S3IDF

Small-Scale Energy-Dependent Enterprises & Projects

The Small-Scale Sustainable Infrastructure Development Fund (S3IDF) is an international development organization that builds inclusive market systems to promote equitable economic and social development.

Overview

S3IDF's staff, Board of Directors, advisors and network of consultants are engineers, development finance specialists, and trained field practitioners with decades of experience in the provision of infrastructure services – energy, water, sanitation, communications, transport – through market-based delivery models.

At present, our Indian project portfolio has over 200 small-scale enterprises incorporating a variety of technologies and business models. In addition, S3IDF has analyzed, conceptualized, and implemented solutions around improved infrastructure access, especially for underserved populations, across the globe for a range of advisory service clients.

Our energy expertise and experience spans solar photovoltaics, biogas and liquefied petroleum gas (LPG), small-scale hydropower, and grid-connected and grid-hybrid electricty.

Solar Photovoltaics (PV) . S3IDF pairs solar PV with a variety of technologies, including grain and spice grinders and processors, reverse osmosis drinking water purification systems, small refrigeration and fan-based cooling systems for agricultural products, and small CFL and LED lighting systems for vendors at night markets.

Grid-Connected or PV-Grid Hybrid Electricty. Grid-tied enterprises supported by S3IDF use a variety of technologies, including energy-efficient computerized sewing machines, batteries for off-grid lighting applications, and computer mainframes in schools.

Biogas and Liquefied Petroleum Gas (LPG). S3IDF pairs biogas and LPG with a variety of technologies, including cookstove and burner units for both domestic and commercial use and generators to power small appliances and machines.

Small-Scale Hydropower. S3IDF focuses on smaller systems, especially pico- and micro-hydro, and on a variety of technologies, including biodegradable plant-based dinnerware fabrication machines, seed and plant oil extractors, grain grinders and rice hullers, and village-level electrification systems.

Selected examples from S3IDF's work on energy-dependent enterprises and projects are summarized below.

Solar Photovoltaic Enterprises and Projects

PORTFOLIO ENTERPRISE:

Integrated Energy Centres (IECs)

Location: S3IDF, in conjunction with partners, has replicated the Integrated Energy Centre (IEC) concept with variations on the business model in over 20 communities in India.

Skills/Expertise Required: Renewable energy and livelihood integration, deal structuring, end-user affordability, supply- and demand-side assessments, replicable business models, entrepreneur training.

Description of Work and Services: Integrated Energy Centres (IECs) are solar-powered community centers that can supply a range of basic services and activities that are often unavailable in underserved rural, urban, and peri-urban areas. By addressing fundamental energy needs and by providing energy-dependent services, IECs positively impact the quality of life of IEC users and create livelihood opportunities for local entrepreneurs and other residents. IECs can be stand-alone structures or can be co-located with community spaces such as libraries, education facilities, and health centers. Examples of services and technologies that can be included as part of IECs include:

- Energy Services – LED lantern or battery rental for evening in-home lighting, mobile phone charging, pay-per-use access to income-generating technologies (e.g. grain grinders).
- Education and Information Access – Audio-visual education aids, Internet access through computer mainframes, community television.
- Healthcare – Charging points for portable medical devices, refrigeration for storing vaccines.

IEC operational structures include an "operator model" and "entrepreneur model." In the operator model, the IEC is owned by a partner entity (e.g. nonprofit organization) but is run by a resident of the local community. The partner entity manages IEC finances at the local level with business development and technology support from S3IDF and others. Entrepreneur model IECs can be owned and operated by a single individual or a group of individuals (such as a community) and are typically financed through both grants and local bank debt, often 20% and 80% respectively. The grant funding provides a critically important subsidy of initial capital expenditure, enabling the IEC to make necessary early investments and to reach profitability more quickly.

Revenue generated by IECs covers maintenance and operating costs, debt repayments, and contributes to future investments. Depending on the range of services offered, IECs typically cost between USD $3,000 to USD $15,000.

ADVISORY SERVICES:
Electrifying Villages and Schools

Contracting Entity: Applied Materials Foundation.

Location: India.

Skills/Expertise Required: Renewable energy services, monitoring and evaluation system analysis and development, innovative end-user financing.

Description of Work and Services: Building on the positive outcomes and outputs of a prior project, *Electrifying Villages and Schools*, S3IDF partnered with SELCO Solar Light Pvt. Ltd. (SELCO) for *Round II: Electrifying Villages and Schools* to further expand access to solar photovoltaic lighting and electricity in underserved and marginalized communities in India.

S3IDF and SELCO formed or extended partnerships with 11 financial institutions, facilitating transactions between these financial institutions and "unbanked" individuals and households, supporting progress toward greater financial inclusion for underserved communities. S3IDF and SELCO addressed gaps in end-user/household financing through customized arrangements, including down payment grants, interest rate subsidies, loan guarantees, and extended after-sale service contracts and payment plans for difficult-to-service areas.

Community Type	Barrier to Solar Home Lighting System Financing	Intervention
Urban Slums	• Lack of documents necessary to secure loans (e.g. land titles as collateral).	• Creation of a revolving fund with a weekly loan repayment collection system that extends financing for solar home lighting systems to a few households at a time. A nominal security deposit from each household is used to manage risk of any defaults.
Remote Tribal Settlements	• Remote locations of these settlements increase the transaction costs for financial institutions, forcing potential customers to travel long distances to the financial institutions.	• Cover high transaction costs of financial institutions in retrieving repayments from communities in remote areas. • Risk guarantee funds provided to financial institutions give them confidence to extend financing.
Rural Agricultural Communities	• No connection to formal financial institutions and cannot afford to make down payments to obtain loans. • High transaction costs to convince a new financial institution to extend credit to these communities.	• Cover high transaction costs of convincing financial institutions to extend financing. • Provide funding support for the down payment (15% of loan amount) to help households access loans.

The project also successfully expanded energy solutions in schools to power lighting and educational equipment through solar PV systems and customized ICT hardware and software combinations that were tailored to meet priority educational learning objectives.

S3IDF led an outcome measurement and impact assessment that involved developing a set of metrics, creating standardized surveys, collecting and analyzing end-user responses, and piloting an online data tracking system aimed at increasing capacity to assess the social, environmental, economic, and "systems" effects of projects among renewable energy practitioners. S3IDF ran detailed analyses for all metrics based on pre- and post-data collection to assess changes over time and carbon finance potential from GHG reductions.

Over the course of the two phases, the *Electrifying Households and Schools* initiative reached 3,982 households, reaching an estimated 19,910 people, worked with 11 local small and large banks (including micro-finance institutions), provided lighting and digital educational tools to 30 schools serving over 2,758 students and developed 5 long-term partnerships with community organizations committed to improvements in learning.

Grid-Connected Enterprises and Projects

PORTFOLIO ENTERPRISE:

Last Mile Rural Electricity Distribution through a Franchisee

Location: Cherlapatelguda, Kappapadu, Turkaguda and Khanapur in the Ranga Reddi District, Anhra Pradhesh, India.

Skills/Expertise Required: Public-private partnerships, replicable and scalable business models, end user affordability, supply- and demand-side assessments.

Project Description/Concept: Provision of grid electricity, especially in the rural areas of India, has seen significant challenges; even when villages are electrified, the quantity, quality and reliability of the electricity supply have been poor and universal access to all households within the villages has not been achieved. The project developed a last mile franchisee of a feeder and provided bundled value added services through an innovative institutional intervention that empowered local players and communities. In addition to electricity provision, the project structure enabled the local franchisee to bundle and facilitate other service delivery, including financial and other infrastructure services.

The primary objectives of setting up this model were to:

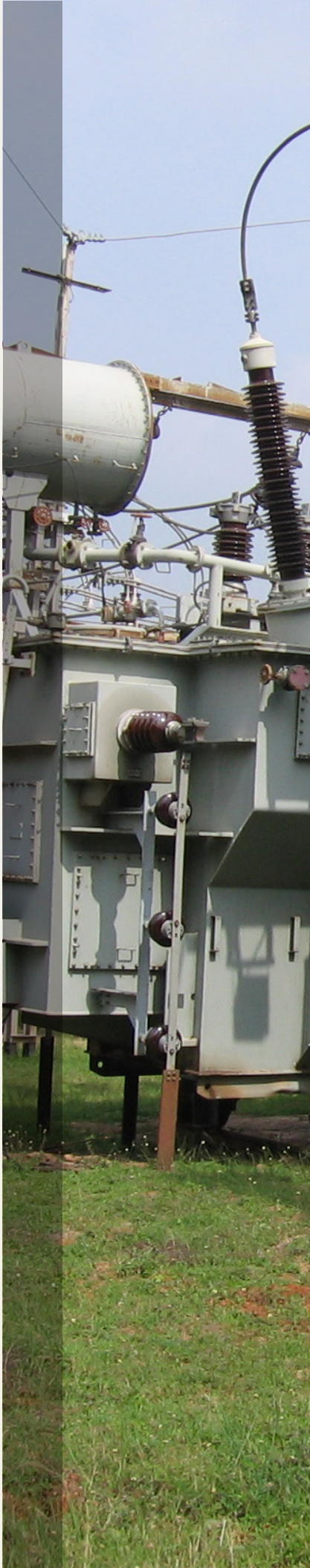
- Provide access to electricity to all households, including to Below the Poverty Line (BPL) families, through affordable electricity connections and tariff structures.
- Promote end-use efficiency and energy conservation, resulting in demand-side management.
- Reduce the transmission and distribution losses by replacing inappropriate conductors and replacing faulty equipment in the distribution system.

The key activities undertaken were:

- Detailed technical study of the feeder, including mapping of the various feeders from the substation, listing of the key assets of the feeder, identification and listing of the number of connections and connection categories, and data collection on energy demand, consumption and revenues.
- Baseline developed with the DISCOM on revenue collection, revenue collectable, etc. and formulation of methodologies for computing the amounts collectable from all the consumers connected to the feeder line.
- Finalization of a tri-party MOU between the power distribution company, franchisee operator, and S3IDF.

The distribution company installed meters and undertook repair work, including improvements to the lines and transformers, prior to the franchisee taking over the operations. The franchisee is in charge of reading the meters on a regular basis, managing problems, issuing bills and collecting payments. S3IDF provided a loan guarantee. The remuneration to the franchisee will consist of (i) charges for collection of baseline data (survey of agricultural and non-agricultural services, estimates for improvements of any transformer structures), (ii) charges for maintenance of lines and transformer structures, and (iii) billing and collection from consumers.

The main benefit is regularized supply of electricity for 1,300 households, but additional benefits include regularizing connections for all households (including the ones which have been disconnected due to payment defaults), resolving outstanding electricity related problems through a people's court, introducing energy efficient devices, and value-added services.



PV-Grid Hybrid Enterprises and Projects

PORTFOLIO ENTERPRISES:

PV-Grid Hybrid Light Points for Street Vendors

Locations: S3IDF has replicated the "light point" concept with business model variations in dozens of communities in India.

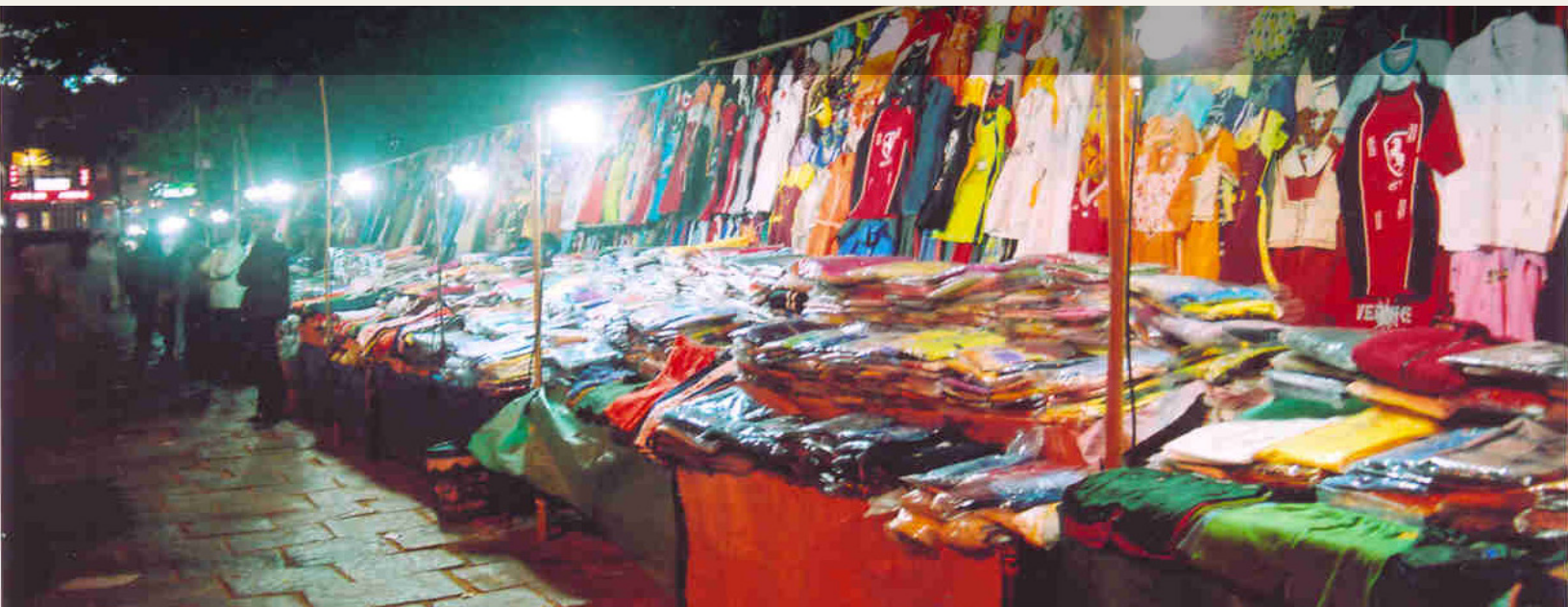
Skills/Expertise Required: Energy and livelihood integration, financial innovation, blended capital and revolving fund structures, end-user affordability, replicable business models, entrepreneur training.

Description of Work and Services: In public spaces and open-air markets throughout India, street vendors typically sell fruit and vegetables, clothing and other items for domestic consumption and use, with many using moveable carts to ply their trade. These public spaces and open-air markets often to not have street lighting and, as a result, the vendors often use kerosene-based lanterns to illuminate their products, which are comparatively expensive to maintain given the cost of kerosene and frequent replacement of the mantle and also emit poor quality light and release harmful fumes. The light points, which run on batteries charged by a combination of solar photovoltaic (PV) panels and grid electricty, are charged during the daytime at a centralized charging station and in the evening, the batteries are delivered by an entrepreneur to the vendors for their use throughout the evening. The vendors need the light points for an average of four hours every night, after which the batteries are collected by the entrpreneur and returned to the charging station. These are supplied to the hawkers on a daily rental payment for use, which is pre-determined based on their willingness-to-pay.

The original concept was that the entrepreneur would invest a small proportion of the total capital needed and S3IDF's provision of partial loan guarantee, in the form of a fixed deposit, would allow the entrepreneur to access a loan from the local branch of Chitradurga Gramin Bank under the UNEP scheme. Enterprises typically serve between 30 - 100 vendors. Percentage of reliance on solar-charging and grid-charging ranges, but is often 50-50.

Although operational and financing details vary, total project investment costs, inclusive equipment and related services, are often the equivilent of several thousand US dollars. Of this, 10 -20% of the investment cost is typically borne directly by the entrepreneur. When entrepreneurs are not in a position to put in a down payment, S3IDF provides a direct loan (e.g. 15% interest rate per annum) with local bank financing the remaining cost (e.g. at 7% interest rate per annum, through a 3-year loan with an equated monthly installment repayment plan.) Initial loans are often facilitated by the provision of a partial risk loan guarantee by S3IDF (e.g. 25%) in the form of a fixed deposit held by the branch. S3IDF charges the entrepreneur development fee (e.g. 4.5% of capital cost) and guarantee fee (e.g. 3% of capital cost).

The vendors benefit from better lighting at a lower cost. Local entrepreneurs gain access to income-generating opportunities and often provide employment for underemployed community members who oversee the maintenance, operation of charging stations, the daily distribution and pick-up of batteries, and the collection of rental payments.



Biogas and LPG Enterprises and Projects

PORTFOLIO ENTERPRISE:

Public Pay-Per-Use Rasoi Ghar ("Cook Shop") at Osmania Government Hospital (OGH)

Location: Located in Hyderabad, India, the OGH is a 2,000-bed government hospital with an average of 250 inpatients and 1,000 outpatients each day.

Skills/Expertise Required: Public-private partnerships, end-user affordability, replicable business models, supply chain strengthening, demand-side assessments.

Description of Work and Services: Many of the poor, in both rural and urban India, do not have access to clean cooking fuels. They are dependent on kerosene or fuelwood or a combination of both to meet their cooking fuel needs. These fuels represent inconvenient, time consuming and potentially hazardous methods of cooking. The challenges and costs associated with cooking are often exacerbated when illness or injury strikes, leaving relatives of hospitalized individuals with few affordable options to feed themselves and sometimes their hospitalized family members due to the high costs of prepared food and a general lack or the expense of fuelwoods.

The pay-per-use rasoi ghar "cook shop" on the hospital campus of the OGH installed a series of cooking stations, each with LPG connections and LPG stoves and other cooking accessories/equipment, such as pressure cookers. The family members of those who are staying at the hospital for treatment can use the cook shop on an pay-for-use basis. The cook shop is equipped with piped water connections with a potable water facility and a facility where cooking items and serviceware can be cleaned.

S3IDF worked to facilitate an agreement between public and private entities, including Hindustan Petroleum Corporation, Vimala Sankar Trust and the OGH, and an entrepreneur. Activities also included modification of an existing OGH facility and installation of cooking stations and LPG, coordination of regular LPG distribution, entrepreneur capacity building, and support of project financing and business model analysis.

The building facility converted into the cook shop was provided by the OGH with the necessary modification costs of several hundred dollars covered by the OGH. Initial working capital was provided and annual operating costs total less than the equivilent of USD $1,000 per year.

PORTFOLIO ENTERPRISE:

Biogas-Based Electricity Generation for a Rural School

Location: Jedacherla, Mahboobnagar District, Andhra Pradesh, India.

Skills/Expertise Required: Supply chain strengthening, demand-side assessments.

Description of Work and Services: The Jedcherla Social Welfare Hostel houses about 500 students and teachers from the adjoining school. While there was electricity connection for the classrooms, dormitories (a total of 14 dormitories with a total of 140 lights, 70 fans and 40 computers) the electricity supply was very irregular and the three phase supply was available only for a few hours everyday. The single phase supply was available for 70% of the time, although with periodic outages and, as a result, on most of the days electricity was not available during study hours. In addition, because of limited three phase power supply, an adequate quantity of water was not pumped into the overhead tanks. The need to set up an alternate electricity supply system which could supplement the power obtained from the grid and also serve as a standby power supply whenever grid supply fails was clear. In addition, cooking was done using firewood on three open stone stoves, and needed to be improved to reduce costs.

Human waste from the hostel was estimated over 500 kgs per day in addition to the kitchen waste. Considering the available feed for biogas production, a 45 m3 biogas plant was installed to be used for both heat and electricity production, and was paired with a 15 kvA biogas dependent generator to pump water. The plant is capable of producing a minimum of 45 units of power per day or the equivalent of 20 liters of LPG, which can be used for cooking.

The cost for construction of the biogas plant totaled about USD $16,000 with maintenance and operating cost at USD $1,000 during the first year and USD $300 from the second year onwards. The capital cost was covered through an equity investment, debt financing, and an available subsidy from the Government of India (GoI), which allows power to be produced more cheaply than the former expenditure on electricity.

Small-Scale Hydropower Enterprises and Projects

PORTFOLIO ENTERPRISE:

Pico-Hydro Systems for Electrifying Households in Remote Villages

Location. Multiple communities in Shimoga and Dakshina Kannada districts in Karnataka, India.

Skills/Expertise Required: Public-private partnerships, end-user affordability, supply chain strengthening, demand-side assessments, financial innovation and deal structuring.

Description of Work and Services: Many rural areas in India, especially in the hilly regions of Malnad (Chikmagalur, Hassan and Kodagu) and coastal districts of Udupi, Dakshina Kannada and Uttara Kannada, the terrain and the associated costs, prevent the expansion of grid electricity. However, there are ideal sites for small-scale hydropower systems to generate sufficient power for household usage. Ministry of New and Renewable Energy (MNRE) approved subsidy for pico-hydro systems/water mills through its local agency, Karnataka Renewable Energy Development Ltd. (KREDL); however, the program requires that the systems are installed before the subsidies can be released, which often takes 6 – 12 months. Without upfront financial investment for the systems, poor families cannot access the subsidy that is primarily meant for them.

The project provided "gap-filling" finance and bridge lending support through Prakruti Hydro Labs (PHL), a manufacturer and supplier of hydro-electric equipment, for the installation of pico-hydro systems to benefit 20 poor families in remote villages of Karnataka that had no or limited access to electricity. S3IDF provided PHL with a loan of apprximately USD $15,000 for commissioning of all 20 pico-hydro systems in the respective households. PHL was responsible for the supply and installation of the systems as well as following up with KREDL for release of subsidies for the systems commissioned and any installment payments made by the households for the difference between the total system cost and the subsidy.

The 20 families in the region have a new means for renewable power generation, reducing their dependency on unreliable grid electricity or kerosene and improving their standards of living. PHL benefited from an expansion of its market and distribution capabilities. MNRE and KREDL in turn received a reputation boost to their Renewable Energy Programme since more poor families opted for hydropower system installation and benefited from the subsidy scheme offered by the Government.

ADVISORY SERVICES:

Improved Water Mill Program (IWMP) in Nepal

Contracting Entity: Asian Development Bank.

Location: Select districts in the Hills Region of Nepal.

Skills/Expertise Required: Energy and livelihood integration, financial innovation; blended capital and revolving fund structures, deal structuring, end-user affordability, risk mitigation, program and fund design, business concepts, supply chain strengthening.

Description of Work and Services: The project applied S3IDF's Social Merchant Bank Approach (SMBA) in the renewable energy sector Nepal by working with an ongoing Improved Water Mill Program (IWMP) to enhance program sustainablility and to expand the penetration of improved micro-hydro systems ("improved water mills" (IWM)) through projects that emphasize livelihood development through productive agro-processing end-uses. The technical assistance project was centered on the establishment of a facility to provide both financial and capacity building support to local partners and IWM entrepreneurs. This facility was structured to operate a bank-hosted revolving fund, with ADB seed capital, that would offer a menu of "gap-filling" finance to IWM entrepreneurs, directly and/or through wholesale financing arrangements with local community-based microfinance and other financial institutions.

The core function of the revolving fund was to fill entrepreneurs' collateral shortfalls through partial loan guarantees and other credit conditioning and financing mechanisms, thus mobilizing local debt financing for IWM investments. Example target investments included IWMs paired with grain mills, oil seed expellers, and village-level electrification systems.

S3IDF played a primary role in designing the revolving fund structure, setting criteria and supporting the selection process of the revolving fund host, recommending practices and procedures necessary to execute direct and wholesale financing, and conducting business cash flow analyses for target investments to support loan product development. Work also included prefeasibility analyses of improved micro-hydro/water mill projects for developing a project pipeline. Such project included various agro-processing options as well as micro-grid village electrification.