Community led Renewable Energy and its impact on Rural Development: A Content Analysis

Mohammad Nazrul Islam
MA Candidate
Environmental Policy Institute
Grenfell Campus, Memorial University of Newfoundland

Energy is the life "blood of the society" because it is playing the most crucial role for human existence and their advancement on this world (Mercer, 2016 p.n.1). Hydrocarbon including different fossil fuels (oil, natural gas, coal) is the main sources of energy supply (IEA, 2015). However, fossil fuels are also responsible for climate change like global warming, ozone layer depletion, and other greenhouse effects (IPCC, 2014; Gregory, 2003). As the result of these climatic incidents, human civilization has been facing the tricky situation for their sustaining. Therefore, the key challenge of the 21st century is to build a sustainable community for the present as well as future generation. Again, due to the recession of global economies, governments from across the world are seeking solutions for a sustainable recovery which will ensure long-term socio-economic and environmental benefits for the people (Payne, 2009). In those circumstances, green economy particularly renewable energy can provide a key opportunity to achieve these goals.

Renewable is a term used for forms of energy which are not exhausted by use over time. It means that the renewable resources can be regenerated or renewed in a relatively short time. The International Energy Agency (IEA) defines renewable energy as the energy which is derived from natural process and is replenished within a short period of time (IEA, 2018b). Renewable energy is often called 'low-carbon' or 'zero-carbon' energy because it is generated from natural sources such as sunlight, wind, or waves. Unlike conventional fossil-fuel derived energy for instance, coal, oil and natural gas, the resources that produce renewable energy do not run out if properly managed and so may be considered sustainable (Hossaina et al., 2017, Renewable Energy Projects Handbook, 2004). Renewable energy is closely associated with the concept of sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The World Energy Council (2004), in its publication "Energy for Tomorrow's World – Acting Now!" (ETWAN) has translated the challenges for sustainable energy development into three goals of accessibility, availability and acceptability. Accessibility requires provision of reliable and affordable energy services for all; availability addresses the quality and reliability of the service, stressing its long-term continuity determined by the right energy mix, while acceptability addresses environmental goals and public attitudes. To ensure development according to these principles of sustainable development, renewable energy is expected to provide an increasingly important contribution to supply diversification, emissions reduction and energy sustainability over the longer term (Renewable Energy Projects Handbook, 2004). Thereby, energy sufficiency, economic growth and environmental mitigation are most common driving factors for expanding renewable energy projects in the pursuit of sustainable regional development (Dornan & Shah, 2016; Sen and Ganguly, 2017). However, different studies also show that many renewable energy projects have failed to ensure sustainability (Karunathilake et al., 2016; Gasparatos et al., 2017; Boksh 2015; Kunz et al., 2007). For instant a large-scale biofuel production can threaten biodiversity due to the land area and water it needs (Gerbens- Leenes et al., 2009; Erb, Haberl, and Plutzar, 2012; Pedroli et al., 2013; Immerzee et al., 2014). Again, a large-scale biomass-based energy production competes with food production for agricultural land and water (Gerbens-Leenes et al., 2009; Dornburg et al., 2010), which could lead to increased food prices, causing major problems for the poorest people in rural area and potentially resulting in societal unrest (Bellemare, 2014). Similarly, a large Hydropower projects can also release large quantities of greenhouse gases as the original biomass under reservoirs rots, when the water level fluctuation increases and they become large catchment areas of organic matter and nutrients (Deemer et al., 2016). Hydropower projects also often result in displacement of the local populace, and are therefore problematic from a societal sustainability point of view, especially if the negative consequences are faced by poor, indigenous populations while economic benefits are reaped elsewhere (Zarfl et al., 2015).

Furthermore, most of the cases renewable energy projects are deployed in countryside areas, but managed and controlled from urban centers where corporate headquarters and the technical and financial decisions lie. Therefore, local people do not financially benefit from these projects as the revenues including taxes go to the urban or provincial/national budgets (Ceborary et al., 2017). Furthermore, the current renewable energy system is dominated by a centralised and one-way supply system where most of the energy authorities have no obligation to sell power or electricity regionally (Huang et al. 2015). Energy producers are often not interested in reinvesting their profit in host communities (Allen et al., 2012, Wiersma & Wright, 2014). It is also creating local distrust and resource conflict among the local groups (Cebotari, 2017, Rashad & Ismail, 2000; Pedersen et al. 2009, Cebotari, 2017). Thus, the question is that, why renewable energy projects are not successful in reaching the expected outcomes and what are the alternative solutions for these problems? One possible answer to these questions is concealed on project's ownership and management structure (Sen and Ganguly, 2017). In that context community governance, renewable energy could be deemed as an appropriate solution because it leads a collective action for local residences. Local inhabitant can smoothly tackle various challenges related to energy project and actively engage with this project for ensuring their regional development.

Community governance renewable energy addresses sustainable development through collaborative management in energy production (Walker, 2008; Walker &Wright, 2008). Collaborative or Co-management refers the sharing of responsibilities, rights, and duties between the primary stakeholders, in particular, local communities and the nation-state; a decentralized approach to decision making that involves the local users in the decision-making process as equals with the nation-state. Through the Community-led renewable energy projects, the local residents can participate in resource management, ownership, and control. Large numbers of study focus on the perception, driven and different barriers of community-owned renewable energy in different European countries including Germany, Denmark, Scotland, England as well the Canada and USA (Blanchet, 2015; Walker and Baxter, 2017; Jami and Walsh, 2014; Shlee, 2015).

This study is primarily a concern on the features of community led renewable energy project. These `main objectives have spilled on several specific objectives such as to find out the significance of renewable energy particularly for rural development; to know the key differences between the tradition investor-owned centralized renewable energy and community based decentralized renewable energy; and to explain features of community owned renewable energy including ownership, institutional context and local impacts. Summative content analysis technique is used as a methodological tool. Typically, content analysis is used for analyzing miscellaneous documents (Zainal, 2007). During the summative content analysis in qualitative research, the researcher has identified few keywords, meaning or content for understanding certain situation or meaning. These keywords either derived from literature review or researcher interest (Hsieh and Shannon, 2005). There are few key themes “Ownership”, “Decentralized Energy”, “Renewable energy” and “Community owned” are used for the unit of analysis. The paper used various secondary sources including journal articles and books as well as a desk-based study that draws on web-based sources including Memorial University of Newfoundland’s e-resources and google scholars.

2. Importance of Renewable Energy in aspect of Sustainable Rural Development

Energy is the critical issue for sustainable development because all human activities like food production, transportation, use of goods and services, security directly related to the energy. However, most of the energy comes from non-renewable hydrocarbons which are deposited under the surface of the earth over the millions of years. Statistics show that 80% of the energy consumption depends on the different fossil fuels including oil, gas, coal (IRENA, 2017), however, the proven reserve of these fossil fuels have been decreasing day by day (Hache, 2018). Consequently, if the trend of present energy consumption is remaining to constrain until 2050, human civilization will need two to three piles of earth for meeting their continuous energy demands (Bassam, 2012). On the other hand, a less amount (around 17%) of the global energy supply found from the different non-emitting sources such as nuclear power, biofuels (IEA, 2015b). Yet, resource insufficiency also crucial factor for nuclear energy since nuclear power production relies on uranium which is very scarce in nature (Harjanne and Korhonen, 2019). Again, nuclear energy production has an incalculable risk to human health and environment if any incident will happen. Fukushima and Chernobyl are two best examples of nuclear devastating accidents. Due to the Fukushima accidents, the radioactive fallout contaminated more than 870 km2 of the area, whereas 220000 people were displaced for Chernobyl disaster (Rosen, 2012). Therefore, it is essential to consider other safe and sustainable energy sources rather than the nuclear power. Moreover, two billion people, who are living in rural are, have no access to sustainable energy sources until now and they are using different traditional biomass or wood also responsible for unexpected more than four million deaths due to the indoor pollution in each year (World Bank, 2015; Bassam, 2012). Therefore, for human existence, for the future generation, we should reduce relay on traditional fossil fuels and deem to be other alternative energy sources. Decarbonise power production could be the best way to ensuring sustainable energy security.

Two-thirds of the world's poor population lives in rural areas (ILO 2012). Important aspects of rural areas are the improvement of road transport infrastructure to facilitate the access to rural areas, the access to electricity and water for domestic use and internet and health care services. There are many other problems facing rural areas including the lack of employment that provides decent income. Greening the rural economy is an important and necessary step to reduce rural poverty and improve well-being of the population. The renewable energy is a source of new jobs and economic growth, but also a way to amplify the challenges of environmental and energy security (McManus et al., 2012; Schouten et al., 2012). To provide an opportunity for rural areas agriculture needs a long-term strategy, a framework of complex and flexible regulations. In return, it will generate firstly a place new income for local authorities in rural areas as an opportunity for further investment, jobs and entrepreneurial opportunities (Steiner and Cleary, 2014). Secondly, it will generate an increased innovation and adaptation capacity of technologies and existing products. Third, it will generate more dynamic local communities as a result of accumulation of new technologies and skills, learning capacity growth, innovation and adaptation of the workforce to labor market needs (OECD 2012). The development of businesses based on renewable resources in rural areas can be advantageous for low-income population with unused high level of education or for underused agricultural land that can be suited for systems of capturing different types of energy. Such new green investments can generate jobs in construction, operation, supervision, distribution of renewable energy which can provide increased opportunities for using human capital and higher incomes for the rural population. The renewable sources of energy, thereby, could be better solutions for comparatively remote and underdeveloped region of any country (Savale, 2015). It is especially suitable for the remote rural areas from where the young and skilled person particularly in European villages and rural cities, often leaves due to economic crisis of the region. In such areas, the development of renewable energy can be considered as a new economic branch. Literatures show that, the development of renewable energy is contributing to the rural community in five different perspectives such as by creating jobs, by creating new revenue sources, by enhancing community capacity, by promoting new innovation and by reducing the costs of energy (Lehr et al., 2012, Moreno and Lopez, 2008; Wustenhagen et al. 2007; Savale, 2015).

1. New income and revenue sources: Renewable energy increases the tax base for improving service provision in rural communities (Wustenhagen et al. 2007). It can also generate extra income for land owners and land-based activities (Shamsuzzoha et al. 2012). For example, farmers and forest owners who integrating renewable energy production into their activities have diversified, increased, and stabilized their income sources (Sen and Ganguly, 2017).

2. Employment and Entrepreneurship opportunities: Renewable energy creating new employment and business opportunities especially when a large number of actors are involved and all activities are embedded in the local economy (Koinuma, 2012). Although RE tends to have a limited impact on local labor markets, it can create some valuable job opportunities for people in regions where there are otherwise limited employment opportunities (Wyse, 2018). Renewable energy can create direct jobs, such as in operating and maintaining equipment (Sharm et al., 2012). However, most long-term jobs are indirect, arising along the renewable energy supply-chain such as manufacturing, specialized services, and by adapting existing expertise to the needs of renewable energy (TREC, 2016).

3. Innovations in products, practices and policies in rural areas: In hosting renewable energy, rural areas are the places where new technologies are tested, challenges first appear, and new policy approaches are trialed (Wei et al., 2010). Some form of innovation related to renewable energy has been observed in different European Countries (OECD, 2012). The presence of a large number of actors in the renewable energy industry enriches the "learning fabric" of the region (Hache, 2018). Small and medium-sized enterprises are active in finding business niches as well as clients and valuable suppliers (Mey, 2017). Even when the basic technology is imported from outside the region, local actors often adapt it to local needs and potentials.

4. Capacity building and community empowerment: As actors become more zrn and innovate is enhanced (Moreno and Lopez, 2008). Several rural regions have developed specific institutions, organisms, and authorities to deal with renewable energy deployment in reaction to large investment and top-down national policies (Greenius et al. 2010). This dynamic has been observed both in regions where local communities fully support renewable energy and in regions where the population is against potentially harmful developments (OECD, 2012).

5. Reasonable energy: Renewable energy provides remote rural regions with the opportunity to produce their own energy particularly electricity and heat, rather than importing conventional energy from outside (Brummer, 2018). Being able to generate reliable and cheap energy can trigger economic development.

3. Sustainability of Centralized vs Decentralized Renewable Energy

The sustainability of the renewable energy depends on its scale, motivation and organizational form (Harjanne, and Korhonen, 2019). Typically, renewable energy systems operate under two main models: centralized and decentralized. Centralized renewable energy model is the legacy model focused on more corporate empowerment. The term decentralized systems, on the other hand, refers to integrated distributed energy resources, such as local renewable generation located on existing buildings or on vacant land close to the point of electricity consumption. It is allows control and ownership of renewable energy resources to reside in the community, rather than in corporate hands. This model, thereby, represents community empowerment.

3.1 Centralized Renewable Energy

The 'centralized' concept is associated with physical infrastructure, such as telecommunication, electricity networks and water, non-physical networks such as social networks, or as a planning and governance mode (Guia,and MacGilla, 2018). Some researchers define centralized networks as ones in which only a small and exclusive set of actors hold positions of power and control, regardless of their density (Sperling et al. 2011, Guia,; MacGilla, 2018, Schaube et al. 2018) . Generally, centralized energy system refers to large-scale power stations and a 'national grid' infrastructure to distribute electricity to centers of demand that are mostly dominated by a few powerful utilities (Huang et al. 2015). The centralized renewable energy model, therefore, is focused on the large, utility-scale, centralized generating systems—big solar PV plantations and large wind farms—which are the products of concentrated financial and economic power (Tokar, 2015). This renewable energy model has some advantages for instance easily integrated with existing regime, utilization of relatively mature and low-risk technologies, including end-use technologies; better understood by communities and industry. The centralized renewable energy model uses extended high-voltage transmission networks, super-grids, to connect renewable megaprojects (CSI., 2010; García-Olivares, 2015) including remotely-sited large solar photovoltaic arrays and wind projects to populous load centers (Farrell, 2011). A variety of factors appear to be driving the growth in both size and number of energy megaprojects, including perceived economies of scale, localized accumulation of expertise, increasing regulation that disproportionately affects smaller projects, competition with national energy companies, as well as a belief that such projects represent modernity and high cultural achievement (Guia,and MacGilla, 2018; García-Olivares, 2015). This energy model strategy seeks to decarbonize the existing economy rather than transform it (Weinrub, and Giancatarin, 2015). Consequently, these projects serve the interests of the politically and economically powerful, empowering corporations rather than communities (Weinrub, 2017). Only on rare occasions are centralized energy developments the result of democratic action of communities. In most cases centralized energy development represents the interests of powerful economic forces aided by a corporate state apparatus unfettered by democratic restraints. Ratepayers pay for these large-scale projects and associated transmission for many years and land is often acquired through use of eminent domain (Farrell, 2011). Energy democracy advocates argue that the so-called "NIMBY" (i.e., not-in-my back yard) response to large-scale renewable projects is more constructively viewed as an appropriate response by citizens who recognize democratic potential in solar and wind energy yet find these technologies developed under a centralized model. In many cases this model appears to deliver lucrative profits to absentee owners who already possess significant economic and political power (Weinrub, 2017; Farrell, 2011). Failing to share benefits of new energy infrastructure may inspire ongoing resistance and slow or prevent the deployment of renewable energy systems (Farrell, 2011; Weinrub, and Giancatarin, 2015). Even remotely-sited large-scale projects meet public resistance by a globally mobilized citizenry.

3.2 Decentralized Renewable Energy

By contrast, the decentralized renewable energy model enables community-based renewable energy development (Weinrub, 2017). It allows for the new economic and ecologically-sound relationships needed to address the current economic and climate crisis (Weinrub, and Giancatarin, 2015). Climate and economic justice strategy not only the shift from fossil-fuel power to renewable power, but also the shift from corporate control of energy systems to more democratically controlled energy system (Cebotari, 2017). Democratic control of renewable energy resources, in particular, is facilitated by the fact that renewable resources are distributed: solar, wind, biomass, energy conservation, and energy efficiency are resources found to some degree in all communities (Weinrub, 2017). Small- and medium-scale renewable systems, deployed at the scale of small town or rural villages, are expected to reduce overhead including capital and administrative costs, reduce energy costs, reduce transmission and distribution losses, increase grid reliability (Kerr et al., 2017; Munday et al. 2011), and reduce incidence of blackouts (Magnaniet al., 2017). Smaller operations reduce the distance between generation and point of use, and allow users to generate and sell energy (CSI, 2010). Again, community-scale projects require smaller land areas, minimizing the need for costly transmission and distribution lines and use of eminent domain (Rogers et al, 2012; Seyfang, 2013). Distributed generation is also expected to significantly reduce financial risk and allow deployment of renewables at a faster pace (Sen and Ganguly, 2017). According to energy democracy advocates, decentralized energy supports decentralization of authority, favoring community control and ownership of renewable energy resources rather than extending the legacy of corporate ownership (Weinrub, and Giancatarin, 2015). Decentralized authority means greater self-reliance, local approval and planning, as well as greater local accountability and responsibility for social and environmental impacts of electricity use (Tokar, 2015; CSI. 2010). By retaining economic benefits locally and sharing benefits more broadly, the distributed renewable energy model is expected to build a stronger political constituency that will support the expansion of renewable energy and oppose fossil fuel systems (REN21,2016; TREC, 2016).. Decentralized energy systems consist of three kinds of distributed energy resource components including decentralized electricity generation, demand reduction, and system balancing (Weinrub, and Giancatarin, 2015).

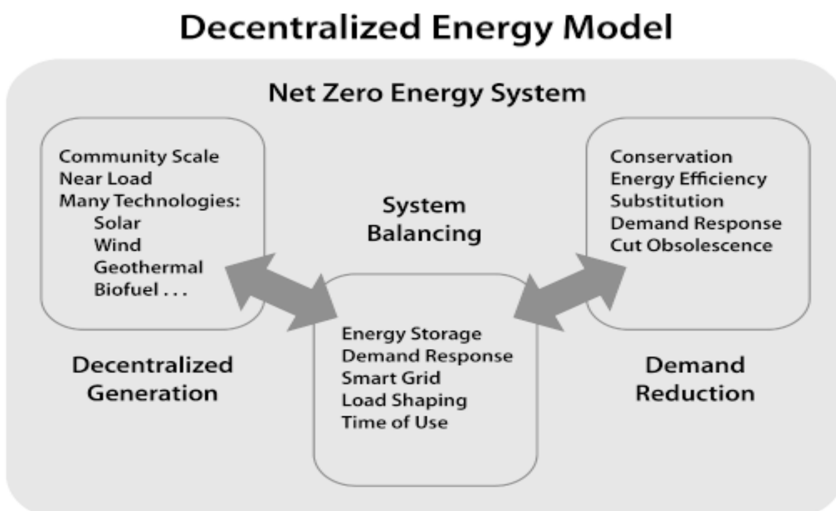

Figure 1: Model of decentralized renewable energy (source Weinrub, and Giancatarin, 2015)

Table 1: A key comparison between community based decentralized renewable energy project and investor owned centralized renewable energy project Source: Weinrub, A. (2017)

	Community Based Decentralized Renewable Energy	**Investor Owned Centralized Renewable Energy**
Principle structure	Nonprofit public organizations	For-profit private agencies or corporations
Purpose	Key purpose is to maximize community benefits for example GHG reduction, economic growth, green jobs, rate stability, social justice and equity, local ownership, management and control of energy, and	Purpose is, by law, to maximize shareholder returns

	other community specific benefit goals.	
Investment	Net electricity revenues remain in the community to expand services, invest and reinvest in new assets, build reserves, or reduce rates.	Net electricity revenues leave the community as utility profits and shareholder dividends.
Energy Model	Follow on an energy services provider model: provides optimum energy services to community such as cuts waste, reduces demand, lowers overall system costs of electricity service.	Follow on a utility model: buys and sells electricity to ratepayers; the more electricity delivered, the better
Implement Model	Implements a decentralized renewable energy model: local distributed energy resources are developed to optimize the electricity system, provide stability, and achieve net-zero energy	Implements a centralized renewable energy model: emphasis is on expanding infrastructure investment
Governance	Encourages strong community participation in shaping the program and in governance	Decisions made by utility executives and state regulatory bodies serving the utilities

4. Community Based Renewable Energy (CBRE) as a form of decentralize renewable energy

Typically, community refers a group of people who are living in a certain territory and have community sentiments. According to Brint (2001), the community consisted of common societal norms and customs within small groups of people who have familiarity with each other and they also have various interpersonal emotional relationships. Each community has three important features including community spirit, cooperative tradition, and locality and responsibilities (Wirth, 2014). Community owned renewable energy is often conceptually connected with decentralized, renewable energy generation. Whether it is solar power, wind energy or combined heat and power energy, these forms of energy generation have a good scalability in common. They can be erected by local communities rather than only by large energy providers (Brummer, 2018). Community renewable energy, therefore, is used as a collective term for all activities that deal with the generation of energy in a community setting. This includes a very wide variety of activities, ranging from rural communities setting up their own renewable energy production technology for instance wind turbine, solar plane, biomass plant and so on , to neighborhoods engaging in collecting waste for energy plant, and small or large energy investments allowing participation of the surrounding community (Hache, 2018). Community led renewable energy projects or initiatives more focused on reducing, managing, generating or purchasing energy (DECC, 2013b). Thus, community ownership or control and the community benefiting are important to these projects (DECC, 2014f). According to the Cox and Bryant (2012) community renewable energy is consisting with relatively small utility-scale renewable energy projects that sell power to the wholesale market and that are developed and owned primarily by local investors. Community led renewable energy projects are therefore utility scale renewable energy projects which are implemented with significant involvement of the community (Mey, 2017). On the other hand, Hargreaves et al. (2013) address three key features of community-based renewable energy; first one is multidimensionality because this type of energy project has not relied on only one particular technology or aspect of behavior. Secondly, community energy project has to bring together diverse groups of people for common community purposes and overcoming all the structural challenges to ensuring sustainability. Thirdly community energy projects are accelerating local knowledge and networking as well as finding appropriate solutions in local and regional context. Thereby, community led renewable energy projects must show a number of principles: i) distributed and local renewable energy technology of any kind, ii) community ownership, iii) initiation and planning by the community, iv) creation of several benefits for the community, v) substitution or integration in the general energy system and vi) geographical proximity of participants (REN21,2016; TREC, 2016; Behrendt, 2014; Greenius et al., 2010). Another key consideration that needs to be defined is the size of the community owned renewable projects. It can vary depending on the geographical and financial circumstances as well as the grid capacity, power demand, regulary restrictions (Mey, 2017; Susser and Kannen, 2017). Typically, the size is measured by the rated output of the power plants and starts from the low kW area and can go up until the multi megawatt area. A community owned renewable project needs to reach utility scale. This means different sizes for each technology used. While the size of roof-top PV projects is often naturally limited to the size of the roof and can therefore not exceed the kilowatt range, utility wind energy projects nowadays start not lower than 300 kW and can reach more than 100MW of capacity. Bio energy projects mostly use the combined heat and power output and their capacity reaches from 300 kW to about 10 MW. (Behrendt, 2014).

Community renewable energy has proven to be a diverse field: having emerged in different contexts and having been driven by a range of motivators, it encapsulates a diversity of technological, organizational, economic and social features (Hicks and Ison, 2018). Different technology and scale opportunities are available to different communities on the basis of their resource availability for example solar, wind, hydro or bioenergy resource in the desired vicinity of the projects (Hicks and Ison, 2018). Physical factor, thereby, is a fundamental to the viability of a particular community based renewable energy project (Magnaniet al., 2017; Denis & Parker, 2009; Kerr et al., 2017). Technology factors, such as cost, also affect which technology a community pursues. Technology factors are perhaps the most universal: technology maturity, modularity and cost are fairly consistent across countries and communities (Cowell et al., 2010; Rogers et al, 2012; Seyfang, 2013; Becker et al, 2017). Many early community renewable energy projects favored wind technology, as it is the cheapest per kWh RE option. As the cost comes down, many of the newer case studies are utilising solar PV, which has the benefit of being a more modular technology, applicable in a greater range of physical contexts (Park, 2012). The viability of a particular technology is also influenced by a range of institutional factors, such as policy support available and regulatory barriers or opportunities (Rogers et al., 2008; Gasparatosa, 2017). Others institutional factors including political mobilization, structure of energy market, laws governing legal structures are also important factors for community based renewable energy. Different economic issues such as local jobs & contracts, local revenue, cheaper energy, energy savings, regional development and income diversification are the leading motivation factor for the deployment of community owned renewable energy project across the globe (del Rio & Burguillo, 2009; Faulin et al., 2009). Different study also shows that manifold social and cultural factors: community building/volunteering, empowerment & skills development, community asset, local history and culture, relationships or social capital, social perceptions of and appetite for certain technologies also contributing to community led renewable energy project (Bomberg and McEwen, 2012; Middlemiss and Parrish, 2010; Seyfang et al., 2013; Wirth, 2014). However, these enable or disable factors are varying in different palaces and promoting different types of renewable energy models.

Generally, four different models of community renewable energy have founded both in Europe and North America including i) for profit investment co-operatives, ii) joint ventures between community groups and private companies, iii) developments by non-profit distributing community organizations, and iv) Community benefit arrangements with commercial wind farm developers (Gubbins, 2010; Nolden, 2013). Again, based on the ownership and funding sources, community owned renewable projects could be classified in six different ways (Greenius et al., 2010; TREC, 2016; May, 2017; REN21, 2016)

i) 100% community owned through self-funding, often with Government or inter-Governmental funding grants;

ii) Co-ownership with a private sector organization. For example, community owns one turbine in a larger commercial wind farm;

iii) Cooperative ownership: people in the community are members of a cooperative that finances a renewable energy project;

iv) Community charities: an association with charitable status runs a community facility such as a village hall with renewable energy;

v) Shares owned by a local community organization;

vi) Individual investment: community members buy shares in a localized renewable energy project, advertised or offered to them directly.

Community-owned renewable energy projects create social, political, environmental, economic and technological benefits by strengthening local economies and building community participation, resilience & empowerment (Denis & Parker, 2009; Kerr et al., 2017; Munday et al. 2011). These energy projects provide stable, meaningful jobs and keep local money circulating within the community. These projects foster a diversified economy, entrepreneurism and local innovation, and are welcome sources of additional income in rural areas that may otherwise rely heavily on a single sector (Walker, 2008; Seyfang et al. 2013). Farmers and ranchers often view renewable energy projects as a way to supplement their income without having to leave their land (Muller et al., 2011). Community participation is a very crucial issue for the community-led renewable energy project. Due to the collaborative approach, active participation in decision-making process, community-based renewable energy projects can be creating local acceptance and minimize regional conflicts among the community people and others (Becker et al, 2017; del Rio & Burguillo, 2009; Faulin et al., 2009). Community-owned renewable energy projects give members a stake in developing local resources, which generally increases project support. These kinds of projects allow community citizens to participate directly in the creation, installation, operation and financial aspects of a project (Cowell et al., 2010; Rogers et al, 2012; Seyfang, 2013). Residents who have a stake in such projects are engaged and empowered citizens, often able to see beyond just financial gains to realize the prospects of community vibrancy and long-term viability. Once operational, renewable energy projects can also provide a range of educational opportunities for people and accelerated them to create a sustainable low-carbon future (Lovekin and Kilpatrick, 2010). Through these renewable energy projects, community people can build their social networking and inter personal relationship including trust, cohesion (Greenius et al., 2010). Therefore, social cooperation is higher among the participant rather than the traditional renewable energy project (Toke et al., 2008). Again, by developing low-impact renewable energy projects, communities can reduce greenhouse gas emissions, decrease air and water pollution, increase energy independence, and set an example for other communities (Seyfang et al. 2013). Technical benefits of establishing community based renewable energy projects include an increased reliability of energy supply due to utilizing localized energy sources (Walker 2008). There are also often shorter transport distances, reduced energy transmission losses and increased energy efficiencies (Van Hoesen 2010; European Parliament 2009). In many cases, producing energy locally helps to ensure that energy supply better meets demand (St Denis and Parker 2008). Similarly, environmental leadership, community empowerment, decentralization, sustainable energy policy, active participation is the most common political benefits from the community based renewable energy project (Magnaniet al., 2017; Denis & Parker, 2009).

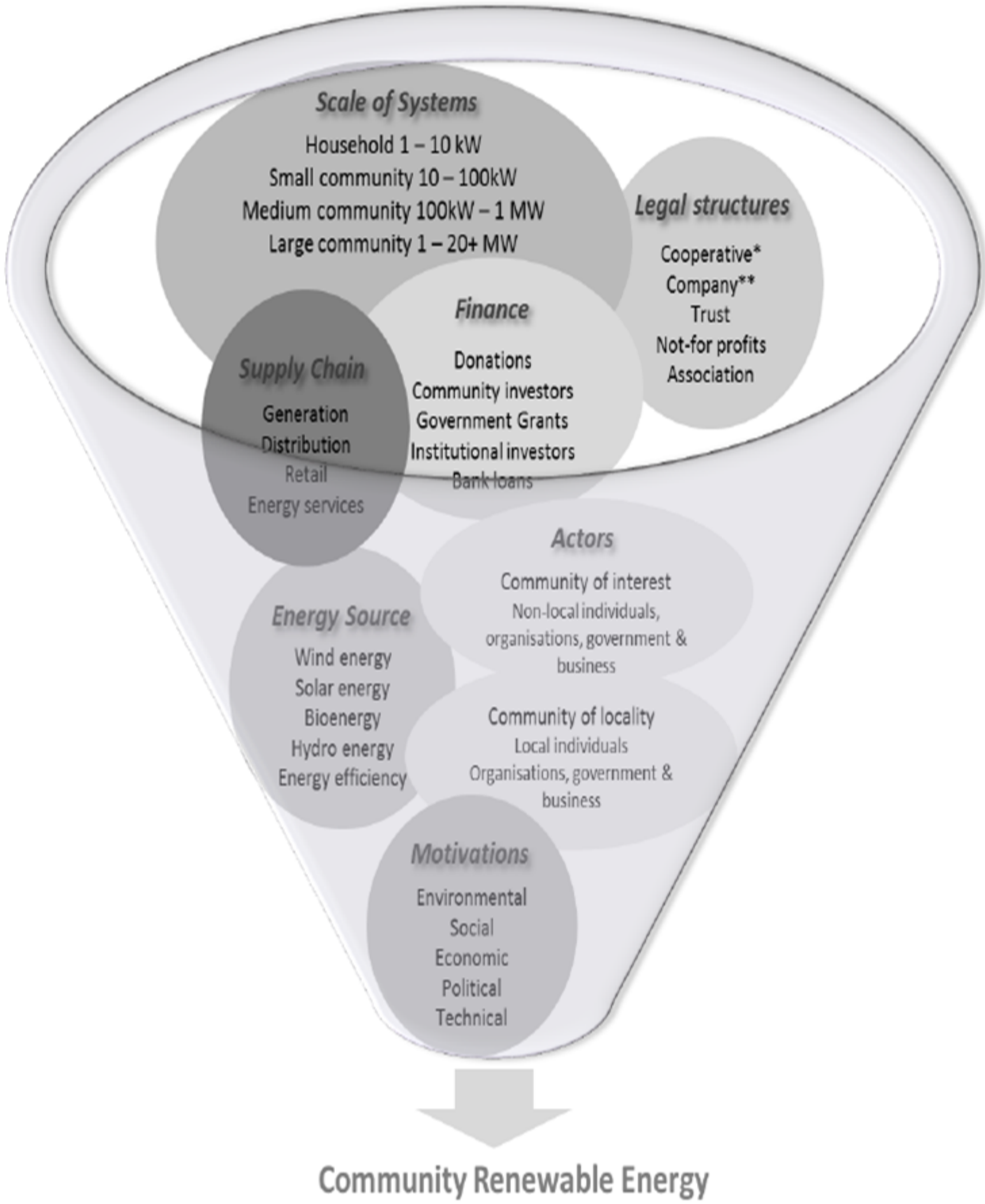

Figure 2: Features of Community owned renewable energy (Source: May, 2017)

5. Stakeholders and organizational form of community owned renewable energy projects

Who is involved in decision-making, and which group of actors hold a controlling interest, defines who has power and influence in the project (Hicks,and Ison, 2018). This spectrum represents the range of choices regarding the distribution of voting rights, or decision-making power, within a project and whether provisions are put in place to ensure equality among members (Becker and Kunze, 2014). Thereby the relationships between the different stakeholders are depending on organizational structure of community led renewable energy projects (REN21, 2016). Organizational structures of community energy initiatives may be in the form of partnerships, co-operatives, community trusts and foundations, limited liability companies, non-profit customer-owned enterprises and housing associations (Becker et al. 2017). The choice of structure often is determined by the interest or goal of the particular community as well as the regulatory framework (Fertel et al., 2013). Partnerships generally are governed by a management board, with the ownership rights linked to the financial stake of each partner and focus on democratic decision-making process and equality (Stow, 2015; Mey, 2017). In Germany, for example, partnerships with a private limited company are a commonly used legal entity for community renewable energy ownership (TREC, 2016). In Denmark, partnerships also are referred to as co-operatives, because of their role as a typical form of "association", and come with different liabilities and tax implications (Mey, 2017). Co-operatives, on the other hand, are democratic structures that follow a set of internationally agreed principles and make decisions on a "one-member-one-vote" basis; day-to-day operation is governed by an elected board (Gubbins, 2010; Weinrub, and Giancatarin, 2015). It also emphasis on local actors and ensure that local individuals maintain the majority of decision-making power over the project in a democratic way (REN21, 2016). This energy structure is existed both in Europe and North America. Again, community trusts and foundations share benefits from community renewable energy projects with citizens that do not have enough money to invest, ensuring that returns on investments are used for specific local or community purposes (Brummer, 2018; OECD, 2012). In the United Kingdom, "Development Trusts" take a number of different legal forms: a charity, a company limited by guarantee, a community interest company (CIC) or an industrial and provident society (IPS) (Hargreaves et al., 2013; Walker, 2008). In Scotland, Development Trusts have become a popular form of community ownership of wind projects (Shamsuzzoha et al. 2012; Ison, 2009). In Denmark, the community foundation model has been used to create a community pot of money where generous profits from renewable energy production can go towards funding local development (Tokar, 2015). Public and private limited liability companies (LLCs) are based on a legal framework that limits the liability of investors, protecting their private assets from losses. LLCs are becoming increasingly common instruments for implementing community energy projects, particularly in Europe and North America (REN21, 2016). Non-profit, customer-owned enterprises are similar to co-operatives in structure but add particular rules: for example, ownership might require grid connection, or votes may be capped to limit the power of individuals who own multiple properties (Hicks and Ison, 2018; Simcock et al. 2016). This type of structure is ideal for community power projects that rely on grid networks that are small or independent. It is particularly popular in Denmark's district heating sector (Magnani et al. 2017) Local governments also are important actors in community renewable energy. Under municipalization (United States), or Stadtwerke (Germany), local governments – often in collaboration with community co-operatives – manage and operate local power utilities to provide a not-for-profit electricity service (REN21, 2016). In Germany, local governments own and operate 1,428 utility companies. Similar efforts are being undertaken in South Asia by panchayats (rural local governments) (Savale, 2015).

6. Five examples of community based renewable energy and its impact on local developments

i. Hvide Sande Wind Farm by Hvide Sande Community Foundation (East Coast of Denmark)

Hvide Sande Wind Farm, on a beach next to the small port town of Hvide Sande in east coast of Denmark, is owned by the local community trust, with profits from the turbines financing local regeneration. Under this community renewable energy project, in January 2012 three 3MW wind turbines installed on Hvide Sande's beach very close to the village. The project has been led and owned by Hvide Sande Community Foundation (HSCF) and aimed to **resist the recent trend** in Denmark toward private-developer led wind farms. In its ownership structure and distribution of profits, it also aims to be different to the co-operative ownership model that has long dominated Denmark's community energy sector. HSCF owns 80% of the project, with the other 20% owned by 400 local co-operative investors, as required by Danish law. Therefore, 80% of the project profits from the windmill goes into the trust and reinvest in local rural area. The project cost EUR 12.2million, the vast majority of which came from a loan from two local banks. The electricity from this wind farm is sold into Denmark's national grid. Any excess profits following the repayment of bank loans are invested in the local area on collective projects, decided on a by a democratically elected board of local residents. HSCF is already plan to support the development of Hvide Sande harbor and the tourism in Ringkøbing/Skjern Municipality by production of renewable energy. The harbor itself benefits from an annual rent of from an annual rent of DKK 4.8 million, paid for 30 years by HSCF in return for allowing the turbines to be sited on harbor land. Thus, the project gained wide acceptance among the local population because of its unique model of community-ownership, with previous proposals for similar-sized but privately-owned schemes having faced significant local dissent (Simcock et al., 2016).

ii. Val di Ledro Centoraggi Cooperative Solar Energy Project (Trentino, Northern Italy)

Val di Ledro is a cooperative based collective solar energy project in Trentino, North-East of Italy has strong investment in development of a green economy and a long-standing tradition of energy cooperatives. The deep-rooted tradition of civic activism in Trentino and other existing technical capitals created favorable condition for participator form of community energy in that area. The aim of the cooperative is to promote more environmentally and socially sustainable approach to renewable energy development. The motto of this cooperative, therefore, is 'For the intelligent use of energy". The key role in the emergence of this Community Renewable Energy (CRE) project is played by an ecopreneur, the director of cooperative enterprise operating in the renewable energy field. At the beginning of the CRE project, the ecopreneur managed to achieve the increasingly greater involvement of local people, however after a few years the cooperative is able to create a local network of electricians and engineers installing solar PV plants throughout the valley. In order to maximize participation by local residents, three kilo watts plant is built for producing 3000kw to cover a household's need. The cooperative financed the plant. As a result of the incentive rate and the sale of energy to the electricity operator, the cooperative managed to ensure each shareholder an average return of 90 to 100 euros per year. The sole cooperative is also able to finance a number of small local development initiatives, for instance, the recovery of a cycle path, the building of a small community biogas plant, and an exchange project between the University of Trento and the cooperative for young trainees in the energy sector. Moreover, it significantly contributed to the spread of solar PV in the valley through leverage on the prices of other private enterprises (Magnani et al., 2017).

iii. Bioenergy Village Jühnde Lower Saxony, Germany

Jühnde is a small village in the southern part of Lower Saxony, Germany, with a population of around 750 inhabitants. In 2005, the village opened a local bioenergy plant to supply heat and power to local residents, making Jühnde the first bioenergy village in Germany. The system contains a 700kW CHP generator that runs on biogas to produce electricity that is supplied to the public grid. A 550kW woodchip boiler is used in the winter to supply heating which circulates around the local district network. Interpersonal trust and social cohesion between residents in the village was strong, helping them to work together to development the project. The original aim of the project was for the village to be self-sufficient in terms of energy consumption, and the plants now produce 70% of the villages heating demand and double its electricity demand. The bioenergy facility is owned locally and collectively by the people of Jühnde. Residents are able to buy shares in the co-operative company and nearly 75% of Jühnde's inhabitants are members of this company. Once they have bought shares and become a member, they are then able to purchase heating and electricity from the company this means that the consumers of energy are also the producers of that energy. The system cost 5.2M Euro, of which 0.5M came from the investing citizens, 1.3M from a grant, and the remaining 3.4M from a bank loan. In the case of Jühnde, the municipal governments were supportive of the scheme and were particularly helpful in encouraging the national government and banks to provide the project with the necessary funding (May, 2017; Simcock et al., 2016).

iv. Horshader Community Wind Turbine, Isle of Lewis, Scotland

Horshader is a small community in the north-west of the Isle of Lewis, Scotland comprising the three villages of South *Shawbost*, *Dalbeag* and *Dalmore,* formed a single 900kW wind turbine-based community wind project. This community based renewable energy project led and owned by the Horshader Community Development Trust, a community-owned, not-for-profit organization with the aim of supporting local development and regeneration**.** The Horshader community energy development begins in 2004, when private developers approached the community with a view of building a wind farm in the local area, but offering only a small financial return to the community. Local people did not want or support such a development, and this resistance acted as a catalyst, motivating them to begin the long road toward their own wind energy project that would solely be for the benefit of the community. The group has a board of eight volunteer directors, and the Trust 900kw single wind turbine creating £100,000 net income through selling electricity to the National Grid. The group also plans to use the income for initiatives such as tackling fuel poverty, community transport projects, a local shop, the development of an old museum building, and a children's play park. Local cultural beliefs, prevalent across the Highlands & Islands region of Scotland, in the value of working together and community self-determination were important factors for inspiring and generating local support for the scheme. This sense of community and working together also shaped the ownership structure and outcomes of the project, which are focused on community development rather than personal profit. A trusting and close-knit local community meant that public engagement happened easily and in an informal and participatory manner. The project drew on the advice and support of the organization Community Energy Scotland which provides advice and support to community groups hoping to develop renewable energy schemes. Through Community Energy Scotland Horshader project got benefit from the Community and Renewable Energy Scheme (CARES) and a representative from CES acted as a networker, allowing the groups to learn from the projects that had taken place elsewhere in the Highlands & Islands. These factors were crucial in enabling the development of the Horshader scheme (Simcock et al., 2016).

v. The Revelstoke Community District Heating Energy Project, British Columbia, Canada

Revelstoke is a small city in southeastern British Columbia, Canada with a population of 6,719. Due to the air pollution from the surrounding sawmills of Revelstoke's Downie Street, in 2003 sawmill owners, community members and the local government planned to create a community district heating system using wood waste (biomass) for power and forming the Revelstoke Community Energy Corporation. They build a 1.5-MW biomass plant for reducing polluting emissions as well as using steam and hot water for the community's buildings. The aims of the project are to provide a feasible alternative for wood waste disposal from local sawmills, to improve air quality, stabilize/reduce heating costs and reduce dependence upon expensive propane, reduce GHG emissions and increase economic development opportunities in this region. The Revelstoke Community Energy Corporation (RCEC) was formed as a wholly owned subsidiary of the City of Revelstoke to own the Community Energy System. The concept for ownership of this project is based on the highly successful community / forest industry partnership formed in 1993 to own and operate a Timber Forest License through the Revelstoke Community Forest Corporation (RCFC). The community energy project is a unique private public partnership with Downie Sawmills Ltd. providing the site, the fuel and operating personnel in association with a twenty-year contract to purchase energy. The City of Revelstoke through its wholly owned subsidiary arranged financing to do the project. RCEC is paid a contract fee to Downie Sawmill Ltd. to operate and maintain the plant (Lovekin and Kilpatrick, 2010).

Case Study (Geographical area, Region)	**Val di Ledro Solar Energy Project (Northern Italy, Trentino); Small Town**	**Jühnde Bioenergy Village, Lower Saxony, Germany; Village**	**Horshader Community Wind Turbine, north-west of the Isle of Lewis, Scotland; Village**	**Hvide Sande Wind Farm, east coast of Denmark; Small port.**	**The Revelstoke Community District Heating Energy Project, British Columbia, Canada; Small Town.**
Primary Initiative	Collective solar project led by cooperative enterprise	Local University with villagers	Community wind project led by Horshader Community Development Trust	Local charitable organization- Hvide Sande Community Foundation	The sawmill owners, community members and the local government
Ownership	Collective	Collective (75% owned by local inhabitant via cooperative)	Community Trust	80% owns by the Hvide Sande Community Foundation, and other 20% owned by 400 local co-operative investors	Public private ownership with local city council
Institutional Context including Political, Cultural and others	Relevance of civil society organizations and social Capital (cooperativism tradition, civicness, etc.)	Legal aspect like Renewable Energy act; social capital and entrepreneurships (cooperativism tradition and trust)	Scottish government project- Community and Renewable Energy Scheme (CARES); social capital for instance local cultural beliefs working together, close-knit local community.	History of community ownership of wind, District heating scheme.	Funding from government including Green Municipal Fund grant, Revelstoke Credit Union
Local impacts	**Direct:** Job opportunities, spread of solar PV, electricity bill reduction **Indirect:** Recovery of bicycle paths, collaboration with University of Trento for training activity in energy sector; local forestry sector involved in energy chain (small biomass plant, solar PV on sawmill, etc.).	**Direct:** Cheap sources of energy including electricity and heating energy. **Indirect:** Reduce local CO_2 emissions, increase community sprite, local forestry sector involved in energy chain (small biomass plant)	**Direct:** Tackling fuel poverty, community transport projects, invest in a local shop, the development of an old museum building, and a children's play park. **Indirect:** Promoting social capital such as trust, togetherness, community self-determination.	**Direct:** Electricity sold in national grid, 65% of the Hvide Sande households have access to a district heating system owned by the community, 80% of the profit from the windmill goes into the trust fund and using for redevelop and modernise local harbour area, repay loan **Indirect:** 'Resistance spirit against the private developer related project, community trust.	**Direct:** Improved air quality, Green House Gas displacement, Fossil fuel import displacement, Alternate energy source, Potential non-taxable, nontax source of municipal revenue, Value-added use of wood "waste", Local processing of local resources. **Indirect:** Great opportunity for municipalities to meet environmental requirements established by higher levels of governments; Further GHG reduction by eliminating trucking of wood "waste" to distant users.

Table 2: Key features of five different community based renewable energy projects and their impacts on local development (source: author)

Conclusion

Due to the climate change, global economic recession, insufficiency of fossil fuels renewable energy deemed to be a best solution for sustainable energy security. However, conventional renewable energy projects also several limitations including large investment, centralized and one-way energy supply. Community owned renewable energy ensures sustainable development through collaborative management in energy production. Community owned renewable energy is followed a collaborative approach where state, regional and others nongovernmental organizations has been involved. The study focused on the difference between the traditional centralized renewable energy and decentralized community based renewable energy project as well as tried to figure out its impact on local development. Study found that community led renewable energy is one of the best way for sustainable development including economic, social, environmental and ecological. CBRE projects primarily focus on more decentralized and democratic energy governance through the active and fair local involvement including management, ownership and control of regional renewable energy projects. It creates an alternative; equitable energy access based on democratic principles and seeks to replace the centralized and corporate energy establishment with decentralized authority. Community ownership of renewable energy is most common and well-established in Europe. Wind power is the most common technology, but there are also many examples of other technologies being used: hydropower, anaerobic digestion with combined district heating and electricity generation, biomass boilers and solar PV. Countries such as Denmark, Germany and the UK (particularly Scotland) are seen as pioneers in renewable energy and in policy approaches that encourage genuine opportunities for democratic control, community engagement and economic participation. Different socio-economic, political and instructional, cultural and technical issues are the key driven factor for the deployment of community owned renewable energy project.

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