

OPERATIONAL EFFICIENCY OF THE UK COMMUNITY ENERGY OWNERSHIP MODELS

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The challenges posed by climate change, energy security and man's endless demand and consumption of energy have become a serious threat to human existence. Surmounting these challenges requires an extensive transformation of the current centrally concentrated energy system in most nations, into a people centred and community oriented system. Community Renewable Energy Projects are emerging form of energy governance system that have contributed substantially to a reduction in this global threat generally and in the UK in particular. This paper presents a critical review of literature which examines the different ownership models of Community Renewable Energy Projects (CREPs) in the UK. In addition, the key aspects of these models that enhance their operational efficiency are reviewed in order to establish the connections between a robust ownership model, its attractiveness to the community groups and individuals involved and the overall project outcomes. Three theoretical concepts are employed in the development of a framework that connects groups of effective ownership model indicators to aspects of the model improvement and their impacts on CREPs Outcome. The framework highlights the importance of competent internal management structures, availability of project administration and management expertise and timely external supports for the UK community energy groups as a precursor to organising successful CREPs with optimal performance in line with expected environmental, social and economic outcome.

Keywords: community, renewable energy projects, ownership models, operational efficiency.

INTRODUCTION

The subject of community (local) involvement in Renewable Energy activities is one of the most active areas in energy research today (Walker and Devine-Wright, 2008). Community based activities towards environmental sustainability are not new, although the approaches are different. Emphasis on such activities in present times tends to be more on Community Renewable Energy Projects (CREPs). According to Alvial-Palavicino *et al.* (2011), CREPs constitute an integral part of the overall global micro Renewable Energy (RE) generation program.

The installation of solar panels on the roofs of many private homes and the collectively organised energy projects by individuals or groups of local environmental activists all attest to this fact especially in Europe. The case of Denmark is a typical example, where local authorities promoted the Danish citizen's participation in implementation and ownership of Energy Projects in the late 1970s. At the moment, a quarter of all the electricity consumed in Denmark is from wind energy projects owned by the community (McLaren Loring, 2007). Evidently, 80% of these wind

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energy systems is owned locally through community partnership, putting Denmark as the World's leader in Wind Energy development.

Similarly, Germany is determined to switch to renewable for at least 80% of her total energy demand before the year 2050. So far, more than 13% of Germany's energy consumption is from Renewable sources with the community competing favourably with the big energy companies. Spain on the other hand has recorded a 14% contribution to its total energy demand from renewables. A major setback in the Spanish energy sector (hindering local participation) according to Sáenz de Miera *et al.* (2008) is the prolonged domination and monopolisation of the sector by larger Energy companies. However, there are community owned RE projects in Spain which are unpopular, but legislative instruments are currently underway to promote these projects.

From the UK RE policies point of view, it appears that the UK Energy System is centrally governed in some way. This is because major legislation and policy on Energy issues are till date, the preserve of the Government's Department of Energy and Climate Change (DECC, 2014). That notwithstanding, locally organised energy has delivered substantial amount of Energy to many homes and businesses in the UK. The multiplier effects include reduction of community carbon foot prints that could lead to attainment of UK's carbon emissions reduction targets.

Numerous studies have attempted to define what Community Energy (CE) means (Walker and Devine-Wright, 2008, MacQueen *et al.*, 2001, DECC, 2014), but there are currently no universally acceptable definition for the concept. For the purpose of this paper, a simple definition within the context of citizen's involvement in RE generation, and in line with the UK Department for Energy and Climate (DECC) is adopted. DECC (2014), sum up Community Energy to mean diverse groups and the various responsibilities undertaken by the groups to ensure that local people accept and participate in small scale Renewable Energy projects and also benefit from positive environmental, social and economic outcomes of the project activities. This can be either temporary or permanent group of enthusiastic individuals generating, purchasing, managing energy and or promoting efficient use of energy.

From the above definition, it can be deduced that local participation and leadership in Energy matters is vital to achieving global carbon reduction. This paper therefore reviews key aspects of operational efficiency of CE ownership models and proposes a theoretical framework that sheds more lights on the connections between the importance of a robust ownership, and its attractiveness to the community groups and individuals involved in CREPs and the overall project outcomes.

REVIEW ON COMMUNITY OWNERSHIP OF ENERGY PROJECTS AND MODELS EMPLOYED

Generally, community ownership implies a change in management control, rights, and privileges over an asset, infrastructure, and services from a centrally governed authority to a relatively more decentralised market and people oriented authority in the form of a long, free or short lease. Research on assets ownership indicates that proper local community engagement in ownership and management of public assets can yield positive benefits.

In the energy sector, citizen's ownership of energy projects can be traceable to energy revolution in Denmark and Germany. Prior to this revolution, European Energy policies were designed to foster the fossil fuel dominated Centralised Energy System

(da Graça Carvalho, 2012). Walker and Devine-Wright, (2008) summarised that the different forms of community-led and community based ownership of energy projects are aimed towards establishment of a unique process of energy sector governance that fosters Citizen's participation, acceptance of the projects and creation of awareness on dangers of Green House Gas (GHG) emissions

Since Energy projects are capital intensive (McLaren Loring, 2007) and usually depend on a long supply chain, it is essential to put in place, an organised, structured and in most cases legal system of managing them. Therefore prior to commencement of any REP irrespective of the scale and size, a vehicle for successful project delivery is a necessity. This vehicle usually is a network of professionals, volunteers, interested individuals and investors with a shared vision of getting involved in the planning, organisation, implementation and ownership of Renewable Energy Projects (Walker and Devine-Wright, 2008). Ownership models for setting up rural electrification have been in used in Germany since early 20th century (Shamsuzzoha *et al.*, 2012).

These models are numerous and as such, not all would be covered in this paper, however, the legal models commonly and widely used in setting up energy projects within the UK and other EU states would be identified for this study. The popular forms of partial or full community oriented REP ownership range from an individual's ownership of a solar panel on a domestic building to commercially organised Social Enterprise, Cooperatives, Community Trusts, Housing Associations and Local Partnership with commercial developers. Table 1 below shows some case Community Renewable Energy Projects, their Models of Ownership and other vital project information that is worth mentioning

Table 7: Community Renewable Energy Projects and Models of Ownership

Project/ Location	Cost	Ownership Model Type	Technology	Local membership	Project Benefits
Horshader Wind Project at Dalbeg and Isle of Lewis	Almost £1.9M	Community trust	Wind Technology	More than 80% of local residents	Proceeds used for local transportation system improvement
Hanover Housing Association Wood fuel Project at Fort William in Scottish Highland	Almost £113,000	Housing Association	Woodchip: Froeling Turbomatic 100kW boiler	Elected governing board	Installed system provides affordable heating to 25 unit sheltered housing development for the elderly
Lewes Solar Project at Lewes, East Sussex	Almost £310,000	Partnership	Solar PV	251 members	Affordable energy for community
Westmill Wind Farm at Oxfordshire	£4.6m	Co-operative	Wind	Over 2,000 local members	Supplies energy to over 2,000 homes annually

From above table, it can be argued that local participation, derived benefits, models of ownership and cost of project vary from place to place. These varying features make it difficult to conclude that a particular model is more effective than another in delivering successful CREPs. The various models identified above are critically examined below.

HOW LOCAL PARTNERSHIP, COOPERATIVES, COMMUNITY TRUST AND HOUSING ASSOCIATION MODELS WORK

Partnership has generally been encouraged as a shield for the individual or community group with little or no risk appetite but with ambition, passion and enthusiasm to engage in business. In the Energy sector, partnership as a model of CEP development is common in Germany where limited companies collaborate to set up CREPs (Bonhoff, 2008). The level of control depends on the amount of shares each partner holds. Membership of this form of model can be restricted to the local residents and or external commercial Energy companies; however this model depends on hired external expertise for daily management of project activities. Unlike partnership model where membership is restricted and expertise is sourced externally, the incentives for setting up CREP through the Cooperative Model are different from every other model. The principle of cooperative ownership aligns well with CEP principles of keeping development, operations, ownership and benefits of the project within the community. The model encourages equal rights and opportunity in decision making and profit sharing amongst participants based on one man one voting right.

It is not surprising that the model has been the most adopted and widely employed for community ownership of REP. According to (Willis and Willis, 2012), membership strength of Cooperatives all over the UK is over 900 million while about 90million locals are gainfully employed by these Cooperatives as at 2014. In contrast to Cooperative, that puts the interest of members first, Community Trust (also known as Development trust in Scotland) on the other hand supports local investors and non-investors alike to benefit from the CEPs. It functions as a medium for attracting wider environmental, social and economic CEP gains to the entire community. The model is structured such that no individual or group can lay claim to ownership of this model because daily administration and decision making are preserves of a democratically elected board of trustee (BOT). The last model of ownership identified for this study is the Housing Association. In the UK, a Housing Association is a not-for-profit organisation that acts on behalf of low income group by securing affordable accommodation in Estates managed by the association, and meeting any other special needs of this category of tenants. According to Saunders *et al.* (2012), the law, permits tenants to be accepted into the membership cadre and even governing board of the association through democratic means. Egmond *et al.* (2006) also opined that a well organised board can access loans to execute projects (see item 2, table 1) for the benefits of other tenants in the estates. However, these models have shortcomings which are detailed in the section below

PITFALLS OF OWNERSHIP MODELS REVIEWED AND THE NEED FOR A FRAMEWORK TO ADDRESS THE PITFALLS

Drawing on DECC (2014)'s definition of CREPs, the focus of each ownership model should be to keep the development, operations, ownership and benefits of the CREPs within the community and to also encourage equal rights and opportunity amongst participants, as these are some of the main attractions for local participants. While the Cooperatives model promotes equal rights, opportunity and profit sharing (among many other incentives), above Social Enterprise, Community Trusts, Housing Associations and Local partnership models, it is however criticised for being associated with huge administrative burden (Schreuer and Weismeier-Sammer, 2010). On the other hand, Social Enterprise, Community Trusts, Housing Associations and

Local partnership models are rigid in the area of membership recruitment. They also face difficulties in securing funds (Warren and McFadyen, 2010), planning permissions for CREPs development over and above the lack of capacity to break market monopoly of the Cooperatives model.

Therefore it is important to address these drawbacks by identifying each model's efficiency indicators and the key aspects of the ownership models to be enhanced. There are a number of these indicators that can influence the operational efficiency of CEPOM. These indicators according to (Zhao *et al.*, 2010, McLaren Loring, 2007, Belassi and Tukel, 1996), although not exhaustive are listed below:

1. Competitive Business Case
2. Control over Principal/Agent interest
3. Access to Grants/ Funding for the Project
4. Risk Management Skills/Strategies
5. Identification of Local needs
6. Track records of Directors
7. Knowledge of the Sector
8. Incentive Programmes
9. Extensive Feasibility Studies
10. Project scope definition
11. Procurement approach
12. Site(Land)ownership
13. Project Management expertise
14. Market share
15. Access to industry information/practices
16. Favourable Regulatory Frameworks
17. Expert advice on emerging trends
18. Local membership route/criteria
19. Equipment supply and maintenance
20. Availability of local skills/expertise
21. Contractor selection criteria
22. Project Environment
23. Communication Management

CLASSIFICATION OF COMMUNITY ENERGY PROJECT OWNERSHIP MODELS (CEPOM) ENHANCEMENT INDICATORS

The CEPOM efficiency indicators listed above are further classified into three groups thus: Organisational Management related, Project related and External indicators. One may argue the basis for such classifications; the above classification is based on the aspects of CEPOM enhancement it addresses, although the three groups of classifications are interrelated and depend on each other to be relevant, the impact of each group in enhancing CEPOM's efficiency is unique. For instance, external factors may not necessarily constitute risk to Partnership model as it does to the Housing Association Model. This is because complementary skills, competence and experience in the industry are major considerations in a partnership business relationship. Also, the incentive programme as part of Management and Board of Trustee enhancer can also influence the construction and administration of project operations. It is important

to state that the classification is meant to draw attention of Community Energy Groups (CEG) in the UK to the importance of a formidable internal top management and project team with vested knowledge of external local and global barriers and drivers of effective Community Energy Project ownership. On this premise, the need for the development of a theoretical framework that captures all the indicators and their impacts on the various ownership models is important. It is expected that the framework will be an improvement to the current models deployed for CREPs delivery in the UK. The framework is presented and discussed in the next section

DISCUSSION ON IMPROVEMENT OF COMMUNITY ENERGY PROJECT OWNERSHIP MODELS (CEPOM)

The framework highlights the connections between group of CEPOM enhancement indicators, aspects and CREPs outcomes. The Community Renewable Energy Project outcomes (CREPO) is presented here as the objective of the CEPOM improvement process, while Management and Board of Trustee Structure (M-BOTS), Effective Administration of project Operations (EAPO), Environmental, Social and Economic Impacts (ESEI) are considered as CEPOM enhancement facilitators.

Conventionally, every project is said to be distinctively different based on the peculiarity of its location, client, the project team and so on (Andersen *et al.*, 2006). This is entirely true of CREPs; the risk appetite, administrative procedures and the process of organising start-up funds vary greatly. This theoretical framework therefore is based on the considerations for setting up ownership models that can overcome these challenges. The considerations relied primarily on the owner's, consumer's and investor's interest such as tax exemption, electricity bill reduction, and self-sufficiency; and community benefits like job creation, climate resilience and GHG emission reduction. Although the Cooperative model has overwhelmingly become the most attractive model for organising CREPs in Europe, other models when effectively set up could bring about a more robust model for use with any Renewable Energy Technology and by any community. In particular, the theoretical framework is developed for the enhancement of the UK CREPs ownership models; this is so because the scope of this paper cannot exhaustively capture the concepts and indicators of all the ownership models in use by various developed and developing Nations. The various groups of CEPOM enhancement indicators, aspects of enhancement and expected project outcomes are discussed in subsequent sections.

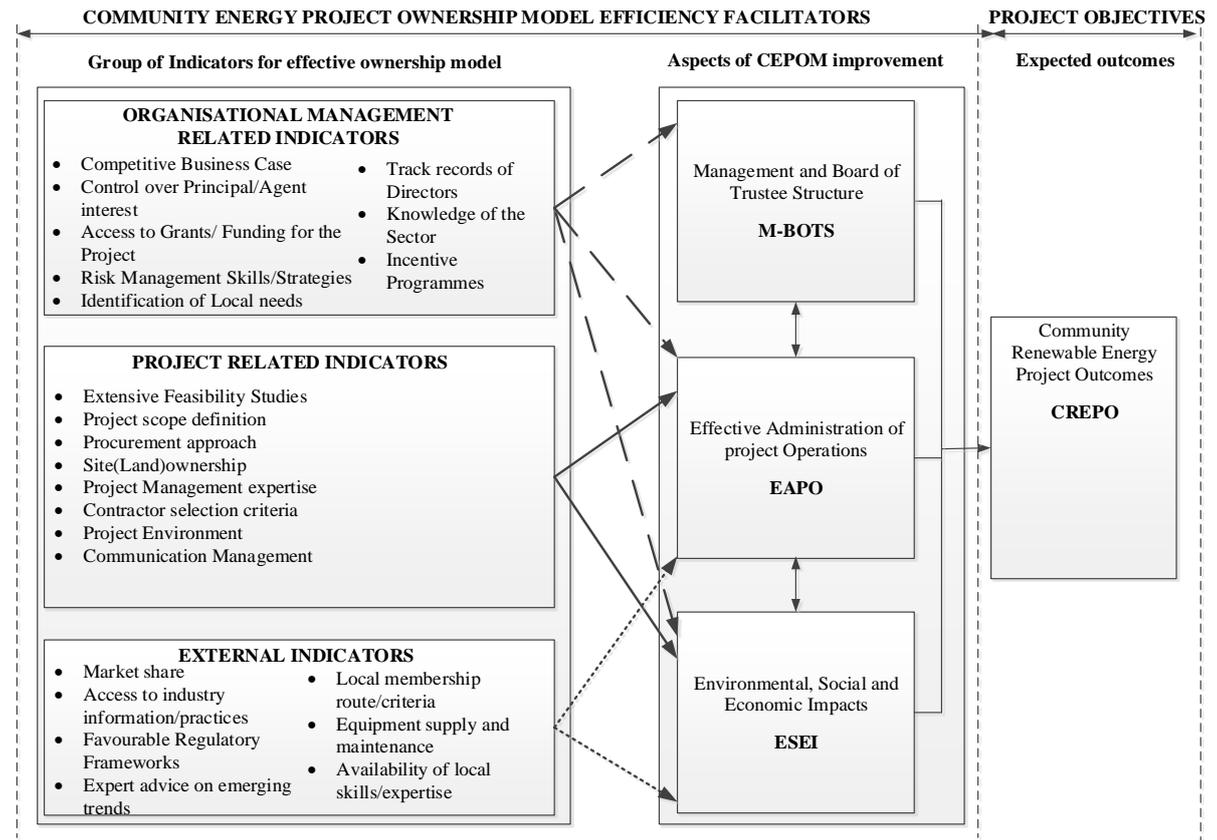


Figure 1 Theoretical Framework for enhancing Models of CREPs ownership

ORGANISATIONAL MANAGEMENT RELATED INDICATORS

Since CE is an emerging energy governance system, the ownership models are vulnerable to internal management failure as a result of an incompetent management and project teams. In addition, failure may be caused by external influences such as lack of adequate technical support, funding, and regulations. CEPOM as an organisational setting for CREP development and management thrives on a formidable and competent top management structure. Although in most CEPs, top managers, shareholders and funders are not part of the daily running of CREP operations, they however have significant power to influence major decisions. The management and Board of Trustee of the model therefore must show the will power to check principal/Agent interest among top managers and ensure the project is profitable, financially stable with a substantial share in the CE market. Effective management of project operations and capacity to deal with bureaucratic obstacles is also an important attribute deserving of the top managers. Above all, members of the model are expected to be experts in Renewable Energy Sector with essential skills to develop a business case that emphasises economic, social and environmental goals.

PROJECT RELATED INDICATORS

Although the focus of this paper is mainly on the operational efficiency of ownership model (operational phase), it is equally important to acknowledge that if the scope is not defined, or project completed on time and according to specification and purposes intended, the operational activities cannot commence.

The group of indicators for determining successful project delivery according to Bowen *et al.* (1997) varies based on the technical features of project, the project

environment, team and stakeholder's expectation from the project. The choice of a contractor in a conventional construction project is determined by the contractor's competence in delivering the project within a specified cost, time and expected quality (TCQ). On the contrary, CREPs in addition to TCQ also emphasizes that the project must be environmentally friendly and dependant, socially cohesive and economically viable and sustainable for the locals.

The construction process of CREPs comprises a long supply chain of equipment manufacturers, installers, designers, developers and so on. It is also the most important phase of the project as soon as planning permission and funding is secured. Therefore any involvement of locals in this phase will place heavy demand on local skills and the respective ownership model top management. It is the responsibility of the top managers of these models to ensure there is sufficient technical, administrative and project management capacity to undertake CREPs.

EXTERNAL INDICATORS

This group of indicators have indirect, yet very critical impacts on the functionality of CEPOMs and the performance of CREPs in the UK. The CE sector is a new and emerging sector that depends largely on external grants and funds for its programmes, this means that for the market to be fully established and sustained, the sources of supply of grants and funds must be guaranteed, because a prolonged cut in cash flow can render the project moribund. Moreover, increasing technology innovations, national regulations, legislations and changing market conditions have long term implications on the survival and outcome of the project.

Although full local ownership of the project is emphasised in CEP, the increasing project demands highlighted above have compelled the local community's dependence on external inputs to fully achieve project goals.

However, whilst the inputs of external commercial and technical experts is appreciated in promoting CEPs, the gradual diffusion of CEPOM with the practices, methods and procedures of these external aid providers must be checked. It is equally important that both local members of the Energy Groups and non-members alike have their opinion respected and considered by top management.

ASPECTS OF CEPOM IMPROVEMENT

The aspects of CEPOM improvement (Management and Board of Trustee Structure – M-BOTS, Effective Administration of Project Operations – EAPO, and Environmental, Social and Economic Impacts – ESEI) may be similar for all models. The importance of each indicator (Organisational Management related, Community Renewable Energy Project related and External influences) varies from one ownership model to another. It is expected that Community Energy Groups (CEG) will make necessary adjustments (introduce local conditions congruent to the project) into their chosen model before organising CREPs. However, the framework is only a guide to CEG on what aspects of the model to prioritise. The practicality of the framework would be further validated as the research progresses, it is expected that many more indicators and aspects of CEPOM improvement maybe identified from survey and interviews to be conducted in the coming months.

CREP OUTCOMES

CEP underpinned by sustainable long term investment plans could scale up local businesses and investments. In addition, the returns on investment from the projects

are used for projects to meet other community needs other than energy over and above development of local skills and job creation. It is also important to clarify that the key aspects of the ownership models can only be enhanced when the various enhancement indicators are holistically considered and responded to by the top management

CONCLUSION

This paper proposes a theoretical framework to both local energy groups and commercial developing partners engaged in or about to start up a community renewable energy project in the UK. Drawing on key aspects of operational efficiency of CE ownership models, the paper sheds more lights on the connections between, a robust CREP ownership model, its attractiveness to the community groups involved in CREPs and the overall project outcomes. One of the most significant findings to emerge from this study is that for any local energy group to effectively organise an energy project that can deliver expected benefits to all the stakeholders, the type of ownership model and internal management capacity must be robust.

The second major finding was that availability of project administration and management expertise and timely external supports for the UK Community Energy Groups is lacking in current models of CEP ownership, thereby limiting optimal CREP performance in line with expected environmental, social and economic outcome. This paper is part of an ongoing PhD research; therefore further work will be focused on collection of primary data through distribution of online questionnaire and face to face interview of CE experts in England and Scotland. The initial data analysis will be based on descriptive statistics followed by a more comprehensive factor analysis, analysis of variance – ANOVA. Based on flexibility and compatibility with a range of variables, Standard Multiple Regression analysis will be employed to model aspects of different CEPOM that enhances or undermines CREPs economic, social and environmental performance.

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