Executive Summary

Grameen Shakti started in 1996 as a non-profit organization selling solar home systems in Bangladesh. After converting into a social business it took Grameen Shakti only four years to achieve sustainability. Today they are successfully supplying Bangladesh’s rural population with solar home systems, biogas plants and improved cooking stoves. Selling rather expensive products to mainly poor customers, Grameen Shakti had to rely on an innovative distribution and after sales care system as well as microfinance to create demand for their products. As a result, it was able to improve the living conditions as well as the environmental impact of thousands of villages and to create jobs that help to empower the rural population, especially women.

The main future challenge is the expansion and scaling of its product lines and the income generating activities associated with them.
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1. Bangladesh: Energy access and consumption

Bangladesh has a per capita electricity generation of 145kWh, which is one of the lowest in the world. Only about 40% of the people have access to grid electricity, most of who live in urban areas. No more than 3% of Bangladeshis receive natural gas for cooking.

The rural people suffer most from the lack of access to affordable, clean and efficient energy. More than 80% of the population living in rural areas (84 million people) is forced to rely on kerosene, biomass, and animal waste for lighting and cooking. These sources of energy are neither cost-effective, nor environmentally-friendly\(^1\).

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\(^1\) Grameen Shakti, *Paving the Way for a Green and Sustainable Future, Pioneering an Integrated Market-Based Approach to Bring Clean and Affordable Energy to the Rural People*, 2010

2. Grameen Shakti - An Introduction

Energy is an area of concern in Bangladesh, which Grameen wanted to address in order to improve the lives of the people in the country. It wanted to find an energy source that would solve the problems of poor people in rural areas without causing additional harm. After experimenting with wind and other kinds of technology, it was decided that solar power is a good option that would work well in Bangladesh. This is why in 1996 Grameen Shakti (which means “village energy” in Bengali) was established as part of the family of Grameen companies as “a renewable energy company with the aim to serve the difficult-to-access rural areas with solar, wind and bio-gas based electricity” in Bangladesh. Grameen Shakti expanded its field of operations to include not only solar energy but also biogas technology. It also launched an improved cooking stoves program.

The mission of Grameen Shakti (GS) is to “empower the rural people with access to green energy and income” and its vision is “a future where rural households of Bangladesh have access to environment friendly and pollution free energy at affordable cost”.

GS does not only focus on providing technical equipment and capacity-building for the promotion of renewable energy. Based on the micro-financing experience of the Grameen Bank, Grameen Shakti has developed a financing scheme that ensures that renewable energy applications are affordable even for poor people from the rural areas of Bangladesh.

The board of directors and top management of GS are mostly founding members of the Grameen Bank and have experience in the field of micro-credit financing. The Managing Director of Grameen Shakti as of 2011 is Mr. Abser Kamal.

Since its foundation in 1996 Grameen Shakti has established 1,097 branches, has installed 650,298 solar home systems, 18,490 bio gas plants, and 324,864 improved cooking stoves. GS currently employs 10,600 people and covers 40,000 Bangladeshi villages through its activities.

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3 Dipal C. Barua, Experience of Grameen Shakti: Market-based Integrated Approach to Promote Renewable Energy Technologies in Rural Bangladesh; internal document.
Grameen Shakti was originally set-up as a not-for-profit organization. It is currently a social business, which became financial sustainable within 4 years of operations\(^8\). Its financial model allows it to recover its investment and cover its operating costs, reinvesting its profit into the business.

3. **Product line**

Grameen Shakti currently has four main product offerings:

- Solar Home Systems (SHS)
- Biogas
- Organic fertilizer (early stage)
- Improved cooking stove (ICS) program

Additionally to these areas of activity GS also organizes technical trainings at its Grameen Training Centers, and provides maintenance and after-sales services to its customers.

**Solar Home Systems (SHS)**

The solar home system (SHS) program is currently one of the most successful GS programs. Grameen Shakti sells, installs, and maintains solar panels for use in households.

The program targets areas in Bangladesh, which have no access to conventional electricity or are unlikely to get connected to the grid within 5 to 10 years\(^9\). SHS are “12 volt stand-alone systems consisting of a PV module, battery, charge controller, fluorescent lights, and wiring as well as outlet fixtures for installation.”\(^{10}\) This technology can be used for a variety of activities from providing light in homes & shops, to charging phones, and running televisions and radios.

SHSs involve no fuel costs, and very little repair and maintenance costs. They provide light and energy, which allows people in rural areas to live and work under better conditions, it diminishes the health problems which occur due to kerosene use, and they also spare the users from monthly electricity bills.

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Solar technology is eco-friendly and also makes use of the high levels of sunlight exposure that Bangladesh has.

The price of a SHS in urban areas ranges from approximately US$ 1000 to US$ 2600. In rural areas the price of a SHS ranges from about US$ 130 to US$ 975. The price depends on the components of the SHS, e.g. lamp points, TV-outlet, computer-outlet, etc.

Grameen Shakti is also promoting the use of SHSs in low-income rural households. Due to the fact that the price of SHSs is not affordable for some low-income families, GS has developed a strategy for bringing the technology to them by providing credit and giving them the possibility to pay in installments.

**Biogas**

GS started its biogas program in 2005, through which it promotes domestic and commercially-sized biogas plants where cow dung, poultry waste and other biomass waste are converted into gas, which is used for cooking and electricity generation. Grameen Shakti even developed a special model of constructing these plants. According to GS “through the natural process of anaerobic digestion, a 3m³ biogas plant is capable of producing sufficient gas for in average 6 to 8 stove hours”\(^\text{11}\). Additionally, “biogas plants can produce electricity for 8 hours per day up to 24 hours per day”\(^\text{12}\). This electricity can

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\(^{11}\) Grameen Shakti, *Paving the Way for a Green and Sustainable Future, Pioneering an Integrated Market-Based Approach to Bring Clean and Affordable Energy to the Rural People*, 2010

\(^{12}\) Ibid.
be used by the owners for a variety of activities, e.g. using electrical devices such as lights, fans, in some cases even computers.

The biogas plant program was implemented by initiating and maintaining close relationships with small farmers & livestock owners, and explaining to them the benefits and advantages of biogas technology.

![Small biogas plant (Photo source: Grameen Shakti)](image)

The plants are designed and built after individual consultation with the clients. Joint biogas plants are also constructed in order to share cooking fuel and electricity between several families, as some families cannot afford to construct their own plant. This way an even larger number of people are able to reduce energy costs and have more disposable income to invest in other activities.

After constructing the plant Grameen Shakti offers free after-sales service, which consists of monthly visits by GS engineers for two to three years following the construction. It also provides the option for signing an annual maintenance agreement for a small fee during the post warranty period.

**Organic Fertilizer**

A by-product obtained from biogas plants is slurry, which has the ability to safeguard organic materials such as nitrogen, phosphorous, and potassium, a property that makes it a valuable fertilizer that ensures higher agricultural production. Slurry based organic fertilizer is meant to reduce the use of

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chemical fertilizer, which has severely damages soil fertility in Bangladesh. The Grameen Shakti Organic Fertilizer aims to improve the soil and thus enhance crop production. In order to prove to the local farmers the benefits of using the organic fertilizer they set up 130 demonstration plots to grow rice, potatoes and maize. GS also trains households on using the fertilizer as a supplement to the chemical one. GS organic fertilizers produced from poultry litter are good for acidic soil and help to reduce acidity and aluminum poisoning.

Grameen Shakti markets the organic fertilizer through local entrepreneurs while GS provides technical assistance and maintains quality control\textsuperscript{15}. GS developed a detailed manual instructing entrepreneurs how to produce the GS Organic Fertilizer. Manufacturing and marketing of organic fertilizers can be a viable business in the context of Bangladesh. An entrepreneur can earn Tk 16,000 (just over $ 200) from selling this slurry at a minimum rate of Tk 2 per kg.

GS has already signed agreements with two organizations to manufacture and promote organic fertilizers in Bangladesh.

\textit{Improved cooking stoves (ICS) program}

In 2006 Grameen Shakti launched a program to promote improved cooking stoves, developed by the Bangladesh Council of Scientific and Industrial Research (BCSIR). These stoves provide many benefits for the household, as well as for the women and children who tend to be the ones most often suffering from the health hazards resulting from the use of traditional stoves in Bangladesh. Some benefits of ICS are\textsuperscript{16}:

1. Reduces indoor pollution (IAP) and thereby reduce health hazards for the users
2. Saves 50-60\% of the traditional fuels used
3. Reduces CO\textsubscript{2} emissions and greenhouse effects
4. Maintains proper nutritive values of the cooked food
5. Causes less blackening of utensils
6. Reduces cooking time as compared with traditional stoves
7. Reduces fire hazards
8. Helps conserve the forest resources of the country.

\textsuperscript{16} Grameen Shakti, Paving the Way for a Green and Sustainable Future, Pioneering an Integrated Market-Based Approach to Bring Clean and Affordable Energy to the Rural People, 2010.
Grameen Shakti is responsible for disseminating ICSs and it does so by training engineers who install the stoves in the households. Over the years GS developed an even more efficient way of constructing the stoves. At the beginning it was faced with the issue that it took up to a week to install and make a stove ready for use. Additionally, during installation it was difficult to maintain the original dimensions of the stove. These challenges were resolved by developing another method for making the stoves and having them ready to be used immediately after installation.

GS has also set up 10 manufacturing units in rural settings for constructing ICS accessories such as metal grates and chimneys. These manufacturing units are run by entrepreneurs with the financial and technical assistance from GS\textsuperscript{17}. In order to make, sell and repair the stoves GS also trains local youth in rural areas, in particular women\textsuperscript{18}.

The ICSs are particularly popular among women of low and middle income households, as well as businesses such as restaurants, hostels, tea stands, etc. ICS are considered to help reduce monthly wood fuel consumption by 50-60\% thus saving an average of BDT 250 to 500 (US$ 3.50 to US$ 7.00)\textsuperscript{19}.

**Grameen Technology Centers**

Grameen Shakti has set up local Grameen Technology Centers (GTCs) in order to train people to market and produce SHS and produce SHS accessories. The program is particularly focused on training

\textsuperscript{17} Grameen Shakti, *Paving the Way for a Green and Sustainable Future, Pioneering an Integrated Market-Based Approach to Bring Clean and Affordable Energy to the Rural People*. 2010.


\textsuperscript{19} Grameen Shakti, *Paving the Way for a Green and Sustainable Future, Pioneering an Integrated Market-Based Approach to Bring Clean and Affordable Energy to the Rural People*. 2010.
women thus allowing them to develop as technicians. After undergoing the training they operate independently or as GS certified technicians who market, install, repair and maintain SHSs for rural customers. They are also trained to produce SHS accessories locally. By June 2011 Grameen Shakti had established 46 GTCs.

4. **Key Innovations**

**A novel financing model**

Being a young technology, renewable energy systems are comparatively expensive. The initial capital investment is especially prohibitive for the poor Grameen Shakti aimes to aid. One of the initial challenges was therefore to find a way to reduce this high upfront cost. This was achieved by developing an installment based financing scheme, which reduced the monthly cost of a solar home system to that of kerosene. This allowed GS to expand its market which led to economies of scale making it possible to reduce unit costs even further. As a result the company became a profitable and sustainable business. The financing scheme promotes ownership (as opposed to a rental model), because this leads to better care and longevity of the systems. At the beginning of 2011 over 140,000 customers had become owners of their own energy source this way. As the prices of traditional energy sources continue to rise, renewable energy will become increasingly attractive due to its low per-unit cost. However, the high upfront cost of the technology is this a major obstacle in generating the important shift away from fossil fuels and further efforts to lower the cost are required.

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Focus on empowerment, income generation & cost savings

Grameen Shakti successfully tied the technology with income generation, cost savings, higher standard of living, and especially social and economical empowerment. In rural Bangladesh, solar power became synonymous with social status, better living conditions, and more income. A rural family could save up to US$ 10 per month in energy cost while enjoying television and other modern amenities. Once the installments were paid off (usually within two to three years), there was minimum operating cost for the remaining lifespan of almost 20 years. This made solar much more attractive than kerosene especially when the other social and health benefits were also considered. The burden on women were reduced as they no longer had to clean kerosene soot, work under dim light, and they were empowered by being able to take part in home based income generating activities. Additionally, children could study under solar light and get connected to the outside world through television. For rural businesses, solar power meant productivity, more sales, income and jobs. A rural business could double its turnover by using solar while minimizing energy cost. Solar power especially helped to improve connectivity, increase the sales of electronic goods, and create new business opportunities such as mobile phones charging shops, electronics repair, maintenance shops and community television centers.

A strong grassroots network to provide after sales service right at the doorsteps of the rural customers

Rural people are unlikely to invest in a technology which is not durable and which they do not fully understand. To assure its customers that the systems would be well looked after, Grameen Shakti introduced after sales services. It focused on creating a vast network of rural engineers who developed one to one rapport with their customers. They visited each client’s home monthly to offer free after sales service for nearly 3 years. GS offered long term warranty (20 years for panels, five years for batteries and three years for charge controllers) plus buyback options under which a client can return his/her system, if the area becomes grid connected.

Important was the creation of a rural network of women technicians to assemble and repair solar accessories to ensure low cost, quick and effective repair, maintenance services, and availability of spare parts right at the door steps of the users. By January 2011 over a thousand women had been trained as technicians. Customers were also trained on how to take care of their systems and provided with user manuals. This meant well kept systems and therefore minimum repair and maintenance cost for both the clients and Grameen Shakti.
Capitalizing on community forces

Important for the company's success was also the active involvement of the rural community. The rural population was initially unaware of renewable energy technology and its benefits. Grameen Shakti had to educate them about solar energy and biogas generation to win their confidence. This was done by engaging community leaders and organizing demonstration events. The focus was especially on creating both social and economical local stakeholders. GS offered special packages for rural schools and madrassas in order to ensure their good will. It introduced scholarship for school children of solar users and designed special programs for rural school children to plant awareness of renewable energy in the next generation. Recruiting local youth who helped to install and maintain the systems and who understood the local market and customs refined the distribution effort. The company set up village based technology centers to assemble all solar accessories, creating jobs for local women in the process. This decentralized grass roots approach helped to keep operating costs low and gain acceptance by the local communities. Grameen Shakti was unique in that it not only provided clean energy solutions, but also created powerful social and economical incentives for their adoption. Creating jobs in the villages led to increased adoption as more families were able to afford installment.

Women as active agents of change

Grameen Shakti set up village based technology centers to train and empower young women to become renewable energy technicians and entrepreneurs. This was one of the most successful programs. These centers, managed by women engineers, train rural women in renewable energy technology thus enabling hundreds of rural women to generate monthly incomes of US$ 100 on average. These women, who belong to the most deprived class of their communities, have learnt skills like assembly, installation, repair and maintenance of one of the most cutting edge technologies in the world. They assemble and repair solar accessories such as charge controllers, mobile chargers, and invertors. This has enhanced their social and economic value in their communities and contributed to women empowerment. These women have become the backbone of the local production and repair network, helping rural people access cost effective and efficient services right at their door steps. They are powerful voices motivating other women, their families, and neighbors to install solar home systems and biogas plants.
Appropriate Product Design & Diversification

GS promotes and designs high quality, innovative products which meet the diversified needs of its rural clients. The customer tailored packages ranging from 10 to 130 watts allow a rural client to save energy, generate income and become the owner of the system after two or three years, at the same cost of kerosene. The standard 50 watt system allows a rural client to power four bright lights, watch television and power mobile phones. For lower income customers, there are 10-20 watt systems and micro-utility models which allow sharing of one system by many. Depending on the income of a rural client, products are designed to power computers, ceiling fans, refrigerators and income generating activities.

A listening culture coupled with strong quality control

Grameen Shakti developed a strong culture of remaining tuned to local needs by listening to its staff and clients. Incorporating a strong audit and management information system, GS I trying to seek new opportunities, meet challenges and forge ahead.

5. Main challenges the business model faced

- High upfront costs
- Very limited consumer financing
- Very limited investments in this sector due to perceived risks and uncertainty
- Knowledge and awareness gap
- Lack of efficient cost–effective after-sales service

Reaching the rural people

The main barriers Grameen Shakti had to overcome were high upfront costs and lack of awareness. A SHS capable of powering two to four small appliances costs about US$ 400. This is too expensive for a rural household in Bangladesh who earns less than US$ 50 per month. Asking them to pay up-front for a system is like asking them to pay an amount equal to 20 years of electricity in a single payment. A rural household who has never heard of or seen a Solar Home System cannot be expected to invest thousands of his hard earned money in such a technology.

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Rural people were unwilling to spend their hard earned money on a new, unfamiliar technology without the assurance that local support is available and there is potential to earn a higher income with the technology.

There are more than 21 organizations engaged in the rural renewable energy sector. With a few exceptions most of them have a very small client base. There is a lack of business acumen in this field because of the prevalence of NGOs. There has been very little incentive for innovation or new product development because most of the organizations depend on guaranteed soft loans from Infrastructure Development Company limited (IDCOL), a government agent.

The present practice of vast rural networks of branches and engineers translates into huge transaction costs and slow penetration rate. A lack of communication especially during the rainy season constrains movements and increases transport cost. Seasonal variation in the income of the rural population makes collection of installments difficult. This is not cost effective or feasible in the long run.

Training and retaining efficient human resource at the field level is difficult. The incentive is low compared to the hard work. It is difficult for organizations to increase incentives in order to keep their costs low. Additionally, there is lack of skilled engineers who can design cost effective and efficient solar energy system especially for product applications.

High battery prices and the difficulty of sourcing quality materials or accessories cost effectively create supply side bottlenecks.

Huge taxes /Vats are charged on import of all raw materials except solar panels. This increases the cost of local manufacturing of solar accessories which in turn increases the cost of Solar Home Systems.

There has been very little incentive from the government to popularize renewable energies except for long term soft loans through IDCOL. Most practitioners are overly dependent on IDCOL and there is no diversification of funding. Mainstream financial institutions are yet to take a major interest in renewable energy in Bangladesh.

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6. **Key success factors**

Grameen Shakti states the following factors as key to its success as an organization:

- No direct subsidies, GS does not want to create dependency.
- Innovative use of micro-credit to reduce costs and reach economy of scale
- Vast rural network with branch offices all over Bangladesh
- Trained & motivated staff who are also known as social engineers
- Local technician training
- Linking technology with income generation
- Local manufacturing of SHS accessories

In the analysis of Grameen Shakti’s business model, former GS Managing Director Mr. Dipal C. Barua adds the following points as relevant for the achievement of the organization’s goals:

- Appropriate designing of the program
- Commitment and dedication for the program
- Motivational program for awareness creation
- Community involvement and social acceptance
- Understanding of market demand
- Constant monitoring and evaluation
- Quality product
- Reliable backup service
- Minimum overhead cost

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7. Future outlook and business opportunities

Future outlook

Solar home systems

Grameen Shakti hopes to have a total of 5 million SHSs installed by 2015.

![Yearwise Installation of SHS](image)

Biogas plants

Bangladesh has the potential for developing four million biogas plants and Grameen Shakti intends to scale up its successful pilot project and develop an action plan for expanding its biogas program in the country. Its goal is to have 205,000 plants constructed by the year 2015.

![Yearwise Biogas Plant Construction Growth](image)

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Cooking Stoves

The goal of GS is to build a total of 5 million stoves by 2015. The company plans to expand its operations with the help of two key stakeholders – local technicians and local manufacturers. For this purpose GS also plans to train more young and women technicians who, in turn, will train others and will produce and market ICSs on the behalf of GS. The company also hopes to inspire these technicians to become entrepreneurs themselves and start their own businesses at the rural level in connection with GS.

Opportunities:

Exponential demand has been created among rural people for solar power and renewable energy sources. This is mainly due to the increase in the prices of kerosene and diesel as well as the lack of grid connected power. Decreasing prices of solar energy, and especially the growing aspiration and economic diversification of the rural population have also increased demand. Dependence on land and agriculture is decreasing, and cattle are being replaced by power tillers, tractors and other machinery. Nearly 60% of the rural people now own a television showing increasing levels of wealth.

Technical progress has reduced cost, increased efficiency and diversified the application of solar energy. For example, use of LEDs and compact fluorescent lamps has reduced the cost of solar power, while increasing its efficiency. The flexibility of the systems allows every segment of society to invest in renewable energy systems. For example, Pico systems (1 to 5 watts) can power two or more lights while charging mobile phones. A solar home system may be sized to power a larger house with a refrigerator and TV (costing US$ $1,000) or a large TV and three lamps (for US$250) or a small TV.
three lamps and a radio (for US$100) or a lamp, radio and cell phone charger (for as low as $50 – about the same cost as a cell phone). Other factors that are reducing costs include efficient loads, innovative batteries, and lower module cost.

**Thrust areas:** The diversification of the rural economy concurrent with increasingly efficient solar systems has created a market for larger solar energy system applications to power pumps, mini/micro grids for SMEs, internet kiosks etc. Farmers suffer from power shortages during the irrigation season and a replacement of electric power pumps with solar pumps would reduce the grid load by 800 mw. There is also increasing demand in the rural health and education sectors for integrated energy systems to power lights, computers, TVs and refrigerators. Solar power can serve these needs. Solar power can also be used for early warning systems, emergency lighting, water desalination and other live saving devices in disaster zones. Increasing load shading in the urban areas has made solar power an attractive option for urban dwellers. One to ten Kw systems to power lights, TVs and other appliances in domestic and commercial sector can easily create a niche, alongside diesel generators and Instant Power Supply.

**Evolving supply chain:** Bangladesh currently is growing a thriving renewable energy sector with multiple companies manufacturing batteries, lightings and other solar accessories. Many of these companies are also exporting their products. Recently the government has decided to include solar as a thrust sector in its industry policy.

Bangladesh Bank has created a special fund of US$ 28.57 million for financing solar and other renewable energies channeled through commercial banks. This is one of the first small steps in linking renewable energy technologies with mainstream financial institutions.
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