Microfinance Intervention for Financing Solar Cooking Technologies -

Financing with Savings

(*Executive Summary*)

by

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Solar Household Energy (SHE) has been promoting the multiple benefits of solar cooking since 1998, with its co-founders each possessing more than 20 years of experience with the technology. When the founders discovered that no durable, portable, affordable device was readily available for purchase off-the-shelf to use in solar cooking projects around the world, they worked to develop specifications and contracted for development and manufacture of the HotPot Solar Oven. Since that time, Solar Household Energy has introduced solar cooking projects and training in many countries throughout Latin America and Africa, gaining valuable knowledge with each introduction. Today we continue to promote solar cooking, in all its various technological forms and devices, for its many economic, environmental, social and health benefits.

The intital vision was that for solar cooking to really spread widely in developing countries, it would need to be taken up by the local private sector to manufacture, market and sell solar ovens. Over time, however, we have recognized that, even modest upfront purchase costs of $60-$100 USD can be prohibitive for the poorest of the poor who stand to benefit most from solar cooking but exist on less than $1 per day. At the same time, many of the benefits such as reducing deforestation and land degradation or air pollution and greenhouse gas emissions, involve stakeholders from across the region or even, in the case of climate change, the world. The rest of the world has an interest in weaning 3 billion people off of open cooking fires and inefficient biomass stoves. Solar cooking provides the very cleanest cooking option of all.

Solar Household Energy continues to seek mechanisms that allow those outside the immediate communities who reap some of the benefits to share in some of the upfront costs. This report is a result of that search. We contracted with Gunjan Gautam of the Georgia Institute of Technology to undertake a study of how microfinancing might be harnessed to assist cash-strapped potential users of solar ovens to purchase them on credit, so that some of those upfront costs could be distributed over time. Mr. Gautam exceeded our expectations by developing a model that can be valuable to both microfinance institutions, as well as public funders and governments, in determining when the microfinancing of solar ovens will be financially sound.

This is the Executive Summary from his research. His longer research report is currently being revised and submitted for publication. When it is accepted, it will be made widely available upon request. We hope that you will find it useful.

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EXECUTIVE SUMMARY

Solar stoves are among the most mature technologies that can not only contribute to improving livelihoods in developing countries but can also help in addressing local and global environmental and health concerns. While solar stoves meet the expectations of environmentally sustainable technologies, they have not yet been widely promoted globally. This study investigates the possibility of involving microfinance institutes in the process of transferring solar stoves. This study analyzes the returns from financing solar stoves to all stakeholders and proposes a procedural framework for transferring solar stoves with the help of microfinance institutions.

Solar stoves have evolved significantly since they were identified as sustainable cooking technology in the mid 1900s. At present, several designs of collector and reflector-based solar stoves exist that directly and indirectly (with a heat transporting medium) use the sun's energy for cooking purposes. The most advanced design uses vacuum tubes and phase change materials to make cooking possible throughout day and night. Adoption of solar stoves has been encouraging as evidenced by acceptance of this technology in various communities across many countries. Most solar stove dissemination programs report consumers to use these technologies for approximately thirty percent of all cooking, while some reflect even usage rates as high as 70% during sunny seasons. Consumers, maintaining this reasonable frequency of use (use rate), have endorsed solar stoves as fuel and time efficient alternative.

The economics of a solar stove depends on its price, use rate, and prices of the fuels for solar stove substitutes. Among these factors, the relatively high initial cost or base price has been considered as major constraint for widespread adoption of solar stoves. Microfinance institutions (MFIs), which have specialized in improving access to credit in marginalized communities, can ease adoption of solar stoves by financing these technologies. The proximity of MFIs to potential users of solar stoves and MFIs' ability to lend in spite of lack of collateral makes them ideal financial intermediaries. The Energy/Microfinance Framework has been conceived in theory and has been applied successfully in practice on several occasions. Using MFIs to enable consumers' and entrepreneurial investments, this framework facilitates successful adoption of sustainable energy technologies. By applying this Energy/Microfinance Framework for promoting solar stoves, this study tries to understand

(i) Would consumers of solar cooking technologies accrue adequate benefits to justify the cost of borrowing for adoption for these technologies?
(ii) Can MFIs lending for adoption of solar stoves expect sustainable repayments?

A comprehensive returns-management scheme has been used to analyze financial returns, economic returns, environmental returns and social returns from solar stoves. For financial analysis, the HotPot, a simple and robust solar stove, has been considered. Distributed by Solar Household Energy (SHE), Inc., a non-profit organization based in United States, the HotPot is a panel oven that uses black enamel pot fitted inside a covered glass bowl and foldable aluminum panel reflector to capture passive solar thermal energy and cook food with zero emissions.

In this study, financial returns to consumers and MFIs from the use of HotPot have been analyzed for three countries – Bangladesh, South Africa, and Mexico. A lending plan developed for the purpose of analysis is based solely on savings from use of solar stoves. With this approach, a

household borrowing for adoption of solar stoves will most likely be monetarily indifferent between use of solar stoves and use of other cookstoves. Results from financial analysis of a savings-based lending plan indicate that net consumer benefits remain positive regardless of changes in the discount rate. However, the discount rate does impact the amount of the net present value of accrued benefits.

The effects of changes in the use rate or costs of fuel substitutes are even more significant. Consumers who have use rates lower than the anticipated use rate (30%) not only risk their financial benefits, but also lower the incentive compatibility constraint of the MFI and expose the MFI to higher risk of repayment defaults. Similarly, the changes in prices of the substituted fuels significantly affect consumer and MFI benefits. If prices of substituted fuels drastically decrease, consumers will find themselves no longer indifferent between other cooking technologies and solar stoves. In such a circumstance, MFIs will observe increased risk of repayment defaults. The results explaining the implications of changes in discount rate, in use rate and in prices of substituted fuels are consistent across cases of Bangladesh, South Africa, and Mexico.

The repayment period varies with changes in the use rate, prices of substituted fuels, interest rates, and the base price of solar stoves. A protracted repayment period would perhaps be a binding constraint for MFIs seeking to finance solar stoves. At a high use rate and high prices of the substituted fuels, MFIs may be able to develop feasible savings based lending plans that conclude before the end of stove's lifetime, even for higher-priced stoves. However, when use rate or prices of substituted fuels are low, MFIs will find it increasingly difficult to finance expensive solar stoves. Savings only from use of solar stoves in such conditions will not be adequate to repay the loan within lifetime of solar stoves. Analysis of financial returns shows that solar stoves increase consumer benefits when financed through savings-based lending plans if the use rate of stoves and prices of fuels substituted by the stoves are sufficiently high. Under the same conditions MFIs will also find financing solar stoves lucrative.

Public sector support in form of subsidies on the base price of solar stoves and interest rate or in the form of taxes on substituted fuels can encourage financing. Solar stoves also generate economic, environmental, and social returns. Consideration of these returns merits support from public sector. Solar stoves reduce the time that women and children must spend collecting fuelwood and in tending a cooking fire. This frees up that time for more productive income-generating or educational activities.

Solar stoves operate without emitting air pollutants or greenhouse gases. The greenhouse gas reducing potential of solar stoves establish them as front-runners in clean cooking technologies. Greenhouse gas offsetting properties of solar stoves have encouraged project developers to tap into carbon funds from Clean Development Mechanism or the Voluntary Carbon Markets. While being environmentally sustainable, solar stoves also mitigate adverse health effects from cooking with solid and conventional fuels. Whereas other cooking options have been found to cause indoor air pollution well above World Health Organization's prescribed levels, solar stoves have no negative health impacts. Solar stoves can avert mortality and morbidity resulting from indoor air pollution and improve livelihood. They also reduce the risk of burns resulting from open cooking fires or biomass stoves within the home. These various economic, environmental and social returns should also be incorporated into the financial analysis when calculating the benefits of offering microfinancing for stove purchase.

This study proposes a procedural framework for integrating MFIs into the technology transfer process. The procedural framework builds on the existing Energy/Microfinance Framework and attempts to use the inherent features of MFI lending. The intervention of MFIs within this procedural framework serves the dual purpose of improving access to the technology and bringing about a behavioral change to accelerate technology transfer. With MFIs providing savings-based lending plans, the base price of solar stoves will be less of a barrier for interested households. Further, MFIs issuing group loans can expect prospective borrowers seeking to purchase and use solar stoves to organize into groups and seek financing. These groups formed through assortative matching can be expected to successfully adopt solar stoves during early stages of dissemination. Using joint liability and dynamic incentives, MFIs can incentivize borrowers to monitor one another's cooking behavior and encourage adequate use of solar stoves. Public sector support within the framework can be employed to reduce the base price of solar stoves, the interest rate of financing, and consequently the repayment period. This procedural framework expects MFIs to accelerate adoption and commercialization of solar stoves. Doing so provides another tool for making solar cooking technology with its multiple individual and societal benefits widely and available and affordable where it is most needed.