the sociocultural environment and political economy structure in which CE projects emerge. The sociocultural group in turn includes civic engagement, social capital, level of income and education, and tradition of social enterprise/cooperatives. The importance of civic engagement for the success of CE initiatives has been highlighted in Walker and Devine-Wright (2008) and Radtke (2014). The importance of trust, which is reflected by high levels of social capital, has been demonstrated by Walker et al. (2010). Magnani and Osti (2016) discussed the role of disposable income as a factor explaining the lower level of CE development in southern Italy compared to Germany. Similarly, Radtke (2014) found that high levels of income and education correlates with high levels of participation in CE projects. Several authors have attributed the success of CE in Germany and Denmark to a long and established culture of cooperatives and social enterprise (see Simcock et al., 2016).
The political economy structure refers to the overall level of decentralization in the political and economic structure of a country. Important factors in this group are the degree of municipal autonomy and regional financial institutions. The degree of local autonomy enjoyed by municipalities has been considered as one important factor favouring the diffusion of CE projects (Gancheva et al. 2018; Simcock et al., 2016). For example, Braunholtz-Speight et al. (2018, p. 28) stated that: "in countries where community energy has achieved a greater share of energy generation than in the UK, it seems it is often as part of a more decentralised political and economic structure". Along with higher levels of local autonomy, regional financial institutions also seem to play a pivotal role. In this regard, Hall et al. (2016) demonstrated the importance of the German local banking sector in facilitating CE ownership.

The second group of factors is energy policy. In this category, the energy price and type/level of support for small-scale energy production are crucial factors. Energy prices can play an important role in both hindering and stimulating CE development. For instance, Ruggiero et al. (2014) found that high energy prices were one of the main drivers for CE projects in several northern European countries. On the other hand, very low energy prices can constitute a barrier to investments in distributed energy solutions (Ruggiero et al. 2015). Several studies have then discussed the role of various incentive schemes in promoting the growth of the CE sector (for an in-depth review see Curtin et al. 2017). These studies have mostly highlighted the importance of feed-in tariffs (see for example Fleiss et al., 2017) grants and loan schemes (Strachan et al., 2015), and tax incentives (Mey et al., 2018).

The third category of factors refers to the benefits of CE projects and the type of setup and project management adopted in running these initiatives. Numerous benefits have been associated to CE development (for a more detailed view see Berka and Creamer, 2018 and Brummer, 2018). Economic benefits and the role of CE in increasing RE acceptance are two positive outcomes often mentioned in CE literature. Berka and Creamer, (2018) suggested that the benefits or perceived benefits of CE are also some of the most important drivers for CE projects. With regard to project setup and management, authors have pointed out the significance of the ownership structure as a factor influencing local acceptance. For example, Musall and

Kuik (2011) carried out a comparative study between two communities in Germany that adopted different ownership models for wind energy. They found that local acceptance was higher in the community that had adopted a co-ownership model between the local people and a private company than in the other community where a private ownership model was chosen. Authors have also indicated that CE projects encounter less obstacles when project leaders engage early on with the local community. Engaging with the local community contributes to enhance trust (Walker et al. 2010) and can facilitate the process of issuing building permits (Ruggiero et al., 2014). Some studies have demonstrated that networking with both other CE initiatives and influential actors can support the development of CE projects (Seyfang et al. 2014). For instance, Seyfang et al. (2013) in a survey of CE projects in the UK, found that networking with external organizations and other CE initiatives was the second largest success factor for CE projects.

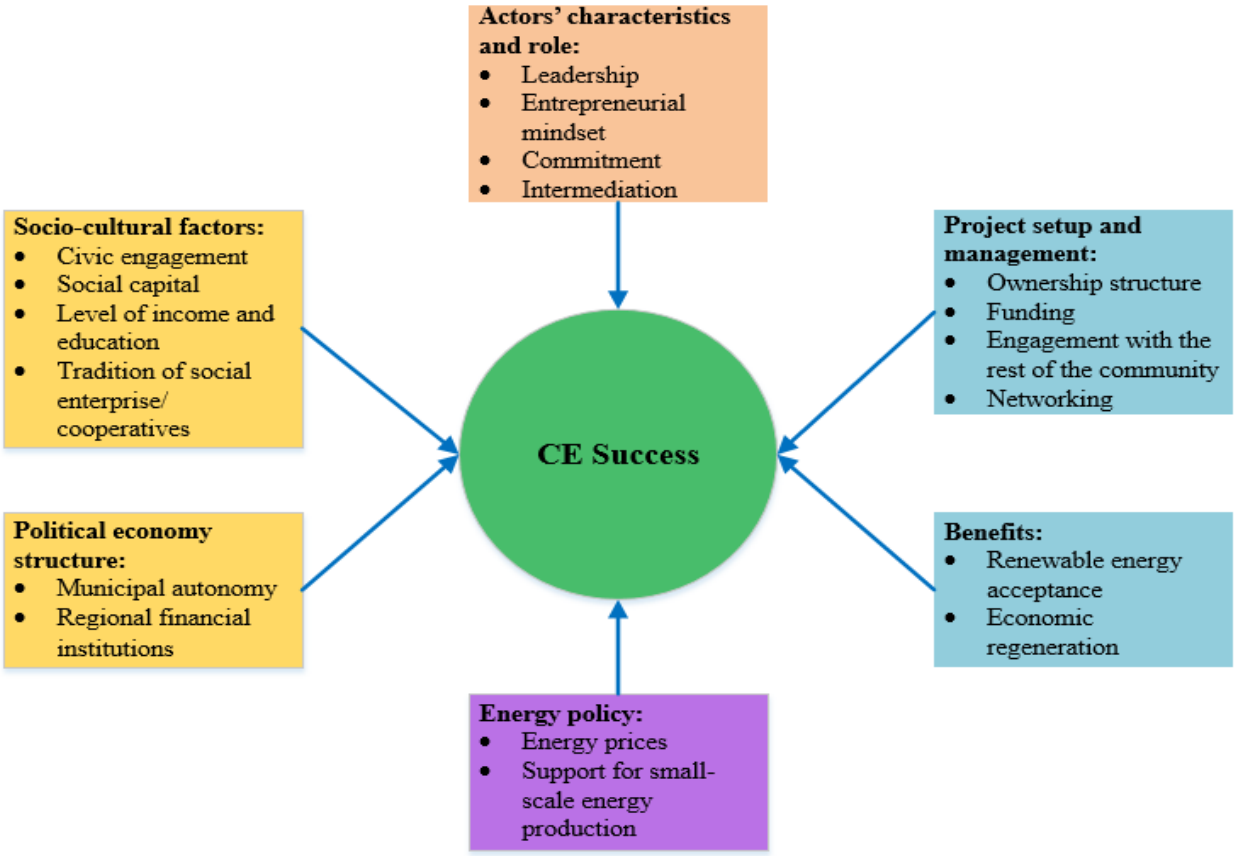

Figure 1. Factors associated with CE success (each colour represent a category of success factors).

The fourth category of factors is related to actors' characteristics and role. Important actor characteristics associated with successful CE projects are leadership, mindset, and commitment. Some studies have showed that leadership skills are crucial for CE development. According to Martiskainen (2017), CE leaders often utilises tacit knowledge, such as the ability to network to find resources that are beneficial to a project. Actors' mindset is also crucial for CE success. For instance, Sperling (2017) demonstrated that the entrepreneurial mentality of the inhabitants of the island of Samsø, Denmark played a considerable role in triggering local RE initiatives. As CE projects are often run by non-profit organizations, they rely heavily on the work of volunteers.

Therefore, dedicated actors are another crucial element for success (Young et al., 2017).
The literature on CE has highlighted the role of specific actors in supporting citizen-driven RE initiatives. Some of the key actors often cited are intermediaries and local champions. Intermediaries are organizations or individuals that facilitate the exchange of information, best practices, and linking of CE projects with the wider world (Hargreaves et al., 2013). In one study on intermediaries supporting CE projects, Hargreaves et al. (2013) found that intermediation activities are more often about creating a "space" for CE initiatives in local, policy, market, and social contexts rather than about developing a single plan for the diffusion of CE.

4 Research Material and Methods

The study follows a case study research design. It relies on 11 case studies of CE projects from the BSR. Table 1 shows the details of the analysed CE cases. The cases were selected by a two-step process. In the first step, the authors requested that all the Co2mmunity project partner list all possible CE cases from their country. This initial search generated a list of approximately 50 possible CE cases. As expected, certain countries had a larger number of cases while others only had a few examples of CE projects. Subsequently, we filtered out all initiatives that did not fall into our definition of CE. To further classify the remaining cases, we applied a maximum variation sampling procedure to select cases with different characteristics. We followed the following criteria to select our final sample:

1. Diversity of renewable energy sources adopted (e.g. wind, solar, biomass)
2. Broad spectrum of activities (both electricity and heat generation)
3. Scale of an initiative (both large and small projects)
4. Different governance models (e.g. cooperatives, associations, housing companies, etc.)
5. Different project outcomes (successful, partially successful, failed)

Our selection process eventually yielded 11 cases of CE projects. Seven out of the eight countries in the BSR were covered. For Latvia, we were not able to find an example of CE initiative that would match our operational definition. To develop a deep understanding of our cases, we conducted in total 37 semi-structured interviews with project leaders, politicians, representatives of energy companies, energy consults, public servants, and municipal officers. The interviews were carried out with two separate interview guides; one for project leaders and one for experts. Through the first interview guide, we gathered information related to the CE initiatives (e.g. project setup and management, financing, project outcomes, network of actors involved) whereas through the second we collected data related to the context in which the initiatives took place (e.g. energy culture, policy and regulatory framework, opportunities for upscaling). In addition to the interviews, we also collected archival data. This data mainly consisted of reports on RE development in the BSR, policy documents, and statistical data about key contextual factors for CE (See section 3.2). Table 2 shows a summary of all the contextual variables we created, their definition, and source.
The transcripts of the interviews along with other written documents were processed with thematic analysis. The qualitative data for each one of the case studies was coded under the themes illustrated in Table 5. All the information from the expert interviews that contributed to understanding the context of the case studies was instead coded under the different countries (See section 5.1).
The identification of the best practices followed Patton (2001) who defined them as helpful principles to guide practice. We followed this definition for two reasons. First, because although the concept of best practices alludes to the "best of all practices" this is rarely the case as often they reflect subjective evaluations given by experts. Therefore, the claim that a certain practice is superior to another is difficult to prove without first identifying all the possible practices and then objectively comparing them with regard to a certain outcome. Second, evidence about something that could be considered as "best" at a certain point in time may change rapidly due to technological and social innovation (Rogers and Williams, 2011).

Table 1. List of CE cases, countries, technologies, and main actors involved.

Name	Country	Type of technology	Main actors involved
Ærø Wind Energy	Denmark	Wind (on and offshore)	Citizens, Ærø Energy and Environment Office
Alpuan Village	Finland	CHP	Members of the small village of Alpua, Local municipal energy company
Citizen Wind Park Wiemersdorf	Germany	Wind	Wiemersdorf village community members; mayor, project manager
Housing Association Vilde 70	Estonia	Solar PV	Members of the housing company
Housing Company Pikku Huopalahti	Finland	Solar PV	Members of the housing company, i.e. apartment owners, researchers
Kagu Commercial Association	Estonia	Solar PV	Municipality of Värska, one municipal company and an NGO plus private individuals
Marstal Fjernvarme	Denmark	district heating (solar+biomass)	The company, municipality, Energy and Environmental office of Ærø
Pszczelna Street Housing Community	Poland	PV	Members of the housing company; Project coordinators and Energy advisor
Smalininkai Community	Lithuania	Wind	Smalininkai village community, municipality, Non-profit organizations; researchers; Private suppliers and contractors, Local Credit Union
Sprakebüll Village	Germany	District Heating (+wind/PV/CHP)	Sprakebüll village community members; mayor, project manager
Törneby Solpark Kalmar Energi	Sweden	PV	The company, municipality

As for the statistical data used, they were first normalized, i.e. a standard score was assigned in lieu of the raw scores we originally had. We normalized the data by first calculating the mean and standard deviation of each of our variables. Then we subtracted from each value the mean and divided by the standard deviation. This gave us the z values ranging from -2 to +2 and with 0 as the mean. Subsequently, we converted our numerical variables into categorical variables.

Table 2. Name, definition and source for each of the contextual variables.

Variable name	Definition	Source
Civic activism	Civic activism refers to the social norms, organizations, and practices which facilitate greater citizen involvement in public policies and decisions. It is measured by using data on the extent of engagement in civic activities, access to sources of media information, levels of civic awareness and information of political matters and concerns, and the extent to which civil society organizations are connected to broader, international	Indices of Social Development by the International Institute of Social Studies.

	networks of civic activity. The latest available values are from 2010.	
Social capital	Social capital refers to the strength of ties to neighborhood and associational life. It is measured by taking data on membership of local voluntary groups, time spent socializing with relatives and in local clubs, attendance of community meetings, and participation in development associations. The latest available values are from 2010.	Indices of Social Development by the International Institute of Social Studies.
Disposable income	The adjusted gross disposable income of households per capita in Purchased Power Standard) PPS is calculated as the adjusted gross disposable income of households and Non-Profit Institutions Serving Households divided by the purchasing power parities (PPP) of the actual individual consumption of households and by the total resident population. The latest available values are from 2016.	Eurostat
Market share of cooperatives	As a variable for the degree of penetration of the cooperative model in a certain country, we used data on farmers cooperatives. Farmers cooperatives are the most traditional model of cooperative therefore they are a good proxy for the assessing the strength of the cooperative model. The latest available values are from 2010.	Bijman et al. (2014)
Fiscal autonomy	This variable refers to the taxation powers of local governments. It represents the extent to which municipalities have the power to impose taxes on their citizens. This is an important characteristic of local autonomy. The latest available values are from 2014.	Ladner et al. (2016)
Electricity prices for households	Electricity prices for households per kWh expressed in Purchased Power Standard (PPS). The latest available values are from 2018.	Eurostat
Historical policies	This variable represents the strength of the policy support mechanisms for CE production over the years. It was created by the authors of this paper based on an extensive review of the main policy mechanisms introduced by each of the studied countries between 1991 and 2017. The level of policy strength was evaluated on a five-level Likert scale: low, low/moderate, moderate, moderate/high, high.	IEA/IRENA joint policy and measures database
Current policies	This variable represents the strength of the current policy mechanisms for CE production. It was created by the authors of this working paper based on multiple sources. It refers to policy mechanisms that were in force in 2018. The level of policy strength was evaluated on a five-level Likert scale: low, low/moderate, moderate, moderate/high, high.	Interviews with experts, REN21 (2018); RESLegal (2018); EurObserv'ER (2018).

Our categories indicate the strength of each of our contextual variables, they are *low*, *moderate,* and *high*. To create these categories, we calculated the 25th and 75th percentile of each variable. All the z values falling in the 25th percentile were assigned to the category *low*, whereas all the z values falling in the 75th percentile were assigned the category *high* and all the values in between the category *moderate*. To sharpen our

categories, we indicated if a value was at the edge of two categories by indicating both the lower and higher category. For instance, if the 25th percentile of civic activism was 0,45 and a country obtained a score of 0,44 or 0,46, it was categorized as *low/moderate*.

5 Results

5.1 Analysis of the current status of community energy in the Baltic Sea Region

In this section, we present the findings of the interviews we carried out with experts to understand the context of our case studies.

5.1.1 Denmark, Germany, and Sweden lead the way

Denmark is one of the leading countries when it comes to CE projects. The country has good wind conditions due to its topography as a flat country with a very high share of coastline. In addition, there has been strong support from the national government for RE. Denmark is also an important energy hub for Europe with electricity being exchange between central Europe and the Nordic countries.
The country has always had a governance system that supported decentralised energy production with a strong role for municipal government. This might be because Denmark comprises of a great number of islands. In this setting, municipalities are the main actor when it comes to energy planning and they often work closely together with local citizen groups and companies (Oteman et al., 2014).
Favourable policies, especially high feed-in tariffs, led to a peak of CE projects around the year 2000 (Mey and Diesendorf, 2018). During that time, around 80% of Denmark's wind turbines were in the hands of individual owners or cooperatives (Bauwens et al., 2016). This has led to a strong culture of collective ownership and many CE projects (Islar and Busch, 2016; Mundaca et al., 2018). A number of policy changes and a liberalisation of the electricity market led to an increasing concentration of RE production by utilities and investors. They were able to provide the financial means to repower many of the wind projects with newer and more expensive technology (Oteman et al., 2014). Despite this drop, CE projects are still an important part of the Danish energy sector. In 2014, the estimated number of CE projects was between 600 and 700, making Denmark second only to Germany. Of these projects, 300-400 are wind power projects (Bauwens et al., 2016). Apart from wind turbines, a great number of small-scale district heating projects exist, with many of them having existed for decades. Historically many of them originally relied on fossil gas or waste incineration but in recent years they have switched to biogas or wood chips (Oteman et al., 2014). Over the last few years, solar energy has started to catch up due to technological progress thus making the panels considerably cheaper.
Apart from feed-in tariff, Denmark has a number of policies in place that help local communities to benefit from the development of RE projects. The unique concept of KommuneKredit helps CE project to gain access to favourable loans. For instance, if a CE group can present a solid business plan, the group can apply for a "grønne lån" (green loan), which is one of the loan models under the KommuneKredit scheme. In the case of bankruptcy, if such scheme is granted, the hosting municipality becomes liable for the economic operation of the CE project. There are three different categories of green loans, best serving slightly different setups of CE projects. The first is that KommuneKRedit scheme makes it much easier for CE projects to access bank loans at preferential conditions compared to regular market rates. The second was the implementation of a municipal monopoly policy for heat production, which favoured local district heating networks based on bio-energy from the country's big agricultural sector. This policy was abandoned with the beginning of the year 2019. The third is the Danish energy law rules that onshore wind projects have to offer 20% of the shares to the local population to ensure local ownership. This was done to lower resistance to such projects (Oteman et

al., 2014). In addition, the Danish law allows for favourable forms of collective ownership and associations, which can be used as legal formats for CE project.

Citizen groups are faced with a number of challenges when setting up CE projects. A general problem is the changing legal framework in which associations have to operate. The change from a feed-in tariff for RE electricity to a premium and then back to a feed-in tariff made planning with a long-term perspective difficult. The change in legislation in regard to heat provision with the year 2019 stripped municipalities of their monopoly position, which in turn will make it harder to find solutions and come to a consensus among all house owners. In addition, government financial support for CE projects is lower than it was 15-20 years ago, thus putting a strain on new CE projects. In the field of wind energy, the technological development has taken a path towards bigger and more expensive turbines, often in an offshore setting. Despite the KommuneKredit scheme, such investments are often not possible for a group of citizens or a community due to higher financial requirements. Therefore, when it comes to decisions on repowering wind turbines in already existing settings, many CE projects will now run the danger of being bought out by investors.

In Germany as in Denmark there is a strong support for RE. The country has established ambitious targets and adopted important measures to promote the energy transition. Germany has also enjoyed widespread public support for community ownership of RE generation. Currently there is a large variety of CE initiatives which are mostly constituted as energy cooperatives formed by local farmers. Energy cooperatives typically operate within municipal energy company networks (Stadtwerke) and supply both heat and electricity. In 2016, there were 1024 registered energy cooperatives across Germany. The majority are wind power-based projects. However, recently solar cooperatives have dramatically increased in number, from only four in 2007 to over 200 by 2010. Besides supporting energy cooperatives, Germany has recently started to explore new forms of CE generation through the concept of virtual power plants to facilitate the integration of decentralised CE generation (Gancheva, et al. 2018).

Several factors have contributed to the success of CE projects in Germany. Some of the most important success factors include a well-established environmental and alternative energy movement, a long tradition of cooperatives and associations, a high level of leadership, and municipal autonomy (Gancheva, et al. 2018). In addition, institutional factors such as the feed-in tariff system and the German public bank KfW have played a crucial role in providing local investors with long-term and low-cost financing (Gancheva, et al. 2018). In Germany, regional development banks have also been important players in the development of CE projects (Braunholtz-Speight, et al. 2018).

Focusing on the Northern German regions, currently one of the main obstacles for CE project development is the overproduction of RE and lack of storage solutions. Another barrier is bureaucracy which includes lengthy and complex paperwork for various procedures. Moreover, the replacement of the feed-in-tariff for an alternative auctioning system has resulted in a dramatic reduction in the number of newly established CE initiatives. Consequently, citizens' energy ownership of RE capacity has seen a 4% decrease between 2012 and 2018 (Agentur für Erneruerbare Energien, 2018).

Nonetheless, opportunities for CE development are continuing to exist in Germany due to the fact that it has a long tradition in working with energy cooperatives. The window of opportunity is open for policy makers, politicians, and RE intermediary organizations to increase pressure on multi-national energy companies and to support the expansion of transmission networks and curb the decline of Germanys domestic wind industry.

Sweden has very good contextual conditions, but its overall level of CE projects is not comparable to Germany and Denmark (Magnusson and Palm, 2019). This limited development of CE might be due, besides to the low energy prices, to the monopoly of municipalities in electricity and heat production that lasted until 1996 (Kooij et al., 2018). For example, 283 of 290 municipalities in Sweden have a district heating system, but a recent study only identified 10 CE heat projects (Magnusson and Palm, 2019). In addition, the Swedish electricity sector is oriented towards a centralised production system. The majority of the country's electricity comes

from nuclear and hydro energy. In recent years, wind energy claims a growing share of the Swedish energy mix (REN21, 2017).
The quota system introduced in the beginning of 2000s stimulated several community wind power projects. Today wind is the main technology used by Swedish energy cooperatives. After 2010, the growth in the number of wind power cooperatives decreased due to the introduction of changes in the building permit regulation and the reducing electricity prices, which made CE investments less convenient than before. Besides, wind power cooperatives, in Sweden there are also several small-scale hydro projects that are owned by energy communities. These are are mostly found in the north of the country.
The governance system imposes high administrative hurdles such as fees (grid connection and transmission fees) and energy taxes on producers thus posing a veritable challenge to CE groups. However, the energy tax is lower for electricity production from renewable sources as long as the amount of electricity fed into the grid stays at low levels (the exact limit depends on the kind of RE technology). CE projects are often facilitated by existing organisations such as housing associations and local energy producers. Another way how CE projects are carried out in Sweden is through eco-villages (Magnusson and Palm, 2019). Promoting CE projects as a way to increase the fight against climate change is not considered an effective strategy since the Swedish electricity mix already has very low emissions levels of only 13g/kWh and only 2% of electricity coming from fossil sources (OECD, 2018).

5.1.2 Finland has a potential for expansion

Finland has significantly less community energy initiatives than Sweden, Germany, and Demark. We identified approximately 100 projects with the bulk of the Finnish CE initiatives being biomass-based heat production (Ruggiero et al., 2015). In the 90's, several municipalities on the eastern side of the country privatised their heating services. During that time, RE cooperatives were established to provide heating to the municipalities through small combined heat and power plants or heat boilers. These cooperatives were often formed by forest owners (Okkonena and Suhonen, 2010). However, after the privatization of municipal heating services, very few CE projects have been established.
Regarding wind power, Finland only has two wind power cooperatives, one of which was inspired by the Swedish wind cooperative model. In recent years, there has been increasing interest around solar PV production in apartment buildings. However, several barriers continue to exist hindering the expansion of CE projects. One of the main issues is that the current regulatory framework does not adequately support self-consumption in apartment buildings as well as in all kinds of energy communities that generate power within their property grid through jointly owned power plants. Currently the only policy mechanism that incentivizes small-scale RE generation in households is the exemption of electricity tax for the power produced for self-consumption through power plants smaller than 100 kW. Investment support is not available for local communities, cooperatives, or the housing sector who invest in RE or energy efficiency projects. The existing investment grants are available only for companies, municipalities and farmers. Therefore, most of the CE projects have to rely on bank loans or EU funding programs such as LEADER in rural areas.
Despite the regulatory and policy barriers, CE has good opportunities for development due to the fact that in Finland there has been a long tradition of communal work (called in Finnish talkoot) and cooperatives. RE production from CE schemes could help the country to reduce its share of fossil fuel, uranium, and electricity imports and increase energy self-sufficiency. Furthermore, in the near future CE initiatives could contribute in increasing and financing the RE capacity needed to replace fossil fuels.

5.1.3 Estonia and Lithuania making progress

Estonia still heavily relies on shale oil for energy production. However, over the last few years more efforts have been made to expand the country's share of RE. CE, in general, does not fit well into the Estonian mindset,

which turned against any collective form of ownership after the fall of the Soviet Union. Estonia introduced a feed-in tariff, which currently supports small power plants up to 50 kW. In addition, Estonia also created a renovation fund to increase the energy efficiency of old buildings and an investment grant scheme covering up to 30% of the investment costs for energy self-production projects. However, despite the level of relatively good incentives, especially for housing associations, CE projects have not taken off due to unfavourable sociocultural conditions, very low energy prices, lack of information, and high cost of investment capital for CE projects.

Opportunities for the expansion of CE projects do exist and are connected with the reduction of the high share of shale oil in electricity production and the new energy efficiency regulation for buildings.

As condition for joining the EU, Lithuania had to shut down its one and only nuclear power plant. Consequently, its share of imported electricity increased dramatically. To increase its energy self-sufficiency, Lithuania has recently adopted an ambitious energy strategy that intends to meet 70% of the country's final electricity consumption from domestic sources by 2030. Within this strategy, RE communities are expected to play an important role. The energy strategy also recognises the need to create dedicated policy mechanisms to support RE communities such as in the case of apartment buildings.

Lithuania already has a net metering scheme to support residential and commercial solar PV. However, much like the case of Estonia, Lithuania also has cultural barriers preventing the popularization of CE initiatives. In Lithuania, the idea of collective ownership evokes memories of the collective farms (kolkhoz) in which people were forced to work during the Soviet Union. During the Soviet time, civil society was heavily repressed and as a result, civil activism is lower than in Western Europe (Aidukaitė, 2013). Besides cultural barriers, other factors slowing down CE initiatives are lack of information, the low-income conditions, and difficulties in borrowing money for CE projects. However, as Lithuania has an ambitious plan for domestic RE production, CE can play an important role in fulfilling Lithuania's self-sufficiency goal.

5.1.4 Poland and Latvia lag behind

Poland's economy is still heavily dependent on fossil fuels and favours large state-owned energy companies over small RE projects. This combined with an outdated cooperative legislation, unstable energy laws, and limited political support for small-scale RE production has created an unfavourable setting for CE development. CE initiatives as we have defined them in this paper are very rare in Poland. However, the government has introduced and intensively promoted its own concept of CE, namely the energy cluster. The current Polish legislation considers energy clusters as a form of local energy communities, which can also include private companies. These clusters aim to meet energy demand with local energy supply, including RE sources.

As is the case of most post-communist economies, cultural and financial barriers prevent the growth of CE projects in Poland. In particular, one reason for the lack of energy cooperatives in Poland is the fact that the cooperative model is still negatively associated in the minds of citizens with state socialism promoted by the communist regimes before 1990 (Beckmann et al., 2015). Besides unfavourable sociocultural conditions, other hindering factors are citizen's lack of financial capital and high cost of investment capital for CE projects. Furthermore, as in the case of Finland, there are numerous regulatory barriers including the inability to self-consume electricity produced from RE installations in single apartments within a block of flats.

Opportunities for CE development are predominantly linked to the development of energy clusters. Most energy clusters have either been established by local authorities or businesses, with the degree of citizens' participation sparse. Despite the clear limitations of energy clusters, they can be seen as an opportunity and positive development to promote a transition towards a low carbon-economy within Poland's highly centralized and coal-based energy system.

For Latvia, we were not able to find any project that would match our definition of CE and consequently no interviews were conducted in that country. However, some initiatives carried out by municipalities, with the

participation of citizens and companies do exist in Latvia. These initiatives are often related to energy renovation of buildings. More information on the general situation of CE in Latvia can be found on the website of Community Power (https://www.communitypower.eu/en/latvia.html).

5.2 Analysis of contextual factors influencing community energy development in the Baltic Sea Region

The results from the analysis of the statistical data about the strength of contextual factors and energy policies influencing CE development in the BSR is presented in this section. In particular, Table 3 shows the strength of sociocultural and political economy factors whereas Table 4 illustrates the strength of the energy policy factors. As it can be noted, there is a clear divide between the countries on the eastern and western side of the Baltic Sea. In Denmark, Finland, Germany, and Sweden, sociocultural and political economy structure factors are consistently stronger than in Estonia, Latvia, Lithuania, and Poland. This confirms the findings of the interviews presented above and can be attributed to the different historical legacies and level of economic development between these two groups of countries. Table 3 also shows that Germany has the highest level of fiscal autonomy, which also confirms the importance of municipal autonomy in the diffusion of CE initiatives.

Table 3. Strength of sociocultural and political economy conditions in the BSR's countries.

Countries	Civic Activism	Social Capital	Disposable Income	Market Share of Cooperatives	Fiscal Autonomy
Denmark	moderate/high	high	moderate/high	high	moderate/high
Estonia	low/moderate	moderate	low	low	low/moderate
Finland	high	moderate/high	moderate/high	high	moderate/high
Germany	moderate/high	high	high	moderate/high	high
Latvia	low	low	low	moderate	low/moderate
Lithuania	low	low	low/moderate	low	low/moderate
Poland	low	low	low	low	moderate
Sweden	high	high	high	moderate/high	moderate/high

Table 4 shows that although some countries like Finland and Sweden would otherwise have good contextual conditions, they have had less favourable energy policies than the leading CE countries. Moreover, Finland and Sweden have very low electricity prices, which makes it even harder for citizen-driven renewable energy projects to become profitable. This also confirms the results from the interviews. Denmark and Germany's current energy policies are less favourable than what they were in the past. This probably reflects the maturity of the CE sector in those countries. Table 4 also tells that in Estonia and Lithuania current policies are becoming more favourable to small-scale renewable energy production.

Table 4. Strength of historical and current energy policies in the BSR's countries.

Countries	Electricity Prices for Households	Historical Policies	Current Policies
Denmark	high	high	moderate/high
Estonia	low	low	low/moderate
Finland	low	low	low
Germany	high	high	moderate
Latvia	low/moderate	low	low
Lithuania	low/moderate	low	low/moderate
Poland	moderate	low	low
Sweden	low/moderate	moderate	low/moderate

Figure 2 presents a classification of the studied countries based of the results presented above. The horizontal axis represents the strength (high or low) of contextual factors whereas the vertical axis the strength (high or low) of the current energy policies. Denmark, Germany, and Sweden have both favourable contextual conditions and energy policies. On the contrary, Poland and Latvia have both poor contextual conditions and energy policies. Estonia and Lithuania have taken steps in creating more conducive energy policies for small-scale energy production, but CE projects are held down by unfavourable contextual conditions. Finland has good contextual conditions but lacks adequate policy support for CE. As cultural factors change slowly, we could expect that Finland could move to the upper right part of the chart more rapidly than Estonia and Lithuania if energy policies would become more favourable to CE development.

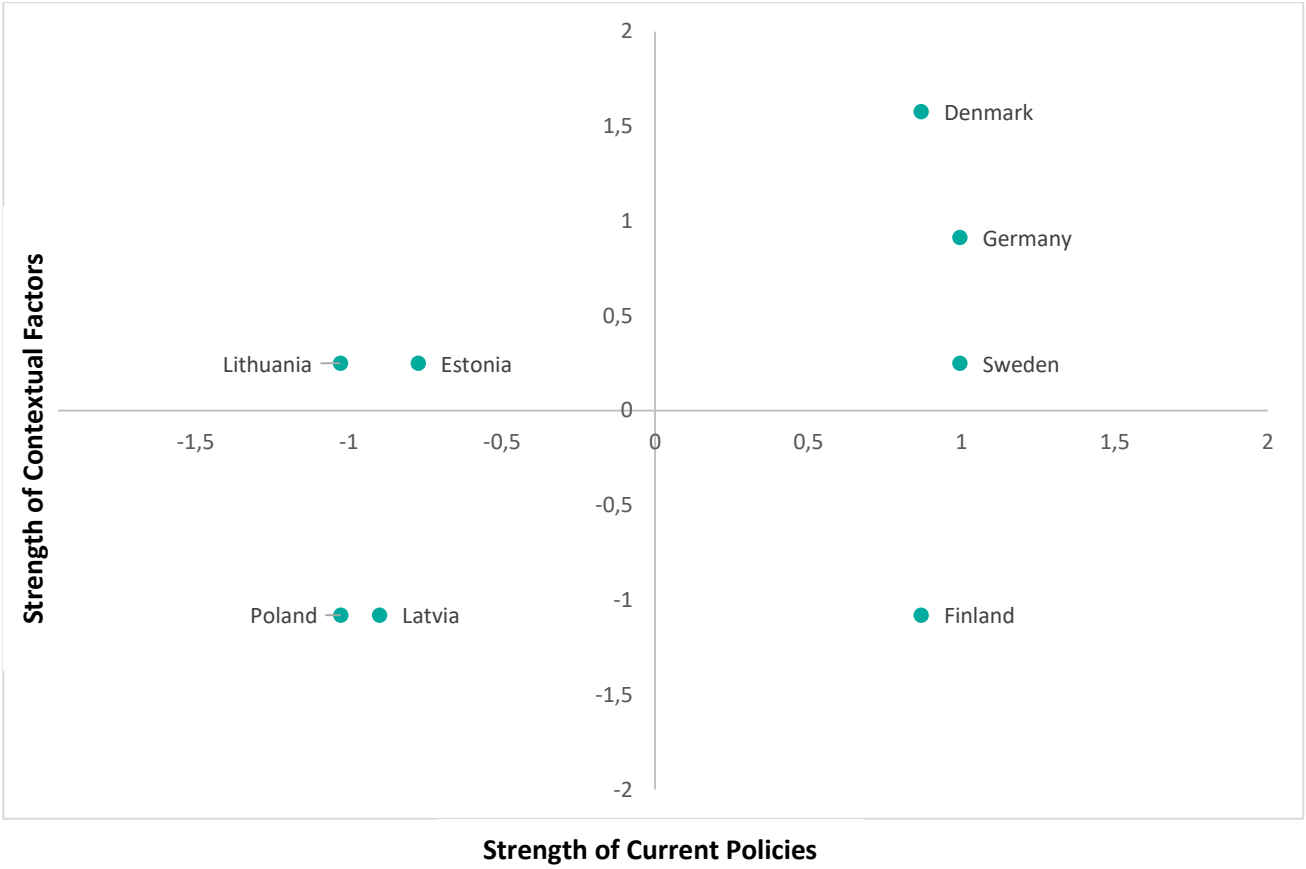

Figure 2. Country comparison based on the strength of contextual factors and current policies

When reflecting on the possibilities to transfer CE practices within the BSR, Figure 2 can be very useful. Compared to policies, the cultural and political economy structure of a country can change over longer periods of time, although these two factors are often intertwined. Accordingly, Finland could be an emergent CE country if regulation would be tuned towards CE projects along with the introduction of support mechanisms. In addition, Poland and Latvia may soon decide to introduce policies to promote citizens' renewable projects but as in the case of Estonia and Lithuania, incentives alone may not be sufficient to trigger significant improvements without also cultural change.

5.3 Analysis of policy development in the leading community energy countries

In the next sections, we review the key policy development steps in the three leading CE countries Denmark, Germany and Sweden since the success of CE is due in part to favorable energy policies.

5.3.1 Denmark

Denmark has a long tradition of active energy policy, which was triggered by the first oil crisis in 1973. The diffusion of local RE initiatives during the oil-crisis period and energy austerity in the 1970s was predominantly driven by farmer's cooperatives and local authorities (Sovacool, 2013) as a move to reduce the dependency on oil. Policy measures imposed in the 1970s and 1980s included income tax exemptions from wind turbines, fixed feed-in-tariffs, guaranteed grid connection, purchase obligations, and priority transmission for wind energy. In the 1980s and 90s wind policies were very supportive of local cooperatives, ensuring minimum prices through feed-in tariffs and 40% investment subsidies for construction (DEA, 2012). By 1990, there were over 2000 local cooperatives and private owners using turbines (Oteman et al., 2014).
The feed-in tariff scheme was replaced in 2001 by RE portfolio standards and an emissions trading scheme, in an attempt to control the support costs for renewables (Oteman et al., 2014). As a result, the competitiveness of wind turbines decreased and in 2003 a premium was set. However, in 2007 the Danish government realised that a trading market approach was inadequate to reach its ambitious goals for RE. Hence, the market-based support system was reversed back to a feed-in tariff system.
A further key policy mechanism was the Danish Renewable Energy Act, which was first adopted in 2009 and contains several measures to promote the development of on-shore community wind turbines. This law gave local residents the option to purchase wind turbine shares. It promoted local ownership by introducing a new subsidy scheme for local co-operatives and imposing a co-ownership requirement for municipal actors.
Other policies targeting specific technologies relating to the CE sector include the 1993 feed-in tariff system, the 1997 Wind Energy Co-operative Tax Incentives for small scale wind power production and the 1998 Net Metering for Small-scale PV. However, the feed-in-tariff system remains the core and most prominent policy support mechanism of CE.
Denmark's energy policy was clearly forced onto the green path by high energy prices in the 1970s. Further demonstrating that a clear and concise combination of energy strategies supported by various technology specific energy policy mechanisms can help support the CE sector. Hence allowing communities to collectively invest in wind energy contributed to the remarkable result of 70-80% of wind turbines owned by communities by 2013 (Basse, 2013).

5.3.2 Germany

As a federal republic, Germany operates a relatively decentralised energy planning system. Local governments are empowered to set their energy mix through control over planning rules and the provision of local energy supply, including the prioritisation of renewables. Although there is a high degree of state involvement in the

strategic direction of energy markets, its structures allow a range of market actors including local communities, commercial, and municipal companies to play a role.
In the past, Germany has provided strong and stable policy support for RE. The government's comprehensive energy transition strategy, the 'Energiewende', became prominent in 2011 after the Fukushima nuclear disaster. The core legislative instrument underpinning the Energiewende is the Renewable Energy Act (Erneuerbare-Energien-Gesetz – EEG), which sets very ambitious targets. For example, Germany plans to acquire at least 40% to 45% of its power from renewables by 2025, and at least 80% of its power from renewables by 2050 (Agora, 2015). This legal requirement to transform power generation to nearly all renewable sources is one of the main pillars of Germany's energy transition.
In the past, Germany's energy policies have clearly concentrated their efforts on targeting specific technologies and financial incentives related to the CE sector. Notable policies include the 1999, 100 000 Roofs Solar Power Programme for the installation of PV systems larger than 1 kW and the 1999 Preferential Loan Programme offered by the Reconstruction Loan Corporation (KfW). Moreover, the state-owned development bank, KfW has also offered inexpensive financing or low-cost capital, among others, also CE investors.
However, the key policy behind the emergence of CE in Germany was the law on the feeding of RE into the electricity grid. This law (Stromeinspeisungsgesetz) entered into force in 1991 and guaranteed a minimum purchasing price for energy produced from renewable resources.
In 2000, the feed-in tariffs were reviewed, expanded, and improved. The amendments to the Renewable Energy Sources Act in 2004 and 2008 ensured priority access to the grid for RE sources. As a result, from 2008 to 2014, the number of new energy cooperatives established increased exponentially. The last key revision to the feed-in tariff law was conducted in 2016 to coordinate a switch from the feed-in tariff system to auctions. Currently, feed-in tariffs remain in place for solar and wind below 750 kW (Morris and Pehnt, 2016).
The German government's decision to introduce an auctioning system in 2014 for nearly all RE sources is a fundamental shift from a system based solely on feed-in tariffs. The introduction of tendering has created more barriers to citizens' energy because the bidding processes are too complicated and costly for many small citizen-driven projects.

5.3.3 Sweden

During the 1990s, most of the Swedish energy policy efforts were focused on reducing CO2 emissions, and this was done by introducing CO2 taxation in 1991 and supporting RE investments through various projects (Swedish Energy Agency, 2017). During the 90s, Swedish energy policies focused on decentralizing energy decision makers to local authorities and municipalities. This laid the foundations for local investments in the field of clean green energy. Programmes such as the 1998 Local Investment Programme (LIP) granted support for investments made by municipalities in cooperation with local companies and civil society organisations.
In 2000, the support for small-scale electricity production focused its efforts on encouraging market penetration of small-scale RE production, rather than integrating CE in the national energy framework. Until the year 2000, most of the policy measures provided only indirect support for the CE sector (Magnusson, 2019).

After 2000, Swedish policymakers started giving more direct support to CE projects. The 2003 KLIMP (Climate Investment Programme) program is an example of a measure that helped the development of local heating systems. Furthermore, the 2007 Grant for Local Authority Land Use specifically focused on upscaling community wind power by supporting wind power development among local authorities and municipalities.
The most important policy instrument in promoting renewable electricity production is the electricity certificate system that was introduced in 2003. **The electricity certificate is a market-based support system for renewable electricity production.** For each MWh of renewable electricity produced, the producer gets one certificate that can be sold on the open market. The electricity certificate system was

introduced to promote a more cost-effective system to incentivize the production of renewable electricity and replace the grant and subsidy systems. RE subsidies and tax reliefs formerly focused on supporting either private citizens or corporations. For example, while non-community actor investments in solar PV received substantial subsidies (up to 30% of investment) support for CE investment was largely ignored (Swedish Energy Agency, 2019).

5.4 Summary of the findings from the case studies

In this section, we provide a summary of the main findings from the case studies regarding the drivers, barriers, and benefits of CE projects. Due to the lack of space, the details of the case studies are not included in this report, but they are available on the Co2mmunity website (http://co2mmunity.eu/outputs/community-energy-cases).
Table 5 offers an overview of the main results. As it can be seen, we often found that before a project started there were favourable conditions that contributed to the success of an initiative. One recurrent factor was the presence of a regional or national plan or vision for increasing RE or energy self-sufficiency. Another often-mentioned favourable pre-condition was previous initiative experience involving citizens participation, co-ownership or collective action for local development. Furthermore, social capital, suitable ownership models, cultures of cooperatives, and the presence of pre-existing networks were other favourable pre-conditions mentioned by the interviewees.
With regard to the drivers of the studied CE initiatives, the case studies show that the pursuit of local economic development was one of the most important drivers. This finding can probably be explained by the fact that most of our cases are from rural areas where depopulation, withdrawal of public services and rural to urban migration are recurrent issues. Along with the possibility to promote local economic development, another important driver was the possibility to reduce energy costs. The presence of support mechanisms for CE projects such as feed-in tariffs or grants were also mentioned in several cases but their role as a driver of CE projects seemed more strongly emphasised in the countries on the western side of the Baltic Sea. Other less often-mentioned drivers of CE projects were environmentalism and the desire to show the “right example”.

The analysis of the case studies revealed that CE projects face barriers in many countries, including those that have traditionally had more favorable conditions for CE development. The two most frequent barriers were on the one hand policy and regulation, and on the other, cultural factors. In some countries, energy regulation does not make self-consumption economically feasible or does not allow the creation of virtual power plants through which citizens can participate in energy provision or demand response schemes. Moreover, policy frameworks tend to be unstable and disrupt investors’ trust and long-term investment planning. One example was the change in the feed-in tariff law that harmed some CE projects in Denmark. Moreover, in some countries that have had favorable policies for CE projects like Germany and Denmark, support schemes do still exist, but they have been significantly scaled down. In some other countries, such as Finland, there are no incentives at all nor a vision about the role of CE production in the overall national energy strategy.
Incentive schemes have been recently introduced in some Baltic states but strong cultural barriers hold down CE initiatives. For instance, in the cases from Lithuania and Estonia we found that there were both an overall strategy and some policy support for small-scale RE production. The existing incentive schemes have not been effective in promoting CE development due to an emerging culture leaning towards individualism, the negative stereotypes from the Soviet time associated to collective ownership, and a lack of information and trust in the authorities. In the cases from Estonia and Finland, we also found that the low electricity and heat prices were considered as another obstacle to the diffusion of CE initiatives.
Besides policy, regulation, and cultural barriers, other important barriers are the somewhat limited knowledge about CE and its possibilities, administration costs due to long and time-consuming procedures (e.g. in

acquiring building permission), opposition by other community members, and the lack of good financing mechanisms through which community groups can easily and affordably raise the needed capital to invest in RE and energy efficiency.

Despite the numerous barriers to CE projects, we also found that CE activists try different ways to overcome them. These include creating new revenue models, engaging with the local community, carrying out a project with a commercial partner, and experimentation. The first approach consists in finding new ways how a project can generate revenues. This was the case of the Alpua Village in Finland that rented or utilized the village school for other activities as another mean to generate income. In the Swedish case, the project developer Kalmar Energi addressed the problem of low profitability by underlining other beneficial aspects of the CE project. They managed to make it very easy and convenient for consumers to become prosumers. At the same time, they appealed to people's environmentalist ideas and simultaneously engaged in green place branding activities for energy produced in the region.

Engaging with the local community was a way to reduce opposition and increase transparency and trust towards an initiative or technology. We found this approach in the case of the housing association in Estonia and the two cases on the island of Ærø. In some instances, regulations would support only on-site self-consumption. A solution sought to overcome this limitation in the case of the Kagu energy cooperative was to establish a partnership with a company who would purchase the generated power through a power purchase agreements (PPA). Lastly, in countries were outdated regulation would hinder the feasibility of certain types of CE projects, local actors embarked on demonstration projects to test new concepts and raise the attention of policymakers. The Pikku Huopalahti housing company from Finland adopted this approach to contribute to the removal of barriers for self-consumption in apartment buildings.

As for the benefits of the studied projects, we often found that CE initiatives achieved the goal they had set. The direct benefits of CE projects were increased market value of renovated apartments, strengthen community spirit, income from energy sales and renting of land for RE projects, skills development, and reduction of energy costs. The case studies also demonstrate that CE projects not only have positive outcomes for the people participating in an initiative, but they also have broader effects on the local economy. Positive effects of CE projects for the local economy included job creation in the construction and maintenance of RE infrastructures, tax income for the municipalities, green branding and policy tourism, and increased local competitiveness through new local know-how. In many cases, the revenues generated by a RE project were spent in the local community to strengthen the infrastructures, create new services or invest in other RE projects.

Table 5. Summary of findings from the case studies

Case	Favourable Contextual Factors	Drivers	Barriers	Actions to Overcome Barriers	Project Benefits
Ærø Wind Energy	Previous experience with wind energy projects Suitable location for wind production Suitable ownership model Local know-how	Repowering of old turbines Economic development Environmentalism Show the good example	High upfront investment NIMBY	Creation of a local foundation Information and direct communication	Strengthened community spirit Green branding Positive impact on the economy
Alpua Village	Past experience with an electric cooperative	Depopulation Closing of the local school Economic development Reduce energy costs	Lack of support schemes Lack of information Profitability Low energy price	Create alternative ways to generate extra revenue	Reduced energy costs Kept in use the local kindergarten and prevented families to live the village Created jobs Strengthened community spirit
Citizen Wind Park Wiemersdorf	Suitable ownership model State's ambition to increase wind power Regional specialisation in wind power technology	Economic development Feed-in tariff Profitability	Lack of information Lack of experience Bureaucracy	Know-how and expertise were simply purchased from external companies located in the region	Reduced energy costs Increased municipal income Founding of local renewable energy company
Housing Association Vilde 70		Renovation grants Reduce energy costs Improve indoor climate	Low energy price Lack of trust in state's support mechanisms Historical background Lack of understanding of the project benefits	Project leaders went door-to-door to explaining the benefits of the project.	Increased the quality of indoor climate Reduced energy costs. Increased 10% value of the apartments Positive impact on the economy

Housing Company Pikku Huopalahti		Environmentalism Show the good example	Energy regulation Value added tax on self-generation	Participate in a pilot project to test a new IT system that allow multifamily buildings' residents to benefit from their solar PV production	Reduced energy costs Reinvested surplus in improving the building's yard
Kagu Commercial Association	Sense of community Network of municipalities promoting development and cooperation Regional plan promoting energy self-sufficiency Suitable ownership model	Depopulation Economic development Reduce energy costs Feed-in tariff Show the good example	Energy regulation Grants only for on-site production Low feed-in tariff Costs of grid connection	To find a company that could buy the generated electricity and situating the PV installation on the company's property.	There are not yet benefits because the project is still in the planning phase.
Marstal Fjernvarme	Existing district heating network	Reduced energy costs	Scepticism in the technology	Step-wise construction of the project	Climate-friendly heat Reduced energy costs Green branding
Pszczelna Street Housing Community	Suitable location for solar PV production	Installation grant Preferential loan conditions Reduce energy costs	Low citizen awareness of renewable energy Lack of support mechanisms Bureaucracy	Project leaders focused their efforts on seeking and applying for grant funding.	Reduced energy costs Increased apartment value Educational effect Surplus reinvested into renovation fund
Smalininkai Community	State's ambition to increase wind power Wind power projects in the region	Economic development	Lack of experience Low energy productivity High upfront investment High-interest loan	Found all the possible ways to understand how energy productivity could be increased	No direct benefits but precious learning experience.

Sprakebüll Village	Long-standing tradition of wind power projects in the region Sense of community Suitable ownership model	Economic development Feed-in tariff Show the good example Profitability	Lack of information Lack of experience Strict environmental laws	Determination and motivation to learn from existing projects and understand how previous projects were implemented	Increased municipal income Reinvestment in local energy infrastructure and services (e.g. district heating system, bike lanes, playground) Founding of local PV company
Törneby Solpark Kalmar Energi	Suitable location for solar PV production Previous experience with wind CE project	Environmentalism Economic development Green branding Strengthening customer relations	Low energy prices Property laws	Appealing to non-economic arguments Support from actors in the community Creativity	Strengthened community spirit Green branding Raised awareness

5.5 Best practices identified

From the analysis of the case studies, we identified five key best practices. They are community engagement, cooperation, collective decision-making, expertise acquisition, and benefits sharing. Engaging with the community refers to the fact that CE leaders have better chances to succeed if they try to involve the members of a larger community (e.g. the other residents of an apartment building or the rest of the people living in the same area) in their initiative. Naturally, not all the members of a community will play an active role in a CE project, but it is important, nevertheless, that the group of people in the leadership role has a clear mandate or acts on behalf of their community. Community engagement implies constant and open communication, which is needed to build trust and support. Talking face-to-face to other community members, organizing personal meetings and expert presentations to share technical information were common ways to communicate with a local community and project stakeholders. Local champions often played a key role in community engagement processes by showing leadership and mediation skills so that the community could solve conflicts.

Cooperation with key partners is another example of best practice. Almost all the CE cases analyzed had some sort of cooperation that helped them in implementing their projects. The most recurrent type of cooperation was between technology suppliers and community groups. Companies providing RE equipment offered the technical know-how which the communities often were lacking. For instance, the community-owned wind farm on the Danish island of Ærø established a long cooperation with the wind turbine producer Vestas. The partnership was beneficial for both parties as the wind farm received good maintenance from Vestas and Vestas received the permission to use the existing turbines for technology testing and education of the company's staff.

Another type of cooperation was with funders. Similarly, to the type of cooperation with technology providers, cooperating with funders provided the missing expertise on project funding rules and procedures. Examples of cooperation were also found between community groups and the local network companies or energy retailers. For instance, in the case of the Alpua Village in Finland, the local energy retail company cooperated with the Alpua Village and other small-scale energy producers to sell locally produced electricity under the Farmivirta brand. The cooperation between the housing company in Helsinki and the local network company also demonstrates the importance of partnership with influential stakeholders that can contribute to the success of an initiative.

A common characteristic to all the CE projects we studied was collective decision-making. Collective decisions were taken when important choices were to be made, e.g. decisions regarding a bank loan or a specific technical design. However, the project stage at which a collective decision was necessary varied across adopted legal entity models and countries. This approach turned out to be successful in guarantying that project proposals would get enough support to be executed and to overcome resistance.

In some instances, CE leaders had the technical expertise for carrying out a RE project. However, often they did not have all the necessary skills to implement an initiative. For this reason, some projects first started with smaller initiatives to then scale-up to larger projects once they had acquired the missing knowledge and resources. In other words, there were instances in which CE actors experimented with a certain business model before expanding to more members. This was for example the case of the Kagu Energy Cooperative in southern Estonia. In other cases, it was essential to access people with technical knowledge and experience in energy projects. Sometimes, when specific knowledge was missing, it was purchased on the market from specialized companies. However, developing or acquiring crucial expertise was a dynamic process that occurred at different project development stages. For instance, even in the case of Sprakebüll Village where people had long experience with CE initiatives, projects leaders were working hard in finding technical solutions to the problem of how to store power during periods of overproduction.

The last best practice identified was benefits sharing. Like in the case of collective decision-making, this aspect was also found in most of the CE cases. Project benefits were shared both internally, e.g. strictly with the people who had joined a project, and externally with the members of the local community. This was particularly the case of the German and Danish CE projects. Project revenues were reinvested in the local community to reinforce the local infrastructures, create new services for local people, or develop other initiatives for sustainable development, all of which contributed to increase support for CE initiatives. In the case of Ærø, this was organized through a local foundation, which holds shares in the island's wind park. This foundation reinvests its profits through local community projects. However, sharing of the benefits of local RE projects can only occur if the community decides not to sell out its generation potential to the first best investor. Instead, communities have to develop a shared strategy to negotiate the deal for the local people.

6 Conclusions and Policy Recommendations

The main goal of this working paper was to identify the challenges and best practices for CE development in the BSR. For this purpose, we developed a theoretical framework based on the extant CE literature to explain the key factors that contribute to the success of CE initiatives. In this framework, contextual factors, energy policy, project related factors and actors' characteristics and role, play an important role in the diffusion of CE initiatives. To fulfil our research goal, we then conducted 11 case studies of CE initiatives from seven countries in the BSR. The main results show that CE projects face numerous challenges in most of the countries, even including those with more favorable policies like Germany and Denmark. In line with previous research, we found that policy, regulatory and financial barriers hinder the diffusion of CE in the BSR. Furthermore, our study demonstrates the importance of cultural barriers especially for the countries on the eastern side of the Baltic Sea. However, we also found that CE actors do not remain idle but try creative ways to overcome barriers; for example, through collaboration with external partners, experimentation, and business model innovation. Apart from the case of Germany and Denmark, CE initiatives have a marginal role in most of the countries in the BSR. To promote a broader diffusion of CE initiatives we consider the following actions to be crucial:

1. **Create a stable policy framework for RE investments**. Many CE projects make investment decisions for several decades. For them, it is essential that they can operate within a stable policy framework. For example, the CE district heating company in Marstal on Ærø in Denmark lost two million Danish crowns (DKK) overnight when a feed-in tariff for electricity from their CHP plant was slashed.
2. **Eliminate regulatory barriers**. The three housing association cases from Finland, Estonia, and Poland show that current metering regulation prevent residents from benefiting from solar PV. Self-consumption of solar electricity in apartment buildings is only limited to the electricity needed to power the common parts of building, excluding the apartments. Moreover, simplifying and making quicker building permit and grid connection procedures are other crucial steps.
3. **Promote training and access to information.** With the advancing of the energy transition, new competences are needed for energy advisors and experts to explain the possibilities and benefits of RE and retrofitting projects to local residents. Additionally, it is crucial in ensuring that energy communities have access to technical information and guidance.
4. **Provide early stage funding.** National or regional governments should introduce dedicated finance support schemes for energy communities to help them during the planning and project set-up phases. Early stage funding is essential for conducting feasibility studies and accessing specialist consultancy services that can transform an idea into an easy to implement project plan.
5. **Provide long-term and low-interest investment funding schemes.** The experiences of Germany and Denmark, who are two of the leading CE countries in Europe, show that CE projects need dedicated financing instruments such as those provided by the KfW in Germany. These might include low-

interest loans guaranteed by the state to secure inexpensive financing and low-cost capital for CE groups.

6. **Support CE projects considering the benefits for society.** Investment grants and/or preferential low-interest loans should be provided to CE projects that promote local economic development and social regeneration. CE projects are often considered as initiatives that depend on subsidies. However, CE initiatives also provide numerous benefits in terms of job creation, tax income, and local socio-economic development and these benefits should be taken into account. Thus, supporting CE should not be seen merely as an energy policy issue but also as a matter of industrial policy. In addition, as CE projects contribute to RE acceptance, minimum quota for CE ownership in large commercial projects should be established to reduce local opposition to RE projects.
7. **Promote cultural change.** This study demonstrated that although some countries have introduced more favourable policy and regulatory frameworks for CE projects, this alone is not able to trigger a broad diffusion of CE initiatives. Especially in the countries on the eastern side of the Baltic Sea, cultural factors prevent them from developing the suitable conditions for CE development. A cultural change is also needed in the mindset of policymakers. CE is an expression of a different set of values and needs, which may not be fulfilled with the same policy instruments employed to promote commercial projects. Policymakers need also to realize that without citizens' participation in the energy transition, ambitious climate goals may not be achieved due to local resistance to RE projects.
8. **Establish the right conditions for support organizations to operate**. The example of Ærø shows that a lot of CE projects can be made possible if intermediary organization exist. People in the municipalities often have more trust in these knowledgeable actors or institutions if they are not directly linked to authorities such as the municipality. National funding programs (in the past in Germany and Denmark) can enable municipalities or regions to establish these kinds of actors.

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