Final report for

‘Innovation and Replication support for Energy Entrepreneurs’

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S3IDF
The Small-Scale Sustainable Infrastructure Development Fund

SELCO FOUNDATION

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Introduction:

A. Overview- Innovation and Replication:

Through the 2.5 year experience of the SELCO Incubation center, there was a clear understanding that preliminary support to entrepreneurs would need to be in the form of training, exposure to field realities, business support in sales, logistics and technical aspects as well as investment, based on organizational maturity. This was facilitated taking into account field and operational challenges, so as to make the Incubation process more relevant to the circumstances and needs of the entrepreneur.

It was soon realized that a form of secondary support was also critical for these newly incubated entrepreneurs/organizations to effectively implement solutions on the ground. This support was essential to implement innovative solutions or incorporate innovative processes within the enterprise. This could be facilitated by leveraging the field experiences of SELCO and SELCO Foundation and replicating relevant processes and solutions- technological, financial and business model-oriented.

With two decades of grassroots level experience, SELCO Private limited and SELCO Foundation were in a position to build up a database of innovative processes across categories, suggest those with high potential for replication in various contexts and facilitate the implementation of the same with Incubatees and partners of the SELCO Incubation center.

The goal within SELCO Foundation has been to effectively and efficiently ensure adaptation or replication of solutions suited to specific contexts rather than attempting a 'cookie-cutter' approach to scale up. Replication would further diversify the reach of incubatees and other partners, thus linking more poor people with sustainable energy for household needs or productive use. Furthermore, this would be a value-addition provided by the SELCO Incubation Centre in building the required ecosystem for energy access. Through initial discussions with incubates and partners, the facilitation and support was better articulated in terms of financing, technological support and operational support. Consequently, interest was expressed in piloting some of the more established innovative approaches in their own varied own geographies.

Innovation, in this context, would be defined as the introduction of a unique product, service, system, process or approach or a combination of more than one, influenced by the specific needs in a certain geography or community that requires alternate approaches for undertaking the technological, financial and/or dissemination aspects of the solution. It is observed that in the process of reaching out to economically poorer communities and deeper in terms of the array of energy services, complexities emerge from the varied local conditions and contexts. To ensure that interventions have impact and sustain themselves, it is important to localize the solutions as well, and this is part of where the innovation itself lies.

For example, solar powered portable light products with low-weight batteries are not an innovation per say and are common in many rural regions in India as back-up or emergency lights. However, in the context of an urban un-electrified slum where households lack the ability to avail loans and therefore, cannot purchase energy products or in the context of a Tribal community where cash flows are limited or occur on a daily basis, it could result in an Innovation of sorts. A daily rental model of solar charged portable lights

and batteries, operated or owned by a local community member, maintained by an established servicing entity where operational costs are covered through the daily rentals, makes it an impactful innovation with high potential for long term sustainability.

Similarly, in areas of Bihar where Consumer finance is available through Self Help Groups (SHGs) managed by Community development and Micro Finance institutions, a Revolving Fund would be a regular financing process of the SHG. However, in regions of Manipur where SHGs and their formation are still at nascent stages, creation of a Revolving Fund would greatly enhance the ability of individuals to access consumer finance in an easier manner while also ensuring long term sustainability of the Fund pool itself.

In the context of this project, innovations have been largely in the form of financial processes, Business processes and/or Product innovations.

Financial process innovations could be in the following forms to address specific issues of stakeholders. This is however not an exhaustive list by any means.

- 25-100% Bank guarantees for initial set of energy loans (risk mitigation strategies for financiers who decide to lend for energy access solutions)
- Subsidies on margin money down payment, i.e. user contribution of the loan (to address end user's inability to pay the full price of a product/solution within a given time period)
- Interest subsidy on loan (to address end user's inability to pay a market rate of interest on a scheduled basis)
- Revolving Fund (to address inability of end users to access institutional financing)
- Partial and matched funding (to address inability of a single investor to take complete risk)
- Business process innovations are those attempting to change the mode in which the solution is disseminated or the operational model – of internal functioning or of externally reaching out to the end user. This could include:
- The use of Entrepreneur-run interventions or partner-run interventions when individual end users prefer renting a particular solution or paying per use rather than owning it (solar powered projector for movies, mixer-grinder or a water purification unit).
- The use of local village youth or electricians as agents to maintain solar energy systems within a certain radius in exchange for a commission on each servicing. This reduces the transportation costs for a technician to go out into the field while also building local capacity to maintain systems; thereby increasing confidence amongst end users about the system's functioning.
- Technology product innovations could include:
- Identification, modification and customization of an existing market product to suit the needs of a specific community- for example, an energy efficient solar powered projector, fitted with an android device and content to be used as a digital aid in the classroom in un-electrified schools.
- Redesigning a product, with support from a manufacturer- for example, new motor designs for silk reeling machines to ensure energy efficiency while retaining or improving productivity.
- Repurposing a product

In this particular context, the lack of modern energy access for relatively poor, under-served and/or remote rural and urban communities is the core issue being addressed through these innovations. Estimates suggest that in India over 290 million people live without access to electricity. According to the Central Electricity Authority, 31,981 villages in India remain unelectrified as on 31st December, 2013. Combine this with estimates [1]that suggest expenditure on fuel and light by the urban and rural poor is the third highest expenditure item after food and health, with poorer households spending up to 20% of their incomes on energy sources including kerosene and candles[2][3]. Experience suggests that most rural areas with access to the grid face issues with the reliability, availability and quality of power supplied. What this reveals is an opportunity for plugging the energy gap by leapfrogging to decentralised, renewable sources of energy, and facilitating improvements in basic quality of life as well as productivity at the household and village level[4]. These alternate solutions allow for local generation and use, overcoming problems such as increasing demand on the centralized grid, increasing cost of traditional fuels, transmission losses and so on.

In recent times, there have been a good number of enterprises and organizations, including the Innovation partners and Incubatees are attempting to take up this opportunity. Energy enterprises with holistic solutions (customized technology with affordable financing and maintenance mechanism) have shown that they can play an integral role in bridging the gap in the provision of cleaner, reliable energy services that improve quality of living for the household, livelihood opportunities for individuals and communities and have the potential to stimulate local development. However, while measures and schemes have been introduced to support dissemination of market based decentralized renewable energy solutions, they are often restricted to measures such as subsidies and tax incentives. What is missed out in the process is the creation of more conducive conditions for these newer enterprises and the development of a supportive ecosystem including technological innovations and increased product range, human resource development and financing options for end users.

Towards this effort, the SELCO Incubation Centre and its partners GIZ and the SELCO Foundation initiated a project entitled 'Innovation support for Entrepreneurs' to single out innovations suitable for replication and scale up by incubatees and partners within the energy access space. These would address certain barriers in the current ecosystem. The project began in April 2014 with a scoping study to identify and short list innovations relevant for each specific Incubatee and partner who were part of this programme. A total of 6 innovative processes were identified for replication through 8 Incubatees and partners.

The organizations include Mangaal, Pushan, Rural Resources and Training Center (RRTC), SELCO hub in Bihar, Tribal Community lab (interventions supported by Abha Innovations, Onergy) and Boond.

Over the past year, 17 replications across 6 different types of innovations were tested/piloted/implemented with 8 incubatees and partners. Following the implementation, this report seeks to consolidate the immediate results of the project, the process used for such replication, the key challenges faced and proposes some recommendations for relevant stakeholders.

B. Innovation and Replication Partners

In addition to the specific incubatee or partner, the key innovation partners involved in the replication include SELCO India, SELCO Incubation Center (hosted by the Small Scale Sustainable Infrastructure Development Fund-S3IDF) and SELCO Foundation.

SELCO India, established in 1995, is a social enterprise whose mission is to enhance the quality of life of underserved households and livelihoods through sustainable energy solutions and services. SELCO India aims to empower its customer by providing a complete package of product, service and consumer financing through grameena banks, cooperative societies, commercial banks and micro-finance institutions.

Created in 2010, SELCO Foundation aims to create a holistic ecosystem needed to deploy reliable energy services, for the benefit of impoverished segments in society. The Foundation works to link the benefits of sustainable energy to poverty eradication by collaborating with NGOs, local financial institutions, education institutions and social enterprises. The solution framework adopted by SELCO Foundation is to create a network of research and development Labs which will be an open source initiative capable of bringing social innovations to scale. The Foundation will be an anchor body that plays a pivotal role in catalyzing innovative and replicable processes of tailored sustainable energy solutions via a bottom top approach.

The Small Scale Sustainable Infrastructure Development Fund (S3IDF) is an organization focused on the creation of enabling conditions, transfer of technology know-how and provision of leveraged financial support for entrepreneurs engaged in delivering socio-economic infrastructure amenities to underserved communities. The SELCO Incubation Centre was established in 2012 under the aegis of the S3IDF, with support from GIZ and others, in order to nurture and empower the next generation of sustainable energy entrepreneurs for the under-served communities in different parts of INDIA. SELCO Incubation Centre, inspired by SELCO India, is responsible for identifying budding entrepreneurs and converting their business ideas into full fledged sustainable businesses, addressing energy access challenges of the poor.

Therefore, SELCO India initiated a number of these innovations in its effort to improve last mile energy access to the poor and underserved. Consequently, SELCO Foundation extended this work by understanding needs of specific communities- rural, urban, and tribal and designing customized innovations for each, with many having the potential to be further customized and replicated across other end-user segments. SELCO Foundation is also engaged in the broader work of

1 Level and Pattern of consumption expenditure, 2009-10, NSSO 66th round

2 Productive Uses of Energy for Rural Development. Energy and Environment Review. Coauthor with Anil Caabral and Sachin Agarwal. 2005.

3 The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid. Hammond et al. 2007

4 Productive Uses of Energy for Rural Development. Energy and Environment Review. Coauthor with Anil Caabral and Sachin Agarwal. 2005

building the ecosystem around these innovations to ensure their impact and sustainability. SELCO Incubation center, as an energy-entrepreneur focused initiative under S3IDF, attempts to incubate entrepreneurs/enterprises that have the inclination and ability to replicate the successful processes of the 2 other entities. The Incubation center, along with the SELCO Foundation, also supports in local ecosystem building in the new regions where the entrepreneurs work to ensure long term sustainability of the business model.

The replication partners include:

- Mangaal, Manipur
- Pushan, Madhya Pradesh
- Rural Resource and Training Centre (RRTC) in Meghalaya
- Onergy working in West Bengal and Odisha.
- Abha Innovations, Odisha
- Boond, Rajasthan and Uttar Pradesh

In addition, partner entities such as Tribal Community Lab in Odisha, and SELCO Hub in Bihar who work with entrepreneurs under the guidance of the SELCO Incubation Centre were also included in the group.

Many more services like photocopying, scanning and printing
have been added to the core services of integrated Energy Center replication.

Process involved in replication:

The process by which innovations were chosen and replication was undertaken is summarized in the sections below

A. Collating list of Innovations
The first step as part of the study included collating an extensive list of innovations developed by SELCO INDIA and SELCO Foundation, spanning the categories of financial innovations, business and process innovations, and technology innovations from various case studies, reports, and interviews with SELCO staff. The comprehensive list of innovations is available as a separate document.

The list includes processes and models such as financial innovations for bank financing of solar home lighting systems to process innovations around improved mechanisms of sales and models to providing technological solutions for immediate energy for those who may not be able to avail of institutional financing.

B. Short listing Innovations to be replicated with Incubatees and partners
The next step of the study included sharing the list with the Incubatees and partners to enable them to think about what were potentially replicable in their own contexts. This was followed up by in-depth interviews and field visits with the Incubatees, partners and the SELCO Incubation Center staff. The objective of the exercise was to understand which of the innovations would be suitable for the respective incubatees and partners. During this process, needs that required energy interventions or interventions that could help propagate energy access, were mapped against similar existing interventions to ascertain what could be replicated. As an illustration, the requirement for after sales service camps in very remote areas was one of the pressing needs that were identified.

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Given below are a set of interventions across Financial, Technological and Business model that were shortlisted as part of the scoping study for 4 of the entities.

Table 1: List of interventions shortlisted based on scoping study

Mangaal (Manipur)	Pushan (Madhya Pradesh)	SELCO Regional Hub (Odisha)	BNGVN (Maharashtra)
Margin Money support	Hawker Model	Bank Guarantees	Solar Refrigeration
Transaction Cost Support	Light for Education	Revolving Fund	Laptop Charging Station
Bank Guarantees	Mobile Charging Kiosk	Service and Business Associate	Solar Drier
Solar Service Camp	DRI Scheme	DC Fans	
Solar Village Concept	Business Associate	Hawker Model	
Solar Drier - Fish	Integrated Energy Center	Light for Education	
Solar Insect Trap	Lighting systems - Poultry Farms	Integrated Energy Center	
Paddy Thresher	Margin Money support	Solar Drier	
Integrated Energy Center	Solar Minigrids	Airlite	
Light for Education	Paddy Thresher	Solar Projectors	
Box type Solar Cooker	Airlite	DC Charging for Laptops	
Institutional Direct / steam Cooking	Solar Fencing	Paddy Thresher	
Solar powered sewing machines	Solar DC Fans		
Solar Street Lights			
Solar Water Pumping			

In addition to the above organizations, the SELCO hub in Bihar and Tribal Community Lab that work with entrepreneurs were also identified as partners in replication. Certain new needs for which solutions do not currently exist in a readily implementable form have also been identified. These include projects such as the need for easily portable, plug and play systems in disaster prone regions of North east and Orissa, institutional cooking in these regions and so on. Work on some of these has begun but still at a pilot stage.

C. Analysis

Following the short listing process, the S3IDF and SELCO Foundation staff analyzed the data and inputs that resulted from the above mentioned efforts and discussed the same with the respective Incubatees/partners. The results of this exercise formed the basis of the conclusions and next steps for the scoping study report.

D. Project Execution

Following the scoping report, further discussion was undertaken with the incubatees and partners to determine the specific projects-geographies, technology specifications (as required), the operational model, the financing involved and the leverage from other sources. The required support from SELCO Foundation and S3IDF was then articulated to begin execution of the project. The support did not include community mobilization and field level operational details.

E. Outcomes and Evaluation

At this juncture, the immediate outputs and outcomes of projects have been studied and details of challenges faced and key learnings at a larger level have been captured. This document attempts to detail out a subset of the replication projects implemented and capture aspects of them as mentioned above.

Sewing machine with an efficient motor replicated by Pushan

Replication of Innovations:

Given below is a quick snapshot of the mixture of financial, business-related and product-based innovative processes that were replicated over the course of the year. From the original set of feasible innovations proposed during the Scoping study, these innovations were finally chosen for replication largely based on the following criteria:

- Community, End user needs and their urgency
- Ecosystem gap in a particular region that became the main obstacle at that point in time.
- Internal capacity to actually operationalize or install the solution and provide servicing (from the replication partner's perspective)
- Technological viability and existence of relatively established vendor linkages for product innovations
- To some extent, priority concern or priority community from the Replication partner's perspective

For the final 6 innovations replicated, the table below includes a brief description of the innovation and its need, benefits that accrue, the area where it has been tried out and the organization(s) through whom the innovation was replicated. In the next section, a sample of this set has been chosen to provide a more detailed idea of the project cycle itself.

Table 2: List of innovations replicated under the project

Innovation	Description and linkages	Need and Benefits	Initial Projects	Replication
Financial innovations				
Revolving Fund (for end user financing in the absence of active financial network)	This is essential a fund used to facilitate end user financing through a community partner in the absence of a bank. The repayment of loans helps refurbish the fund to further extend loans to other end users. Typically, an implementing partner would keep a part of the recovery as Administrative fee for Collections and Fund maintenance.	• Provides an immediate means of facilitating end user financing in the absence of an active bank network • Helps establish creditworthiness for customers • Helps establish a stronger case for solar energy systems, given bank perceptions about risk.	• Solar Home lighting systems financed by Bhagini Nivedita Gramin Vigyan Niketan, Maharashtra; • Systems financed for Puttur basket weavers community in Karnataka	Mangaal with 10 households in West Imphal and Churachandpur in Manipur.
Business Process Innovations				
Service Camp (to restore confidence among end-users and generate new enquiries)	This is an effort to undertake servicing of systems in an area with the aim of building confidence around solar energy systems while also creating an opportunity to showcase the enterprise's own products and services with the aim of generating new sales.	• Ensures servicing of non-functional systems • Introduces households to new products and services of the enterprise • Helps build trust amongst end users and facilitates enquiry generation and new sales.	• SELCO branch locations across Karnataka	Mangaal in G. Monglien Village, Churachadpur District of Manipur.
Integrated Energy Centres (IEC) (to restore confidence among end-users and generate new enquiries)	An IEC is a solar powered center that caters to the immediate energy needs of a community through rental models with an operator, entrepreneur or partner managing the operations. These centers provide basic energy services including lighting, mobile charging and additional services such as purified drinking water, laptop charging, audio-visual aids for schools and so on. By addressing the more basic energy access issues, the centre aims at positively impacting quality of life and livelihoods. The services, activities and structure of an IEC are generally designed dependent on the need in a particular community. Each IEC is custom designed to best suit local environments and situations.	• Immediate access to energy services in areas that are unelectrified; provided on a pay per use model. • Rental, pay per use models are ideal in the absence of institutional financing for individual households (i.e. in areas where households cannot purchase/own energy assets due to illegality of land, temporary settlement etc. • Promotes the creation of energy entrepreneurs and operators from the local community	• 26 centers that are operator/ entrepreneur/partner run across Karnataka • Mainly established in slum communities in Bangalore, Udupi, Belgaum, temple town of Dharmasthala.	Tribal Community lab, Kalahandi district of Odisha 5 Village lighting points catering to approx 30 households each. 1 multi service center providing 4-5 services.

Innovation	Description and linkages	Need and Benefits	Initial Projects	Replication
		Product Innovations		
Mobile charging kiosk (for remote off-grid areas, where households spent time and money on transportation and mobile phone charging)	This is a structure that combines a panel, battery and charging points that allows for mobile charging (with the option of portability) for individuals within the community that is typically run on a for-profit basis by a micro entrepreneur. In these particular cases in Bihar and Madhya Pradesh, this became an essential innovation owing to the fact that the regions were significantly	• Reduced transportation costs and hassle for households in remote, rural, off-grid regions to charge their mobile phones • Entrepreneurship and Income generating potential for an individual	• Significant number of entrepreneurs in Karnataka	Pushan, A village demo system in Fulmal village, Madhya Pradesh. SELCO hub in Bihar: 2 entrepreneurs in Kharagpur of Munger
Solar-powered sewing machines (for remote off-grid areas, where households spent time and money on transportation and mobile phone charging)	This technology innovation seeks to combine retrofitting the machine with an energy efficient DC motor and solar powering the appliance; This has been explored for commercial and industrial machines as well. Financing models are yet to be explored.	• Allows increased hours of working in the event of grid outages • Reduces drudgery when compared to the traditional system • Proven to increase productivity and therefore income generation.	• Individual tailoring shops and Commercial tailoring unit in Kolar and Maddur respectively (Karnataka); • The individual unit in Kolar was also financed by a bank.	Pushan through 2 entrepreneurs; Mangaal through 2 entrepreneurs; RRTC through 1 entrepreneur
DC refrigerators (for remote off-grid areas, where households spent time and money on transportation and mobile phone charging)	Meeting cooling needs using solar powered units in poorly electrified or off-grid areas can be critical to improving livelihoods and health services. At present, a foolproof technology solution is yet to be finalized and the financial viability continues to remain a question.	• Creates a potential market for high value, perishable foods and nutrition products • Adds value to the services being rendered by a petty shop in an un-served region • Brings in the possibility of vaccine storage and health care.	• 3 projects (using different suppliers) implemented in Karnataka including in 2 urban slums in Greater Bangalore where the systems are being used by petty shop owners.	Boond with 1 refrigerator.

In addition to the ones mentioned in the list above, the following interventions were initiated under this project albeit at smaller scale (and have not been included in the final list of process replications).

- Lithium-ion batteries for newer regions: is being explored and options being tested to facilitate business models that depend on low weight, portable lights, particularly in the North Eastern region since weight and bulkiness of materials would add to the transportation costs
- Institutional cooking: with solar cookers installed in 2 institutions through Pushan in Madhya Pradesh. They are still being studied to understand the impacts
- DC Fan and TV: are still being tested by the SELCO Foundation team and are being piloted with the support and feedback of Mangaal.
- Sales training for women bank correspondents: was initiated by Boond in Unnao district in UP and replicated in the same region.
- Given below are additional details on a sample set of innovations. Other innovations have been captured in a separate Case study booklet.

A. Deliverables

Innovation	Description and linkages	Need and Benefits	Initial Projects	Replication
Product Innovation	No of technology and financial problems worked on	4	7	Refrigeration, tailoring, multi service community hubs, institutional cooking, portable and plug and play systems, End user financing for basic energy access, Increased awareness creation about importance of design and servicing
	Total no of processes replicated (replicated with 1 or more entities)	5	6	Revolving fund, Service camps, Integrated energy centers, DC refrigerators, Solar powered sewing machines, Mobile charging kiosks
Projects implemented	Total number of projects executed	-	17	Revolving fund (1), Service camps (1), Integrated energy centers (6), DC refrigerators (1), Solar powered sewing machines (5), Mobile charging kiosks (3),
Technical testing and Evaluation	State of market reports (product category)	1	2	Inverters, Refrigeration
Organizations worked with	Number of organizations worked with	6	8	Mangaal, Pushan, RRTC, SELCO hub in Bihar, Tribal Community lab (supported by Abha Innovations, Onergy), Boond

B. Sample set of Replications

Table 2 (above) provides an overview of the various innovations that were replicated over the course of the project with the different partners and incubates. A few of those innovations are discussed in greater detail in this section. The 3 interventions discussed here are representative of the 3 categories – financial, business process and product innovation.

1. FINANCIAL INNOVATION- REVOLVING FUND in the absence of active bank network

The Revolving Fund innovation and its application in the decentralized energy sector emerged from the need to provide financial mechanisms for purchase of energy systems in areas where end user financing was not possible through the regular banking route, due to the absence of a bank branch or the bank's unwillingness to finance certain end users. The model has been tried and tested in Karnataka and Maharashtra. Loans are extended using soft money to households to purchase energy systems and over a period of time the borrower is expected to repay the cost of the solar system, along with the stipulated interest. The repayment of loans facilitates additional amounts in the fund for further lending. A small commission is taken by the operational partner for maintaining the fund and ensuring collections.

This model was replicated through Mangaal in Manipur, with the support of a partner organization called the Rural Women's Upliftment Society (RWUS). So far a total of 10 households were provided loans in the regions of Imphal West and Churachandpur in Manipur.

Need for Replication:

This innovation was identified for this region owing to the following reasons

- Today, banks in Manipur are comfortable extending loans to Government employees and to those employed in reputed private companies with secure incomes. However, they are hesitant to lend to individuals from the un-organized sector, independent of the actual amount of earnings, including agriculture (the primary profile of Mangaal's customer segment) where proof of income may not

exist and the extent of bank interaction is lower (with no existing savings with the bank). This results in a hesitation from the bank to lend to such customers. This in turn limits Mangaal's business with the customer base being unable to pay for the entire systems upfront.

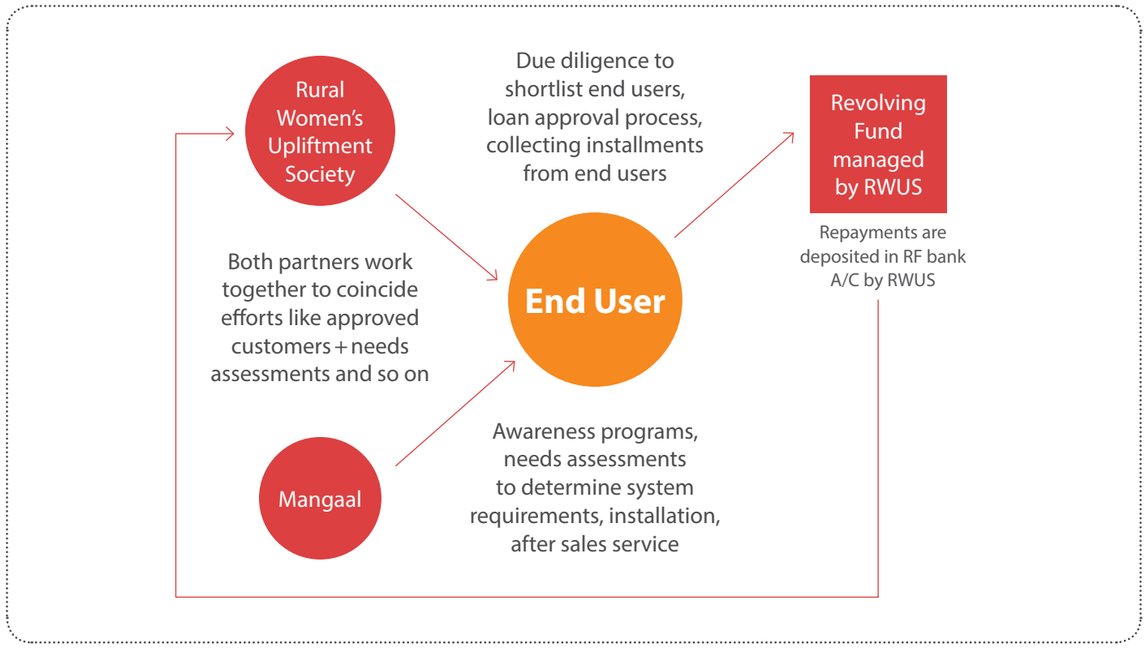
- Bank processing takes a significant amount of time in most cases and the loan and payment terms are often inflexible- including requirements of fixed deposits as Security (in addition to the margin money) even from customers with strong credit histories. The revolving fund helps in creating a proof of concept for solar energy financing to the poor, while facilitating easier access to energy solutions to the households in the near term.
- Manipuris already have a local form of the revolving fund process that is practiced within their various communities. It is called Marup and is used for purchasing TVs, refrigerators and other home appliances. Mangaal wanted to piggy back on this tradition and extend it to solar home systems as well.

Replication project details

The pilot was taken up in Bethel village, Churachandpur district in Manipur. The community mainly comprises of farmers with income levels ranging from Rs. 10,000 and Rs. 25,000 per month. The power situation is very poor and the community expressed interest in solar home systems through loans. While the income levels are relatively high, due to the nature of employment being unorganized, banks are unwilling to recognize these individuals as formally creditworthy, eligible borrowers. In cases where there are a few Government employees, they are expected to place a fixed deposit as security. Owing to the constraints associated with bank financing, Mangaal suggested the revolving fund process as a good alternative. The organization tied up with the Rural Women's Upliftment Society (RWUS) in Churachandpur that agreed to take responsibility for collections.

Given below is a schematic representation of the process and stakeholders involved.

Figure 1: Schematic representation of the Revolving Fund operation



The terms of the Revolving fund in this case include the following:

- Cost of system at Rs.18000 per system– Total allocation of Rs. 1,80,000 for 10 households
- Interest free loan with a payback period of 6 months (plan to have a small interest component going forward)
- Margin money down payment of Rs. 5000 per system.
- Rural Women's Upliftment Society (RWUS) in Churachandpur responsible for collections - Retain 7% of Monthly collections as commission.
- Additional commission to RWUS in case of collection completed earlier than agreed time-frame.

RWUS is an organization that works largely with Churches, faith-based institutions and their members. Through these institutions and their heads, it is also able to act as a guarantor in the case of default on payments. Although, due to the nature of entities involved, defaults are perceived to be highly unlikely. Following the establishment of the first Revolving fund, Mangaal has employed one individual to work within RWUS to focus on collections and help operationalize other revolving funds in the future (leveraging other financial sources).

The systems were installed in March 2015, and so far, the operations have been smooth. The customers are satisfied with the systems installed and have been paying margin down payments as well as the first set of installments in a timely manner.

Plans for Scaling up the Innovation:

Mangaal has found this financial process useful in reaching out to end users who cannot otherwise be reached due to poor banking support. They plan on identify more such communities in which Marup is already practiced and identify community leaders/ local NGOs who can serve as effective collection agents. Proposals for getting further soft funds for these new projects will be pursued and their execution will be planned for the next couple of years. In parallel, Mangaal will showcase this financial innovation with rural banks and MFIs in the region to show them the potential and success of such implementations, so that they may be encouraged to replicate the same through existing Self Help Groups or other mechanisms.

2. BUSINESS PROCESS INNOVATION- SERVICE CAMPS to restore end user confidence

The concept of Service Camps emerged in Karnataka with the intent of addressing the loss of faith in solar technologies due to the lack of servicing and non performance of systems installed in the past by various solar distributors across the state. SELCO would set up service camps in villages where such systems were installed and service them, including replacement of components as required. SELCO would further enter into an agreement with the community to undertake regular maintenance for these systems in the future. This played a critical role in helping SELCO build trust with end users and establish itself as a solar solutions company, which then became a trigger for new enquiries and sales in the same regions. Service camps also served as opportunities to reconnect with SELCO's legacy customer bases and introduce them to new products and services.

Need for Replication

The solar market in Manipur is very much a retail market. Cheap, sub-standard components are sold in retail shops that are bought off the shelf and installed by individuals themselves, without understanding the functionality of each component and the need for proper system design. In a short span of time, most of these systems end up defunct or not delivering as expected. To make matters worse, there is no service network available to them, rendering their investments worthless. This also affects household perception of solar energy.

Mangaal itself loses a significant percentage of its potential customer base to Mangaal has had to constantly address this issue by creating awareness They lose huge chunks of their potential customer bases to this market and were not sure how to go about addressing this issue. People end up viewing Mangaal's products as expensive and unaffordable because of these cheaper alternatives.

Mangaal viewed the Service Camps concept as an effective way to solve these issues that were being faced. Service camps would help create awareness on the importance of customized design for solar home systems and timely maintenance, while simultaneously introducing Mangaal's products and services and providing an opportunity for enquiry generation.

Replication Project Details

The first service camp was undertaken in G. Monglien Village of Churachadpur District in Manipur. This is a socially backward, off grid village on top of a hill. It is located about 25 km from the main town of Churachandpur, with the approach road having steep slopes and in bad condition. There are 53 households in this village; of 8 houses have tin sheet roofs while the others have thatched roofs. The community is largely comprised of farmers who depend on seasonal agriculture.

Some of the households had previously bought solar home systems, small solar panels for charging torches and solar lamps. However, many of the systems had failed and had not been working for long periods of

time. Mangaal, with the cooperation of the village Chief, organized a service camp. Service was provided for free and components were replaced at nominal costs. About 10 systems were serviced, and the average fee per service was about Rs.850. In the absence of fixed incomes, many customers were asked to pay for the replaced components through installments over a 5 month period.

During the camp, Mangaal emphasized on solar system design, components used and servicing requirements. It helped to address basic maintenance issues such as the need to top up batteries or the functioning of charge regulators. Mangaal asserted that their branding in the area received a boost on account of the service camp.

3. PRODUCT INNOVATION- SOLAR POWERED SEWING MACHINES to improve productivity and incomes

The need for solar powered sewing machines (and other productive machines like looms and lathes needed for livelihood generation) has been looked into by the SELCO Foundation technology team over the last 2 years. Through the work, solar powered energy efficient retrofits and products for commercial and industrial machines at relatively lower costs have been identified and piloted within the organizational network. These solutions have been tested in the field and have shown positive results in terms of addressing the requirements of uninterrupted power and increases in livelihood generation.

The technological specifications of the typical new system include a DC motor- 60W, 12 V with a rated efficiency of 75%. Its rated speed is 3,000 rpm, it can manage up to 1,000 stitches per minute, and has a pulse width modulated speed controller. The system runs on a 60W panel, 40 Ah battery and 10 A charge controller. It can be run for 8 hours on a daily basis with 25% duty cycle.

Need for Replication:

Although tailoring is a major profession practiced in rural Manipur and Madhya Pradesh, power outages significantly affect productivity. The problem with current sewing machines is also the power consumption of motors that are inefficient. This results in a situation where solar powering and inefficient motor becomes extremely expensive. Traditional machines are also laborious and slow down the production resulting in lower incomes for the entrepreneurs.

The future replication of the solution requires a combination of solar power, energy efficiency and a suitable financial product.

Replication project details:

This technology innovation process was replicated through 3incubatees/partners- Mangaal in Manipur, Pushan in Madhya Pradesh and Rural Resources and Training Center (RRTC) in Meghalaya.

Through Mangaal, two sewing machine projects were implemented with entrepreneurs- Joykumari Devi of Thoubal district and Laishram Chanu Devi of Imphal West.

- Both involved in traditional embroidery; earned between Rs. 3000 and Rs. 4000 per month while working on the AC powered sewing machine.
- A new design sewing machine and a straight stitch machine, each with DC motor retrofits with solar power installed as part of testing and demonstration at each of their homes.
- Following the interest shown by these entrepreneurs in owning the system, they have been asked to pay back through monthly installments over a period of 1.5 years.
- Impact for the women entrepreneurs includes a 4-5 fold increase in income- at an average of Rs. 12000 to Rs. 15000 per month.
- Through Pushan, 2 systems were implemented for Jatan Fulmal and Naval Singh, both of Alirajpur district in Madhya Pradesh.
- The average income per month is about Rs. 30,000 to Rs. 40000 on the AC powered sewing machine while stitching shirts and blouses.
- The existing sewing machines were retrofitted with DC motors and solar powered.
- While the system was installed for testing and demonstrations, one of the entrepreneurs was able to avail of a loan from Narmada Jhabua Gramin Bank.
- Following the interventions, each of the entrepreneurs has given an order of 2-3 additional solar powered sewing machines and expects increase in order and sales.
- Through RRTC, one entrepreneur Judith Suchiang of the Jaintia hills of Meghalaya adopted the technology.
- RRTC also facilitated the entrepreneur's enrollment into a Tailoring course with another vocational training center in Guwahati.
- The additional income through this livelihood has been critical in the family. RRTC also believes this intervention will play an important role in promoting the use of solar power for household and productive activities in the village and surrounding areas.

Plans for Scaling the innovation:

Mangaal has expressed confidence in the product after several months of testing with the end users. The organization is keen on including this product into their product portfolio in the financial year 2015-16. However, it is yet be worked out how these systems can be financed - through Regional Rural Banks and local MFIs or explore the option of dipping into (or creating) the Revolving fund for financing of solar powered livelihood applications.

Pushan has since received orders for 3 more sewing machines from each of the tailors. The organization is now working closely with the technology team at SELCO Foundation to determine the supply chain, warranty and service terms with the vendors.

RRTC on the other hand has looked at the intervention both from product as well as skill development points of view. The Training center is convinced that this could be promoted as a good model for solar power contributing to local livelihoods and thereby increase interest in adoption. It has also recognized the possibility of including information on solar powered sewing machines and tailoring into their course curriculum.

Solar lighting system enables an enhancement in livelihood for this hand-loom weaver

IV. Key Takeaways

A. FACTORS CONTRIBUTING TO SUCCESS:

Based on the inputs of replication partners, there were certain key aspects that contributed to the success of projects implemented and their continued functioning.

- Owing to the inaccessibility or unreliability of the grid in most of the regions where the partners operate, there is a strong case and a clear demand for alternate, affordable solutions that are off-the-grid and decentralized. i.e. solutions that can function independent of the grid, using locally available resources and skills.
- The availability of Technology know-how through implementation partners and their networks (beyond basic solar lighting applications) was vital to the interventions; in particular- their support with procurement of components, system design and troubleshooting, as required.
- Soft funding support for these projects was critical in reducing initial risks and helped prove the technological and financial viability of the innovative process itself. These 'proof of concepts' can now be used to increase confidence amongst bankers and other project development partners.
- The support of opinion leaders, Self Help Groups and NGOs in local level community mobilization, project implementation and management, particularly for Incubatee driven projects was extremely useful (as they would not have had the bandwidth or expertise to handle community-based engagement.)
- The constant interactions between the Innovation and Replication partners ensured a more Need-based approach to problems and applications. A holistic approach- considering Technological, Financial, Operational and social aspects- to looking at each solution also helped with better designed solutions.

B. CHALLENGES:

The challenges articulated with regard to implementation and replication of innovations were linked largely to technological aspects and capacity. Here, they are divided into challenges around Financial or Business process innovation and Product innovations.

Challenges around Financial and Business process innovation:

Lack of human resource capacity for Replication partners: Owing to the scale of operations and geographical conditions under which the Replication partners work, it is difficult for them to identify and retain to individuals with strong technological and operational expertise. Dedicated resources may not be available or affordable to newer enterprises in remote regions, including Operational support for better monitoring of projects on the field or individuals to build better rapport with communities, local bankers and so on.

Challenges around Product innovation:

1. Value chain- Market potential and market linkages: Considerable amount of effort goes into each project to better understand market potential for the interventions and the ideal scale of operations in a particular region. At the other end of the value chain, the limited existence of market linkages for livelihoods (following the intervention) could become a barrier if not understood well at the beginning of the project itself.
2. From a basic overview of the innovations replicated, it is clear that many capital intensive technology solutions may not have an immediate viable business case scenario – (E.g.: cooling and refrigeration for health services, water purification technologies). Even in the long term, it may be difficult to ensure a completely financially sustainable model for such product innovations.
3. Technology supply chain: In the initial phase of Innovation replication, there was a strong involvement of SELCO Foundation and its technology team, particularly for the technology based interventions. It required a team to identify ideal vendors and work out the supply chain and logistics for the intervention, but solely on a 'one-off project' mode. Going forward, a mechanism for strong supply chains and vendor linkages would have to be established, considering factors of product quality, costs and volumes, transportation, taxation across states and so on.
4. Limited skilled resources within newer enterprise also affect product related innovation. This may include a lack of technical experts who could more easily handle aspects of system design for larger electrical systems or explore options in terms of vendors, and ensure long term maintenance and troubleshooting of even complex systems.

C. Learnings and Recommendations:

Based on the learnings from this project, a set of recommendations are proposed, categorized according to the stakeholders involved.

1. Continuous Ecosystem and Capacity building efforts:

While process replication may be specific to a financial aspect or a technology aspect, every solution would have to take note of relevant ecosystem building efforts for long term operational sustainability. Ecosystem building especially around aspects of awareness creation, addressing myths or perceptions around decentralized renewable energy, skilled resources creation for system servicing and sensitizing financiers, policy makers etc are processes that must continue alongside every intervention.

- Banker Awareness using Innovations as 'proof of concept': Banks should be encouraged to engage in decentralized energy financing, with appropriate targets and monitoring. This can be undertaken through training and capacity building workshops, which include practical demonstrations and discussions with financiers who have engaged in energy lending. Innovations undertaken through this project can be used as demonstration projects to expose bankers to the possibilities.
- Creation of appropriate focused modules for technicians, operators and entrepreneurs for the Renewable Energy sector- ideally those that can be rolled out as part of existing courses in vocational training institutions such as Industrial Training Institutes (ITIs) and Rural Development and Self Employment Training Institutes (RSETIs). The Clean Energy Access Network has begun some work in this direction.

2. Importance of soft funding linked to Innovations:

This project has shown that the availability of small amounts of flexible, soft funding directed at innovative solutions for a particular context, can play an important role in diversifying the services for the poor.

- **Utilization of National Clean Energy Fund (NCEF)** for Innovation: There should be serious consideration of a mandate for NCEF (which is under the Ministry of Finance) for money to be used as viability

gap funding on field implementation projects in renewable energy and energy efficiency as well as to support replication of innovations successful in other contexts.

- **NABARD's Innovation Fund** could also be used in a similar manner, but more focused on projects that are able to leverage funding from banks or other institutional sources.

3. Mandate for Technology innovation and solution diversification:
On account of this project, entrepreneurs and partners found themselves mandated to identify additional issues within the communities and determine possible solutions to address the same. By providing a mandate along with financial support and technology know-how, this project triggered a process of problem capture and solution diversification - which these organizations are now attempting to institutionalize.

- Increased attention on technology innovation for livelihoods: There is an imminent need for manufacturers, R&D labs, current technology institutes and small energy enterprises to work together on understanding the complete value chain of current rural and tribal livelihoods to design appropriate technology solutions to address their energy needs.
- Strong incentives for manufacturers need to be provided along with higher energy efficiency standards for technologies to be powered using off-grid sources, addressing energy needs for livelihoods, households, community spaces, education, health etc.

Service camp replicated at Manipur by Mangaal

Conclusion

Over the course of the year, 6 innovative processes- financial, business oriented and product oriented- were replicated through 8 entrepreneurs and partners of the SELCO Foundation. Other replications are still in progress including light weight batteries in hilly regions, solar powered refrigerators, institutional solar cooking solutions.

The learnings through these projects have been largely in terms of reinforcing the need for separate pools of innovative funding and the importance of human resources for the enterprise implementing newer innovations to ensure their sustainability.

Implementation of these innovations have increased confidence among newer entrepreneurs and interest among their end users with the diversity of solutions being offered. There has also been a realization that with product replications come the need for additional innovations on the financial mechanism to make them affordable for end-users. Thus, making it an iterative process and allowing for further replications through other partners of the SELCO Foundation.

These iterations and contextual replications would be an effective way to reach out to communities with need-based solutions, while ensuring long term sustainability and impact.

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