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The value of cooperatives in rural electrification

Annabel Yadoo*, Heather Cruickshank

Centre for Sustainable Development, Engineering Department, University of Cambridge, Cambridge CB2 1PZ, UK

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ABSTRACT

The electricity sectors of many developing countries underwent substantial reforms during the 1980s and 1990s, driven by global agendas of privatization and liberalization. However, rural electrification offered little by way of market incentives for profit-seeking private companies and was often neglected. As a consequence, delivery models for rural electrification need to change. This paper will review the experiences of various rural electrification delivery models that have been established in developing countries, including concessionary models, dealership approaches and the strengthening of small and medium-sized energy businesses. It will use examples from the USA, Bangladesh and Nepal, together with a detailed case study of a Nepali rural electric cooperative, to explore the role that local cooperatives can play in extending electricity access. It is shown that although there is no magic bullet solution to deliver rural electrification, if offered appropriate financial and institutional support, socially orientated cooperative businesses can be a willing, efficient and effective means of extending and managing rural electricity services. It is expected that this paper will be of particular value to policy-makers, donors, project planners and implementers currently working in the field of rural electrification.

1. Introduction

The importance of rural electrification for achieving both human and economic development has been well documented (DFID, 2002; GNESD, 2007; IEA, 2004). However, the provision of electricity to rural areas was often neglected during the widespread privatization and liberalization of electricity sectors during the 1980s and 1990s (Cherni and Preston, 2007; Haanyika, 2006). As it stands, rural electrification in developing countries provides little by way of market incentives for profit-seeking private companies (Haanyika, 2006). It is characterized by geographical remoteness, dispersed consumers, higher costs of supply and maintenance, low consumption and limited ability to pay (Reiche et al., 2000). World Bank research has shown that in some instances, particularly those of the most isolated or poorest of communities, an electrification project may lie beyond both the boundary of market efficiency and that of sustainability (projects that would not be viable under normal market conditions unless the initial costs were subsidized, but could then independently finance their maintenance and operating costs) (Navas-Sabater et al., 2002).

As a consequence of this privatization, several developing countries have had to redress their rural electrification policies and implementation processes (Haanyika, 2006). This paper will review the experiences of the various delivery models that have been established in developing countries, including concessionary models, dealership approaches, and the strengthening of small and medium-sized energy businesses. It will use examples from the USA, Bangladesh and Nepal, together with a detailed case study of a Nepali rural electric cooperative, to explore the role that local cooperatives can play in extending electricity access to the rural poor.

Although the need to improve rural access to modern energy services is well established, the optimal way for achieving this goal remains unclear. This paper highlights the opportunities arising from the involvement of 'third-way' socially orientated cooperative businesses and will be of value to those policy-makers, donors, project planners and implementers working in the field of rural electrification today.

2. Electricity sector reforms and rural electrification

Inspired by the initial success of Chilean and UK reforms pioneered in the late 1970s and early 1980s, numerous developing countries proceeded to privatize and liberalize their electricity sectors during the 1980s and 1990s, believing the prevailing ideology that the market would revitalize their 'decaying state infrastructure' that was 'intrinsically inefficient and inevitably mismanaged' (Cherni and Preston, 2007, pp. 143, 145). According to neo-liberal doctrine, increased liberalization and the

* Corresponding author. Tel.: +44 0 1223 333321; fax: +44 0 1223765625.
E-mail addresses: aly21@cam.ac.uk, annabelyadoo@gmail.com (A. Yadoo).

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privatization of state-owned utilities would encourage competition, lower energy prices and improve sector efficiency, flexibility and transparency (Froggatt and Takács, 2002). Privatization would increase state revenues, provide access to valuable foreign direct investment (supposedly leading to greater macro-economic stability) and reduce fiscal pressures on state budgets (Cherni and Preston, 2007, pp. 144–5).

Although the World Bank emphasized that the reforms' principle objective was service expansion, 'specific policies for rural electrification were not integral to the initial reforms' and it was mistakenly assumed that improvements would be 'an almost inevitable consequence of better market operations' (Cherni and Preston, 2007, p. 145). In general, rural electrification is not considered a profitable market, particularly in developing countries. The clients' physical isolation, the low density of settlements and minimal consumption all increase the per capita and per kWh cost of distribution and maintenance. Unsurprisingly, therefore, rural electrification often found itself left by the wayside following privatization. Initial increases in private investment (particularly in Latin America) fell after 1997 due to 'poor returns and uncertainty about possible regulatory developments' (IEA, 2004, p. 355). On the whole, tariffs have increased in developing countries (particularly in rural areas), rural electrification rates have experienced sharp drops and electricity consumption has declined as a result of the reforms (Haanyika, 2006).

In light of these market inadequacies and a heightened awareness concerning the importance of electrification for human and economic development (particularly with regard to achieving the Millennium Development Goals) (DFID, 2002; GNESD, 2007), the governments of some developing countries such as Brazil and Peru subsequently reasserted their role as key providers of rural electrification. They introduced specific rural electrification laws, regulations, funds, subsidies and authorities, thereby improving their institutional frameworks to better meet service expansion needs (Haanyika, 2006). A specific rural electrification fund even had to be established in Chile, where reforms had initially been considered successful, since 'the progress of rural electrification lagged as a result of the privatization of the power sector' (Barnes and Halpern, 2001, p. 35).

Nevertheless, these retrofit measures left much room for improvement (Cherni and Preston, 2007). For example, the mere creation of a rural electrification fund from 'the proceeds of the sale of the public electricity companies' has proved unlikely to succeed, either the 'urban-based utility (public or private) [often] acquires the majority of funds, [and only extends] service marginally along the periphery of the existing grid' or the 'funds remain unutilized as the traditional utilities, public or private, face strong political and financial pressures to focus their resources on the urban and peri-urban customer base' (Barnes and Halpern, 2001, p. 33). Therefore, alternative delivery models have been sought to better target rural electrification. The outcomes of some of these models will be reviewed in the next section.

3. The experiences of rural electrification delivery models

Private sector investment is often believed to be vital for a programme's long-term sustainability and a number of different approaches aimed at encouraging private sector participation have been tried across developing countries (Barnes and Halpern, 2001). These range from dealer networks offering consumer credit schemes for solar home systems (for example, in Kenya), the creation of concessionary areas for rural electrification (for example, in north-west Argentina) and the assisted development of emerging retail markets for local energy service companies (for example, in India, Sri Lanka and Laos).

The success of the above delivery models has been mixed. While the dealer credit approach has been successful in Kenya, it has tended not to work as well in countries where a strong network presence is not already available (Barnes and Halpern, 2001, p. 33). In Sri Lanka dealers in a World Bank-funded project rejected a credit scheme 'because of the time and difficulties associated with collecting fees' (Bond et al., 2007, p. 6539). The experience with concessionary companies in Peru has shown that they tend to focus on those areas closest to the existing grid network that are most likely to create a profit, rather than prioritizing areas on the basis of social development needs (Miranda and Soria, 2006). Nevertheless, this model has been more successful in countries where output-based contracting subsidies have been introduced (for example, in Chile, Argentina, Cape Verde and Panama) (Barnes and Halpern, 2001).

These output-based targets, 'using private providers and linking payments of subsidies to outputs', appear to be particularly adept at mobilizing private investment whilst ensuring that subsidies are well-targeted and operational efficiency is achieved (Tomkins, 2001, p. 47). For example, 'when many areas are being electrified under a phased programme, grants are paid as a certain number of villages gain access to electricity or a certain number of consumers get connections' (Tomkins, 2001, p. 50). In this way, the government is able to direct the concessionary's investment towards the areas of greatest need, whilst minimizing budgetary expenditure and regulating participating companies on the basis of contracts (Barnes and Halpern, 2001, pp. 33–34). However, even with such subsidies in place, uptake can be slow and the process of monitoring and ensuring accountability can present administrative challenges for governments (Tomkins, 2001, p. 55).

The funding of local businesses to provide electricity services has been favoured by international donors such as the World Bank. Nieuwenhout et al. (2001) point out that this 'approach centralizes the requirement for capital, which can make financing easier' (Bond et al., 2007, p. 6539). The World Bank works alongside motivated communities or local entrepreneurs to develop viable business models before they can seek further assistance with loans and subsidies (Martinot et al., 2001, p. 55). Ensuring that businesses offer a high quality of service is essential since service quality directly impacts their customers' willingness to pay (Nieuwenhout et al., 2001) and untimely fee collection remains one of the most important barriers to a successful business model (Bond et al., 2007).

To combat these pitfalls, some businesses have introduced adjusted payment schedules and tariff levels (such as cross subsidies) for poorer users (Srinivasan, 2005). Prepayment technologies (such as those used in South Africa) can also be used to limit demand and help 'customers not to incur unaffordable consumption costs' (Bekker et al., 2008, p. 3133–4). The small and medium-sized business approach has seen some success. In Zambia, following the requests of local energy service companies (ESCOs), the government no longer donates PV systems but allows ESCOs to purchase the systems from them over a 20-year period, passing on system ownership at the end of the sale (Ellegard et al., 2004, p. 1259–60).

However, while micro-enterprise management models for off-grid rural electrification projects can be successful post-installation (as shown in the model promoted by the international non-governmental organization Practical Action in Peru) (Sanchez, 2007), it is often considerably more challenging to engage local entrepreneurs in the initial capital investment stage. Experience in Mali, Morocco and South Africa shows that local entrepreneurs are not encouraged to become shareholders in the Decentralized Services Societies established by the international

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energy company Electricité de France (EDF) due to the sector's low-to-non-existent profit margins; rather, those who have engaged with the scheme have been the more socially orientated community members who are principally motivated by aspirations of local development (Massé, 2008).

Given the historic inadequacies of large state utilities, coupled with some recent failures to incentivize macro-, meso- or micro-level private sector investment in rural electrification, certain developing countries are now employing an alternative, 'third-way' approach: decentralized delivery by local cooperatives.

4. A cooperative-driven delivery approach

The formation of local cooperatives to increase rural electricity access is not new. The majority of rural USA was electrified in this manner during the 1930s, 1940s and 1950s. In the mid-1930s 90% of rural homes lacked electricity. However, President Roosevelt established the Rural Electrification Administration (REA) in 1935 and the Rural Electrification Act was passed in 1936. Within 13 years—and in spite of the Second World War—locally owned rural electric cooperatives 'borrowing funds from the REA to build lines and provide service on a non-profit basis' were able to double the number of rural electric systems in operation, triple the number of consumers connected and increase the amount of grid distribution lines more than five-fold (NRECA, 2009). By 1953, over 90% of the USA's farms had electricity (NRECA, 2009).

These rural electric cooperatives continue to outstrip the performance of alternative management models in the USA even today, '[c]alculations based on federal government financial reports show that rural electric cooperatives receive the least federal amount of subsidy per consumer' even though they 'have an average of 7 customers per mile [of distribution line] compared to 35 for IOUs [Investor Owned Utilities] and 47 for municipal owned utilities' (NRECA, 2009). Today, 930 rural electric cooperatives (864 distribution and 66 generation and transmission cooperatives) serve 42 million people in 47 states (12% of the USA's population) and own assets worth US$ 112 billion. Employing 70,000 people, they own and maintain four million kilometres (42%) of the nation's electric distribution lines covering 75% of the nation's landmass, deliver 10% of the total kilowatt hours sold and generate nearly 5% of the total electricity produced in the USA each year (NRECA, 2009).

As democratically governed businesses that are motivated by socially orientated goals of local development and closely regulated by their consumers, local cooperatives offer an attractive alternative to (the often ineffective) public sector management or principally profit-motivated private sector involvement. Its decentralized implementation approach also extends significant advantages. Decentralization is thought to 'significantly improve and even shape efforts to expand access to modern energy services, particularly for poor rural women and men' by facilitating 'the active involvement of local actors in development processes, which can help to scale up energy service delivery to the poor' (UNDP, 2009, p. iii). In fact, cooperatives often function on a one member, one vote basis, thereby promoting equal participation and empowering rural people to shape the course of local development. Cooperatives can also benefit from the self-regulatory forces derived from this direct accountability to their customer base, improving both the efficiency and effectiveness of the service provided (Pandey, 2005).

The United States Agency for International Development (USAID) encourages the participation of local communities and consumers in its rural electrification projects in South Asia, believing that 'locally developed and managed solutions have the best chance for sustainability' (CORE, 2008). In Bangladesh, the Rural Electrification Board acts as the apex organization to 70 rural electric cooperatives and has 'gained worldwide recognition as a very successful model for rural energy service delivery with distribution losses around 10% and collections rates around 96%' (CORE, 2008). In Nepal, local cooperatives have considerably advanced the rate of rural electrification and lowered the amount of electricity theft in rural areas (K.C., 2009).

5. Rural electric cooperatives in Bangladesh

The Rural Electrification Board (REB) took over the responsibility of rural electrification from the Bangladesh Power Development Board in 1977. Whereas its predecessor's efforts were principally limited to urban areas, the REB has successfully increased electricity access in rural parts of the country and is regarded 'by many as one of the most successful rural electrification programmes within developing countries' (UNDP, 2009, p. 25). The REB works with rural communities to establish local electrical cooperatives known as Palli Bidyut Samities (PBSs) that develop and distribute electricity. To date, there are 70 PBSs that employ approximately 16,000 people (GNESD, 2007). The PBSs draw up an electrification master plan for their own operational area and their members (the rural consumers) 'participate in decision making through elected representatives to the PBS governing body' (UNDP, 2009, p. 25). The REB must approve the retail tariffs that each cooperative sets for its consumers and while cross subsidies are permitted, 'average tariffs should at least cover costs for operation, maintenance, depreciation and financing' (UNDP, 2009, p. 25).

REB assistance takes the form of 'initial organizational activities, training of manpower, operational and management activities, procurement of funds, liaising with energy utilities and other relevant agencies, and conducting elections' (UNDP, 2009, p. 25). Moreover, the REB offers the PBSs 'subsidized financing through low-interest loans with long repayment periods. During the start-up period (up to six years), cooperatives with losses receive direct subsidies, and a common revolving fund allows them to benefit from cross subsidies' (UNDP, 2009, p. 25). In addition to the subsidies PBSs receive for investments in distribution infrastructure, the REB also negotiates subsidized rates at which the PBSs can purchase power from the national grid (REB, 2009).

The PBSs are independent and privately owned yet remain under the direct regulatory control of the REB who monitors their financial sustainability, procurement processes and management effectiveness. They must sign an annual performance target agreement committing to revenue increases, system loss decreases and new connection increases based on the previous year's achievements (UNDP, 2009). Distribution losses within PBS areas are low at about 16%, compared to 30–35% for the national utility (GNESD, 2007). Additionally, the PBS' collection rate of 96% is 'far higher than that of other utilities', with over US$ 276 million billed and collected from consumers every year (GNESD, 2007, p. 19). Around 47,650 villages now have electricity supplied to their homes following the PBSs' installation of 219,006 kilometres of distribution lines (REB, 2009). Over 170,000 irrigation pumping stations also receive electricity due to the PBSs' efforts in rural Bangladesh (REB, 2009).

6. Electric cooperatives and community-based organizations in Nepal

In 2002, the then Water Resources Minister and Chairman of the Nepal Electricity Authority (NEA), Dipak Gyawali recognized

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that the NEA was under several constraints that significantly restricted its progress with rural electrification. Firstly, registered as a commercial entity, the NEA found itself legally obliged to operate on the basis of profit-maximization and was therefore reluctant to electrify rural areas which can 'never be profitable, at least initially' (Gyawali, 2009). Secondly, it was becoming increasingly difficult for the NEA to mobilize capital for rural electrification schemes and thirdly, the NEA was encountering problems with regard to controlling the theft of electricity, particularly in the Terai region along Nepal's southern border.

At the same time, Nepal had a history of community-based organizations (CBOs) successfully working for local social services and public goods, such as local forestry committees, water supply, irrigation and sanitation working groups, mothers' associations, micro-hydro electric groups and dairy cooperatives, and it was thought that CBO-led grid extensions could also be successful. In particular, the experience of the UNDP's Rural Energy Development Programme (REDP) showed how the legalization of community-level micro-hydro functional groups into cooperatives could help diversify local activities and increase incomes (Neupane, 2009; Subedi, 2009). Legally permitted to issue loans, the newly formed cooperatives began to use the profits generated from electricity sales to offer their members micro-financing for small-scale income generation activities (Neupane, 2009; Subedi, 2009).

Therefore, in 2003, amidst parallel efforts to promote internal unbundling of the generation and distribution functions of the NEA, the Community Electricity Distribution Bylaw was passed. This bylaw allows any organized rural group to buy electricity in bulk from the grid and retail it amongst its users. These CBOs are made responsible for any non-technical losses (that is, theft) occurring within their area. The bylaw also allows for the community-led building of new rural electrification infrastructure. While the NEA provides up to 80% of the capital investment, communities must contribute at least 20% of the total cost of grid extension via labour, household donations, bank loans, or loans and grants from the local village and district development committees (VDCs and DDCs). The policy makers hoped that the CBOs' entry into the institutional framework would lead to 'balanced policy tenure' and that communitarian values and ideas of equity would accompany those of profit. A new 'creative relationship' between the State, private sector and local communities had been struck (Dixit, 2009).

This community-led process of grid extensions received significant government attention during its early years and there were examples of great achievements in rural electrification particularly at the hands of Mothers' Groups and Forest User Groups, despite the highly disruptive political conflict ensuing with the Maoists at the time. The new delivery mode continues to expand the national grid at lower cost than similar extensions financed through the Asian Development Bank or World Bank, reportedly owing to less corruption and the avoidance of the more costly international contractors that tend to be chosen under bulk procurement deals (Gyawali, 2009).

The introduction of CBOs helped improve the transparency of the electrification process, localize decision making and widen the space for dialogue on rural electrification issues (Gyawali, 2009). Their ability to operate outside of the government's direct control can also be beneficial, particularly given Nepal's current state of political upheaval (Gyawali, 2009). Nevertheless, government impetus waned from 2006 as CBO-led electrification was effectively side-lined by 'a total infatuation with export [to India]' (Dixit, 2009). To re-focus attention and effort on CBO-led electrification, members from around 17 rural electric cooperatives and user groups independently established the National Association of Community Electricity Users in Nepal (NACEUN) in 2006 (Ghimire, 2009).

7. The role of NACEUN and experiences to date[1]

NACEUN is the overarching body responsible for the development of the CBOs involved in the grid-extension projects. It was formally established in April 2006 and held its first general meeting in November of that year. NACEUN's main aims and responsibilities include: (1) national level policy advocacy, (2) capacity-building, technical training, administrative and management support for its member organizations, (3) institutional development, and (4) research and promotion of some renewable technologies (for example, biogas and improved cooking stoves). NACEUN has 187 member CBOs spread over 42 districts and 14 district branches (formed where there are five or more CBOs working together). To date, it has assisted the rural electrification process for 79,000 households. Once all projects in the current pipeline are completed (within the next two years), the NACEUN network will include approximately 180,000 households.

NACEUN's first port of contact with the CBOs occurs after their proposal for grid extension has been submitted to the relevant Steering Committee in the Concerns Department of the NEA. Thereafter, NACEUN can informally work with the CBO to improve the proposal before resubmission (if necessary). Following payment of the membership fee (US$ 20/year), the CBO is incorporated into the NACEUN network and can benefit from a wide range of training on subjects such as in-house wiring, electrical safety and productive end uses. The CBOs (or cooperatives, once they have chosen to formally register as such) charge households an initial connection fee (approximately US$ 67 with all in-house wiring, cost of the meter and basic wiring included) and then provide electricity at the tariff rates specified by the NEA for rural areas. The CBOs are free to choose to subsidize the tariff to their poorest members if desired.

Many of the CBOs have formally registered as cooperatives and offer micro-financing loans to their members to promote productive end uses of electricity and other income-generating activities (such as poultry raising, carpentry, computer workshops, etc.). Others are also looking into investing some of their profits into off-grid or near-to-grid systems to further extend electricity provision into nearby areas. However, institutional barriers have hampered the practical application of feed-in tariffs for near-to-grid systems wishing to sell their surplus generation to the grid and the concept faces ongoing opposition from trade union groups within the NEA (Ghimire, 2009; Gyawali, 2009).

Another problem shared by some of the member organizations is an inability to retain personnel once trained as technicians or linesmen. Although one person in each village is trained by NACEUN to be a local electrician, approximately 10–15 of these skilled workers (around 7%) have migrated away from the community to seek more highly paid work in the cities or abroad. Therefore, NACEUN now provides the communities with selection criteria for the appointment of trainee electricians: the person must be between 20 and 45 years old and with an educational background of grades eight to ten (preferably no higher) in the hope that they might remain in the community for longer.

Nevertheless, the CBO-led approach to decentralized electricity distribution and management has been highly successful. Collectively, users in the South Lalitpur area used to spend US$ 455/month to receive electricity from a diesel generator but now

[1] Note that information in this section, unless stated otherwise, is principally based on an interview conducted with Dilli Ghimire, President of NACEUN, on the 4th May 2009 in Kathmandu, Nepal.

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pay their local cooperative US$ 94/month for the energy they use from the national grid (generated from hydropower) (Gyawali, 2009). Self-management has reportedly 'demystified electricity' to cooperatives and community user groups and enabled discussions of the distinction between technical losses and pilferage (Pandey, 2005).

On average, system losses were reduced from around 25% under NEA management to around 15% within one year of community management (mainly achieved through theft reduction) (Pandey, 2005). For example, non-technical losses (theft) in the community of Mugling have reportedly dropped from 35 to 15% following a shift in management from the NEA to local cooperative (Dixit, 2009; K.C., 2009). Similarly, 'unpaid bills from as long as five years were settled once the community took over management' and the NEA was 'paid for the electricity promptly each month based on the bulk sales meter readings' (Pandey, 2005). The CBOs' costs for meter reading and system maintenance are also lower than under the NEA since the linesmen live locally and can 'respond immediately to service disruptions' (Pandey, 2005). On average, the time required to acquire a household meter 'was reduced to one day and the time for a three-phase meter for pumps and industries was also substantially reduced' (Pandey, 2005).

The CBO approach to grid electricity distribution has been particularly successful where the cooperative has also worked at improving the productive uses of electricity (to increase daytime demand) and the capacity of its members to pay for electrical appliances and invest in new businesses. Surrounding infrastructure such as roads and existing commercial activity has played a fundamental role in developing such productive uses (K.C., 2009). Some cooperatives have even been able to generate 'substantial surpluses' from the management of local grid services (Pandey, 2005). However, experts have also expressed a word of caution against allowing cooperatives to grow too large. For example, some fear that the cooperative in South Lalitpur, the case study to be discussed in the following section, might be more vulnerable to local political power struggles now that it encompasses 19 VDCs (K.C., 2009).

8. Case study of the South Lalitpur rural electricity cooperative (SLREC)[2]

The South Lalitpur Electrification Campaign Committee was formed in 1996 and was the first example of a CBO successfully applying for grid extension and taking over local distribution from the NEA. In 2000 the committee formally registered as a cooperative and the South Lalitpur Rural Electricity Cooperative (SLREC) was formed. Today the SLREC encompasses 19 VDC areas, 2321 households and is the largest cooperative within NACEUN. Over the next seven to eight years the SLREC expects to directly distribute to 7000 households.

The cooperative's board is made up of four voluntary members of staff: Chairman, Vice Chairman, Treasurer and a full-time (paid) Secretary who manages daily operations. The cooperative also employs one engineer, two overseers, 12 technicians, one social mobilizer (SM) and one accountant. An annual meeting is held for the 359 general members and shareholders of the cooperative to approve the action plan, policies and budget, while the executive committee (board members plus nine other members, elected every three years) meets on a monthly basis.

All proceeds from the tariff payments go towards the ongoing operation and maintenance costs of the cooperative. Nevertheless, income from this alone would be insufficient for the SLREC to break even. Therefore, the SLREC supplements this income with the sale of electrical appliances, meters, cables and other in-house wiring equipment to their members (bought at wholesale prices from the manufacturers). Interest payments from the micro-financing scheme (described below) also help fund ongoing running costs. Sub-committees are formed to mobilize funds (largely from VDC and DDC donations) and apply to the NEA for further grid extensions within the 19 VDCs. 37 of these sub-committees are currently active, although this number is set to double by next year as new projects are started.

Average domestic consumption is 21 kWh/month. Approximately 85% of consumers consume 15–25 kWh/month, 5% consume under 10 kWh/month and 10% over 25 kWh/month. Those who consume more tend to have higher incomes and might engage in poultry farming activities. The largest consumer is a telecommunications centre that spends US$ 201/month to power a substation in the area, followed by three milk chilling centres that cater for ten VDCs. The majority of users only use electricity for lighting or to run small devices such as radios, televisions and mobile telephone chargers.

The cooperative has set up a revolving fund to provide micro-loans to its members from the seed capital donated by donors and personal contributions from shareholders (there is currently US$ 10,040 in the revolving fund). The SM is employed by the SLREC to work with households and communities interested in receiving loans. Poor households unable to connect to the grid without initial financial assistance are prioritized for receipt of loans, followed by local income-generating activities, productive end uses and welfare projects such as biogas digesters. Loans vary from an average of US$ 60 (plus 10% interest) for a new connection to an average of US$ 268 (plus 14% interest) for a small enterprise and typically require repayment within 12–18 months. From the beginning of the scheme (July 2005) until the end of the last fiscal year (July 2008), these micro-loans were directly responsible for 167 new meter connections, 237 new small enterprises (loans funded carpentry tools, poultry farming, mills, irrigation units, grass cutters and a community milk refrigeration unit) and the building of 23 biogas digesters.

The SM also encourages the formation of savings groups of 15–20 households and subgroups of three to five households that meet her on a monthly basis and assist each other to meet loan repayments when needed. However, approximately 30% of loans are paid late, and there is a shortage of SLREC personnel to enforce timely repayments (the SM is helped by the local linesman but otherwise works alone). In fact, of the seven main savings groups across ten VDCs which have been formed, only one can be said to regularly attend the monthly meetings and meet loan repayments. Households in this savings group belong to a large community with reasonable road infrastructure and they can sell their goods both within their community and at local markets. They have also participated in NACEUN training on poultry farming which has improved their resilience by teaching them how to produce their own chicken feed.

Therefore, although the SLREC's work in rural communities is still occasionally hampered by poor road infrastructure and a lack of personnel to collect loan repayments and tariff payments (approximately 6% are late), the delivery method it provides is considerably more efficient and effective than under the NEA. The SLREC has increased electricity access in rural areas faster than the NEA, users can pay bills in their own homes or at a temporary desk in their own village, users have faster and easier access to meters and appliances and the high level of community participation ensures speedier access to services and a greater

[2] Note that data in this section has been compiled from interviews with various key members of the SLREC (the Secretary, Treasurer, Accountant and Social Mobilizer) that were conducted between the 23rd and 25th of May 2009 in South Lalitpur, Nepal.

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sense of ownership. The productive end uses training provided to the cooperative's members have increased rural incomes, while poorer households are offered financial support (loans) for grid connections. Finally, numerous training events have made members more aware of the services that they could receive from the SLREC and its responsibilities towards them, increasing their ability to hold the management accountable and thereby improve overall service.

9. Policy implications

The experience of the SLREC contains key elements for success that are common to many rural electric cooperatives. Firstly, the cooperative acts primarily in the interest of local development and their *raison d'être* is supported by their member-clients. Nevertheless, these social goals have not been allowed to interfere with the operation of a financially sustainable business. Cooperatives need to generate profit in order to improve their core activities and offer their members additional services such as micro-financing schemes or training on productive end uses. These additional services are popular amongst the SLREC's members and have led to the creation of various micro-enterprises that help raise overall electricity demand. As a consequence, electricity sales (particularly daytime demand) and the cooperative's revenues have increased. This is vital for the cooperative's financial sustainability since the consumption pattern of an average rural household is often limited to one or two hours of electric lighting during the early morning and evening.

Secondly, care is taken to run the cooperative democratically. A one member, one vote policy is in place, while elections and regular meetings are held to improve transparency. The cooperative's executive committee is aware of the responsibility they have to their members and the latter are given the opportunity to hold the committee accountable. Local participation can lead to greater equity and empowerment if appropriate checks and balances are put in place; however community-based delivery is also more vulnerable to cooption and coercion by local power brokers (Cornwall and Jewkes, 1995). Therefore, strong and effective regulation is necessary to prevent the exacerbation of existing power structures and income, ethnic, age or gender divides. In the case of the SLREC this regulation is both internal (via member-wide meetings) and external (through involvement with NACEUN).

However, regulating a wide and dispersed network of cooperatives that provide electricity to remote and rural areas is challenging. An appropriate institutional environment must be created—be this a government regulatory body like the REB in Bangladesh, or a decentralized membership-based self-regulating body such as NACEUN in Nepal. Therefore, an important first step is to strengthen existing institutions (or, more exceptionally, create new ones) that would be able to cope with the necessary regulation enforcement, target-setting and subsidy administration. As seen with NACEUN, this institution could also provide training for the cooperatives' committees to ensure that staff are sufficiently skilled, for example in account-keeping and management.

The SLREC's experience also underlines potential pitfalls for cooperative-led delivery models and these should be borne in mind when designing policy for future cooperative electricity distribution systems. For example, cooperatives might wish to significantly expand their geographical service area so as to further their social goals, increase their revenues and take advantage of economies of scale. However, if their coverage grows too wide the cooperative might find itself having to service and collect tariff payments over a vast area with poor road infrastructure and limited personnel. Ironically, this challenge would be similar to that of a centralised distributor such as a state utility (for example, the NEA). A careful balance needs to be struck to ensure that a high quality service is provided across the service area, particularly during a cooperative's early years when it might not be able to employ sufficient numbers of adequately trained staff to service a larger area. Assistance could come in the form of a favourable policy environment that offers cooperatives target-based subsidies, such as in Bangladesh. These subsidies could be used to reward efficient cooperatives, relieving the financial pressure and detracting from their need to continuously seek out new clients and increase demand.

Transferring the responsibility and ownership of electricity distribution to local communities increases their communal workload and not all positions on the executive committee are necessarily paid. Therefore, the aforementioned advantages of cooperative-led delivery—improvements to service, the opportunity for micro-financing, a sense of empowerment and so forth—must be experienced by the local population for them to endorse the approach long-term. In Bangladesh and Nepal member-clients have seen such improvements and the future success of the cooperative delivery model elsewhere will also depend on these experiences. Therefore, care must be taken to ensure that operations are as democratic and transparent as possible and that the cooperative is not subverted or co-opted by local power brokers. For this reason it is essential to design policies that establish effective regulatory mechanisms in countries where a cooperative-led approach is contemplated.

10. Conclusions

The case study and country-wide experiences of Bangladesh and Nepal have shown that while local cooperatives are no magic bullet solution, with the appropriate financial and institutional support, they can represent a highly favourable delivery mechanism for rural electrification in developing countries. Examples have shown that while the entry and longer-term commitment of profit-motivated enterprises may be hard to achieve, socially orientated cooperatives are more inclined to contribute to a sector that will improve local living conditions even if profit margins remain minimal.

Due to the nature of rural electrification, both private enterprises and cooperatives are likely to require carefully crafted subsidies to ensure that they can at least break even. However, the USA experience has shown that rural electric cooperatives require fewer subsidies than private investor-owned or municipality-owned utilities, despite being disadvantaged with far fewer customers per kilometre of distribution line.

Furthermore, with the added advantages of being decentralized and community-led, cooperatives have shown to provide a more efficient and effective service to local electricity consumers and can extend the national grid at a faster rate than central utilities. Operation and maintenance costs have been lowered and distribution losses (particularly non-technical losses derived from pilferage) have been significantly reduced where cooperatives have taken over management from public utilities. Better-informed cooperative members are also more able to hold the management accountable for the service provided and ensure improvements for the customer base through the cooperatives' system of self-regulation.

As a result of these findings, rural electrification policy-makers, donors, project planners and implementers are advised to focus more of their efforts on strengthening local cooperatives and encouraging other socially orientated community-based

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organizations to become involved in the delivery of electricity services in rural areas. At the micro-level, this assistance should be tailored to the needs of individual cases. For example, it might take the form of financing, training or advice on issues such as, electricity end uses, effective accounting procedures and micro-financing, depending on the lack of expertise in a particular community. At the wider institutional level, work should be done to ensure that a favourable policy environment, effective regulatory mechanisms and appropriate subsidies are established so that the cooperatives are provided with the necessary financial and institutional support to effectively and efficiently deliver electricity services to rural areas.

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