IFAD-APRACA FinPower GreenFinance Forum

Integrating Clean and Renewable Energy and Environmental Sustainability Components into Rural Financing: Case Study of GHEL and ASA Initiative

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I. Current environmental, economic and energy challenges of Bangladesh

11. Overview and Environmental Threats of Bangladesh.

Bangladesh is the seventh most populous country (162 millions) and is among the most densely populated countries in the world with a high poverty rate. However, per-capita (inflation-adjusted) GDP has more than doubled since 1975, and the poverty rate has fallen by 20% since the early 1990s. The country is listed among the "Next Eleven" economies (countries promising to be major economic actors of our century). As a result, Health and education levels (literacy rate is now about 43%) have recently substantially improved. Most Bangladeshis are rural people, living on subsistence farming. Health problems abound, ranging from surface water contamination, to arsenic contamination of groundwater (more than half of the country's groundwater has been identified as naturally arsenic-contaminated), and diseases including malaria, leptospirosis and dengue. Natural calamities, such as floods, tropical cyclones, tornadoes, and tidal bores occur almost every year, combined with the effects of deforestation, soil degradation and erosion. In September 1998, Bangladesh saw the most severe flooding in modern world history. As the Brahmaputra, Ganges and Meghna spilt over and swallowed 300,000 houses, 9,700 kilometres of road and 2,700 kilometres of embankment, 1,000 people were killed and 30 million became homeless with 135,000 cattle killed, 50 square kilometres of land destroyed and 11,000 kilometres of roads damaged or destroyed. Two-thirds of the country was underwater. The recent cyclones known as SIDR and AILA have also greatly affected Bangladesh.
Bangladesh is now widely recognized to be one of the most vulnerable countries to climate change. Natural hazards that come from increased rainfall, rising sea levels, and tropical cyclones are expected to increase as a consequence of global climate change and temperature rise, seriously endangering agriculture, water & food security, human health and shelter. Most parts of Bangladesh are less than 12 m above the sea level, and it is believed that about 50% of the land would be flooded if the sea level were to rise by 1 m. The IPCC (Intergovernmental Panel on Climate Change) predicts that the sea level will rise between 18 cm and 59 cm in the coming century. It is thus believed that in the next decades the rising sea level alone will create more than 20 million climate refugees in Bangladesh.

Air and Water pollution are also dramatic environmental issues in Bangladesh. For instance, a recent study analyzed the water quality parameters of the Buriganga River, one of the major and most resourceful rivers of Bangladesh and economically crucial to the city of Dhaka. According to the chemists' findings, the Buriganga River is in danger of becoming a "dead river". The vast quantities of solid waste, wastewater, surface runoffs, industrial

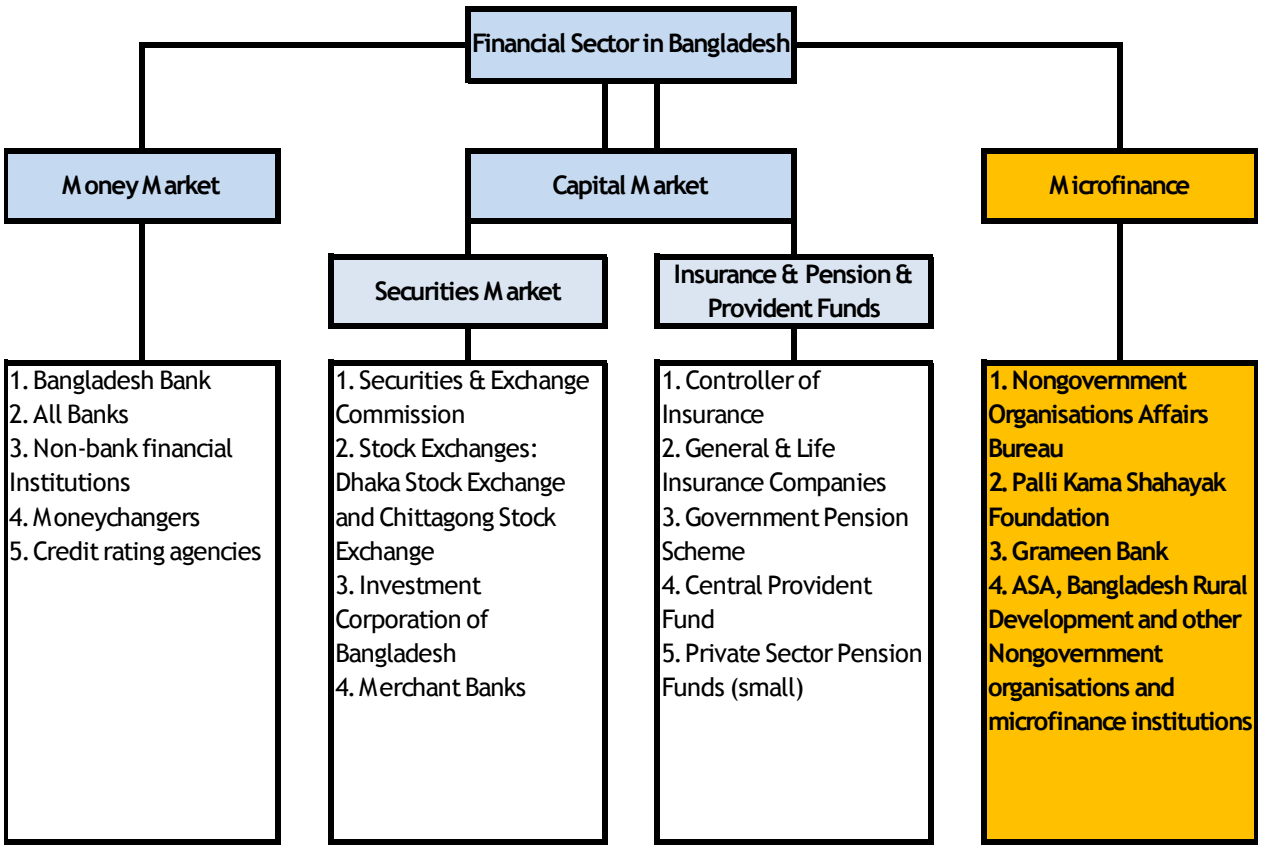
effluents and chemical nutrients rejected by human activity directly affected the pH, dissolved Oxygen and chlorides parameters to the detriment of all aquatic life and ultimately to all human activities based on the river resources (drinking water, fishing…). Regarding air pollution, experts agree on the fact that Dhaka is the most polluted city in the whole world in the dry season with 463 micrograms of particulate matter (PM) per cubic metre, followed by Mexico City and Mumbai.

The recent Copenhagen United Nations Conference ended with a political agreement to cap temperature rise, reduce emissions and raise finance. The countries reunited for UNCOP15 agreed to heed the scientific warning that an increase of global temperature below two degree is required to stave off the worst effects of climate change. A special focus on reducing vulnerability and building resilience of developing countries was adopted. Bangladesh, as one of the most threatened by climate change consequences, should undoubtedly benefit from the $30 Billion to be unlocked within the next two years ($100 Billion by 2020).

12. Economy: Financial overview

The government's National Poverty Reduction Strategy reaffirms that reducing poverty level and accelerating the pace of social development are Bangladesh's most important long-term strategy goals. The development of the financial sector is critical to meet the twin goals of economic growth and poverty reduction, since it is the financial sector that mobilizes resources and allocates them to those investments that make the difference in the long-run.
The financial sector development can benefit to the poor:

i) By promoting overall economic growth which in turn may lead to improved income overall.
ii) By reducing the risk of financial crises, whose adjustment costs are most felt by the poor.
iii) By improving access of the poor to qualitative and adapted financial services.



Source: Based on Policy Analysis Unit, Bangladesh Bank.

Despite its strong growth since the early 90s', the financial sector of Bangladesh has to face many challenges today: low Gross Domestic Savings Rate (20.5% in 2007 compared to 34.8% in India), low level of financial intermediation, high consumption pattern, low disposable income, nonperforming loans (13.2% in March 2008). All these elements characterize a resource gap, which, even if it has steadily decreased for the last 10 years, still attained 3.9% of the GDP in 2007.

The member-based Microfinance Institutions are a rapidly growing segment of the rural financial market of Bangladesh, the microcredit loans constituting 44% of total disbursements in the Credit Sector. Grameen Bank is the only formal financial institution offering microfinance products. Nearly 1,000 semiformal institutions also operate in Bangladesh, mostly in rural areas, the Bangladesh Rural Advancement Committee, the Association for Social Advancement and PROSHIKA being the lead and most meaningful organizations with 94% of loans volume and 73% of Savings.

62% of borrowers lie below the poverty line and the vast majority of them have no physical collateral to secure loans, thus needing alternative collateral mechanisms. This simple fact surely helps to understand why microfinance organizations constitute the main financial actors in rural Bangladesh. World Bank's figures indicate that the "Big 4" (GRAMEEN, ASA, BRAC, PROSHIKA) are liable for 86% of the 14.3 million Bangladeshis borrowers, for US $1,249 million in outstanding loans and for around US $402 million in Savings. The average loan size is Tk. 4000 (US $60) and the average interest rate is respectively 12.5% for Nongovernment organizations and 25% for Microfinance Institutions. The financial landscape of rural areas is also marked by the progression of Lease financing, accounting for 54.5% of total long-term financial assets.

The development of microfinance in Bangladesh can be roughly divided into four main phases:

- 70s': Action Research Phase.
- 80s': Micro Credit Development Phase.
- 90s': Consolidation Phase.
- 2000s': Expansion phase.

Microfinance has not only been proved to be an essential instrument for enabling the poor to transform their skills and existing resources into sustainable income generating activities. The microfinance organizations' huge networks also create considerable development and commercial opportunities. The example of GHEL, to be found later in this paper, perfectly illustrates the means by which microfinance actors can further extend their social & environmental positive impact.

13. Energy Considerations

It is our capacity to control and to adapt our energy production and consumption that will for a good part determine the intensity of the climatic changes that are yet to come. Experts indeed agree that fossil fuels account for between 9 and 26 % of total greenhouse gases of Bangladesh. Developing countries, often caught between their will for a strong paced development and the lack of adapted technological alternatives, are most keenly confronted to the thorny issue of fossil fuels dependency. Today, 93.7% of Bangladesh's energy is produced out of fossil fuels (6.3% hydraulic source). Last year, the overall consumption of electricity in Bangladesh was 21,370,000,000 kWh (151 kWh inland availability per capita) and is growing quickly, by more than 10% per year, with still a large unsatisfied demand. Bangladesh's energy infrastructure is quite small, insufficient and poorly managed. The per capita energy consumption in Bangladesh is one of the lowest in Asia. Around 70% of Bangladesh total population is still living in the dark.
The energy issue is a major obstacle to the development of rural Bangladesh, embracing around two-thirds of the total population but only liable for 2.5% of overall consumption with an inland availability per capita more than 50 times inferior than the one in cities. Isolated farmers excluded from energy networks have no choice but rely on more expensive and non renewable energies- batteries & Kerosene-, rejecting huge quantities of greenhouse gases to the obvious detriment of our environment: 800,000 tons of Kerosene are used every year by Bangladeshi Households.

Even with 400,000 households gaining access to electricity every year, it could take another 40 years for all the people of Bangladesh to have power, without mentioning the fact that inaccessibility and low-consumer density are likely to exclude the most remote rural areas of any electrification project. That is why it is so crucial to spread off-grid renewable energies -particularly of solar and of biomass origin- to help speed off that electrification process. More than 100,000 Households have already been equipped with independent solar energy systems in Bangladesh in the framework of the Renewable Energy and Rural electrification project involving major field organizations such as the Global Environment Facility, Grameen Shakti or BRAC. But the market remains widely untapped and the possibilities of improving rural living conditions while reducing the country's carbon footprint huge. There is no doubt that Renewable Energies Technologies will play a

significant role in the future development scenario of the country, especially when the capital costs of such technologies will further become competitive with grid electricity as shown by the historical trend of dramatic cost reduction and efficiency increase of Solar PV Technology. Solar Photovoltaic electricity has not only been shown to be the cleanest and the most convenient of all forms of energy, but it also appears to be a key solution to the electrification of the sunny rural areas of Bangladesh. However, at the core of this sector's potential lies our will to propose adapted and low-cost financing means, which is not yet always the case.

14. Governmental actions:

Several ministries and policies led by the government implement actions to improve Bangladesh's access to energy and to encourage private initiatives acting in the field of renewable energy, and in particular solar energy. One of the main objectives of the government is to increase power output using renewable energy resources by 10% (at present, it is 5%). Simultaneously, the government tries to act as the safekeeper of the country's myriad of microcredit initiatives and to make sure that rural areas have access to adapted financing means.

Governmental actions in the microcredit field

Micro Credit Regulatory Authority

The Microcredit regulatory authority was enacted in 2006 and is now an independent agency whose board is composed of members chosen from the government and from MFIs (Micro Finance Institutions). It aims at developing an appropriate regulatory and supervisory system for the flourishing subsector of microfinance by:

- Requiring all MFIs to register with the MRA in order to operate legally in the country.
- Monitoring MFIs in Bangladesh to safeguard the interests of microfinance clients by fighting against overpricing (MFIs that deviate from them incur the risk of financial penalties or imprisonment).
- Assessing the performance of MFIs so as to protect the sustainability of the sector.
- Establishing a depositor's insurance fund to ensure safety of the depositors and to secure all MFIs depositors.

Governmental actions in the energy field

National Energy Policy (NEP)

The NEP was initiated in 1996 by the government of Bangladesh and has the following objective:

- To ensure energy provision to all economic sectors to prevent any economic slow-down due to energy shortage.
- To meet the energy needs of populations who are now excluded from the electricity grid.
- To encourage the development of all energy sources, from the commercial fuels to the renewable energy sources such as biomass, solar energy, etc.

- To make sure energy sources are used in a rational way.
- To protect the environment by promoting sustainable energy development programs and encouraging private initiatives in this field.

Bangladesh Power Development Board (BPDB) and Rural Electrification Board (REB)

There are attempts by the government to develop Bangladesh's electricity network. The Bangladesh Power Development Board (BPDB) and the Rural Electrification Board (REB) have indeed implemented important grid extensions in order to provide a significant larger portion of Bangladeshi households with electricity. However, due to a lack of financial resources from villagers, to the high cost of grid extension and to the government's constraints to develop the country's other infrastructure, only 50% of the nearly 10,000 rural markets and commercial centers in the country benefit from the electricity provided by the national service.

Example of a governmental action: Clean Air and Sustainable Environment Project for Bangladesh

The objective of the project is to improve air quality and safe mobility in Dhaka.
It provides technical assistance and funding to foster all kinds of initiatives in the key air polluting sectors in Bangladesh, especially in urban transport, in order to crack down on pollution due to major traffic congestion. It also encourages policies and regulations governing these sectors by boosting institutional, policy and regulatory framework for public transport, and by strengthening the Bangladesh environment agency.
The Bangladesh government strongly supports initiatives favouring the development and the use of renewable energy, but its actions alone are still outmatched by the country's large demand and unfortunately remain insufficient.

II. Green financing : how to combine rural microfinance and renewable energy

21. Renewable energy: a promising sector for microfinance

Renewable energy is among the most promising industries for MFIs seeking to invest in wide-impacting social enterprises. Indeed, acting on the energy sector is one of the most efficient ways for microfinance actors to positively impact the social and economic conditions of their local targets.
Reliable and affordable energy sources are a major prerequisite for economic development and environment protection. Energy is undoubtedly a basic need, for daily activities such as cooking, lighting, heating, for health (boiling water, refrigeration,...) and also for any income-generating activity (light of a shop, vehicle, communication means...). This is then one of the first sources of expenses for households and small businesses. Access to energy is thus a good leverage to help people and micro enterprises reduce their daily expenses and satisfy ever more basic needs dependent on energy delivery.

Moreover, sources of energy currently in use (fossil fuel) and the way they are used have bad consequences on health and environment. Fossil fuels are both responsible for a great

part of the greenhouse gases by emitting carbon dioxide, and for rejecting polluting gases indoors that are frequently the cause of respiratory diseases.

In the last decades, new technologies have appeared, further unlocking the Renewable Energy Systems' potential and reducing their cost. For instance, between 1990 and 2005, prices were reduced by 50% (REN21 2005). Besides, with the increasing prices of oil, Renewable energies have become more competitive. MFIs now dispose of a new opportunity to promote and invest in clean energies and green housing installations such as: Solar Water Pumps, Solar Water Heaters, Solar Home Systems, Better cooking stones, Hydro-power generators, Adjustment of fireplaces for heating rooms, Bio Gas, Solar Lanterns, etc.

Clean and renewable energies have 3 majors assets :

Cost-efficient : The initial required investment can sometimes be quite high, but no regular expenses are necessary, in opposition to fuel-consuming devices. Consequently, the initial investment is rapidly recovered by the absence of utilization cost.

Environment-friendly : there is no rejection of greenhouse gases, no use of fossil resources, non destruction of biosphere.

Flexible: Renewable energy technologies can operate via decentralized and autonomous installations and can be independently set and adapted to houses and local facilities, unlike the centralized electricity grid distribution.

Thanks to these technologies, MFIs could be able to provide poor people with clean, renewable and cheap sources of energy. They are even the best imaginable structures to endorse the combined roles of promoters, investors, educators, and service-maintainers. Their knowledge of poor rural people's needs, the availability of their staff, the geographical extent of their unequalled customer networks and their demand in terms of financial sustainability make MFIs the best suited to develop this promising market and diffuse these best-practices.

22. Hindrances faced by Renewable Energies Systems in rural areas

In spite of the pressing need of new sources of energies and the proved efficiency of sustainable energies like photovoltaic, their development in rural areas remains weak for the following reasons:

- The **cost of reconversion** of old infrastructure designed for oil, gas or coal.
- The lack of awareness and information about what is available in the renewable energy sector.
- The **lack of confidence** in performance, viability and regularity of renewable energy.
- The fact that proposed renewable energy systems are **not adapted and customized** to answer to low income rural population needs.
- There is a **conceptual and technical gap** resulting in a lack of synergy between the technology experts and the environmental initiatives.
- The **small amount of people working** for R&D, installation and maintenance in Renewable energy systems.
- The **still limited government policies and coordination** among the co-organizations involved (government agencies, NGOs, R&D institutions, companies).

Microfinance has the means to overcome these obstacles.

First by making renewable energies more affordable: MFIs are flexible enough to **offer appropriate loans** to finance initial cost of appliance. Secondly by raising awareness about sustainable development, about health problems caused by the use of fuel, and about potential savings that can be generated through the use of renewable energy. Thirdly by using their wide-spread credibility to promote clean energy products. Eventually by creating an ecosystem of workers and specialists of the sector working hand in hand on the development of clean energies with NGOs, governmental agencies and entrepreneurs. However, these entrepreneurs leading promising projects in renewable energy face many difficulties because:

- Financiers (banks and government institutions) have many difficulties **to identify the promising projects**, because they do not have the technical knowledge from the field.
- Governments are used to finance their own projects but those are rarely efficient.
- The **non-clarity of the policies** in favor of the development of such projects: no tax exemption for the importation of green products components.
- The **lack of appropriate political channel** prevents entrepreneurs to have access to public funds.
- The **long and demanding bureaucratic process** preceding implementation and the projects financing.

It is thus clear that the government has to develop a clear policy in order to foster the creation of firms specialized in the renewable energy sector and to help them offer affordable products to the poor people of rural areas.

23. Financing mechanisms and models

Thanks to their flexibility, MFIs can develop various financing models to penetrate the renewable energy market. In Bangladesh, three kinds of mechanisms have been customized:

-The **fee-for-service** option: this system was tested by the Bangladeshi Rural Electrification Board which has supplied about 800 Solar Photovoltaic units. It is a kind of rental approach where customers pay weekly or monthly fees depending on the type of solar product concerned. This solution eliminates the up-front costs occurring when the customer wishes to acquire photovoltaic systems. As a consequence, more of them can be installed without any necessary donation or subsidies. Most of the time with this type of financing option, companies or MFIs keep the ownership over the materials and provide all the services of installation, maintenance and reparation (all these services are included in the fees).

The case of Solus Honduras is a good example of this kind of service. This private company provides three quarters of its customers from out-of-grid rural areas with electricity by supplying affordable photovoltaic installations using the fee-for-service method. People pay monthly for the rent of photovoltaic (PV) devices and the company employs local engineers who are responsible for the installation and the maintenance of the PV system. Today, Soluz Honduras can offer more affordable products to local households, with prices varying between $10 and $20 per month which is almost equivalent to the amount paid for kerosene and dry cell batteries.
The monthly collection rate for the payment is more than 90%. The reason of this high level rate is that collection agents and area managers use incentives to receive the payment and that the non-payment result in quick dismantling of the client's PV system.

This option has proved very successful. Nevertheless, this kind of programs requires high investment levels and results in a major risk for the organization initiating them.

-The **Credit Sale** option: globally this system offers to customers the possibility to purchase Renewable Energy System through multiple payments supported by micro credits. The major advantage of this model is to enable the client to buy a given device without having to bear the burden of a high initial cost. The second advantage is to ensure the payback of the loan thanks to the savings generated by the use of renewable energies instead of other sources of energy like oil, gas or coal. Finally, the customers can better manage the credit payback by selling energy in excess to their neighbors.
Of course the energy needs vary greatly from a customer to another which implies that the types of RES needed are different and that the savings realized thanks to the reconversion can also differ. In any case, the amount of the loan, interest rate, duration and costs of the service are adapted to the customers need.
Here are for instance the offers of Grameen Shakti, from the Grameen Family (Grameen Shakti's aim is to develop, popularize and provide cost effective and clean renewable energy systems to out-of-grid rural households in order to improve poor people's life in Bangladesh) :

- *The user has to pay 15% of the total price as down payment. The remaining 85% of the total cost is to be repaid within 36 months with 6% (flat rate) service charges.*
- *The customer has to pay 25% of the total price as down payment. The remaining 75% of the cost is to be repaid within 24 months with 4% (flat rate) service charge.*
- *Micro-utility: The customer has to pay 10% of the total price as down payment. The remaining 90% of the loan amount is to be repaid by 42 checks. There is no service charge.*

For instance, in the first case, a family buys a solar kit consisting in a 17W solar module and 2 fluorescent lamps for the price of $170. They will pay a $25 down payment and then $4.70 per month over 36 months (reimbursement of the loan + 6% of service charges). This $4.70 is half of the cost of the former kerosene lamps. If the family can afford the initial $25 (for which they can contract a micro credit), the solution is preferable.

-The **Cash Sale** option: This is a more basic option which permits customers who can afford it to acquire directly the ownership of the Renewable Energy System. A discount is generally granted to the customers choosing this option. It is often used by private companies or as an alternative choice by MFIs and non-profit enterprises.

These options are useful to clear the hurdle of the initial cost of a Renewable Energy product, but they do not totally allow an efficient market penetration. In order to have a real impact and reach as many people as possible in rural areas, an organization distributing Renewable Energy Systems must hinge upon a solid network of local managers having in-depth field knowledge. That's the key of the Grameen Shakti's success in the development of its products : thanks to Grameen Bank’s network and experience, Grameen Shakti has been able to select the appropriate areas, diffuse information about clean alternative energies, offer appropriate systems (in terms of design, dimension, source of energy and appliance) and set up an effective after-sale and payment collection service.
Furthermore, this local approach has greatly helped in reducing the costs by building a whole local production chain, a proximity distribution network and by training both users

and local technicians to ensure a reliable maintenance of the systems. That's the reason why organizations like Grameen and ASA are the best positioned to promote Renewable Energy in rural areas. They have the required market knowledge and network and are have the utmost ability to create co-operation among local actors, government and companies developing the technologies.

III. GHEL: an innovative firm offering low-cost solutions to environmental, economic and social shortcomings.

31. About GHEL

Green Housing & Energy Limited (GHEL) is a sister concern of Association for Social Advancement (ASA) highly reputed microfinance institution in Bangladesh, and of International Center for Microfinance and Social Enterprises Ltd.(ICMSE) which is dedicated to Social Enterprises Development by linking corporate social capital venture funds with new technologies for a sustainable development.

The ultimate objective of GHEL is to overcome the dependency on fossil fuel by offering alternative green energy like solar energy for Bengalis' everyday activity. Today, the immense needs of electricity, gas or proper housing system are difficultly met by the government alone. Therefore, GHEL comes up with innovative solutions by providing both its microfinance clients and its staff with the best and cleanest technology at an affordable price.

Green Housing and Energy Ltd. will get technical assistance from INES (a French National Solar Institution) and technological support from Taiwan based institute "AFTA Technology". The project hinges upon a Private Public Partnership (PPP) model, and addresses the need of decent housing and energy solutions for the low-income people.

There is today a huge market to conquer with renewable energy since the vast majority of Bangladesh rural areas still have no access to electricity, and this ambitious project is undoubtedly realizable since more than 100,000 solar home systems have already been installed in Bangladesh through major contributions from Grameen Shakti (which sells photovoltaic systems on credit to rural households). Besides, entering the market of renewable energy in which powerful actors are already extremely active is not a problem because GHEL's positioning will be focused on the low price of its products: they are planned to be 20 to 30% cheaper than Shakti's.

Implementing a comparable project, but at low-cost, and with the skills, knowledge and huge cli

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32. GHEL products

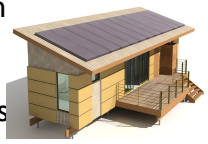
All GHEL products can be financed with a micro-credit provided by ASA. Indeed, such a combined solution ensures the access to vital, robust and sustainable products that have been until now inaccessible for rural people in Bangladesh for 2 reasons: the difficult access to credit and the lack of low-cost clean products in Bangladesh.
The GHEL-ASA initiative meets this crying need by coming-up with the three products: Low cost green housing, solar energy, and agro business development.

321. Low-cost Green Housing

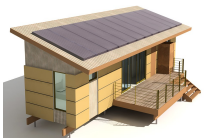
Low cost green housing is an ideal house that will be sold at a retailing price that **is 40% cheaper than any other regular house**, and will integrate the following devices:

- Solar Panel & other solar utilities
- Biogas plant or Modern Stove
- Pure water supply through reserved rain water shallow tube well
- Environmental & Ecological Sanitation

Besides, the house can be used not only to live, but also to host a home-grown business. The **longevity** of the house will be ensured for minimum 50 to 80 years and will be protected from natural disaster. Low-cost green housing has numerous positive impacts that are not only environmental, but also economic and social. Such a house not only improves the quality of its inhabitants' every-day life by providing them with a decent place to live, but also fosters their productivity by allowing them to have a work place where they can set-up their own SME.
Moreover, this house ensures less emission of Greenhouse gas and a smaller dependency on fossil fuel thanks to the numerous solar products it includes, thus helping reducing the global warming. Its solid waste management, safety water and sanitation will also disallow diseases transmissions in the environment. At the same time, the concept and an approach of recycling the nutrients from human and animal wastes in biogas plant will meet th demand of Natural Gas.



The strength of this project is that it offers low & mid-income people an affordable, robus and energetically-self-sufficient housing equipped with hybrid and eco-friendly technology. The microfinance support program eradicates the weight of down payment. Eventually, education may be encouraged in the long run due to the acquisition of a better standard of



living.

322. Solar Energy

Just like for the Green Housing product, solar energy products are sold by GHEL thanks to a micro-credit provided by ASA. In other words, **ASA grants GHEL's potential clients with a micro-loan** at an interest rate of 12% **provided this loan is used to purchase one of ASA's low-cost solar energy devices.** GHEL's solar energy project is undoubtedly promising since Bangladesh is endowed with a great solar energy potential. Indeed, Bangladesh receives an average daily solar radiation of 5kWh/m², offering an annual amount of solar radiation between 1,840 and 1,975 kWh/m², which is significantly higher than in Europe, and represents a sufficient resource to meet a large portion of the country's electrical demand.

For now, 5 products are available: a solar lantern, a solar water pump, a solar panel, a rechargeable solar battery and a solar tricycle.

Solar panel

A solar panel is a packaged interconnected assembly of photovoltaic cells that makes use of renewable energy from the sun, and is a clean and environmentally-sound mean of collecting solar energy. GHEL Solar panels withstand heat, cold, rain and hail for many years. The usual warranty is 15 years at 90% of rated power output and 25 years at 80% of rated power output. The average cost of a solar panel is from Tk. 5,500 to Tk. 85,000.

Solar panels are easy installations and portable technologies which provide clean, uninterrupted power supply unlike fossil fuel electricity. Their impact is thus inherently economic (they are less expensive in the long term), social (the living standard of low & mid income people will

Solar lantern

The Solar lantern is a lighting system whose duty cycle is about **4 hours a day**. It consists of a lamp, a battery and electronics, all placed in a suitable box, made of metal, plastic or fiber glass, a photovoltaic solar panel and one or more rechargeable batteries. The battery is charged by electricity generated through the photovoltaic module. The lantern is basically a **portable lighting device** for either **indoor or outdoor lighting**, covering a full range of 360 degrees. A LED based solar lantern system aims at providing solar electricity for operating LED lights for specified hours of operation per day.

This solar lantern is a great alternative resource to fossil fuel lanterns; i.e. kerosene lantern, gas lantern, candle stick, torch light etc. Its environmental impact is extremely high: it reduces carbon emissions, guarantees daily energy supplies, hinders fire and environmental hazards caused by the use of kerosene, and is even less expensive than any other source of energy in the long run. Indeed, people in Bangladesh's rural areas spend an average of 12 to 15 BDT per day on kerosene while a solar lantern has a total cost of 2500

BDT. Considering an interest rate of 12%, it can be deduced that GHEL Solar Lantern is amortized in 207 days.

Solar water pump

GHEL Solar water pump **allows uninterrupted water supply in irrigation**. It consists of a solar panel, a deep cycle battery for continuous use, and a motor.

Rechargeable battery is a multi-usage power storage system. It offers economic and environmental benefits compared to disposable batteries. The price of the battery depends on its sizes and life cycle. A battery can be **recharged** and **reused up to 500 times**. This battery can be charged through both solar and electricity lines. Rechargeable batteries are most of the time used as automobile starters, portable consumer devices, light vehicles, etc.

Solar Tri cycle

Solar Tri Cycle is a clean and **renewable solar-powered vehicle** used for short distances. It requires no additional fuel cost and is easy to drive & maintain. It consists of an attached photovoltaic panel module and a rechargeable solar battery with a tri cycle. The minimum speed is 40 to 60 miles per hour.

The commercialization of such a product would have a crucial impact on Bangladesh's environment since rickshaws are ubiquitous in the country, and especially in Dhaka where more than 400 000 of them circulate every day. This number is even more dramatic considering that rickshaws emit 30 times more pollution than a normal car. There is thus a huge market to conquer and an environmental plight to address since 47% of Dhaka's CO2 emissions are due to transportation.

323. Agro Business Development

GHEL intends to invest in the area of agro business development by building a seed preservation center in which farmers could preserve their seeds for a low-price, and to cultivate and commercialize Stevia which is a highly efficient substitute for sugar.

Seed Preservation Center

The seed crisis is most keenly felt during the agricultural season. Lack of seed storage system is the only reason behind it. Sometimes, overproduced seeds get decayed because of the unavailability of this facility and farmers count irreplaceable loss. A Seed Preservation Center will provide storage facilities to the remote people with **minimum charg**e. The center will be techno-oriented, preserving the quality of the seeds for a long period of time for a very low fee. This center will have a direct economic impact on low

and mid income people by preserving their seeds and thus their independence, ultimately becoming less vulnerable to the fluctuations of the seeds-rate on the market and to the high prices fixed by seed banks and GMOs retailers.

St

St any developed countries, grows wild as a small shrub. A scientific research shows that extracts of Stevia is 300 times sweeter than a table spoon of sugar with low-carbohydrate. Stevia is an all-natural herbal product and totally non-toxic, so there is no harm in taking it. It is being used widely as an alternative to sugar and an artificial sweetener in all kinds of food products for years. Raw herbal Stevia contains nearly one hundred identified phytonutrients and volatile oils which remain intact in extracted Stevia as well. Most importantly, the cost of Stevia will be Tk. 5 per Kg whereas producing regular sugar costs Tk. 50. Besides, Stevia is adapted to diabetes patients who are intolerant to regular sugar. GHEL plans to acquire its own lands to grow Stevia, harvest it and commercialize it at a low-cost retail price.

33. A customized marketing strategy

GHEL concretely addresses the issue of the lack of affordable customized products in the renewable energy sector. Offering **Low-cost, multiple-used, highly guaranteed and qualitative affordable products to the low-income people of Bangladesh** is the main objective of GHEL social-business initiatives.
Every product is thus designed and conceived in order to respect these predicaments:

- The **solar Lantern** is mainly sold as a costly lamp by GHEL competitors. GHEL came up with an **innovative solution** to help local people meet multiple daily needs with a single item. The new version of GHEL's solar lantern can thus also **serve as a phone charging device**, using the same rechargeable battery the lantern does. Additionally, the solar lantern is equipped with the **LED technology**, increasing its **duration time** up **to 20 hours** before it needs to be recharged.
- GHEL's solar panels will revolutionize the Bangladeshi market. Thanks to its partnership with the French solar technology expert INES, GHEL will sell the cheapest solar panels or solar panel's equipped products of the market. INES has indeed developed plastic-made solar panels that will reduce the fabrication cost by approximatively 40%.

- Simultaneously, all GHEL solar products will be at least 20% cheaper than competition thanks to low-cost taïwan-based suppliers.
- GHEL has a strong quality commitment. Its solar panels will be associated with a 15 years guarantee (batteries only 2 years) while its houses will come up with a 50 years guarantee.

GHEL products commercial details:

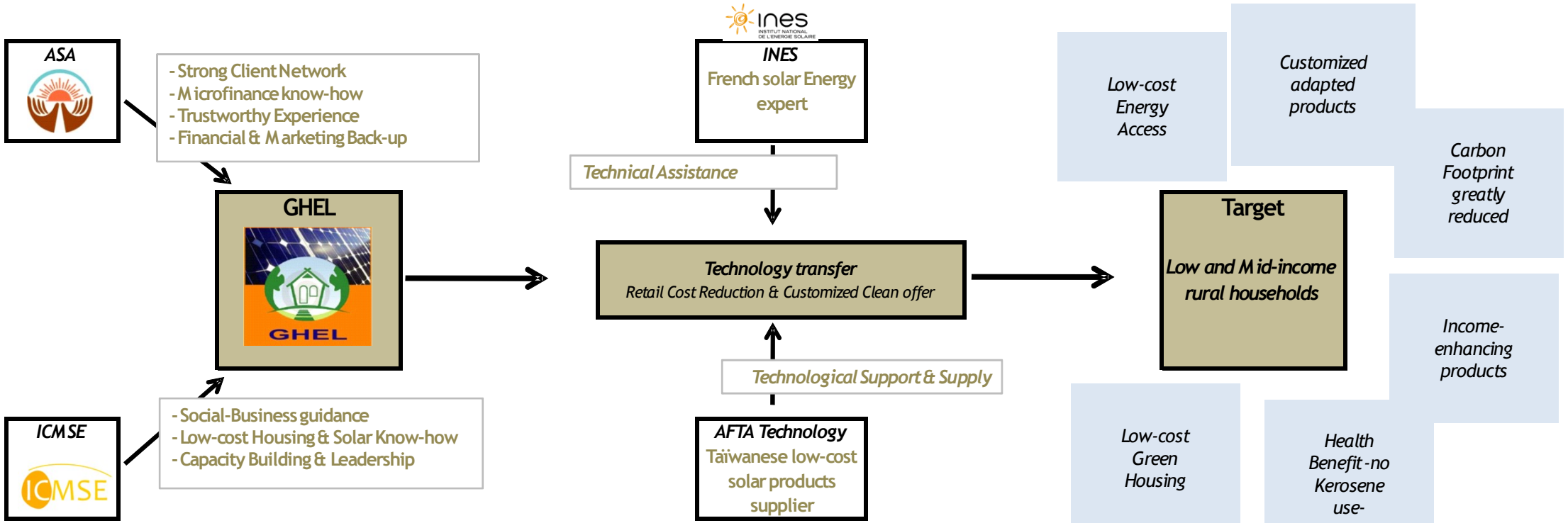
GHEL Product	Characteristics*	Gross selling price	Loan terms and conditions	Target identification**
Low-Cost Green Housing	***Model A: >>> square feet*** (solar panel, sanitation & cooking systems) ***Model B: >>> square feet*** (solar panel, sanitation & cooking systems + water system)	Model A: $>,>>> *(>>>,>>> Tk.)* Model B: $>,>>> *(>>>,>>> Tk.)*	*bi-weekly or monthly repayment* - > to > years timeframe - >>% interest rate - no down-payment	*>st deployment period:* ASA staff->>,>>> people minimum identified market: >>,>>> Houses under construction *>nd deployment period (within > years):* ASA clients-> million minimum identified market: >>>,>>>
Solar Panel	Price proportional to the panel electrical capacity in Watt-**average price >>% less than current lowest market price**	$>> to $>>> *(>,>>> Tk to >>,>>> Tk.)*	*weekly repayment* - > to > years timeframe - >>% interest rate - no down-payment	Low and mid-income family. Identified market: ASA rural clients
Solar Lantern	***Model A:*** lighting- **> hours** rechargeable cycle ***Model B:*** **LED** technology lighting- **>> hour**s rechargeable cycle + **Phone charging** application	Model A: $>> *(>,>>> Tk.)* Model B: $>> *(>,>>> Tk.)*	*weekly repayment* - > year timeframe - >>% interest rate - no down-payment	Low and mid-income family. Identified market: ASA rural clients Test phase -ordered-: >>>,>>> lanterns
Community Charging Center	Phone Charging Independant Center electrified by GHEL solar panels and delivered to freely trained micro-entrepreneurs	*depending on solar installation-charging fee freely chosen by entrepreneur*	*weekly repayment* - > to > years timeframe - >>% interest rate - no down-payment	Rural Entrepreneurs in off-grid areas Potential market estimation: >>,>>>
Solar Tricycle	-	$>,>>> *(>>>,>>> Tk.)*	*weekly repayment* - > to > years timeframe - >>% interest rate - no down-payment	Rickshaw drivers (>>>,>>> in Dhaka) & Rural people lacking transportation means
Solar Water pump	-	$>>,>>> *(>>>,>>> Tk.)*	*weekly repayment* - > to > years timeframe (depending on number of farmers involved) - >>% interest rate - no down-payment	Cluster Villages >st Phase: ASA staff villages >nd Phase: ASA clients with combined & community credit solutions

**** The technological partnerships of GHEL allow all selling prices to be in average 20% inferior to the current lowest market price of the respective products. INES is for instance developing plastic solar panels reducing their cost by approximatively 40%.***

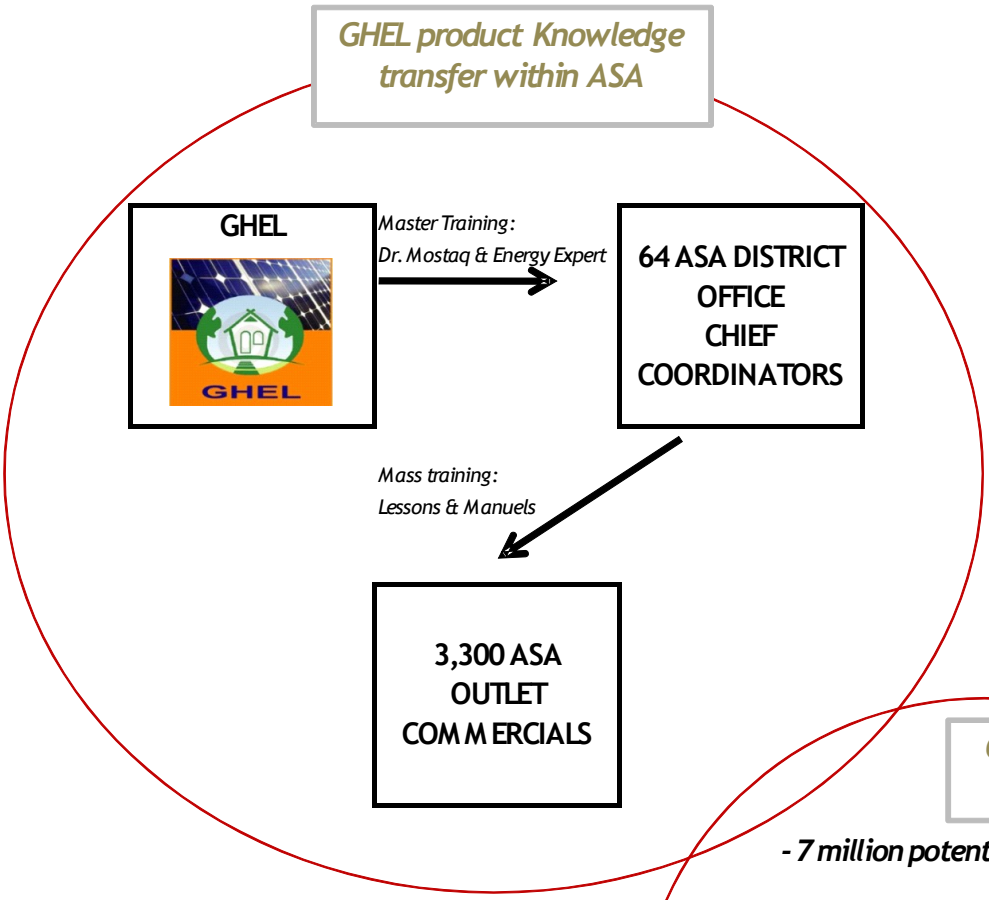
***** GHEL has initiated a marketing study in two phases in partnership with ASA to better understand the demand for all its products: 27,000 questionnaires were distributed to all ASA staff who give theit own opinion about the products offered and who in turn initiate their own field enquiry in their respective locations and villages. The figures of this table are supported by the early results of this mass-scale enquiry.***

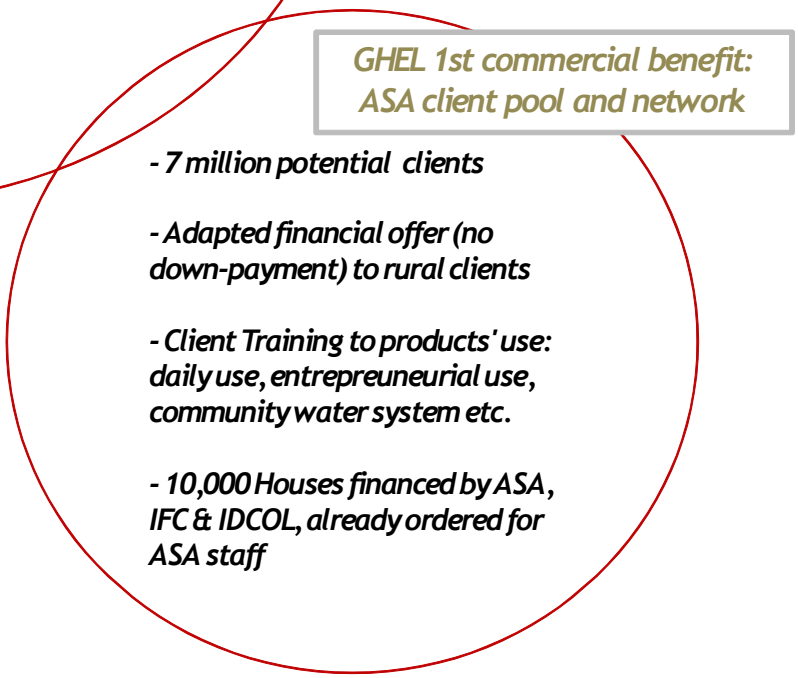
34. Technology transfer and Capacity Building

GHEL SUMMARY: SKILLS INPUT, TECHNOLOGY TRANSFER & FINAL IMPACT



GHEL MARKET PENETRATION THROUGH CAPACITY BUILDING





Conclusion

Renewable energy sources have been identified as key solutions to the energetical but also social and economic challenges of the rural Bangladesh. The use of Microfinance Networks and Expertise undoubtedly constitute one of the fastest and most adapted penetration means for the fast spreading of these off-grid energy technologies. Many successful initiatives can already be praised for their contributions in the country's electrification process and in the promotion of renewable alternatives. However, the environmental urgency must remain at all times coupled with the social context and needs peculiar to a poor and rural environment.
Green Housing & Energy Limited enters the market with a strong social objective and innovative customized solutions to these same challenges. Multiple-use solar lanterns, low-cost green houses, solar Panels, water pumps and tricycles are all items that can help make a difference when distributed on a massive scale. Through technology transfer and affordable clean products, GHEL intends to help Bangladesh become a role model of the green economy. The cooperation of motivated partners –Investors, Government, NGOs & companies- is crucial to carry out such ambitious and meaningful achievements.

Bibliography

Diffusion potential of renewable energy technology for sustainable development : Bangladeshi

experience, Mozaharul Alam, Atiq Rahman and Muhammed Eusuf, Bangladesh Centre for Advanced Studies (BCAS), Energy for sustainable development volume VII No 2, June 2003

Gender and Rural Electrification : A Case from Bangladesh, Sadeka Halim Ph. D, Associate Professor, Department of Sociology, Part-time Faculty, Department of Women's Studies. University of Dhaka, 2005

Grameen Shakti : Financing Renewable Energy in Bangladesh, Firoze A. Siddiqui and Peter Newman, Institute for sustainability and technology

Grameen Shakti and the solar revolution, Jim Fritz

Grameen Shakti, An integrated Approach to Rural Energy Service, Dipal C. Barua, Grameen Shakti 2005 - and Grameen website, www.grameen-info.org/grameen/gshakti

Installation of 50,000 Solar Home Systems, World Bank, 2006
http://www.worldbank.org.bd/

Model for Empowering rural poor through renewable energy technologies in Bangladesh, Wahidul K. Biswas, Paul Bryce and Mark Diesendorf, Environmental Science & Policy 4, 2001

Expanding the Role of Microfinance in Promoting Renewable Acces in Developing Countries, Shamarukh Mohiuddin, The Georgetown Public Policy Review, Winter 2005-2006

Programme Framework, Sustainable Energy Programme, Government of the People's Republic of Bangladesh & UNDP, http://www.powercell.gov.bd

Hydro Nepal: Journal of Water, energy & Environment Issue No. 3 July 2008

http://www.discoverybangladesh.com

http://www.gefweb.org/

http://unfccc.int/

http://www.nationmaster.com/

http://www.Bangladesh-bank.org

http://www.adb.org/

http://www.microfinancegateway.org/

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