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South Africa's Transition to a Low-Carbon Economy: The Role of Cooperatives

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ABSTRACT The South African energy sector has been plagued by incessant power outages in recent years due to decreasing energy generating capacity, increased population and economic growth, political interference with the country's energy provider, and a lack of maintenance of aging energy infrastructure. Economists are unanimous that incidences of load shedding have resulted in a loss of billions of Rands in revenue. Using a desktop review, this paper examines the potential roles of cooperatives in South Africa's budding clean energy sector. The paper argues that although cooperatives can potentially contribute to the country's clean energy transition, challenges such as policy constraints, access to finance, dearth of technical skills as well as poor understanding of the cooperative movements are barriers to cooperatives' involvement in South Africa's low-carbon future. The paper argues that these barriers must be addressed in order to unlock the contributions of cooperatives to the country's clean energy transitions.

INTRODUCTION

Around the world, meeting human energy needs has increasingly become a focal point for governments as economies become more energy intensive. Most of the energy in today's society is derived from fossil-based sources. Arguments against fossil-based fuels (FBF) revolve around the scientific evidence that they contributes to changing climatic patterns with resultant negative impacts on human beings and on the sustainability of planet earth. In response to this awareness, many countries, including South Africa, have embarked on the drive towards the adoption of climate-friendly and renewable energy alternatives.

This paper assesses the role of cooperatives in South Africa's transition to a low-carbon economy. Section two of the paper explores the rationale that underpins the global drive towards a low-carbon economy. Section three examines the South African energy sector focusing on barriers to South Africa's energy generation and distribution and the implications of these for the country's socio-economic development. This is followed by a review of South Africa's drive towards a low-carbon economy including a review of related policies and regulatory frameworks. Section four provides an overview of the cooperative movement citing examples of how they have contributed to clean energy transition. This section notes barriers to the participation of South Africa's cooperatives in the renewable energy sector. The paper concludes with suggestions on how to address identified challenges.

This paper is a desktop study and has two main objectives. Firstly, the paper aims is to present insights into South Africa's transition to a low-carbon economy. In doing this, the paper situates South Africa's energy transition within the global context where international agreements are compelling states to reduce their greenhouse gas (GHG) emission and take steps towards upscaling the renewable sector. The second objective of the paper is to establish the potential contributions of the country's cooperative sector to the transition to a low-carbon economy. This is against the backdrop of current challenges of the country's transition to a low-carbon economy and the contributions of cooperatives to clean energy transitions in other economies.

METHODOLOGY

This study is based on the review and analysis of secondary sources of information. In implementing the study, various sources of information including reports of government departments and energy related organisations were examined to understand the past and current policies and programmes in relation to clean energy transitions. In addition, the study reviewed journal papers on topics related to clean energy transitions and cooperatives. Through the re-

view, the paper presented perspectives on clean energy transition as a whole and the roles of cooperatives in clean energy transitions in particular. Information gleaned from these reviews were critical to the conclusions and recommendations presented in this paper.

GLOBAL TRENDS TOWARDS A RENEWABLE FUTURE

The advent of the industrial revolution was a testament to human ingenuity in devising means to address mundane challenges. Among other things, the industrial revolution contributed to the rapid economic growth and technological advancement. These, coupled with advancement in healthcare, resulted in improved quality of life and life expectancy within a relatively short period. At the heart of the industrial revolution is the mechanization of production (Bose 2010; Ogunlade et al. 2006; Rifkin 2012; Steffen 2011). Machines powered by FBF replaced human beings in many tedious activities like agriculture, transportation, mining and manufacturing. As the pace of industrialization quickened, human dependence on FBF has consistently increased over the years (Höök and Tang 2013; Peters et al. 2012). Global estimates in 2013 showed that FBF constituted 78.3 percent of global energy (Sawin et al. 2015).

While FBF has been critical to the rapid pace of industrial development in the past century, there are ongoing concerns about its negative impacts on human health and the health of planet earth. Over the years, scientists have argued that crude consumption of FBF results in GHG emission (Höök and Tang 2013; Intergovernmental Panel on Climate Change 2011). The amount of GHG emission has doubled since 1973. Coal is the biggest contributor to GHG (43.9%) with an 8.9 percent increase over a 44-year period. The second biggest contributor to GHG, oil, decreased from 50.6 percent in 1971 to 35.3 percent in 2012 (International Energy Agency 2014: 44).

It is internationally recognized that the increasing concentration of GHG in the atmosphere poses a significant danger to the health of the planet and by implication, human health. Bose (2010: 9) observes that "burning of fossil fuels (coal, oil, and natural gas) generates pollutant gases, such as SO_2, CO, NOX, HC, and CO_2, that cause environmental pollution problems". One immediate impact of increased accumulation of GHG in the atmosphere is global warming (Pegels 2010; Republic of South Africa 2011). The positive correlation between increased GHG emission and global warming has provided the basis for modeling the impact of GHG on the planet over an extended period (Dai 2013). For instance, it has been estimated that "atmospheric temperature will rise typically between 1.1 and 6.4^{o}C in the next 100 years due to GHGs if no remedial actions are taken" (Bose 2010: 11). Rising atmospheric temperature can significantly alter climatic patterns with potential cataclysmic outcomes.

In recent years, extreme weather conditions such as floods, drought, submergence of low-lying areas, cyclones, diseases and surging heat waves have been attributed to global warming (Dai 2011; Pegels 2010; Rong 2010). The foregoing implies that FBF, which was at the heart of rapid industrialization in the past century, can reverse the progress made thus far. To assuage the negative impacts of FBF energy on the environment, alternative non-fossil energy sources such as nuclear energy have been presented as possible solutions to reduce GHG emission. However, its adoption is confronted by a number of challenges including difficulties associated with the handling of radioactive materials, safe storage of nuclear wastes, human and environmental costs associated with nuclear accidents and the fact that materials required for nuclear energy are finite. These arguments against nuclear sources have resulted in countries such as Germany pledging to decommission its nuclear plants (Fürsch et al. 2011).

The realization of the negative impacts of FBF on climate as well as the need to stem the tide of its impact have resulted in calls for a paradigm shift in patterns of human energy production and consumption. Besides improving the health of the planet, arguments for the transition to a low-carbon economy has been anchored on the view that a low-carbon economy is labor intensive and is, therefore, critical to reducing global unemployment (Edkins et al. 2010; Rifkin 2012). Globally, an estimated 7.7 million people are employed in the renewable energy sector and this is poised to grow as the uptake of renewable energy increases (Sawin et al. 2015: 31).

The depletion of fossil fuel is another contributory factor to the acceptance of clean energy alternatives (Bose 2010; Höök and Tang

2013). Furthermore, cost-effectiveness in providing off-grid renewable energy to remote locations also influences the adoption of clean energy alternatives. In low-income countries, particularly rural areas characterized by sparsely distributed population, it is technically and economically non-viable to provide grid-based electricity that is often generated from FBF. In addition, the remoteness of some communities makes operational maintenance of grid lines cumbersome and expensive (Lemaire 2011). For such populations, off-grid decentralized renewable alternative sources of energy is an ideal option (Barnes 2011).

The shift towards low-carbon energy alternatives is about ensuring sustainable development. Through the adoption of clean energy, development needs are simultaneously addressed while ensuring that minimal harm to the environment is caused. In addition, clean energy sources ensure that the ability of future generations to meet their needs is not undermined (Lemaire 2011: 277). In this way, the transition to sustainable energy sources encompasses the three pillars of sustainability, that is, the social, economic and environmental pillars.

Transition to a low-carbon economy entails the use of non-carbon-based energy sources such as photovoltaic systems, solar, wind, biofuel, hydro and geothermal energy. Clean energy provides energy, which is devoid of air pollution and GHG emission. Over the years, the production and consumption of clean energy have been on the increase. Although projection by the International Energy Agency (2015b) shows that renewable energy's net addition in accelerated cases will decrease from the peak of about 130GW in 2014 to below 129GW from 2015 to 2020, projection into 2020 shows a level higher than that of 2010.

Barriers to Transitioning to a Low-Carbon Economy

Despite the ongoing interests about the advantages of clean energy alternatives, its adoption is constrained by a number of factors. In low-income countries where the use of non-grid energy sources is considered important to meeting universal access to electricity, such energy sources are undermined by factors such as high initial financial investment, high costs of back-up batteries, and limited energy output (Lemaire 2011). To address the problem of high initial cost of off-grid energy sources such as photovoltaic panels, Lemaire (2011) argues that governments must provide some form of institutional support in collaboration with international organizations that play strategic roles in rural electrification in developing countries. Often, this form of strategic partnership that is a prerequisite for the provision of cost-effective renewable energy, is lacking, resulting in duplication of activities and the inability to harness the benefits of collective action (Bhattacharyya 2013).

Unfavorable state policies are a disincentive to public participation in clean energy transition (Mendonça et al. 2009). Bhattacharyya (2013: 462) observes that "…unfavorable policy environment militates against large-scale mobilization of financial resources in the poorest countries of the world where energy access is a chronic problem". When government designed clean energy policies do not encourage local participation, they could be construed as impositions from above and therefore rejected. In addition, cumbersome government policies that make the production and distribution of electricity difficult undermine investment in renewable energy business. When this happens, the transition to a low-carbon economy is significantly hampered since governments are limited in the amount of funds they can invest in the sector.

Besides the foregoing, perceptions about the implications of low-carbon energy sources for economic development have also been identified as another barrier to clean energy transition. In the United States, for instance, different coalition groups have formed around the adoption of clean energy sources. While proponents of renewable energy argue for its benefits such as decreased environmental degradation and job creation, opponents contend that it is a clog in the wheel of development (Elliott 2013). Opponents of low-carbon economy argue that the adoption of renewable energy alternatives reduces the amount of energy required for development. This, they contend, drives up production costs, resulting in reduced demand for goods, slow economic growth and produce associated challenges such as increased unemployment and poverty. Effectively, a low carbon economy and economic growth are considered to be mutually exclusive.

Government subsidy to renewable energy initiatives has also been described as a barrier

to free market capitalism in countries such as the US and Germany (Elliott 2013; Jacobsson and Lauber 2006). At the heart of the debate is the notion that government regulations around renewable energy are detrimental to economic interest as it makes the energy sector uncompetitive. In the US, opposition to clean energy sources led by those with conservative political leanings, and a coalition of businesses is playing a leading role in rolling back policies that promote clean energy (Mufson and Hamburger 2015).

Sovacool (2009) conducted a study, which examined cultural barriers to renewable energy and energy efficiency in the United States. The study found that the disconnect with electricity production contributes to a negative perception and misinformation about it. This disconnect is related to "deeply held values related to consumption, abundance, trust, control and freedom shape American attitudes toward energy" (Sovacool 2009: 365). Perceptions about abundance and how electricity is produced hinder people's appreciation of and the need for renewable energy. Opposition to clean energy in this view has nothing to do with its economic prospects or efficiency. Against this backdrop, Sovacool (2009) observes that there is an urgent need for policymakers to address the cultural attitudes towards renewable energy and how these impact its adoption.

SOUTH AFRICA'S ENERGY SECTOR AND THE DRIVE TOWARDS A LOW-CARBON FUTURE

Historically, access to energy in South Africa has been shaped by the apartheid system. During the apartheid era, much of rural South Africa was devoid of electricity (Bernard 2010). This was in line with the apartheid regime's deliberate policy of under developing rural areas populated by black South Africans. At the end of the apartheid era, about two-thirds of the population were without access to electricity. This reality has been radically transformed in the post-apartheid era with the ANC-led government's focus on universal access to electricity (Winkler 2007). Within the framework of this policy, there have been increasing demands for energy as more households are connected to the electricity grid. This, coupled with population and economic growth and urbanization, has strained the country's energy (Phaahla 2015). The government was apprised of the country's looming electricity crises in the early 1990s. This was reiterated in the White Paper on the Energy Policy of 1998, which called for massive investment in the energy sector (Department of Minerals and Energy 1998).

Despite the government's awareness of the country's electricity constraints, there was little investment and maintenance of existing infrastructure (Centre for Development and Enterprise 2008; Public Protector 2009). In addition, Eskom has been embroiled in political interference (Centre for Development and Enterprise 2008). The recent scandal related to how the ruling party influenced and benefitted from an Eskom's deal with Hitachi further underscores the extent of political interference. Lack of investment in electricity generation and poor operational maintenance resulted in decreased electricity generation from 252,938GwH in 2007 to 252,578GwH in 2014 (Phaahla 2015). The growing mismatch between demand and production forced Eskom to introduce scheduled load shedding in 2008 (Odhiambo 2009; Phaahla 2015; Sebitosi 2008). Load shedding disrupts economic activities, which results in losses of revenue and jobs (Centre for Development and Enterprise 2008).

To meet increased energy demands, South Africa committed to building new energy facilities that would generate electricity through the combustion of coal at Medupi and Kusile. The combined production capacity of both plants is 10GW of electricity (Edkins et al. 2010). South Africa is endowed with an abundant supply of coal and is therefore heavily dependent on it for its energy needs. About ninety percent of electricity produced in South Africa is derived from coal (Department of Minerals and Energy 2003; Pegels 2010) resulting in South Africa being ranked the 12th largest emitter of CO_2 (Florini and Mansell 2015: 1). Its GHG emission is on a growth trajectory and is expected to peak by 2025 (National Planning Commission 2011).

Like every other country in the world, South Africa is aware of the implications of climate change for its socioeconomic development. This is even more so because it is highly vulnerable to climate change (Republic of South Africa 2011). Future predictions have shown "that by mid-century the South African coast will warm by around 1 to 2°C and the interior by around 2 to

3°C" (Republic of South Africa 2011: 9). The country will have to deal with the negative consequences of changes in temperature if the current global trend in GHG emission continues. The condition will worsen by 2100 when "warming is projected to reach around 3 to 4°C along the coast, and 6 to 7°C in the interior" (Republic of South Africa 2011: 9). In recognition of this reality as well as the need to reduce South Africa's GHG emission, the country has developed policies and strategies aimed at climate change adaptation and mitigation.

Over the years, the South Africa government has taken proactive steps in developing the policy and regulatory framework in relation to clean energy transition. These initiatives include the 2000 Initial National Communication under the UNFCCC, the 2006 Framework for Considering Market-based Instruments to Support Environmental Fiscal Reform, the 2010 Carbon Tax Discussion Paper, the International commitment to a GHG target in Copenhagen, the 2011 National Climate Change Response White Paper, Renewable Energy Independent Power Producer Procurement Programme and the National Development Plan which emphasises the importance of clean energy to South Africa's sustainable development aspirations. Chapter 5 of the National Development Plan is dedicated to addressing issues related to environmental sustainability and South Africa's transition to a low carbon economy. The National Development Plan states that "a low-carbon future is the only realistic option, as the world needs to cut emissions per unit of output by a factor of about eight in the next 40 years" (National Planning Commission 2011: 91).

In recent years, the country has implemented a number of strategies aimed at increasing its renewable energy profiles. One of these is a program to accelerate off from grid electrification which was implemented in 1999 and which resulted in the rapid expansion of solar energy solutions for homes (Lemaire 2011). The Biofuels Industrial Strategy is another important step taken by the government in its drive towards a low-carbon future. The draft strategy was approved by cabinet in 2006 after a series of stakeholder consultations and extensive theoretical and empirical studies to assess its socioeconomic impacts and prospects. The strategy takes cognizance of the potential contribution of biofuels to South Africa's carbon emission reduction, employment creation and economic development (Department of Minerals and Energy 2007).

Another strategy is the solar heating rebate program that came into effect in 2008. The program seeks to reduce electricity demands in residential areas through a rebate system that ranges from R3,280 up to R8,964 (Eskom n.d.:2). Since coming into effect in 2008, "Eskom has subsidized the purchase of registered solar water heaters, and to date 156,000 claims have been received for systems installed as at end September 2011" (Eskom n.d.). Through the solar heating program, the country has saved 60Gw of electricity per annum. Government support of the program has also resulted in the creation of employment opportunities as evident in the rapid increase in the number of accredited suppliers of solar heating appliances (Eskom n.d.: 2).

The Integrated Resource Plan (IRP) is another means by which the South African government seeks to transition to a low-carbon economy. The IRP is a highly participatory process that sought to include citizens' voices in the development of the energy sector (Department of Energy, 2011). The plan is revised continuously to make it relevant to changing energy demands and uses. Under the IRP program, 3,725 MW has been allocated to Renewable Energy for the period 2010-2030 (Department of Energy 2015).

In 2009, the National Energy Regulator of South Africa approved renewable energy feed-in tariff (REFIT) scheme aimed at encouraging the participation of private producers in South Africa's energy sector. The scheme covers renewable energy derived from "wind, small hydro, landfill gas methane and concentrated solar panel (CSP), plant parabolic trough with storage (6hrs per day)" (International Energy Agency 2015a). Under the scheme, Eskom is obligated "to purchase the output from qualifying renewable energy generators at pre-determined prices based on the levelised cost of electricity" (International Energy Agency 2015a).

REFIT was replaced by the Renewable Energy Independent Power Producer Program (REIPPP) considered to be more competitive. Under this scheme, preferred bidders are provided with a guaranteed contract for a period of 20 years to generate and feed electricity into the national grid. Since its inception in 2011, "five rounds of reverse auctions were held for construction and

supply of 3,625MW of large-scale (>5MW) renewable energy capacity" (International Energy Agency 2015a) and a total of USD 14 billion has been invested in 64 projects awarded to private business (International Energy Agency 2015b). The foregoing provides an overview of South Africa's renewable energy industry against which the potential contributions of cooperatives is assessed.

UNDERSTANDING THE COOPERATIVE MOVEMENT

The idea of cooperatives stretches back to ancient times. However, it has been argued that modern cooperatives emerged during the industrial revolution in England (Mazzarol 2009; Satgar 2007). The emergence of modern cooperatives at this historical juncture has been construed as a reaction to the harsh socioeconomic conditions triggered by the industrial revolution (De Peuter and Dyer-Witheford 2010; Diamantopoulos 2012; Hannan 2014; Okem 2016a). During the industrial revolution, skilled artisans, as well as unskilled labourers, lost their jobs as production became mechanised. In addition, the concentration of capital in the hands of a few industrialists resulted in the pauperization of many smallholder farmers and artisans who were unable to compete in the industrial age (Tchami 2007). The formation of cooperatives during this period enabled peasants to mitigate the harsh socioeconomic and political dynamics of industrialization. By merging their resources, members of cooperatives leveraged scale economics.

Recognizing the socioeconomic and political context in which cooperatives emerged, the International Cooperative Alliance (1995) defines a cooperative as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically-controlled enterprise organized and operated on cooperative principles". The definition emphasizes the social and cultural values of the cooperative movement. The cooperative movement is guided by seven key universal principles: voluntary and open membership, democratic member control, member economic participation, autonomy and independence, education, training and information, cooperation among cooperatives, and concern for the community. Cooperatives today form a global movement with "over 1 billion memberships and clients" and "12.6 million employees work in in 770,000 cooperative offices and outlets" (Merrien 2014: 1).

COOPERATIVES AND THE TRANSITION TO LOW-CARBON ECONOMY

As interest in renewable energy has risen, a growing number of cooperatives have become engaged in this sector. Studies have examined renewable energy cooperatives (RECs) in the UK (Mathie 2012; Seyfang et al. 2013; Willis and Willis 2012), Canada (Gipe 2007; Viardot 2013), Denmark (Mendonça et al. 2009), Germany (Viardot 2013) and the US (Viardot 2013). Cooperatives in these countries are bottom-up organizations established to meet members' collective interest. RECs operate on various scales and are usually classified into three categories based on level of maturity: "start up, community scale developer, and mature cooperative" (Viardot 2013: 759). These cooperatives engage in different forms of renewable energy activities and may operate at a local or regional level.

A review of RECs by Tarhan (2015) shows that they provide benefits to local communities unlike large-scale government energy producing companies. Positive outcomes of RECs include income for members, economic opportunities in the energy value chain at the local level, and stronger community ties through community participation in RECs. The review identified community dynamics and lack of finance as barriers to RECs.

In the UK, cooperatives provide renewable energy to some 55,000 households (representing nearly one in every 500 households) (Mathie 2012). The rising number of energy cooperatives in the UK is seen as a sign of collective action and a testament to communities coming together to address common needs. Collectively, cooperatives are revolutionizing the energy sector in the UK (Willis and Willis 2012). The Cooperative Group has played and continues to play a critical role in the establishment of RECs through its Cooperative Enterprise Hub. The growth of RECs in the UK has been attributed to the introduction of the feed-in tariffs, which made it possible for small independent producers to generate and feed electricity into the national grid. Cooperatives in the UK have implemented renewable energy projects including

Valley Wind, Cwm Arian Renewable Energy, OVESCo, River Bain Hydro and Green Energy Nayland (Willis and Willis 2012).

Renewable energy cooperatives in the UK are bottom-up community organisations typically characterized by a core group of individuals passionate about implementing clean energy projects through collective action. This group undertakes a feasibility study of the project, seeks advice from existing energy cooperatives as well as non-cooperative institutions, and actively sources funds from government, other cooperatives, and non-cooperative institutions. As a member-owned organization, shares of such projects are sold locally with a clear explanation of the business plans and profit prospects (Willis and Willis 2012).

In Europe, Denmark is a leading country in terms of RECs (Bauwens 2013). According to Mendonça et al. (2009: 384), cooperatives own about twenty percent of installed renewable energy capacity in Denmark. These cooperatives have different scales of operation and are characterized by democratic member control. Through local participation, people are empowered and made to see that they can bring about changes in mitigating and adapting to climate change. In addition, local ownership of clean energy projects encourages local support and facilitates a sense of community and network formation (Willis and Willis 2012).

In the US, cooperatives are active in the renewable energy industry. The Community Power Network (n.d.) provides an extensive list of RECs in the US. The list includes different forms of RECs such as worker cooperatives, consumer cooperatives, producer cooperatives, hybrid cooperatives and purchasing or shared services cooperatives. In the US, there are over 900 electricity cooperatives, ninety percent of which produce their electricity from renewable sources and serve approximately 40 million Americans (National Rural Electric Cooperative Association 2015).

An Overview of the South African Cooperative Sector

The history of cooperatives in South Africa is closely tied to the country's political history. There are two historical periods in relation to cooperatives in South Africa. The first epoch (in the apartheid era) was characterized by a lack of clear definition of the cooperative movement, a lack of compliance with the principles and values of the cooperative movement, state control, and the predominance of white-owned cooperatives. The transition to democracy in 1994 ushered in the second epoch characterized by the prospect of creating a just and equitable society aimed at redressing the socioeconomic injustices of the apartheid era. The democratic regime, led by the African National Congress (ANC), identified cooperatives as a mechanism for bridging the country's unjust past (Department of Trade and Industry 2004b). Cooperatives were also viewed as a means of fostering local economic development (Kanyane 2009). To this end, national, provincial, and local governments are committed to promoting cooperatives as a means of developing the economy of rural areas and inserting the poor into the formal economy.

The 2004 cooperative policy, the *Cooperative Act* (Act 14 of 2005), and the *Cooperative Amendment Act* (Act 6 of 2013) all recognized the need for the South African cooperative sector to operate according to the internationally recognized principles and values of the cooperative movement. Government's approach to cooperatives is characterized by various support structures as well as financial and non-financial incentives for the establishment of cooperatives. Government's stance in promoting cooperatives as a tool for socioeconomic development has resulted in an increased number of newly registered cooperatives. In its 2013-2014 report, the Companies and Intellectual Property Commission (2015: 105) noted an increase in registered cooperatives "from 15,340 in 2011-2012 to 21,330 in 2013-2014". This growth has however not translated into the strengthening of the country's cooperative sector as evidenced in the eighty-eight percent mortality of newly registered cooperatives (Department of Trade and Industry 2010). In fact, some cooperatives exist merely on paper but provide no specific goods or services.

The South African government approach to cooperatives has created a cooperative sector characterized by poor performance (Mabuyakhulu 2010; Mkhize 2013). Most newly established cooperatives are confronted by multiple challenges including a lack of knowledge about the purpose and functions of cooperatives (Dlamini

2010), a lack of information about support and business opportunities (Gadzikwa et al. 2007), a lack of marketing skills (Department of Trade and Industry 2009), a lack of financial resources (Department of Agriculture Forestry and Fisheries 2011; Dlamini 2010), and donor dependency (Parliamentary Monitoring Group 2010). Added to the foregoing is the prevalence of agricultural cooperatives. About thirty percent of the country's cooperatives operate in the food and agricultural sector with only two percent engaged in secondary agricultural activities (Department of Agriculture Forestry and Fisheries 2013).

DISCUSSION

Situating the Cooperative Movement in South Africa's Transition to a Low-Carbon Economy

The review of the international literature on RECs demonstrated a growing trend in the contributions of RECs to clean energy transition in industrialized countries. These countries, however, are characterized by strong and vibrant bottom-up cooperative organizations. As a form of collective action, cooperatives in these countries are established mainly through members' aspirations to address collective needs. As such, members' commitments to the success of these cooperatives are expectedly high. Unlike these cooperatives, the South African case is characterized by weak cooperatives struggling to gain relevance (Okem and Tshishonga 2016).

Although cooperatives in South Africa are underpinned by principles and values that promote engagement in businesses such as renewable energy, there are a number of barriers to their engagement in the production and distribution of renewable energy. Firstly, South Africa is characterized by weak cooperatives with a third of these operating in primary agriculture (Okem 2016b). These do not have the capacity to operate in South Africa's complex renewable energy industry. A comprehensive search of the activities of cooperatives in South Africa revealed that they are not involved in renewable energy production and distribution. This is not unexpected given the characteristics of cooperatives earlier presented.

Engaging in renewable energy business entails a sound understanding of business principles and how the renewable energy sector works. As shown previously, cooperatives in South Africa rely largely on government support to function. In addition, they lack the technical know-how required for the renewable energy industry. This is another reason that accounts for the present scenario in which cooperatives are not engaging in renewable energy generation and distribution.

Related to the foregoing is the lack of finance on the part of cooperatives (Okem 2016b). Most cooperatives in South Africa rely on government funds in order to function (Okbandrias and Okem 2016). This, coupled with the fact that renewable energy business in South Africa is capital intensive, places the industry beyond the reach of small businesses such as cooperatives (Pegels 2010). Added to this is that most of these cooperatives lack the reqquisite collateral for securing loans to engage in the renewable energy business. Effectively, therefore, cooperatives cannot participate in the country's renewable energy business. Although the government has considered promoting small-scale independent renewable energy producers, the scope of this is still beyond the reach of most cooperatives.

The promotion of cooperatives as a government poverty alleviation tool is another barrier to the involvement of cooperatives in the renewable energy sector. Conceived as a poverty alleviation tool, cooperatives are only relevant to the poor and the vulnerable (Okem 2016b). Consequently, members of cooperatives are often poor people that lack the requisite skills, finance and business experiences required for an industry such as the renewable energy sector.

Although the renewable energy business is on the increase in South Africa, most of these are driven by private companies. Funds for these renewable energy projects are sourced both locally and internationally from commercial banks and other investors. Effectively, the renewable energy sector in South Africa is dominated by large private sector initiatives with limited participation from small independent producers.

CONCLUSION

Energy is critical for a country's socioeconomic development. A steady source of power can spur the growth of small businesses enterprise thus enhancing economic growth, employment creation and poverty reduction. This paper has presented how challenges associated with FBF informed the transition to a low-car-

bon economy. In response to its commitments to the UNFCC as well as the need to increase energy efficiency and create new jobs, South Africa has committed to transitioning to a low carbon economy. This paper has shown that although cooperatives have, and continue to play a role in the renewable energy sector of countries such as the UK, the US, Germany and Denmark, this is not the case in South Africa. Among other things, cooperatives in South Africa are constrained by challenges such as lack of finance, technical skills and poor understanding of the cooperative movement. In addition to these, the conceptualization of cooperatives in South Africa as a tool for poverty alleviation limits the scope of individuals that engage in cooperative activities and by implication, the sector in which they operate. For cooperatives to participate in the renewable energy sector there is need to address the challenges identified including a paradigm shift in the way cooperatives are conceptualized. If this does not happen, the failure that presently characterizes cooperatives will also be experienced by those that go into the renewable energy business. In addition, the government must take proactive steps to make the renewable energy sector accessible to small businesses by eliminating existing barriers.

REFERENCES

Barnes DF 2011. Effective solutions for rural elctrification in developing countries: Lessons from successful programs. *Current Opinion in Environmental Sustainability*, 3(4): 260-264.

Bauwens T 2013. What Roles for Energy Cooperatives in the Diffusion of Distributed Generation Technologies?. From <http https://papers.ssrn.com/sol3/Data_Integrity_ Notice.cfm?abid=2382596> (Retrieved on 13 September 2015).

Bernard T 2010. Impact Analysis of Rural Electrification Projects in Sub-Saharan Africa. The World Bank Research Observer. From <http://docu-ments.worldbank.org/curated/en/277651468 002406239/pdf/814320JRN0WBRe00 Box379873 B00PUBLIC0.pdf> (Retrieved on 13 September 2015).

Bhattacharyya SC 2013. Financing energy access and off-grid electrification: A review of status, options and challenges. *Renewable and Sustainable Energy Reviews*, 20: 462-472.

Bose BK 2010. Global warming: Energy, environmental pollution, and the impact of power electronics. *Industrial Electronics Magazine, IEEE*, 4(1): 6-17.

Centre for Development and Enterprise 2008. *South Africa's Electricity Crisis: How Did We Get Here? And How Do We Put Things Right?* Johannesburg: Acumen Publishing Solutions.

Community Power Network (n.d.). Renewable Energy Co-ops. From <http://communitypowernetwork.com/node/9220> (Retrieved on 23 December 2015).

Companies and Intellectual Property Commission 2015. Annual Report 2013/14. From <https://www.thedti.gov.za/parliament/2014/CIPC_AR2014.pdf> (Retrieved on 23 December 2015).

Dai A 2011. Drought under global warming: A review. *Wiley Interdisciplinary Reviews: Climate Change*, 2(1): 45-65.

Dai A 2013. Increasing drought under global warming in observations and models. *Nature Climate Change*, 3(1): 52-58.

Davidson O, Winkler H, Kenny A, Prasad G, Nkomo J 2006. *Energy Policies for Sustainable Development in South Africa: Options for the Future*. Energy Research Centre, University of Cape Town: Cape Town.

Department of Agriculture Forestry and Fisheries 2011. Annual Report on the Status of Agricultural Co-operatives. From <http://www.nda.agric.za/doaDev/sideMenu/cooperativeandenterprisedevelopment/docs/Annual%2 0report% 20on%20 cooperatives% 202010.pdf> (Retrieved on 13 February 2015).

Department of Agriculture Forestry and Fisheries 2013. *The 2nd Annual Report on the Status of Cooperatives in the Sector 2012/13*. Pretoria: Department of Agriculture Forestry and Fisheries.

Department of Energy 2011. *Integrated Resource Plan for Electricity 2010-2030 Revision 2 Final Report.* Pretoria: Department of Energy.

Department of Energy 2015. Renewable Energy Independent Power Producer Procurement Programme. From <http://www.ipprenewable s.co.za/> (Retrieved on 22 December 2015).

Department of Minerals and Energy 1998. *White Paper on the Energy Policy of the Republic of South Africa*. Pretoria: Department of Minerals and Energy.

Department of Minerals and Energy 2003. White Paper on Renewable Energy, Pretoria. From <http://www.energy.gov.za/files/esources/petroleum/white_paper_renewable_energy.pdf> (Retrieved on 4 May 2015).

Department of Minerals and Energy 2007. Biofuels Industrial Strategy, Pretoria. From <http://www. energy.gov.za/files/esources/petroleum/biofuels_ indus_ strat.pdf%282%29.pdf> (Retrieved on 22 March 2015).

Department of Trade and Industry 2009. *The DTI Baseline Study of Cooperatives in South Africa*, Pretoria. Department of Trade and Industry.

Department of Trade and Industry 2010. Briefing on the Development and Support Programmes for Co-operatives: Empowerment and Enterprise Development Division (EEDD), Pretoria. From <http://www.dti.gov.za/parliament/082510_dti_ State_of_Co-ops.pdf> (Retrieved on 21 February 2015).

De Peuter G, Dyer-Witheford N 2010. Commons and cooperatives. *Affinities: A Journal of Radical Theory, Culture, and Action*, 41: 30-56.

Diamantopoulos M 2012. Breaking out of co-operation's 'Iron Cage': From movement degeneration to building a developmental movement. *Annals of Public and Cooperative Economics*, 83(2): 199-214.

Dlamini TR 2010. *Collective Farming: Elements Constituting an Effective Agricultural Co-operative, the Case of Three Co-operatives in the uMgungundlovu District.* Master of Agriculture (Food Security). Pietermaritzburg: University of KwaZulu-Natal.

Edkins M, Marquard A, Winkler H 2010. South Africa's Renewable Energy Policy Roadmaps. From <https://open.uct.ac.za/bitstream/item/19473/Edkins_ South_ Africa_ 039_s_ renewable_ 2010. pdf?sequence=1> (Retrieved on 18 May 2015).

Elliott ED 2013. *Why the United States Does Not have a Renewable Energy Policy.* Washingtom: Environmental Law Institute.

Eskom (n.d.). Solar Water Heating Rebate Programme. From <http://www.eskom.co.za/AboutElectricity/FactsFigures/Documents/The_Solar_Water_ Heating_ SWH_Programme.pdf > (Retrieved on 20 December 2015).

Florini K, Mansell A 2015. *S*outh Africa: The World's Carbon Markets: A Case Study Guide to Emissions Trading. From <https://ieta.memberclicks.net/assets/CaseStudy2015/south_africa_case_ study_ may 2015.pdf > (Retrieved on 20 December 2015).

Fürsch M, Lindenberger D, Malischek R, Nagl S, Panke T, Trüby J 2011. German Nuclear Policy Reconsidered: Implications for the Electricity Market. From <http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Working_Paper/EWI_WP_11-12_German_ nuclear_ policy_ re-con-sidered.pdf> (Retrieved on 13 May 2015).

Gadzikwa L, Lyne MC, Hendriks SL 2007. Horizontal coordination and free-riding in a group of certified organic crop growers: An empirical study of the Ezemvelo farmers' organization in KwaZulu-Natal, South Africa. *AfJARE*, 2(1): 129-149.

Gipe P 2007. Wind Energy Cooperative Development in Anglophone Canada For the Canadian Co-operative Association. Wind Energy. From <http://www.wind-works.org/cms/uploads/media/Wind_Energy_Cooperative_Development_in_Anglophone_Canada.pdf> (Retrieved on 18 June 2016).

Hannan R 2014. The institution of co-operation: A pathway from governance to spillover and poverty reduction. *Journal of Co-operative Organization and Management*, 2(1): 34-42.

Höök M, Tang X 2013. Depletion of fossil fuels and anthropogenic climate change - A review. *Energy Policy*, 52: 797-809.

International Cooperative Alliance 2007. Statement on the Co-operative Identity. From <http://www.ica.coop/coop/principles.html> (Retrieved on 8 January 2015).

International Energy Agency 2014. 2014 Key World Energy Statistics. From <http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf> (Retrieved on 17 December 2015).

International Energy Agency 2015a. Renewable Energy Independent Power Producer Programme (REIPPP). From <http://www.iea.org/policiesandmeasures/pams/southafrica/name-38785-en.php> (Retrieved on 16 December 2015).

International Energy Agency 2015b. South Africa Statistics. From <http://www.iea.org/policiesandmeasures/renewableenergy/?country=South%20Africa> (Retrieved on 16 October 2016).

Intergovernmental Panel on Climate Change 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. From <http://www.ipcc.ch/report/srren/> (Retrieved on 11 December 2015).

Jacobsson S, Lauber V 2006. The politics and policy of energy system transformation—explaining the German diffusion of renewable energy technology. *Energy Policy*, 34(3): 256-276.

Kanyane MH 2009. Co-operatives as part of social security mainstream for poverty alleviation in selected municipalities. *Journal of Public Administration*, 44(4): 1123-1137.

Lemaire X 2011. Off-grid electriûcation with solar home systems: The experience of a fee-for-service concession in South Africa. *Energy for Sustainable Development*, 15: 277-283.

Mabuyakhulu M 2010. Budget Policy Speech 2010/2011, Pietermaritzburg. From <http://www.kznded.gov.za/Portals/0/BUDGET-SPEECH%20final.pdf> (Retrieved on 14 December 2015).

Mathie J 2012. *Co-operative Farming Farming is Vital for the UK – Not Just for Rural Communities but the Security of the Country as Whole*. Borehamwood: Mutuo.

Mazzarol T 2009. Cooperative Entreprise: A Discussion Paper and Literature Review. From <http://www.cemi.com.au/sites/all/publications/0901%20COOPS%20WA%20LIT%20REVIEW.pdf> (Retrieved on 13 December 2015).

Mendonça M, Lacey S, Hvelplund F 2009. Stability, participation and transparency in renewable energy policy: Lessons from Denmark and the United States. *Policy and Society*, 27(4): 379-398.

Merrien A 2014. The Socio-Economic Impact of Co-operatives and Mutuals. From <https://www.usherbrooke.ca/irecus/fileadmin/sites/irecus/documents/impact_socio-economique_ coops_mutuelles/IRECUS-Socio-economic_impact_of_ coops_and_ mutuals.pdf> (Retrieved on 11 December 2015).

Mkhize Z 2013. State of the Province Address (KwaZulu Natal). Royal Showgrounds, Pietermaritzburg. From <http://www.info.gov.za/speech/DynamicAction?pageid=461andtid=99948> (Retrieved on 15 November 2015).

Mufson S, Hamburger T 2015. A Battle is Looming Over Renewable Energy, and Fossil Fuel Interests are Losing. *Washington Post*, 18 February.

National Planning Commision 2011. *The National Development Plan: Vision for 2030*. Pretoria: National Planning Commission.

National Rural Electric Cooperative Association 2015. From <http://electric.coop/> (Retrieved on 13 December 2015).

Odhiambo NM 2009. Electricity consumption and economic growth in South Africa: A trivariate causality test. *Energy Economics*, 31(5): 635-640.

Okbandrias MA, Okem AE 2016. *Cooperatives in Vogue: A Case Study of Cooperatives in South Africa. Theoretical and Empirical Studies on Cooperatives.* Switzerland: Springer.

Okem AE 2016a. *The Implementation of Cooperative Policy: Perceptions from Cooperatives in the Umgungundlovu District Municipality (Kwazulu-Natal, South Africa).* Doctoral Thesis, Unpublished. Pietermaritzburg: University of KwaZulu-Natal.

Okem AE 2016b. *The Meaning and Defining Characteristics of Cooperatives Theoretical and Empirical Studies on Cooperatives.* Switzerland: Springer, pp. 1-14.

Okem AE, Tshishonga N 2016. *The South African Cooperative Sector: Which Way Forward? Theoretical and Empirical Studies on Cooperatives.* Switzerland: Springer, pp. 95-104.

Parliamentary Monitoring Group 2010. Development and Support Programmes for Cooperatives: Deputy Minister of Trade and Industry Briefing. From <http://www.pmg.org.za/report/20100825-state-co-operatives-provinces-department-trade-industry-briefing> (Retrieved on 13 May 2013).

Pegels A 2010. Renewable energy in SouthAfrica: Potentials, barriers and options for support. *Energy Policy,* 38: 4945-4954.

Peters GP, Marland G, Le Quéré C, Boden T, Canadell JG and Raupach MR 2012. Rapid growth in CO2 emissions after the 2008-2009 global financial crisis. *Nature Climate Change,* 2(1): 2-4.

Phaahla E 2015. The State of Electricity in South Africa - Part I: The Problems in Eskom. From <http://hsf.org.za/resource-centre/hsf-briefs/the-state-of-electricity-in-south-africa-part-i-part-i-the-problems-in-eskom> (Retrieved on 10 December 2015).

Promethium Carbon 2012. Sectoral Classification for the Low Carbon Economy in South Africa. From <http://www.promethium.co.za/wp-content/uploads/2012/10/2012-10-11-Sectoral-classification-document_low.pdf> (Retrieved on 9 December 2015).

Public Protector 2009. Report of the Public Protector in Terms of Section 182(1)(B) of the Constitution of the Republic of South Africa, 1996 and Sections 8(1) and 8(2)(B)(I) of the Public Protector Act, 1994. From <http://www.pprotect.org/library/investigation_ report/Kungwini%20Report.pdf> (Retrieved on 2 December 2015).

Republic of South Africa 2011. National Climate Change Response White Paper. From <http://www.gov.za/sites/www.gov.za/files/national_ climatechange_ response_whitepaper_0.pdf> (Retrieved on 8 December 2015).

Rifkin J 2012. The third industrial revolution: How the internet, green electricity, and 3-d printing are ushering in a sustainable era of distributed capitalism. *World Financial Review,* 1.

Rong F 2010. Understanding developing country stances on post-2012 climate change negotiations: Comparative analysis of Brazil, China, India, Mexico, and South Africa. *Energy Policy,* 38(8): 4582-4591.

Sawin JL, Sverrisson F, Rickerson W 2015. Renewables 2015 Global Status Report Renewables 2015 Global Status Report: Key Findings 2015. From <http://www.ren21.net/wpcontent/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf> (Retrieved on 7 December 2015).

Sebitosi A 2008. Energy efficiency, security of supply and the environment in South Africa: Moving beyond the strategy documents. *Energy,* 33(11): 1591-1596.

Seyfang G, Park JJ, Smith A 2013. A thousand flowers blooming? An examination of community energy in the UK. *Energy Policy,* 61: 977-989.

Sovacool BK 2009. The cultural barriers to renewable energy and energy efficiency in the United States. *Technology in Society,* 31(4): 365-373.

Steffen W, Grinevald J, Crutzen P, McNeill J 2011. The anthropocene: Conceptual and historical perspectives. *Philosophical Transactions of the Royal Society of London: Mathematical, A Physical and Engineering Sciences,* 369(1938): 842-867.

Tarhan MD 2015. Renewable energy cooperatives: A review of demonstrated impacts and limitations. *Journal of Entrepreneurial and Organizational Diversity,* 4(1): 104-120.

Tchami G 2007. Handbook on Cooperatives for use by Workers' Organizations, Geneva. From <http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_ 094046.pdf> (Retrieved on 10 December 2015).

Viardot E 2013. The role of cooperatives in overcoming the barriers to adoption of renewable energy. *Energy Policy,* 63: 756-764.

Willis R, Willis J 2012. *Co-operative Renewable Energy in the UK: A Guide to this Growing Sector*. London: Co-operatives UK.

Winkler H 2007. Energy policies for sustainable development in South Africa. *Energy for Sustainable Development,* 11(1): 26-34.