# INNOVATIVE SOCIAL PRACTICES IN RURAL ELECTRIFICATION

**A comparative case study of Rubagabaga mini-hydropower project (Rwanda) and PECO Rwenzori Micro-hydropower project (Uganda).**

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**ABSTRACT**

Rwanda and Uganda have very low rural electrification rates such that only a small percentage of the rural population has access to energy or connected to the grid. The states have implemented some strategies to extend the grid to rural areas; however, the results of the strategies show little achievement in the much needed rural electrification and its impacts to the local community. The socio-economic conditions in the rural area coupled with the government `s inefficiency attribute for the failures of the previous strategies used by the government to enhance energy access. The energy sector in the both countries has had significant changes that have the potential to accelerate the rate of rural electrification if the governments are willing to commit to the policies and regulation. The decentralisation of the energy sector has opened up space for the private sector, both local and foreign to venture in the energy sector of these countries.

This thesis attempts to explore and examine the innovative social practices used by the different entrepreneurs in the two cases; Rubagabaga min-hydro power project in Rwanda and the PECO Rwenzori micro-hydro power project in Uganda. I used qualitative methods of research to collect and analyse data which presents efforts, approaches, constraints and opportunities faced by the two different entrepreneurs in rural electrification. I examine innovative socio-economic practices used about how they involve the community, relate with the institution, and ensure financial viability in rural electrification. Using the literature framework in the thesis, I draw comparisons between the two forms of entrepreneurship how the two different entrepreneurs

**KEYWORDS:** Rural electrification, entrepreneurship, and innovation, initiative and organisation, social system, financial viability community participation.

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# CHAPTER 1. INTRODUCTION

Rural electrification has in the past decade been the center for discussions among the politicians in both Uganda and Rwanda. The connection rates by rural households to electricity are low and yet approximately 80% of the total population in these countries in rural based. Several strategies are implemented with an aim of improving the efficiency of the energy sector and accelerating sustainable electricity access in rural areas. The success of these strategies is however limited to a small portion of the rural population. The thesis seeks to examine the use of social innovations as a tool to achieve energy access and consumption in the rural areas, and it specifically focuses and draws comparisons between two cases 1) the Rubagabaga min-hydropower project in Rwanda and PECO Rwenzori micro-hydropower project in Kasese /Uganda. Electrification processes are unique and play out differently in each place, time, and space. My aim is to examine the mentioned projects and then present an in-depth study of innovative social practices implemented to achieve energy access and consumption. I take into account literature that includes theoretical insights developed by scholars whose work focused on entrepreneurship and innovation, initiative and organisation, communal participative and interactive decision- making, and capacity support strategies. I view the electrification process from the economic perspective and perspective of multiple actors such as the government institutes, the local population in their roles as users, customers, and beneficiaries of the local utility. And the entrepreneurs in their role as service providers that aim to create both economic and social value in the local community.

## 1.1 A FOCUS ON GOVERNMENT POLICIES FOR RURAL ELECTRIFICATION

Rural electrification policies are an essential part of the socio-political development efforts of most developing countries. Extension of energy to the isolated populations tends to be driven by existing economic inequalities between urban and rural populations and the social equity objectives. In other words, governments in developing countries have intentions of leveling out the rural/urban disparities through rural electrification that is likely to improve the living standards of the rural populations. However, substantial upfront cost, long-term financial investments as well as appropriate strategies are required to accelerate rural electrification (international energy agency, 2010)

Rural electrification programmes often require regulations and market reforms including private involvement and government involvement for efficient and effective implementation. However technical standards and norms tend to lead to costly or oversizing infrastructure set-

up for rural households, which may have a direct impact on the connection costs and the price of electricity (ibid). According to the international energy agency (2010), the reassessment of these standards and norms at the government level is necessary to reduce the additional financial burden of the electrification effort in the rural areas.

## 1.2 STRATEGIES FOR RURAL ELECTRIFICATION IN SUB-SAHARAN AFRICA

Approximately 80% of the total population in Africa is rural based, have no access to energy, often poor with limited purchasing power and highly dependent on traditional methods of heating and lighting (Barnes 2005, World Bank 2008). The local people commonly used for cooking and collection of firewood are both times consuming and can with time lead to deforestation and other related problems. The socio-economic conditions coupled with operations costs for rural areas attribute to a large number of populations with no access to energy. Also, the high costs of investments and inadequate financial resources pose as an immediate obstacle to energy access in rural areas (ibid) The limited household incomes force families to priorities other urgent human and societal needs and ignore the need for energy. Making energy accessible to rural households especially for income generation has a positive impact as it may break the vicious circle of low incomes. In other words, it is possible to improve the quality of life for many poor households with a level of energy consumption that is far below that of the average citizen in an industrialized country.

Rural households may generate ideas with a potential to improve their income levels, but they may however on their lack the capital (human and financial) and organizational capacity to develop these ideas.

Strategies for rural electrification have in the last 30 years focused on infrastructure development in the Sub-Saharan Africa. In the early 1980s, investments in infrastructures took a central role in the development policies of most Sub-Saharan countries (World Bank, 2008). For example, enhancing investments in rural areas was partly meant to reduce rural-urban migration. Rural electrification was considered to be a suitable solution given its predicted benefits in enhancing rural economic productivity through reliable sources of energy to support economic activities, limiting deforestation as households switch away from fuel woods (Arnold et al., 2006). With above mentioned predicted benefits, rural electrification programs received strong support as policymakers also believed that marginal costs that arise due to high initial investments would rapidly decrease as connection and consumption rates increased (ibid). There is, however, increasing concern that the low power

generation and distribution capacities as well as limited infrastructure development accounts for a relatively large shortfall in economic growth (World Bank, 2008).

By the early 1990s, it was acknowledged that the infrastructure programs had contributed to unsustainable debt burden in most Sub-Saharan countries, and yet these programs failed to generate the expected growth in return (Barnes, 2005). The Structural adjustment plans led to the reassessment of the relative impact of these programs including the rural electrification program. Despite improved access, the rate of household connection was low due to the limited household incomes as well as limited use of electricity for production and environmental benefits were also limited as connected household continued using wood. Usage of electricity in the few connected households was limited to lighting, radio or televisions. The cost-benefit analysis from the previous years appeared overrated as several macro- and micro-studies argued that the growth of income created the demand for electricity and not the vice versa (Foley, 1992). The International Labor Organization negatively judged the benefits of rural energy program as over-estimated about the costs are incurred. However, the adoption of Millennium Development Goals4 (MDGs) in 2000 underlined the importance of energy as a necessary condition to fight poverty due to its direct positive impacts on health and education, women empowerment as well as degradation of natural resources. While the United Nations Millennium Development Goals4 (MDGs) do not include specific targets for access to electricity or to clean cooking facilities, the United Nations declared 2012 as the "International Year of Sustainable Energy for All." Other strategic platforms to discuss the link between energy access, climate change and development include the "Energy for All Conference" in Oslo, Norway in October 2011, and the COP17 in Durban, South Africa in December 2011. These issues were addressed at the United Nations Conference on Sustainable Development (UNCSD) in Rio de Janeiro, Brazil in June 2012. The conference aimed at securing renewed political commitment to sustainable development, to assess progress to date and to address new and emerging challenges.

MDGs are today used in the rural electrification documents by some international initiatives as a justification for increased investments in the energy sectors of developing countries. New strategies are being considered that promote energy services to avoid the failures observed in the 1980s that were characterized by low connection rates and limited productive use (World Bank, 2008). The role of subsidies in enhancing rural electrification is highly debatable, and it is thus argued that electrification should be seen as an input in integrated projects involving access to productive equipment( via grants, loans, etc.) and training on the usage of electricity

(Peters et al., 2009). Peters et al. (2009) further suggest the possibility of achieving higher connection rates through considering the use of targeted subsidies, prepaid meters or technologies that reduce the barriers to connection. Sustainable adoption to low-carbon technologies is not only dependent on the technologies themselves or how they are provided, but also on how processes of technology develop, financing, transfer, and adoption may connect with the institutional infrastructures at the local level (UNESCO, 2014). To achieve this, developers and implementers of these initiatives need to adopt new and better approaches that can create both social and economic values. Including; a combination of distinctive ideas, resources, capabilities and values; shifts in roles and relationships of actors (involvement of the local community); and effective ways of mobilizing both financial and non-financial capital such as the integration of private capital with public and philanthropic support (Mckinsey research, 2015).

### 1.2 PREVIOUS AND CURRENT STUDIES WITHIN RURAL ELECTRIFICATION

Studies show that the rate of connection in rural areas is still low even in the grid-electrified villages. For instance, it is documented that connection rates in rural Uganda are at less than 5%, which is relatively similar to Rwanda and Kenya, 12% in Botswana (Kelogetswe et al., 2007), 39% in Ethiopia (Bernard and Terero, 2009). Research results in one energy connection rates by Heltberg (2003) in South Africa and Ghana points out that low connection rates are more prevalent among the poorer households in rural areas. He states that this deprives the poor of reliable energy sources and also poses a problem related to cost recovery. The low connection rate is closely related to the connection costs and the average household incomes. The families are usually responsible for 10 to 20% of the overall connection costs which is likely to cost about $ 50 to $250 and, yet a large part of the household in Sub-Saharan earn less than $2 a day (World Bank, 2008). Over the past few years the allocation of subsidies to target social groups has significantly improved in efficiency and effectiveness and yet the connection rates remain very low.

An in-depth study on the willingness to pay for energy done in the Philippines by ESMAP (2003) estimated the total demand for lumens in households via the budgets allocated to lighting by kerosene showed high levels of willingness to pay. It may give another explanation for the low connection rates that is seen in the households' low perceptions of the benefits of electricity. Most poor families may also perceive electricity as a luxury good rather than a productive good (ibid). Usage of electricity for production is still low, and it's rarely used in agriculture, handicraft, and other economic services. Peters et al. (2009)

remind us of the extensive promotional campaigns explaining the potential benefits of electricity in rural areas of industrialized countries and how this positively affected their perceptions. He argues that the lack of demonstration effect, which allows households to learn from others experiences with electricity, reinforces these attitudes. Also besides, most households have fears of high costs of energy that has its roots in how they understand the billing system. It is often the case with connected households that consume less electricity than they should (ibid)

### 1.2.1 HISTORICAL PERSPECTIVE

The steady growth in energy consumption for the last 200 years has been closely tied to the rising level of prosperity and economic opportunity in much of the world, however, the world finds itself confronting an enormous energy challenge (ibid.) This challenge can be seen in two critical dimensions; 1) the overwhelming reliance on fossil fuels that threatens to alter the climate to an extent that could have grave consequences for both humans and nature. 2) Access to energy continues to divide the 'haves' from the 'have-nots.' (Ausubel, 2007).

Globally, a large fraction of the world's population still lacks access to one or several types of basic energy services, including electricity, clean cooking fuel and adequate means of transportation. Of course, there has been a wide recognition for a profound transformation of the world's energy-producing and using- infrastructure due the mounting concern about global climate change (Rogner, & Popescu, 2000). Countless reports on sustainable energy may not highly focus on the perspective of developing countries where a significant portion of the population still lacks access to basic energy services. The worry about long-term environmental sustainability is overshadowed by more immediate concerns about energy access and affordability. (Martinot, E., et al. 2002).

Another historical trend likely to be relevant to future energy sustainability involves a change in the carbon content of fuels used as primary energy sources. The gradual shift in energy use from the reliance on coal during the first part of the industrial age, to an energy mix that includes large shares of oil and renewable energy, has implications carbon intensity. In fact, the ratio of tons of carbon in the primary energy supply to units of energy consumed globally has declined by about 0.3 percent annually since 1860, which is sufficient to reduce the overall ratio by 40 percent by 2050 ( Grubler and Nakicenovic, 1996).

### 1.2.2 CONCEPTUAL BACKGROUND

Many of societal challenges such as energy poverty were in the past perceived as constraints to economic actors and individuals wishing to handle such problems turned to non-profit models, government subsidies and private donations that were unable to attain sustainability. Today these problems are increasingly perceived and understood as opportunities for innovation and growth markets. These attitudes attribute for the growing excitement around new entrepreneurial answers and solutions to these challenges (European Commission, 2013). Social innovative practices adopted as interventions to enhance energy access and consumption in rural areas may present new various ways of dealing with shortcomings related to rural electrification. The key element of the theoretical foundation of the economic dimension of social innovation is emphasised in its crosscutting nature (business, public and civil society) and networks built (ibid)

Based on the literature discussed above, I chose four independent variables in order to capture the important elements of the innovative practices used by entrepreneurs for enhancing rural electrification: Social system, Organizational form, Community participation, and financial structure. The social system variable examines the government institutions, the community, and stakeholders. The organizational form variable focus on initiatives and how they are locally organized, different forms of partnerships, such as public-private-community partnerships, private-public partnerships, and private community partnership. The target community variable examines community participation strategies, interactive policy making and capacity supporting strategies. And the financial structure variable presents information on how capital is ensured and how initial investment and operational costs are managed. The variables shade light on the innovative strategies used but may not include some aspects for understating the outcome.

I have therefore added more aspects relevant to institutional context to capture their impact on the rural electrification strategies used by entrepreneurs. I have also added the physical context because remoteness of the areas is directly related to the potential viability of grid extension and the difficulties of managing, operating and maintenance. I collected data through a combination of secondary sources, site visits, observations as well as interviews with project entrepreneurs, local authorities, local entrepreneurs and local organizations.

## 1.3 RESEARCH QUESTIONS AND OBJECTIVES

To what extent can innovative social strategies be used as tools to achieve rural electrification? My desire to understand more about the strategies used to achieve sustainable rural electrification drew me to explore this topic. After my bachelors' degree in social sciences and having gained more knowledge about the energy situation in the rural areas, I become increasingly concerned about the way in which the electrification programs interplayed with the local conditions and their inefficiency in achieving the much needed sustainable energy access in rural areas. The challenges faced in rural electrification increased my awareness of the need for more innovative, suitable and sustainable strategies for rural electrification programs.

The literature review on ongoing impact evaluations of rural electrification showed the steady progress in the effectiveness of the strategies. However, most of this literature is technology specific, micro-level project reports, business success stories and geographically limited (Hisham, 2010). My study explores the institutional issues that are known to impact the results of rural electrification through case-based analysis. The individual case studies selected for comparison purposes include discussions of institutional issues such as electrification regulations and policies, access to financing, community participatory strategies, etc. They also present new approaches advocated for rural electrification. My aim is to explore challenges and constraints faced during the implementation processes mainly focusing on ensuring financial viability and community involvement. I also identify some of the social impacts of these projects to the beneficiary communities. The scope of the cases makes it difficult to generalize; however, the findings have been generalized from the existing literature that covers the institutional issues examined in this research.

The research presented in my thesis seeks to contribute to existing knowledge by providing a rich description of how and why various social innovation strategies come to matter in rural electrification. This study may fit well into the ambition of rural electrification research as it also explores human-energy interaction. My purpose is to understand the strategies implemented, decision-making process, organization forms (public, community, private) and actors involved and specific issues related to policy and regulation. I focus on the actor's subjective view and related aspects in the local context and how these strategies may impact rural electrification.

For the purpose of this study, I seek to explain the following research question as they may deal with the question of sustainability.

- What is the role of entrepreneurs in rural electrification process? How does the institutional structure influence the role of the entrepreneurs in rural electrification?
- How can entrepreneurs enhance rural electrification using innovative practices that are social, economically and environmentally sustainable?
- What challenges and constraints do the entrepreneurs face while implementing the innovative practices?

## 1.4 CHOICE OF STUDY AREA AND DELINEATING THE STUDY

I conducted in Kitabona village in Uganda and Rubagabaga village in Rwanda. These areas are isolated from the main grid, are generally energy poor and yet with high potential for hydropower production and solar energy. Subsistence agriculture is the main economic activity in these two areas. It explains the poor socio-economic conditions characterised by low-income households. The location of the cases selected for the study is in areas that have the above-mentioned challenges. Both cases have high potential to provide electricity to the marginalised local communities using new approaches. The differences and similarities in these two cases make it possible for comparison purpose about the strategies used for rural electrification. The challenges of ensuring rural electrification are indeed complex, spanning across all disciplines and thus to narrow down my field of study I chose to focus on the implementation of the innovative social strategies to ensure sustainable rural electrification.

The thesis consists of five chapters. The introduction chapter includes a brief presentation of the research topic, rural electrification strategies, discussion of various perspectives on the topic and lastly the objectives and research questions. The theoretical framework in chapter two, reviews main concepts and theories (entrepreneurship and innovation, initiative and organization and governance) used in the study and the analytical framework for how they are linked and used about rural electrification in Africa. The methodology (chapter, 3) gives a description of how I conducted the research, processes of case selection, data collection, and analysis. In chapter four I present the countries profiles to give relevant background information about each study area. I briefly present historical overviews, demographic outlines, political and government situation, socio-economic, cultural and linguistic

information, energy situation (demand and supply) and energy sector policies and reforms. Also, I present the cases and research findings. Chapter five presents the comparisons between the two cases using the research questions. It also includes the discussions and conclusions about the findings and the theoretical framework.

## CHAPTER 2. THEORETICAL FRAMEWORK

A theory is defined as a set of analytical statements that are drafted to structure our understanding, observation, and explanation of the phenomenon (Nachmia, 1996 cited in Nilsen, 2015). In this thesis, I do not present these theories as exclusivist models but rather as conceptual meeting points that embrace other theories to help shade light on innovative social practices and rural electrification. Existing literature on rural electrification usually presented in three broad categories namely; the technology specific analyses, the micro-level project reports, and the business success stories. The technology specific analyses literature that focuses on the opportunities of using a particular technology to meet rural electricity needs. And the micro-level project reports focus on a particular activity for example village level projects well as the literature on the business success aims at filling in the gap in the literature like understanding reasons for the failure or success of business models for electrification (Hisham, 2010).

The theoretical framework forms the context for my study by exploring concepts and empirical evidence around social innovation/ entrepreneurship, social system (organisation and community). In my analysis, I focus on the implementing organisations, the local utility, and local users, as well as the strategies to enhance rural electrification. My focus is how the projects handle the economic challenges related to rural poverty and the need for financial viability, as well as challenges related to involving the local community. I further elaborate the entrepreneurial opportunities and roles in rural electrification, the local utility and how it is socially organised and adopted in the local community. I further draw theoretical insights from various studies and articles about strategies, implementation, interactive policy making and the roles of different actors.

### 2.1 DEFINING RURAL ELECTRIFICATION

It is pertinent for me to present various definitions of rural electrification before I start with the main issues of my thesis which is the innovative social practices used by entrepreneurs to enhance rural electrification.

The definition of rural electrification is becoming complicated as new ideas, devices and systems are emerging into the energy sector market. The choice of technology and strategies used for rural electrification depends on the targeted country, community, business, and farm or household that benefits from the process (international energy agency, 2010). Other factors likely to influence choice include customer and load density, relative distance to the national

grid, landscape, and availability of natural resources such as the wind, water, and sun forests, economic and financial aspects. Rural electrification programs and strategies may vary in generation techniques, its costs and quality of the services delivered depending on the degree of urbanisation of the target group (international energy agency, 2010)

Rural electrification is defined as the process of providing electricity access to households or villages in remote areas. It includes the provision of electricity to areas with highly dispersed potential consumers and low demand (Cohen, 2006, Clough, 2002). Rural electrification may include village level input into the social and economic development, utilized by households, farms, and establishments. It is likely to lead to socio-economic changes such as employment, incomes, productivity especially in agriculture. The changes at the household level and community reinforce each other into a self-sustaining process (Ibid).

### 2.1.2 PRECONDITIONS FOR RURAL ELECTRIFICATION

I present a summation of what international energy agency considers as baseline preconditions that can serve as a precursor to effective rural electrification to fully realise the socio-economic benefits. The results of the comparative study present practical examples of strategies used for rural electrification in emerging economies (Barkat, 2002). Brazil as used as an example of instructional structures whose 1988 constitution recognised universal access to electricity as essential, whereby the government took full responsibility. At that time, most centralised concessionaries had no clear universalization targets well as privately run concessionaries` interest to run rural electrification was limited. The lack of interest attributed to the high costs of supplying electricity services to low-consuming and dispersed households (international energy agency, 2010). China that has about 99% rural electrification coverage had a separate entity dealing with the bulk of planning related to rural electrification well as India with 44% rural electrification rate has baseline legislation in the form of the Electricity Act of 2003. The legislation covers generations, transmission, and distribution of utilities as well as it compels utilities to supply electricity to all (Leedy, 2003).

The socio-economic impacts of rural electrification programs maximised through; long-term and sustained government support, long-term funding that guarantees effective implementation of electrification objectives as well as eliminating misuse of electrification funds and the establishment of a strong market infrastructure that can attract the private investors (Barkat, 2002). Implementation of effective and efficient energy policies and regulation, connection costs should either be eliminated or spread over a certain period to

reduce up-front hindrances to household connections. Affordable electricity coupled with effective metering and billing methods which ensure payments from the local people. Involving the rural community in the decision-making process may increase a sense of ownership and support to the utilities (Chaurey et al., 2004). Community involvement is more apparent in small hydropower projects which utilize a lot of manual labour than the large hydropower project the require extensive use of machines. Amahoro energy project in Rwanda illustrates the importance of small hydropower plant to the local community given that over 1500 local people were employed for both skilled and manual labour on the Musarara 450kW run-of-the-river hydropower plant station.

### 2.1.3 RURAL ELECTRIFICATION AND GENDER EQUITY

The growing literature on energy and gender has attained increased prominence in the debate on sustainable energy development (Cecelski, 2000) Critical issues of gender equity are pushed forward by international programs such as ENERGIA, UNDP, NREL, and Winrock as well as policy researchers and development practitioners. Several energy projects are encouraged to pay more attention to gender equity during in all the stage of the project (ibid). An example is the PELNICA project in Nicaraguan that aimed at creating conditions for gender equity in the rural electrification projects. Diverse strategies such as forum for women participation in decision-making, gender analysis and gender sensitivity and programs that can respond to the economic gap in the rural areas were implemented (ENERGIA, 2014)

The World Bank projects review on infrastructure shade light on how women participation in the design of the plant and decision-making in rural electrification cooperatives can improve their effectiveness in the local community (ENERGIA, 2011) The projects also present empirical evidence on the effectiveness, sustainability of infrastructure and environment when women are directly involved. The exclusion of women from planning rural electrification project attributed on the gender blindness many planners that may not understand the difference in the energy impacts women and men. Rural electrification provides a platform for women empowerment through involving women in infrastructure planning, training and employment, SME promotion, domestic energy use and community resource availability (ibid).

## 2.2 RURAL ELECTRIFICATION AN OPPORTUNITY FOR ENTREPRENEURS

The literature on socio-technical systems contributes perspectives in rural electrification that see the interrelationship between technology, societal change and multi-actor processes (Geels et al., 2008). I theorise electrification as a process which connects technology, resources, institutions and people together into specific relationships and networks that form around systems of energy production and distribution (ibid). Local actors connect to each other through networks which also connect national and international stakeholders as well as provide support to each other. Scholars in the field of socio-technical systems acknowledge the actors and human perceptions as well as power relations in rural electrification (ibid). In my thesis, I focus on the different forms of entrepreneurship as grassroots alternatives to supposedly inefficient and corrupt agencies.

Entrepreneurship crosscuts all disciplines including the political agendas such as rural electrification of most countries. It operates within government and non-government programs and services that promote and support entrepreneurial activities (Tillmar, 2010). For example, energy access has become an integral part the sub-Saharan African governments' Poverty Action plans whose strategies target at providing renewable energy to rural areas. Political philosophers such as Stuart Mill, Adam Smith, David Ricardo and Karl Marx and other political economists attempt to connect economic behaviour to its social and political context by focusing on issues related to the distribution of income and social class and how these affect socio- economic change and resource allocation (Mitra, 2012). Economic problems such as unemployment and environment damage may be visible signs of shortcomings of an economic system dominated by big corporations, and entrepreneurship can mediate between the available resources to ensure value in a given political and social context (ibid).

Entrepreneurial opportunities emerge from situations that influence a person to come up with new means-ends framework for recombining resources (Shane, 2000). Literature offered on the Schumpeterian Perspectives focuses on knowledge or a new combination of existing knowledge as an important explanation for entrepreneurial opportunities. To Schumpeter (1934) changes in political forces, technology, regulation, macroeconomic factors and social trends create new information that entrepreneurs can use to recombine resources to more valuable forms. The three categories (Technological, regulation and socio-economic) introduce changes that alter the value of resources, upset the equilibrium creating the potential for entrepreneurial opportunities (Shane, 2000). For example, the invention of the

computer, a technological change from typewriters created an opportunity to manufacture and sell microchips. The government's mandate to involve the private sector in the renewable energy sector, regulatory change, creates an opportunity for entrepreneurs to venture into the sector. About rural electrification, the increased demand for energy in remote areas with dispersed population has in the past few decades resulted in the manufacturing of small-scale, distributed power generation technologies suitable for rural areas (Hisham, 2010).

Research in rural electrification shows the potential for private and semi-private actors in enhancing access to energy in poor remote, inaccessible areas. The poor returns and technical difficulties in rural electrification call for the need to establish an autonomous division within the utility and devolving more responsibility to the local organisations such as local communities and cooperatives (ibid). For example in Morocco, their financial arrangement for rural electrification included 55% from the National d`Electricite, 20% from the local authorities and 25% of the beneficiaries. Senegalese rural electrification Action plan established in 2002 that aimed at mixing investments from the private sector raised an average of 49% private finance (Mawhood and Gross, 2014)

The argument that technological change is a source of entrepreneurial opportunity is only indirectly seen, as one cannot measure the existence of opportunities and must use proxy measures namely; the tendency for people to engage in self-employment and the tendency for people to form firm (Shane, 2000). Political and regulation changes present entrepreneurs with possibilities of reallocating resources to new uses that are either profitable or redistribute wealth within the society. Some debates argue that firms founded at times of political change may not necessarily perform better than those founded at other times as the skills and abilities of entrepreneurs might be limited. Schumpeterian concepts on opportunities are innovative in nature and break away from existing knowledge, and are higher than the risk associated. He acknowledges the importance of individual-level attributes such as the willingness to make decisions on very little evidence to the discovery and exploitation of opportunities (Shane, 2000)

Social entrepreneurship is seen as entrepreneurial activities with an embedded social purpose, and most of the social entrepreneurship innovations have origins in developing countries seeking new ways to address basic human needs (Santos, 2009). Social entrepreneurs often target localised problems with global relevance such as access to water, energy and waste management or promoting small business creation. The local solutions validated in the local

context are often replicated in other geographical regions and can spur new industries, create new business models as well as allocate resources to neglected societal problems(ibid). Debates on social entrepreneurship emphasise participation and civil society as important categories that indicate that social entrepreneurship is not just about achieving objectives, on the contrary, it also encompasses processes and relations that create social value (Moulaert, 2005). Social innovation is about changing social relations that bring about innovation and it's also an empirical fact that actors from the civil society are the most common partners of social entrepreneurship inform of organisations, or concerned groups of citizens wishing to make a difference (ibid). The relationship between social entrepreneurship and social innovation is illustrated by Schumpeter's conceptualization of innovation and the role of entrepreneurship in innovation.

### 2.2.1 SOCIAL INNOVATION/ENTREPRENEURSHIP VERSES PRIVATE ENTREPRENEURSHIP

There is growing interest in the field of social entrepreneurship, social innovation and social enterprise as tools to encounter the need and demand for development. To spread the social impact, they depend on the support of people with resources-funders, investors, purchasers and philanthropic support (Nordic Council of Ministers, 2015). The support from these actors has increased awareness that new collaborative configurations among the private sector, public sector, and the civil society need to be formed to meet social challenges (Nordic Council of Ministers, 2015). ). For example in Tanzania, the traditional energy development organisation works closely with the government and communities to promote and establish small scale entrepreneurs to develop partnerships and management skills in green energy (Darci et al., 2015).

The Nordic Council of Ministers (2015:5) defines "social entrepreneurship as creating value through innovation with a high degree of participation orientation, the participation of the civil society and often with an economic significance". The underlying drive for social entrepreneurs is seen in the entrepreneurs desire to create social value by using new and better ways and not to appropriate value for themselves (ibid). They are seen as creators of social value – while social value remains largely undefined. In some cases, the social value is purely alienated from economic value and in other cases, the economic value considered as part of social value (Dankbaar and Groot, 2014). One cannot ignore the fact the entrepreneurs is also driven by the desire to create social value and perhaps the distinction between social and private entrepreneurship is somewhat blurred (ibid) Entrepreneurs chose

which organisation, investors or stakeholders to partner. Private entrepreneurs tend to be a more effective mechanism for actions in market-based economies due to their ability to acquire resources and to scale solution faster than social entrepreneurs. However, in situations where the potential for value creation in the society are beyond the benefits accrued to a private entrepreneur, social entrepreneurs are more effective (Santos, 2009)

The considerable literature on social entrepreneurship overlaps with the literature on social innovation though there is considerable debate on the definition of social entrepreneurship that completely views it as entrepreneurship without profit (Dees et al., 2002). Whereas some authors argue that entrepreneurship without profit does not exist (Marshall, 2010); Wilson and Post (2011) emphasise that the discussions on profit/non-profit aspect of social entrepreneurship should not constrain the concept of entrepreneurship. The meaning of the word `non-profit´ tends to appear vague and unclear; one might wonder whether it implies living off charity and subsidies, making no profits but generating income to cover costs or making profits but sharing with stakeholder (Dankbaar and Groot, 2014). An example that may illustrate it is the current trend of Corporate Social Responsibility that represents the duty of profit-oriented corporations in accounting for the full cost of activities to the society.

The literature on social entrepreneurship emphasises the importance of non-profit organisations (Waddock, 1991), the concern for financial resources from the philanthropic capitalist (Osberg, 2006), and also focus on the private sector (Nicholls, 2006). For example, simple private companies can be most suitable for small ventures as they may help raise equity, formalise the contribution of small groups of founders. Funding to social ventures tends to decline over time since the founders may not indefinitely commit to mission (Chao, 2014). The debate over the role of social entrepreneurs to development unfolds issues related to ownership and result based management and how it relates to the local level. That is, ownership is an ambiguous concept in organisations with social goals of benefiting the communities, and yet involves organisations with some measure of private interests, finance, staff, suppliers and purchasers (ibid)

### 2.2.2 LOCAL ENTREEPRENUERSHIP PARTICIPATION IN RURAL ELECTRIFICATION

Sociology researchers such as Sharpero and Sokol(1982) explain how entrepreneurship results from the interaction of situational and cultural factors. That is, the explanation broadens the focus of entrepreneurship to the social dimension of the individual and the

social group. The explanation diverges from the conventional perspective of entrepreneurship that focuses on an individual as a highly successful, self-employed individual to more collective actions (Bates, 1993). In Bates (1993) analysis of small business owner as a group, she presents the entrepreneur as a member of supportive kinship, peer and community subgroups on which he is heavily dependent on for social resources. Private-led initiatives in the energy sector are concerned with access to efficient energy and can be categorised as; off-grid projects are providing small devices to remote communities, Min-grid and micro-grid projects that provide a home-based system, community grid services which include local grids operated and maintained by the community (Hisham, 2011).

The incremental approach to economic innovation focuses on how people in business constantly adopt and adapt new ideas. And the porters (1998 cited in Hess and Adam, 2002) revised competition theory that adds locality and culture as enablers of competitive advantage give credibility in economics to social factors particularly to the agency of people and place as significant (Hess and Adam, 2002). **Social capital** literature has struggled to gain attention in policy and business world and yet social capital ideas are related to personal and collective well-being. For example, there has been a steadily increased capacity for the community involvement to interventions (Hess and Adam, 2002). **Community strengthening:** research in social capital claims that community engagement reduces the impacts of social disadvantages (Gerard, 1985 cited in Adam and Hess,). Hess and Adam (2002) argue that the characteristics of locality (people and place) emerge from both social capital literature and community strengthening practices.

### 2.2.3 RELEVANCY OF ENTREPRENEURSHIP AND INNOVATIONS TO RURAL ELECTRIFICATION

Social innovations fundamentally constituted around actors and institutional frameworks embedded in broader social context and provide a framework of how practices are created and institutionalised. Entrepreneurs provide an innovative, efficient and effective mechanism for financing and management of sustainable rural electrification programs (Darci et al., 2015). Government's rural electrification programs are characterised by poor management and political interests that hinder their stated objectives of making energy services accessible and affordable to the poorest families (Barnes and Halpern, 2000). The efficiency of social innovation is seen by analysing and presenting social action in a Weberian tradition of instrumental action, whereby actions conducted towards fulfilling intended goals (M. Weber 1947 cited in Giovanni, 2013).

The innovation journey as mentioned by Van de Ven (1999, cited in Jan Fagerberg, 2006) is seen as collective achievements requiring key roles from numerous entrepreneurs in both the private and public sector. The term collective is used in different ways such as interactions and networks of businesses (Jonsson, 1997), the interactions and networks of the communities (Putnam, 1993). An example of collective action in rural electrification is the community committees and co-operatives that are proactive at all stages of electrification process and the role they play in reducing individual costs (Modi Vijay, 2005). Hess and Adam (2002) define social innovation as an integrative phenomenon that derives its strength from the intersection of established debates theorising around economic innovation, social capital, community strengthening and regional development**.** A growing body of evidence supports the benefits of a particular range of social innovation to the interaction between different actors. Examples of such innovations include; encouragement of distributed leadership, use of intermediaries such as local councils to cross boundaries between sectors, fostering and maintaining networks, encouraging enterprise, promoting creativity and proper application of resources (Hess and Adam, 2002)

## 2.3 INITIATIVE AND ORGANISATION IN RURAL ELECTRIFICATION

An organisation is seen as a locus of innovation diffusion. The structure of an organisation or initiative gives a framework around which the project/initiative is organised. Some important elements of an organisation include; decision-making, governance rules, and regulations as well as the distribution of work (Unterman and Davis, 1984). Initiatives in communities aim at envisioning desired changes, transforming the community as well as supporting efforts of those working to promote change (ibid) Hisham (2011) examines organisations in two dimensions namely centralised and decentralised. He explains the determinant for the centralised organisation about whether decisions made at the time of innovation implementation, and the decentralised about whether the organisation is governmental or non-governmental. Until recently the energy sector in most African countries has been wholly managed by the government- owned utilities have not been efficient and effective in enhancing rural electrification (ibid). Government institutions have different functions and responsibilities in the field of rural electrification and are considered to influence the rural electrification programs and implementing actors (international energy agency, 2010).

In an attempt to address electricity access problems, some countries have adopted different institutional models such as 1) **electrification through public companies**; the state-owned utilities take the lead in addressing rural electrification problems, in spite of the inefficiency

and political agendas associated with examples including Thailand, Tunisia, Uganda and Rwanda, Mexico. 2) **Private and decentralised electrification companies;** the private sector meet the energy needs and demands of the communities. Such companies are criticized for their business interests that are not compatible with extending services to markets perceived unprofitable. Chile is an example of the countries encouraging private companies to explore rural electrification. 3) **Rural electrification agencies (REAs);** some countries opted to establish designated institution to manage earmarked resources to support rural electrification projects with the hope of minimizing political interference. 4) Rural electrification cooperatives; the cooperative approach derived from the experience in the US and several developing countries are adopting the approach (World Bank, 2010)

Rural electrification involves multiple actors ranging from highly centralised organisations such as national governments and large companies to decentralised organisations that may include individual owners, local entrepreneurs, and local governments. Establishing appropriate organisational infrastructure is viewed as an important aspect of current debates on energy poverty and the productive use of energy in marginalised groups (UNESCO, 2014). For example, the government can offer support to decentralised organisations through the dissemination of information, supporting the decentralised programs, support for financing organisations and provide favourable tariffs and subsidies (Hisham, 2011). Studies show that production of fossil-fuelled energy has co-evolved with markets, infrastructures, regulatory institutions and energy-related consumption practices that may disadvantage the diffusion of path-breaking socio-technical practices, like community-led energy initiatives (Smith et al., 2005 cited in Smith et al. 2011).

According to Smiths et al. (2011), recent literature mainly focuses on the technology manufacturers and intermediaries, business, government actors, ignoring factors that influence and might transform consumption-demand- at the individual household and community level. The potential for a holistic approach in energy transition has been acknowledged by policy makers and community energy initiatives in recent years in particular when trying to find ways of changing people`s behaviours (Wilhite et al., 2000). A holistic approach in rural electrification which includes socio-technical aspects that engage and respond to challenges in the rural areas are likely to achieve sustainable consumption outcomes (Heiskanen et al. 2010). For example, community-based approaches do not only engage the local people but can also improve their capacities (Walker, 2008); “reach parts others can’t reach” (Steward et al., 2009:147). The community-based approaches shape local

infrastructure and positively impact the socio-economic factors such as local income, skills, and social cohesion; promote behavioural change and embed social acceptability for sustainable energy technologies (Steward et al., 2009).

The argument for the benefits of project preparation is supported by literature related to implementation and sustainability (Moser, 2016). The preparation stage is regarded as the critical first step towards developing sustainable infrastructure projects. It involves the following steps as stated by Moser (2016)

- *Developing approaches toward the enabling environment for an infrastructure project, including any regulations, laws institutions. It also includes local capacity and consensus building to ensure a projects effective implementation, replicability and sustainability*
- *Defining a project, including designing the basic project concept. Identifying desired outcomes and potential partners and conducting pre-feasibility studies that gauge the technical, and financial challenges of implementing the project*
- *Determining project feasibility through detailed social, financial, environmental, technical and other relevant studies.*
- *Structuring the project, including assessing the appropriate mix of public and private partners and determining viable options for the financial, legal and technical make-up of the project*
- *Achieving community buy-in as soon as possible*
- *Providing transaction support, including overseeing the implementation of decided project financing, legal and technical plans and managing procurement*

*(Moser, 2016:17)*

### 2.3.1 DECENTRALISED ORGANISATIONS IN RURAL ELECTRIFICATION

Rural electrification projects are increasingly advocating for public community participation as an essential tool for sustainable energy access and consumption. Implementation of programs in decentralised electrification is done through competitive bidding procedures or single source selection (IEA, 2010). According to World Bank (1995), participation can be defined depending on the context in which it occurs. It could, for example, be a matter of

principle or practice. Implementation agencies range from government-owned enterprises covering various mixtures of private companies to public-private ownership. There is an increasing amount of community ownership of the small scale electricity generation technologies in rural areas that are supported by NGOs, governments or donors. They aim to electrify community structures like schools, clinics, and other communal areas or create village level grids (Hisham, 2011). A common aspect is the high level of community involvement in the decision-making making process regarding the innovations and implementation strategies. It can also be a combined approach that involves the government and other actors, in which the community owns the technology, but the commercial entity may operate the unit, and both receive shares of the profit (ibid). In a Community approach partnership, the local people/groups without access to basic public service such as electricity join forces to obtain and distribute the service. Community management is advocated in Africa due to its advantage of greatly involving the local population in the project operation (European Commission, 2010).

Rural electrification studies on local participation in different countries such as the rural electric distribution franchise in India, the electricity cooperatives in Nepal and Palli Bidyut Samities in Bangladesh show that local participation has helped reduce theft and distribution losses. Improved billing and revenue collection efficiency and also ensured stable delivery of electricity (Bhattacharyya, 2012). The research further indicates local participation in decision-making committees can add value to the planning process as well as give the communities a sense of ownership as they assume responsibility for their welfare.

Public community participation in rural electrification is a process of growth that is enhanced as the community develops its capacity to contribute to community development (Oakley and Marsden, 1984). It's necessary for project implementers to communicate advice and convince the locals on the roles and importance of participation. Focusing on capacity building through skill training to handle simple routine operation, maintenance, and some administrative jobs create a sense of ownership and increase the sustainability of the project (Dwivedi, 2012).

### 2.3.2. PUBLIC-PRIVATE PARTNERSHIP (PPP) IN RURAL ELECTRIFICATION

The role of non-government actors in accelerating the development of rural electrification has recently gained more support from different scholars in development studies and international organisations. In the Sub-Saharan countries, electrification rates are very low in comparison with other countries, and this may make it difficult for these countries to reach MDGs

without increasing access to energy (European Commission, 2010). In most African countries the public investment may not be sufficient to sustain the financial support towards rural electrification and thus creating a need for mobilization of private financing from international cooperation institutions and the private sector (European Commission, 2010). The new partnership function on specific conditions such as opening the rural electrification sector to the private sector as this is seen as an essential tool to rural electrification. The concession system moderated in the rural areas due to the high costs involved in serving rural areas and low payment ability by the local people. It is based on bidding for a minimum subsidy from the central government (Ibid). The government also take the responsibility in defining markets tax and frameworks for the energy sector within which the private partners can operate.

Based on the definition by the European Commission (2010) Public-Private Partnership (PPP) as long-term contracts between the public and private sector whose objective is to participate in the implementation and management of a public service, whereby in this case is the distribution of electricity in rural areas. In other words, it includes involving the private business in infrastructure financing, building and maintenance operations and electrical service provisions. In Uganda for example, financing the $800 million for the 250MW Bujagali project by the government was not forthcoming until a PPP venture formulated in 2005-2006 reached a financial closure in 2007. The partnership included the government of Uganda, Aga Khan Group, World power holdings, Sithe Global power and the Blackstone Group who together formed the Bujagali Energy Ltd. There are also several examples of PPP cases in India and Chine that have attracted substantial attention from all over the world. Community approaches promoted in some countries like Burkina Faso, North America, and other Asian countries.

### 2.3.3 THE SOCIAL SYSTEM AND ITS INFLUENCE ON RURAL ELECTRIFICATION.

A social system is a set of interrelated units such as social structure, social norms and interpersonal networks engaged in a joint effort to accomplish a common goal (Roger, 2003). It sets boundaries within which innovations diffuse and attention to contextual factors like social value systems, living habits, social norms and culture rather than just focusing on only economic and general infrastructure indicators can prevent misfits between models and reality (Lehmann 1995). For example, several states, as well as some large cooperatives with energy sector advocate free solar system distribution programs as a strategy to energy access

without studying the community, needs as well as ignoring the local cultures and habits (Hisham, 2011). Roger (2010) in his Korean investigations, the results show how village norms affect the rate of adoption of innovations. In this investigation, 24 villages were studied to find out the level of adoption of family planning methods. The study shows differences from village to village in the adoption of both family planning and particular family planning types (Roger 2010). System norms determine how one behaves or responds to change; they can be a barrier since they are established behaviour patterns for members of a social system (Ibid).

Communication with the community through channels that occur interpersonally within existing social network is necessary for the diffusion of innovations (Roger, 2010). A social system may consist of individuals, informal groups, organisations or subsystems that are interrelated and engaged in joint problem-solving to accomplish a common goal and community leaders can be beneficial in communicating (Rogers, 2010). Community leaders are exposed to all forms of external communication, have higher status and are at the centre of interpersonal communication networks. These networks consist of interconnected individuals that linked by the patterned flow of information (ibid).

Nilsen (2015) framework for environmental analysis proposes four factors conditioning the management of operations in developing countries namely, economic, political, cultural and demographic factors. It presents theoretical approaches that explain and give a better understanding of how and why implementation may succeed or fail with an aim of improving the relevance and appropriateness to the particular circumstance at hand (ibid). Mckinsey research (2015) research on the growth potential of the Sub-Sahara electricity sector emphasises the importance of the governance structure to implementation and sustainability of the rural electrification. Factors such as political will, government commitment to the private-sector, and prioritization aspects contribute to rural electrification. Planned actions/models offer practical guidance in the planning and execution of implementation strategies by prescribing some steps that are used to guide change (Graham et al., 2009). In a study by Ahlborg and Hammar in Tanzania about driver and barriers to rural electrification, political priorities are mentioned as a crucial problem that may hinder proper planning and efficient implementation of the programs. Several frameworks developed from different fields of study intended to give support for planning and managing implementations (Nilsen, 2015). For example, the how-to-implement models that mainly emphasize the importance of careful planning, capability and opportunity that may influence motivation (ibid)

The relationship between different actors and structural features illustrated through the institutional theory frameworks which explain how institutions may constrain or enable the activities undertaken by the actors (ibid). For example in Uganda, independent micro-hydro power producers and distributors in the form of individual entrepreneurs or communities are increasingly joining the energy market. The energy generated is for purposes of household use and also for specific clients that are within the proximity. The entrepreneurs can officially get government support such as subsidies through the rural electrification agency. The support is, however, rare and involves a lot of paperwork and bureaucracy which make it time-consuming processes (GTZ, 2009). The concession for exploitation of energy resources is usually subject to permission by the state and with a timeframe under conditions determined by the state. Institutions draft energy policies and regulation that provide the frameworks within which the electrification process should occur. In an organisational setting, in this case, government, rural cooperatives or groups, some individuals are usually involved in the decision-making process, and this may create a problem during the implementation period (Roger, 2003).

Adoption of a social system can include; stimulation of interest within the system, initiation of the new idea by the local opinion leaders and the legitimation of innovation by the locally powerful people in the community (ibid). The example from Nepal demonstrates that cooperatives established by the rural electric entrepreneurs adapted to new technologies and strategies as rural organisations to extend energy access to their communities. The cooperatives offer appropriate financial and institutional support to the socially oriented cooperative businesses as well as provide efficient and effective ways of extending and managing rural electricity service (Annabel and Heather, 2010).

### 2.3.4 COMMUNITY PARTICIPATION STRATEGIES AND DECISION-MAKING

Application of renewable energy technologies can be relatively small scale such as the mini and micro hydropower systems, but the investment and decisions will impact several stakeholders including the community. The aspect of acceptability becomes an issue due to the many stakeholders involved in the decision-making process, and it gets complicated when the actors involved include foreign investors, large energy companies, and government. Legitimisation of the project is likely to depend on its social characteristics of the application of the new technology (Sauter and Watson, 2007). And questions about community participation, community influence in the process, the usefulness of specific local, tacit knowledge to the project become relevant. The relevancy of community participation in rural

electrification is seen in the positive outcomes of the project including saving time which reduces both costs and unnecessary delays (Woltjer, 2002).

Rural electrification programs pose different impacts for women and men because of the traditional divisions of labour in households that have enormous meaning on the adequacy, effectiveness and efficiency of the programs initiated in the local community. Local community participation in identifying community needs, community resources such as human capital, should encourage gender sensitive practices and tools specifically to identify both needs as well as opportunities for women in the target community (ENERGIA, 2014). Given the broad literature that supports participatory or collaborative decision-making process in planning and policy analysis, direct involvement of local people in the preparation process should go beyond just the formal consultation but also for normative and instrumental reasons (Woltjer, 2002). A certain level of support and approval from actors within the local areas can positively enhance the implementation of the project by ensuring effectiveness and efficiency of investment while the normative argument is that participatory processes enhance the democratic legitimacy of both the process and the outcome (ibid). Exclusion of stakeholders could have adverse effect on the adequacy, effectiveness, and legitimacy of the implementation of initiatives as their interests and values may be misrepresented (ibid)

It is argued that involving social actors in decision making is key to social acceptance of social initiatives. It increases the probability of positive outcomes by saving time, reducing both delays and costs when the local people join the policy process, collaborated with so as to reach a consensus (Renn, 2008). Acoording to Renn, social actors are engaged in decision making through the following ways; *empowering all actors to participate actively, generate a common understanding about framing the problem, potential solutions, and likely consequences. Conduct a forum for decision making that provides equal and fair opportunities for all parties to voice their opinion and to express their preferences and establish a connection between the participatory bodies of decision making and the political implementation level (Renn 2008: 274).*

Despite all the significant claims, research shows there is little evidence regarding the long-term effectiveness of participation, empowerment and sustainability in involving the beneficiaries in decision-making and using the participatory approach as a strategy for development (Cleaver, 1999). For example, empowerment is a frequently used concept in

development and has simultaneously become a tool for analysis. Empowerment can be achieved through the full participation of people in the formulation, implementation and decisions making. Most governments include the concept in their policies and investments with an aim of maximising their capacities, resources and opportunities (Ranjani et al., 2005)

Participatory development is criticized for being too rapid and used to prove projects participatory credentials are ignoring time yet time relates to the unfolding of the political process and how they allow transformation to take place (Mohan, 2004). William et al. (2003 as cited in Mohan, 2004) explain how political projects may use more time than a one-off transformative event and may require institutional change.

### 2.3.5 CAPACITY SUPPORTING STRATEGIES AND ITS RELEVANCY TO RURAL ELECTRIFICATION

Capacity building is briefly defined as the development of an individual's core knowledge, skills, and capabilities and may also include enabling the environment with appropriate policy and legal frameworks. It also includes institutional development and human resources development and strengthening of managerial systems (international energy agency, 2003) it is facilitated through the provision of technical support activities, training specific technical assistance and resources networking, awareness raising, preparation of business plans (ibid). Sustainability Problems associated with rural electrification can be related to limited capacity building within specific sector whereby expertise dissipated after the project is completed (ibid). Empowering the community through capacity building enables the local people to remove social, economic and cultural barriers and transform them to active participant as well as stop them from being passive recipients of government programs (Ranjani et al., 2005). Organisations such as ENERGIA advocate for women engagement in opportunities achieved through capacity building (ENERGIA, 2014). Capacity building strategies directed towards women involve identifying the gaps and opportunities that encourage women to participate actively in all stages of rural electrification projects. It may include increasing training and capacity building for SME development, training local women with basic education technical skills (ibid).

Participation in decision-making may require resources like education and time, scarcity of these resources mean that much of what is considered as participatory is merely a small number of people that is representing the majority of the population (ibid). The poor may also see direct participation as risky, and they may willingly hand over their rights to others (ibid)

Scholars have different perspectives on how and individual is exposed to knowledge. It is argued by some scholars such as Coleman et al. (1966) that one may not actively seek an innovation but accidently becomes exposed to the awareness-knowledge about the innovation. Well as other diffusion scholars believe that individual gains awareness-knowledge through behaviour that has to be initiated. Hassinger (1959) emphasises that individuals tend to expose themselves to ideas that are in line with their interests, needs or existing attitudes. Regarding sustainable rural electrification, the need for energy in rural areas motivates the local people to seek knowledge on strategies that can be used as a local community maintain sustainable energy access.

## 2.4 FINANCING SMALL HYDRO-POWER PROJECTS IN RURAL AREAS.

The rural market for electricity is too small to cover the costs of extending the grid to marginalised areas as compared to urban areas where the demand for electricity is high. The cost of building 1Kwh of energy in Africa cost two to three times as much as in Europe and yet profitability may appear marginal for private investors (Mckinsey research, 2015). Rural electrification achieved through innovative and efficient financing mechanism. Financing structures separated in two aspects that include financing of capital costs or support mechanisms and the recovery of operating expenses and the tariff structure (Hisham, 2011). Government involvement is often considered necessary for covering Capital cost because technology diffuses at a low rate, and yet it's very costly. The government support in the form of technology installations, loan guarantees with favourable terms, or partial subsidization. Central governments encourage power companies to seek to fund their activities as well as encourage local governments to increase support for rural power grid construction. Private lenders can privately provide capital financing, micro-financing organizations, and international donors and other organisation (ibid) Energy systems require long-term maintenance and operating expenses recovered through the tariff for sales. Rural electrification projects may have different mechanisms of covering both the capital and operational cost and in some enterprises operating expenses are part of the financial structure. In several developing countries, utility- based system providing energy to customers in remote areas can in theory cover some costs through government grants or subsidies (Hisham, 2011).

Dispersed and less populated rural areas, with high levels of illiteracy, present big challenges in the extension of renewable energy. Specific challenges for financing rural electrification and provision of energy services are categorised as; 1) lack of end-user financing

mechanisms. 2) local entrepreneurs and businesses have limited access to working capital and credit at low cost. 3) lack relevant mechanisms and organisations that can channel finances towards the end-user. 4) investment uncertainty that is related to the risk of non-payment by end-users and small enterprises (Darci et al., 2015).

The uncertainties in the energy sector pose a threat to investments in rural electrification. Provision of clear, consistent policy decisions and transparent regulations saves time and reduces risks (McKinsey research, 2015)

### 2.4.1 ENSURING FINANCIAL VIABILITY FOR RURAL ELECTRIFICATION

Models have been created and employed that ensure financial viability for rural electrification. These models include; public-private partnership, incumbent corporatization, independent power producers, Market liberation and clear, consistent and transparent regulations (Mckinsey research, 2015). Several countries in the sub-Saharan have for the past decade adopted and pursued a combination of these models to ensure financial viability.

The **public-private partnership** is possible in situations where the government wishes to retain ownership of the electricity asset. This partnership is demonstrated in Abu-Dhabi were government maintains ownership more than 60% of all new energy project (ibid). The positive aspect of this arrangement is that the risk is shared between the government and the private partner. The disadvantage is the bureaucratic nature of government that often makes the process time consuming. 2) **Incumbent corporation** approach ensures private sector funds through using existing assets as equity. For example simple infrastructure bonds, asset sales to equity and auctions to the private-sector player. 3) Independent power producers entirely privately generate power that is sold the market through a power-purchase agreement (covers, capital costs, return on investments and risks) or sold to the own clients. For example widely common in South Africa, Azura-Edo power in West Africa. 4) Market liberalisation which has become commonly adopted in Western Europe and the United States. Market signals and wholesale prices provide sufficient incentives for the private sector. A wide variety of financing sources that ranges from government and private is available through grants, loans, direct investment and in-kind contribution (Barnes, 2007).

Results from the study done on small hydro projects in Tanzania by Ahlborg et al. (2015) emphasise an approach that is social oriented to ensure financial viability. They argue that financial viability in a rural setting is ensured when the project enhances household access and increase the consumption of electricity by the local population. Enhancing household

access involves encouraging productive end users of electricity such as milling services. And ensuring free energy connections for the public services such as schools, health centre, lower costs than the average national electricity connections for households They define financial viability as managing monthly budgets and raising enough income to cover costs of operations and maintenance including unexpected events and long-term depreciation costs (ibid).

### 2.4.2 FINANCIAL SUSTAINABILITY MECHANISM

A study carried out by Darci et al. (2015) in the sub-Saharan region evaluated three financial mechanisms (pay-as-you-go, free for services and NGOs) for rural electrification by their ability to overcome the financial sector specific barriers. The key finance chasms for rural electrification are the small scale enterprises and end-user finance. Pay-as-you-go model allows flexibility in the end-user payment as it presents possibilities for them to split monthly consumer bills into small, affordable instalments. Splitting the bills in small installments, may, in turn, decreases the burden of start-up capital for investors by reducing uncertainties related to payment of energy used. These new innovative models of Pay-as-you-go such as M-kopa, Mobisol, Azure technologies and Yaka created in the East African countries and other African countries such as South Sudan, Zimbabwe and Zambia (ibid).

Free-for-services model is commonly used across Africa by energy service companies to supply free equipment and also provide service and maintenance. But usually, the initial investments remain unfordable to the end-users living in the rural areas. Some scholars argue that this model may provide affordability to rural households if rural populations have information on how to manage the equipment (Darci et al., 2015). In some countries such as Morocco, South Africa, Argentina and Zambia, the responsibility of funding infrastructure development and subsidy has partially been taken by the government. This action is due to the low purchasing power of the rural people and the limited local financial institutions (ibid).

Lastly is the Non-governmental organisation (NGOs) are a valuable financial structure as they break down top-down structural barriers and fill the intermediate level between the national, local and political ( Darci et al., 2015). The NGOs are instrumental in securing good management and sustainability of the energy utilities through income by generating productive use of electricity. Research shows that NGOs can operate successfully as Market facilitation organisation if the adopt a private sector orientation. An example is the traditional energy development NGO in Tanzania which promotes and establishes small and medium-

scale entrepreneurs, works closely with both the government and the communities to develop partnerships in the green energy sector (ibid). It is argued that these projects initiated by NGOs may function before, during and shortly after implementation but then fail when the NGOs leave the local community without empowerment and building capacity for the local people to be able to manage the electrification projects.

The theories I used in chapter two are not exclusive models but rather conceptual meeting points that embrace other theories to help shade light on the topic of this thesis. As explained in sections 1.2.2 the theory chapter has main four independent variables namely rural electrification, entrepreneurship/innovation, and organisations, community participation, and financing rural electrification. I use these variables as important focal points of my discussions in chapter 5. To capture the important elements of the innovative practices used by entrepreneurs for enhancing rural electrification, I also integrate aspects from another sub-theories.

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# CHAPTER 3. RESEARCH DESIGN AND METHODOLOGY

This chapter describes the methodological aspects used in conducting the study on achieving energy access and consumption through innovative social practices for rural communities. My role and relationship with the stakeholders as informants is presented in this part of the thesis. I organized the chapters under the following subsections: preparation stage, research design, Case selection procedure, research instruments, validity and reliability, data gathering procedures, data analysis, ethical considerations and limitations of the study.

For comparison purposes, I chose two cases that were at different stages of development. One of the cases in Kitabona in Uganda has been implemented and runs whereas the Rubagabaga case in Rwanda is at its planning stage and under preparation.

## 3.1 RESEARCH DESIGN

The basis of my research is qualitative in nature since I seek to carry out a descriptive inquiry on cases regarding innovative social practices used to achieve sustainable energy access and consumption in rural areas. I purposively selected the cases by particular characteristics that would best answer my research questions.These characteristics include; business models that are designed to create both economic and social value, integration of various stakeholders to jointly tackle the energy problem in rural areas through new ways of working together, mobilisation of local actors and involving users. Choosing a research method is a challenging process as the reliability, relevance and quality of research results depends on the methodological design used (Myers, 2009). The methodological approach should be determined by the appropriateness of the method for the phenomenon studied (Yin, 2012). Normally both qualitative and quantitative methods can be used to collect data from secondary and primary sources, and their strength and limitations explained by their difference in characteristic and the fact that they share similar basic scientific principles (Mikkelsen, 2005).

Qualitative research approach seeks to gain an understanding of underlying reasons and motivations, provide insights into a phenomenon being studied and generate ideas. Methods used in qualitative research are characterised by 1) understanding the phenomenon from an insider`s perspective, in its natural settings. 2) Flexibility, creativity, and openness that connected to having learned to sustain a fair amount of ambiguity (Strauss and Corbin, 1998).

3) In-depth data that comes from various sources such as interviews, observations, and documents; 4) procedures used to interpret and organise the data (Darling, 2014). Qualitative research is concerned with exploring and explaining human environments and experiences, and thus, it's used in many areas of human geography that seek to explore the meanings, feelings and experiences (ibid). Several authors point out qualitative research as a key tool in identifying, describing and understanding the implementation processes given its focus on empirical accounts of individuals, collective and organisational process and practices. To understand the experiences and the linkage between their subjective view and the actions of the involved actors in these projects, I focused on stories told by the participants.

The case study approach was used to get an in-depth understanding of the subjective realities; and interpret the experience in its social and spatial settings (Jackson and Smith, 1984 cited in Dwyer and limb, 2001). Yin (2012) defines a case study as a rich empirical description about a contemporary phenomenon (e.g., a 'case'), set within its real-world context and based on a variety of data sources. It involves a up-close and in-depth understanding of the *case* (ibid). I chose to use multiple case analyses in order to derive as much knowledge as possible from the cases. The method enables the comparison of commonalities and differences in the events, activities, and processes (Yin, 2012). The advantage of using cross-case analysis is that it provokes the researcher's imagination, prompt new questions and reveals new dimensions, produce alternatives (Stretton, 1969). Also, this method enabled me to delineate the combination of factors such as social entrepreneurship vs. private entrepreneurship. The factors contributed to the outcomes of the cases, explain the differences in the cases, and make sense of the unique findings (ibid), and also articulate the concepts, theories constructed, and understand how relationships may exist among discrete cases (Eckstein, 2002)

With limited experience in conducting case studies, my view on this strategy is shaped by different authors (Yin, Crang, and Cook), and experts on case study research. The choice of the method used was also greatly dependent on the nature of the research problem, research questions, theory and my understanding of social reality. I believe that social reality is constructed, multidimensional changing and not waiting to be observed or measured (Merriam, 1995). This approach was used to understand the phenomenon of social innovation and its impact on energy access and consumption. It fit well with the aims of the study, which are to examine how innovative social practices can be used to achieve energy access and consumption in rural communities.

The research design assumes that the innovative social practices implemented by the actors present dimensions seen in development literature as important strategies, challenges, constraints as well as opportunities. The research design emphasises the actor- oriented approach as this permits the exploration of self-organising practices of actors involved (Long, 2001). Multiple case studies give rich empirical descriptions of a particular phenomenon based on several sources of data.

### 3.1.1 THE PREPARATORY STAGE

Fieldwork research is often messy, confusing, and stressful and frustrating as it may not go as planned and it also requires personal involvement (punch, 1998). Early preparations were necessary to analyse the conditions in the field such as physical conditions, socio-cultural conditions, and resources needed to extract as much useful information in the field as possible for the purpose of acquiring knowledge (ibid). Preparation period started in September 2015 following the choice of topic to be studied. Topic selection was a challenging task however my desire to understand more about social innovation as a tool to help achieve sustainable energy access and consumption in rural areas raised my interest to study this topic. Social innovation is still an emerging body of knowledge which is not well elaborated as other forms of innovations primarily perceived to have clear economic effects such as technologies, marketing, and organisational measures in enterprises (Adams and Hass, 2008).

During the preparation period, I reviewed literature and publications relevant to the research topic, contacted experts to solicit advice about study topic, research population and how to obtain information and literature. The knowledge gained from the literature reviews was useful in choosing the research methods, formulating the research questions, and selection of the cases to be studied. I contacted each potential study project leader either through telephone or emails and informed them of my study and its purpose. Two cases were identified, selected and each key respondent was contacted to request participation in the study. The first meeting scheduled with project leaders that were open to the idea of the case study and confirmed their participation. The purpose of these meetings was to explain the purpose of my study, gain cooperation, and collect key contact information; and to also schedule Interviews. From the information gathered on the internet about the topic, it was determined that an in-depth study of representative projects from three categories; self-standing innovator, philanthropically funded project —are feasible.

## 3.2 CASE SELECTION

New approaches/ practices are being adopted by actors in the energy sector to ensure energy access and consumption in rural communities. My study was delimited to a small number of cases (Rubagabaga min hydro-power project and PECO Rwenzori micro power project) to enable me to explore the dynamics of each project. With such a small number of cases, no representational scheme was used, but cases that presented some features/factors (local people participation, rural based) considered to be of interest, were selected (Yin, 2012; Silverman, 2005). The cases I selected were diverse, influential, both similar and different and thus ensure the analytical generalisation of cases to theoretical propositions rather than populations, an inductive theoretical sampling method was also applied (Eisenhardt, 1989). The advantage of using inductive theoretical sampling is that it provides a structure to data collection as well as data analysis. It also gives room for flexibility when one wishes to change the sample size or number of cases (Silverman and Marvasti, 2008). Smith et al. (2000) argue that theory can drive the selection of cases, and also an examination of cases can lead to elaboration or reformulation of theories. I started the screening process beforehand by contacting six projects on energy access in rural areas in Uganda/Rwanda and reviewing the available reports and literature.

The cases selected from some possible alternatives present a business model that has both economic and social value. And within each case two conditions were highly prioritized: Financial viability and the involvement of the local community. These two criteria were necessary to illuminate the opportunities, constraints and challenges faced by implementers of energy initiatives in rural areas. Also, they presented an occurrence of exemplary outcomes (Ginsburg, 1989 cited in Yin, 2012); Secondly the study`s concern for the rural energy policy in the two countries and; finally the different economic conditions of these projects to maximise the difference in comparative groups (Patton, 2002)

**Table 1: Case selection**

| Case | Community/country | Reasons for selection |
|---|---|---|
| **Rubagabaga min hydro-power project 350Kw** | Rubagabaga, Rwanda | Philanthropic funding, community involvement, socio-economic value. At planning stage. Energy produced will be fed into the main grid |
| Rukarara micro hydro-power project. 9.5MW | Rukarara/ Rwanda | Not selected: didn't have the necessary criteria. |
| **Peco Rwenzori micro power project 5kw** | Kitabona/ Kasese, Uganda | Local private investor, community involvement, socio-economic value, in operation, supply energy to clients within proximity |
| Kilembe mines Hydro project, | Kasese/Uganda | Not selected: an independent producer for the copper mines. |
| Waki, Masindi, SN power Invest AS | Masindi/Uganda | Not selected: difficulty in contacting project leaders |
| Kuluvu | Arua/Uganda | Not selected: the location of the project was not financially viable for me |

### 3.2.1 SELECTION OF RESPONDENTS

Although the two study cases were selected before I went out to the field, the number of participants was not fixed. I purposely selected my respondents basing on the knowledge I had acquired about my topic and study area. Initially, my plan was to interview only the representatives of the selected cases to collect information about the projects, and the innovative social practices used views on the current energy situation in these areas, intended

social impacts of the projects, the level of community involvement. However, I decided to include some representatives of the beneficiary communities to get more in-depth information. I purposely selected local entrepreneurs, cooperative leaders, two local authorities from each project area and women representatives based on their position and influence in the communities. My reason for selecting them was to find out their views, attitudes, behaviour and perceptions about the projects. I further wished to know about their contribution and roles during the implementation period.

### 3.3 DATA COLLECTION METHODS AND TOOLS.

I collected data from multiple sources of evidence using various data collection technics such as semi-structured interviews, observation and literature reviews of previous reports and documents (Yin, 2012). The aim of combining the methods was to maximise the range of information, enhance the trustworthiness of the data, and to give a basis for comparison and facilitate data analysis. These data collection tools provided complementary perspectives on social innovation as a tool to achieve energy access. Each method collected different information necessary for the research. Each technic or source has its limitations and strengths, combining the technics during data collection minimised the inadequacy of one technic.

I categorised data collection around the objective of the study, predefined themes and sub-categories. I was, however, flexible enough to allow other themes and sub-categories to emerge during the process of data collection. Data collection was an iterative and interactive process that involved all the three sources. For example information from previous reports gained meaning and utility because of information collected through interviews. Research questions were formulated based on pre- determined information about the topic and the study area.

#### 3.3.1 FOCUS GROUP DISCUSSIONS

The representatives of the project in the case studies contacted the local community participants and asked them to take part in the focus group discussions. The focus group discussions were organised to save time, and it was also easier to gather them together on the market day. Initially, I had not planned to carry out any focus group discussions in Rubagaga. My intention was to interview people who were actively participating in the construction of the power plant and the community leaders. The interview did not go as planned, however after spending a day at the site observing what was happening, I found it

appropriate to carry out a focus group discussion. Kvale (1996) mentions the importance of interviews in the construction of knowledge through the interactions between the interviewer and the interviewee. To ensure uniformity and consistency in the data collected, I used a check-list, took field notes and also recorded two of the interviews.

From the focus group discussion in Rubagabaga, I also noted that the participants that represented the community had different perceptions or views about how the project would impact them or their role in the project. Some of the sensitive issues such as gender were not deeply discussed. During the interview, I noted that both the women and men seemed to have similar views about income generation and usage in the family, shared roles and activities. However through observation, I noticed that the men in the village spent more time having the locally made brew as the women worked in the market. The women insisted that they gave their men permission to drink. It was not clear to me as to why they were not completely open about the gender differences.

### 3.3.2 INTERVIEWS

The interviews were semi-structured, and they focused on understanding the practices/strategies used by the different entrepreneurs to achieve energy access in the rural area, their challenges, constraints, and opportunities. I conducted a total of six interviews were, and each of them lasted approximately 60 to 90 min. Four of the interviews were carried out with the leaders of the projects who represented the key participants, two interviews with community leaders in Kitabona village and a focus group discussion with community people in Rubagabaga. Although I did not have preconceived theories, the interview guide consisted of questions that helped define the key areas. The interview guide had open-ended questions to open up conversations about the topic. The semi-structured interviews allowed for divergence during the discussions, and this enabled me to elicit more information about entrepreneur opportunities in rural electrification, implementation, challenges, and significance of social innovation in enhancing sustainable energy access in rural areas. These social innovations discussed include community participation, business models used and innovative financial mechanisms and structures. Information was shared on how the different projects can ensure and sustain financial viability in the projects. Semi-structured interviews are flexible which explains why they are time-consuming and could last for hours if not controlled. All interviews were scheduled to take less than two hours. Interviews were spaced over a period of a week to allow me to reflect on the interview preceding and to adapt to any changes as appropriate as possible (Seidman, 1998). Spacing

the interviews allowed following up on some unclear issues previously raised in the previous interview. The follow-up interviews were conducted by telephone and Skype call to minimise travel costs.

### 3.3.2a INTERVIEWS IN RWANDA/RUBAGABAGA

The interview was semi-structured in nature to allow openness and in-depth discussions about the mini- hydropower project, its aim and perceived impacts to the local community, community involvement and how they ensure financial viability. The first interview was important for me to establish rapport to enable thorough exploration of issues under discussion. Scott and Darlington (2002) emphasises that relationship between the researcher-participant is subject to continuous negotiation and reworking. Throughout the interviews, it was important for me to show genuineness in the discussion and the respondent's experience. As the discussion progressed, it was clear to me that I needed to visit the site and also interview the beneficiaries of the project to gain an understanding of their views and perceptions about their role as the local community and how they will benefit from the energy initiative. The project leader contacted one of their representatives at the site in Rubagabaga to arrange a meeting and focus group discussion with co-operative leaders the rural entrepreneurs and the local authorities including women representatives. I had an interpreter while carrying out the group focus discussion. The interpreter reduced the language barrier between the group and me. However, it was not always easy to capture everyone's contribution since it was one person interpreting for a group of people. Also, it was time-consuming as information were often repeated twice or more.

During the site visit in Rubagaga, the project construction had not yet started and therefore some the information I got was based on wishful thinking and not facts. I kept field notes of what was happening during the interviews, some comments and observations in the field (Eisenhardt, 1989). The field notes allowed me to review and reflect on my perception on the emerging issues in the field. The project was delayed to start, and I couldn't get the actual information I needed to answer my research question, with advice from my field supervisor and my reflections I decided to change more focus to implementation of the project. And then I arranged, another interview with the project leader, to find out reasons for the delay of the project and other challenges they face during the implementation phase. Also, I wanted to know the extent to which the local people would be involved in the implementation phase.

### 3.3.2b INTERVIEW IN UGANDA/ KASESE

The interview with the project owner was semi-structured (See interview guide appendix) and lasted for about an hour. The aim was to gain information on the challenges and constraints faced during the implementation phase of his micro-hydro power station, the factors behind the success and the extent to which the community is involved in this project and how the owner was able to ensure financial viability in the implementation phase. Using reflexive questions during the interview enabled me to find out about his motivation, future hopes, and expectations. Scott and Darlington (2002) mention that reflexive questions are facilitative in intent, and can be useful when opening up discussions. The respondent suggested some other potential informants that benefited from this power station. I interviewed one beneficiary and one of his employees (woman), the member of the local authority (LC1-chairman as locally called) to find out their views about the project and their role in enhancing the provision of off-grid energy to their community. I also wanted to know their experiences, challenges, and benefits of supporting a local energy provider. People's stories unfold in different ways, and some of the interviews were too detailed. The project owner told stories about himself that were not connected to the questions asked and stories about the community that were not directly related to the topic or questions asked. However, some of the stories were relevant for the analysis. He also explained details of the design of the turbines and generators using technical terms that were irrelevant for the research. The long stories were time-consuming, and yet I didn't wish to interrupt the conversational flow or to follow the guide rigidly. I was, however, able to gain new knowledge that is useful to my research.

For the purpose of comparison between the PECO Rwenzori micro hydro project and the Rubagabaga min hydro-power project, it was important for me to draw out both the differences and similarities of these two projects so as to get the different perspectives on innovative social practices used to achieve energy access and consumption in rural marginalised areas.

### 3.3.3 POWER RELATIONS IN THE FIELD

The objective and value-free research questioned by several feminist critics such as Rose (1997) and Harding (1991) that sought to explore how power relations between researchers and informants influence the interpretation and presentation of knowledge (Mullings, 1999). As Mulling (1999) states that a researcher`s positionality always has a crucial impact on an interview and the outcome of the data. As I carried out my interviews, I constantly reflected

upon my role as a female research student and how this constructed my position and relationships with the respondents in the field and the information they shared. The two cases were also in different countries and communities and thus presented different aspects. I am not sure whether I fitted within the boundaries of outsider or insider category as I felt that I had to negotiate my position and access constantly. The willingness and openness with which the respondents shared information at times made me feel like I assumed the insider position and yet at the same time, there was always that "gap" that still made me feel like an outsider. After the interview, I reflected over this gap and wrote a few notes to help understand the interactions during the interviews and focus group discussion. While some discussions where more open and the interactions between the informants and me allowed easy flow of information others were shallow and very little information was shared. I constantly reflected upon how characteristics like gender, ethnicity, age, educational background and a combination of my role as a wife, mother and student affected the type of information I sought to collect in a male dominated field and the interpretation of the information. I was clear to the group from the beginning about my status as a student and why I was collecting the information I needed.

### 3.3.4 OBSERVATIONS

Observations during site visits mainly focused on human behaviour, practises and the physical environment in the different project areas.To collect observed data, one has to engage all the five senses and take notes immediately following observation (Yin, 2012). In Rubagabaga, my observations were focused on the economic activities such as farming, transportation, small shops, quarrying and resources such as stones, land, human resources, and human interactions. Observing these aspects and the processes related to them enabled me to understand the verbal information more efficiently. It was also a way of checking the validity of data as it improved the precision of data. During the focus group discussion with the local people I observed that the people were somehow reserved and not too open, so asked the interpreter to tell me his thoughts about my observation. He explained that it's rather common in this community and the people take time before they can open up. I reflected back to what happened during the Genocide and its impacts. Durin the genocide this area was highly affected, and many people lost friends and relatives. The pain connected to the genocide may take generations before it disappears among the people. The experience from the genocide creates barriers as one may need more time to build rapport and trust to get

deep and more open information  The interpreter was familiar with the area, and he was helpful in clarifying some of the observations.

In Kasese the observation was relatively different from what I observed in Rubagaga, I however also observed the interaction between the local project owner and the people in the community, economic activities such as coffee processing that may benefit from his project. The observation was important to connect the verbal response about some of the factors that have influenced his success.

It was necessary for me to reflect on my experiences and feelings about the observation I made. The necessary aspects seen during field work were documented, and I took photos. Through observation, information about certain aspects of human actions, physical environment, and events was collected (ibid).

### 3.3.5 SECONDARY SOURCES

Secondary sources provide information that was collected by other people for some other purpose (Mikkelsen, 2005). Social innovation is still an emerging body of knowledge which is not well elaborated as other forms of innovations primarily perceived to have clear economic effects such as technologies, marketing, and organizational measures in enterprises (Adams and Hass, 2008).The sources may not provide direct answers to the research problem in question but can give information that may act as a guide to the research topic.  The advantage of secondary sources is that they provide rich data without consuming a lot of time, and they help understand how people view the phenomenon studied. The disadvantage of using secondary data according to Darlington and Scott (2003) include authenticity of the data, lack of credibility, difficult to interpret, and may not be representative of the particular purpose of the collection of information.

The secondary sources used in this research included project documents and baseline surveys, to find out their aims and objectives and get a better understanding of the projects and how they implement these innovative practices. Other secondary sources were included previous research in the field of social innovations and renewable energy, government reports, web information.

## 3.4 DATA ANALYSIS

Data analysis was probably the most challenging part of the research. Some of the problems that surfaced were related to my expectations of the data collected. Because the key

assumptions for the analysis were made when the research questions and the case were defined (Yin, 2012). The analysis was concurrent with data collection to allow questions to be refined and to develop new avenues for inquiry (Yin, 2012). The basis of my analysis was inspired by the tradition of grounded theory so as to understand the phenomenon of innovative social practices and how they can enhance energy access in rural areas (Strauss and Corbin, 1998). The approach was appropriate for the objective of the study, which was to examine the new practices used by actors to achieve energy access in rural areas, and how these practices affect energy consumption. Grounded theory is in reality hard to follow as a given theory always influences one. Due to the complexity of the selected projects, and the fact that the topic is not an extensively researched field –social innovation- grounded theory was the most salient form of analysis (Ibid). The analysis involved coding and categorising, shaping themes about the participants' experiences along with the integration of the existing literature.

I started the analysis by systematically organising data into hierarchical relationships, coding the data and inductively explored the data to generate categories and explanation. The concepts that emerged were compared with the extant literature to enhance the internal validity, generalizability and theory building (Eisenhardt, 1989).

### 3.4.1 CODING-CATEGORIES-THEMES

Data from different sources coded into small phrases that symbolically assign a summative attribute for a portion of data. Using data from the interviews of stakeholders, history of the study areas, observations, initial reports and documents, I created codes, then categories and subcategories. Four broader codes were created encompassing areas of finance, identity (community and culture), organisations, perceptions, sustainability, and governance. Under each of these broader codes, other codes were created. I examined the interview transcripts to find codes that appeared in the respondent's interviews. Th codes enabled me to find concepts that relate to action/events that frequently appear and which may influence the outcomes (Strauss and Corbin, 1998). I started with creating many codes that were later refined so as they can contribute towards theory building and ensure that the codes fitted the data. Many of the codes were repeatedly used throughout the coding process to create repetitive patterns (ibid).

I arranged the data into categories and subcategories and codes (see Appendix 1); I was able to see the frequency, intensity of these codes. The number of these codes was reduced to reflect the actor's experiences and events affecting the participant. This stage of coding was

necessary for relating incidents and creating an understanding of the constraints actors face in implementing strategies that enhance energy access in rural areas. I was able to detect the most popular codes amongst the participants and those that were least popular.

"Changing people's perceptions" was a more frequent theme across all the cases that connected to constraints and explanations as to why it hindered the implementation of innovative social strategies. The themes were then creatd using the categories to assist with theory building. As I explored issues emerging from the interviews, patterns were created from the themes to establish linkages- for example how diffusion connected to the literacies as well as how the environment connected to the constraints and opportunities as well as the forces that impinged on financial viability. I coded all the data I collected through observations and the interviews including secondary data, I later realised that not all the coded data was relevant to my work. I, however, consider this coding process as my learning curve on how to choose substantive material for coding.

### 3.4.4 ENSURING VALIDITY AND RELIABILITY

Colling ridge and Gantt (2008) define validity as the extent to which research measures what is supposed to measure. When assessing the validity of qualitative research, one has to look at the kind of questions or problems the research approach is designed to address (Merriam, 1996). Qualitative research seeks to clarify and understand situations when operative variables cannot be preconceived (ibid). According to Merriam (1996), the validity of a qualitative study can be strengthened through several strategies including; triangulation, member checks and statement of the researcher's experiences, assumptions, and biases. What one understands as reliability in qualitative research differs from quantitative research where reliability revolves around repeated measures of the phenomenon (Merriam, 1996). Qualitative researchers seek to understand the social world through the perspectives and interpretations of those in it. And given the various perspectives and interpretations, one cannot take repeated measures to establish reliability but rather researchers can aim at dependability or consistency (Lincoln and Guba, 1985). Qualitative research assumes that social reality constructed, dynamic and changing (Dwyer et al., 2001). Rather the researcher constructs findings based on the in-depth interaction between her and the researched. Merriam (1996) states that it's important for the results of the study to be consistent with the data collected.

Ensuring validity and reliability were appropriate for attaining rigor in this research. The researcher is the primary human instrument in data collection and analysis (Yin 2012). Thus, multiple sources of bias can surface which may weaken the validity of the data collected. Pre-existing concepts and assumptions could blind the researcher from seeing salient details in the phenomenon. The documentation tools used were flexible enough to allow the actors to give rich information, but these tools were also structured enough to build consistency and quality control (Yin, 2012). For example, a certain phenomenon observed during data collection was also discussed in an interview with the concerned actors, and I also reviewed some documents to strengthen the validity of the data. The use of field notes (Silver, 2005) was another strategy used to ensure reliability.

### 3.5. ETHICAL CONSIDERATION

Potential respondents were contacted to gain informed consent. The complete disclosure of the purpose and nature of the study given to the potential respondents by telephone, email and face to face at the start of the interviews. They also informed that they can choose whether or not to participate. As stated above out of the six cases, I chose to contact four cases to ask whether they were willing to participate in my study. In one of the case, Waki project in Masindi(Uganda), the project leader was not easily accessible, and I just talked to the secretary who was not in a position to decide whether the project should be part of the study or not.

In each of the cases, confidentiality was emphasised as participants expect that information provided should be treated in a confidential manner. I edited the transcripts and made them anonymous to ensure privacy. I obtained authorization to use the information collected through the interviews from the informants. The potential respondents had busy schedules and thus to avoid intrusion, I scheduled the interviews to take place in their workplaces and also limit the interviews to a maximum of one and half hours. Because intrusion into personal space maybe an issue for some individuals. For some respondents, a neutral location was selected to hold discussions especially the focus group discussions we used one of the building in the town centre which is used for community gatherings.

#### 3.5.1 MY EXPERIENCE IN THE FIELD

In general, all research faces limitations, and this research was no exception. Although I carefully planned the research, there were some concerns that probably affected the findings obtained and my ability to answer my research questions effectively. For the purpose of

comparisons, I chose two cases at the different level of development and in different countries. I prepared two different research guides to answer my research question. One of the guides was to hold interviews with the implementation actors (in this case the entrepreneurs/developers) and the other the affected community. The case in Uganda where the project was already implemented didn't present a lot of field challenges like the case in Rubagaga were the construction of the hydropower station had not started as scheduled

It was frustrating but at the same time a great experience for me. At first, I thought that this part of the field work had failed, but I, however, decided to take some time and observe the site and what was happening in the community without interviewing the local people. From my observations, I realised that there were much interactions in the community that would be useful to my research. I, therefore, decided to rephrase my interview guide and find out more about what I had observed in the field about the project. The guide mainly focused on community involvement in the planning process, their knowledge of the project and how they intend to contribution to the project during implementation time. After having the discussion with my supervisor about the changes, it becomes apparent to me that I also needed to add some questions to the-the interview guide meant for the entrepreneurs regarding the reasons for the delay in implementation of the project.

Though rephrasing my interview guide was time-consuming, it was also important because I managed to hold focus group discussion with local leaders, cooperative leaders, and some local entrepreneurs. The focus group discussion as a data-collection method was appropriate for achieving the aim of the research. Interviews could have provided richer information in the sense that individual information regarding the community involvement in the implementation of the project could have been collected.

The research was delimited to a small number of cases that may not represent the majority of actors enhancing energy access in rural areas through innovative social practices. I could not empirically know the extent to which the two actors in the cases are similar or different from other such actors in East Africa. It is recommended to use the study's theoretical framework to establish a logic that can apply to other situations (Yin, 2012)

## CHAPTER 4. SCOPE OF THE STUDY

Uganda and Rwanda's power generation capacity is from the small and min/micro-hydropower systems. For example in Uganda, Bujagali 300MW, Karum 700Mw still at construction stage, and the 50MW thermic power whose construction stopped when the Bujali project completed. On the other hand, Rwanda has also built 40MW thermic power to meet the energy demand in the country. However, thermic power generation requires tong oil which is environmentally unfriendly and very costly for the country. Solar energy is another form of renewable energy that highly recommended. There are several identified sites in these countries with a potential to produce energy for both local consumption and export to other neighbouring countries. These hydropower schemes are financially and technically less demanding than the large hydropower projects. Also, they have the potential to stabilise the grid and are easily developed off-grid to serve the remote rural communities. However, the exploration of these potential is hindered by some reasons that are briefly explained below.

**Grid based rural electrification:** Grid based rural electrification is hampered by the limited resources and low energy supply. The supply crisis forced the government of Uganda to concentrate its efforts to extending the grids to the major urban and peri-urban areas that have populations willing to pay for electricity. The household tariffs are higher than the industrial tariffs mainly because domestic consumption is very low compared to the industrial consumption. Th low consumption of electricity imposes higher investment and operational costs on the system, and yet the poor households may not afford the connection fee and electricity costs. Also, collection costs have for a long time been a problem in rural areas with dispersed households; however the introduction of prepaid meters is slowly reducing the problem. There is an increasing number of a private company or individuals investing in mini-grids, micro hydro in exceptional areas that are remote with dispersed populations and difficult terrain.

**Off energy grid technologies and services;** Investments costs for hydropower are unfordable rural communities and investors. Also, the lack of management skills coupled with weak marketing and maintenance structure and limited micro-finance schemes for energy technologies in rural areas hinder off grid energy and technologies. The existing rural micro-finance institutions are often characterised with narrow credit product line,

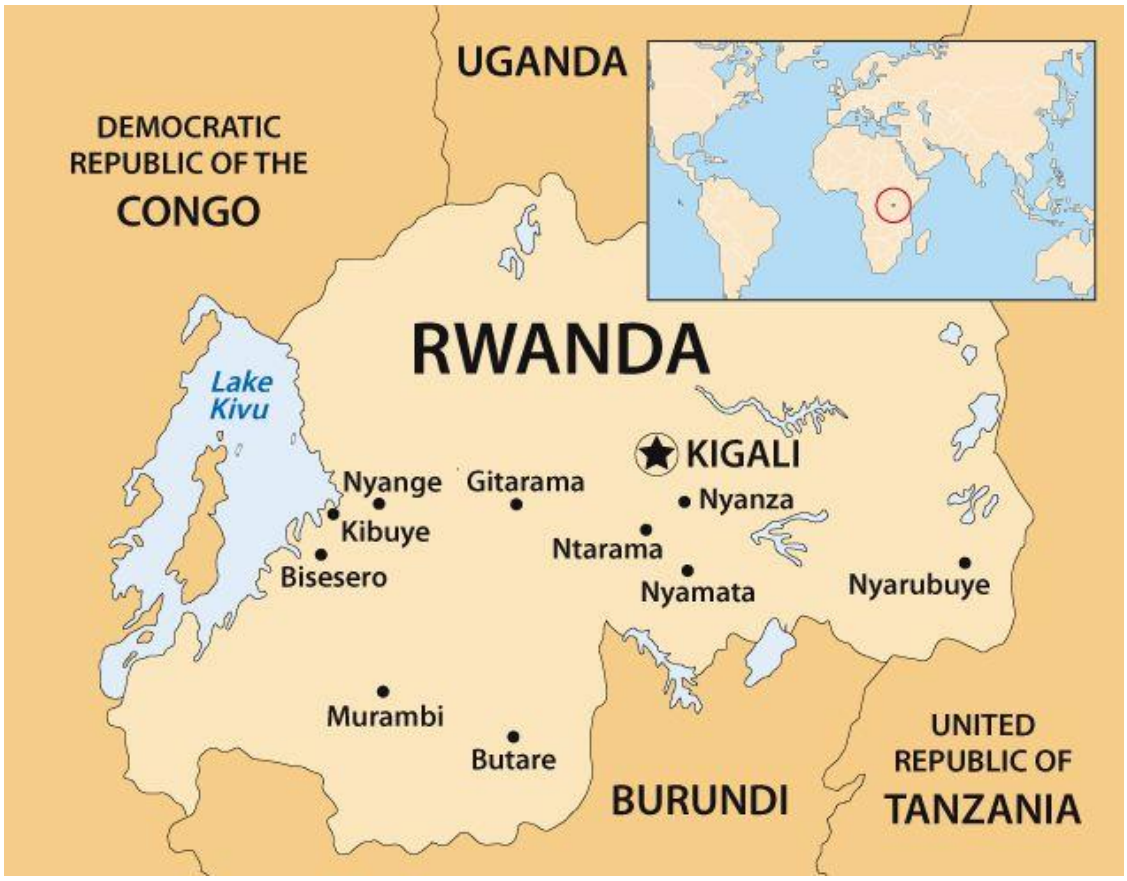
limited experience in rural markets and limited access to good practical information and technology.

In this chapter, I briefly present the background information on Rwanda and Uganda. I also give a brief introduction to the current energy situations, institutional frameworks and energy policies of the two different countries. Also, I narratively present the cases.

## 4.1 INTRODUCTION AND DESCRIPTIONS OF RWANDA

Rwanda is densely populated (12,337,138 people) with a population growth rate at 2.63%, infant mortality rate is 59.59/1000, and life expectancy at 59.26. It has one cultural and linguistic group; the Banyarwanda subdivided into three small groups; the Hutu (84%), Tutsi (15%) and the Twa (1%). The Two is a small group of forest-dwelling pygmies. Kinyarwanda is widely spoken by most of the people though French and English used as official languages. Kigali is the capital city. Rwanda has four religious groups namely Protestants, Catholics, Moslems and others. Christianity is the largest religion in the country

**Figure 1: Map of Rwanda**




*Source: Rwanda on Pinterest*

**Economy:** Majority of the population is predominantly rural, and subsistence agriculture is widely practised. They mainly grow coffee and tea pyrethrum as their cash crops while bananas, sorghum, and potatoes are grown for subsistence use. It also has some industries like the cement industry, agricultural products, small-scale furniture, and textile. Rwanda is endorsed by natural resources like gold, cassiterite, methane, water and arable land. The country earns about 538.3 million dollars in exports, and 1.937 billion dollars pays for imports. Country's GDP/PPP is about 16.37 billion per year, per capita. It has a growth rate of 7.5%; inflation is at 5.9%. Rwanda like many other African countries is highly dependent on foreign aid that is in the form of grants and loans to build its infrastructure. An example is the fast growing communication and transport system in Rwanda. The government sector in Rwanda is said to experience less corruption than the neighbouring countries due to the high penalties were given to the corrupt officials.

**Geography**: Rwanda is located a few degrees south of the equator and its bordered by Uganda, Tanzania, Burundi and the Democratic Republic of Congo. The total land area is about 26,338 so km, and it's endorsed with mountains in the west and Savanna to the east, numerous lakes like Kivu and subtropical climate with two rain seasons and dry seasons each year

**Historical Overview:** In April 1994, the genocide that marked a change in the Rwandan history started. The deep-seated hatred between the Hutu and the Tutsi exploded into rampaged killing of the Tutsi by the Hutu, who were the majority members of parliament after unknown people killed the president. An estimated number of about 800,000 Tutsi women, children, men and moderate Hutu sympathisers killed during the genocide. The intention of these massacres was to wipe away all the Tutsi people in Rwanda. In response to this action, the Tutsi rebel force swept the country forcing more than 1.7million Hutus out of Rwanda. And the Tutsi, who are now ruling the country took control of the government. No country came to rescue Rwanda during the genocide despite the horrific reports that were sent out through media, UN peacekeepers in Rwanda also fled after some of their soldiers killed. After the genocide, there were continued massacres of the Tutsi and Hutus in the refugee camps. However Rwanda has seen steady growth economically, socially and politically after the genocide through reports by the human rights organisations claim tendencies of suppression of opposition groups, intimidation and restrictions on freedom of speech. It has a female majority in the national parliament.

**Politics and government:** the country has a democratic multiparty government system with Paul Kagame as the president. The country governed by a strict administrative hierarchy that has its roots from the colonial times. In 2006, the country was divided into five administrative provinces with 26 members of the governing body that serve for eight years. The local council elects 12 of them; the president appoints eight, and the rest of the members represent political end educational groups. 80 deputies that serve for five years for the board room seats; 53 members elected by the public, and the rest nominated from women, youth, and other groups. Legislations are made by parliament which also oversees the activities of the president and the cabinet. 24 of the parliament deputies are women. The lawful system is still based on the (Belgian and German) colonial masters' civil law systems and customary law.

### 4.1.2 ENERGY SECTOR IN RWANDA

Rwanda has demonstrated an impressive commitment to move past the genocide and has ambitiously worked towards achieving her development goals including energy access. The number of households with access to grid electricity had increased from 11% in 2010 to 22% in 2014. The government has an ambitious plan to achieve 80% of energy access by 2030, given the technical and financial challenges in the country. 85% of the overall primary energy consumption in Rwanda is based on biomass which is used for purposes of cooking; 11% is from petroleum products for purposes of transport, electricity generation and industrial purposes; and lastly 4% from hydropower sources for electricity. Approximately 14% of the total rural population has access to electricity from the national grid. Rwanda has for a long time depended mainly on hydropower whose limited capacity was characterised by dilapidated networks and commercial losses of about 30% this in combination with long droughts may explain the severe load shedding. The severe load shedding forced the government to opt for alternative sources such as diesel generators that are expensive. These sources of energy increased the fuel tariffs by over 100% to about the US $ 0.22/kwh.

Currently, it's about 97MW installed generating capacity meeting the needs of approximately 9% of the total population. The 57 MW is from hydropower, and 40 MW is from diesel and tang oil generators. Rwanda is endowed with potential renewable energy sources that remain unexploited. The streams and river suitable for Micro –hydropower with significant potential for rural electrification remain unexploited; it also has potential for solar power with a solar radiation between 4-6 $kWh/m^2$ per day and biogas for thermal energy needs for farms and small institutions. For example in 2015 Rwanda built 10MW of solar energy, the construction was done by the Norwegian Skate and the local entrepreneurs (Afritek Rwanda).

The energy sector is faced with some problems including; low accessibility to electricity, high costs of new connection, lack of entrepreneurial capacity hinders small commercial electricity projects which may result in over consumption of biomass (firewood /charcoal).

**Structure and organisation of the energy sector**

There are some institutions and government agencies that play a significant role in the energy sector including the Ministry of Infrastructure (MININFRA). MINIFRA has a role of coordinating activities such as planning and monitoring the implementation of different programs, attracting private sector investments and coordinating support for development partners in the energy sector. The Rwanda Utilities Regulatory Authority (RURA) ensures that electricity tariffs reflect recurrent costs as well as has a role of approving and registration of all energy activities. Well as the Rwanda's Energy Corporation (RECO) is responsible for implementation of the energy project programs such as the roll-out program that intends to connect 250,000 new customers to electricity.

There is an increased focus on the private sector participation in electricity production. And as such there are a few local private enterprises such as ASM and Chez Silver in Kigali and COFORWA in Muhanga that are producing pico-turbines. Private companies are registered through the Private Sector Federation (PSF) whose role is to guarantee the application of good practices with the private sector. The Rwanda Environment Management Authority (REMA) approves the environmental suitability of the project activities. Rwanda has also seen increased interest from donors and other implementing agencies in the energy sector. And as such a large scale programme for building electricity network to increase household connection was started in 2009. The government contributes 20% of the total budget while the balance is provided by donors such as World Bank, Arab Funds. The government of Rwanda has for example executed four micro hydro power plants (Nyamyotsi I, Nyamyotsi II, Mutobo, and Agatobwe) in collaboration with UNIDO. The NGOs are instrumental in providing funds for eligible projects, risk mitigation instruments and capital subsidies for eligible energy projects (Energy Investor Forum, 2012)

**Energy sector policy and strategy**

The Poverty Reduction Strategy program (PRSP) drafted in the post-conflict period (2002-2005) was basically to manage the transition period of rehabilitation and reconstruction of the country. The energy policy plan was drafted in 2009 to provide a framework for the rehabilitation and reconstruction of the country. These policies were then later re-adjusted in 2011. This was to increase the rate of economic growth as well as support the country's economic development agenda. The policy translates into four main goals for the energy sect; 1) Liberalise and regulate the energy sector, 2)To ensure the availability of reliable and affordable energy supplies; 3) To encourage the rational and efficient use of energy. 3) To establish environmentally sound and sustainable systems of energy production, procurement, transportation, distribution. 4) Create an environment that attracts the private sector investments. The key principles are further explained below.

**Development of Domestic Energy Resources**: diversification of energy resources including hydropower estimated at 313MW, renewable methane gas in Lake Kivu estimated at 60 billion cubic meters, the potential for solar energy. **Efficient Use of Energy:** pursue energy efficiency and conservation through the use of efficient technologies such as energy saving appliances in households and appropriate economic incentives like financial incentives. For example, energy is mainly used for lighting. However, most households use energy consuming bulbs. Efficient use of energy may also involve replacing energy consuming bulbs with led lights that consume much less energy. **Energy pricing and subsidy:** appropriate energy pricing that may encourage productive use of energy and sustainable operations. Subsidies may cover some costs to ensure the adjustment of the prices according to the incomes of the consumers especially in rural areas where there is high dependence on agriculture. **Institutional Development of the Energy Sector:** through creation of a national electricity utility that operates on commercial basis, promoting private sector in generation of electricity and off-grid supplies, facilitating private (domestic and foreign) investment through transparent selection and contractual procedure, regulating agency mandated to promote competition and issue concessions and licenses as well as clear mechanism for sector coordination and strategy. **Capacity building:** Capacity enhancement in all institutions and functions of the energy sector to effectively operate public-private machinery that can provide strategies, plan, develop and operate a sustainable energy sector

## 4.2 CASE: RUBAGABAG MIN-HYDROPOWER PROJECT.

In this section, I narratively present the Rubagaga case mentioned in chapter 3. The methods used to collect data from the different actors explained in the methodology part of the thesis. The narratives are told from the social entrepreneur point of view about the stories and experiences while implementing the innovative social strategies to achieve energy access. The narratives marked by stories told by the local community who are the direct beneficiaries of the min-hydropower projects. The concept of narratives is in some field such as sociolinguistic restricted to brief, topically specific stories organised around characters, setting and plot (Langellier et al. 2003). My interest lies mainly in the content of the interviews because I intend to interpret what is said by focusing on the meaning in the told stories (ibid).

**Figure 2: Map showing Rubagabaga**


*Source: Baseline survey Rubagabaga 2015*

Rubagabaga village is relatively isolated, energy poor and off-grid. The village established in 1930 in Banana cell; the western province is home to about 1,238 people in 314 households.

The area is vulnerable to flooding and mudslides during the rainy season. Subsistence agriculture is the main economic activity growing crops such as sweet bananas, beans, cassava, coffee and sorghum as well as the rearing of livestock. Other economic activities include petty businesses, and a collection of non-timber forest products. The results from the baseline survey done in 2015 show that majority of the population in this village use kerosene lamps and dry-cell battery torches for lighting while charcoal and firewood commonly used for cooking. Other sources of energy include candles and pico-solar lighting systems. According to this report, 87% of the households collected from the forest while 13% purchased the firewood or charcoal.

The local people operate the small business enterprise in the village centres and on market days the village centre attracts farmers selling their produce from the nearby areas. The report shows that 16 households in this village own small business enterprises such as bars serving locally brewed banana beer and other alcohol drinks purchased from the neighbouring town selling mobile airtime, charging mobile phones using pico-solar systems, restaurants, small shops, etc. These businesses were negatively affected by the lack of energy. Some of the problems cited in the report for not having reliable sources of energy include; insecurity(thieves), limited ability to work longer hours, food products easily get spoilt, existing business activities fail to grow, and diversify into new businesses is limited (Rubagabaga project baseline survey, 2015).

Households lack access to clean and stable energy services, and this has had impacts on their health and economic activities. The baseline survey showed that pollution from cooking fuel and smoke from kerosene had negative impacts on the health of the local people. Common illness related to air pollution were cited as coughing, headache, eye problems and breathing problems9.2% of their respondents had respiratory illness and eye problems related to smoke pollution (ibid).

### 4.2.1. DESCRIPTION OF THE RUBAGABAGA MIN-HYDRO POWER PROJECT

Rubagabaga hydropower project has captured the interest of experts and private investors as much as for its transformational capacity for the people in this rural area. The planned 300KW power run-off-river plant on the Rubagabaga River in Ngororero and Nyabihu districts will complement the ongoing energy initiatives with appropriate solutions that reach the majority of communities living in rural areas with no access to the national grid. The project intends to establish a community-based organisation (CBO) responsible for ensuring

community access to electricity and productive usage of electricity by creating community-based enterprises that have a potential to create value for the community through linkages to external supply chains. According to the project leader, it is expected to take 16months of construction. Below is the picture of the Rubagabaga River where the proposed 390KW power run –of-river mini-hydropower plant will be constructed.

**Figure 3: The Rubagabaga River for the proposed mini hydro plant**

*(Photo was taken by Mary Yaledi. S, 13/12/2015)*

Though the Rubagabaga project is relatively small, it aims to demonstrate a new comprehensive development model for the poor in rural communities. The local management model that is Public-Private-Community- Partnership (PPCP) approach will ensure that both a portion of electricity generated and a portion of revenues from the supply of the national grid is re-invested into development and another social impact project in the local community. The local community is currently off-grid, and the main lighting technologies in this village are mainly kerosene lamps and dry cell battery torches while firewood is used for cooking.

According to the project leaders, they aim to extend energy to households, schools, health centre, and micro-businesses as well as empower the local people with skills with new and diverse skills through training. Empowering local commnity by providing emploment oportuitis as well as boost local cooperatives and other income generating activities. The project will in adition focus on communal practices aimed at protecting the environment through bamboo farming on the river banks. Furthermore, this Bamboo will be used to create

furniture and other art and craft pieces. The cooperative leaders had hope that this project would revive the cooperatives that once flourished to empower the farmers in these villages

**Figure 4: The bamboo project in Rubagbaga**

*(photo taken by Mary Yaledi. S, 13/12/2015)*

During the interview with the project leader, it was also mentioned that this village was selected to be among the smart villages by the Smart Village Initiative and Research Association from the University of Cambridge and Oxford. This smart village team designed data collection instruments that operationalize and enhances the Global Tracking Framework from SE4ALL and the World Bank to measure the energy access and its impacts on the rural communities. Measured using tested indicators quantifying the impact of energy access on factors like livelihood activities, health, education, food security, vulnerabilities, and aspirations. The main aim of the smart village concept is to create the evidence base that can convince policy makers and other stakeholders to take action. The Rwanda government plans to use the PPCP concept from Rubagabaga project as a template approach for providing modern energy access in the rural areas.

### 4.2.2. INITIATIVE AND ORGANISATION FORM

Afritech the company responsible for developing the Rubagabaga Min-hydropower project has "local management model, that is Public-Private-Community- Partnership (PPCP) approach" as an innovative strategy to ensure sustainable rural electrification. With this approach, the company intends to ensure that both a portion of both the revenue and electricity generated is re-invested into development and other social impact projects in the local community. The principle partners in the PPCP include the government represented by Rwanda Utilities Regulatory Authority (RURA), the private sector represented by Afritech Rwanda the social entrepreneurs and the local community represented by local associations and co-operatives, philanthropies.

According to the project leader, each partner contributes differently to the project and participation ranges from informal and immediate actions such as the contribution of labour or community mobilisation, to more formal and continuing actions namely management of energy distribution and billing system.

**Provisions and obligations in the Concession Agreement.**

The model requires the participation of the different stakeholders and as such Concession agreement was drafted to specify the role of the partners including the local community. In this case, the local people can neither provide the technology and expertise or the financial support. The community has no experience in forming associations and cooperatives by themselves and thus need guidance on the basic principles of cooperatives from the other partners. The guidance from the partners enhances their capacity for optimum participation in the partnership as well as their efficiency in the local community.

**Service Obligation:** the government will buy all the electricity made available with taking or pay contract for 25 years, they will also facilitate grid connection but will not finance the connection, provide regulatory operators licences, provide environmental approvals (as stated in chapter 2) and water resource certificate. The private partners are responsible for the daily operation, financing

Financial Obligations: The financial obligation is solely left to Afritech, which acts as an umbrella for several philanthropies and NGOs financing the project.

Other provisions: Key partners (Public and private) have periodic meeting,

Risks from the drafting of PPCP contracts

The Rwandan Utilities Regulatory Authority (RURA) responsible for approving and registration of the energy activities delayed to approval the project. The project could not start in time without these contracts being approved. The PPCP model is new in Rwanda, and this poses challenges since they might not be basic guidelines in the regulations that support this specific model. The commonly used model that involves the private sector is the public-private partnership (PPP) and the other model that involves the community is the public-community partnership PCP). Key partners should understand the PPCP contracts because vague contracts pose a risk of costly renegotiation in the operation phase. Renegotiating the contracts resulted in delays which in turn has created additional costs and other shortfalls.

> *The project employed some people to work with an assumption that we would start on time as planned. We don't intend to lose them. Therefore, we plan to continue paying their salaries and get them something else to do as we wait for the contracts to be approved (interview with the project leader, 9/12/2015)*

Drafting the PPCP is challenging as it will determine the rules imposed on the partners for the next twenty-five years.

**Project Preparations Stage:** According to the project leader, the following steps were taken by the project during the preparation stage;

- Project developed strategies such as regulations, networks and plans to build local capacity.
- The basic project concepts were designed including; identifying desired outcomes and potential partners, gender issues, sensitization of the local people, conducting pre-feasibility studies.
- Assessing the partnerships including the PPCP, identifying viable options of the financial, legal and technical make-up of the project
- Assess community buy-in into the project, crowd financing on behalf of the community
- Overseeing project financing, legal and technical plans including procurement processes

### 4.2.3 FINANCING THE PROJECTS.

The private investor is entirely responsible for the financing of the capital cost and operating costs of this project. Well as the government's responsibility is to guarantee loans with favourable terms

Ensuring financial viability

Numerous international financing institutions have shown interest in the development of the min-hydro power project in Rubagabaga. 30% of the investment cost funded by Global Village Energy Partners (GVEP), Practical Action East Africa Methodist ministries and Group hope international. The social entrepreneur/developer acts as an intermediator between the funders and the rural electrification programme. The Public-private-community partnership ensures the government bears some risks and also finances some of the rural infrastructures such as constructing transmission lines. This project will also involve *community buy-in* into the project. To ensure community buy-in, the developers will crowd-fund on behalf of the community as stated by the project leader;

> *I believe this will make a unique model, Crowdfunding on behalf of the whole community. Community buy-in into the project will be determined by a combination of a qualitative assessment of the community itself, as well as what the quantitative inputs perhaps labour that can be contributed to the project (interview with the project leader, 9/12/2015)*

70% of the funds (a loan at 3% interest rate) will be from Norway through the Norwegian Export Credit Guarantee Agency (GIEK). A Norwegian company will have to deliver equipment for the project as well as other services that cover 30% of the project cost in order for the project to acquire the loan. Viability gap financing is needed, and affordable debt financing is vital for this project. Autonomy power Norway in cooperation with Afritech Rwanda will access the loan from GIEK,to injected into the Rubagabaga project. However, the 30% of the loan will include equipment such as turbines, generator, penstock; consultation work, sand filters from Sedition and later operations and maintenance follow up from International Centre for Hydropower (ICH). The project has its financial foundation that will transfer the funds directly to the project through the entrepreneur. Implementing the energy project and managing funds are complimentary responsibilities that require different skills and the project has gathered skilled manpower that is both locally and international to handle different activities. Stakeholder communication is critical for the financing of the

project. The stakeholders/funders need to be informed on the progress and constraints the project faces at every stage

> *We use the Dropbox for shared data with the partners and have monthly called to give monthly updates on the progress and reports are provided to our key partners/ funders (personal interview with the project leader, 9/12/2015)*

Mobilizing financial resources from international cooperations require projects merits regarding its capacity to create both economic and social value to the local community before they could lend or give enough money to allow the project to go forward. Given the socio-economic infrastructure in Rubagabaga, the bottleneck in ensuring financial viability would be the guaranteed off-take agreement whereby if power is produced; it will be consumed and paid. Since the project proposes to generate power that will be fed to the main transmission line, a power-purchase agreement had to be drafted. The agreement was structured to include a combination of capacity payments that covers capital costs, return on investments and certain risks. It also included energy payments. The energy sector is characterised by high losses whereby 35% of these losses are non-technical; poor collection means, few paying end users as well as theft which is common with prepaid meters (Mckinsey research, 2015). To get finances from the partners, it was important to present a detailed business plan that covers a wider area of the project with very specific details.

> *In the plan, we cannot only mention the supply objectives, but we however have also to explain how we will reach the objectives with sustainability and also ensure profitability for their funds as well as socio-economic impacts. The funders are mainly interested in the socio-economic impacts of the project, and we have to convince them that this project will lead to positive impacts in the rural areas as well as make some profit that will be either re-injected in the project or used in other projects (interview with the project leader, 9/12/2015.*

According to the project, the finances are necessary for the construction and financing of the socio-economic activities in the village. The performance indicators are both social and financial in nature.

<u>Financial sustainability mechanism.</u>

In Rubagabaga, the populations are poor without access to energy that can be used for production to increase their incomes. The Rubagabaga project aims to boost businesses in the

area for the purpose of productive use of energy. The energy is intended to support small business and also partner with the local micro-finance institution in the neighbouring villages to provide affordable loans to the small local enterprises. Some of the enterprises that will be directly managed by the project include art and craft production which is directed towards empowering women. Their intention is to market the craft- work made of bamboo to the town centre that is about 30km from the village. The district is known to attract lots of tourists from all over the world due the presence of gorillas and other tourist attractions. To boost agricultural production, the project intends to revive the farmer cooperatives so as to make it easy for the farmers to sell their products to neighbouring villages and other markets through these cooperatives

Another way the project intends to ensure financial sustainability is through the establishment of energy cooperatives that will ensure that the local people can pay for the power consumed. The energy cooperative will manage the utility line that will directly supply energy to the community. Local cooperatives will ensure that electricity losses through thefts are minimised since the members of the cooperatives are also part of the community. This energy will be supplied to the village centre, schools, and health centre but it will also be available for households that wish and can afford the connection fee. The project proposes to have a pay-as-go model for the community utility line to ensure flexibility in payments for the users and to reduce the burden of start-up businesses that may find energy unaffordable. By using the pay-as-go, the small rural enterprises can consume what they can afford

### 4.2.4 COMMUNITY PARTICIPATION AND DECISION-MAKING

The Rubagabaga min-hydropower project will highly involve the participation of the community both for the purpose of sustainability and job opportunities for the project. According to the project leader, the project aims to meet its social objectives in the community effectively and efficiently using appropriate tools that enable community participation. The community is poor with very low incomes, and thus, their participation is economically unviable, however, factors such as social values, norms, living habits and cultural practices had to be identified through community sensitization. This was important for enabling communication, acceptance as well as better interactions with the local community. Knowledge about the local community made planning on how to involve the community less complicated and enhanced appropriate strategies. In March 2015, a baseline survey was done in the local community to make an in-depth context and needs analysis. This included finding out practical problems faced by the community, how the community felt

about these problems and what the community wants about energy. This process required extensive field presence and the involvement of local people that are trusted by the community. The consumers of the energy produced from the min-hydropower station are not uniform about their earnings, habits, and thus, the project has to ensure that it meets the needs expressed by the community. These clear assessments are necessary for decision-making and may determine the willingness of the community to pay for the energy produced.

> *"When we first came to this community, we had our thoughts on what people needed, and it took us time to change the ways to tackle this problem and focus on what people want rather than what we think people need. Time in the field with the local community was important about sensitising them and involving the people in the project. We wish to reach out to the community in the best possible way so that the positive impacts of the projects can create the needed social value (personal interview with the project leader, 11/12/2015)*

The project proposes to distribute part of the energy generated by the community. The target consumers include schools, market centre, health centres, micro-business, and households. The consultations with the local community during the preparation stage involved discussions on the electrification plans, financial contributions, community needs and constraints. The project will require strong local support and cooperation, therefore, as part of public relation strategy in the local community, local meetings were held in the village centre that involved village heads, and local authorities. Issues discussed in the meeting included land rights-of-way about cutting trees for to create a way for roads and setting up poles and general construction of the plant and its impact.

When the project is completed and commissioned, Afritech has to supervise, run the project and also consult the local agencies to run part of the project that aims to maximise the social impacts. Consulting the local representative will highly depend on the readiness of the local agencies to handle the tasks at hand. Afritech has the sole responsibility of the project in the start, but as it progresses, their intention is to withdraw and limit itself to consultancy role while government and the community take up the responsibility of operating and maintaining the project. The supervision of the operations and maintenance of the project is under ICH with funding from NORAD. In an interview with the project leader, he mentioned that;

> *The extent of local participation in the project will depend on upon the visible direct impacts of the successful implementation and operation of the project in their lives.*

*And the participation of public officials creates genuine interests of the people in the project. We wish that the local community will view their participation as a process of growth and not just a formal process to comply. Community ownership still poses a challenge because we are not yet sure how we shall eventually do this. Currently, one cannot tell the percentage the community will own, could it be 10%, 35% or 25% that's something we plan to see into in the future. We intend to include progressively community ownership alongside the potential developer who will determine management and ongoing operation and maintenance (project leader).*

### 4.2.5 CAPACITY SUPPORTING STRATEGIES

The Rubagabaga project will empower the local community through capacity building. By empowering the local people especially women, the project will be able to meet its social objectives effectively and efficiently. Providing training to local people with the basic education to handle simple routine operations and maintenance of the power plant and is likely to induce a sense of ownership as well as increase employment levels and ensure the sustainability of the project. The company representative at the site was communicating with the local people about the project and the need for the local people to participate. The representative commented that;

> *Capacity building is an important part of this project. The largest number of the population is illiterate and unskilled. It is a barrier for the project and by training people and equipping them with simple skills we break one of the immediate bottlenecks in the community. We intend to focus also on women, identify their needs and the opportunities this project can offer them. We need to; even the regulations specify that gender sensitivity is a necessity. Again looking at the community, the women are always working and……. well, if we want to impact the local community, then the women are the key to achieving the social impacts (interview with the project leader,11/*

The basic trail for the local people on how to get a household connection and connection fee payment, how to fill in application forms, and also promote adoption to electricity by village members. Also, the cooperative and association leaders will be trained in basic management skills. The Loca entrepreneurs will get basic training on how to draft budgets and information on how to access credit.

### 4.2.6 ROLE OF THE LOCAL COMMUNITY IN THE PROJECT

Afritech intends to involve the community either directly or indirectly at various levels of the project life cycle. By tapping the knowledge base of the community during the planning and designing stage, ideas for social involvement and how to address high priority challenges were presented by the community. The local community was instrumental in proposing sites for local agencies, give knowledge on the available local skills and resources that are useful to the project. The initial survey study about the community in March 2015 was instrumental in the project as it gave insight into active members of the community as well as identify the potential customers who are seen as an indicator of expected revenue, And to also guide the local people broaden their perception on potential businesses and innovations in the community.

> *When I relocated to this area, I didn't know that I will ever get a chance to learn how to build houses. This project, they said we will be taught how to build roofs and windows. And of course the market is there, builders are coming from the nearby villages to build our houses. This is something we are going to do ourselves. Currently, I sell meat, but this business is difficult to maintain without electricity, my meat gets spoilt if I don't sell all of it in one day and that's why I only open on the market day when a lot of people come to the trading centre (butcher in the village, 13/12/2015).*

The village has a potential for businesses that can locally be sustained by the local people if they are taught basic skills. The local people could be encouraged to use the available raw materials like bananas for more productive and healthy products than just making alcohol from the bananas. Alcohol consumption is one of the biggest challenges in this community and is likely to have a negative impact on the project since it will involve a lot of manual labour from the community.

> *In our village, we mainly grow passion fruits and sweet bananas nothing also will grow well in these two things. That is why every home has passion fruits and bananas. I used to work in a factory which made juice and other beverages with a machine and when I came to this area I wanted to start making my juice and other packed food but there was no electricity, and I did not also have that machine we used to have in that factory. Well if this project constructed a similar factory here and also bought machines, and then I am willing to teach others how to make the juice. This factory*

*can also provide employment to our members that drink the whole day. Drinking is the problem in this community, the brew is made from the bananas because we have plenty of them and have to use them otherwise they get spoilt. The women brew the beer and sell to the men in this village (local leader, 13/12/2015)*

The local community may also provide land (land for Bamboo farming) and labour required for the project. The women and men in the community equally contributed in proposing the potential cooperative groups that can be created in the community. The women created an association that will oversee the activities of women such as handcraft, farming and small business that are related to the project. The local authorities were actively involved in identifying the potential local entrepreneurs, soliciting people to join the cooperatives and pushing forward the proposed actions.

*The project is important to us, we have had people coming from different places promising us things, but then they never come back. But if this project is finished it will change our community. I see that our cooperatives are now going to be revived, and we can trade again, and even we women have our association that will ensure that we also earn money. (local woman entrepreneur, 13 /12/2016).*

During the discussion with some of the local representatives, it was clear that women involvement in decision-making is vital for this project as stated below. Through observation, I noticed that the women were directly involved in most of the productive work in the village centre. The small shops were run by main women who combined their home chores with income earning activities. This may indicate that the women can also be trusted with the responsibility of managing some of the cooperatives related to this project if given proper training and basic skills. However, the challenge can arise on how to balance time between home chores and the project work and could result in unnecessary conflicts in homes.

*We want to contribute to this project, but we are not experts, we have no skills, and none of us here has ever worked in a hydropower plant before. But maybe we the women will cook food to the constructors, and we can also carry stones and dig trenches. Here in Rwanda both women and men do the kinds of jobs as long as the woman has her strength to dig then she can dig. We can both contribute income to the family and decide how to use it together. The only problem some men drink too much, and it's a shame. But we have formed our cooperation's, so I guess they have some plans for this cooperation because we were told to organise ourselves into small groups that will represent different activities in the local*

*community. But we also have stones and sand in this area; trucks come from other villages and carry the sand like you can see all our houses are just made of mud except these two new houses. We will start using sand soon after the project; I assume that business will increase (women leader, 13/12/2015).*

In Rwanda, the public has a mandatory community service day at the end of each mother were all members of the community combine efforts to clean and maintain the infrastructure. The collaboration between the stakeholder and the community will ensure that the community offers necessary maintenance, and the local people can keep the leadership accountable for any inefficiency.

Agricultural and utility cooperatives will be created in Rubagabaga, whereby the customers (local community) are members and owners of the hydropower project with equal power as other members of the cooperative. The cooperatives are created with a specific intent of progressively changing ownership of the project to the community. The community will be responsible for their utility grid that is proposed to serve the community with energy at the lowest possible rates. The cooperatives will also ensure to bring appropriate services such as the distribution of energy to households, in the community at the lowest possible cost. The entrepreneur believes that the success of the cooperatives in achieving economies of scale, share expertise and their ability to stand together on regulatory issues can ensure sustainability of the project.

## 4.3 INTRODUCTION AND DESCRIPTION OF UGANDA

Uganda's population was by 2014 estimated to be 35,918,915 people with a population growth rate at 3.24%. It has several cultural and ethnic groups including the Bantu. English and Swahili are used as official languages even though Luganda is widely used the population. The largest percentage of the population is Protestants followed by Catholics. The capital city is Kampala. Literacy level at 66.8% for men and 57.7% of women and public spending on education was at 5.2%. Geographically Uganda lies across the equator and is divided into three main areas Swampy lowlands, a fertile plateau with wooded hills and a desert. It is bordered on the west by Congo, Sudan in the north, Kenya in the East and Tanzania and Rwanda in the south. It's endowed with some lakes and river.

**Figure 5: The Map of Uganda**


Source: Atlas Uganda

**Economy:** The economy is Agro-based with 82% of the population either directly or indirectly involved in Agriculture and mainly growing coffee, tea, cotton, tobacco mainly for

export and potatoes  Maize, millet, bananas, legumes, and vegetables mainly for home use, but the surplus is sold.  5% is employed in industry, 13% in service oriented sectors.  Uganda is also endowed with a good number of natural resources such as minerals (copper, cobalt), rivers, forests, arable land. Earnings from exports are estimated at $3.156billion per year well as imports (capital equipment, vehicles, petroleum and medical supplies) were estimated at $4.858 billion. Uganda is also one of the poorest countries in the world with 37.8% of the population earning less than $ 1.25 a day. Despite the poverty alleviation programs in the past 25 years, poverty remains deep-rooted in the rural areas. The communication system is fairly developed, and there is still room for improvement.

**History:** Between 1894- 1962 Uganda was established as a British protectorate after that several territories and chiefdoms were integrated. This was done to protect the British interests in Egypt. On oct.9, 1962 Uganda got its independence from her colonialists the British. Edward Mutesa, the then King of Buganda, became the first president of Uganda and Milton Obote as the prime minister. Obote later seized control of the government with the help of Col. Idi Amin. After getting independence, Uganda went through a long period of political instability and conflicts until Jan 29, 1986, when the National Resistance Army took over power under the leadership of Yoweri Museveni, the current president. Despite the peace in most parts of the country, there has been continuous political unrest in the northern part of the country.

**Governments and politics:**  Uganda has a multi-party democratic system with President Yoweri Museveni as the head of state and government. He appoints the ministers well as the government is formed by the National Assembly with 332 members. 104 of the members are nominated by interest groups including women and the army while other members are elected for five terms by the public. Uganda's public sector has been rated by Transparency International to be the most corrupt in the world.  It is divided into districts, counties and sub-counties, parishes and villages. The political subdivisions are officially served under the Uganda local Government Association. Also, Uganda still maintains the traditional leaders as a symbol of cultural heritage. Some political issues still challenge the country's stability such the endless war in the northern part of the country, presidential election as well as issues regarding human rights such as the rights of the homosexuals. The Ugandan government had considered passing the Anti-Homosexuality Bill to broaden the criminalisation of homosexuality by introducing the death penalty for homosexuals.

### 4.3.2 UGANDAN ENERGY SECTOR

**Electricity generation and demand**

The majority of the Ugandan population highly depends on Biomass in the form of firewood (78.6%), charcoal (5.6%) and crop residues (4.7%). Electricity accounts for 1.4% while other oil products such as petroleum and diesel account for (9.7%). Installed energy capacity is about 822 of which 84% consists of hydropower. Other sources of energy in Uganda include; solar energy, wind energy, geothermal energy. By 2013, household's access to electricity was still estimated at 15% and only 7% in the rural areas. Energy demand has steadily grew at an average 10% per annum which was higher than the supply. The increasing demand of elecricity ouped with low supply resulted to constant load shedding.

**Table 2: Energy and electricity demand in Uganda**

| Sector | Energy Demand | Electricity demand |
|---|---|---|
| Residential | 67.09% | 24.24% |
| Commercial | 13.35% | 11.16% |
| Industrial | 11.86% | 64.60% |
| Transport | 7.25% | 0.00% |
| Agriculture | 0.45% | 0.00% |
| Total | 100% | 100% |

*Source: Ministry of Energy and Mineral Development (2012)*

High demand for wood fuel as a source of energy for mainly cooking in rural areas has resulted in the overuse and depletion of the forests (Ministry of energy and mineral development, 2012) In relation to health, the use of firewood pollutes the air which if used over longer periods of time becomes hazardous to the health of the people. The women go long distances to collect firewood. This can be time-consuming and deprives the woman of time to engage in income generating activities. Limited access to electricity constrains the economic development of rural areas, limits the establishment of businesses thus constraining job creation, as well as preventing access to information and communication and further isolation of rural areas (ibid)

There are more than 50 mini and micro hydropower sites with a potential of producing 210MW if developed into electricity generation sites. The energy potential in rural areas can be linked to an economic factor depending on their financial viability and potential to bring economic growth (ERA, 2007) According to the ministry of energy and mineral development(2012), small hydro projects are estimated to be less cost-effective over time than the larger scale hydropower projects.

**Structure and organisation of the Energy Sector.**

The governmental institutions that are dealing with renewable energies include; 1) The Ministry of Energy and Ministry Development (MEMD) which is responsible for policy formulation, promotion, coordination, monitoring, and evaluation. It is also responsible for legislation in the energy sector. 2) Rural Electrification Agency (REA) which is the secretariat to rural electrification board. It's responsible for implementing MEMDs plans in rural areas.3) Electricity Regulatory Authority(ERA) established by electricity Act in 1999, responsible for issuing licences for power generation, transmission, distribution or sales of electricity as well as tariff structures and investigate tariff charges and approve the rates of charges. Other state-owned energy companies include; Uganda Electricity Generation Company (UEGCL), Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Distribution Company Limited (UEDCL).

A large community of international development partners in the energy sector whose activities are coordinated through the energy and mineral development of partners group are actively operating in Uganda. Over 30 photovoltaic system providers were operating in Uganda by 2010 and several NGOs implementing the use of solar systems and solar lamps.

**Policy framework and regulation**

Over the past years, Uganda has embarked on a power sub-sector reform programme that has led to the implementation of significant structural changes within the sector. The aim of these programs was to provide adequate, reliable and least-cost power supply to meet the country`s demand. It was also intended to promote efficient operation of power sector and scaling up rural and peri- urban access with an aim of maximizing the impact on poverty reduction (Ministry of energy and mineral development, 2012) However there has been little progress and the energy supply is not able to meet the demand of the increasing population.

The Uganda's **energy policy (2002)** was drafted to meet the social and economic development goals of the country through providing affordable energy in an environmentally sustainable manner. Most of the electricity in Uganda was generated by the two hydro-power stations in Jinja until 2005 when the water levels in Lake Victoria dramatically dropped and led to persistent power shortage and load shedding. The government had to resort to expensive thermal power plants running on diesel and at the same time the state had to cover the difference between the cost per unit of thermal generation and the end-user (Ministry of energy and mineral development, 2012).

The **renewable energy policy** was drafted in 2007 to provide a framework to secure 61% generation capacity from the renewable energy. The main features of the policy include; introduction of the feed-in tariffs, standardised power purchase agreements, tax incentives on renewable energy technologies. The policy includes the need for increased private participation and large power plants (MEMD, 2012).

Rural electrification is an integral part of the Ugandan Governments Poverty Eradication Action Plan (PEAP) and because of this it has set a target of providing the rural population with energy that is specified in the rural electrification strategy plan as well as in the PEAP.

### 4.3.3 RURAL ELECTRIFICATION STRATEGY AND PLAN 2013-2022 IN UGANDA

Grid access in the rural areas is estimated at 2% which means that approximately 200,000 rural customers are connected to the grid. In 2001, a rural electrification strategy plan was adopted after recognising the importance of accelerating energy access in rural areas. The programme is managed by the Ministry of Energy and Mineral development, and it also incorporated into on-going activities which include the planning of the priority rural electrification projects, the local community rural electrification initiatives and lastly the extension of the grid electricity to agricultural enterprises. Energy for rural electrification projects is funded by the Private sector foundation for Uganda whereas the rural electrification Agency manages the investment subsidies. Though the private sector such as electricity service providers will continue playing an important role, the government proactively plan and enable the programs implementation and mitigate commercial risks and related barriers that may prevent the private sector from actively participating in the energy sector.

**Program implementing policies and structures (energy sector plan 2013-2022)**

1. The government will assume greater responsibility for planning, financing and overall management of the rural electrification sector.

2. Rural electrification shall be implemented on a model of scaled, multi-technology electricity service territories comprising the entire rural territory of the country

3. Planning and management for all rural electrification sector programs and investment resources will be centralized in the rural energy agency

Four rural electrification services and infrastructures shall be managed by the duty licensed non-governmental concession holders

5. Off-grid electrification services comprising energy service technologies not dependent on the national grid shall, preferably, be planned, offered and furnished to eligible consumers in the service territories in tandem with on-grid electrification services

6. Investment in small distributed power generation facilities as local sources of supply will be given increased priority and enhanced support.

7. New emphases will be given to building organisational and professional competencies through technical assistance and training

## 4.4 CASE 2: PECO RWENZORI MICRO-HYDROPOWER PROJECT.

The in-depth interviews with the different actors as explained in the methodology part of the thesis. The narratives told from the local entrepreneur point of view about the stories and experiences during implementation and operation of the initiative. The narratives are marked by stories told by the local community who are the direct beneficiaries of the min-hydropower projects. The concept of narratives is in some field such as sociolinguistic restricted to brief, topically specific stories organised around characters, setting and plot (Langellier et al. 2003). The PECO Rwenzori project was already implemented and running by the time of the interviews. My interest lies mainly in the content of the interviews because I intend to interpret what is said by focusing on the meaning in the told stories (ibid).

**Figure 6: Map of kyarumba sub-county showing Kitabona/Kalonge parish**


*Source: Uganda public maps: mapping tool 2016*

Kitabona village (Kyarumba sub-county) is located in Kasese district, the western region of Uganda. Kasese sits in the foothills of the Rwenzori Mountains which may explain the many small rivers found in this area. The water in the rivers comes from the Crater Lake on top of the mountain that mainly supplies the Mobuku River and Isya River. The district is endowed with natural resources such as wetlands, vegetation, mountains and wildlife. Average rainfall received annually ranges between 900-1,600mm. The local economy is predominantly agriculture, growing crops such as bananas, cassava, and maize for local consumption well as

coffee and cotton grown as cash crops. Small-scale mills for millet and maize and locally processing coffee and small enterprises. The district has a population of about 747,800 people, and Kyarumba sub-county is home to approximately 1,546 people. Based on a survey done in 2006 by Byamugisha the households spent approximately US $ 2.62 on energy. The major source of energy used is biomass and only 2.5% of the population had access to grid electricity.

### 4.4.1 DESCRIPTION OF THE PECO MICRO-HYDROPOWER PROJECT

PECO Rwenzori micro hydropower hub was constructed locally in 2011 by a 43-year-old member of the community. The owner of the power project is a water technician by profession whose desire to start a business that would both benefit the community as well as earn him income motivated him to start a micro hydropower project independently. Besides his work as a water technician, he owns a restaurant and cottages that he hires out to students and low budget tourists that wish to save money and also explore the region around the mountains. The business is located in the mountains; he had few customers due to lack of energy. The few guest he received used kerosene lamps or candles for the light. The energy problem in Kitabona coupled with the changes in the government rural electrification programs that support local community initiatives motivated the entrepreneur to venture into micro-hydro power generation. As stated in section 4.3, the government mandate to involve the private sector to provide renewable energy in dispersed and inaccessible areas opened an opportunity for the local entrepreneur to venture into the sector. Also, the entrepreneur has access to the water source he exploited to produce energy. He then decided to train and attain skills in making simple turbines using the available local materials. After several trials and testing the turbines, he was able to make one that was appropriate enough to generate energy that would serve his business and other households and businesses within proximity.

The start of the project was very challenging for him because he didn't know whether the generators would produce power, he sought for technical help from several experts willing to offer help. The project went through significant phases which also involved a commitment of the local population that would gain from the energy generated, Legitimisation of the project by the local authorities and the local electrification agency, and lastly planning and marketing the power produced. Despite the economic risk and the concerted or sometimes misdirected efforts, he was determined to produce power for his community. He took some time off his work as a water technician at the local government office to concentrate on the project, and this gave him the possibility of involving the community and discussing with them about the

project and his intentions. The demand for power is high and people in this village were willing to pay for the electricity the only hindrance was the initial investment capital. The entrepreneur needed a big sum of money of about the US $ 5,000 for his project and given his small salary that sum of money was like a dream for him. Some of the local people were willing to pay him a certain amount of money to secure their connection to electricity after the end of the project; other community members didn't have a lot of belief in the locally made turbines and thus doubted the durability of his project. Other local members thought that the entrepreneur had support from a broad and that the expected him to compensate them if he used their land or had to cut their crops.

*It is interesting how everyone assumes that all developmental projects have to come from outside countries. I designed the turbines myself with the help of some experts; I showed the people who constructed the Bugoye plant to get some technical assistance. But I was surprised when my fellow people wanted me to compensate them for the land I was not even going to take, but just lay my pipes. It was a lesson, or maybe the community is not used to us local people generating power (interview with the local entrepreneur, 3/12/2015)*

As stated above, Kitabona is isolated from the main grid, and yet a large number of the population need the energy to process the coffee grown in the village. Limited access to energy forces the local people to walk long distances while carrying heavy sacks of coffee on their heads to the processing plant with energy. His intention was to produce and sell energy to address the needs of local clients, including small businesses, small agro-processing plants especially coffee processing and households. In his concession license and permit to provide energy, the local entrepreneur has to ensure that he provides the service promised by the regulation drafted by REA. The demand for energy is high in this area, and yet the supply is still low even when he produces to reduce the burden.

**Figure 7: PECO Rwenzori micro-hydro power plant**

*Photos were taken by Mary Yaledi. S.*

### 4.4.3 INITIATIVE AND ORGANISATION

The initiative is informally organised, and its main objective is to provide clean and affordable energy to household and businesses within proximity. It, also, aims to contribute to sustainable rural electrification from the grass roots that will improve the lives of the local people. It is a small enterprise managed by the entrepreneur and three other people and developed with the support from the renewable energy business incubator, the community and the rural energy agency in Kasese. The rural energy agency and the community were instrumental in legitimizing his project in the village. The financial support was necessary at the initial stage to help him start his construction. Some of the equipment used for construction were locally made by the entrepreneur himself which supports as well as harmonizes modern technologies with the traditional and indigenous knowledge for sustainable electrification of the community. He gained such knowledge from his work as a water technician in the community. The years he spent working in the community on water projects attained him simple skills and knowledge which he used with the help of other experts in electricity. He intends to expand to other small villages in the mountains where the grid may not reach in the next 20 years. The Rural Electrification Agency approved his project and with this approval, he was able to get partial financing from the Renewable

Energy business solution agency. The rural electrification agency is responsible for implementing all the energy activities in rural areas. As he states in his words

> *There is no local person in this area producing energy, and yet the local government is willing to support independent producers of energy. I presented my idea to the rural electrification agency in the town centre and told them that I had a water source on which I wish to construct a powerhouse and produce energy. The first time I tried to apply for the licence to generate power, the application was rejected without them coming to the site for inspection, I left my application forms at their office for them to see through my plans. Two days later I went back and was given a gentleman to come and inspect my site, and I was permitted to construct after waiting for about two months (interview with the local entrepreneur, 3/12/2015)*

The power produced and generated is supplied to five households which use it for lighting and maybe watching TV and listening to radio, and to three small businesses including his own business. Power charges range between Ugandan shillings 10,000-30,000 per month for the business owners who are relatively lower than the national grid and about Uganda shillings 5000 to 10,000 for households. Measuring the power per kWh consumed or supplied is close to impossible because he has not yet installed a metering system and him, therefore, charges on a flat tariff basis. The energy he produces is used for lighting, charging phones and batteries, as well as processing coffee.

Through active community involvement and the entrepreneur working with the community organisation, his project demonstrates a successful model for enhancing electricity access to rural areas if extensively financed and implemented by hydropower experts. There have been considerable challenges along the way that are related to the quality of the equipment and limited skills. He spends most of the time at his workplace and when he has the time he comes to the site, therefore, the plant is mostly management by his staff with limited skills who cannot repair the generator and who have limited management skills.

### 4.4.4 FINANCING THE PROJECT

Central government encourages the local government to increase financial support to the local private producers of energy in the rural areas. With this in mind, the entrepreneur expected to get some subsidize from the local government through the rural electrification agency. However, he was financially supported by renewable energy business incubator which is a domestic non-profit organisation that locally supports innovative ventures in renewable energy.

The local network collectively provided him with financial support in the form of loans or advanced payments for the proposed power production. The community group from the existing Bugoye hydropower project of which he had been a member was very helpful in organising resources such as information and financial support for him.

**Ensuring financial viability for the project**

For the entrepreneur to raise a total of US $ 5,000 required to construct the mini hydro power, he received some fund from the Renewable energy business incubator, the entrepreneur himself and a loan from the local network and some friends in the community. The cost per unit was approximately US $ 750. The entrepreneur partially received both financial and technical help from the Renewable energy business incubator. This financial support from this organisation comes as part of the government effort to support local community rural electrification initiatives as stated in the rural electrification strategy.

The entrepreneur was able to pay part of the loan he got from the local lenders using income from the electricity sales. The electricity was to be sold locally to support household and businesses within the power range. The entrepreneur did not need to secure any guarantees. The risks of construction and risk to income from low water flow were not secured. As an independent local entrepreneur, he constantly struggles with mobilising funds because it's not always easy to find organisations willing to invest their money in micro-hydropower projects that produce 5Kw in a rural setting where the infrastructure is not good enough. The entrepreneur believes he was lucky enough to meet some representatives of the Bugoye hydropower plant who were very helpful in giving some expertise and also referred him to the renewable energy incubator where he got both technical and financial help.

> *My budget was approximately 6,000 US dollars to set up the powerhouse and to buy the necessary equipment to complete my project. I had a good idea but lacked the*

*income to realise it. I was informed to discuss my idea with this organisation that gives support to innovative businesses. I didn't expect them to help however my determination to implement the project was very high. I took courage and arranged a meeting with the head of the organisation, they later visited my site, looked at the potential to produce power and how it would benefit the community. It had taken some time before I received any response so I started asking around among my friends and colleagues whether they could lend me a certain amount of money for the project. Well, that was a challenge due to the risk involved. Some of them promised though they never really kept their promise, others contribute, and also I borrowed money from the local lender, but it was not enough. I just had to contact Renewable energy business incubator again to remind them of my project. They promised to avail to me about 60% of the total sum I needed to finish the project. That was more than I had expected from them, it made my work much easier, and I was able to buy the necessary equipment to start with my work (Interview with the Entrepreneur, 3/12/2015).*

The initial investment cost of constructing the micro-hydropower in Kitabona was dependent on the major components such as civil works (gradient of the waterway), generating equipment (Turbine, Generator, control, and protection) and the electrical distribution lines. The entrepreneur designed and constructed the micro-hydropower himself with the help of the renewable energy business incubator to minimise the costs which are likely to compromise on the quality of the construction.

*I have a small river that runs over my land, and yet there was no electricity. With my knowledge as a water technician, I started designing and making plans for the project. It takes took some time to draft the necessary designs. The plans and designs were simple, and I gave some experts to adjust and make changes. I made the turbines myself, and this reduced the cost however they are not efficient enough to produce to its capacity. Operations and maintenance are challenging because the people employed limited knowledge about turbines and generators. It's not easy to get qualified people who can handle basic repairs if needed; I just have to call an electrician from the centre when the need arises in my absences. (Interview with the Entrepreneur,3/12/2015)*

The load centre in the powerhouse is basic and may not economically justify for high reliability. The entrepreneur used local material to make the turbine and all the necessary equipment. The local network helped to raise some the funds needed for construction. The bank could not take the risk of lending him money for his project without substantial guarantee; he, however, managed to borrow many from the local lenders. The problem with the local lenders is that their interest rates are too high and they never really have enough money needed at the time. He, also, used his savings to complete and produce the needed energy.

**Financial sustainability mechanism.**

Currently, the production is lower than expected due to the poor quality equipment used for generating the energy. But he, however, believes that the project will in the long become profitable for him as well as the community if sustained and maintained well. The local materials used during construction means that spare parts are easy to find and thus easy to maintain in case of any breakages. The local entrepreneur produces energy which the sales directly to the population within proximity. Part of the money from the sales is saved to meet the operation and maintenance costs of the equipment.

He also managed to pay off the debts he obtained in the initial stage of the construction. He used part of his salary and what he earned from the power station and his cottages to clear the debts. He narrated his experience with the local lenders below;

> *I needed money, so I borrowed it then, as I said the bank would not lend me money without guarantee and yet the local micro-finance demands a lot of paperwork, and they usually give less than Ugandan shillings 200,000 the first time one borrows money from them. The micro-finance gives payment deadlines so it wouldn't work well with this project. I borrowed money from money lenders because I could obtain more than Ugandan shillings 1,000,000 without paperwork. However as soon as I started producing power, they started knocking on my door and reminding me to make payments. I was reminded of the debt whenever I met them at least I had to come up with a payment plan with at least the first instalment of the payment (interview with the entrepreneur, 3/12/2015)*

### 4.4.5 Community participation and decision-making

For the local entrepreneur making a profit from the production of power would be measured as a parameter for success and as such involving the community was both a marketing strategy for his project to reach to the society and also to understand how best to serve the local people within proximity. He first held meetings with community leaders together with potential consumers to disseminate key information about the project and to ensure that he included their interests in decision-making and solicited for their participation and approvals. The entrepreneur had to consult the village leaders to seek permission to construct a micro-hydropower station and to ask for their help regarding sensitising the community. The village leaders communicated with the village people and this gave a small project some popularity in the village. During the interview with the village leader, he said that;

> *It is a private project, and he is planning to sell the power to a limited number of households. People always expect some fee for using their property but then he needs our support, this will make us proud when one of our sons makes such efforts to try and meet our energy need. People in this area are lucky because we receive a lot of people that are coming in this town with good ideas which our children should learn. As a leader, I am very content that at least one of us can see the need of the people and help them in a productive way. We need energy; the national grid will take time before it gets to us, and though it finally gets here the electricity will be too expensive for us and unstable. I see this whenever I go to the town centre, people with shops complain about UMEME and the unstable power, and yet one has to pay highly for it every month. For example, power just goes off; maybe one is in a salon cutting hair and has to either wait until the power is back. That's time wasted, and if one decides to use batteries, the hair cut looks different. It's a shame. (Village leader, kitabona, 5/12/2015)*

As local entrepreneur convincing the local people to take part in the construction was a challenge since majority expected compensation for the land which he used. The local community contributed regarding planning, voluntary labour for building the powerhouse, digging the canal and general construction as well as identifying other areas that have the potential for micro-hydro power. During the construction phase, the entrepreneur did not use women but preferred men due to the heavy manual labour involved.

Also, the construction of the small hydropower project in Bugoye had affected the people's perception. The local people emerged with questions concerning compensation, ownership,

especially after the construction when their attitude towards the project changed. The local people were positive about the construction before implemented but some of the neighbours started to oppose selfishly. However, the Village leader played an instrumental role in convincing the local people within proximity. The entrepreneur involved both women and men in his project and he trained and employed a woman to run the generator

> *I dream to expand to isolated areas where I am sure that the national grid will not reach in the next 20 years to make energy accessible to the small marginalised communities. These communities up on the mountain are very productive, and there is a high potential for micro hydropower due to the many small rivers that are running from the Rwenzori. I have had discussions with the local utility service in Kasese, visited some of the sites and talked to the people in the mountains. Many said that they have to walk down and up the mountain just to charge a phone or use electricity to process their coffee, but if they had energy close to them this would reduce the time spent travelling to the nearest centre with energy (interview with the Local entrepreneur, 5/12/2015).*

# CHAPTER 5. CASE ANALYSIS, DISCUSSIONS AND CONCLUSION

## 5.1 CROSS-CASE ANALYSIS.

### RQ1: What is the role of the entrepreneurs in enhancing rural electrification?

Through this question, I sought to explore the similarity and differences of the spillover effect of the two forms of entrepreneurship on the society and how entrepreneurs can recognise opportunities in rural electrification. The common aspect found in all the 2 cases was that entrepreneurs identified opportunities in rural electrification and recombined available resources such as human and financial capital and local materials to produce energy for the marginalised communities. Specific relationships and networks were formed around the systems such as institutions, NGOs the community, etc. that are related to energy production and distribution.

In the case of Rubagaga, the actors (Afritech Rwanda) represents some international philanthropies and social entrepreneurship network that involves several organisations such as Global Village Energy Partners, and Group hopes international to raise equity for the purpose of creating socio-economic impacts in the local community as a parameter of success rather than profit. The partnership ensures funds for the implementation of the project through different partners have different requirements that have to be fulfilled for the project to receive the needed finances. The developer has a challenge of ensuring the interests of the funders remain subordinate to the mission at hand since the construction of the project has delayed. Some of the measures the project took included focusing on the social impacts of the project such as Bamboo farming, setting up cooperatives. Communication with the partner monthly to give them updates is another way of ensuring the cooperation of the funders.

The case in Kitabona/Kasese is a local entrepreneur that had new ideas that would benefit both the community and the entrepreneur. He raised his start-up capital and capital for improvements to meet the licensing required for the community network, support from the local organisation and informal loans from local lenders that usually have high-interest rates. The initial installation cost is high for an individual local entrepreneur, and yet the local population is also too poor to raise the needed financial capital. In kitabona village, the demand for electricity is high, but the supply is very low. The low supply of electricity attributed to the financial problem and limited capacity and skills. The village is energy poor forcing the local community to use fuel which is expensive and environmentally unfriendly. The entrepreneur has a dream of expanding to other smaller communities up in the

mountains, however, implementing of micro hydropower project is limited by several challenges such as, the cost of setting up private generation and distribution systems, business risk of investing in a system that is susceptible to being undercut by an extension of a national grid.

The implementation of the PECO Rwenzori micro hydropower project was less formal, and the local authorities and local energy utility needed to legitimise the project, less bureaucratic, less time consuming. The formalities and bureaucracy involved in the implementation of the Rubagabga project delayed the construction of the power plant from starting as scheduled. PECO Rwenzori project may not supply energy at a level that is equivalent to that offered by a probably well-managed grid in Rubagaga, but it is easy to construct, less costly and a less time-consuming process of extending energy.

I find that entrepreneurs offer economic, social and environmental value to the local community which promotes local development. Specifically, I found that both projects will offer clean energy to the local community at rates lower than the national grid by constructing independent electricity generation and distribution systems that service one village or households within proximity. Creating directly or indirectly employment opportunities that present a significant step forward in the quality of life in the community.

Another aspect common in both cases was the extent the entrepreneur involved the community in participating in the projects. In both cases community participation is relatively high especially at the planning stage of the projects and construction stage. The entrepreneurs mobilise the community through the help of local leaders. In the case of Rubagaga, the external outsiders have limited knowledge about the area and the needs of the community. In this case, involving the local community provides them with the opportunity to tap into the knowledge base of the community about ideas for social involvement, better insights on the active members of the community and possible collaborations with neighbouring regions. It also involves training the local people to build their capacity in such a way that the community can sustain itself. The barrier to community involvement in the Rubagabaga project is more pronounced by the cross-cultural aspect that my limit communication and interpretation of the information presented, the levels of education among the members of the community may limit the number of participants, political considerations and the differences in culture and behaviour. In the case of PECO Rwenzori project, the local entrepreneur has good knowledge of the community and its liabilities through involving the community gives

the local people a degree of ownership which in return accelerates the implementation. The desire for the entrepreneurs to develop better ways of collaborating with the community was a necessary aspect of the sustainability of both projects. In both projects, the entrepreneurs challenge and inspire the local members to adopt alternative ways to sustain the energy products.

**How does the institutional structure influence the role of the entrepreneur in rural electrification?**

The entrepreneurs respond to the government's change in regulations and policies that aim at integrating the private sector so as to accelerate the process of rural electrification as stated in the energy action plan in the sections above. In both cases, it is very clear that government institutions are playing different roles which can constrain or enable the activities of the entrepreneurs. In other ward institutions present challenges and opportunities formulated in subsequent policies and guidelines concerning rural electrification and the involvement of the private sector.

The partnership between the Rubagabaga mini hydropower project and the government allows higher government involvement in the project since the government retains a certain percentage of ownership and the state is also highly involved in decision-making. The advantage of this partnership is that government bears some risk and will strongly support the project however the disadvantage with this partnership lies in the number of partners and stakeholders which adds complexity and can risk the progress of the project. The project could not start within the time scheduled because the Rwandan utilities regulatory authority responsible for approving and registration of the energy activities delayed to approve the partnership. The project has several paperwork including the concession papers, a power-purchase agreement that have to be approved, and thus it involves lots of discussions and yet the regulations are not so straightforward and easy to understand.

PECO Rwenzori is a micro hydropower project whose management is basic and non-formal. For the entrepreneur to start his project, he needed permission from the rural energy agency and the local authority to legitimise his project. Rural electrification policy encourages the local government to support the communal initiatives aimed at increasing energy access to the local people. Financial support involves a lot of paperwork and bureaucracy, and yet the local government lacks enough funds to support all the local initiatives in the area.

**RQ2: How can the entrepreneurs enhance rural electrification using Social innovative practices are used as strategies that are social, economically and environmentally sustainable?**

In this question, I wanted to find out the new rural electrification strategies used in the projects and constraints and impacts of the project. I use the theoretical framework presented in Chapter three for comparison purposes between the two cases. I take into consideration theoretical concepts such as organisation and management of the projects, innovative interactive policy making, financing mechanism, community participation in decision-making and capacity building to explain the innovative strategies used in the two cases and how the community adapts to the new practices. Some strategies such as government subsidies (see Chapter 2) used by the government have faced some barriers that prevent them from being used to their full social and economic potential. Governments in both countries have a target clearly stated in the Action Energy Plan that is presented in chapter two, to extend energy to the rural and remote areas.

**Initiatives and organisation of the case project**

In the use of innovative rural electrification strategies in the selected cases is the Rubagaga min-hydro power project that proposes to use a new model of public-private community partnership which ensures community ownership and participation. The partnership is formal, and a concession agreement drafted specifying the role and contribution of different actors namely government, investors, and the community. The social entrepreneur has also built a network with several funders from different organisations that support financially support the project. The advantage of these networks is that the financial base is widened, however maintaining the collaboration between the different organisations is challenging as different organisations require different criteria to release the money. Even though the organisations promise to support the project, the developer has to remind them continuously of the project and need for their support. They also need constant updates on the progress of the project, and the inefficient of government institutions resulted in delayed approvals of documents which may, in turn, have delayed the implementation of the project. The entrepreneur, however, continued with the capacity building program which was part of the project, such as providing training, bamboo planting, creating cooperatives and organising the local community.

The Rubagabaga project proposes to generate electricity that will be fully fed into the transmission grid and the project proposed to earns from a Feed-in-Tariff. In this case, Afritek had to draft a power Purchase agreement with the Rwandan Utility Regulatory Authority (RURA). And on the other hand is the PECO Rwenzori micro-hydro power that is owned by and independent local producer and distributor. The entrepreneur sells the generated electricity as his business lines to his clients without the involvement of the Uganda electricity transmission company (UETCL). His operations are informal the local authorities ensured, however, the legitimization of the project in the villages and the rural electrification agency (REA). Decision making is entirely left to him though with the limited capital base, expansion of the project is a challenging process.

Below is the summary of how the two projects organised their activities and I use letter O-o to show the difference.

**Table 3: Summary of the project organisation**

| Initiative and Organisation | Rubagabaga | PECO Rwenzori |
|---|---|---|
| **International and local collaborations** | | |
| Local partnerships | O | - |
| Supporting organisations | O | o |
| Local councils | O | O |
| Coordinating committees' | O | o |

**Financial sustainability mechanisms**

THE strong social orientation of the Rubagabaga project will probably make the electricity affordable for the local community as well as ensure sustainability of the utility line that will serve the community. The approach is supported by literature among scholars who argue for the benefits of subsidies to cover the upfront cost of technology. (section2.1) The Rubagabaga project proposes to establish both agricultural and utility cooperatives, women associations that represent the interests of women about energy consumption. If the Local Energy cooperatives are well managed, they might promote development in the local community by offering services such as microfinance, improved infrastructure, technical training and assistance on the innovative and productive end uses of energy. Crowd-funding

on behalf of the community is another strategy the social entrepreneur intends to use to enable the community buy-in into the project. The existing empirical evidence in rural electrification supports community ownership and responsibility as an important factor that can contribute to positive impacts of the project. Community responsibility will include utility cooperatives with decision-making power that will act as an arena for collaboration and problem solving for the community. Though the social entrepreneur proposes community buy-in into the project, community ownership of the utility line still poses challenges on how it will be implemented. The developer plans to set out ownership rules about their mission, governance structures and how they distribute the profits from the energy. At the sometimes they intend to provide practical skill training to the local people about basic operation and maintenance, basic management skills which will benefit both the project and the community.

Well as the case in Kitabona, a simple private model was the most suitable given the energy load and the number of people he is selling the energy to. Rural poverty is viewed as the main obstacle to rural electrification and such I fervently believe that friction created between the financial needs of the PECO Rwenzori project and the economic structure of the local community. I found that the challenge lay in the PECO Rwenzori project to generate enough energy as well as income to manage the operations and maintenance of the plant. In a rural setting, that is characterised by low incomes that are dependent on the harvest planting. Perhaps it is relevant for the local entrepreneur to adapt financial strategies appropriate for the rural economic environment. During the planning stage, the local entrepreneur was instrumental in raising equity and managed to formalise the contribution of a small group of local funders within the community. Less formal in nature, promotional activity and measures included involvement of the community in the initial stage, use of local materials, used in small scale to provide energy to the household within proximity as an alternative to a centralised electricity system.

**Community participation in decision-making**

Community participation has two dimensions; one from the project initiate and 2) the community. The findings from Rubagabaga, show that the foreign developer of the project used the time to get to know the community before deciding on how the community would contribute and at what level the community would make decisions. The project was still at preparation stage at the time of my study; implementation was not on schedule due to the delayed approval of document by Rwandan Utilities Regulatory Agency (RURA). RURA is

responsible for approving contractual projects concerning distribution and transmission of electricity and gas including assessing the tariff structure (Rwandan Energy Sector review, 2011). Therefore, at this point community participation is very limited though they were instrumental in providing knowledge about the community; economic activities and how the project would best meet their needs. The community leaders and local entrepreneurs were useful for consultations in the community and during the baseline survey, community contribution towards the project will be more apparent during the implementation period. The project proposes to implement gender-sensitive energy programs that will present opportunities for women to participate in decision-making. The implementation of the programmes will be through women associations and cooperatives that give women a platform to air out their views and ideas.

Integrating gender-equity in the project is in line with the requirements of the Rwandan energy sector action plan that encourages the active participation of women in the energy projects. On the other hand, the community was involved at different stages in the PECO Rwenzori project. In the planning stage, he involved the community leaders who sensitised the community about his project. The local people also helped him in raising some of the capital needed for his constructions and also volunteered to dig trenches and lay the pipes so as to transmit energy to the households and businesses. When the project ended, he employed three people from the community including a woman to run its daily operations. Below I present the summary of community participation. I use letters C-c to represent the extent of community participation.

**Table 4: Community participation**

| Community participation | Rubagabaga | PECO Rwenzori |
|---|---|---|
| **Project initiated participation** | | |
| Community sensitization | C | C |
| Gender-sensitive activities | C | c |
| Cooperatives and associations | C | - |
| **Community initiated participation** | | |
| Provide local knowledge | C | c |
| Manuel labour | C | C |
| Raise Capital | - | c |
| Organising the community | C | C |

**RQ3: what challenges do the entrepreneurs face when implementing the strategies in rural electrification?**

In my analysis of this third question chose to use a table to present the barriers faced by the two initiatives. The identified barrier presented according to the magnitude they affect the activities of the actors in rural electrification. I use letters (B) to represent a significant hindrance to the initiatives and letter (b) for relatively minor hindrances.

**Table 5: Identified barriers**

| Identified barriers | Rubagabaga | PECO Rwenzori |
|---|---|---|
| **Initiatives and organisation barrier** | | |
| Structures and strategies | b | B |
| Decision-making process | B | b |
| Lack of co-investments | b | B |
| **Institutional barriers** | | |
| Bureaucratic | B | B |
| Time consuming processes | B | b |
| Incompatible regulations and policies | B | B |
| Lack of consistency | B | B |
| **Rural infrastructure** | | |
| Dispersed population | B | B |
| Limited rural infrastructure | B | B |
| **Social dimension** | | |
| Poverty and affordability | B | b |
| Local participation barriers | b | B |
| Limited local engagement | B | b |
| Local perception | B | B |
| **Economy and finance** | | |
| Limited rural financial institutions | B | B |
| Poor rural market | B | B |
| Low productive use | B | b |
| Donor dependency | B | b |
| Limited skilled personnel | | B |

## 5.2 DISCUSSIONS AND CONCLUSIONS

In this section of the thesis, I present different perspectives on the topic linking different viewpoints to my findings in the field and theory presented in chapter 2. I seek to give a broader understanding of my topic and research questions. In Chapter 2.1, I briefly present the factors that influence the choices of technology and strategies in rural electrification and preconditions for the sustainability of the rural electrification strategies. In my cases, I look at two initiatives that may represent the non-profit oriented entrepreneurship and the profit oriented entrepreneurship that is locally based. I point out the differences especially about challenges and opportunities in rural electrification which I use in my discussion get a broader understanding of the topic.

### 5.2.1 ENTREPRENEUR OPPORTUNITIES IN RURAL ELECTRIFICATION

Rural electrification is more than ever linked to entrepreneurship, institutions, local communities, and individuals promoting it now see the private sector including entrepreneurs as an intervention that could accelerate the rural electrification process (Tiller, 2010, European Commission,2013). This link further illustrated in the cases were the entrepreneurs identify the opportunities in rural electrification, from specific relationships and networks and then recombine the available resources to produce energy as well as create value for the local community. The opportunities in rural electrification identified when one takes into account the energy access aspect and the energy consumption aspect which indicate the degree to which the energy sector supports national growth. About the electricity access aspect, the many Sub-Saharan countries including Uganda and Rwanda still have an average electricity access rate estimated at 20% as well as a very low consumption rate (Mckinsey research, 2015). According to the McKinsey research (2015) Energy demand in the sub-Saharan countries is steadily growing and this presents opportunities for entrepreneurs/actors willing to propel it. Even though the energy sector of Uganda and Rwanda faces several challenges, the dynamic in this sector is changing. The starting point is the rural energy strategic plan and policies that support the private-sector including independent energy producers and different forms of partnerships. Secondly the UN program on sustainable energy for all which is strongly pushing global institutions to create an energy revolution which includes involving the private sector activities in many different parts of the value chain (ibid).

The entrepreneurs in these two cases have pertained to the new organisation of productive factors which are not exclusively innovations that are on the technological cutting edge. The practices used in the cases do not involve anything new from a global or even national perspective but rather adopted new practices that were not previously existent in those villages. However, the practices are linked to specific interventions within rural electrification that are to be implemented as well as the choice of tools used in the projects is meant to match the situations in the rural setting. One can clearly say that entrepreneurship can fill up the existing gaps in the rural electrification processes. Theses gaps are due to the persistent failure of initial rural electrification programs implemented by the state as briefly stated in chapter one and chapter 4.

Entrepreneurship may seem like a central force for rural electrification and socio-economic growth in the rural areas, given that entrepreneurs create innovative strategies that meet the needs of the localised population. However, the acceptance of entrepreneurship as a central force by itself may not result in the much needed rural electrification and advancement of the rural enterprise if the environment poses strong obstacles that may hinder their operations in the rural areas. What is needed is to create an environment that enables the involvement of the private sector in the energy sector.

An appropriate environment for entrepreneurs willing to invest in rural electrification largely depends on the policies promoting rural electrification and the involvement of the private sector, effectiveness of these policies, transparency and commitment to the regulation. For example projects like the PECO Rwenzori were the local entrepreneur desires to produce more energy for the marginalised communities is not easily realised given the current policy that requires a feasibility study within a limited period. Feasibility studies are costly to carry out depending on the size of the project and number of affected people. The local entrepreneur on his own is likely not to have the funds to invest in the feasibility study, and yet it's impossible for him to attract investors without an approved feasibility study (MEMD, 2012). On another hand, it is false to assume that entrepreneur participation in rural electrification will enhance energy access and transform the social and economic situations in the local community into fast-growing areas by injecting external investment funds and expertise. The local communities need to develop entrepreneurial capabilities and potential that can boost the creation of local enterprises, the creation of jobs and add economic value to the community as well as utilise the available resources. Otherwise, the projects may fail to achieve the long-term economic growth in the communities which may consequently lead to

more isolation, depopulation due to outward migration and less capable of attracting new people. Specific relationships and networks created during project period that is from planning stage to implementation stage facilitate the flow of information within the networks built.

Private participation in the public-private partnership and philanthropic capital require some profitability from the initiative. However in Rwanda and Uganda were the majority of the rural population live below the official poverty line, profitability may not be forthcoming for the private people. The public-private partnership is more attracted to projects with more commercial potentials and with fair returns on investment. One may say that the public community model is more appropriate for energy projects that are not commercially viable but with high priority about socio-economic development in an attractive area for private investment and community needs. The model used in the Rubagabaga project combines both models into one which is the public- private community model. The case of Rubagabaga pioneering partial community ownership of the power production is best understood when looked at against the energy policy and regulations that seek to support strategies that are socio-economically and environmentally sustainable and the structure of the project that seeks to achieve its social objectives. The model seeks to balance between the societal objectives and the commercial needs of the private sector. The community ownership of the project will be ensured through crowd financing so that the community can afford to buy-in into the project. After this project is implemented, energy will be made available in the village centre, health centre and schools while household connections will be based on individual demand.

### 5.2.2 THE SOCIAL SYSTEM AND ITS INFLUENCE ON THE INITIATIVES IN RURAL ELECTRIFICATION

Nilsen (2015) points out that aspects conditioning the management and operations of initiatives in developing countries are related to economic, political, cultural (living habits, norms) and demographic factors. According to energy entrepreneurs in the cases, political priorities are determinates for the implementation of rural electrification programs. The two countries face these challenges both at the national and local level. Reference to political barriers was seen during local elections in Kasese district (Uganda). One of the local authorities used the PECO Rwenzori hydro project as a strategy to push forward his local campaigns. Political priorities may also influence the level of government commitment to the implemented policies in such a way that more focus and support is directed to the projects

that are politically viable than projects that seek to meet the energy needs of the rural areas (Alhborg and Hammer, 2011). In line with section 1.2 of my thesis, governments may continuously allocate subsidies to strategies that do not produce substantial results due to the political pressure to maintain the operation of these strategies. However, advocating for more transparency in the energy sector may open room for discussions and participation as well as expose the strategies that are winning or losing. By showing how the subsidies are allocated to different strategies, the support for reforms may broaden (Peters et al., 2009). Also, transparency may also influence institutionalising public discourses, compel openness from the diverse actors in the energy sector as well as improve the flow of information among the interrelated networks that work collectively to engage in providing electricity to the rural communities (GTZ, 2012)

Behind each of each of the cases, there is some institutional support that determines their success. The stimulation of interests within the social system where entrepreneurs initiate new ideas that are legitimised by the locally powerful people in the community can account for the support and success of the initiative. As stated in the theory section of the thesis, that a social system sets boundaries in which innovation diffuses that includes the activities of entrepreneurs. Based on my findings, these boundaries set are limited by how the community perceives the projects, their social value, norms, regulations and policies set that are likely to constrain or enable the activities of the actors. One can say that a conducive environment starts already at the national level with the foundation policies for macroeconomic stability, well-defined regulations, policies that support private sector involvement in rural electrification, rural agricultural activities and other rural activities that may increase the incomes of the rural community.

Mckinsey research (2015) explains how the government demonstration of commitment to the energy projects gives private-sector assurance that the government will not default on the project. Lack of government commitment to the project is clearly seen in the PECO Rwenzori project whereby the local energy producers are in theory promised financial support but then in practice; it is made impossible for them to get the financial help from the rural electrification agency. Another form of limited commitment from the government is seen in the Rubagabaga project whose approval delayed. Rural electrification may not be commercially viable, and yet the top-down orientation and donor dependency can create bottlenecks to budgeting. Due to this, the project budgets are reduced to wish- list rather than planning tools (Ahlborg and Hammer, 2011). Lack of government commitment may also

have its roots in the government's skepticism to approve many energy projects at the same time. In Uganda and Rwanda, this scepticism is attributed to the nett problem that could be dramatically overloaded (MEMD, 2012). One may wonder why the governments spend incredible amounts of the fund on environmentally unfriendly thermal energy rather than creating space for more use of renewable energy like the hydro-power project. According to MEMD (2012), there is a collective effort among the East African countries to construct transmission lines around Lake Victoria even though this is likely to take the time to complete. The government skepticism for over production in Uganda can be understood if one looks at the many hydropower plants constructed along the Nile River. For example, the 300MW that has recently been completed and serving the net, 700MW from the Karma and the Isimba 50MW, which is in the planning process (GTZ, 2012). However, the energy potentials in the whole region are under-exploited, and there is still a significant need for energy, especially in rural marginalised communities. And yet governments still prefer the so-called modern and visible large hydropower projects. In such a situation, local entrepreneurs that can independently produce energy for small communities become very significant in rural electrification.

The rural electrification strategy plan stated in section 4.3.3 has one of its plans to increase the priority and enhance support for the small distributed power generation facilities which can act as local sources of energy supply. PECO Rwenzori project falls under this category of local producers and distributors of energy in areas where the central grid may not sufficiently meet the demands of the marginalised communities. The energy sector has created special rules and regulations for licensing these power projects so as rural electric energy providers can engage directly in small-scale power investment for their consumption needs and sale on a small scale. However the existence such regulations may not be useful for the local producers if they have no access to enough information about the regulations or if the regulations or policies are vague and difficult for the local entrepreneurs to understand. Capacity building in the energy sector may also include training the local energy distributors on policies, regulations and their importance to the project.

With reference from the cases, it is illustrated that regional or community leaders push forward the actions of initiatives or projects within the community. Because they are aware of the region's social liabilities and strength which puts them in a position to accelerate the flow of knowledge in the community, propose challenges in the community and how to best meet.

### 5.2.3 COMMUNITY PARTICIPATION IN DECISION-MAKING

The community strategies and choices used in these projects are linked to the specific intervention aim at meeting energy demands of the community in the most appropriate way. Uganda and Rwanda have drafted policies in the energy sector plan of each country that encourages local community participation in the rural electrification programs. The policies in line with literature concerning community participation (Woltjer, 2002). The intensity of community involvement in decision-making differs in these two cases. This difference is seen in the goals and interests of the projects. The Rubagabaga project has a social goal of benefitting the community and some measure of private interests well as the PECO Rwenzori project was implemented by the local entrepreneurs with an aim to earn income and at the same time meet the energy demands of the community. Based on these findings on can say that perhaps the difference between social entrepreneurship and private entrepreneurship is not a clear dichotomy but rather they are interconnected and may re-enforce each other. Direct community involvement in decision-making process and planning that goes beyond community consultation and makes use of local specific (tacit) knowledge to the project positively enhances the implementation of the project as this ensures social acceptance, effectiveness and efficiency of the strategies used (Woltjer, 2002). Social acceptance of the initiatives has a positive outcome by the fact that it saves time which in turn may reduce delays and costs. The PECO Rwenzori project, the local entrepreneur, ensures use of traditional knowledge and resources when he designs and makes turbines using the material available in the local community.

As seen in the cases, community participation in decision-making poses a challenge in communities where a large number of the population is illiterate. However, encouraging the local population especially women to participate promotes local empowerment. Gender sensitive energy projects that involve women in planning and implementation is believed to be effective and efficient. In the Rubagabaga project, small groups inform of cooperatives, associations, and representative groups were formed to meet the needs of the community when the project starts. The model in Rubagabaga project requires the total involvement of the community; however the local people, in this case, are not in a position to provide technological expertise. The entrepreneur thus takes the responsibility of capacity building and consultancy since there are no local institutions in the community that may cater for the need of this project. The project has to take the initiative to encourage the community

members to from community groups and associations and then provide them with duties that are related to the community and their involvement.

Ren (2008) proposes a forum for decision-making that presents equal and fair opportunities for the local people to voice their opinions. Such platforms are in the form of local groups such as the participatory body of decision making. Such platforms act as a bridge between the project and the local community and will ensure easy communication between the actors. Since the community lacks such experience, they are likely to be apprehensive about their participation in the local groups. However, the attitude of the entrepreneur may play an important role in convincing the community about the significance of participating in the local group. Also, there is need to practice patience while communicating and advising them to participate in the groups. In the Rubagabaga project, the decision platforms have been created in the form of cooperatives that facilitate the active participation of different groups including the vulnerable groups such as women and the youth. The cooperative members will get educated about the responsibility and rights of the community about the project. This information is further disseminated to the community through the cooperatives and the community leaders.

Just like all projects, these cases also have a life cycle with various stages that require particular functions of the community. During the preparation stage, collective action that engages the local population to participate in identifying various activities is recommended. The activities included; proposing potential local needs that are related to energy access, identifying sites, and skilled labour that are useful during the implementation period, and potential enterprises. However as the project progresses, the community becomes less involved in the project. On the other hand, it should be noted that community participation may not take into consideration the time factor and yet time may relate to the unfolding of the project processes and how information is understood. The project presents practices the community needs to adapt. However, the time frame within which the local people may adapt to the new practices remains uncertain. Participation also involves direct community investments like attending the meeting, providing labour, identifying more potential local entrepreneurs and also creates locally based organisations.

### 5.2.4 CAPACITY BUILDING STRATEGIES AND ITS RELEVANCY TO SUSTAINABLE RURAL ELECTRIFICATION

Rural electrification has the potential of improving the economic condition of marginalised rural areas if energy access is extended to the health centres, education centre agricultural and commercial centre. However to achieve and sustain rural electrification, the capacity building becomes essential across all actors in the energy sector including; local organisations and groups, the community, government institutions as well as the entrepreneurs involved. Hassinger (1995) mentions about the tendency for individuals to expose themselves to ideas and knowledge that is in line with their needs and attitudes. The capacity building required may differ among various actors. About the local community, appropriate capacity building strategies have to be used that focus on the skills needed to achieve energy.Capacity support strategy considered should have a long-term perspective so as to achieve sustainability of the projects and their impacts on the society (international energy agency, 2003). Mckinsey research (2015) point out that several countries in Africa face skill shortage for local project-delivery capacity, which forces institutions to utilize the limited capacity on already selected projects to complete them. State energy institutions and administrations at the local level often employ people that possess the minimal capacity to design, implement as well as revise the mini and micro hydropower projects. And indeed, supportive policies and regulations at both a technical level and local capacity are often missing to plan and implement the power plants. With that in mind, rigorous regulatory developments and continued refining of the frameworks is a pre-requisite to achieve rural electrification (Mckinsey research, 2015).

The Rubagabaga project is using a new model that has not been used in Rwanda before though other countries like India have successfully implemented the model. It is necessary for institutions to focus on capabilities and regulations instead for just plants and infrastructure. Graham et al. (2009) consider planned action/models may offer practical guidance in the planning and execution of implementation strategies. The energy action strategy and plan in both countries emphasise the need for institutional capacity building in the energy sector. Capacity building, in this case, may include training the public-sector leaders on how to run Public-private community Partnership (PPCP) using examples from other countries that have successfully implemented this model. To appropriately balance the requirements of the private sector, power sector operators, government stakeholders and electricity end

For example not every government department within the energy sector can be considered suitable entities for implementation of projects; however, entities with the appropriate

technical and management expertise should handle the implementation projects (ibid). Both the government of Uganda and Rwanda recognise the importance of capacity building within the energy sector especially the entities managing rural electrification. The capacity building is necessary to mitigate potential bottleneck in rural areas that are related to government inefficiency and ineffectiveness. The capacity building activities in the energy sector may include, evaluation and selection of projects and technology options, resource assessments, investment promotion, financial analysis, technical advisory services, establishment of community-based utilities, set tariff structures and accounting structure (international energy agency, 2003)

The project in Rubagabaga has a potential to bring returns on experience and build local capacities. The local building capacity includes raising awareness about the project through community sensitization, Training cooperatives and local association with basic management skill, training local entrepreneurs on how to draft simple business plans. The energy cooperatives will need training on daily caretaking and maintenance, a collection of energy payments and management of the payments. The project also considers offering to train to the community on how to access finance from local micro-finance institutions and how to obtain small loans for their start-up business. Capacity building also includes changing the perception and behaviour of the community to enable the local people to adapt to new practices. For example, the men in the village could reduce drinking alcohol so that they can take up work. In other words, change in behaviour will directly impact the household incomes and encourage productive use of energy.

The project in Rubagabaga proposes community ownership and a utility cooperative that will manage the user payments of the community energy service. In a community with limited management skills, utility cooperatives will need training on how to manage payments and collection of payments. During consultation with community leaders and some proposed members of the utility cooperatives, it is agreed that price of energy should be sufficient enough to pay for the operation and maintenance services and also boost socio-economic impacts.

Capacity building may also include training the local entrepreneurs that wish to become independent power producers in the rural area as well as meet the needs of the local

communities. There are three important aspects required to boost the economic growth of local communities including; access to energy, skilled labour, and a functioning infrastructure. The growing market within the energy sector opens the possibility for several local entrepreneurs; however limited skills and expertise pose as a bottleneck for the local entrepreneur to venture into this market. The PECO Rwenzori case is a good example of a local entrepreneur that venture in the market. With his limited technical expertise, he was able to design and locally make turbines that he is using to generate energy. However the quality of the turbine can be doubted, and this is seen in the low capacity of energy produced and constant repairs. More technical training is necessary to ensure availability of skilled labour. Support from the government about training local independent producers and distributor on the rules and regulations is necessary. One of the problems faced by PECO Rwenzori was the limited skilled labour in the local area that would handle simple repairs of the machines. Training the local and marginalised youth technical skills would widen the knowledge base of the community and ensure a good supply of skilled labour in the local community. There is also a tendency for people with skills to return to the local community after education and job experiences from outside the local villages. The realisation of the potentials of micro-hydro power plants may further create demand for turbine parts that are locally produced and may with time result to domestic manufacturing capacity for hydro systems that are appropriate to the local conditions as well as reduce dependency on expensive imports.

### 5.2.5 FINANCING HYDRO-POWER PROJECTS IN RURAL AREAS

Financing small hydro-power projects in areas that are dispersed and less populated, with high levels of illiteracy may seem marginal. Because these areas present big challenges about end-user financing mechanism and at the same time the target community may have limited access to institutions such as microfinance that can channel finances to rural areas (Darci et al., 2015). However, to realise this in the presences of limited incomes of the target population, and non-conducive policy frameworks, innovative and efficient mechanisms for financing rural electrification are necessary. One could start by separating the financial structures in two aspects that include; financing of the capital costs and then the support mechanisms that cover operating expenses and the tariff structures (Hisham, 2011). Based on my findings, capital financing can be provided by the government, private sector including entrepreneurs and philanthropies, non-governmental organisations, financing organisations such as the World Bank, international donors and the target community itself. Normally the

mentioned actors may join as networks with different roles and contributions to achieve rural electrification and its much-needed impacts. An example can be seen in the Bugoye hydropower plant whereby the construction of the 13MW plant and annual power production of 90 GW per hour had investment costs of 65.7 million US dollars. The different actors on the project formed a consortium to raise the capital investment, whereby the Ugandan private sector provided 3.92 million US dollar, a grant from the Norwegian government at 8.9 million US dollars as well as a loan of 33 million US dollars from the African infrastructure fund. Equity contributions from Norfund (6.3 million Us dollars) and Trønder Energi (13.4 million Us dollars) as well as support from the Ugandan government in the form of taking or pay the tariff and the windfall period at 13cents in the first three years of production (Private infrastructure development group study, 2016). Well as financing long-term maintenance and operations costs may depend on the project. Whereas in some enterprises operating expenses can be part of the financial structures, in others expenses are likely to be recovered through the tariff sales.

However based on my findings, in particular, the Rubagabaga project in Rwanda, having a network of various funders may create complications to the project progress because different funders may have diverse requirements about financial instruments and packages. The project is considered a feasible and bankable project, this way the project can secure funding from a range of organisations and philanthropies (see section 4.2). The multiple financing institutions provide sufficient funds to deliver the project. However, some issues arise from involving various funders or partners. It may create conflicting pressure on kind of organisational form the project should take, decision-making, accountability processes to adopt, kind of information to report or share and the financial management systems to put in place. Addressing the different requirements from various partners is a time-consuming process. On the other hand, government project approvals and legitimisation are time-consuming, and this may have an impact on the level of collaboration with the funding institutions who might want to see immediate results. This according to Mckinsey (2015) requires an unprecedented level of international cooperation and collaboration to maintain the loyalty of all the funders. Indeed, ensuring that the interests of investors remain subordinate to the project, and the social objectives remain a critical question given that the founders influence tends to decline with time.

The role of NGOs in financing rural electrification cannot be ignored. According to Darci et al. (2015), NGOs not only act as a valuable financial structure to rural electrification but they

also have the ability to break down the top-down structural barriers as well as secure good management and sustainability. For example, the power Africa program intended to add more than 10,000 megawatts of clean, efficient electricity generation capacity through expanding both mini-grid and off-grid solutions, power generation, transmission and distribution structures (Mckinsey research, 2015). This NGO has intentions to boost resource capabilities of partner countries for them to meet their critical energy needs as well as achieve sustainable and long-term energy security. One should, however, think about the frequently overrun timelines and budgets in several projects in the Sub-Saharan region. Overrun timelines are attributed to the bureaucratic institutions coupled with limited skilled capacity in the energy sector and the overwhelming projects that have to be approved (ibid) The overruns are most common in the larger energy project that is usually complicated and is rarely on schedule. In line with the findings regarding my two cases studied, it is common that international developers tend to view investing in Africa as a high economic risk. Normally investors interested in investing in the energy sector usually put aside approximately 30-40% of the planning timeline and budgets on the projects (Mckinsey research, 2015). The Rubagabaga min hydro-power project intends to operate on a model that will openly avail assessments of costs and benefits to all the actors and with such transparency, the project may perhaps minimise the economic risks associated with investing in Africa.

Government involvement may cover the low rate of technology diffusion in rural areas in the form of technology instalments, loan guarantees with favourable terms or partial subsidization, as well as creating conducive environments and policy frameworks that support the private sector involvement in rural electrification and finally sharing the investment risks (Hisham, 2011). For example, both in Rwanda and Uganda, the energy sector has drafted new policy frameworks that support the decentralised power systems and the involvement of the private sector. Central government encourages power companies to seek to fund the activities as well as encourages local government to increase support for rural power grid construction. In line with my findings, micro-hydro-power projects such as PECO Rwenzori providing energy to customers can, in theory, get financial support from local government. However in practice, such strategies involve a lot of paperwork, and may be limited to rural energy cooperatives in the form of subsidies or government grants. Also, policies and regulations concerning access to financial support for the micro- hydro-power independent producers are not very clearly understood by the local entrepreneurs. A local

organisation such as the renewable energy business incubator is instrumental in financing small innovative projects. The challenge is that such organisations operate on limited funds and are likely not to provide sufficient funds to cover all the construction costs.

According to my findings, the participation of the local entrepreneurs in rural electrification can have direct positive impacts on the communities. However, access to capital is limited by the poorly-structured micro-finance institutions that may not provide loans at a reasonable interest rate and reasonable pay-back procedures. Normally the local entrepreneur with a licence to generate power should have approved copies of the feasibility study within a given time frame. Feasibility studies are costly to carry out and for this reason, a local entrepreneur with limited resources may not be in a position to attract investors that can partner with him if he lacks an approved feasibility study.

We should not ignore the role of the community in ensuring financial viability. It is illustrated in the PECO Rwenzori case were the local entrepreneurs as a member of the community obtains support from the community group in term of funds or knowledge of how to access finance for his project. As Bates (1993) point out that an entrepreneur can serve as a member of supportive kinship, community group commit to them for socio-economic resources. Financing power systems can be shared between the beneficiaries in the local community by contributing to the constructions; purchase needed material when they fall short and also voluntarily work on the construction. It reduces total cash demand which makes construction of such local plants financially feasible (Barnes, 2007)

The economic viability of the project is necessary for rural electrification. In other words, the projects should have enough funds to cover operational and maintenance costs, unexpected events as well as long-term depreciations costs. The PECO Rwenzori project had as its priority to finalise the construction and connected the customers within proximity that would benefit from the energy generated. The income from the energy produced was used to pay off some of his debts and at the same the entrepreneur has been saving a certain amount of money to enable him to expand to other areas that have energy problems. Financial viability of micro-hydro project such as the PECO Rwenzori is dependent on whether the load factor can be increased through the productive demand of power. For example in cases of a small scheme like the PECO Rwenzori, the plant may be directly integrated with a functioning milling service to increase consumption of electricity.

For larger schemes such as Rubagabaga Min- hydropower project, promotion of productive end uses and better management is important to ensure economic viability. The Rubagabaga project proposed to sell most of the energy produced by the government and as such had to have a power-purchase agreement that ensures power payments. On the other hand, the project intends to establish a utility that will provide the local community at rates relatively lower than the government. To ensure this, they propose to create utility cooperatives to ensure that the interests of consumers are taken care of and that power payments and are fulfilled by the consumers. Also, the proposed pay-as-you-go model for the community ensures flexibility as well as makes it easy for the start-ups in rural areas.

The growth of local businesses in rural areas is limited due to the socio-economic factors including limited access to financial institutions. The approach used in Rubagabaga aims at maximising the social impact in the local community. The project proposes to set up a credit scheme for customers using the already existing micro-finance institution in the neighbouring community so that consumers may have access to affordable loans for their business, and small enterprises. It should enable the low-income households to afford connection and thus, increase the consumer base. Current micro-credit initiatives are used as a tool to empower women in rural areas. It is common that women in rural areas run the small enterprise and are taken to be good credit risks. However, access to credit without basic knowledge on use and management of the credit may result in uncontrollable debt burden on the women it seeks to empower. Several households in this area are built of wattle and grass and may not meet the minimum standards of grid connection. However, household that may wish to connect may have to dig trenches and use pipes. It poses an extra cost for the poor households that have family members that can't dig the trenches by themselves; however they intend to make tariffs and connection costs lower for the community members.

Regarding financing the rural electrification, it's easy to assume that financial support alone may stand as a viable solution to make the rural projects economically sustainable. However, how to blend productive end uses of electricity is equally important as an integral part of rural electrification programs right from the planning stage of the project. As much as government subsidies are necessary to improve financial return and attract investors, the subsidies may also be beneficial for developing environment targeted at a better performance in the rural electrification programs.

## 5.3 CONCLUSIONS

In conclusion, my study objective was to analyse the extent to which innovative social practices are used by entrepreneurs to achieve rural electrification. The cross-boundary dimension of two cases; The Rubagabaga min-hydro power project in Rwanda and the PECO Rwenzori micro-hydro power project in Uganda make a unique study for comparison purposes. The findings of my research are in line with literature that aims to draw awareness on the new collaborative configurations between the public sector, Private sector, and the local community to achieve rural electrification and its much-needed impacts. The study contributes to the existing literature on innovative social practices by offering empirical insights that underpin the importance of community involvement as well as reveal setbacks deriving from community participation. It also gives insights on the challenges faced in financing rural electrification by the entrepreneurs

Basing on my findings, perhaps, the differences between the social entrepreneurship as seen in the Rubagabaga project is likely to be blurred compared to the private entrepreneur illustrated in the PECO Rwenzori project given that they both illustrate a certain level of social commitment in their respective societies. However be seen in the perceived values, a measure of profitability as well as an emphasis on either collective action or individual action (see Section 2.2.1). They may not be presented with the same opportunities however they are likely to face the some challenges within the rural electrification sector. The economic, political and social challenges faced by the entrepreneurs can be seen both as a hindrance or an opening to the creation of new energy paths that benefit the both the entrepreneurs and the local community as well as are environmentally friendly and sustainable. Acknowledging the challenges and then combining resources such as finance, knowledge and capital to restructure the strategies accordingly opens up stunning diversity in rural electrification. There is little doubt that innovative social practices advocated by the entrepreneurs are should be applied as tools to achieve the much need rural electrification and its intended social impacts. The innovative social practices together with supportive institutional mechanism can foster rural electrification.

Nevertheless, my study had some limitations because of the time constraints in my field work, however, it is interesting to study more about the Rubagabaga project and follow up the outcomes of the discussed social innovative practices.

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## CHAPTER 6. APPENDIX

Appendix 1: Code Categorization

**Category 1: Identity**

**Subcategory 1: cultural practices**

Code: values and norms

Code: occupational tasks

Code: daily activities

Code: tacit knowledge

Code: habits

Code: interactions

**Subcategory 2: Social networks**

Code:  interactions

Code: interpersonal networks

Code: groups

Code: communication

Code: daily activities

Code: participation

Code: position

**Subcategory 3: Settlements**

Code: villages

Code: communities

Code: neighbourhoods

Code: kinship

Code: norm

Code: participation

Code: interactions

**Category 2: Perceptions**

Code: roles

Code: risks

Code: fears

Code: practices

Code: interactions

**Category 3: organisations**

Code: structure

Code: interactions

Code: forms

Code: corporations

Code: NGOS

Code: local initiatives

Code: participation

Code: capabilities

**Category 4: Governance**

Code: centralised

Code: decentralised

Code: regulation and policies

Code: efficiency/ inefficient

Code: interaction

Code: Roles

Code: support

**Category 5: Sustainability**

Code: Strategies

Code: participation

Code: Support

Code:  skills/knowledge

Code:

**Category 6: Finances**

Code: structure

Code: mechanism

Code: availability

Code: financial institutions

Code: accessibility

Code: incomes

Code: economic activities

Code: Investment

Code: costs

**Category 7: Environment**

Code: natural resources

Code: terrain

Code: population

Code: Economic activities

Code: climate

Code: Rural/Urban

## 6.2 APPENDIX 2: INTERVIEW QUESTIONS AND GUIDE

Question to Entrepreneurs

What is your role in rural electrification?

What innovative social practices/strategies are you using to enhance rural electrification?

What challenges do you face when implementing these strategies?

How do you involve the community?

How do you interact with the community?

Do you get any support from the government?

What is the role of the state in the projects?

How do you ensure financial viability to the projects?

How do you maintain collaboration between different groups of funders?

Questions to the community

What are your reflections on the project?

How do you contribute to the project?

What economic activities are common in this community?

How will the project affect you?

Do you feel involved in the project planning?

How will you maintain the supply of energy to your community?

### 6.2.1 INTERVIEW GUIDE

Initiative and organisation/ entrepreneurs

Culture /norms, values, practices

Community participation/ skills, capacity building, roles

Government support

Opportunities

Constraints and challenges

Sustainability

Finance.