Progress in Development Studies 16, 1 (2016) pp. 24–38

Social enterprise development and renewable energy dissemination in Africa: The experience of the community charging station model in Sierra Leone

Paul Munro

School of Humanities and Languages, University of New South Wales, Sydney, Australia.

Greg van der Horst

School of Geography University of Melbourne, Melbourne, Australia.

Simon Willans

Energy For Opportunity, Freetown, Sierra Leone.

Preston Kemeny

Department of Geosciences, Princeton University, Princeton, New Jersey, USA.

Ame Christiansen

College of Education, Victoria University, Melbourne, Australia.

Nicole Schiavone

Department of Mechanical Engineering, Stanford University, Stanford, California, USA.

10.1177/1464993415608080

Abstract: In many parts of Africa, the spread of grid electrical networks into rural areas has remained a pernicious challenge. There has been a persistent bias towards expanding electricity access to urban centres, perhaps understandably as they are the main drivers of national economic growth. In contrast, the expansion of grid electricity networks into rural areas is largely seen as being financially unviable and thus is unlikely to be achieved in the foreseeable future. Using the example of energy kiosks in Sierra Leone, this paper examines the potential commercial and policy implications of a social enterprise approach to address this impasse. Specifically, the success of the community charging station model of one non-governmental organization, Energy For Opportunity, is evaluated in the context of ongoing commercial viability, the overcoming of financial and technological barriers, and the lack of for-profit entities in the market. This case study demonstrates how an innovative blending of non-profit and for-profit models of development interventions can provide effective institutional arrangements to realize solar electrification in rural Africa.

Key words: Africa, Sierra Leone, solar power, social enterprise, renewable energy, moral economy

I Introduction

From independence onward, the establishment of modern electrical grids has been a key goal of most sub-Saharan African states and their aid donors. Progress, however, has often been lacklustre, and rates of grid expansion have rarely matched those of population growth (Bhattacharyya, 2013). Furthermore, a persistent bias towards urban centres as the main drivers of national economic growth (Acker and Kammen, 1996; Khennas, 2012) means that of the estimated 589 million Africans with no direct access to electricity, 75 per cent are rural residents (IEA, 2012). At present, the widespread expansion of grid electricity networks into rural sub-Saharan Africa is largely financially unviable and is highly unlikely to be achieved in the foreseeable future (Pode, 2013; Wamukonya, 2007). The lack of modern energy sources such as electricity and poor energy governance contexts (Pueyo *et al.*, 2013) are ultimately seen as pernicious barriers to the livelihood diversification and social development (Akpan *et al.*, 2013; Brown *et al.*, 2011).

In this context, there has been an increasing interest in the potential of small-scale decentralized power systems, typically based on renewable energy sources, to help alleviate the dearth of electrical services. Among these, solar cells have emerged as a key technology, not least because sub-Saharan Africa's solar energy endowment is almost twice as high as that of Europe, which is currently the largest solar energy market (Deichmann *et al.*, 2011). Moreover, solar power is seen as a leapfrog technology due to its decentralized nature, relative immunity to supply and price fluctuations, consistently falling costs, and its investment appeal to institutions looking to shift to lower carbon energy sources. Indeed, it has the potential to mimic the success of mobile phone uptake across the continent (Collier and Venables, 2012). The realization of this potential is far from straightforward and dissemination of solar power into rural areas remains extremely limited due to the number of key barriers (Gómez García and Montero Bartolomé, 2010). For one thing, rural African consumers are frequently conservative and risk averse and hesitant to invest in technologies or products with which they do not have prior experience (Lighting Africa, 2010). In addition, private sector investors have exhibited a general reluctance to expand solar energy provision into rural African markets due to the perceived high level of risk associated with a range of economic, governance and institutional challenges (Bazilian *et al.*, 2012). Meanwhile, the non-profit sector has generally operated with a project mentality for solar power distribution, conducting individual

projects rather than facilitating conditions for its wider dissemination.

In the last few years, dissatisfaction with the problems and difficulties arising from the 'traditional' gulf between non-profit and for-profit models of development interventions have led to increased experimentation with the notion of social enterprise. In Africa and elsewhere in the 'developing world', non-governmental organizations (NGOs) have typically distanced themselves from private sector actors for whom they have frequently been vocal and even bitter critics, and the relationship between the non-profit agencies and the business is characterized by mutual distrust and even hostility. An unfortunate side effect of such friction is distancing those who work most actively for positive social change from the segments of society with the greatest financial resources and organizational expertise. As a result, NGOs with laudable aims often remain constrained by high operating costs, constantly threatened by inadequate budgets and narrow donor-dictated mandates (Bebbington, 2005; Edwards and Hulme, 1996).

In this paper, drawing on the example of community charging stations (CCSs) in Sierra Leone, we examine how the chasm between non-profit and for-profit operations might be breached through a social enterprise approach to rural development. Building upon existing social enterprise scholarship, we analyze how civil society, through engagement with the creative potential of local entrepreneurs, can provide new options for the sustainable solar electrification of rural Africa. The research for this paper was conducted between April 2012 and July 2013 in Sierra Leone, with data collected through multi-strategy research, including active participation (and observation), unstructured interviews with people involved with the CCSs, an analysis of financial records generated as part of the project, and household surveys conducted in nine CCS villages.

II Social enterprise and development

The overarching purpose of a social enterprise approach is to bridge the divide between the charitable and private sectors (Katz and Page, 2010). It is underpinned by notions of a 'moral economy' that challenges the more conventional view that defines morality and the market in oppositional terms; the former being assumed to be 'concerned with notions of care and responsibility, the other concerned with the apparently rational and amoral calculus of price and profit' (Jackson *et al.*, 2009: 132). This notion has been increasingly challenged (Popke, 2006; Sayer, 2000), with the argument that the operation of markets depends on, and influences, moral and ethical sentiments as well as norms and behaviours. From this perspective, the 'moral economy' emerges as the study of how economic activities are influenced and structured by moral dispositions and norms, and how those norms may be compromised, over-ridden or reinforced by economic pressures (Sayer, 2000). Consumption is thus viewed as a social practice with moral and ethical dimensions (Popke, 2006).

Social enterprise approaches thus represent a pragmatic attempt at teasing out and fostering the (positive) moral economy, focusing on the potential opportunities for unique partnerships between the for-profit sector and the non-profit sector. It is an approach that focuses on creating a moral economy of alternative development that operates both 'in and against the market' (Goodman, 2004). As such, the role of NGOs is reconceptualized from the former role of being a service provider for poor communities to being an active agent in helping to shape and influence markets to ensure positive externalities for poor and marginalized households. It therefore proposes—first—that NGOs can often generate desired social impacts more efficiently and sustainably by the selective employment of business-style models themselves and, second—that in many cases their goals

may be most effectively achieved by taking a coordinating role, identifying 'service and trade gaps' and addressing them through the strategic facilitation of private sector involvement (Katz and Page, 2010; van Rensburg *et al.*, 2008).

Perhaps the most prominent example of a social enterprise approach to development has been the Fair Trade movement: a certification scheme, which has sought to 'connect' consumers in the 'developed world' with narratives about producers in the 'developing world'. The Fair Trade movement thus embodies a geographical and conceptual separation of consumers (e.g., developed world latte drinkers) and beneficiaries (e.g., developing world farmers), and subsequently attempt to construct a novel morality that connects developing economies with wealthy consumption, embodying an entrepreneurial developmentalism of ecological, economic and identity-based empowerment (Dufays, 2013; Goodman, 2004). Social enterprise approaches, however, do not need to operate at a global scale, and indeed, the case study examined in this article represents a relatively small-scale initiative, targeting a handful of villages across northern Sierra Leone. The CCS focus is on changing the institutional arrangement of consumption in a discrete geographical location. Thus while the Fair Trade movement is largely reliant on the 'good will' of northern consumers for its success, the agency to realize change in the CCS comes from the community itself, and thus the role of intervention (e.g., by Energy For Opportunity (EFO)) is to develop a governance and technological geography that facilitates the necessary institutional change.

1 A history of solar-based electrification in sub-Saharan Africa

Though the project of solar electrification in rural Africa is by no means novel, it is only in recent years that the technology has begun to emerge as a viable household energy option in smaller communities. Whereas earlier efforts were dogged by poor implementation and institutional neglect, over the past decade, factors such as reduced cost, technological improvements and renewed international support have revitalized interest in solar energy as a potential technology for scattered rural communities.

The first development aid installation of solar power in Africa reportedly occurred in Niger in 1968 (Lorenzo, 1997), with African markets for solar power beginning to emerge during 1970s, spurred by the oil price shocks of 1973–74 and the subsequent flurry of investment in renewable energy development. By the late 1980s, however, despite substantial multilateral and bilateral funding to promote solar power in rural areas (Chaurey and Kandpal, 2010), dissemination remained largely restricted to more affluent sections of the population and only urban Kenya and South Africa had some form of a market for solar power (Acker and Kammen, 1996; Bawakyillenuo, 2009; Hajat *et al.*, 2009).

Perhaps most important to note is that the collapse of the first wave of solar electrification efforts was largely the result of weak project design and poor implementation rather than technological or economic difficulties. For one thing, many installations were hastily built, substandard and faulty, reinforcing public perception of solar power as an inferior technology (van der Plas and Hankins, 1998). Even where initial installations were technically sound, however, most projects failed to attend to the more critical issues of institutional and commercial viability, dissemination to remote communities, mechanisms for equipment maintenance, sources of credit and expertise, and incentives for continued operation and expansion (Nygaard, 2009). Organizations and donors had failed to establish a sustainable renewable energy market (Martinot *et al.*, 2002: 315). As a result, by the late 1980s, aid donors became disenchanted and many beneficiaries had become cemented in the view that solar power was the energy sector equivalent of poverty rations—a second-class

technology not good enough for developed countries to adopt themselves (Martinot *et al.*, 2002).

While this situation changed little during the 1990s, over the past decade there has been a resurgence of interest in the potential of solar energy for rural African electrification. One critical factor has been the rise of public environmental consciousness (notably with the identification of anthropogenic climate change), which has generated broad-based concern over the environmental impacts of rising energy demand in less developed countries (Dincer, 2000). Also, technological shifts such as the now widespread dissemination of light-emitting diode (LED) lighting (Pode, 2010), along with dramatic reductions in the cost of equipment, have considerably improved performance-to-cost ratios for solar equipment (Bazilian *et al.*, 2013; Nygaard, 2009). Indeed, the use of solar power technologies is increasingly being seen as a vital technology to help reduce the widespread energy deficiency that plagues sub-Saharan Africa (Khennas, 2012; Kornbluth *et al.*, 2012; Suberu *et al.*, 2013; Szabó *et al.*, 2013).

Despite increasing political momentum and the benefits of hindsight, however, it is not yet fully clear how rapid dissemination of solar power in rural Africa may be achieved without falling into the same pitfalls that stalled previous attempts. On one hand, there is a substantial body of recent literature calling for a proactive approach by African governments as the key factor for facilitating private sector engagement (Kemausuor *et al.*, 2011; Lemaire, 2011). To be sure, experience clearly indicates that a conducive policy environment and the support of state agencies are important to the spread of solar technology (Dulal *et al.*, 2013). Moreover, it is equally evident that the lighting of rural Africa will be neither feasible nor sustainable if based wholly on charity, state or international funding, and that the emergence of functional solar energy markets can be greatly facilitated by early private sector involvement. In Kenya, for example, the emergence of one of Africa's largest and most dynamic solar power markets and the spread of household solar systems deep into rural areas was driven less by external intervention than by the rise of consumer demand and the development of a domestic solar equipment industry that catered to the needs of rural households (Hajat *et al.*, 2009; Ondraczek, 2013).

Conversely, however, experience also indicates that in most African countries, overcoming the considerable and often pernicious barriers to rural electrification will require the participation of actors operating beyond (or between) the state and the private sector (Gómez García and Montero Bartolomé, 2010). As previously stated, rural African consumers are frequently risk averse and hesitant to invest in technologies or products with which they do not have prior experience (Lighting Africa, 2010). What's more, the perceived high level of risk associated with a range of economic, governance and institutional challenges frequently discourage private sector investors from attempting the expansion into the rural African markets (Bazilian *et al.*, 2012). It is in this context that the NGO community can play a critical role. On its own, the non-profit sector has certainly performed poorly in most cases with respect to solar power dissemination due to its pervading 'project' mentality and a lack of the expertise, mandate and funding required for broader sectoral approaches. Nonetheless, its greater ability to forge close relationships with rural communities, experience with pilot project setup and ability to access start-up funding independent of profit concerns are key strengths compared to state or private actors. As elaborated in the following section, it is precisely because of this relative distribution of strengths and weaknesses that a growing number of observers and practitioners, including those in the African energy sector (Howe *et al.*, 2012), are beginning to advocate for, and experiment with, innovative new forms of partnership that bridge the gaps between

the practices of the international business community and the realities of daily life in rural Africa (Sovacool, 2013).

III Hybrid organization: Social enterprise for rural electrification in Africa

While a social enterprise approach could be of critical use in resolving a wide variety of socio-economic problems, the long-standing challenge of disseminating solar technology in rural Africa presents a perfect example of its potential. Currently, most of rural Africa relies on kerosene, battery powered lanterns, and, to a lesser extent, candles for light. Kerosene lamps alone provide primary lighting for an estimated 580 million people across the continent (Lighting Africa, 2010). While kerosene yields considerable heat, such lamps are extremely inefficient light sources and provide only a dim 30–60 lumens compared to the 600–900 lumens from conventional electric bulbs (Pode, 2010). Deemed insufficient for reading, such low levels of domestic light hinder a child's ability to study (Pode, 2010). Furthermore, as the World Bank notes, candles and kerosene 'are typically expensive and often both dangerous and environmentally harmful' (Lighting Africa, 2010: 14): they produce toxic smoke and create household fire and burn hazards (Chaurey and Kandpal, 2010). While dry cell-powered torches are much safer to use, they produce only marginally better light and the poor quality batteries generally available represent not only a considerable drain on household finances but also a considerable source of pollution given the lack of disposal facilities. Whereas state-led and NGO efforts have struggled to resolve such issues, social enterprise approaches have gained traction by treating rural energy transition not as a 'problem' to be 'solved' but as an opportunity to create new arenas in which local entrepreneurship may generate improved social outcomes. The challenge, then, is to overcome the financing, technological, social *and* cultural barriers that prevent LED lighting and solar power technologies from penetrating into rural African markets (Chaurey *et al.*, 2012).

IV Case study background: Solar power and light in post-war Sierra Leone

By the end of its civil war in 2001, Sierra Leone was a in a dire state—the legacy of over 30 years of misrule and chaotic conflict remained evident in the nation's crumbling infrastructure and weak governance structures. After initial optimism at independence in 1961, the state declined considerably during the 1970s and 1980s under President Siaka Stevens' patrimonial and authoritarian single-party regime (Richards, 1996). Focused on exploiting the mining sector for personal benefit and the consolidation of his power in the capital, Stevens' 'administration' allowed most of the economy—and indeed the country—to fall into disarray as the maintenance and development of rural areas and smaller urban centres were increasingly neglected (Riddell, 2005). The most severe devastation, however, was wrought by the civil war of 1991–2001, destroying, among many things, most of the remaining functional infrastructure. In the aftermath, while Sierra Leone has made considerable short-term progress, conditions remain exceedingly poor: post war, the country has been consistently ranked near the bottom of the human development index.

In the country's attempts at recovery, electricity supply has remained a consistent and economically pernicious problem. In 2009 only 10 per cent of the overall population had access to grid electricity, while in rural areas the level was only 1 per cent (MEWR, 2009). Overall, the vast majority of connections are limited to the capital city of Freetown and district capitals, leaving most of the rest of the country with little or no grid access. In response to this situation (along with the unreliability of supply, which results in frequent blackouts) many businesses and households rely on small gasoline or diesel-powered generators. This option remains far beyond the

reach of most citizens however, and among the (majority) rural population generator ownership is only around 1 per cent (MEWR, 2009). On the whole, although infrastructure reconstruction has been vigorously pursued, the situation seems little likely to change for rural communities in the near term. Due to the severe national energy deficit, electrification projects have necessarily been focused on supplying the concentrated demand of urban centres and plans for improved rural electrification remain largely aspirational (MEWR, 2009).

Intriguingly, despite widespread poverty, a lack of state intervention and the piecemeal nature of NGO-led projects, Sierra Leoneans have been re-working the energy sector from the ground up and there is considerable evidence of a broad transition towards 'improved' sources of fuel and light. First, although firewood was the dominant rural and urban cooking fuel prior to the 1990s (Davidson, 1985; Kamara, 1986), over the past decade there has been a dramatic rise in the (rural) production and (urban) consumption of charcoal, producing considerable economic as well as health and safety benefits (Munro and van der Horst, 2015). The second key shift, more pertinent to the present discussion, has been the change in rural lighting patterns. As in most of sub-Saharan Africa, kerosene has long been the dominant source of light in rural Sierra Leone (Davidson, 1985). In the past few years, however, dry-cell battery powered torches have become almost ubiquitous. Indeed, in the villages surveyed as a part of this project, between 85 per cent and 100 per cent of households used battery-powered lanterns as the main source of domestic light instead of kerosene lanterns (between 0 per cent and 10 per cent) while a minority relied on other sources such as grid power, personal generators, candles, fire and solar-powered lanterns (Kemeny *et al.*, 2014). Such transitions indicate that there is a clear (and active) demand for changing and improving lighting sources in rural Sierra Leone. The challenge, therefore, is to find a way to compete with and undercut the current market in cheap lanterns and disposable batteries.

V Social enterprise for rural electrification: The CCS model in Sierra Leone

Energy For Opportunity's CCS is a model that combines for-profit and non-profit approaches to disseminate electricity throughout rural Sierra Leone. At the core of the CCS model is a small solar-powered kiosk, which is constructed next to a central communal structure such as a market or community centre. The kiosk serves as a hub for the charging of mobile phones and the rental and sale of solar-powered rechargeable LED lanterns and solar home systems. The LED lanterns rival the cost of battery-powered lights and kerosene, but provide a much higher lumen output and have no adverse health effects (Kemeny *et al.*, 2014; Willans *et al.*, 2011).

Though the CCS is *initially* funded through non-profit finance, its self-sustaining operation is based on purely for-profit principles. All services, including charging and lantern rental, occur on a for-profit basis with all revenue recycled into operations. Ongoing support for the CCS, such as maintenance and resupply of lighting products, is also all handled through for-profit principles. Excess profit is then used to fund future community projects such as solar installations on health clinics and schools, water purification systems and streetlights (Kemeny *et al.*, 2014). EFO also provides substantial training to the CCS staff in both the technical and administrative management of the kiosks.

The EFO CCS model, in combining for-profit and non-profit operating principles, has proven to be effective in addressing traditional issues hindering entry and penetration into the rural Africa energy market. This case study will specifically analyze how the EFO CCS model addresses three such issues: (i) ongoing commercial viability of the project; (ii) financial and technological barriers; and

(iii) lack of for-profit entities in the market. Each of these areas is a major concern of for-profits and non-profits alike, and much of the success of the EFO CCS model can be traced to its efficacy in addressing these three issues.

VI Ongoing commercial viability

One of the key weaknesses of NGO projects is that they lack the necessary mechanisms to continue after the initial funding period. This can be linked directly to the project-to-project operating philosophy of non-profit entities and to a lack of personnel skilled in conventionally for-profit areas such as supply chain management and business development. The EFO CCS model is an example of some of the successes and challenges that combined for-profit and non-profit methodologies to reach long-term commercial viability.

All products sold through the CCS are priced at market rates with average profit margins of 10–15 per cent for sales and an average payback period of less than one year on all rental products. Nearly all of the revenue for each CCS comes from mobile phone charging, with the remaining 0–1 per cent from the sale of lanterns and purified water. Monthly expenses typically include salaries for the CCS attendants and the purchase of additional mobile phone chargers. The profitable nature of this model is clearly seen in Figure 1, which shows the profit and expenses of the first five months of 2013 for the CCSs in nine villages. Although there are limitations in comparing CCSs in different towns due to variables such as population, phone reception, and proximity to grid electricity, the large profit in Kamakwie is attributable to the town's large population and lack of rival charging stations and the large expense in Kamabai is due to the CSS funding the construction of a solar-powered water purification system. Nevertheless, in all

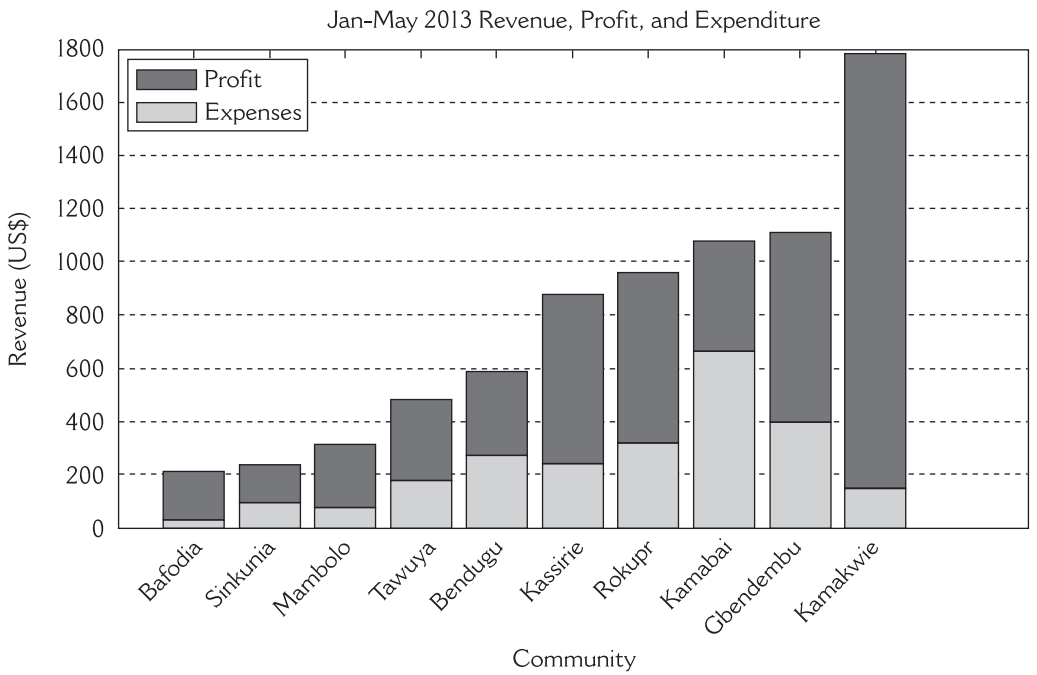

Figure 1 The total profit and expenses for January 2013 through May 2013, calculated using the blended exchange rate Le4300/US$

Source: Authors' own.

nine villages, revenue greatly exceeds costs, demonstrating that the CCS is a commercially viable operation.

Every CCS surveyed had a payback period of 2–3 years depending on the level of initial inventory; although all of EFO's CCSs have been realized through donor funding, these revenues indicate that they are a viable business, with a short payback period relative to other private sector entities. Indeed, as Figure 2 shows, all of the CCSs were profitable almost immediately after installation. Strongly aiding the profitability of these CCSs has been the high penetration of mobile phone ownership into rural areas, with between 90 per cent and 100 per cent of households surveyed in each of the villages reporting that they owned at least one phone. Even in the village of Bendugu, where there is no mobile phone reception, more than 80 per cent of households reported that they owned a phone. As such, the majority of revenue at each CCS is realized from charging mobile phones.

Historical data, from the Kamabai CCS, the earliest installed CCS (March, 2010), also shows an upward trend in monthly revenue and implies that community uptake of the products requires several years (Figure 3). Moreover, the rapid rate of growth suggests there is tremendous room for market expansion.

There have, however, been some issues that have tempered the success of the CCSs. The sinusoidal nature of the revenue increase at Kamabai shows that the profitability of the CCS is somewhat hostage to the vagaries of local weather conditions. Each rainy season, there is a sharp drop in power production, meaning that the CCS batteries occasionally run out of charge before meeting the day's demand for mobile phone recharges. Attendants also reported that even on

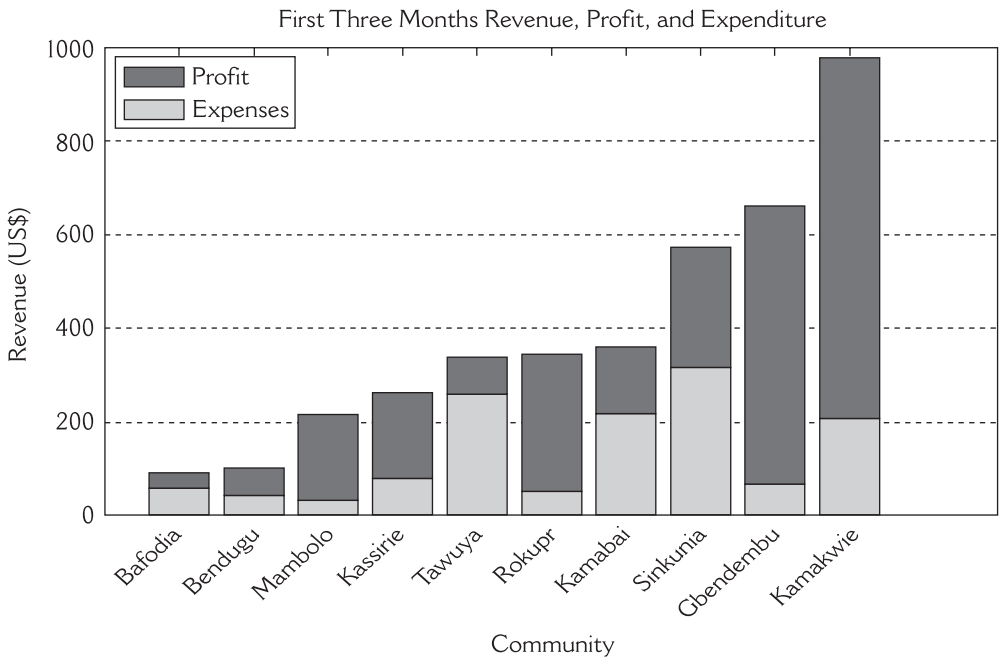

Figure 2 The total profit and expenses for the first three months of operations, calculated using the blended exchange rate Le4300/US$

Source: Authors' own.

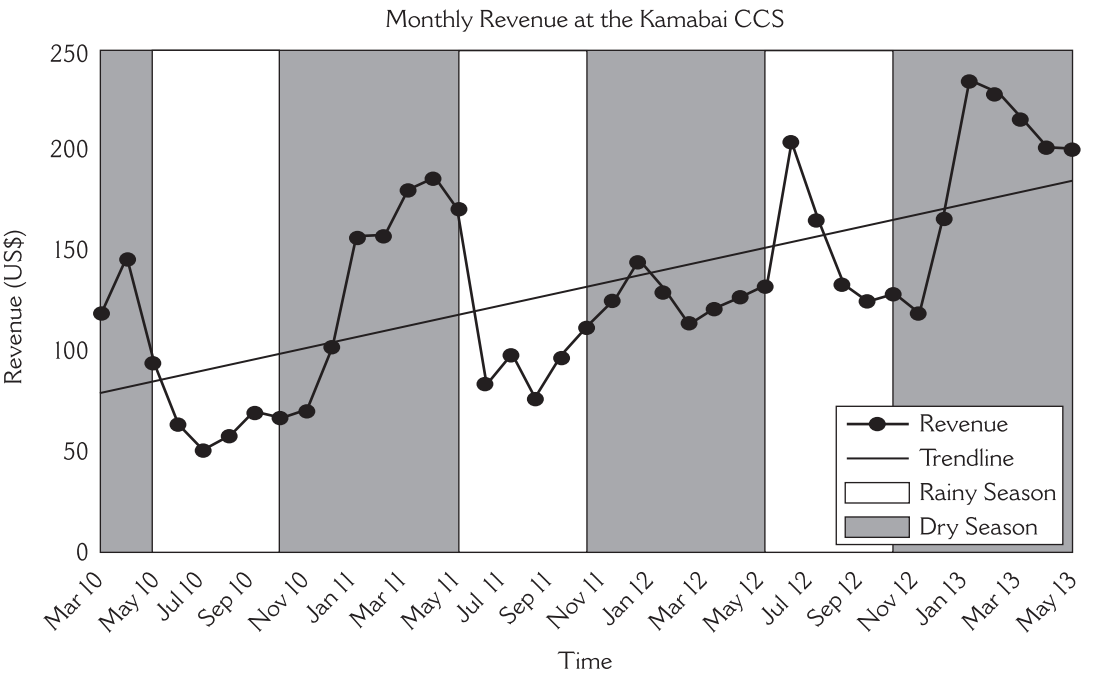

Figure 3 Monthly revenue at the Kamabai CCS over the past 3 years, calculated using the blended rate of Le4300/US$

Source: Authors' own.

some days in the dry season the CCS batteries ran out of charge before recharging all mobile phones. Thus, in the short term, this insufficient power hampers the growth and community impact of the CCS.

Other challenges with the CCS have related to the overall management of the kiosks. Many CCS operators are unfamiliar with budgeting, financing, record-keeping and debt control, which make short-term business planning difficult and long-term business planning almost impossible. The lack of business experience is particularly acute in the financing of products, leading many kiosks to struggle with credit defaults. While EFO works in close partnership with the CCS kiosks to improve these areas of financial management, such improvements represent a long-term objective given the lack of business management skills common in most of the target villages.

Thus, overall, the CCSs clearly represent a commercially viable model, with demand from mobile phone charging, and to a lesser extent LED lantern selling, being easily enough to sustain operating costs, even in relatively small and remote villages. The project, in essence, is already tapping into an existing market and demand for mobile phone charging and improved lighting. It is illustrative of the ways in which NGOs can focus their interventions to take advantage of local economies, providing local communities with the means to ensure the long-term sustainability of a social enterprise.

VII Financial and technological barriers to entry

A further area that provides opportunities for effectively combining non-profit and for-profit operating principles is in overcoming the financial and technological barriers that

exist in introducing new products into risk-averse rural African communities. These are two of the most critical issues affecting the penetration of micro-solar products into Sierra Leone despite their superiority to existing options.

The EFO CCS model circumvents traditional financial barriers by providing credit to enable product access. This has been the key to the success of the CCS, and elsewhere it has been identified that providing sufficient credit and effective mechanisms to ensure payment is fundamental to the success of micro-enterprise initiatives (Brown *et al.*, 2011). For the EFO CCS model, credit is provided in two tiers in the project design, first by EFO to the CCS in the form of inventory and then from the CCS to the customer. At the first level, EFO supplies the CCS with initial inventory that can be sold or used as product rentals. The revenue generated from this initial inventory is then available either to purchase replacement goods or to reimburse EFO. This is a low-risk model as the CCS also generates revenue from phone charging and purified water sales, which diversifies the revenue stream and provides for payback options outside of pure sales. At the second level, the CCS supplies products to community members on either a rent to own or pure credit basis. This is based on a local trust exchange, which is commonly used in Sierra Leone for purchasing products.

Technological barriers have historically also been a major issue inhibiting solar power in Sierra Leone as low-quality products have led to market spoilage. While within the last few years initiatives such as the World Bank's Lighting Africa project have supported high-quality products specifically designed for bottom of the pyramid markets (Avato and Madeira, 2010), a prominent issue now is addressing previous market spoilage and gaining customer confidence in the quality of the new products. Non-profit actors have significant advantages in this area over their for-profit counterparts as they typically have relationships with communities that can prove vital in introducing new technologies. EFO provides a unique and significant case study in this regard as it has utilized the CCS to build strong relationships with many communities and has used those relationships to introduce solar technologies.

A high degree of community participation in all stages and aspects of the CCS projects have been vital for ensuring their success. With EFO's interventions, the relationship begins with the installation of the CCS, in which the community provides lodging, food and labour for EFO. In return, the organization provides the solar systems and installation knowledge. This partnership is then furthered as revenue from the CCS funds larger, traditional solar installations at local schools and community health clinics (Kemeny *et al.*, 2014). While the relationship between EFO and the community is particularly strong in towns like Kamabai and Kamakwie, where the CCS has been operating for multiple years, almost every town continues to feed and house EFO staff when they visit on monitoring trips. To develop such partnerships, EFO has had to react to problems with the products and operations quickly and thoroughly. One example was when a local generator-powered charging station began a campaign falsely claiming solar power damaged mobile phones and provided low voltage in rainy periods. While a for-profit entity would likely not have had the necessary community links to quickly and effectively address such claims, potentially crippling the project, EFO simply called a community meeting to further explain the technology and rebut the rumours.

Thus, by combining for-profit widespread credit distribution with non-profit community partnership, the EFO CCS model has successfully overcome many of the financial and technological barriers plaguing traditional for-profit and non-profit operations. It has been able to instigate an institutional change surrounding renewable energy products through an iterative engagement with target

communities, gaining trust and enabling the dissemination of new technologies. In this sense, while the financial aspect (provision of credit) has been vital, arguably the more critical change has been the NGO–community relationship, which facilitated a community ontological shift towards renewable profits.

VIII Lack of for-profit entities in the market

In the rural areas of Sierra Leone, there are currently no existing wholesalers or for-profit vendors of micro-solar products. Typical challenges cited from local actors include the high duty and tariff costs, challenges with reaching the necessary economies of scale, limited access to business finance and start-up capital, and a lack of distribution and credit networks in the country. These challenges create significant risks for for-profit entities and inhibit the establishment of a vibrant market sector despite clear demand for new products. As seen through the EFO CCS, however, non-profit operating principles can substantially reduce the risk associated with entering rural African markets by providing alternative funding mechanisms and assisting in the development of distribution networks.

A major issue affecting the entry of for-profits into Sierra Leone is the lack of business finance and start-up capital, an issue EFO avoided by funding its initial project work through grants. The CCS model has appealed to donors by combining the numerous social and health benefits of solar lighting with the for-profit structure of the CCS, giving access to vital funds that would not have been available to a purely for-profit or non-profit entity. Indeed, many grants require a for-profit component to the project or are only accessible to applications that propose for-profit and non-profit partnerships. As this funding is typically available on a grant or subsidy basis it dramatically reduces the risk to for-profits during the initial stages of entering the market.

Another concern hindering the entry of for-profits into Sierra Leone is the lack of distribution facilities, as establishing a full distribution chain requires significant capital and human resource development. EFO overcomes this issue by temporarily facilitating the growth of supply lines between the various CCSs, transporting products and helping to manage inventories. This degree of involvement in the businesses, while impractical for a for-profit, is entirely possible for a non-profit. As the number of CCSs increased from merely a few in 2011 to over 30 in 2013 and with over 100 planned for the future, the CCS network approaches a robust economy of scale and the supply chains begin operating independently of the organization. The long-time period required for building an extensive internal distribution network gives EFO ample opportunity to foster and learn from its facilitation, making further involvement more efficient.

The final transition, however, from being an NGO-supported network of CCS, to one operating independently, is an issue EFO continues to address. One of the major issues in this regard has being establishing supply chains for the re-supply of LED lanterns and solar household systems for the CCSs. Currently much of the CCS inventory is bought from North America, while EFO has attempted to partner with local (private sector) lantern distributers to remedy this problem, such attempts have frequently resulted in failure as many companies are either unreliable, delivering incorrect products or prohibitively expensive.

Given this challenge, EFO has looked to expand its intervention not only towards rural lighting end-users, but also towards the broader market supply change for LED lanterns. Its first move to address this has been through the establishment of private charging stations (PCSs) in different district capitals across Sierra Leone. The PCS is different from a CCS in three key ways. The first difference is that PCSs are only established

in large towns without effective community organization, such as district capital towns. Second, because there is no community structure in such locations the revenue from a PCS is not used for community projects. Instead the PCS operators pay EFO a predetermined fee each month and keep the remaining profit for themselves. This model allows EFO to disseminate solar technologies into towns where the CCS model could not function and provides EFO with a small but reliable income. Finally, the PCS enters an exclusive deal in which EFO is the sole lantern supplier to the PCS and the PCS is the sole lantern distributor to the surrounding CCSs (Kemeny *et al.*, 2014).

This model is designed to overcome previous lantern supply chain issues through the establishment of a reliable distribution network between EFO, the PCSs and the CCSs. In this distribution network, EFO is only responsible for transporting lanterns to the PCSs, as opposed to all of the CCSs, which translates into significantly fewer shipments taking place over superior roads. The CCSs, no longer dependent on EFO, can buy any desired quantity of product from their local PCS (Kemeny *et al.*, 2014). This distribution model is still much in its infancy and therefore it is too early to judge its efficacy; however, if successful it will represent an innovative approach to the blending of for-profit and not-for-profit approaches for securing improved household lighting in rural Africa.

IX Conclusion

The notion of a social enterprise approach in sub-Saharan Africa has ultimately emerged in the context of the neoliberal area, with governments generally operate in a relatively weakened state, particularly in rural areas. There, however, should be some caution in viewing social enterprise as a panacea for all electricity issues in Africa or the broader developing world. It certainly has a role to play, as the case study explored in this paper has demonstrated, but it would be naïve to suggest that a single paradigmatic approach can solve all challenges. Rather, social enterprises should be seen as one developmental approach and tool in the broader context of development debates and interventions. The case study examined here provides some insights in terms of how this might be realized.

Overall, the CCSs being implemented by EFO in Sierra Leone represent an example of how a social enterprise approach can produce positive development outcomes and long-term solutions for improving electricity access to rural communities in sub-Saharan Africa. The CCS approach taps into existing markets, using commercial mechanisms to ensure that its improved lighting products, such as LED lanterns, can directly compete with existing lighting sources. While EFO provides the initial project design and the initial credit and financing for the CCS installation and LED lantern inventory; the 'project' is designed to operate almost completely independent of EFO, driven by community desires for improved lighting. EFO's role has been to provide occasional strategic advice and awareness campaigns about the benefits of solar. Indeed, the NGO has now moved its focus to the broader issue of supply chains, as the programme's biggest limitation is in terms of upstream supply issues, rather than project problems at village sites. The long-term presence of NGO actors has been important in this sense, expanding the number of CCS over a long period of time to create an economy of scale, and then focusing on improving strategic supply networks around the country. To an extent, EFO is creating a market sector from which private sector operators can profit and thrive.

This model is certainly replicable to other parts of rural Africa and the developing world where electricity access is limited. However, critical knowledge of the implementation context is always an important factor in the designing such intervention. The CCS, for example, would unlikely have been successful two decades ago, prior to the mobile phone

revolution, as mobile phone recharging makes up an essential part of the CCS revenue. Thus, the CSS social enterprise, in this context, represents a broader conceptual approach that needs to be adapted to local geographies and the broader political economies in which they are situated.

References

Acker, R.H. and **Kammen, D.M.** 1996: The quiet (energy) revolution: Analysing the dissemination of photovoltaic power systems in Kenya. *Energy Policy* 24, 81–111.

Akpan, U., Essien, M. and **Isihak, S.** 2013: The impact of rural electrification on rural micro-enterprises in Niger Delta, Nigeria. *Energy for Sustainable Development* 17, 504–09.

Avato, P. and **Madeira, L.** 2010: Innovative marketing and business models for the rapid development of off-grid lighting markets in Africa. *Boiling Point 58,* 6–8.

Bawakyillenuo, S. 2009: Policy and institutional failures: Photovoltaic solar household system (PV/SHS) dissemination in Ghana. *Energy & Environment* 20, 927–47.

Bazilian, M., Nussbaumer, P., Rogner, H., Brew-Hammond, A., Foster, V., Pachauri, S., ... Musaba, L. 2012: Energy access scenarios to 2030 for the power sector in sub-Saharan Africa. *Utilities Policy* 20, 1–16.

Bazilian, M., Onyeji, I., Liebreich, M., MacGill, I., Chase, J., Shah, J., ... Zhengrong, S. 2013: Re-considering the economics of photovoltaic power. *Renewable Energy* 53, 329–38.

Bebbington, A.J. 2005: Donor–NGO relations and representations of livelihood in nongovernmental aid ahains. *World Development* 33, 937–50.

Bhattacharyya, S.C. 2013: Electrification experiences from sub-Saharan Africa. In Bhattacharyya, S.C., editor, *Rural electrification through decentralised off-grid systems in developing countries*. Springer, 131–56.

Brown, A., Garguilo, S. and **Mehta, K.** 2011: The relentless pursuit of financial capital for micro-enterprises: Importance of trust and social capital. *International Journal for Service Learning in Engineering, Humanitarian Engineering and Social Entrepreneurship* 6, 78–97.

Brown, J.H., Burnside, W. R., Davidson, A.D., DeLong, J.P., Dunn, W.C., Hamilton, M.J., Mercado-Silva N., Nekola J.C., Okie, J., Woodruff, W.H. and **Zuo, W.** 2011: Energetic limits to economic growth. *BioScience* 61, 19–26.

Chaurey, A. and **Kandpal, T.C.** 2010: Assessment and evaluation of PV based decentralized rural electrification: An overview. *Renewable and Sustainable Energy Reviews* 14, 2266–78.

Chaurey, A., Krithika, P., Palit, D., Rakesh, S. and **Sovacool, B.K.** 2012: New partnerships and business models for facilitating energy access. *Energy Policy* 47, 48–55.

Collier, P. and **Venables, A.J.** 2012: Greening Africa? Technologies, endowments and the latecomer effect. *Energy Economics* 34(Supplement 1), S75–S84.

Davidson, O.R. 1985: *Energy use patterns*. International Development Research Centre (IDRC).

Deichmann, U., Meisner, C., Murray, S. and **Wheeler, D.** 2011: The economics of renewable energy expansion in rural sub-Saharan Africa. *Energy Policy* 39, 215–27.

Dincer, I. 2000: Renewable energy and sustainable development: A crucial review. *Renewable and Sustainable Energy Reviews* 4, 157–75.

Dufays, F. 2013: Fair trade organizations and social enterprise: Social innovation through hybrid organization models. *Social Enterprise Journal* 9, 123–24.

Dulal, H.B., Shah, K.U., Sapkota, C., Uma, G. and **Kandel, B.R.** 2013: Renewable energy diffusion in Asia: Can it happen without government support? *Energy Policy*. 59, 301–11.

Edwards, M. and **Hulme, D.** 1996: Too close for comfort? The impact of official aid on nongovernmental organizations. *World Development* 24, 961–73.

Gómez García. V. and **Montero Bartolomé, M.** 2010: Rural electrification systems based on renewable energy: The social dimensions of an innovative technology. *Technology in Society* 32, 303–11.

Goodman, M.K. 2004: Reading fair trade: Political ecological imaginary and the moral economy of fair trade foods. *Political Geography* 23, 891–915.

Hajat, A., Banks, D., Aiken, R. and **Shackleton, C.M.** 2009: Efficacy of solar power units for small-scale businesses in a remote rural area, South Africa. *Renewable Energy* 34, 2722–27.

Howe, C., Lawrence, J. and **Patel, H.** 2012: *Solar aid: Revolutionizing the way to make energy affordable for everyone going beyond the status quo—creating bigger, better, bolder, faster, and cheaper solutions*. Hult International Business School Publishing.

IEA. 2012; *World energy outlook 2012*. International Energy Agency.

Jackson, P., Ward, N. and **Russell, P.** 2009: Moral economies of food and geographies of responsibility. *Transactions of the Institute of British Geographers* 34, 12–24.

Kamara, J. 1986: *Firewood energy in Sierra Leone—Production, marketing, and household use patterns*. Verlag Weltarchiv.

Katz, R. and **Page, A.** 2010: The role of social enterprise. *Vermont Law Review* 35, 59–103.

Kemausuor, F., Obeng, G.Y., Brew-Hammond, A. and **Duker, A.** 2011: A review of trends, policies

and plans for increasing energy access in Ghana. *Renewable and Sustainable Energy Reviews* 15, 5143–54.

Kemeny, P., Munro, P.G., Schiavone, N., van der Horst, G.A. and **Willans, S.** 2014: Community carging stations in rural sub-Saharan Africa: Commercial success, positive externalities, and growing supply chains. *Energy For Sustainable Development* 23, 228–36.

Khennas, S. 2012: Understanding the political economy and key drivers of energy access in addressing national energy access priorities and policies: African perspective. *Energy Policy* 47, 21–26.

Kornbluth, K., Pon, B. and **Erickson, P.** 2012: An investigation of the cost and performance of a solar-powered LED light designed as an alternative to candles in Zambia: A project case study. *Renewable and Sustainable Energy Reviews* 16, 6737–45.

Lemaire, X. 2011: Off-grid electrification with solar home systems: The experience of a fee-for-service concession in South Africa. *Energy for Sustainable Development* 15, 277–83.

Lighting Africa. 2010: *Solar lighting for the base of the pyramid—Overview of an emerging market*. The World Bank.

Lorenzo, E. 1997: Photovoltaic rural electrification. *Progress in Photovoltaics: Research and Applications* 5, 3–27.

Martinot, E., Chaurey, A., Lew, D., Moreira, J.R. and **Wamukonya, N.** 2002: Renewable energy markets in developing countries. *Annual Review of Energy and the Environment* 27, 309–48.

MEWR. 2009: *Sierra Leone national energy policy*. Freetown: Ministry of Energy and Water Resources.

Munro, P. G., & **van der Horst, G.** (2015). Breaks with the Past: Conflict, Displacement, Resettlement and the Evolution of Forest Socio-Ecologies in Sierra Leone. In J. I. Lahai & T. Lyons, editors, *African Frontiers: Insurgency, Governance and Peacebuilding in Post-Colonial States*. (pp. 119–130). Ashgate Publishing.

Nygaard, I. 2009: The compatibility of rural electrification and promotion of low-carbon technologies in developing countries-the case of solar PV for sub-Saharan Africa. *European Review of Energy Markets* 3, 125–58.

Ondraczek, J. 2013: The sun rises in the east (of Africa): A comparison of the development and status of solar energy markets in Kenya and Tanzania. *Energy Policy* 36, 407–17.

Pode, R. 2010: Solution to enhance the acceptability of solar-powered LED lighting technology. *Renewable and Sustainable Energy Reviews* 14, 1096–103.

Pode, R. 2013: Financing LED solar home systems in developing countries. *Renewable and Sustainable Energy Reviews* 25, 596–629.

Popke, J. 2006: Geography and ethics: Everyday mediations through care and consumption. *Progress in Human Geography* 30, 504–12.

Pueyo, A., Gonzalez, F., Dent, C., & **DeMartino, S.** (2013). *The Evidence of Benefits for Poor People of Increased Renewable Electricity Capacity: Literature Review*, Evidence Report No. 31, Institute of Development Studies.

Richards, P. 1996: *Fighting for the rain forest: War youth and resources in Sierra Leone*. James Currey.

Riddell, J.B. 2005. Sierra Leone: Urban-elite bias, atrocity & debt. *Review of African Political Economy* 32, 115–33.

Sayer, A. 2000: Moral economy and political economy. *Studies in Political Economy* 61, 79–103.

Sovacool, B.K. 2013: Expanding renewable energy access with pro-poor public private partnerships in the developing world. *Energy Strategy Reviews* 1, 181–92.

Suberu, M.Y., Mustafa, M.W., Bashir, N., Muhamad, N.A. and **Mokhtar, A. S.** 2013: Power sector renewable energy integration for expanding access to electricity in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews* 25, 630–42.

Szabó, S., Bódis, K., Huld, T. and **Moner-Girona, M.** 2013: Sustainable energy planning: Leapfrogging the energy poverty gap in Africa. *Renewable and Sustainable Energy Reviews* 28, 500–509.

van der Plas, R.J. and **Hankins, M.** 1998: Solar electricity in Africa: A reality. *Energy Policy* 26, 295–305.

van Rensburg, J., Veldsman, A. and **Jenkins, M.** 2008: From technologists to social enterprise developers: Our journey as 'ICT for development' practitioners in Southern Africa. *Information Technology for Development* 14, 76–89.

Wamukonya, N. 2007: Solar home system electrification as a viable technology option for Africa's development. *Energy Policy* 35, 6–14.

Willans, S., Christiansen, A. and **Munro, P.G.** 2011: *Emerging forms of entrepreneurship: For-profit and not-for-profit partnerships for the dissemination of solar power into rural sub-Saharan Africa*. Paper presented at the The 56th Annual ICSB World Conference, Stockholm, Sweden.