Energy and Natural Resource Depletion

A Proposal for the Empowerment and Sustainability of the Rural Poor in Bangladesh

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Project Summary

The rural poor in Bangladesh are being left behind when it comes to the development of sustainable technologies; however, they are the population most dependent on, and have the most to benefit from the development of these technologies. The proposal that follows outlines a project that will enable the rural poor, who are predominately farmers, to increase their productivity and output. The use of renewable energy technologies (RETs) on a small scale, will provide small cooperatives the ability to develop and sustain their own income generating organization, while at the same time reducing economic vulnerability, dependence on non-renewable natural resources, and pollution. The project will be overseen by officials from the Global Environmental Exploitation Prevention Project (GEEPP) and financed through the already established system of micro-credit. GEEPP works to reduce the exploitation of the environment and resources through education, funding, and implementation of projects throughout the developing world. The proposed project will not only provide a method of increasing standards of living, but also educate those involved on the dangers of natural resource and environmental exploitation. Drawing further on the knowledge of micro-credit professionals and organizations, the project will allow the rural poor to take ownership of their own culturally individualized projects and empower them to challenge the effects of globalization in their own communities.

Impact of Energy and Natural Resource Depletion on Bangladesh

The 150 million people of the People's Republic of Bangladesh live in one of the most natural resource rich areas of the world. Bangladesh, a developing country, is situated on the Indian Ocean to the southeast of India. Much of the country is rich in farmland, forests, and freshwater. Bangladesh also sits on one of the largest natural gas reserves in the region. Each one of the above mentioned benefits, however, has significant drawbacks associated with it, all with immense consequences for the Bangladeshi people, their society, their culture and their economy.

The second largest river system in the world flows through the country, forming the Bengal Delta (Hellin, et al. 17). This is both a curse and a blessing as the annual monsoon season, June to October, brings severe floods to the agricultural plains of the delta causing a disruption of agricultural production, contamination of drinking water, and the displacement of tens of thousands of people (Discovery Bangladesh). In fact, it is estimated that due to climate change, over 30 million Bangladeshis will be displaced over the next century from the rural plains of the delta into the already overcrowded cities, such as the capital city of Dhaka, as the flooding worsens (International Institute for Environment and Development). In addition to flooding, it is estimated that over the next 30 to 35 years, the ocean level could increase by up to one foot as a result of climate change (Chu). An event of this magnitude is estimated to displace over 12% of the Bangladeshi population (Chu). These displaced men, women, and children have become known as "climate refugees" (International Institute for Environment and Development). On the flip-side of the same coin, the flooding leaves rich silt in the fields, bringing much needed nutrients to agricultural lands for the planting season (Hellin, et al. 17). With such a large portion of the economy, approximately 36%, and the livelihood of so many on the line, it would

only take a moderate size natural disaster, in the way of a flood, to cripple the country (Biswas, et al., "Model" 2).

To further compound these problems, at the rate of growth currently prevailing in Bangladesh, about 1.8% per annum, the country's farmers cannot produce enough food to make the country self-sufficient. As recently as 2001, Bangladesh imported over two million tons of food to cover the agricultural shortfall within the country (Biswas, et al., "Model" 2). What is even more burdensome is that over 85% of the Bangladeshi population lives in rural areas, relying on agriculture to support their families and communities (2). Of the rural population, 28% of households are without land suitable for cultivation while another full 57% are functionally landless. Functional landlessness is denoted by less than 0.2 hectares of cultivable land outside of the homestead (Salam, et al. 542).

With so little land to utilize, and thus limited agricultural output, many households cannot afford to invest in new production methods or tools and cannot afford the upkeep needed for their land or for their families' survival. These households, where needs exceed income, become known as "deficit households" (Biswas, et al., "Model" 2). To cover the gap between income and needs, they often labor on larger farms during growing and harvest seasons and any other work that comes their way. Many travel to the cities to compete for work in the already oversaturated labor market. To help cover expenses, many of the deficit households create financial relationships with the few "surplus households," many of these relationships dissolve into illiquidity for the poorer households, resulting in land transfer from poor to rich (2). As such a disparity between rich and poor has developed, with only 8% of households controlling almost 50% of cultivable land, while over 50% of marginalized households control only 4%

(Biswas, et al., "Model" 2). The social inequality that is created only exacerbates the vicious cycle of poverty.

The more specific burden of household energy consumption is placed unequally on the shoulders of women. The role of many rural women in Bangladesh is to manage the family by providing basic needs such as food, water, and energy. Often times, especially in areas that have been deforested, women spend a disproportionate amount of time gathering fuel for cooking and heating their homes. Biomass fuels, including wood and other agricultural waste, accounts for over half of the fuel consumed in rural communities. Wood, while at one point one of the most abundant sources of biomass energy, has been disappearing as communities expand into forested areas, or has been consumed with little to no thought of the future over the years and was never replanted (Salam, et al. 543). Wood now accounts for over half of the rural family's annual budget (Biswas, et al., "Model" 3). As such, people are turning to low-grade fuels, such as agricultural waste (i.e. stalks and leaves from crops after the harvest), to help cover their energy requirements (3). Furthermore, as Wahidul Biswas, Paul Bryce, and Mark Diesendorf discuss in their article, "Model for Empowering Rural Poor through Renewable Energy Technologies in Bangladesh," as the "calorific value of these fuels are low," more is needed to produce the same heat required for cooking as a higher grade fuel such as wood (3). The time estimated to collect this fuel is anywhere from one to five hours a day, time which could be spent engaging in income generating activities (3).

In addition to the loss of productivity, other effects include ecological imbalance as well as numerous health consequences. An ecological imbalance is created when the agricultural waste is removed from the natural decomposition process. The waste once provided nutrients to the soil as it decomposed; however, there is less of this occurring as households remove the

waste to use as an energy source. As such, there is a heavier reliance on non-organic fertilizers, which are often times very expensive, keeping many households out of the market. Furthermore, health side effect from burning lower quality fuels can result in acute respiratory diseases and lung cancer to name just two (Biswas, et al., "Model" 3).

Multifaceted yet practical solutions are needed to help combat these problems. The arguments for natural resource management range from the need for renewable energy technologies for the poor to finding and using more of the resources available more efficiently. Currently, Bangladesh sits on a large natural gas reserve. However, it is estimated that current reserves will be used up by the year 2015 if growth in demand for natural gas continues at its current estimated rate of 7% (Rahman). The government of Bangladesh has been in talks with the government of Myanmar to import natural gas to help sustain growth in the country. This methodology of attacking the issue of energy resource depletion, however, does not provide a long-term solution to the issue at hand, it only prolongs it. With an estimated commercial growth rate of 5%, the question becomes how long Bangladesh can rely on the support of a politically unstable neighbor for their resource needs (Azad, et al. 87). In their article, "State of Energy Consumption in and CO_2 Emission in Bangladesh," Abul Azad, S.W. Nashreen and J. Sultana predict that, "[t]he most visible effect of economic development [in Bangladesh] will be the replacement of biomass fuels by fossil fuels" (87). This statement is in direct contradiction to the position taken by Biswas, Bryce, and Diesendorf who argue that economic development in rural areas will involve the replacement of biomass fuels with those of a renewable and sustainable nature.

Fossil fuel consumption in Bangladesh is driven primarily by the larger manufacturing businesses in the country. In fact, the largest consumer of natural gas in Bangladesh is

Karnaphuli Fertilizer Company, a joint-export-venture fertilizer plant that is owned by Bangladesh, Japan, Denmark, and the Netherlands. Natural gas is a large component in preparing fertilizers, and the proposed increase in production at the plant will call for another 100 million cubic feet per day. An estimated 24 trillion cubic feet of natural gas will be required to continue the growth rate of 7% to the year 2025 (or ten years after Bangladesh's own reserves dry up) (Rahman). The use of natural gas is primarily for the benefit of big industry and ignores the rural population, the group that is in greatest need of efficient energy sources and use strategies to ensure their economic livelihood.

As Biswas, Bryce, Diesendorf, and many of their fellow academics argue, renewable energy technologies (RETs) will provide the best opportunity for the rural poor to develop their economic livelihoods and ensure the overall sustainability of a region that contributes more than 36% to the gross domestic product (GDP) annually and employs over 65% of the total population (Biswas, et al. "Model" 2). RETs provide a small scale, efficient, and cost effective way to provide small pockets of communities with the technology needed for development. The dispersion of the population across rural Bangladesh, as 85% of the population lives in rural areas, makes it difficult and impractical to expand a cost effective unified energy infrastructure to all peoples of Bangladesh (Salam, et al. 542). Instead it is argued by Biswas, Bryce, and Diesendorf that each community can be tasked with operating their own RET, thus making them self-sufficient while providing them with the necessary tools to succeed.

Solutions need to be implemented to ensure the stability of Bangladesh and the people into the future while providing for them in the present. The current state of natural resource management is estimated to last Bangladesh only 15 to 20 more years before changes to the system will be too late. Yet at the same time, the rural population, those with the most need, will

be overlooked by any advances in technology unless they are incorporated now. Flooding plagues farmers and their livelihood— over 65% of the population directly relies on the employment provided by agriculture, while all 150 million people in Bangladesh rely on the food produced by the farms (Biswas, et al., "Model" 2). A solution is needed, and as Mark Diesendorf claims, "[s]ustainable development comprises types of economic and social development which protect and enhance the natural environment and social equity" (qtd. in Biswas, et al., "Model" 3).

Project Proposal

Renewable energy technologies (RETs) are going to prove to be a key component in the sustainable development of less-developed countries in the years to come. Sustainable development, further, will include an economic development strategy that will encompass the basic needs and socio-cultural differences of a specific population, appropriate technology, and in many cases, like that of Bangladesh, a decentralized implementation process. Many ideas and concepts that follow in the project proposal are based on those proposed by Biswas, Bryce, and Diesendorf in their article, "Model for Empowering Rural Poor Through Renewable Energy Technologies in Bangladesh." However, they have been restructured so as to: (1) emphasize an even more marginalized segment of the Bangladeshi population, and (2) emphasize the role of micro-credit financing of the project.

Appropriate technology can be best defined as a technology that best utilizes the resources of a geographic area, or people, to reach a goal that may otherwise be unattainable. It may not always be the most technologically advanced or complicated technology, but it is "what works best in a certain case" (Kelleher and Klein 137). For example, a water treatment plant may not be the most cost effective or logical approach for treating waste water in a rural area, where, instead, a basic plumbing and septic system may help to contain the spread of disease through common waterways. Biswas, Bryce, and Diesendorf expand this definition to include the notion, "that the 'non-violence of a technology' is an essential part of its appropriateness, suggesting that an appropriate technology is completely under human control, has no unintended side effects, and in particular social and environmental disruption" (Biswas, et al. "Model" 5). Following from those definitions, a truly appropriate technology will complement the culture and environment of the community it is intended to help, while not adversely affecting the same

environment and community. Thus, it is important to select technologies that will be received by a population with little to no disagreement, while at the same time remaining cost effective for all those involved.

There are a number of considerations that need to be factored in when selecting and implementing a RET. Generally, RETs must replace or complement resources already in place in order to achieve their end goal. Also, they must be feasible, financially sound, simple, and save resources (both time and energy), while increasing the productivity of the affected community. Another significant issue of a RET that needs to be considered, according to Biswas, Bryce, and Diesendorf, is the institutional sustainability of the newly created organization, or its ability to continue as a going concern after being established (Biswas, et al. "Model" 3). All of these issues need to be addressed in the planning stages. A failure to properly and fully address one of these components could result in failure of the project for any number of reasons.

The proposal that follows is designed to provide limited energy coverage to a small number of households in rural areas of Bangladesh. Specifically, the proposal focuses on small farming households that are adjacent to one another or within a reasonable distance over which to transmit electricity or water, and lack resources such as irrigation pumps, electricity and a localized pump for drinking water. The aim of the project is to provide a small network of families or households with limited resources, the ability to achieve the following objectives:

- provide irrigation to increase crop output,
- provide electricity for the operation of electric lights, communication devices, and a cooking element, and
- clean drinking water and increased sanitation.

The projects will be carried out in phases, dependent upon through discussions with the cooperative (explained below) to identify which specific goal is most pressing to them, and then move forward from there. Before the next phase of a project can begin, all or a significant portion of the previous loan paid must be back with a forecast for continued growth and income from the cooperative.

For the purposes of this proposal, we will look at a system to implement photovoltaic (PV) pumps and basic household lighting. The amount of light available during the dry season, is more than ample to power a small PV system, at 3.85 kWh/m^2/year (Biswas, et al., "Can" 1200). The monsoon season brings unpredictable levels of solar energy, so a system such as that proposed below would need to be supplemented during the rainy season. The applications during the dry season, however, cannot be overlooked, as they provide the most opportunity to increase and help sustain rural economic development. Despite the economic benefits afforded by a PV system Biswas, Diesendorf, and Bryce, in their article, "Can Photovoltaic Technologies Help Attain Sustainable Rural Development in Bangladesh?" demonstrate that only about 8.8% of rural households in Bangladesh could afford a PV system with a 15% down payment (1200). It can then be concluded, that these technologies would be economically infeasible and out of reach of the majority of rural households in Bangladesh. Therefore, an outside organization, such as the Global Environmental Exploitation Protection Project (GEEPP), is needed to help form groups of economically disadvantaged households.

For the purposes of this proposal, GEEPP will organize a small number of households (up to the economic feasibility of breakeven), somewhere between five and ten households into a cooperative. The households will form a cooperative, with agreed upon terms, in which all households have a stake equal to the amount of land that is given to service for the cooperative.

For example, if each household out of the five participating dedicates ten acres to the cooperative, then each family will receive 20% of the income generated and each will incur 20% of the overall maintenance and debt service expense. GEEPP will appoint a liaison from the organization for the cooperative, who will also function as a financial trustee. The liaison will help the cooperative secure financing, establish an operating committee, oversee construction, and loan repayment.

The liaison will help to arrange financing for the project through a local bank— in Bangladesh, the Grameen Bank and the Bangladesh Rural Advancement Committee (BRAC) do extensive amounts of work in terms of micro-lending (or micro-financing). Where amounts to be borrowed exceed limits established by the banks for micro-credit, the outside organization, GEEPP, may choose to act as a guarantee on the cooperative's behalf. Also, as a condition of taking the loan, under the cooperative agreement, each member of the cooperative will have a savings account opened at the granting bank into which a percentage of the loan will be deposited, again, based on their percentage of ownership in the cooperative. This will not only act as a security deposit on the loan, but also encourage the individual households to start saving. This has been found to be very successful at the Grameen Bank, as over 94% of the bank is now owned by the depositors— the rural poor of Bangladesh (Grameen Bank).

After the cooperative and funding have been established, the liaison will arrange for education of all parties involved. Experts from GEEPP may or may not be brought into the cooperative to provide this training. This is dependent on the technical complexity of the project and the technical competency of the liaison. Before any work begins, everyone will have an understanding of the technology to be deployed by the cooperative, specifically in this proposal, PV technologies. The cooperative leader, chosen when the cooperative committee was formed,

under the guidance of the liaison, will initiate construction. The liaison will function primarily as an expert and resource person from this point forward, helping to guide the cooperative in governance during construction and the first steps of the project. GEEPP on the organizational level will provide the cooperative with geological survey information (i.e. the best location for the equipment on site) and assist in the acquisition and transportation of equipment. After the equipment is on site, however, the remainder of the work will be the responsibility of the cooperative.

As part of their training, the cooperative members will be instructed on construction techniques for the specific phase of the project that is underway (i.e. laying irrigation pipes or electrical wiring for lights), in addition to a generalized education on natural resource use and management. Depending on how many people are involved directly from the cooperative, there may be the possibility of sub-contracting the work out to other community members who are either marginalized or landless. Depending on the type of work to be completed, this would be an opportunity to train others in the community a new skill set in order to help facilitate any future projects in the community, as well as complete the project at hand. For example, a landless community member could become proficient in laying irrigation pipe and, as a member of the community, he could be called upon to work on other projects for other farmers or even community-wide projects, thus increasing his value as a contributing member of the community, while also providing himself with a wage.

Upon completion of construction of phase one, income generating activities will commence dependent upon the nature of the first project. For example, if an irrigation pump was installed, the income would be created from a higher-yield harvest. At the end of each month, the cooperative will make a payment to the lending bank to pay down the cooperative's debt.

After repayment of the loan during each specified period, money remaining can be used at the discretion of the individual families; however, savings will be encouraged as a method to help finance future endeavors. After the loan is 85% recovered and there are strong indications of sustained economic growth within, the cooperative would be eligible for another loan, to expand on the technologies already in place. Examples include:

- expansion of the irrigation pump to include a filter and cistern for collecting and holding clean drinking water for use in the homes of the cooperatives, or
- the placement of PV cells on the individual homes or in a common area to provide electric lights for the cooperative.

The overarching economic development goes far beyond an increased crop yield. In their article, "Rural Populations Need Non-Agricultural Employment," Jon Hellin, Mike Abul, and Abdur Rob suggest that a meshing of traditional agricultural and non-agricultural work is imperative in the reduction of the vulnerability of the rural poor (Hellin, et al. 17). The lack of sufficient lighting or other energy sources, reduce the amount of time that could be better utilized in petty trades, generating additional family income. With the training programs already in place in Bangladesh through Practical Action (formerly Intermediate Technology Development Group), a non-governmental organization based in the United Kingdom committed to reducing the vulnerability of the rural poor, a rural farmer could find additional work from the home. Electric lights produce more light, with less energy than the kerosene lamps now used. This improvement in the standard of living increases the amount of time available for work during evening and early morning. The increased work day coupled with the training supplied by Practical Action has enabled many rural Bangladeshis opportunities unknown to many of their peers throughout the countryside (Hellin, et al. 19).

The major obstacle in implementing a project such as the one outlined above in Bangladesh is directly related to the dominant patriarchal society that is rooted in Islamic tradition. The rural women of Bangladesh are more prone to the affects of poverty because of their status in society. Women in Bangladesh have been shown to participate more in the income generating activities than the men of the households. However, the customary household positions and status leave women economically dependent on men (Biswas, et al., "Model" 3). Despite the traditional gender roles in Bangladesh, the Grameen Bank has found women to be more "bankable" than men, meaning that the majority of funding secured will have to be secured through the women of the households, especially if the lending institution believes in this factor strongly (Grameen Bank). Convincing men to allow the women to take out these loans could prove difficult, while at the same time allowing women to have a say in the running of the cooperative.

Finally, the last significant obstacle to this type of project would be the securing of financing through a traditional micro-credit bank, as the amounts considered often exceed the amounts transferred in this form of lending. This is why it is important that the cooperative function efficiently and be willing to work together. If the cooperative fails, then the project will fail and the creditors will be out a significant sum of money. However, creditors, including BRAC and the Grameen Bank are supportive of initiatives involving RETs and sustainable economic development (Biswas, et al., "Can" 1201).

Global Application— Implications for Implementing the Project Elsewhere

The issue of natural resource and energy depletion does not only affect Bangladesh, but nations the world over. Depletion of natural resources is most evident in developed nations such as the United States, Japan and much of Western Europe as well as developing nations including Russia and China (Simmons 63). Financial professionals around the world, however, are confronting and responding to these global trends, primarily through proactive efforts like those above, or even more generally, through micro-credit. Micro-credit has been enabling impoverished people throughout South Asia to take capitalize on their own strengths, abilities and aspirations. For instance, in Bangladesh, birthplace of micro-credit, the Grameen Bank reports that over 64% of households involved with the bank have emerged from poverty. The founder of the Grameen Bank, Muhammad Yunus, founded the bank on the principle of "uncollateralized loans" for the poor in 1976 to help stimulate economic development on a small localized scale (Grameen Bank). In many ways, the Grameen Bank lives up to its name—grameen means "rural" or "village" in Bangla.

As mentioned above, micro-credit is a very South Asian concept developed by South Asians for South Asians. However, BRAC, one of the world's largest non-governmental organizations, has expanded beyond the borders of Bangladesh. BRAC International operates offices in the African countries of Uganda, Tanzania, and Southern Sudan, and also in Afghanistan and Sri Lanka. According to BRAC's website, there are over 20 offices in Uganda and Tanzania servicing over 19,000 members with over $1.13 million disbursed. In Afghanistan, BRAC has found that micro-credit can be just as successful as in Bangladesh. Due to the large number of women-lead households, either because of war or working away from home, there is a true market for micro-credit. The loans are being repaid at the same rate or higher than those in

Africa, and even Bangladesh where these rates have averaged over 98.5% for the past 30 years (Bangladesh Rural Advancement Committee). Numbers of that significance dwarf those of even the most industrialized countries. This evidence further substantiates what Yunus knew in 1976 when he formed the Grameen Bank, that no matter how poor or economically disadvantaged people are, if given the right tools and training, they will succeed.

No matter what the overarching issue arising out of globalization, whether it is disease prevention, energy or natural resource depletion, poverty or gender inequality issues, money is needed to help combat the problem. The financial professionals of the Grameen Bank and BRAC, along with many smaller organizations across the globe, have found that often times it is best to attack the problem at the bottom of the pyramid and start building their way up. The over 7.3 million borrowers of the Grameen Bank have taken the opportunities afforded them and made a difference in their lives and indirectly, the lives of other community members (Grameen Bank).

The concept of micro-credit has been significant in combating major problems arising from globalization. The effects from just one small loan can be substantial. Take the proposal put forth above; just a small loan to a handful of people has the opportunity to shape a community and the world, through a reduction in natural resource use, while at the same time empowering an often voiceless people. Provided that cultural obstacles (such as a patriarchal society) throughout the less developed world can be overcome, like those overcome in Africa by BRAC, then micro-credit can be implemented worldwide. A worldwide implementation of micro-credit lending could lead to significant increases in the standard of living for billions of people, regardless of location and cultural identity. Micro-credit is a resounding answer to many of globalization's toughest challenges facing billions of people around the globe each day.

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