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Rural Electrification Initiatives in Fiji – A Case Study of Solar Home Systems

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Abstract

Fiji is striving towards to provide its entire population with access to modern forms of energy, especially access to electricity. In 2007, 89% of the population had access to electricity which comprised 82% of rural and 96% of urban dwellers. Although access to electricity in rural areas is still significantly low compared with urban areas , it represents a marked improvement from 69 % in 2003. The current (2014) estimates of overall national electrification rate are 92- 95% .The progress in rural electrification can mainly be attributed to a number of on-going initiatives including main grid extensions, solar home systems, diesel mini-grids and pico-hydro schemes but the solar home systems (SHS) program is the most popular and preferred option in remote rural and maritime regions.

Keywords: *Electrification rate, Solar Home System (SHS), Fiji*

1. Introduction

The challenges of providing electricity services to communities in smaller islands and remote rural areas of Fiji are multi-faceted and are further compounded by their geographical distances from the main electrical grids. Also, as the infrastructure developments for electricity supply are capital intensive, the typically lower power demands and low returns in these areas do not generally encourage investments from the power utility or any other private investors. Thus, the members of the public in such localities mainly rely on State assistance for their electricity needs.

In addition to grid extension wherever feasible, there are two common options for electrification in Fijian rural communities are (i) village diesel generator based mini-grid systems and (jj) Solar Home Systems (SHS). The main criterion underpinning the preferred option includes utilization of clean energy resources, affordable and reliable power system and more importantly, the least-cost option.

The SHS initiative has been found to be the most cost-effective and affordable to the end users. By the end of 2014, the Department of Energy (DoE) under its Rural Electrification initiative had installed over 5,700 SHS, directly assisting over 28, 000 people across the country (DoE, 2014 II).

2. Policy Frameworks

The overarching policy guideline for national development in Fiji is the Green Growth Framework (GGF) of 2015 (PIDF,2014). The GGF has ten thematic focus areas which include Energy Security as well as Technology and Innovation respectively. The GGF is closely aligned to the National Sustainable Energy for All (SE4All) Initiative and the National Energy Policy. The main targets are that all households be electrified by 2020 and the share of renewable energy in electricity generation will be 80 % by 2020. Long term targets are to double the share of renewable energy in the overall energy mix to up to 25 % by 2030. Moreover, energy supplies should be clean, affordable, environmentally friendly and sustainable.

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Government also has a Rural Electrification Policy through which the costs for energy infrastructure are largely subsided in order to provide electricity to the rural, remote and maritime communities (DoE, 2014 I). The SHS program is one of the major programs under the Rural Electrification initiatives. The Department of Energy (DoE) manages the rural electricity programme which is heavily subsidised by the government. This has resulted in the establishment of 500 diesel generator based mini-grids and more than 1500 grid extensions since the programme began in 1994(DoE, 2014 III).

3. Quasi-RESCO Model

The SHS project implementation, maintenance and management approach is an extension of the Renewable Energy Service Company (RESCO) model. The SHSs are fully funded, maintained and owned by the Government, which partners with RESCOs through formal contracts for servicing and maintenance works. The end-users are levied a reasonable and affordable service fee per month, which is paid 6 monthly in advance. The table below summarizes the details of the SHS program.

Table 1: Details of Government funded Solar Home Systems

Project Type	SHS Type I (2009 – 2013)	SHS Type II (2014 to present)
Major components	Solar Panels 2 x 50Wp Battery 100Ah DC LED lights: 1 x 1W DC CFL lights: 3 x 11W & 1 x 7W Charge Controller 1 x 10A	Solar Panels 2 x 135 Wp Battery 200Ah DC LED lights: 3 x 9 W, 1 x 7W, 1 x 1W Charge Controller 1 x 20A, Inverter 300 W
No. Installed (2014)	3460	2346
Refundable End User Contribution (FJD)	84	108
Monthly service fee (FJD)	14	18

However, there are only a small number of RESCOs operating in Fiji and even fewer in rural and maritime areas. Usually, either two or at most three RESCOs are contracted on an annual basis through DoE's tendering process to carry out servicing and maintenance works. Each household with SHS is assigned to one of the six Service Zones, where each RESCO has a defined non-overlapping geographical boundary as its area of operations.

Table 2: Summary of SHS servicing and maintenance plan – 2015 (source: DoE)

Service Zone	1	2	3	4	5	6
Service Areas	Bua	Macuata	Cakaudrove	Lomaiviti, Kadavu, Rewa	Yasawa, Rotuma, Viti Levu	Lau
No. of SHS	992	1078	1640	802	873	421

Basically, service zones 1, 2, 3 and part of zone 5 are SHS on rural and remote mainland's predominantly on second largest island of Vanualevu and the other zones cover the maritime islands. At the end of 2015, a total of 5806 SHS were on ground.

The DOE SHS programme has been rolled out in 10 phases with the pilot phase implemented in 2002 when 259 systems were installed in Vanua Levu. As fig.1 shows, by the end of current 11th phase, a total of 9,000 SHS systems would be in existence across Fiji.

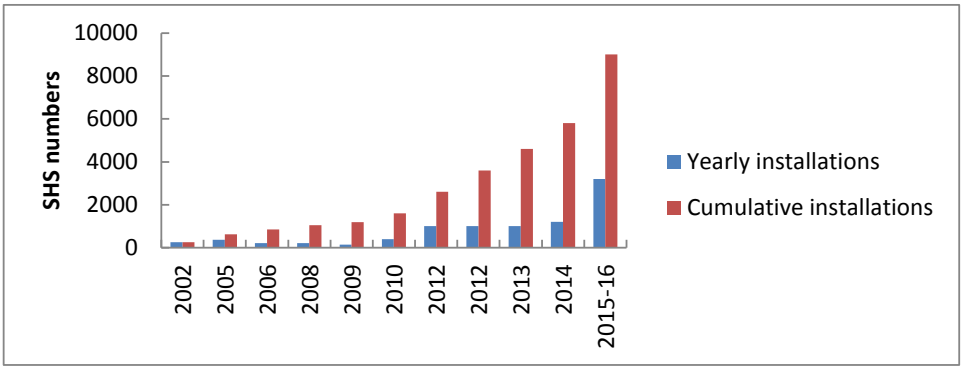

Figure 1: Yearly and cumulative SHS installations (source: DoE)

4. SWOT Analysis of Quasi-RESCO Model

Table 3: SWOT analysis of the Government funded Solar Home Systems

Strengths	Weaknesses
• Provision of clean and affordable electricity services. • Sustainability of the projects is guaranteed as SHS is maintained by a government entity(DoE). • Rural and remote communities are not burdened with maintenance and servicing costs. • In some communities, village solar managers collect monthly rental from individual households and handover to designated Revenue collectors from DoE.	• Rural market for SHS maintenance and backup support is restricted to Government contracted service providers. • Accumulating arrears due to defaulting SHS customers. • Limited transfer of Technical knowledge to SHS households. • Recurring annual cost to Government for procurement of replacement equipment and costs for payments of maintenance contractors. • Irresponsible use of SHS by households; battery misuse and system overloading impacts battery life. • Not all households could be visited by DoE officials during the scheduled revenue collection trips, given the geographical spread of SHS customers and transport logistics.
Opportunities	**Threats**
• To open up the market for RESCOs for SHS service and maintenance works, enabling business opportunities for more companies, SME's and individuals that would generate economic activities in rural areas. • Upgrade of system sizes/capacity to cater for growing electricity demand by households. • Training and knowledge transfer to communities on SHS technical aspects. • Government to transfer the ownership of SHS to individual households and the savings from the	• Lack of care for SHS by individual households. • Misuse of the SHS by households reduces project components lifetime. • Non-payment for maintenance jeopardise the whole initiative.

avoided costs of service and maintenance can be diverted to other projects.	

5. Impacts of SHS Program

Most SHS recipients have directly benefitted through having improved basic lighting in their homes and consequently reducing their dependence on expensive fuels like kerosene, benzene and diesel which were previously used for lighting. Also, the time spent and transportation costs to reach the usually distant commercial centers to purchase fuels are now utilized for other income generation activities including farming.. The extended lighting hours in these households as a result of SHS has enabled improved night time study facilities for school children and also assist the women with their daily household chores/weaving etc. Similarly, the introduction of Type II SHS with inverters has provided the supporting infrastructure for better communications and entertainment such as radios/TVs, and use of computers. With the spread of cellular network in remote areas, phone charging has become a daily need for most of the remote population. Moreover, fuel supply chain issues with associated logistical challenges of transportation to remote rural and maritime locations from the main business centers is of much lesser concern to the recipients of SHSs. The families assisted through the SHS are relieved of their former regular financial costs of repair and periodic maintenance of their kerosene and/or benzene lamps and in few cases diesel generator systems. In addition, the numerous health and environmental benefits of the use of clean, affordable, renewable solar energy has catalyzed positive social changes into these communities. Above all, the avoided dependence on fossil fuels for lighting purposes in these communities, contributes towards the national goal of reducing fuel imports and increasing the share of renewable energy into our national energy mix. Furthermore, the SHS program has had significant impacts on improving Fiji's national electrification rate.

A 2012 study (Urmee and Harries, 2012) surveyed one hundred and five SHS using households in Fiji and found that 84% of the respondents had an increase in their quality of life. They did not report any significant income-generation activities emanating from this initiative. However, a similar study conducted in Bangladesh (Urmee and Harries,2011) reported that SHS can be used productively to create extra income. Some of the driving factors for a successful SHS programme were identified as systems designed to fulfil user's needs and a sense of ownership.

Figure 2: A typical Solar Home System in rural Fiji (Photo: DoE)

Figure 3: SHS lighting for income generation: an example from Tonga (Photo: IUCN/Atul Raturi)

6. Challenges

The main challenge is ensuring the sustainability of these solar projects and improving the overall management of the SHS program. The current practice of managing the SHSs entails the government issuing short-term service and maintenance contracts to RESCOs for specific project localities. However, the RESCOs are not necessarily the same as the ones that initially designed and installed the SHSs. This discontinuation of services from RESCOs does not guarantee a commitment from their end to see successful operation of the SHSs for the expected project lifetime. Also there are no incentives for the RESCOs to make every SHS work properly because it could be perceived as limiting future business opportunities for the RESCOs. As such, there is high possibility that standards of service and maintenance works carried out by RESCOs could be compromised compared with if there was some system of direct financial reward to the RESCOs for ensuring continued operations of SHSs.

The current practice of SHS maintenance requires RESCOs to visit their designated service areas at least once every 3 months and any requests to attend to technical issues that arise after the RESCOs scheduled visit usually takes considerably longer period of time to respond. This warrants a significant shift in the current practice.

Another significant challenge is the recovery of arrears (maintenance fee) as a result of defaulting customers, which was around 1000 SHS customers in 2015. However, this challenge is mostly a result of those SHS where the pre-payment meters were either non-functional and households had to pay a standard monthly fee or where pre-payment meters and/or cut-off switches were not part of the SHS installed. However, the DoE through a dedicated consultations program targeting such defaulting SHS customers can improve the situation if not solved completely. On the other hand, although relatively expensive but upgrading the SHS with technical features such as cut-off switches as part of charge controller would be better.

Another area of concern for the rural electrification projects including SHSs is the absence of private sector investments in electricity generation for the rural and maritime areas. The numerous incentives provided by the Government including supportive national policies for uptake of renewable energy projects, have failed to materialize into a truly RESCO model for electricity supply at community level. The greatest challenge faced by the Government is to find ways to reduce its direct role in the RESCO process and focus on a regulatory framework for anexpanded RESCO model.

7. Way Forward for SHS program

SHS program has not been operating under a true RESCO model because Governmenet is still financing the servicing and maintaemanace as well as having absolute control over the projects. Moreover, most of the SHS

capital financing is donor-funded . Thus, there is a need to open the market and let the SHS households and RESCOs to operate freely. This will result in fewer blackout periods for customers as they will not have to wait for the periodic visit by Government contracted service providers and the Government can concentrate on other energy projects since the DoE will not be involved in maintenance and revenue collections. This presents an opportunity for Government to become more strategic and focus more on its core role in the energy sector of providing access to electricity rather than managing energy projects. Overall, the removal of government control over the SHS will enhance the sense of ownership for SHS customers.

Alternatively, in view of the present system of contracting RESCOs by Government, there is a need for long term contracts with RESCOs which bundles together; system design, supply, installation and service & maintenance contracts, which could bring about more RESCOs to participate through competitive tender process, conducted periodically by government. This would also encourage more genuine commitments from RESCOs leading to enhancement in their standards of service delivery as well. Either way, the monitoring system for SHS program within DoE needs strengthening and timely evaluations for continuous improvements.

Furthermore, Government needs to come up with other options to enable financing for SHS rather than people just waiting for DoE to roll out SHS projects annually, where households have to wait on average between 14 to 18 months from the time of payment of their contribution to DoE and the time they get a SHS installed. With alternative financing options, people can still benefit from a reasonable level of subsidy from Government for their capital costs and hence can have other arrangements for regular system servicing and maintenance with their preferred RESCO. This would not only open up the market for more RESCOs to participate in SHS program but provide options for households to acquire different sizes of SHS, usually slightly larger than the Type II systems supplied by DoE, depending on the energy needs of households. With the above, the DoE can provide standard designs and technical requirements for a range of SHS sizes that the people can choose from. However, the Government needs to ensure at the same time, that the alternative financing mechanism(s) is accessible, affordable and reliable to ordinary Fijians.

Moreover, some changes to policies and regulations governing the energy sector is necessary. Especially, the review of national rural electrification policy and its limitations on SHS program beneficiaries. Likewise, regulations need reconsiderations to allow some level of flexibility and inclusivity with regards to registartion and licencing of electricians and RESCOs, in view of potential solar technicians and smaller RESCOs that could participate in SHS program from a broader spectrum of the society. In addition, the abovementioned regulatory changes would enable more choices for SHS customers and provide certainity and confidence to all stakeholders. Similarly, enforcement of technical standards for SHS installations including for servicing and maintenance works and ensuring compliance by all stakeholders through a more responsive regulatory framework can contribute immensely to the sustainability of SHS program in Fiji.

8. Conclusions

The SHS program has over the years provided affordable lighting solutions to many Fijian households in rural, remote and maritime communities. It has helped bring positive changes to the lifestyles of the common people enabling better environment for children's education, connecting people with modern means of communication through cell phones, televisions etc. In short, SHS program is a critical factor towards Fiji achieving its Sustainable Energy for All goals and hence supporting SDG goal seven. Cutting down the use of kerosene for lighting will also have an immediate impact on black-carbon emissions which is considered a potent short-lived climate pollutant.

Fiji could consider provision of electricity to the remaining rural and maritime communities by grouping all such SHS projects into a single national comprehensive project and possibly make submissions to the Green Climate Fund (GCF) for financing. This comprehensive SHS program could be part of a broader national Green House Gas (GHG) mitigation program. Training and capacity building are of paramount importance to make the SHS programme a sustainable initiative.

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