

SMALL COMMUNITY FINANCE FOR RENEWABLE ENERGY SYSTEMS IN  
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## ABSTRACT

In this project, I identified finance mechanisms for use in a small, mainly indigenous community in Chiapas, Mexico. The mechanisms can make renewable energy more affordable while allowing these communities to maintain some control of the projects. In addition, I designed a framework for a financially sustainable payment collection, monitoring, maintenance and education program that aims to ensure the successful operation of the energy technologies and is paid for through the sale of voluntary carbon credits. This research is based on review of literature and current market practices, along with field research and interviews in both Nicaragua and Chiapas, Mexico.

Although there are opportunities for small communities to finance renewable energy, many small communities lack the funds, knowledge and access to tools that can allow them to successfully implement a program while using those tools at their discretion. This project gives EduPaz, a Chiapas-based Microfinance Institution (MFI), the roadmap to access those tools.

My key finding is that a solid roadmap for this program will allow the MFI, EduPaz, to show external funders (microlenders, subsidy providers, and carbon credit funds) of the technology used that the monies available will be used appropriately. In addition, EduPaz is well-positioned to draw from its own expertise and understanding of local conditions as it works to implement a more sustainable future for community members that choose to participate in the program. This project examines most aspects of

this undertaking for EduPaz and provides a framework for making renewable energy systems more affordable via an energy services finance program.

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## INTRODUCTION

For my thesis project, I have designed a community finance program to facilitate the use of biodigesters and efficient woodstoves to meet energy needs in Chiapas, Mexico. Utilizing existing community infrastructure established by a small micro-finance group and a technology transfer group, EduPaz (a Chiapas-based NGO) and the International Renewable Resources Institute (IRRI) in Chiapas, Mexico, I have overlaid an additional finance mechanism to provide credit and subsidy for these energy technologies. In addition, I have developed an on-going collection, maintenance, monitoring and education program for the technology. By aiding the affordability of this technology for low-income farmers, the design of this program has three additional goals. The first goal is to create a financial model that exhibits community stakeholders are willing to participate financially in the project, yet allow the program to receive outside subsidy funding if necessary. The program will be locally supported and run by stakeholders, paid for via microloans, and able to receive outside subsidy funding. The second goal is the development of a financially sustainable collection, maintenance, monitoring, and education process paid for using revenues from voluntary carbon credits, yet created and managed through the Chiapas-based organizations. The third goal is to identify characteristics of the program that can possibly be replicated in other communities to accomplish similar goals.

Small scale renewable energy technologies such as solar, biogas, and wind have been available for over 40 years. Many governments and thousands of non-governmental organizations (NGOs) have tried, sometimes successfully, to implement these technologies, mainly in remote regions, to serve a variety of purposes. Those purposes include, but are not limited to, electrification, development, education, health, and most recently, climate change mitigation. While engineers have slowly ratcheted up the efficiency of these technologies, they have not been implemented rurally on a wide scale when compared to traditional, non-renewable technologies.

Currently, there are several options to finance these renewable energy projects. One of the largest finance models, the Clean Development Mechanism (CDM), was developed to limit greenhouse gas (GHG) emissions and foster technology transfer from developed (Annex I) countries to underdeveloped countries through investment (UNFCCC, 2009). In addition, small carbon credits, micro-loans, and grants and subsidies from private institutions and governments have all contributed to multiple financial models across large and small projects worldwide.

However, there have been relatively few financial models developed to address the needs of small renewable energy projects on a local level that incorporate the multitude of financing options, credits, and subsidies that can spread renewable energy technology to poor, underserved communities while utilizing their support and control (Morris et al. 2007). The Clean Development Mechanism (CDM) largely fails to reach this market.

In addition, many current models have been mainly developed specifically for one region as a solitary program, to disseminate a certain technology one time, or without early local stakeholder input (Morris et al. 2007, UNFCCC 2009). Some have sought to show community stakeholders are willing to participate financially in these projects. Few have addressed the ability to identify multiple, changeable finance sources that can take advantage of large inter-country transfers of loan funds, while leaving project control and implementation mainly up to regional community micro-finance institutions (MFIs). Finally, few if any, programs have been developed that use voluntary carbon credits to create a workable maintenance, monitoring, collection and education model that is financially sustainable for at least five years.

In creating this program, I have analyzed and aggregated available finance tools and simplified them so small communities can take advantage of those tools for the development of clean energy. In doing so, I have specifically designed the program with a goal of allowing the local groups to maintain autonomy and have input in the decision-making process for the community.

Small renewable energy projects have been mainly publicly funded (Morris et al. 2007). The need for public funds and the size of CDM financing trending towards the larger projects, gives small poor communities few options. My proposed program offers a middle path. It utilizes current financial tools to access global climate change and microloan funds, yet relies on the participation and direction of locally run organizations to give the program local control.

I will begin the thesis with some background information on microfinance, Chiapas, energy lending models in Latin America, and small microfinance organizations (MFIs) in Chiapas, Mexico. I continue with background information on internet loans through Kiva, the Clean Development Mechanism, MicroEnergy Credits (MEC), and small-scale biodigesters and cook stoves in Chiapas.

In the second chapter, I introduce my Community Finance Program for EduPaz and its twelve step implementation process. Finally, I discuss how this program meets the goals of my thesis and show my conclusions.



## BACKGROUND

In order to understand the implications of my project, I will give the reader background information about the history of microfinance and its use in international development. I then give historical information about Chiapas, the groups working there and various microfinance models that are in use in Latin America. I close this chapter with a discussion of various finance tools and their application to energy products, as well as the introduction to the main energy technologies included in the main program (i.e., biodigesters and cook stoves).

### Microfinance

#### History

In the 1970's, the economist Dr. Muhammad Yunus had the epiphany that many poor people just needed access to capital to help them out of poverty. Thirty years later, he won the Nobel Peace Prize (along with Grameen Bank, which he started) for his work in building Grameen and helping thousands of people in Bangladesh. As of 2003, Yunus purports that Grameen Bank has provided \$3.8 billion to 2.4 million families in rural Bangladesh (Yunus, 2003).

Dr. Yunus' efforts to help people out of poverty have garnered much attention. In addition to Yunus and Grameen being awarded the Nobel Peace Prize in 2006, 2005 was

named the year of Microfinance and the UN has recognized access to capital as an important step in alleviating poverty (UNCDF, 2005).

Aside from his Nobel Peace Prize, Dr. Yunus' identification of a new market and successful contribution to its growth has caught the attention of many financial institutions and internet groups. Although Grameen Bank was not the first microcredit organization, it has become one of the world's largest and most well-known due in part to the Nobel Peace Prize. The term microfinance institution (MFI) has become synonymous with microfinance (as MFIs are the lenders) in the developing world. The terms microfinance and microcredit have at times become interchangeable. However, microfinance implies a suite of lending services (loans, deposits, and insurance), while microcredit is essentially just small personal or business loans.

Historically, predatory moneylenders are an informal source for many people to borrow money in developing countries. MFIs are essentially small banks and have supplanted moneylenders in many areas. Baydas and colleagues (1997) correctly predicted that MFIs would rush to fill the void of "dismantled" repressive financial market policies (predatory moneylenders) in developing countries. The main reason for filling this void is the demand for deposit-type accounts and the capital banks can raise by providing them. Rahman (1999) says savings accounts and loans are necessary for the poor, yet NGOs are reluctant to take up that risk. In many cases, they prefer to be conduits for lending money instead of actually becoming lenders. Thus, MFIs are filling the void. Because of the remote locations of many villages, there may be only one choice

for an MFI. The potential lack of competition can be an issue going forward as populations can become dependent on only one option.

Dr. Yunus saw microfinance as a way to empower people-mainly women-through access to capital and group lending where they previously had no access or were reliant on predatory money lenders. He wanted to create a program only for the poor because if the poor and non-poor are in the same program, the poor will be “elbowed out” by those better off (Yunus, 2003). Jonathan Morduch (2003), perhaps the most published academic voice on microfinance, succinctly adds “The microfinance movement is striving to match the convenience and flexibility of the informal sector, while adding reliability and the promise of continuity.” The current incarnation of Grameen has maintained its autonomy and local presence in stark contrast to many other MFIs worldwide as they slowly rely more and more on global capital markets for their funding (Yunus, 2009). While there are many MFIs worldwide, Grameen’s model and sustainability have remained a bellwether in the industry. Today, Grameen Bank is 95% owned by its borrowers and the Bangladeshi government owns the other 5% (Yunus, 2009). Also, Grameen does not require any collateral or documentation for loans. When groups are involved, the loan is the responsibility of only the individual borrower. As of 2010, there are over 8 million total members; 97% are women (Yunus, 2009). Currently, Grameen Bank has 2,563 branches, works in 81,343 villages, and has a total staff of over 25,000 people. In January 2010, Grameen disbursed US\$115.47 million in loans and have a loan recovery rate is 96.54%. It funds 100% of its loans from deposits, 58% of which comes from its own borrowers (Yunus, 2009). Grameen does not accept donor money

anymore and has made a profit every year except 1983, 1991, and 1992. Grameen offers 8.5% to 12% interest on deposits and charges from 0 to 20% interest depending on the loan type and person. In addition, Grameen has expanded and diversified to offer other services to its members like cell phones, home solar systems and a beggar-loan program to reach the poorest of the poor (Yunus, 2007).

While Grameen has become a household name in microfinance with its receipt of the Nobel Peace Prize, it is actually the third largest MFI based on numbers of borrowers (MIX Market, 2009). Bangladesh Rehabilitations Assistance Committee (BRAC) was founded in 1972 and is also based in Bangladesh. BRAC also has a presence in many countries and is actually a bit larger than Grameen. They use a group lending approach similar to Grameen (BRAC, 2009). The largest MFI, however, is Vietnam Bank for Social Policies (VBSP) with 6.8 million borrowers (MIX Market, 2009). It was established in 2002, is government funded and run, and uses similar, village-based implementation like both Grameen and BRAC (VBSP, 2009). Microfinance Information Exchange (MIX) Market was incorporated in June, 2002 as a not-for-profit private organization for microfinance. According to MIX Market, as of 2010, there were over 1400 MFIs worldwide, some with as few as 10 borrowers (MIX Market, 2009).

An example of a for-profit microfinance approach is Swayam Krishi Sangam (SKS) India. SKS uses the capacity, capital and costs approach and in fact converted from non-profit organization to a for-profit in 2005 and recently filed to go public (SKS, 2010). Its strategy utilizes access to capital, scaling organizational capacity and technological innovation to take advantage of economies of scale and reduce its costs.

One of its main motivations for the conversion to for-profit is access to capital. While SKS acknowledges a “social business” strategy similar to Grameen is an option, its philosophy is that microfinance must have a return for its investor (SKS, 2009). Thus, as I continue to discuss MFIs, I will later draw distinctions between Grameen and other MFIs like SKS as to how the different models operate with respect to profit expectations.

Historically speaking, there have been many debates over microfinance, its intent, benefits, and future. The three areas I find most compelling and applicable to my thesis are economic target market, organizational structure (non-profit versus for profit) and internet funding. In the next section, I will discuss these three areas.

Does microfinance reach and benefit the poor?

The first discussion is does this lending reach and benefit the poor? Defining poor and the poorest of the poor is difficult. Khandker (2001) correctly explains that poverty varies from country to country. He continues that poverty may mean the lack of some or all of the following: food and other basics, access to public infrastructures, credit and consumption stabilization, empowerment, and access to a social safety net. Khan (2009) questions whether microfinance reaches the poorest of the poor or only serves those near the poverty line because of limitations in lending. Hashemi and Rosenberg (2006) suggest those limitations behind reaching the poorest of the poor are both supply and demand related. On the supply side, although the poor are targeted, those poor without any source of income are ignored as too risky. This excludes the poorest of the poor as most have little to no stable income. With respect to the demand for microcredit from the

poorest of the poor, the poorest clients may hesitate to borrow as their confidence in repaying the loan suffers due to lack of income (Hashemi and Rosenberg, 2006) Khan (2009) suggests the focus on group lending makes this demographic risky even for neighbors as others are unwilling to be responsible for their neighbors' loans through group lending. In addition, Khan (2009) explains that the necessity of the poor to start paying loans back immediately (sometimes within a week), does not favor the poorest of the poor as their income is both small and unpredictable. Khan (2009) continues that it is unclear whether microfinance impacts the poorest of the poor enough to justify the vast amounts of funding and resources that are being channeled in that direction. Morduch and Haley (2001) concur and state that microfinance has insufficiently penetrated the poorer strata of society. They continue that the poorest of the poor can benefit from health care and education but may not benefit from microfinance. Khandker (2001) also believes that the poor can benefit from healthcare and education but thinks access to microcredit can stimulate those activities by leveling off consumption costs. Karnani (2007) believes microcredit is more advantageous to those living above the poverty line because those people with more income are willing to take the risks that may increase income flows.

By separating the two groups and focusing mainly on those groups that are nearer the poverty line and have some consistent (albeit small) income, does microfinance benefit those that it reaches?

The case for microfinance as a mechanism for poverty reduction is simple. If access to credit can be improved, the poor can finance productive activities that will allow income growth (and elimination of reliance on predatory lenders), provided there

are no other binding constraints (Weiss and Montgomery, 2005). In addition, access to financial services can help the poor create an asset base and protect the poor against risks that could interrupt their income flow (Khan, 2009). This smoothing of income and expenses can provide an added safety net and additional layer of stability for some.

Muhammad Yunus believes microfinance benefits the poor and states that Grameen alone has helped 200,000 families out of poverty and on their way to sustainability (Yunus, 2007). While his study is over ten years old, Morduch (1998) disagrees and states that little evidence has been found to support claims that microfinance programs increase consumption levels or increase educational enrollments for children relative to levels in control villages. Khan (2009) goes further and questions whether microfinance actually creates a cycle of indebtedness and pits small entrepreneurs against each other due to the frequent lack of external market linkages.

The MIX Market (2009) reads:

Experience shows that microfinance can help the poor to increase income, build viable businesses, and reduce their vulnerability to external shocks. It can also be a powerful instrument for self-empowerment by enabling the poor, especially women, to become economic agents of change.

However, Agguire and Prosser (1999) see microfinance going too far at times and meddling in local culture. They feel that

Providing the poor with credit access has been demonstrated to be a beneficial economic opportunity for poverty alleviation, but when credit-providing institutions act to shape the size of their borrower's families (by means of linking promises for a small family to credit access and/or promoting information on the same at mandatory borrower meetings) this involves a decision much more intrusive and consequential for the family than the provision of financial services.

Some go so far as to discount the ability to judge the benefit process entirely.

Zeller and Meyer (2002) think MFI operations have grown so fast that they just cannot be researched quickly enough or effectively to actually make these poverty alleviation claims.

More recently, Weiss and Montgomery (2005) have taken the question on in a more detailed fashion. Their view is that, similar to Zeller and Meyer (2002), it is difficult to obtain accurate data. A big reason is an inability to design a valid control group to compare effects. Weiss and Montgomery (2005) continue to discuss a very detailed model to measure and differentiate between groups of the poor. However, their conclusion is more in line with others that the topic needs more detailed research to better inform microfinance groups or NGOs.

Even though some organizations state that their charter is poverty elimination, this does not necessarily mean that they are able to successfully achieve that goal. The focus on who is actually poor varies from country to country and determining whether just the access to microcredit is enough to help those in poverty or that microcredit must be offered with other services such as healthcare and education. Not all people that access loans are entrepreneurs, however if there is no access, it is obvious there is no microlending. How poverty elimination is measured and its effects on the population are ongoing discussions as more studies continue to examine available data.



## For-profit versus non-profit

There are both for-profit and non-profit models for MFIs. The MFI structure has evolved over the years from a mainly non-profit approach to one of both for-profit as well as non-profit. Currently there are no rules prohibiting a non-profit MFI from converting into a for-profit MFI. I will show how that has happened. In addition, I will delineate a few clear differences in the for-profit and non-profit model. The main difference is how an MFI accesses and delivers funds and some potential ramifications. To effectively differentiate between both models, it is important to understand the characteristics of each approach as well as the shifting landscape that has contributed to the movement from mainly non-profit to a combination of both non-profit and for-profit. Debates about the commercialization of the microfinance market involve a tension between the goal of providing financial services to poor people and the need for investor profits to enhance scalability. The ongoing argument that MFI profit is necessary to attract capital flow may make sense, provided organizational structure stays consistent throughout the life of the organization.

Grameen Bank, one of the earliest MFIs, is the epitome of non-profit banking. Its spirit is collective advancement and empowerment with a secondary goal of profitability only to be financially sustainable. Grameen's intent and purpose is community-based, not profit-driven, and it is devoid of any formal outside control (Yunus, 2007). Also, Grameen is less subject to the fluctuations of the world economy and the global capital

markets as other financial institutions. The main reason for this is the money used for Grameen loans is mainly sourced and controlled locally (Yunus, 2007) No money can be lent that is not generated via the deposits of other borrowers. Because of this relative independence from both markets and governments, Grameen is different than many for-profit MFIs.

Grameen's popularity has furthered microfinance's expansion into many markets. Earmarked as a solution for female empowerment, halving global poverty has been included in the Millennium Development goals with microcredit specifically being mentioned in the 2005 World Summit Document (United Nations, 2005). This positive press has interested both capitalists and social entrepreneurs. While Grameen gets most of the press, their financially self-sustaining model is not always the type being funded.

As I have shown, Grameen Bank's loans are now fully funded by its borrowers with no outside sources. That is in contrast to some other MFIs worldwide. For years, World Bank, International Monetary Fund (IMF), Asian Development Bank, and others have funded MFIs but with very little money, if any, going to Grameen (Aguirre and Prosser, 2007). However, more financial institutions like Citibank (2007) are rushing to deliver funds to the MFI market in many countries. While there are benefits to microfinance that I have discussed (reduction of poverty and female empowerment), Grameen also limits funding risks by loaning out only money it generates itself. For-profit models are set up differently.

Rahman (1999) describes the commercialization of MFIs in Bangladesh as a relatively new idea with understandably wide ramifications. He adds that MFI

commercialization is gradually gaining ground in some other developing countries around the world. Specifically, he says “Mainly, for-profit MFIs tend to treat the poor as clients rather than beneficiaries. It conceives the microfinance market not as segmented markets, but as an integral part of the country’s total monetary system.” This implies that microfinance is an extension of the traditional banking system and the clients he speaks of will be more greatly influenced by global capital markets.

Many people have taken notice of this practice of categorizing microfinance in the same way as traditional loans. According to Littlefield and colleagues (2006) there are over 100 microfinance funders (not counting banks), individual investors, international non-governmental organizations (INGOs), and individual lenders. Most of the larger funders know little of their portfolio size or performance (Littlefield et al. 2006). This simply means that by being disengaged, they have little understanding of the effects of their funding. Thomas Dichter (1996) correctly predicted that NGOs would have a crisis of the soul as they moved into microfinance and decided whether to achieve financial benchmarks or provide a necessary service. Choosing between keeping score and effectiveness on the ground can be a difficult transition (Dichter, 1996). On one hand, the funders are disengaged regarding their portfolios and, on the other hand, NGOs may start to measure effectiveness based on metrics like payback rates as opposed to the livelihoods of the people they wish to help.

According to the World Bank, foreign private investment in MFIs has grown to more than \$4 billion in 2006. Commercial banks like Deutsche Bank, Citigroup, and HSBC and others are entering the market (CNBC, 2007). In addition, not only big banks

are investing in microfinance. The Wall Street Journal points out that most microfinance funds outside of banks are targeted towards rich investors with over \$100,000 to invest (Silverman, 2006).

Citigroup has an entire section of their website with questions like: “How does a rug change a family?” Through their CitiGroup Foundation, they have moved millions of dollars to NGOs with their goal to “establish deep, multifaceted relationships with microfinance institutions and networks” (Citibank, 2007). It is unclear who these relationships serve. Fortunately, as Jackson and Islam (2005) point out, there is a call for scrutiny and regulation of this flow of money. This regulation will hopefully raise the issue of sources and uses of funding and any potential pitfalls.

As of February 2010, 1,715 MFIs reporting to the MIX Market have 75.6 million borrowers, deposits of US\$22.6 billion and a gross loan portfolio of US\$39.3 billion (MIX Market, 2010). This is a huge market that largely began as a local non-profit network to help people but has grown into a more profit-driven, growth-oriented capital market. This change creates a division in the microfinance world between Grameen-like groups that are mainly locally funded (putting people before profits) and MFIs that are mostly profit-based.

There are several examples of big investment firms getting involved in microfinance, and the history of these firms is more profit-driven. One such firm is Sequoia Capital. Sequoia Capital, a venture capital fund that funded YouTube, Google, and Yahoo, has funded the aforementioned SKS in India who loans to its 600,000 members. SKS’s founder Vikram Akula says “We charge average interest rates of 24%,”

explaining that while this rate is high compared with conventional loan standards, "It is actually the lowest cost financing available to the poor" (CNBC, 2007). Thus, the free market sets rates for SKS. However, there is not always competition on the village level and villagers may have no choice.

This free market can lead us exactly where Compartamos Banco has gone. Compartamos Banco, a nine-year-old MFI in Mexico, recently went public. From 1990 to 2000, it was an NGO and its main goal was expanding access to capital for women in Mexico. It received many grants, was profitable, and its profits were poured back into the firm for further growth (CGAP, 2009). Expanding capital access to women was its motivation for rapid growth and expansion (and its rationale for the high interest rates charged to pay for it). Once it turned into a for-profit in 2000, the profits no longer had to be used solely for social purposes. They went to private investors rather than future clients (CGAP, 2009).

In 2007, when Compartamos Banco went public, it had sold its shares to pro-bono investors and a small number of private individuals. The original investors received a return on their investment of 100% a year for eight years (CGAP, 2009). Thus, the original reason for charging high interest rates (to scale the MFI and reach many women) was turned into a highly profitable venture for the "non-poor" as Dr. Yunus (2003) called them. The original profit was re-invested and then the model changed. Compartamos had an average interest yield on its portfolio in 2005 of 86% (CGAP, 2009). As a comparison, non-profit Edupaz in Chiapas charges 24% annually for its loans in Mexico (Appendix B). What is preventing this model change from happening to any other MFI or NGO?

There is currently no regulation that says banks cannot buy or absorb not-for-profits and change the model to for-profit.

Does the ownership of impoverished people's loans by well-to-do westerners bring to fruition the exact situation Dr. Yunus sought to avoid with his earlier "elbowing out" comment? It seems the goal he had earlier was to keep the two socio-economic groups separate when it comes to lending. Now, not only are the non-poor involved in the loans, but many times the non-poor are not even from the same village or country as the poor. In fact Dr. Yunus himself warned that the globalized economy was becoming a dangerous "...free-for-all highway. Its lanes will be taken over by the giant trucks from powerful economies. Bangladeshi rickshaws will be thrown off the highway" (Gibbs, 2006).

The U.S. and other countries have millions of dollars being funneled into MFIs in mainly developing countries. This money is subsequently lent to individuals based on the arbitrary criteria of the MFIs and, in some cases, large banks. For individuals that barely get by, the overwhelming flow of money and added players is going to subject them to market fluctuations. If villagers become dependent on the loans (as most are recurring loans) and global markets cause a pullback, it leaves them few options. This is similar to a local bank drying up. The only options are to approach another MFI or to revert back to moneylenders. The reason for this is most MFIs have filled the gaps where banks do not exist anymore (Baydas et al, 1997).

The globalization of MFI funding has some negative effects. It seems now many MFIs are moving away from its social mission of helping poor families thrive toward the

capitalistic mission of profitability for its investors. In this context, key metrics include gross portfolio, average loan balance per borrower, total assets, number of active borrowers, deposits, and number of depositors (MIX Market, 2009). These metrics are less about how the poor are functioning and more about the financial performance of the institutions (CGAP, 2009).

There are two key differences between Grameen's model and what seems like a fast-growing for-profit model whose goal is not just to empower people in emerging markets. First, in the for-profit model, the money is coming mainly from outside the community as opposed to inside like Grameen. Second, a for-profit model relies frequently on unregulated flows of capital into a smaller market, while Grameen, as a local MFI, has some built-in limiters to insure that growth is sustainable.

Currently, Grameen is funded and run locally in Bangladesh (Yunus, 2009), which has allowed the local community to have greater control than if for-profit financial institutions had control. The borrowers are also shareholders (Yunus, 2009). If money were allowed to start flowing from other sources, the new lenders would most likely impose their expectations of returns. Having the well-being of people living on pennies subject to the investment cycles of the U.S. (or other western countries) is not what Dr. Yunus had in mind when keeping the poor from the "non-poor" as mentioned earlier.

The next difference is self-limiting activities, which Grameen has because the poor own Grameen through shares that all borrowers receive (Yunus, 2009). The organization can only grow through growth in deposits and through expansion of its community-owned banks. However, referring back to the Compartamos Banco example,

it is evident that growth can occur exponentially in a for-profit model with no local input or control. Compartamos Banco fueled its post non-profit growth by selling bonds in Mexico and socially-motivated international investors began creating large funds to invest in the debt and equity of high quality MFIs. Before commercialization in 2000, Compartamos Banco's operations were supported by direct or indirect grants of about US \$6 million from private Mexicans and international donors (CGAP, 2009). What is to prevent that metamorphosis of models from happening to other MFIs? Nothing tangible is preventing it.

While there are negative aspects to this transformation to for-profit, there is a positive side. The positive aspect of that change is that the buyers of the Compartamos Banco IPO shares were much larger mainstream institutional investors and represented a larger long-term funding source as opposed to socially motivated sources. It will also stimulate the growth of MFIs because of its great success (CGAP, 2009). But the conditions of these outside sources can change and borrowers have no control over them. These growth strategies are seemingly contradictory to Dr. Yunus' design of Grameen. Grameen has grown organically with profits secondary.

People versus profits is an ongoing debate in many industries. In this particular industry, the fragile financial nature of loan recipients must be taken into consideration with the argument. Both Grameen and for-profit firms like Compartamos Banco have seen great success by rapid growth, financial sustainability and profitability. However, in the long run, and especially in a potential downturn, letting the stakeholders (in this case the borrowers) have a say in the organizational direction seems like a valuable strategy to



mute any potential negative outside influence. As much as these large outside funding sources have influenced microfinance, there has also been a new funding source introduced in the last ten years: internet funding.

### Internet funding

Nearly every facet of our lives has been influenced by the expansion of the internet. In the last few years, several organizations have sprung up to take advantage of the supply and demand of microfinance funds to help a new market of developing nation entrepreneurs. These groups foster the claim that access to capital is a notable way that the poor can pull themselves out of poverty (Kiva, 2009; Microplace, 2009). The ability to lend money via the internet, and the recognition by many large banks as to the enormity of this market (Citibank, 2009), has magnified interest in commercializing microcredit in many developing countries. Some of these organizations are non-profit and some are for profit, depending on their charter. Kiva (2009), Unitus (2009), Microplace (2009), Katalysis (2009) and Namaste Direct (2009) are just a few U.S. based for-profit and non-profit internet firms that connect lenders and loan recipients through MFIs in developing countries.

The emergence of internet funding for MFIs has altered the landscape, both positively and negatively, as there are few controls in both the for-profit and non-profit realms. The websites are set up like eBay or other internet e-commerce sites. An individual can click on a site, browse by country, activity, or even gender, and choose to lend money. Lending amounts are between \$25 and \$1,000 and the site lenders use

PayPal or other convenient methods to send money. In addition to the internet firms, the money is lent to the consumer through a local MFI. If the amount you lend is less than what is needed, it is pooled with other lenders' funds and distributed. The websites normally do not control who the money goes to, yet the lender gets an email when money is disbursed and being paid back. In some cases, you can click on a picture and description of the person the money was lent to and read about the MFI. Some sites are more detailed than others. However, the websites are normally just a conduit to the MFI and website due diligence is mostly limited to linking individual lenders to the MFI website (with some basic metrics like payback rates shown) and requires the lender to dig a little deeper when investigating (Kiva, 2009).

The relationship between these internet sites and MFIs vary. There are statistics listed on some sites such as ratings, delinquency rates, interest rates, and loan location. On others, there is just the loan recipient's name and a brief description. By choosing a recipient, the lender is usually choosing an MFI also. However, any credit due diligence on the loan recipient is done by the MFI. The one big selling point-that these sites are directly linking lenders and borrowers socially-is misleading. Kiva says "Kiva connects people through lending to alleviate poverty." In many cases, the recipient may know where the money originally came from; however, the loan goes through a middleman (the local MFI) and the relationship lies there (Kiva, 2009). From a U.S. perspective, the donor gets to see a picture of the recipient and tell all of his or her friends, for example, that they lent money to Sanjay in Bangladesh for his Coca-Cola store. There is an emotional connection on the U.S. side, yet not necessarily from the recipient's side. If the

goal is to move money, the ability to pull lenders in emotionally works. In some cases, like Namaste Direct, there is the lure of eventually having the lender travel to visit the city, person, or project that their loan is helping (Namaste Direct, 2009). So, for example, lend \$200 to someone in Guatemala, and then spend \$2,000 to go see them. This does not seem sustainable. In the fall of 2009, the question of transparency and pre-funding of loans caught up with Kiva. Kiva was loaning money out and then securing the money after the fact through their website. To some bloggers, this approach, while legal, seemed disingenuous. Kiva is currently addressing the issue (The Chronicle of Philanthropy, 2009).

As one can imagine this microfinance process has gotten great notoriety. With Mr. Yunus having won the Nobel Peace Prize, microfinance (especially Kiva) has received much press. Kiva has been featured in Time, New York Times, Fortune and Wall Street Journal (Kiva, 2009). Yet there is little knowledge of how these loans truly affect the people receiving them other than project completion and/or loan payback status. EBay recently purchased a for-profit site called Microplace. Its tag line is “Invest Wisely. End Poverty.” (Microplace, 2009). The site actually states that the customer is purchasing an investment that provides returns while helping people out of poverty. Unitus, also a globally-linked MFI, uses “Innovative Solutions to Global Poverty” according to its charter. They seek out and partner with young, high-potential microfinance institutions, helping them build capacity, attract capital, and unite with their network to achieve rapid, sustainable growth (Unitus, 2009).

Kiva does not currently charge interest on its loans. However, Unitus and others, as well as the MFIs they serve, do charge interest and most of these investments expect a return. When interviewing Kiva, they had considered changing to for-profit status. However, they decided against it and instead ask donors to give an extra 10% per loan (as an option) to cover costs.<sup>1</sup> These fees net Kiva than \$400,000 a month. This is still a fairly new market, but the working poor (Kiva's target market) promise to be an expanding new market of consumers. Citibank and other traditional banking institutions also anticipate this market will grow rapidly, even during a downturn (Apps, 2007).

The positive aspect of this for-profit growth, according to the Wall Street Journal (Silverman, 2006), is that some of these MFI firms will be providing savings accounts and insurance in places where they are sorely needed. The Wall Street Journal also claims that private individuals, institutional investors, and government investment arms invested around \$600 million in microfinance projects worldwide by the end of 2004 (Silverman, 2006).

The loose controls of these internet funding sources can give some organizations pause before utilizing their potentially massive funds. However, one can argue, because of those loose controls (and in Kiva's case, no expectation of return) these potential capital flows can have positive benefits when utilized in a more pointed fashion like green technology for a whole community. However, introducing new rules and regulations-as well as uncertainty-to smaller, sometimes more subsistence-based economies can have negative consequences. The expectations of returns (or simply the

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<sup>1</sup> Interview with Chelsa Bocci, founder of Kiva in June 2009

generosity of interest-free lenders) are always subject to fluctuations. For those populations that live on less than \$1 a day and require microloans to smooth out the rough edges of living, those fluctuations can create further heartache.

## Summary

The above sections have a central theme of the effectiveness of microfinance and the impact of outside forces on borrowers. While it is arguable that there are both positive and negative possibilities (i.e., access to capital, the reliance on that capital) when microfinance is introduced to an underserved society, there is little argument that there is less chance for exploitation when the local community or local stakeholders have at least some hand in the development and/or implementation of the microfinance program. One way to limit the level of exploitation can involve a system where the borrowers are lending money to each other (as in the Grameen case). Additional approaches include controls on what the borrowed money is used for (infrastructure or consumables), limits on the profits that outsiders make on the loans by setting a ceiling on interest rates by local stakeholders, and a close scrutiny of MFI organizational structure. Regardless of the influence the local stakeholders have, it is safe to say some rather than no local influence is the preferred approach. Having no local stakeholder say in how loans are distributed, the terms of those loans and to whom they are lent is a recipe for disempowerment and potential exploitation. While the level of input from the loan recipients can be difficult to measure, the Grameen approach seems to be a pragmatic and potentially effective system.

Allowing the local stakeholders to have some control when the infrastructure and philosophy is first initiated is best achieved by local stakeholder involvement in planning and pricing feedback. Now that microfinance is not a new phenomenon and there is plenty of information for small programs and funding, there is greater argument for a local approach that integrates various global ideas into a smaller, more locally managed model. This local model can thus reap the proposed global benefits (access to capital) of microfinance, but on the terms at least partially dictated by loan recipients and those close to them.

In order to understand what those terms may be, for a small, locally-based group like EduPaz, it is important to have a historical understanding of the political, economic and social background of the region. With respect to Chiapas, I will give a brief overview of its economics and history along with the role that relationships play in getting things done there.

#### Chiapas-Economic overview, history of outsider influence and the role of social capital

In order to better understand the implications of an energy finance program in Chiapas, it is imperative to have an understanding of both the historical and present role that economics and relationships play in everyday life. In this section, I give a brief overview of the economic state of Chiapas, its political history and the role outsiders have played. I also introduce social capital and its role in Chiapas.

## Economic overview

Chiapas is a diverse and beautiful state in southern Mexico. The Mexican states of Oaxaca, Veracruz and Tabasco border it clockwise from the Pacific Ocean to the west and end with Guatemala starting in the Northeast and South (see Figure 1). While the estimated per capita GDP of Mexico was \$14,200 in 2008 (Central Intelligence Agency, 2009), the average income in Chiapas is only US\$4.80 per day or US\$1,752 annually.<sup>2</sup> Chiapas has 4,293,459 inhabitants and 58.3% of the population works in agriculture. Of these inhabitants, 957,255 of the state's residents are indigenous. Some other facts about Chiapas:<sup>3</sup>

- 25.9% of homes do not have running water;
- 5.88% do not have electricity;
- 8.07% have no sewage system or equivalent;
- 32.9% have dirt floors;
- 85.7% cook with wood or coal

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<sup>2</sup> [http://www.sipaz.org/data/chis\\_en\\_02.htm](http://www.sipaz.org/data/chis_en_02.htm)

<sup>3</sup> *ibid.*



Figure 1. Map of Chiapas<sup>4</sup>

<sup>4</sup> [http://www.travelamap.com/mexico/chiapas\\_I.htm](http://www.travelamap.com/mexico/chiapas_I.htm)



In addition, Chiapas produces a significant share of the petroleum and natural gas in Mexico. In 2001, Chiapas produced 17.5 million barrels of crude oil, equivalent to 21% of the national production, and 222,964 million cubic feet of natural gas, representing 47% of national production.<sup>5</sup> The rural population is largely agrarian and comprises 24% of the total 120 million people in the country. However, agriculture only represents 4% of the total GDP of Mexico. In addition, much of the population raises and sells pigs on small farms (World Health Organization, 2008).

Finally, there is a substantial income, ownership, and access to services gap. Since 2000, Chiapas has been the state with the second highest level of marginalization in Mexico. Marginalization is defined as “population which does not enjoy the use of goods and services essential to the development of its physical capacities.”<sup>6</sup>

The distribution of land has a long history in Chiapas. Though one reason for the Mexican revolution was land reform, this region was dominated by large private estates or haciendas, owned by families from Comitán, until 1930. In the early 1930s, this situation changed as president Lázaro Cárdenas sought to implement land reforms throughout Mexico (Haar, 2001). By 1970, only ten percent of the land remained in the hands of private, non-indigenous landowners. During this redistribution of land, many *ejidos* were formed. An *ejido* is the result of the process where government promotes the use of communal land shared by the people of the community (Haar, 2001).

In addition to the marginalization, the concept of *ejido* (collective land ownership) has been a constant source of conflict and dispute. Haar (2001) writes that piecemeal land

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<sup>5</sup> [http://www.sipaz.org/data/chis\\_en\\_02.htm](http://www.sipaz.org/data/chis_en_02.htm)

<sup>6</sup> [http://www.sipaz.org/data/chis\\_en\\_02.htm](http://www.sipaz.org/data/chis_en_02.htm)

redistribution was part of manipulative political strategy to keep the peasantry in check. This seems somewhat effective as there are continual disputes between *ladino* groups (the non-indigenous inhabitants of Chiapas) and indigenous groups as well as within indigenous groups (Vargas-Cetina, 2001). In fact, relations between Mexicans and Mexico's indigenous people seldom, if ever, manage to breach colonialism and its exploitative nature (Vargas-Cetina, 2001). One view is that land in Chiapas is ancestral and not for sale, while the other view is that it can be sold.<sup>7</sup> This difference of opinion has led to continual land disputes in many regions between those subscribing to the free market and those with a more collective mentality. While the *ejido* is well-established in Chiapas and increased land ownership by the peasant community seems like a positive development for the poor, this continuous disagreement only adds to the blurred lines of formal government and the informal nature of relationships in Chiapas.

#### History of outsider influence and its effects

In order to be able to design a workable energy-lending model, one must understand the notion of outside influence and the history behind these informal relationships in Chiapas. In Harvey's book, "The Chiapas Rebellion", he discusses the opposition to rural bossism, or *caciquismo*, in the areas in and around where I have done my research. This *caciquismo* is said to be at the root of the concentration of political and economic power because of the uncertainty and shifting political power during and after the Mexican Revolution. Those areas, the Lacandon Forest, Simjovel, and Venustiano

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<sup>7</sup> *ibid.*

Carranza, are adjacent to Comitán and San Cristóbal de Las Casas (Harvey, 1998). Both of those locations are areas where I visited and conducted my research. Haar (2001) discusses how social relations were re-structured around the land endowments. In this process, the land reform beneficiaries adopted the *ejido* model that the state offered, but also re-worked it. Although conditioned from above, land reform also involved processes of appropriation from below. This relative independence and notion of local input (and opposition to consolidation of power) is a critical component for understanding the implications of implementation of a new energy lending model in Chiapas by an outsider.

Historically, peasant organizations functioned within a power structure that made State provided goods indispensable for community development. This made communities dependent on the state for their provisions (Harvey, 1998). In turn, as the state sought to fill the gaps, the result continued to be an uneven state presence. Because of that, the church sometimes filled this gap (Harvey, 1998). This combination of top-down reliance and control combined to create a structure-weary population in Chiapas that continually sought its own voice and empowerment. In practice, communities exerted a considerable degree of control both within and beyond the field of land tenure (Haar, 2001).

In the 1970s, United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), United Nations Children's Fund (UNICEF), and Food and Agriculture Organization (FAO) funded the Socioeconomic Development Program for the Chiapas Highlands (COPRODESCH) which targeted indigenous populations in order to help them raise their living standards (Vargas-Cetina,

2001). Again, this is more of a top-down implementation with little to no up-front input from the local population.

The Zapatista rebellion in 1994<sup>8</sup> was seen as a demand for dignity, voice, and autonomy in an area where *caciquismos* have dominated the concentration of wealth and power through the exploitation of the indigenous population (Harvey, 1998). However, after the uprising, Chiapas indigenous people have started to disappear behind different forms of misrepresentation obscuring the fact that they are human beings and not just a group defined by that uprising (Vargas-Cetina, 2001). Because of this, indigenous people have become defined by their “otherness” and in fact, further alienated (Vargas-Cetina, 2001).

Even though the 1994 uprising has been given most of the press, there has been frequent historical reoccurrence of exploitation via outside influences and/or *caciquismos*. In his book, Harvey (1998) draws a connection between ladino elites and the *caciquismo* phenomena and their control over the indigenous agrarian community. In addition, he details the historical exploitation of indigenous peoples. Understanding this historical context of outside exploitation, it is imperative to emphasize the need for local organizations and their stockpile of social capital to implement any new program in Chiapas.

While the Zapatista uprising is the latest and most highly publicized rebellion, because of the media coverage and its dramatic takeover of San Cristobal de Las Casas January 1, 1994, it is not alone historically. Since the conquest of Chiapas in 1524-27,

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<sup>8</sup> The Zapatista movement is a long and complicated interaction. This section is meant to summarize its occurrence. For a more detailed discussion, see Harvey’s book “The Chiapas Rebellion”

regional elites have fought for control over the indigenous population's land and labor. This fight for control of the indigenous population provoked violent rebellions in both 1712 and 1867-70 and worked very hard to divide the indigenous people. In addition, this struggle to divide and control the indigenous population by the elites created an informal network of *caciquismos* and maintained a constantly blurred line between indigenous and ladino society in Chiapas (Harvey, 1998). There were extensive gray areas between various groups. However, the uprisings are but a few responses to outside influence and exploitation.

It must be noted that absence of outside exploitation and influence is not necessarily a recipe for peace and tranquility in Chiapas. While National Courts would rather have indigenous communities settle their own problems, it does not mean that these communities live in total harmony, since conflicts are permanent and often deadly (Vargas-Cetina, 2001). In addition, Vargas-Cetina (2001) warns against the unwarranted expectation that individual motives of indigenous persons are suppressed in favor of the will of the majority.

Because of the informal nature of the relationships between people and groups (and regardless of any internal conflicts), it would seem to be more difficult for outsiders (especially outside of Chiapas and/or Mexico) to gain traction for newer programs or to make changes. To have a greater understanding of this difficulty, it is necessary to understand the role of social capital in Chiapas.

## Social capital and its role in Chiapas

There are various ways that social capital can be defined. Putnam (1993) defines social capital as networks, norms, and trust. His definition implies there is a linkage between normal connections and trust. He postulates that this trust has a causal relationship with joining civic groups. He does not however, state which comes first, the trust or the joining. The trust must be reciprocal and thus trusting is as important as being trusted. He says accurate information and reliable enforcement are essential to successful cooperation (Putnam, 1993). Karlan (2002) defines social capital as the links and commonalities that bind a group of people together and determine their social interactions.

While social capital is not defined as a local phenomenon exclusively, it should have greater value in the rural areas of developing countries. In the rural areas of developing countries, where local travel and information is sometimes limited, social capital, word of mouth and trust logically take on greater roles. In the villages I visited in Chiapas, there was no internet or newspapers, only some radio. Thus, word of mouth takes on greater meaning. This may change, but for now it is the primary communication source. Because word of mouth takes on greater value, the trust developed in what a person says to those in his or her social network has greater value.

In addition, social capital has economic value and can be transformed into financial capital by lowering transaction costs, fostering trust, and speeding information exchange and innovation (Putnam, 1993). This social capital can utilize its trust

mechanisms to lower transaction costs through the resolution of conflicts using methods other than legal and/or contractual constraints.

In a very simplistic sense, because of lack of marketing and advertising, word of mouth and personal experience lends greater credibility to any program. Being able to point to current relationships as a success story, especially if people benefit and are empowered, can reduce the difficulty of implementing new ideas. Conversely, negative experiences with a program or person can have an exponentially negative effect, especially when dealing with outsiders. While new ideas and products still face skepticism, adoption of these ideas can be achieved more rapidly when both tangible and intangible benefits are verified by those within one's social network. In the section titled "Small Scale Bio-Digesters and Cook Stoves in Chiapas, Mexico," I detail how the social capital EduPaz has developed will benefit my proposed program.

### Summary

While this is not a complete historical or political analysis of Chiapas, it does lend credibility to the value of working with a locally-run organization for the proposed project in Chiapas. This area is highly impoverished, historically has exported valuable resources, and has been prone to exploitation. There are subtleties surrounding which communities to approach for services and how they view outsiders. Thus, relying on a local organization to implement a program is instrumental in its success. Being pointed in the right direction, introduced to those influential people in the informal network, and

helping one avoid blatant cultural missteps are just a few benefits of engaging a local organization.

### Energy Lending Models in Latin America

As local interaction is valuable when designing a new energy finance program in Chiapas, it is important to summarize and discuss energy lending models that are currently in use regionally. The following section details some current energy lending models in Latin America.

#### Introduction

Microfinance and consumer lending can improve access to quality modern energy services for poor people. Such loans can help offset the high upfront cost associated with cleaner technologies, such as biogas, micro hydro power, wind, or solar. Microfinance institutions have been very successful in expanding access to financial services in the Latin America and Caribbean region (LAC), reaching close to six million low-income households by the end of 2006 (Navajas and Tejerina, 2006).

Energy lending in the Latin America region can be broadly categorized as coming from government or donor programs or partnerships among energy companies, MFIs, and NGOs (Navajas and Tejerina, 2006). Through my research, I looked at several energy lending models in both the for-profit and non-profit arenas. Many MFIs have taken the basic philosophy of Grameen Bank, using access to capital and poverty alleviation as its main goal and not being product or service specific. They just administer and service loans. However, there are organizations that have integrated energy services onto already



existing MFI organizations to leverage their capabilities. In addition, others overlay MFI services onto existing renewable energy technology sales and service by creating an in-house, energy-only lending solution. Both have overlaid non-existing services onto existing infrastructure while leveraging relationships to quickly deploy technology to help underserved communities (Navajas and Tejerina, 2006).

Depending on the size of the organization, there are several points to consider when adding energy services or MFI services to current services. The main issue is how to leverage already existing relationships to avoid costly start-up times.

When discussing Energy Service MFIs, I will detail three organizations that each use one of the above models. The first is the for-profit model whose primary function is to develop an in-house MFI model to specifically bundle and deploy standard renewable energy technology to middle class people in Nicaragua. Next, I detail a for-profit model that uses existing MFI relationships to sell Photovoltaic (PV) systems in the Nicaraguan regions the MFIs serve. Last, I show a non-profit model that uses grants and a revolving loan structure to reach some of the poorest communities in Nicaragua with various technologies and financial models.

#### Tecnosol

Tecnosol, a Nicaraguan Corporation, is a successful for-profit model in microfinance and energy services delivery. Tecnosol provides clean energy alternatives for the lighting and refrigeration needs of rural Nicaraguan households, schools and hospitals that have no access to the main electricity grid. Started in the 1990s, it has

equity funding from E + CO, a company that makes clean energy investments in developing countries<sup>9</sup> and installs home PV systems in several locations in Nicaragua. It has received \$1.3 million in equity over 5 years from E +Co (E+Co, 2009).

In 2005, Tecnosol received \$900,000 from the Inter-American Development Bank's Social Entrepreneurship Program. This money included a \$520,000 loan (at 4% interest for 10 years) and a \$180,000 grant for a microfinance program. Its target market is families with an annual income of more than US\$1500. It normally requires some form of collateral (cows, etc.) but also use the solar panels as collateral. Tecnosol administers the loans, pays a loan collector, and bears the risk. The money borrowed at 4% allows Tecnosol to have an internal microfinance program. This internal finance program helps Tecnosol speed sales and installation of equipment by simplifying the financing of the PV systems.<sup>10</sup>

Photovoltaic (PV) system sales are set up as a single transaction. Tecnosol representatives speak with the community, sign people up for systems, and make a list of interested consumers. For those that qualify (by income), Tecnosol finances and installs the system. It uses subcontractors to install the system and makes basic repairs. A local money collector collects payments. Per Tecnosol, its target market is mainly middle class families off the grid and it writes five year microloans for the equipment. While Tecnosol approaches communities as a whole, loans are individual.<sup>11</sup>

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<sup>10</sup> Interview with Tecnosol President Vladimir Delagneau in Managua, Nicaragua in July, 2008

<sup>11</sup> See Appendix A for more detailed information that Tecnosol provides its customers

As recently as 2008, the Nicaraguan government was subsidizing the transactions retroactively and paid the subsidy to Tecnosol monthly. The system users sign over the carbon credits to Tecnosol and Tecnosol aggregates them and uses them to increase its profit if they are sold. When Tecnosol approaches a town or village, the villagers all say they want electricity. However, when asked to pay, half say they can pay, but only 25% can really pay.<sup>12</sup> In July of 2008, Tecnosol was installing 600 systems a month and 30% of those are part of the finance program. At the time, the program only included residential PV systems. Tecnosol would also give a \$10,000 credit line to local dealers to sell the system and install it. Some of the installers maintained the systems.

In summary, Tecnosol has taken the free-market approach using its size and access to capital to its advantage. It uses a captive finance market model similar to what IBM and General Electric have employed for years. The company rolls all the costs, subsidies, and credits into a single payment and accepts credit risk. The model takes advantage of a single point of contact for pricing and maintenance (with lower combined transaction costs) while controlling the financing. The model also takes advantage of aggregation and market conditions (the IDB loan, subsidies, and carbon credits) to lower the costs for Tecnosol. The five year loan period is longer than the period given by most MFIs and it gives Tecnosol the advantage of a lower monthly payment. Tecnosol does absorb some finance risk but it is measurable as the company uses the PV panels as collateral. Thus, the risk is mainly only soft costs (i.e., installation) as Tecnosol can repossess the PV panels and re-use them. Essentially, Tecnosol sets a baseline revenue

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<sup>12</sup> Interview with Tecnosol President Vladimir Delagneau in July, 2008 in Managua, Nicaragua

structure (costs minus subsidies), and uses creativity and relationships (carbon credit aggregation and subcontracting) to enhance profitability by lowering its costs even more.

### Suni-Solar

Suni-Solar is part of Grupo Phoenix (a Nicaraguan NGO) that sells and installs small, home renewable energy systems. I met with Douglas Gutierrez, one of the managers in their Managua facility. They mainly compete with Tecnosol and have a similar business model. They also have some funding from E + CO.<sup>13</sup> Suni-Solar's property for the business was used as collateral for the loan from E + CO. In the organization's beginning, they used recycled photovoltaic (PV) cells by cutting them up and installing small home systems up to 75 watts. They had a problem with technical certification due to the used components, could not compete as well as they would like, and started to import components. They focus mainly on home PV, wind, and some backup PV systems.

Their main market is stand-alone rural PV systems. Until 2008, the Nicaraguan government was subsidizing this market with payments from the World Bank.<sup>14</sup> The subsidies were mainly for systems under 100 watts. The Nicaraguan government could then subsidize systems up to 500 watts for other "production" reasons, (i.e., cow-milking), or other tasks that are more business oriented. The system size measurements are all based on the capacity to produce electricity as opposed to actual electricity use. This is important as it is much easier to measure installed capacity for subsidies as

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<sup>13</sup> Interview with Douglas Gonzalez of Suni Solar July, 2008 in Managua, Nicaragua

<sup>14</sup> *ibid.*

opposed to electricity use. It also assumes the systems will be sized appropriately for the needs of the users. There are voluntary market carbon credits associated with the implementation of these home PV systems. Suni-Solar owns the carbon credits that are produced through the use of clean renewable energy instead of biomass or fossil fuels. However, Suni-Solar had no system for verification of those credits. The verification requirement for many types of carbon credits requires more data than Suni Solar currently is capable of collecting.

The microfinance component of the program is implemented through MFIs Prestanic and Cooperativa among others. The PV loans are mainly set up for three years. Because the MFIs Suni-Solar partners with already have sales personnel in the areas Suni-Solar targets for sales, these MFIs “sign up” people for the PV systems and the loans at the same time, thus reducing transaction costs. The key component of the loan structure is the MFIs being able to use the PV equipment as loan collateral (as well as cows and other assets).<sup>15</sup>

Prestanic is a Nicaraguan MFI that has been in business since 1991. I met with the General Manager Armando Gutierrez to discuss his program with Suni-Solar. Suni-Solar is mainly church group funded, but have relationships with other groups. E + Co and others have provided some equity funding. Oikocredit, a Dutch funding organization, also funds the organization.

According to Prestanic, there is a social aspect to their work. Prestanic’s goal is to help people as well as make money. Prestanic sells PV systems through representatives

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<sup>15</sup> *ibid.*

on motor bikes and then Suni-Solar comes in and does the installation and maintenance. As far as the collateral, they are mainly using the PV panels and cows. Armando says if someone cannot pay they do two things. If the person really cannot pay, they try and restructure the loan or work with the consumer to pay. If they refuse to pay, they “hit them hard” as Armando punched his open hand. I chose not to ask him to be more specific. Prestanic leans towards the less risky loans and are mainly in the middle-class market. The transactions are predominately one system at a time (as they are signed up). Prestanic differs from Tecnosol as Tecnosol tends to approach whole communities at once. Once Prestanic signs up a system owner and it is installed, the technicians from Suni-Solar make rounds for repair, etc. However, when I asked about maintenance and battery replacement policy, Armando did not know how it was handled.<sup>16</sup>

Armando says the panel transactions are only 2% of their business and there are currently no plans to diversify. He has no knowledge of carbon credits. The loans are two to three years and 24% compounded annually. Prestanic has a two or three year agreement with Suni-Solar and 14 offices.<sup>17</sup>

For Suni-Solar, the PV panels are mostly maintenance free and the batteries have three to five year lives. However, the batteries only come with a one year warranty. The panels are supposed to be owner maintained and a manual is provided. The owners are instructed to keep water in the cells, to not overuse the batteries, and to keep the terminals clean. The batteries cost between \$120 and \$130 and are mainly Trojan 27 TM Deep cycle batteries. They have 105 Amp hour 12 volt batteries and 205 Amp hour 6 volt

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<sup>16</sup> Interview with Armando Gutierrez of Prestanic on July 9<sup>th</sup>, 2008 in Managua, Nicaragua

<sup>17</sup> *ibid.*

batteries. Douglas says the 27 TMs are not going to be produced anymore and Suni-Solar is looking at others with better performance, yet higher pricing (around \$160). The main concern for system users as well as Prestanic is the short warranty life of batteries (one year) versus loan payments (three years). This can cause collection problems as well as disuse by the consumers if the batteries fail.

Douglas also mentioned a problem with donated systems. If systems are donated, the user pays nothing so there is a question of where the responsibility of system repair lies. Suni-Solar has no solution to this problem but very few systems are donated.

Suni-Solar has a model that uses PV systems in more of a commodity role. Since the PV technology is mature, it is more of a financial sell based on monthly cost. The monthly payment (a component of principal and interest) is the deciding purchasing factor for the consumer. The costs are aggregated and presented to the consumer as a single payment, much like Tecnosol. Suni-Solar is at a competitive disadvantage against Tecnosol because Tecnosol writes five year loans and Suni-Solar writes three year loans through the MFIs.

#### Asofenix

Asofenix is a small Nicaraguan NGO run by Jaime Muñoz out of Managua. I spent two months in Jaime's office and accompanied him on site visits. Jaime's approach is somewhat haphazard as he visits many communities on an intermittent basis. However, he seems to have strong relationships, respect, and social capital within the communities

he visits. Jaime used to work with Suni-Solar. For this section, I will detail one of Jaime's projects.

Jaime is working with the community of San Jose de Los Remates. San Jose's stated goal is to be totally sustainable and off the grid within 15 years.<sup>18</sup> The goal is based on a community sustainable economic development and green energy plan. They are trying to implement a fund that charges 6% interest to the loan recipients annually for various projects like solar panels and a micro hydro system. They finished one micro hydro project where the users put in sweat equity (labor to install it) and had to take out a loan to make up the difference in cost.

In order to jump-start the program and extend the benefits to all members of a community, grant funding was needed. Short-term funding could help start an on-going sustainable project because the funds will be used to implement the program and establish a revolving loan fund for equipment purchases. As the project is implemented, the equipment will be sold to individual families on a partially subsidized loan basis. The repaid loans will seed a Renewable Energy Fund administered by the Local Development office of the District. The Local Development Office has experience administering micro-credit agricultural loans and thus is set up administratively to collect payments and keep financial records. This loan fund will be available for future parts replacement, system expansion, and new systems to new families.

A range of sizes of photovoltaic systems will be offered so that each family can determine a system appropriate to their needs and economic resources. The loans will

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<sup>18</sup> Interview with San Jose de Los Remates community leaders July 14<sup>th</sup>, 2008 in San Jose de Los Remates, Nicaragua



have low interest rates and a repayment length sufficient to pay back the loan. The specific terms will be defined upon a detailed economic analysis at the initiation of the project. However, the monthly cost of the system is based on the ability to pay by the families and the rest of the cost components are calculated using subsidies to reduce cost.

When a battery needs to be replaced, or other repairs made, families can obtain a loan from the Office of Local Development. As the initial beneficiaries repay the loans, a Renewable Energy Fund will be created for the maintenance of the systems, upgrades and purchases of new systems. These new systems can accommodate population growth and the extension of the program into other communities.

Initially, 40 Solar Home Systems will be purchased and sold to individual families on a 25% average subsidized micro-credit basis. Thus, 75% of the initial fund will be recovered and loaned out again to an estimated 30 additional families. After 3 revolutions of the fund, 93 families (465 people) are estimated to benefit.

By creating an environment that has some predictability, AsoFenix and San Jose de Los Remates has blended microfinance traits with development ideas to create a space where development organizations can place their money and feel confident the money is accomplishing what it has set out to accomplish. Their approach sheds light on five issues:

1. It creates a personalized financial component of responsibility and commitment amongst all community members using systems. This is accomplished by having each community member commit to a payment structure, thus insuring financial participation.

2. It lays out a long-term plan that insures completion of a program so everyone benefits. This elicits support from those community members that may not be involved in the first phase of the project.
3. It has a cross-collateral approach (the repayment of loans is needed for other systems to be installed) that would allow for future funds (via repayment of loans) because the community is committing to this and there is no loan from outside sources.
4. The money comes from within the community (thru loan payback) except for the initial grant money to stimulate the project. While the money will not last forever on account of paying for the equipment, the fund has a sustainable mentality that looks to the future of all community members. This methodology can be transferred to other projects within the same village.
5. Finally, it leaves the door open for a small business component. There will be future loans available for green business and eco-tourism.

### Summary

All three of these groups have a few things in common. The most important is they all set their monthly payment amounts based on ability to pay. They determine what individuals can pay based on income class and how the consumer values the technology both monetarily and otherwise. In general, all three groups compete in some geographic and income areas, yet not all. It seems essential for all three groups to aggregate all the costs and subsidies behind the scenes to give the users of the equipment as little choice as

possible. This makes it easier to deploy a program where there is little negotiation and/or wrangling. Just a yes or no answer from the consumer is what matters. This simplicity allows for more predictability and scaling because there are fewer variables. While this may seem strange at first, it aids in the speed at which the technology can be deployed because costs and profits can be more easily predicted based on number of systems. Also, in San Jose's case, it gives the community better information to plan where to deploy the loan money paid back.

The information provided to me during these interviews and meetings made a few things very clear to me. One is that the users of this technology must pay something for the technology, no matter how small that payment may be. Doing so appears to give them a feeling of ownership of the project. I will discuss this in more detail in Step 4 of the "Step by step implementation" section. Next, a systemized approach to the technology cuts down on installation, limits consumer choices and reduces transaction costs. While it is nice to give people a choice, it also takes time to educate the consumer and let them choose between multiple options. Eliminating multiple choices simplifies the project somewhat. Finally, it is imperative to have local representation at the table. Local representation gives credibility to the local population as to the validity of the project and gives feedback from the community members for project quality. This is mainly because several of the organizers are taking part in the project themselves and installing units in their homes.

These organizations all have their individual models that have been modified to either include energy services or microfinance. In order to overlay an energy services

component onto EduPaz in Chiapas, it is important to understand the current small MFI market in Chiapas.

### Small MFIs in Chiapas

In this section, I detail local MFI groups in Chiapas and how they model and administer their loan and/or savings programs. I also discuss the costs associated with the programs and how they are funded. Finally, I introduce the International Renewable Resources Institute (IRRI), a renewable energy technology organization.

#### Introduction

I was first introduced to EduPaz when taking a class through Solar Energy International in Chiapas in April 2007. During that time I was impressed by their progressive view of and commitment to sustainable development within the communities they serve. In May of 2009, I was approached by EduPaz thru Alex Eaton of the International Renewable Resources Institute (IRRI) to design a community finance program aimed at increasing the affordability of cook stoves and biodigesters for farmers in Chiapas. When visiting EduPaz again in August 2009 to learn more about their plans and to help design a community finance program for them, I had a chance to interview two other small, community-based MFIs (FORO and DESMI) in the area. My interviews with them were at times translated by Alex Eaton where I could not communicate in English or my Spanish.

The following is an overview of those three organizations. The purpose of the interviews was to obtain information about the viability of designing a finance model for

EduPaz that incorporated micro-loans, subsidies and carbon credits into a single offering to farmers to make bio-digester and cook stove technology more affordable to them. In addition, I wished to obtain information about the ability of EduPaz to administer such a program in partnership with IRRI.

#### EduPaz and EcoPaz

EduPaz is an NGO that was formed in 1998 to help the people of Chiapas. Shortly thereafter, EcoPaz was formed and designed exclusively as an MFI. There is a high-level of accounting and financial transparency between the two as separate organizations, but they are essentially the same organization with the same employees and founders. However, the MFI group is EcoPaz and is separated for legal and financial transparency issues. For the sake of discussion, I will refer to EduPaz throughout the summary as decisions are made by the founders, Jose Domingo, Mari Elena, and Javier Inda, in such a way that at least two of the founders must agree to move forward (Appendix B). The three founders share tasks and no one has a separate responsibility. They work and communicate sometimes independently and sometimes as a group.

In my description of the EduPaz program, I refer to an original program and a current program. At the time of an earlier interview,<sup>19</sup> EduPaz had about a 5% rate of delinquency amongst the borrowers of its original program, started from the inception of EcoPaz. EduPaz has made some changes that lowered the delinquency rate to close to 0% currently. To accomplish this, EduPaz has used methods to enhance re-payment of loans,

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<sup>19</sup> Jose Garcia and Javier Inda were interviewed by Maggie Pettit in April 2007

including but not limited to, more aggressive collection tactics such as legal enhancements (a contract with detailed payment plans) and group collateral. They have included a payment schedule with the loans, and the borrowers are asked to fill out an application and sign the document. They have engaged an attorney to review and comment on their processes. In addition, groups guarantee all of the loans and individuals sign an *Acta Interna* (internal record), or an agreement within the groups. The group collateral is similar to Grameen Bank's process. Individuals in the group are collectively responsible for repaying the loan and no future loans can be made to any member of the group if they are delinquent. These more aggressive tactics are to set an example for the community that responsibility is important. Their intent is to show those community members that take loan payback seriously will benefit from the program.

EduPaz lends primarily to women, groups and cooperatives. Groups can include spouses of the women. A cooperative is a group with one common project and the groups are made up of mainly poor people. Javier Inda, one of the founders of EduPaz, stated, "We work with the poor, but not the most poor. We understand with our small resources we will not be able to solve poverty." Currently there are 250,000-300,000 pesos ( $\approx$ US\$19,230-US\$23,076)<sup>20</sup> outstanding from the original program with a handful of non-payers. The most recent program has 150-180 people, mainly in 12-15 groups, and only two people are not paying. There are approximately 300,000 pesos ( $\approx$ US\$23,076)<sup>21</sup> outstanding and the borrowers are timely in paying back their loans (Appendix B).

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<sup>20</sup> Using an exchange rate of 13 Mexican pesos/US\$

<sup>21</sup> *ibid.*

Groups are mainly 6-10 people. Everyone receives money as a group but can use it individually. In addition, two or three women are put in charge of the groups. The interest rate is 2% monthly on the unpaid principal and interest MUST be paid every month. Normally, the group agrees to a payment schedule in advance yet principal payments can be skipped (Appendix B). The detailed payment plans are meant to eliminate the habit of individuals and groups to borrow more money than is needed for equipment or an asset and thus use the remainder on consumption. Javier used an example where the person borrowed 5000 pesos (US\$385), paid 2000 pesos (US\$154) for equipment and the remaining 3000 pesos (US\$231) for consumer goods. He stated he wanted to eliminate that option and require the use of the funds to be declared. He also said he will be hesitant if the funds are not either helping to produce cash flow for the borrower thru income generating activities or cost reduction. Again Javier states “We work with the people that want to work but do not have access to bank funds. We work with people with initiative. How can helping 20-30 people affect this sea of poverty? We hope that the few people will lead by example.” (Appendix B).

Payments are made monthly to EduPaz. When payments are made to EduPaz, three copies of the receipt are produced. One copy each goes to the borrower, the accountant, and the EduPaz office file (Appendix B).

The last official external audit for EduPaz occurred in 2007. It does not happen every year and costs around 15,000 pesos (US\$1,154). Administering the program takes approximately one-half the time of a full-time staff member. A full-time person costs

about 6000 pesos (US\$462) a month so in effect the cost of administration is approximately 3000 pesos (US\$231) per month.

EduPaz and EcoPaz have four bank accounts (two each). For EcoPaz, one is for pure interest payments and expenses to the program come out of that. The other is for principal capital to be paid back and credit comes out of that account.

Overall, the people of EduPaz stress community spirit and giving to the communities where EduPaz serves. They supply the tools to improve the farmers' lives. Because of its size, EduPaz does not always have the capability to be aware of or use the latest funding ideas or mechanisms available. Much of their time is spent trying to access funding or providing services to clients.

#### FORO para el Desarrollo Sustentable (FORO)

The next group I met with is FORO para el Desarrollo Sustentable (Sustainable Development Forum) and the interview notes can be found in Appendix C. It is a small MFI based in San Cristobal de Las Casas, Chiapas. Alex Eaton and I met with Adriana Alcazar to discuss the program FORO provides. FORO has an MFI model that utilizes micro-lending for basic needs, greenhouses, latrines and cook stoves and has both a credit and savings program. Since 2007, FORO has become more systematic in their approach by working in only five areas. The main areas are Zinacontun (where they have been for seven years and serve about 250 women mainly in groups of 5-20), Ocosingo, Yajalon, Comitan, and Benamito de las Americas. They have an office in San Cristobal de Las Casas and their field employees normally live in or near the areas they cover. Their basic



program is to lend 500 pesos (US\$38) and the person pays it back over 6 months. The payback amount includes 50 pesos (US\$4) of interest and 100 pesos (US\$8) that go into a savings account. The savings is a collective fund used as collateral for more loans and allows the group to lend their own money to each other. This program is designed as a financial independence tool. The philosophy is meant to encourage savings and financial management amongst the villagers and the savings aspect is a very big motivation among the borrowers. The additional motivation to keep the money in savings is to make the program work and provide security/insurance for the family.

The women are mainly, but not exclusively, organized into groups (Appendix C). While most borrowers are in groups, they do not discourage individual borrowing. The groups have 5-20 women and they elect a president and secretary. They meet every 15 days to collect money and that money is paid to FORO once a month per their agreement. The interest rate is 20% compounded annually on borrowed funds and they do not receive interest on savings. The loan recipients cannot receive more money without paying off an existing loan.

The loan agreement of 1500 pesos (US\$115) has the money disbursed and paid back in increments of 93 (US\$7) pesos every two weeks. The repayment includes an interest “fee” of 300 pesos (US\$23), a personal savings account of 262.5 pesos (US\$20) and a group savings account of 262.5 pesos (US\$20). At the end of the year, the people get their individual savings back if their loan is paid back. If the group keeps its savings in then it can receive more loans and it acts as collateral as mentioned above. If all the

individual loans are paid off and any groups loans are paid off then both savings accounts can be given back.

Many of the loans are used to buy improved cook stoves. The stoves they are buying currently cost 1500 pesos (US\$115) with 500 pesos (US\$38) down and two payments of 500 pesos (US\$38). The two main reasons for purchasing improved cook stoves are reduction in fuelwood costs and improved respiratory health. A “tarea” is a cubic meter of fuelwood and costs about 600 pesos (US\$46). Villagers buy on average 10-14 tareas a year. Adriana confirmed the efficient woodstoves cuts the wood consumption in half so the stove can typically save 3000 to 4200 pesos (US\$230-\$323) a year. In addition, men encourage women to participate because less smoke is produced and they see a value in that healthier environment. Also, those men with improved cook stoves tell other men their wives are healthier. Currently, the improved cook stove owners get no financial benefits for carbon reduction (Appendix C).

When Alex Eaton and I met with Adriana Alcazar, we gave her a brief overview of my proposed program and discussed ideas for taking advantage of carbon credits. Adriana thought we could have a savings program along with my basic program and the payment of 278-300 pesos (US\$21-\$23) a month is manageable for the population in the regions that FORO serves.

While meeting with Adriana Alcazar, we also met a young woman named Xanchu who works part-time to collect loan payments. FORO also has an accountant and a driver. FORO averages 7000 pesos (US\$538) a month in operating expenses. Adriana says 40% interest would have to be charged (they currently charge 20%) to their current 250 groups

to cover the 7000 pesos (US\$538) a month, thus they are subsidized by various donor organizations.

FORO has a good model that emphasizes savings and they have an interest in a comprehensive program that takes into account all grants, subsidies or credits that are available. They take pride in their ability to provide quality jobs to community members through their collection process.

#### Desarrollo Económico Social de los Mexicanos Indígenas (DESMI)

DESMI is a 40 year old organization that gets funding from many organizations with International Development Exchange (IDEX) a primary source. The funds are now locally controlled and managed by DESMI where before they were managed by the donors. I met with Asela Sun Roman (Appendix D) and discussed their program.<sup>22</sup> Asela Sun Roman has been with them for 9 years and lived in the U.S. for six months. They have 8 full-time and two part-time employees, each responsible for a specific region.

DESMI has primary clientele in Zapatista villages like Tiopisco, Soltocanango, and others south of Comitán. The main thrust of their efforts is to combine a revolving fund for agriculture projects and some cow and pig projects with what she called *acompañamiento* (consulting that accompanies the loans). These projects consist of organic agriculture best practices, education and empowerment. However, she emphasized the process was a two-way street and DESMI workers learn much from working with the farmers. They provide *acompañamiento* alone, but will not provide

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<sup>22</sup> Her English was good and between English and Spanish we arrived at many answers. I confirmed most answers in both English and Spanish.

loans without it. She says the consulting is integral to the success of the projects as it adds a layer of best practices and shortens the learning curve through education. Essentially, the loans are provided for one year for corn crops and for two years for cattle to coincide with when the crops and cattle can be sold. Sale of products within the local community is encouraged. The entire amount of principal and interest are due at the end of the loan period with no payments due beforehand. The annual rate is 6%, and that is down from 12% annually as recently as 2007. The lowering of rates has coincided with a tightening of restrictions to have more routine and predictability.

The loan is mainly delivered in a cooperative fashion. They have 200 cooperatives within 132 communities with anywhere from 5-800 people in the cooperative. The cooperatives may elect people to manage the process, but this is not required. The loan is a revolving fund (so future loans are made from funds paid back) with small loans to individuals. Therefore, payback is encouraged to stimulate economic solidarity. The revolving funds have limitations per region. If loans in a particular region are not being paid back there are restrictions on any more loans. They will only loan 50% of the entire project and the budget for the project is analyzed before the money is disbursed, normally in increments of 20,000-30,000 pesos per cooperative. The land must be held in a collective fashion. Sometimes loans are “recommended” or guaranteed by donors to DESMI to promote activity.

DESMI has many funders and although it is a non-profit, is slightly different than EduPaz and FORO. The main difference is interest rate. Because of its funders, they have the ability to subsidize its rate and be lower than EduPaz and FORO.

## International Renewable Resources Institute (IRRI)

International Renewable Resources Institute (IRRI) is a valued partner with EduPaz and other MFIs in Chiapas. They are based in Mexico City but cover many regions in Mexico, including Chiapas. The mission of IRRI is to promote programs and businesses that produce sustainable goods and services and help reduce human reliance on fossil fuels and consumptive resource allocation. IRRI supports rural and low-income communities with the objective of improving the quality of life through generating, developing, and conserving local resources. IRRI's vision is sustainable and equitable prosperity in a world without contamination (IRRI, 2009). IRRI works with a number of renewable and efficient energy technologies, water treatment and purification systems, and agricultural management strategies in order to address the complex environmental challenges that Mexico and the world face today. They offer a wide variety of courses, consulting services, project management, and products in order to build human capacity and promote direct positive environmental change. Through strategic alliances with community members, government and non-governmental organizations, and educational facilities, they are able to provide a wide network of services without forgetting the importance of the individual personalities of each project. They are funded through both private donations and Mexican governmental organizations (IRRI, 2009).

IRRI has been very creative in using market ideas to benefit some of the poorest people in Mexico. They have an open mind as far as technology solutions and have cultivated strong relationships with many groups within Chiapas, particularly EduPaz.

## Summary

The overarching theme that ties the MFIs and IRRI together is that they are Mexican-based with relationships or offices in Chiapas. While they have different funding sources, each has crafted a solution that speaks to the issues of the loan recipients and technology users. In addition, they are small and flexible enough to be able to make changes based on feedback from the villagers. Most of the employees, if not all, have spent a significant portion of their lives (with the exception of IRRI) in the area to understand the dynamics. They all seem very open-minded and eager to work with creative solutions. With IRRI, although they have a few outsiders working for them, they are Mexican-based and have spent a significant portion of the last five years working with EduPaz and FORO and rely on their relationships with them to accomplish many goals.

### Utilization of internet loans for EduPaz through Kiva

After detailing small MFIs that lend to communities in Chiapas, it is important to highlight an organization that provides access to loans to MFIs worldwide. A key component of my proposed program is having the ability to use internet microloans to help fund the biodigesters and cook stoves for EduPaz in Chiapas.

Kiva was founded in 2004 with the goal of providing person to person lending to some of the poorest people in the world. Motivated by the success of Muhamad Yunus and Grameen Bank, the founders sought to create a portal to connect those that wish to lend money with those that could use the loans. As of November 2009, they had funded

over \$100,000,000 in loans from 584,189 Kiva lenders in their first 4 years of operations (Kiva, 2009).

Kiva loans money to entrepreneurs through their field partner MFIs. They show how money flows throughout the entire cycle, and what effect it has on the people and institutions lending it, borrowing it, and managing it along the way. To do this, they use the power of the internet to facilitate one-to-one connections that were previously prohibitively expensive. Kiva provides MFIs interest-free US\$ loans in exchange for client and project information for Kiva promotion. MFIs lend this capital at prevailing interest rates and keep the interest income. The individuals lending money through Kiva's website-Kiva's social investors-bear the risk of each individual loan they make through Kiva. The social investor makes no return on their loans (Kiva, 2009).

Throughout my conversations over 2 ½ years with Kiva, I have learned they have viewed themselves as a positive force to help eliminate poverty. In addition, they have professionalized the program and grown it by adding some very talented individuals with a passion for helping people.

However, their focus continues to be on scaling the organization in its current model, which mainly involves providing funds for entrepreneurs. They have discussed with me the intent of being more environmentally focused and creating a product that speaks to renewable energy and have recently put a tab on the website that promotes "green loans." One reason they have not entered this space in a larger fashion is that MFIs have not demanded an energy product. That seems to be changing with their relationship with an MFI in Mongolia. Another reason is that Kiva does not want to be

seen as pushing products or philosophy on MFIs. However, not having an environmental focus will not hinder any potential relationship with EduPaz as long as EduPaz meets the MFI parameters set by Kiva.<sup>23</sup>

Kiva is actively seeking partners in Latin America. Kiva has many pre-screening qualifications that can be seen in Appendix F. In my micro-loan analysis, I will detail where they match up with EduPaz, where any shortcomings lie, and how to overcome them. They currently have partnerships with three MFIs in Mexico (Kiva, 2009).

While Kiva is one of the first and currently the largest on-line lender, there are many others. Because of their professional approach and size, I will focus only on Kiva when analyzing an approach for EduPaz. Because I have chosen an on-line lender over more conventional finance sources, it is important to detail current market options for renewable energy development. One of those options, the Clean Development Mechanism (CDM) is a valuable tool for large clean energy development projects. However, the CDM does not reach all communities for development. In the next section, I will give some history of the CDM and discuss in shortcomings for smaller communities.

#### Clean Development Mechanism Benefits and Shortcomings for Small Communities

In order to appropriately design a community finance program, it is important to detail current finance mechanisms that are available in developing countries for larger projects. With this overview, I explain the Clean Development Mechanism (CDM), its

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<sup>23</sup> Interview with Tim Hassett, Vice President, Microfinance Team, Kiva in January, 2010



original goal and its shortcomings in reaching small communities for renewable energy development. In addition, I compare the size necessary for CDM projects to be profitable on a relative basis with the proposed technology for EduPaz.

## Overview

The Clean Development Mechanism (CDM) is a component of the Kyoto Protocol that allows countries with greenhouse gas (GHG) reduction commitments to invest in emission reduction projects in developing countries as an alternative to potentially more expensive reduction projects in their own country. The CDM is meant to stimulate sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reductions or limitation targets (UNFCCC, 2003). With respect to renewable energy projects, the CDM has tended to be used towards larger projects, has very high up-front transaction costs, and typically gathers local involvement towards the tail end of the process (Appendix I). This leaves few options for small communities that want to grow in a more sustainable fashion using local input and accessing officially sanctioned carbon markets.

In March 1994, the United Nations Framework Convention on Climate Change entered into force. Its goal is the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” (UNFCCC, 2009). While linked to the UNFCCC, the Kyoto Protocol differs in that it actually *commits* those that ratify it to stabilize GHG emissions. As a subcomponent of the UNFCCC, the CDM focuses on sustainable development. The CDM

does that with its tradable component, the Certified Emission Reduction (CER). The UNFCCC says “Ideally, it will encourage additional capital flows into developing countries, accelerate technology transfer, and enable developing countries to leapfrog to cleaner technologies” (CDM User Guide, 2003).

The Kyoto Protocol committed 37 industrialized (Annex B) countries to reduce their greenhouse gas emissions to an average of 5% below established 1990 levels. Under the Kyoto agreement each nation is required to reduce national emissions, but it also established three market mechanisms to “offset” emissions in other ways. Of those, the CDM allows businesses from carbon intensive industries within Annex I countries to receive CERs by investing in carbon reduction projects in countries that are not required to reduce emissions (UNFCCC, 2009).

The Clean Development Mechanism process is fairly straightforward on paper and there are several steps to a successful project. The initial motivation for a project starts with the identification of a project and the development of a project concept note. The CDM User Guide, published by the UNDP, has a simplified project flow chart (Appendix I). This flow chart identifies the responsibility of project identification as solely that of the project developer or investor. The investor or investor country hopes the project produces CERs or Certified Emissions Reductions that can be sold or traded. The project developer must do much of the legwork to identify the project and make sure it passes the many tests that the UNDP has provided to assure compliance. The theory is that these projects will go through an identification and design stage and generate a Project Design Document (PDD) where a project baseline is established and an

additionality argument is made. The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (UNFCCC, 2009). These two hurdles are meant to assure that the project has forward-reaching benefits and that the project would not take place without the CDM. The hurdles strive to legitimize the transactions and limit false claims and manipulation of the system. The process is quite involved (CDM User Guide, 2009). The detailed nature of the process implies that one must be a specialist in this area to produce a document that will be accepted by the country's Designated National Authority (DNA). The size and complexity of the transactions make it more difficult to abuse the system. However, the complexity of application, upfront costs and necessity of monitoring and verification also push the projects more toward the larger end (UNFCCC, 2009).

#### Larger CDM projects

The CDM is divided into two major categories, large-scale and small-scale projects. These are categorized by the number of CERs generated by the project. Small-scale projects are those that represent less than 60 kilotons of CO<sub>2</sub>e per year or have energy generation capacity of less than 15 Megawatts of electricity or 45 Megawatts of thermal energy (UNFCCC, 2009).

As methane capture projects, industrial bio-digesters have been installed in 16 countries through projects funded by the CDM. Mexico has been an active participant in developing anaerobic digester projects as it has almost 30% of the historical global methane capture projects within the Clean Development Mechanism (UNFCCC, 2009). Overall, it is estimated that there has been nearly US \$40,000,000 of international investment towards infrastructure projects in the country since 2003 (UNFCCC, 2009).

While the majority of anaerobic digestion methane capture projects in the agricultural sector have fallen under the small-scale methodology<sup>24</sup> *AMS-III.D: Methane Recovery in animal manure management systems*, they are still fairly large when comparing them to the proposed EduPaz project. There are currently three registered projects in Mexico under *AMS-IIID*. When those projects also contain an energy generation component such as a biogas powered electrical generator or Combined Heat and Power (CHP) system, the *AMS IA: Electrical Generation by the End User* or the *AMS IC: Thermal Energy Generation by the End User* methodologies are used. However, there are currently no projects registered worldwide with these two bundled. There is also another methodology, *AMS IIIR: Methane Recovery in Agricultural Systems at a Household or Small Farm Level*. This application applies to small household digesters. There is currently only one project of this type and it is registered in Hubei Province, China, involves the Netherlands, and it is combined with *AMS IC* (UNFCCC, 2009). Its PDD states that it wants to install 33,000 digesters ranging in reactor size from 8 m<sup>3</sup> to 15 m<sup>3</sup>.

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<sup>24</sup> This is the approved methodology for monitoring and verification of emission reductions

## CDM transaction costs for small scale systems

The CDM (through CERs), like most financing vehicles, is inherently top down in its structure. Consequently, they require financial institutions, capital, and markets to move that capital. To initiate a transaction, an individual or group has to mold the transaction to match the market and subscribe to the rules and regulations of that market. Normally, this matching process involves some expertise in this area and cannot be achieved by the novice. But mainly, it is the cost that makes CDM prohibitive on a small scale. It is estimated that costs through registration alone for CDM projects average between US\$60,000 and \$200,000. Lack of financing for upfront costs means project developers must recoup these costs within 1 to 2 years (UNDP, The Clean Development Mechanism an Assessment of Progress, 2006). Both the CDM User Guide (2003) and CDM Capacity (2009) have extensive details as to how these projects are formed. It is daunting. Even the chapter on “Simplified Procedures for Small-scale Projects” (CDM User Guide, 2003) is not for the novice, though it requires less paperwork, justification, and verification. All of these traits point towards the need of professional financiers, not small group expertise.

At a current rate of US\$11.12<sup>25</sup> per ton of carbon equivalent (CO<sub>2</sub>e) abated, the low end project that costs at minimum US\$60,000 in up-front costs would have to reduce 235 tons of CO<sub>2</sub>e per month<sup>26</sup> just to recoup the up-front costs over two years. Using conservative emission reduction estimates (Eaton, 2009), 435 two pig digesters of the

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<sup>25</sup> CER prices fluctuate, the pricing is based on data as of February 20, 2010  
<http://www.ecx.eu/CERemindx>

<sup>26</sup> Assuming 6.5 tons of CO<sub>2</sub>e per 2 pig digester, 3.6% cost of capital and monthly payments

size I propose would have to be installed. In my section on “Transaction costs”, I give a financial comparison of my proposed program versus the CDM.

#### Lack of local involvement

The CDM has the purpose of technology transfer and sustainable development. However, the stakeholders are normally the last party to be involved in the planning process (CDM Capacity, 2009). The size of the projects and costs associated with the analysis process cause the financial component of CDM projects to be identified first before the wishes of the locals are considered. When a project is undertaken, the decision-making criterion is skewed towards the financial end, with the local sustainability question answered last or entirely ignored (CDM Capacity, 2009).

When analyzing sustainable development versus financial characteristics, the definition of sustainable development can sometimes be difficult. In 1987, the World Commission on Environment and Development published the report, *Our Common Future*. In it, the Commission defined sustainable development as “development that meets the needs of the present without compromising future generations to meet their own needs.”<sup>27</sup> In that sustainability definition, it is implied that those “needs” are defined by those who are affected. Who is affected by those issues can be debatable but a safe assumption is the local population. There may be gray areas as to the definition of “local”. However, a clear line can be drawn with respect to “future generations” of a community as a whole. “Future generations” should be defined as which offspring of

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<sup>27</sup> [http://en.wikipedia.org/wiki/Our\\_Common\\_Future](http://en.wikipedia.org/wiki/Our_Common_Future)

stakeholders will be affected. So essentially, the current population whose offspring have a vested interest in sustainability should be considered local stakeholders. Since there is no guarantee that a renewable project activity per se shows good sustainable development performance, one has to default to the local stakeholder opinion. It should be their definition.

However, sustainability has many challenges in its definition and implementation in the CDM. The local country's Designated National Authority (DNA) essentially determines if a project is sustainable or not. This is difficult in most cases, and sustainability can be confusing. Schmitz (2006) comments that each country's DNA is responsible for assessing a project's sustainability impact, so there is confusion between countries as to the sustainability criterion for each project. This DNA rarely has local representation. Additionally, since it is left up to the individual country, it is doubtful that two countries have the same criterion for sustainability. Moreover, it is impossible to sell, transfer or store that sustainability between countries or even within countries. In fact, Burian (2006) states, that one of the CDM's ideas; the sustainability piece of the CDM could not compete with the financial piece of the CDM. By having those two components not competing, the only transferable component is financial.

An Environmental and Social Impact Assessment (ESIA) is carried out to evaluate a project's interference with nature and is thereby an essential element of a sustainable development assessment. However, with all of this comment, assessment and notification of stakeholders (and the ambiguous definition of who is a stakeholder), it happens after the project is moving forward. The comment period is also coupled with

imperfect information and gives the local person very few options should he/she not be in agreement with the project. More importantly, did public consultation begin early enough to ensure that stakeholder views were incorporated into the design of the project (Schmitz, 2006)? Of all the projects rejected by the CDM committee, none have been rejected for reasons of stakeholder objection or lack of sustainability as defined by the host country (UNFCCC, 2009). In some cases, projects are posted on websites and the comment period is 30 days (UNFCCC, 2009). It is hard to assume there would be much stakeholder involvement in areas that do not have the internet using this method. While this lack of stakeholder involvement applies to all project types, one can apply the lack of involvement to any potential agricultural methane projects that may be implemented.

### Summary

Most CDM projects (including digesters) are large in nature, have fairly substantial (mainly upfront) transaction costs, and have little to no local involvement (especially in the beginning and formative stages) in the project. This leaves a gaping finance hole for communities that don't have the potential to abate the 235 tCO<sub>2</sub>e per month I mentioned earlier, let alone install 33,000 digesters as in China. In addition, the expertise and methodology for the smaller communities are both cost and time prohibitive. This currently leaves smaller communities few other choices than to wait for someone outside the community to implement a renewable energy-type project through grant or subsidy funding without the CDM. In the next section, I will detail a new



program available in the market that may give these communities more choices for sale of carbon credits.

### Overview of MicroEnergy Credits (MEC) for Small Rural Communities

Micro Energy Credits (2009) is a corporation set up to take advantage of the voluntary carbon offset market by standardizing and aggregating Voluntary Emission Reduction Carbon Credits (VERs) in small rural developing communities. Its premise is based on a simpler audit and verification methodology that can streamline and assist MFIs in financing renewable energy projects on a smaller basis. In “Step 5. Selling of Carbon Credits and their use” of the “EDUPAZ ENERGY FINANCE PROGRAM”, I will discuss how we will be using the credits to finance an on-going collection, monitoring, maintenance and education program. Based on my interview with Tamar Azous of MEC<sup>28</sup> and my study of their materials, I have highlighted parts of the program and generated a detailed list of responsibilities for MFIs and MEC (Appendix E).

MEC is set up to allow MFIs to take advantage of VERs and the revenue they can produce. The premise is that MEC can provide various value-added services to help MFIs quickly launch and scale clean energy product lines. Additionally, MEC can supply references and ratings on energy system manufacturers and link MFIs to government renewable energy subsidies and programs (MEC, 2009). To assist the MFIs in this process, MEC provides a methodology for the MFI to record, report and audit renewable energy projects so as to aggregate and fund their carbon credits. During this process,

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<sup>28</sup> Meeting with Tamar Azous, Client Relationship Manager of MEC in September, 2009 in Seattle, WA

MEC pays MFIs a fixed cost for VERs and MFIs can use the proceeds from the credits for market development activities. To facilitate the transaction, MEC provides random auditing services of the technology (MEC, 2009).

Throughout the relationship with the MFIs, MEC has clearly delineated its own responsibilities along with the responsibilities of the MFIs in its Memorandum of Understanding (MOU) found in Appendix E. The responsibilities must be managed once the MOU is agreed upon. The responsibilities of the MFI include providing enhanced customer service and maintenance of the assets either through their own organization or a subcontractor. The MFI must also provide end-user training in system use and maintenance and community awareness of the benefits and availability of renewable energy products. The goal of these services is to improve the incomes and the quality of life of the users of the technology (MEC, 2009).

In addition, there are other responsibilities the MFI must agree to perform before the sale of the VERs. The most important steps are generating and providing audited financial statements from the previous year, an unaudited quarterly financial statement for the current year, a credit rating report and background information, and financial projections (Appendix E). After the sale of the VERs, there are several responsibilities that need to be performed, mainly administrative. The most important one is that of the Credit Tracker Data Form (Appendix K), which tracks information regarding each transaction. In addition, the MFI must monitor the technology and update the “status” section of the Credit Tracker Data Form at least once every three months to indicate whether each piece of equipment is “functional,” “faulty but in use” (suffering from

temporary disrepair) or “out of use” (stolen, irreparable, no longer used). If a piece of equipment falls out of use (e.g. with a particular user), it must be replaced with a new piece of equipment by the MFI before another credit payment can be received (Appendix K). The MFI must allow a random audit of equipment by MEC at any time. Finally, the MFI must agree with MEC how the project will be publicized, if at all.

MEC has several responsibilities they agree to perform as a party to the MFI project. First, MEC originates VER Credits and receives them for the project. This includes project development, validation, registration and verification of the VER Credits. They can, however, sell the VERs to whomever they choose (Appendix E). In addition, MEC will assist the MFI staff to upload data to MEC’s web application for reporting purposes. MEC will also provide MFI with location aware electronic devices (e.g. GPS units) to record location information for the installed technology. MEC also agrees to provide additional technical assistance to the MFI where needed to accomplish the project.

In determining the purchase price for the VERs, MEC has developed its own proprietary methodology. The purchase price is equal to 80% of the price that MEC

receives for the VERs, multiplied by an Institution Rating<sup>29</sup> and Project Rating.<sup>30</sup> MEC will pay the MFI the purchase price with respect to the VER Credits within 30 days after MEC receives payment from a sale. The purchase price is be agreed upon by the MFI and MEC at the beginning of each project undertaken by the MFI.

In addition, there are other terms and conditions in the MEC Memorandum of Understanding that can be viewed in Appendix E. However, in my discussions with MEC, they have currently put the price of Carbon at \$6.80 per ton of CO<sub>2</sub>e. For small groups, this eliminates the Institutional Rating and Project Rating process to make pricing easier at this time. It is the beginning of MEC's program and they are trying to scale so they are attempting to make the rating and pricing process simpler. While an MFI must put a formal document in place, the pricing will not be fixed until that document is in place and could possibly be subject to the Institutional Rating or the Project Rating.

MEC eventually wants to target MFIs that have more than 1000 users because of the number of MFIs in the market. However, since EduPaz is smaller than that, Tamar Azous of MCE has assured me she will grandfather EduPaz into their program should size be an issue.

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<sup>29</sup> Institution Rating is a calculation of the accuracy of MFI's reported assessment of ongoing maintenance of the Products. The purpose is to project the accuracy of the maintenance status of the products based on reports MFI provides. It is based on a comparison of audit findings with MFI - reported results. It will be developed based on discrepancies between the audit findings and data recorded in the Credit Tracker Data Form [www.microenergycredits.com](http://www.microenergycredits.com)

<sup>30</sup> Project Rating is a calculation of the robustness of products in a given project. The purpose is to project the likely number of product failures. It is based on audit findings and MFI-reported results. It will be measured based on a calculation gauging the number of MFI Products out of repair. [www.microenergycredits.com](http://www.microenergycredits.com)

Selling voluntary carbon credits is the most current way for MFIs to take advantage of those carbon credits for small energy systems. It is a progressive mentality that allows small users to take advantage of global carbon markets. Even though the pricing of the carbon credits is lower than CERs because they are voluntary, this mechanism is giving carbon credit access to projects that normally would have few options to sell their carbon credits. While simpler than CDM methodology, the MEC methodology is similar for all users and most of the input is done upfront by the MFI.

Now that I have detailed how the carbon credits will be sold, it is important to discuss the technology that will be implemented and how those carbon credits will be generated.

#### Small Scale Bio-Digesters and Cook Stoves in Chiapas, Mexico

The following section details the technologies International Renewable Resources Institute (IRRI) will be implementing in partnership with EduPaz. Both plug flow gas digesters (biodigesters) and improved cook stoves have been proven to reduce GHG by reducing fuelwood use, mainly for cooking (Eaton 2009). IRRI has a track record of installing and testing both of those technologies (IRRI, 2009). As a partner with EduPaz in Chiapas, IRRI's work with those technologies allows EduPaz to off-load the technological piece to IRRI as part of this program. Their relationship goes back over five years and it is a solid working relationship.<sup>31</sup> IRRI installs and maintains both bio-

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<sup>31</sup> Personal experience and discussions with EduPaz and IRRI from visits in April 2007 and August 2009 as well as on-going conversations with Alex Eaton

digesters and improved cook stoves in partnership with EduPaz. I have given an overview of both technologies below as well as how existing social capital will benefit the program.

### Bio-digesters

Bio-digesters have the ability to treat waste materials and produce usable methane gas via anaerobic digestion. Many feed stocks are used with bio-digesters. However, in this application, mainly pig waste is treated (Eaton 2009). Anaerobic digestion is a complex process, but in simple terms, organic waste is broken down into methane gas and carbon dioxide over a period of time depending on loading rate, liquid volume, hydraulic retention time, and type of organic matter (Eaton, 2009).<sup>32</sup>

Historically, digesters have been both large and small. However, the small scale digester has remained relatively unchanged for over 20 years, until recently, and has come in three variations: fixed dome, floating cover, and plug flow (Eaton 2009). The digesters that EduPaz will be working with are improved plug-flow (See Figure 2) digesters that Eaton (2009) helped design through his work at IRRI. The flow process is an on-going flow of manure into the digester with relatively steady biogas stream coming out. In most cases, the digester will be producing useful biogas within 30-60 days (Eaton 2009).

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<sup>32</sup> For a full description of the digesting process, see Eaton (2009).



Figure 2. Plug flow biogas digester in Chiapas under construction

The improved IIRRI bio-digesters have several useful benefits including lower cost, improved reliability, improved methane production/elimination and improved health benefits. According to Eaton (2009), the smallest bio-digester (3m<sup>3</sup>) can be purchased for approximately US \$473 (6,149 pesos).<sup>33</sup> However, that cost does not include accessory structures and concrete work, if necessary (Eaton 2009). In my site visits and conversations with Mr. Eaton, he says he has the cost lowered so that he can install a turnkey (including all structures) system for US\$600 (Eaton 2009). The installation time is normally less than one day (Eaton 2009). Mr. Eaton also claims that the useful life of the improved digester is that of the reactor material used to build it, mainly plastic. The material has a guaranteed life of 20 years in all outdoor applications within a temperature range of -75 to 180 degrees Fahrenheit (Eaton 2009). He also cites benefits of clean, renewable energy production, carbon equivalent sequestration and the associated reduction in greenhouse gas emissions (GHG), waste processing, reduced water contamination, improved indoor air quality, and cessation of environmental degradation (Eaton, 2009). Eaton (2009) estimates that the average household in rural Mexico produces 5-10 tons of CO<sub>2</sub>e per year through fuelwood use and a household with eight female pigs would produce 8-10 tons of additional CO<sub>2</sub>e per year through methane emissions.

Eaton (2009) spent several years along with IIRRI in the engineering of the improved biodigester. They studied both the appropriateness of the technology and used detailed measurements to understand the carbon value of this technology. I have

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<sup>33</sup> Using an exchange rate of 13 pesos/US\$



witnessed firsthand the use and acceptance of digesters in Chiapas. In my view, it is ready for widespread installation and use should the appropriate financial and maintenance mechanisms be put in place.

#### Carbon equivalent emissions reduced by biodigesters

A bio-digester is able to convert methane that would normally escape into the atmosphere into usable fuel. Because of that, the methane emissions it eliminates are highly valuable for the purpose of greenhouse gas emission reduction. Because methane has 21 times the global warming forcing potential of carbon dioxide and only a 7-20 year retention time in the atmosphere (compared to an average 100 year retention time for carbon dioxide), it is considered to be one of the highest priorities for making near-term gains in reducing the atmospheric concentration of GHGs. Anthropogenic methane emissions represent 15% of the total annual anthropogenic GHG emissions on a CO<sub>2</sub> equivalence basis (EPA 2008, UNFCCC 2008). In addition, the use of methane as a fuel reduces the CO<sub>2</sub> emissions from fossil fuel and fuel wood use in the home. Combined, it is estimated that a 3 m<sup>3</sup> system abates 6.5 tons of Carbon Equivalent (tCO<sub>2</sub>e) annually (Eaton, 2009).

Because of this dramatic difference in carbon abated, bio-digesters have the ability to take advantage of carbon markets both today and in the future. However, it must be noted that because of the high value of carbon abated by biodigesters, in comparison to other small renewable energy technologies, the high value for the carbon credits is somewhat unique to bio-digester projects.

## Cook stoves

In addition to offering biodigester technology to farmers through EduPaz, IRRI also offers a Patsari cook stove (Figure 3) through their partnership with the *Grupo Interdisciplinario de Tecnología Rural Apropriada* (GIRA, 2009), a rural cook stove provider in Mexico. IRRI will be using GIRA to supply the cook stoves, but IRRI will install and maintain them.

About 95% of rural Mexican households cook with wood on open fires. Although this is bad for their health and uses unsustainable wood resources, the majority cannot afford to change to cleaner liquefied petroleum gas (LPG), even though the government encourages the population to use it. This problem is especially pervasive among poor indigenous people in the Central Mexican Highlands, where thousands of small businesses run by women sell hand-made tortillas cooked over open wood fires for many hours each day (GIRA, 2009).

GIRA (2009) started a stove program to improve the health and security of rural households, bring new opportunities for small businesses, and improve the supply of fuelwood. The Patsari stove, developed through a participatory approach involving stove-users, is an improvement on the 'Lorena'<sup>34</sup> design with a more efficient combustion chamber and made of more durable materials, including a prefabricated metal chimney

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<sup>34</sup> [http://www.appropedia.org/Rocket\\_Lorena\\_Stove](http://www.appropedia.org/Rocket_Lorena_Stove)



Figure 3. Patsari cook stove<sup>35</sup>

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<sup>35</sup> [http://www.bioenergylists.org/files/images/Patsari%20%28Ladrillo%29\\_0.jpg](http://www.bioenergylists.org/files/images/Patsari%20%28Ladrillo%29_0.jpg)

and hotplates. GIRA has shown that respiratory disease decreases by 30% and eye infections by 50% in women who use the Patsari stove rather than an open fire. This is mainly due to a 70% reduction in indoor air pollution. Fuelwood consumption is also cut by 50% (GIRA, 2009). These cook stoves, in combination with biodigester technology, can help reduce fuelwood use by up to 75% and improve indoor air quality substantially in rural homes (Eaton, 2009).

#### Carbon equivalent emissions reduced by cook stoves

Eaton (2009) estimates a rural Mexican household that utilizes fuelwood for a significant amount of their energy produces an average of about five tCO<sub>2</sub>e per year from the combustion of the wood. Using that data and the 50% reduction rate for wood that the Patsari cook stoves average (after the 50% reduction via the biodigester), Eaton (2009) estimates an additional 1.25 tCO<sub>2</sub>e can be avoided via the Patsari cook stove when used with the biodigester. This extra amount from the stove use brings the total tCO<sub>2</sub>e abated using both technologies to  $\approx 7.75$  tCO<sub>2</sub>e per combined system.

#### Social capital and its role in a new program

Social capital and its system of trust and reciprocity can hold a key role in the dissemination and adoption of the technologies discussed in Chiapas. The main benefits to strong social capital are the identification of potential loan and technology recipients, the adoption rate of a new product or service, and targeting of communities for the new technologies and loans.

With microfinance, as with any loan product, there are inherent risks of default and non-payment. Historically, small loans to the poor (including all MFIs) have about a 98% repayment rate (Yunus, 2007). Yet, it still makes sense for local MFIs to choose who they lend to wisely as individuals may have more information about each other than institutions do (Karlan, 2002). In addition, because of the size of the loans and collection difficulty, the local relationships of trust and group lending that have been built are valuable in the microfinance process (Karlan, 2002).

Social capital can reduce risk and enhance repayment rates for EduPaz (Karlan, 2002). In addition, the MFI and its borrowers can increase success through trust networks and lower transaction costs (Putnam, 1993). It is also important to value the trust a local group can bring when implementing a new program that enhances the collective good with respect to environmental health (Pretty and Smith, 2004). Finally, social capital has value when adding a new environmental program over existing MFI infrastructure. In fact, Pretty and Smith (2004) go on to say that these regional relationships can enhance economies of scale and make it easier for outside groups to develop links with poor or excluded groups.

Since improved cook stoves and biodigesters are not widely used in Chiapas, a local group introducing them along with a finance option can enhance the likelihood they will be adopted. As I discussed previously, because of the historical presence of outside influence and the exploitation of farmers in Chiapas, a successful program for energy-lending should take advantage of existing social capital and current relationships in Chiapas.

Implementing a less-established technology by a locally-run group with a track record has its advantages over an outside group trying the same. The appropriateness of the technology and loan program in relation to local customs and norms should not be undervalued. A local group with enough social capital such as EduPaz can frame the payment structure (and its value) for the local population, so that it is more easily adopted (Pretty and Smith 2004). Implementing a newer technology and loan program is challenging alone. Trying to implement the program as an outsider would be exponentially challenging.

In addition, these communities targeted for the technology may be viewed as very similar to an outsider. In my discussions with EduPaz, they stressed the need to understand the current state of the Zapatista movement and which communities may be risky to approach with any foreign or government projects. EduPaz has an up to date knowledge of the social and political movements occurring in Chiapas and thus can point the project in the best direction (Appendix B). Because of its fractured political history, this area of the country can benefit from a locally-run, renewable energy finance project as it can at times be difficult for separate groups to agree on a process to benefit everyone environmentally and economically.

## Summary

Biodigesters and cook stoves have quantifiable benefits for health and the environment. In addition to reducing biomass use (mainly fuelwood for cooking) and GHG emissions, there is a cost benefit to users of the technology via avoided fuelwood

cost. While the technologies are not widely used in Chiapas yet, these combined benefits make both of these technologies an attractive option, especially when they are installed together in an affordable manner.

It cannot be stressed enough that the social capital established by EduPaz will be instrumental in the implementation phase of this project. The variables of technology and finance can be overwhelming for poor farmers and there are times when trust can speed the implementation process by eliminating variables. It is evident the value of social capital in the areas of borrower identification/screening, introduction of a new idea, and community targeting will benefit from the strong trust relationships EduPaz has established over 12 plus years of service in Chiapas.

## EDUPAZ ENERGY FINANCE PROGRAM

In the previous sections, I detailed the background of the components for my proposed energy finance program. In the following section, I describe the proposed EduPaz Energy Finance Program that I designed using the previously discussed background information and field research in Nicaragua and Mexico.

### Overview

While designing the EduPaz Energy Finance Program involving biodigester and cook stoves for Edupaz, I set out to provide a program that will make the technology more affordable to low-income farmers in Chiapas. I wanted to make the various tools available today (micro-loans, subsidies, and carbon credits) that are sometimes available for larger MFI programs, available to EduPaz. In addition, I want to accomplish three goals with my thesis project. The first goal is to create a financial model that shows community stakeholders are willing to participate financially in the project, yet allow the program to receive outside subsidy funding if necessary. The program will be locally supported and run by stakeholders, paid for via microloans, and able to receive outside subsidy funding. The second goal is the development of a financially sustainable collection, maintenance, monitoring, and education process using revenues from voluntary carbon credits (VERs) that is created and managed through the Chiapas-based organizations. The third goal is to identify characteristics of the program that can possibly be replicated in other communities to accomplish similar goals.



I have set up the EduPaz Energy Finance Program design as a step-by-step process for EduPaz to implement with IRRI as its partner. In addition, where applicable, I have provided more than one option that EduPaz can implement at its discretion. The step-by-step approach has supporting information within each step in the process. Where there is a great deal of detailed supporting information, I have provided documentation via appendices or web links. In addition to an overview of the process, I have provided my analysis and a discussion of my recommendations. An overview schematic of the flows of money, equipment, and services can be seen in Figure 4.

The basic premise of the schematic in Figure 4 shows the flow of money, equipment, services, and obligations from one organization to another with EduPaz as the hub where all the flows eventually enter and leave.

Starting with Micro-energy Credits (MEC) at the top and moving clockwise, the following is a brief overview of the flows of cash, equipment, rights, and services:

- Between MEC and Edupaz, there is a flow of the rights of carbon credits from the household via EduPaz to MEC and payment for those credits flows back to EduPaz.
- The subsidy source (if necessary) has a one way flow of money to make up any deficiency in cash for the program as determined by EduPaz.
- Kiva sends money to Edupaz to pay for equipment and installation services, while EduPaz remits loan repayment funds back to Kiva as the loans are collected.
- The individual households pay EduPaz (through IRRI) monthly for the loans it received to obtain the technology and the households also transfer any rights to the carbon credit rights to EduPaz. In addition, the households receive equipment (paid for by the loans) as well as a collection, maintenance, monitoring, and education program from IRRI paid for by carbon credit revenue.

- IRRI receives money for the equipment and installation services from EduPaz as well as carbon revenues to pay for the collection, maintenance, monitoring and education program it provides. It delivers and installs equipment to the households and provides the service program mentioned. It passes loan repayments and carbon credit rights on to EduPaz.
- Finally, Edupaz receives carbon credit revenues from MEC, subsidy dollars (if necessary) from the subsidy source, equipment dollars from Kiva, carbon credit rights from the households and loan repayments from the households via IRRI. It provides carbon credit rights to MEC from the households via IRRI, repays the household loans collected by IRRI to Kiva and pays IRRI for the equipment and the collection, maintenance, monitoring, and education service IRRI provides to the households.

The following section gives a step by step implementation process for the Edupaz Energy Finance Program and more clearly details the various flows of money, equipment, services, and obligations from one organization to another. In addition, the step by step process gives rationale for the recommendations and specific financial analysis for those recommendations.

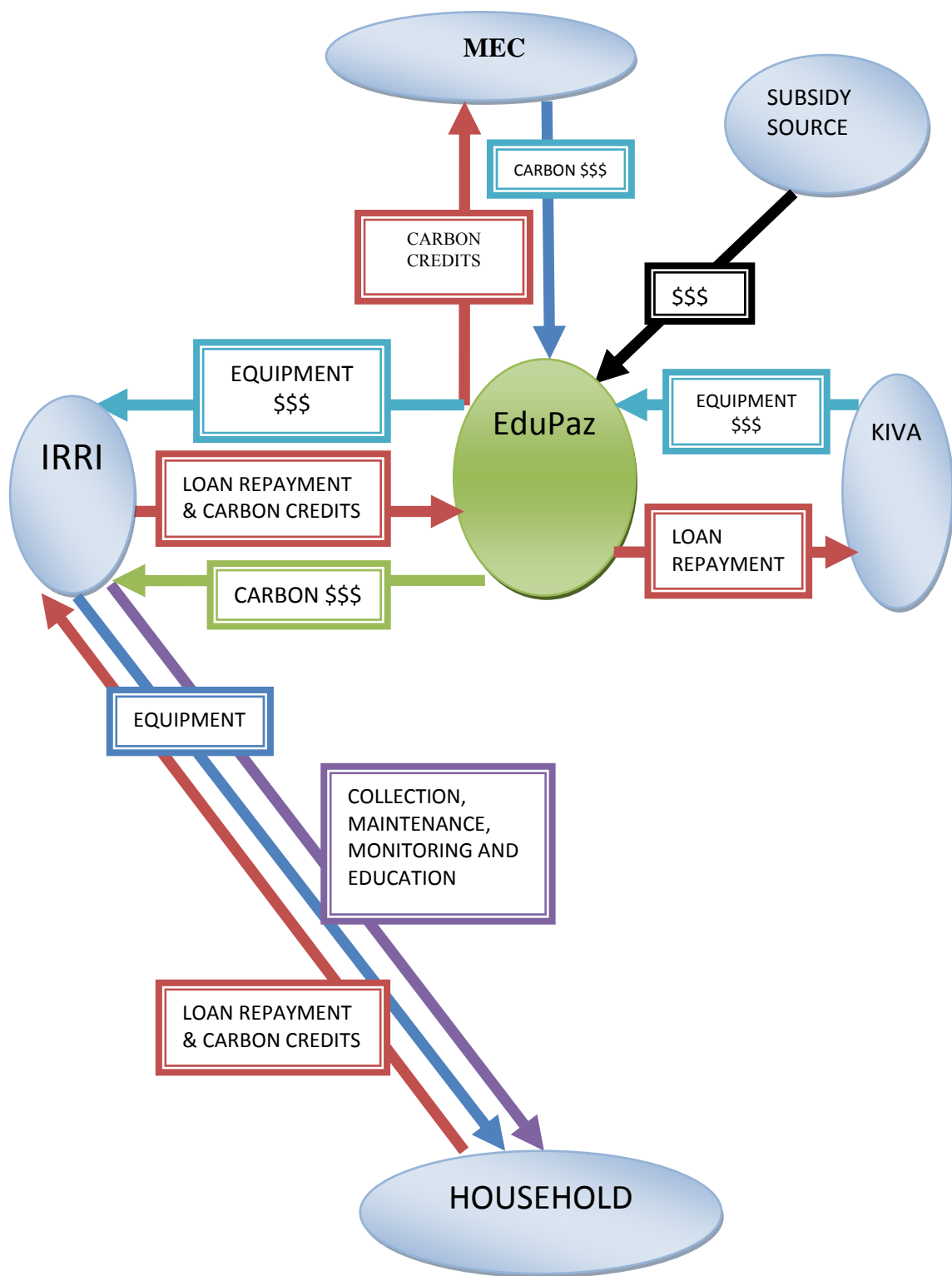


Figure 4. Schematic diagram of the EduPaz Energy Finance Program

## Step by Step Implementation

The following is a step by step process that EduPaz can follow to implement its EduPaz Energy Finance Program for bio-digesters and cook stoves.

Step 1. Obtain formal outside audit of financial statements and prepare program for transparency

Most financial institutions inside and outside of Mexico have a formal audit of their financial statements either quarterly or annually. MFIs are no different (MIX Market, 2009). In discussions with Kiva,<sup>36</sup> the only two concerns they expressed regarding EduPaz were its small size and the lack of a formal financial audit. Most other MFI funding groups (Unitus and Katalysis Bootstrap Fund) require a formal audit from the MFIs they fund.<sup>37</sup> In addition, there is information and structure to be gleaned from the aforementioned MIX Market (MIX). Thus, to assure funding, all financial documents for EduPaz must be audited by an independent organization based on the parameters used in reporting to MIX. As an example, Kiva suggested a Nicaraguan-based MFI, CEPRODEL.<sup>38</sup> Per Javier Inda (Appendix B), a formal audit for EduPaz costs approximately 15,000 pesos (US\$1,154).<sup>39</sup>

In addition, all on-going financial and technical information (e.g. payment receipts and bio-digester specifications and performance information) should be made

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<sup>36</sup> Interview with Giovanna Masci, Microfinance Partnerships Manager for the Americas for KIVA, September, 2009

<sup>37</sup> Interview with Stuart Krengel Relationship Manager of Katalysis on July 24<sup>th</sup>, 2009 and Catherine Shaw of Unitus on July 16<sup>th</sup>, 2009

<sup>38</sup> CEPRODEL'S audit for 2008 can be found here  
[http://www.mixmarket.org/sites/default/files/medialibrary/20501.1065/INFORME\\_DE\\_AUDITORIA\\_EXTERNA\\_2008\\_\\_2007.pdf](http://www.mixmarket.org/sites/default/files/medialibrary/20501.1065/INFORME_DE_AUDITORIA_EXTERNA_2008__2007.pdf)

<sup>39</sup> Using an exchange rate of 13 pesos/US\$.

available to the stakeholders at pre-determined times and places. The best option would be to make them available to anyone during normal office hours at the EduPaz office in Comitán, Chiapas. This availability of information is instrumental in maintaining the goodwill and social capital that EduPaz has built with its current loan recipients. While there may be very few recipients that take advantage of this transparency, the ability to see inside the organization will enhance the comfort level of loan and equipment recipients that interact with EduPaz.

By enhancing its institutional professionalism, EduPaz will be viewed the same as other MFIs when EduPaz applies for funding. EduPaz will be utilizing standards set up on a worldwide basis, yet maintain its autonomy in internal functions. Regular audits and transparency will increase EduPaz's credibility at a relatively minimal expense to them, thus giving them more funding options going forward.

## Step 2. Determine structure of loan offerings

In order to properly put a finance program in place, EduPaz must decide between a few variables in relation to its loan offerings. First, they must determine if they wish to offer group loans or individual loans for the bio-digesters and cook stoves. Next, they must determine if they wish to have a separate loan product, specifically for bio-digesters and cook stoves.

Individual loans versus group guarantee: It is my recommendation that EduPaz structure their program in groups of at least ten households individually and have their loan agreements set up as such. There are two reasons for this. First, EduPaz currently

administers its loans in groups, so there will be no major change culturally and administratively. In addition, Kiva now has a group loan product in their portfolio and, as an option, EduPaz can structure individual loans through Kiva but treat them as a group loan in Chiapas. They can aggregate the payments to Kiva to reduce transaction costs. Kiva will treat them as individual loans, but EduPaz can treat them as a group loan and thus their internal practices regarding collection will be streamlined and within current practices. This approach can provide a more seamless transition and reduce transaction costs by adding the energy services model to existing administration and leveraging current capabilities and practices.

Discussion of energy services lending model: I have discussed several models for energy finance in the “Energy Lending Models in Latin America” section. Microfinance was originally created as a way to end poverty by stimulating entrepreneurship. The proposed program presented here may have the indirect effect of stimulating entrepreneurs, however its core purpose is to increase the affordability of small renewable energy systems to people in impoverished communities. Consequently, this particular program will be used exclusively to finance the installation of selected clean energy systems, namely bio-digesters and cook stoves. The loans, administration, and associated programs will all be based on the goal of improving affordability to home users of bio-digesters and (at times) improved cook stoves.

Microfinance in Latin American Countries (LAC) has generally targeted existing micro-enterprises. As a result, Latin American MFIs tend to serve middle-income populations rather than poor households, which have the greatest need for modern energy

services (Allderdice et al. 2007). This lack of affordable energy services leaves a large population of the world without service.

As I have discussed in the section on Microfinance, there is debate whether microfinance actually helps the poor. In addition, in the section on Energy Lending Models in Latin America, I discussed the potential benefits of coupling financial components (microfinance, carbon credits, and subsidies) to rapidly deploy technology in a for-profit model like Tecnosol as well as non-profits in Nicaragua. Javier Inda, one of the founders of EduPaz, said the organization wishes to focus lending away from consumables (Appendix B). An energy-lending model that focuses only on bio-digesters and cook stoves addresses all three issues. This model will not replace or necessarily compete with current MFIs in the area (including efforts currently underway by EduPaz). Instead, the program will be a focused, infrastructure project that narrows down choices and options for users, but ensures the fairness of the program through the oversight of non-profit EduPaz.

In my section, “Does microfinance reach and benefit the poor?”, I discuss whether microfinance alone can be relied upon to benefit the poorest of the poor. I show how the poorest of the poor may in fact benefit from programs in addition to microfinance, yet microfinance alone may not solve their poverty. While the potential borrowers in this program may not be the poorest of the poor, many of the people who may benefit are nonetheless very poor. In addition, most MFIs tend to focus on entrepreneurship but not everyone is an entrepreneur. This EduPaz model actually uses microfinance principles for lending, but does not focus on entrepreneurship. Thus, this model speaks to improving

health and environmental education (shown later in Step 5 of this section) as an additional (albeit secondary) benefit to clean energy lending and there is still potential and capability for entrepreneurship through the original EduPaz program. These benefits are more likely tangible because the population has income through subsistence farming and pig ownership and thus are not the poorest of the poor.

Tecnosol has successfully shown how to rapidly scale household Photovoltaic (PV) in Latin America by using a bundling technique that offers consumers little choice and is in a sense crafted before it is deployed, yet speaks to host country conditions (micro-loans use, carbon credit value, and government subsidies). Tecnosol utilizes its ability to buy in bulk and carry the cost of the equipment on their balance sheet, bundles subsidies and carbon credits, and delivers a single payment option to the user. The process reduces transaction costs by limiting the number of times Tecnosol must interact with the consumer. The EduPaz model, while non-profit, does something similar yet goes a step further. It takes all the services available, bundles them for a small community to take advantage of, yet separates the carbon credits to pay for a collection, maintenance, monitoring and education program that I discuss in detail in the section “Step 5. Selling of carbon credits and their use.”

Finally, this model solves one of the larger issues EduPaz faces. Javier Inda indicated that an equipment-based loan product solves a very distinct problem that is their number one concern: financing something that is consumable and will not be there long (Appendix B). The proposed program finances infrastructure equipment that avoids other costs (fuelwood use), without supplying the borrower money for consumer goods.



Step 3. Determine whether to use a revolving fund from subsidy money or to use loan money from Kiva

It is my recommendation that EduPaz structure its program using Kiva or another inter-net MFI funding source for its loans instead of creating its own loan fund using all subsidy funding. There are three main reasons for this approach. The first reason is access to capital. While it may seem like a duplicate process to seek both loan capital and subsidy capital, once EduPaz has signed up for Kiva and met its loan parameters, loans can be executed fairly easily and predictably as the loans parameters have been approved in advance. As of November 10, 2009, Kiva's average time to fill a loan was 55 hours from when the loan was submitted from the MFI (Kiva, 2009). Thus, the overall program would not have to worry about funding as an obstacle as long as the borrower meets the criteria of the MFI. Showing a potential subsidy funding organization that more systems can be installed via Kiva loans (as opposed to only through the subsidy) would make that subsidy more attractive. The leverage capability allows for more households to be integrated into the program at a similar subsidy amount as more funds will be available near the beginning of the project. The grant funding will only be used to subsidize loans immediately as opposed to being using used partially as loans.

The second reason for using a Kiva-like approach is predictability. Many revolving funds rely on repayment of loans to give out more loans. While revolving loans add a community payback/pressure dimension, having to wait for some loans to be paid back to re-loan that money is a constraint that can be avoided by using Kiva, because each loan has a separate lender and each new borrower is not dependent on existing loans being

paid to receive their loan. In addition, a revolving fund can potentially run out (as outflow payments for equipment, administration, and interest costs). Kiva loans are interest free to EduPaz. While the Kiva loan requires a formal request to receive money, it can be done quickly and predictably once the parameters are set up with Kiva.<sup>40</sup> Thus, the limited constraints using the Kiva approach makes Kiva loans easier and more predictable for EduPaz than a revolving fund model.

Step 4. Show stakeholder willingness to participate financially in the project by establishing payment structure

Developing and confirming the acceptance of individual bio-digester and cook stove technology by users is an important proposition. However, to assure that the stakeholders are willing to participate financially in project they must pay something for it. Later, in the section “How this model meets program goals,” I will discuss more deeply the importance of stakeholder willingness to participate financially in these projects. The monthly amount that families are willing to pay must be determined by EduPaz, yet I have developed a pricing structure as a reasonable estimate. It is assumed here that EduPaz will create value for the farmers to install and use this technology and determine pricing for each community. However, it must be compared with a monthly reasonable estimate of a family’s willingness to pay.

Once that payment amount is determined, it is recommended that EduPaz have at least 10 families agreeable to installing home bio-digesters and possibly cook stoves

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<sup>40</sup> Interview with Giovanni Masci, Microfinance Partnerships Manager for the Americas, for Kiva in September, 2009

before the project commences. The reasons for this are to achieve some cost savings with installation of the units, give EduPaz the opportunity to present the loans as a group loan if necessary, and have a project of reasonable size if subsidy is necessary. I have used US\$ as the currency, consistent with EduPaz's financial reporting requirements. Finally, though I suggest bundling at least 10 homes together to start the project, my analysis assumes at least 100 homes overall.

For discussion in this section, I have made the following assumptions:

- Total costs for 3m<sup>3</sup> installed biodigester are \$700.<sup>41</sup>
- For present value calculations, I have used a 3.6% discount rate.<sup>42</sup>
- Cost for a cook stove is \$100.<sup>43</sup>
- Interest costs paid upfront are \$149.<sup>44</sup>
- Cost for one m<sup>3</sup> of fuelwood is \$46.15.<sup>45</sup>
- A typical family in Chiapas uses 10 m<sup>3</sup> of fuelwood in a year (Appendix C).
- A biodigester reduces fuelwood use by 50% (Eaton 2009).
- A Patsari cook stove reduces remaining fuelwood use an additional 50% (Eaton 2009).
- Household fuelwood is used evenly throughout the year (Appendix C).
- The 1<sup>st</sup> phase of the project is 100 homes within two hours drive of each other.<sup>46</sup>
- The annual interest rate on loans is 25%.<sup>47</sup>
- The exchange rate is 13 pesos per dollar.

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<sup>41</sup> Current pricing received from Alex Eaton November 3, 2009

<sup>42</sup> 3.6% is Mexico's inflation rate for 2009 <https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html>

<sup>43</sup> Current pricing received from Alex Eaton November 3, 2009

<sup>44</sup> Using 25% interest on a monthly basis for 2 years, but paid up-front. The fee was arrived at by using an effective rate of 25% annually and compounded monthly. The monthly interest expense was then present valued at the 3.6% rate of inflation for 24 months.

<sup>45</sup> Pricing information received as 600 pesos per tarea (m<sup>3</sup>) from Adriana Alcazar of FORO in August, 2009. Exchange rate of 13 pesos/US\$. These numbers are based on farmers buying and not collecting fuelwood.

<sup>46</sup> Assumption made through discussions with Alex Eaton of IRRRI

<sup>47</sup> Rate used by FORO is 20% annually and is 2% monthly by EduPaz. Both groups agree 25% is manageable for this program.

Identifying the willingness of consumer to pay monthly costs by identifying avoided fuelwood costs: As part of my analysis, I have first established the avoided cost of fuelwood by using the digester and cook stove. In Table 1, I show estimates for avoided fuelwood costs (using above assumptions) based on using the digester alone. In Table 2, I provide avoided fuelwood cost estimates for using both a digester and a cook stove combined. In Table 1 I exhibit an average family will save \$19.23 (250 pesos) per month by fuelwood cost avoidance with an installed 3m<sup>3</sup> digester. In Table 2 I show an average family will save \$28.85 (375 pesos) per month by fuelwood cost avoidance with both the digester and the cook stove. The cost avoidance amount will be important in determining what a household is willing to pay. It is assumed if this avoided fuelwood cost is shown to be valid and the families can save this amount monthly by using the biodigester and cook stove, then they would be willing to pay that amount of avoided costs monthly to install a clean energy system. This willingness to pay the same amount assumes the cooking quality is the same for the biodigesters as fuelwood.

Interviews of FORO's leaders indicate, that 280-300 pesos monthly (US\$21.53-US\$23.08) was a reasonable monthly price point for biodigester and/or cook stove technology, especially if there was an offset in costs by way of direct financial benefit (i.e., fuelwood cost reduction) to at least partially offset the monthly payments each family will make (Appendix C). FORO and EduPaz work with similar socio-economic classes, mainly poor farmers without electricity and running water (Appendix B and C). These sources support the use of a monthly payment of \$19.23 for the biodigester alone and \$28.85 for the biodigester and cook stove, as the willingness to pay per family. I have

used these monthly avoided costs in my calculations to establish installed equipment costs, interest costs, term, unsubsidized monthly payments, target monthly payments, and monthly subsidy in the next section.

Table 1. Fuelwood and avoided costs for biodigester only (Appendix C)

	Pesos	US\$
Cost for one m <sup>3</sup> of fuelwood	\$ 600.00	\$ 46.15
Number of m <sup>3</sup> of fuelwood used per year by an average family for cooking	10	10
Cooking fuelwood costs per year by an average family	\$ 6,000.00	\$ 461.54
Number of m <sup>3</sup> of firewood used per yr (based on savings of using a biodigester)	5	5
Annual cooking fuelwood costs when using a biodigester	\$ 3,000.00	\$ 230.75
Annual avoided fuelwood costs from using a biodigester	\$ 3,000.00	\$ 230.79
<b>Monthly avoided fuelwood costs from using a biodigester</b>	<b>\$ 250.00</b>	<b>\$ 19.23</b>

Table 2. Fuelwood and avoided costs for biodigester and cook stove (Appendix C)

	Pesos	US\$
Cost for one m <sup>3</sup> of fuelwood	\$ 600.00	\$ 46.15
Number of m <sup>3</sup> of fuelwood used per year by an average family for cooking	10	10
Cooking fuelwood costs per year by an average family	\$ 6,000.00	\$ 461.54
Number of m <sup>3</sup> of fuelwood used per yr (using a biodigester and cook stove)	2.5	2.5
Annual cooking fuelwood costs when using a biodigester and cook stove	\$ 1,500.00	\$ 115.38
Annual avoided fuelwood costs from using a biodigester and cook stove	\$ 4,500.00	\$ 346.16
<b>Monthly avoided fuelwood costs from using a biodigester and cook stove</b>	<b>\$ 375.00</b>	<b>\$ 28.85</b>

Establishing installed equipment costs, interest costs, term, unsubsidized monthly payments, target monthly payments, and monthly subsidy: Table 3 details the total installed equipment costs (established in the section “Small-scale biodigesters and cook stoves in Chiapas, Mexico”), interest costs, unsubsidized monthly payments, target monthly payments, and monthly subsidy for a stand-alone digester for 24 months. Table 4 shows the total installed equipment costs (also established in the section, Small-scale biodigesters and cook stoves in Chiapas, Mexico), interest costs, unsubsidized monthly payments, target monthly payments, and monthly subsidy for a stand-alone digester and cook stove for 24 months. One option is to finance only the bio-digester using its fuelwood savings and the other option is to add an improved cook stove and combine the savings. Most assumptions stay the same between the two options, but the total system cost and monthly avoided cost change.

Tables 3 and 4 first establish a monthly cost for a digester over 24 monthly payments with no subsidies. Mr. Eaton of IRRI indicated that at least 16 months seems to be the minimum time for technology to become entrenched in a household in Chiapas. Over 24 months with no subsidies, a biodigester would cost \$35.38 per month (Table 3) and a combination of biodigesters and cook stoves would cost \$39.54 per month (Table 4). I then subtract avoided monthly costs from Tables 1 and 2 for each scenario to arrive at the amount of monthly payment that needs to be subsidized for each scenario. For 24 months, Table 3 shows that \$16.15 per month is needed for a subsidy for a biodigester only and Table 4 shows that \$10.69 per month is needed when a cook stove is added to the biodigester.

Table 3. Estimated microfinance and subsidy calculations for EduPaz biodigester only

	Pesos	US\$
<b>Initial costs for biodigester</b>		
Equipment cost biodigester	\$ 5,200.00	\$ 400.00
Installation costs	\$ 1,950.00	\$ 150.00
Site costs (improvement of ground or surrounding areas)	\$ 1,950.00	\$ 150.00
<b>Equipment total</b>	<b>\$ 9,100.00</b>	<b>\$ 700.00</b>
Interest cost paid upfront as fee	\$ 1,937.00	\$ 149.00
<b>Total equipment cost + interest fee</b>	<b>\$ 11,037.00</b>	<b>\$ 849.00</b>
Minimum number of months financed	24.00	24.00
Monthly payments for biodigester only with no subsidy	\$ 459.88	\$ 35.38
Target payments based on avoided fuel wood costs from biodigester only from Table 1	\$ 249.99	\$ 19.23
<b>Monthly cost subsidy for biodigester only</b>	<b>\$ 209.89</b>	<b>\$ 16.15</b>

Table 4. Estimated microfinance and subsidy calculations for EduPaz biodigester and cook stove

	Pesos	US\$
<b>Initial costs for biodigester and cook stove</b>		
Equipment cost biodigester	\$ 5,200.00	\$ 400.00
Cook stove cost	\$ 1,300.00	\$ 100.00
Installation costs	\$ 1,950.00	\$ 150.00
Site costs (improvement of ground or surrounding areas)	\$ 1,950.00	\$ 150.00
<b>Equipment total</b>	<b>\$ 10,400.00</b>	<b>\$ 800.00</b>
Interest cost paid upfront as fee	\$ 1,937.00	\$ 149.00
<b>Total equipment cost + interest fee</b>	<b>\$ 12,337.00</b>	<b>\$ 949.00</b>
Minimum number of months financed	24.00	24.00
Monthly payments for biodigester and cook stove with no subsidy	\$ 514.04	\$ 39.54
Target payments based on avoided fuel wood costs from biodigester and cook stove from Table 2	\$ 375.01	\$ 28.85
<b>Monthly cost subsidy for biodigester and cook stove</b>	<b>\$ 135.24</b>	<b>\$ 10.69</b>

In addition to my cost assumptions, I had to calculate interest rate for both scenarios. I used 25% in my example as FORO charges 20% and EduPaz charges around 2% compounded monthly.<sup>48</sup> Presently, FORO uses the approach of including the interest cost in the transaction as a fixed fee. Based on my discussions with community members in other Latin America countries and FORO (Appendix C), it is best to include a fixed fee for interest in the transaction. The main reason for this is that borrowers are very concerned about interest rates and this avoids the problem of haggling over rates and wanting to use another MFI outside of the program. It eliminates a competitive step in the process and makes the program more uniform. In addition, adding the cook stove should

<sup>48</sup> Both groups agree 25% is an acceptable rate for this program



have no effect on the interest fee as there is no extra transaction cost to EduPaz to administer. Normally, interest charges would be a motivating factor for early repayment. However, the benefits of a systematic approach and predictability far outweigh early repayment. Depending on Kiva's comfort level with this, an interest expense makes it easier to account for the money and EduPaz can take advantage of the cash to expand services. I have calculated 25% interest annually over two years (compounded monthly) but prepaid in this model using a 3.6% interest rate.<sup>49</sup>

The monthly payment for 24 months is determined by dividing the total system cost amount by 24 in each case since interest is paid up-front by way of a fee and Kiva charges no interest. The "target" payment amount is based on avoided fuelwood costs through the use of the biodigester and cook stove shown in Tables 1 and 2. Again, information from EduPaz and FORO said that 280-300 pesos (US\$21.53-US\$23.08) was a reasonable amount for the individuals they support with their program (Appendix B and C). However, the exact amount and term must be determined by EduPaz to reach the most people quickly. It is EduPaz's decision, but they expressed agreement with the avoided fuelwood cost scenario (Appendix B). EduPaz should set payments based on the user's ability to pay monthly, the overall long term value of the digester and cook stove applied by the user (including avoided costs), and any payback requirements by the MFI funding organization with respect the length of the loan. Payments and loan length should be uniform across communities within close geographic reach (Appendix B). Based on a

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<sup>49</sup> 3.6% is Mexico's inflation rate for 2009 <https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html>

24 month payment, a \$15.85 (206 pesos) and \$10.40 (135 pesos) monthly subsidy would be required with a biodigester and a biodigester and cook stove, respectively.

Now that I have established costs (equipment and interest) and monthly subsidy for both the biodigester and cook stove, I can examine how the number of payments made by the user of the systems can affect the calculation of subsidy amounts in the following section.

Duration of payments and calculation of subsidy amount: The subsidy amount is calculated by using simple subtraction and multiplication. The targeted payments based on fuelwood savings for both options (\$19.23 and \$28.85) are subtracted from the monthly payments that were calculated with no subsidies (\$35.38 and \$39.54) and multiplied by 24 to arrive at total subsidy per system for 24 months (\$2.88 and -\$2.95) as shown in Table 5. With the interest cost being paid up-front to Edupaz, 100% of the loan repayment will go to Kiva. This simplifies paperwork and transaction costs and gives EduPaz more cash flow to work with. In addition, it is much simpler for a subsidy partner and subsidy amount to be determined. The subsidy amount is simply the difference between the total upfront costs of all funds collected for the project minus the Kiva loan. The main reason for this is simplification. Building all of these costs into one payment is used very effectively in a for-profit model both in the United States and Nicaragua and can also be used as an effective tool in non-profit models to limit the choices and different payment schemes. This leaves most of the structural decisions in the hands of EduPaz, which enhance the local aspect of the program. While discussed in detail later in the section “Selling of carbon credits and their use,” it must be noted that since the

collection, maintenance, monitoring, and education piece will all be done by one person (per 100 households). Because the field technician will be interacting with the consumer and providing a service, payment collection should not be a problem even though EduPaz receives their interest fee up-front. Those additional tasks (maintenance, monitoring, and education) need to take place to keep the units in working order and receive the carbon credits that pay for the on-going program. Thus, the visits that will take place for monitoring, maintenance and education offer a natural interaction to receive payments.

While we have focused on a monthly payment amount as a threshold for the user, it is also important to establish the duration of the payments. Arguably, if there is a direct financial benefit (via fuelwood savings) on a monthly basis, it is easier to spread out the payments over time. In Table 5, I have provided a sensitivity analysis for both options (biodigester alone and biodigesters and cook stoves) keeping the established payment the same and then increasing the number of months to pay back the loan. In addition, I show the effect of payback time on any subsidy. It is evident that the longer the payback period, a smaller subsidy is needed as the payments remain the same. There are few (if any) additional on-going costs (see the section “Selling of carbon credits and their use”) to EduPaz, if they spread out the payments to a longer term, as they will be subcontracting the collection, monitoring, audit and maintenance tasks to IRRI. The IRRI representative will be visiting these sites in any case and those costs are being paid out of the fund for carbon credit sales to MEC. Thus (as discussed earlier in this section) EduPaz should balance the payback period based on the norms in the region and Kiva’s requirements for loan duration. On a standard 24 month term, 100 digesters and cook

stoves would need \$24,967.31 in subsidy, but when the term is extended to 32 months, the subsidy is near zero (Table 5). This is because the increase in number of payments increases the total revenue paid back and the cook stove adds a larger avoided fuelwood cost in comparison to cost of the cook stove unit. Table 5 also shows the relationship between the number of payments and the subsidy needed for 100 systems. Figure 5 shows the graphical relationship between number of loan payments and the amount of subsidy needed for 100 systems.

Administration costs: Edupaz currently pays someone half-time to administer their program at a cost of \$3000 (US\$230) pesos per month. A full-time person would cost \$6000 pesos (US\$460) per month and it is assumed the part-time person would move to full-time. Thus, the extra 3000 (US\$230) pesos per month would be incurred by EduPaz and paid out of the interest income from the program. For example, \$149 in interest income from 100 systems nets EduPaz \$14,900 in one-time present value dollars. At that incremental monthly administrative cost (US\$230) paid twice a month, the \$14,900 would last more than 5 ½ years assuming a 3.6% nominal interest rate. This simply suggests the interest fee can pay for increased administration costs for the program.

Table 5. Sensitivity analysis for number of loan payments vs. subsidy needed

<b>One biodigester</b>	<b>Amount financed</b>	<b>Target monthly payment</b>	<b>Number of payments</b>	<b>Monthly payment with no subsidy</b>	<b>Subsidy needed for one system</b>	<b>Subsidy needed for 100 systems</b>	<b>Number of additional months of payments for no subsidy</b>
	\$ 849.00	\$ 19.23	24	\$ 35.38	\$ 387.42	\$ 38,742.31	10.95
	\$ 849.00	\$ 19.23	32	\$ 26.53	\$ 233.56	\$ 23,356.41	8.80
	\$ 849.00	\$ 19.23	36	\$ 23.58	\$ 156.63	\$ 15,663.46	6.64
	\$ 849.00	\$ 19.23	44	\$ 19.30	\$ 2.88	\$ 288.00	0.15
<b>One biodigester with one cook stove</b>	<b>Amount financed</b>	<b>Target monthly Payment</b>	<b>Number of payments</b>	<b>Monthly payment with no Subsidy</b>	<b>Subsidy needed for one system</b>	<b>Subsidy needed for 100 systems</b>	<b>Number of additional months of payments for no subsidy</b>
	\$ 949.00	\$ 28.85	24	\$ 39.54	\$ 256.67	\$ 25,667.31	6.49
	\$ 949.00	\$ 28.85	27	\$ 35.15	\$ 170.13	\$ 17,013.22	4.84
	\$ 949.00	\$ 28.85	30	\$ 31.63	\$ 83.59	\$ 8,359.13	2.64
	\$ 949.00	\$ 28.85	32	\$ 29.66	\$ 25.90	\$ 2,589.74	0.87
	\$ 949.00	\$ 28.85	33	\$ 28.76	\$ (2.95)	\$ (294.95)	-0.10

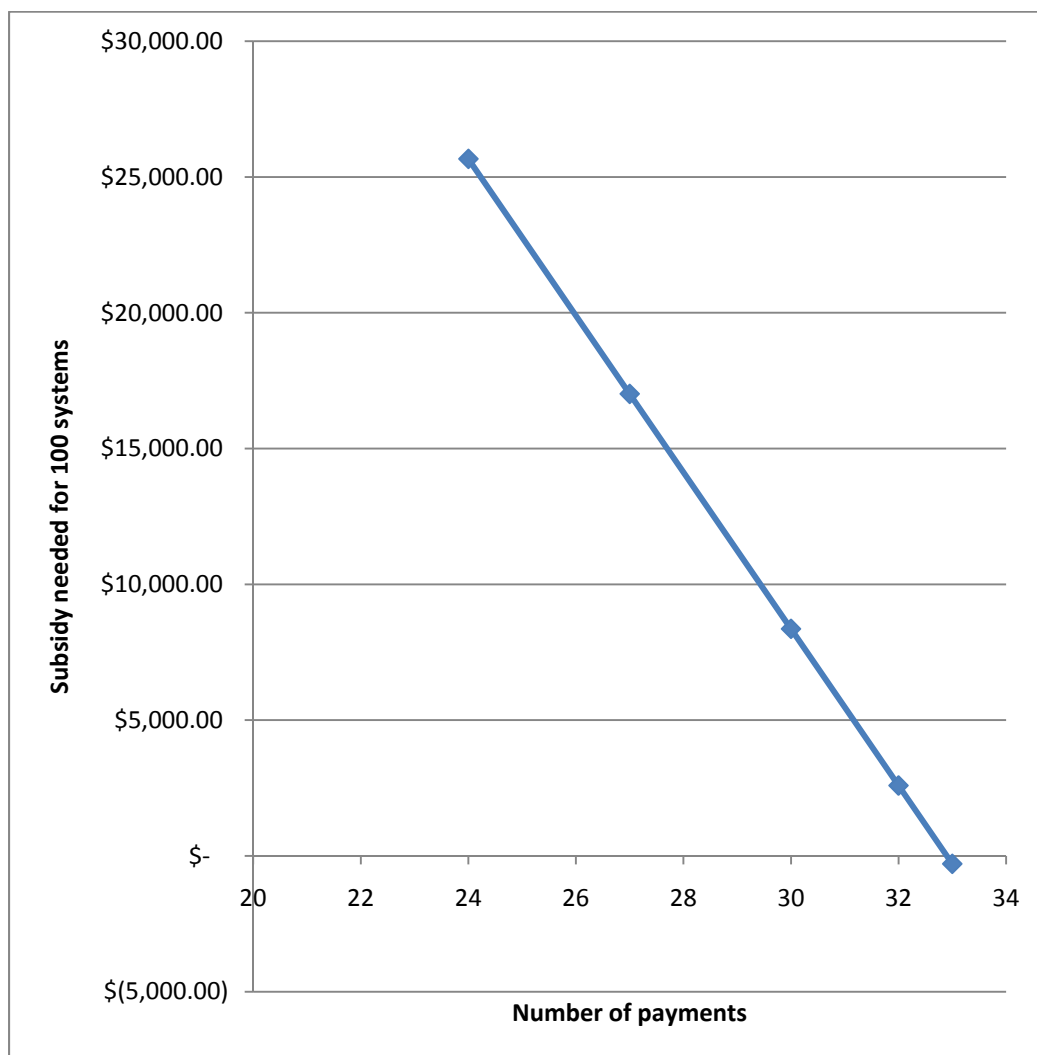


Figure 5. Sensitivity analysis for number of loan payments needed to reduce subsidy versus subsidy for 100 biodigesters and cook stoves

Savings account option: FORO currently overlays a savings account option as a component of its microloans to encourage villagers to start saving. It is a very popular program (Appendix C). Thus, EduPaz is encouraged to offer a savings account option along with the proposed model once it is implemented. The most obvious method would be to incorporate the savings option after the biodigester and/or cook stove system has been completely paid for, as there may be philosophical differences with subsidy funding groups. Specifically, the funding groups may have issues with subsidizing a project while the villagers are saving the extra money through an EduPaz fund. Thus, EduPaz could establish a monthly payment program, then have the payment (the associated cost offset due to fuelwood savings) continue as savings once the loan requirement is paid off. This approach has the benefit of utilizing current loan practices in the area, while satisfying the desire of FORO and EduPaz to create a savings program and encourage savings within the farming communities. In addition, the person collecting loans and maintaining the units etc., will still be visiting the community monthly.

In summary, the development of the payment structure is an important step. It takes advantage of internet-based loans, yet uses local conditions and fuelwood cost avoidance to arrive at the numbers provided. Most importantly, it utilizes the local knowledge EduPaz has about the local costs and concerns the participants may have about the technology and its financial, cultural, environmental, and health benefits to arrive at the monthly rate and duration of payments. In addition, it incorporates a savings option for the loan recipients, once the loan is paid off. Because of the savings in fuelwood costs by using the biodigester and cook stove together (and the low cost

increase in comparison to wood savings), it is my recommendation that EduPaz makes its best effort to include the cook stove option with the biodigester whenever it can. Going forward when discussing carbon revenue and its use, I will assume the two pieces of equipment will be installed together for the sake of comparison.

#### Step 5. Selling of carbon credits and their use

The selling of voluntary carbon credits (VERs) is an instrumental step in insuring the longevity of the technology within the community. The following section exhibits how to sell the VERs, examines revenue potential and provides a recommendation for their use within the community with respect to the biodigester and cook stove.

Recommendations: I recommend that EduPaz contract with MicroEnergy Credits (MEC) to conditionally sell the voluntary emission reduction credits (VERs) achieved by the installation and use of the bio-digester and cook stove. An overview of MEC is given in the section “Overview of MicroEnergy Credits (MEC) for Small Rural Communities.” Once the carbon credits are sold, the cash flow from the sale of the carbon credits will be placed in a separate fund to pay the costs associated with collection, monitoring, maintenance, and education with respect to the technology once it is installed. I present the possible revenue from carbon credit sales and the use of those revenues in this section.

Value of carbon revenue: For both revenue and uses of carbon sales, I assume a family will purchase both a biodigester and a cook stove. In Table 6, based on a cost of



\$6.80 per ton of avoided CO<sub>2</sub>e,<sup>50</sup> the carbon fund will provide approximately \$26,350 over five years with a present value of \$23,957 using a 3.6% discount rate.<sup>51</sup> That is using a conservative average of 7.75 tons of CO<sub>2</sub>e emissions avoided per combined biodigester and cook stove system annually (Eaton, 2009). EduPaz should plan revenue based on the actual value of the credits once they are sold to MEC. Any extra revenue should remain in the collection fund and should be used for pro-active hiring and training of field personnel.

Table 6. EduPaz carbon credit revenue and assumptions over 5 years

<b>Base assumptions</b>	
Initial contract period in months	60
Carbon credits per system/yr in tons (Eaton 2009)	7.75
Carbon credits for 100 systems/yr. in tons	775
Market value per ton of carbon credit per year	\$ 6.80
Total carbon credit value per system per year	\$ 52.70
Total gross carbon revenue for 100 systems annually	\$ 5,270.00
Gross carbon revenue over 5 years per system	\$ 264.00
Gross carbon revenue over 5 years for 100 systems	\$ 26,400.00
<b>Present value of carbon revenue for 5 yrs.</b>	<b>\$ 24,581.26</b>

<sup>50</sup> Based on email communication with Tamar Azous of MicroEnergy Credits on October 9<sup>th</sup>, 2009; they are currently paying MFIs \$6.80 per ton of CO<sub>2</sub>e.

<sup>51</sup> 3.6% is Mexico's inflation rate for 2009 <https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html>

Using sensitivity analysis for carbon pricing first, I have shown the revenue available annually based on tons sold and price per ton (see Table 7 and Figure 6). As carbon pricing is agreed upon at the beginning of the project, the pricing is fixed for the entire project time (normally 5 years). However, as the actual pricing of this particular project is not fixed until an agreement has been made, I have provided a range of pricing from \$4/tCO<sub>2</sub>e to \$10/tCO<sub>2</sub>e. By way of comparison, MEC is pricing their product at \$6.80/tCO<sub>2</sub>e as of November, 2009. In addition, I have assumed that a biodigester and cook stove will avoid 7.75t/CO<sub>2</sub>e per system per year (Eaton 2009). I have provided results for a range of values from 400 to 1000 tons of CO<sub>2</sub>e (per 100 systems) for comparison.

The value of the carbon credits has two main components: tons of CO<sub>2</sub>e avoided and price per ton of CO<sub>2</sub>e. Of those two components, the price of carbon is what will vary the most as it is based on market conditions. However, even though the price is not paid until the credits are sold, it is fixed once sold and thus should not fluctuate for the 5 years analyzed. The number of tons of CO<sub>2</sub>e has a chance to fluctuate, but mainly on account of variance in the size of installed systems. The use of energy in the rural Mexican home and the amount of pigs someone owns may be susceptible to changes (from selling or slaughtering of pigs), but not in a broad sense like the market value of a ton of CO<sub>2</sub>e. Thus the quantity of CO<sub>2</sub>e avoided will be relatively more stable than the price of CO<sub>2</sub>e per ton.

Table 7. Sensitivity analysis for annual revenue available from sale of carbon credits for 100 biodigester systems

Tons CO <sub>2</sub> e sold annually for 100 systems	Cost per ton CO <sub>2</sub> e						
	\$4	\$5	\$6	\$7	\$8	\$9	\$10
400	\$ 1,600	\$ 2,000	\$ 2,400	\$ 2,800	\$ 3,200	\$ 3,600	\$ 4,000
500	\$ 2,000	\$ 2,500	\$ 3,000	\$ 3,500	\$ 4,000	\$ 4,500	\$ 5,000
600	\$ 2,400	\$ 3,000	\$ 3,600	\$ 4,200	\$ 4,800	\$ 5,400	\$ 6,000
700	\$ 2,800	\$ 3,500	\$ 4,200	\$ 4,900	\$ 5,600	\$ 6,300	\$ 7,000
800	\$ 3,200	\$ 4,000	\$ 4,800	\$ 5,600	\$ 6,400	\$ 7,200	\$ 8,000
900	\$ 3,600	\$ 4,500	\$ 5,400	\$ 6,300	\$ 7,200	\$ 8,100	\$ 9,000
1000	\$ 4,000	\$ 5,000	\$ 6,000	\$ 7,000	\$ 8,000	\$ 9,000	\$ 10,000
<b>Assumed scenario</b>	\$ 6.80						
775	<b>\$ 5,270</b>						

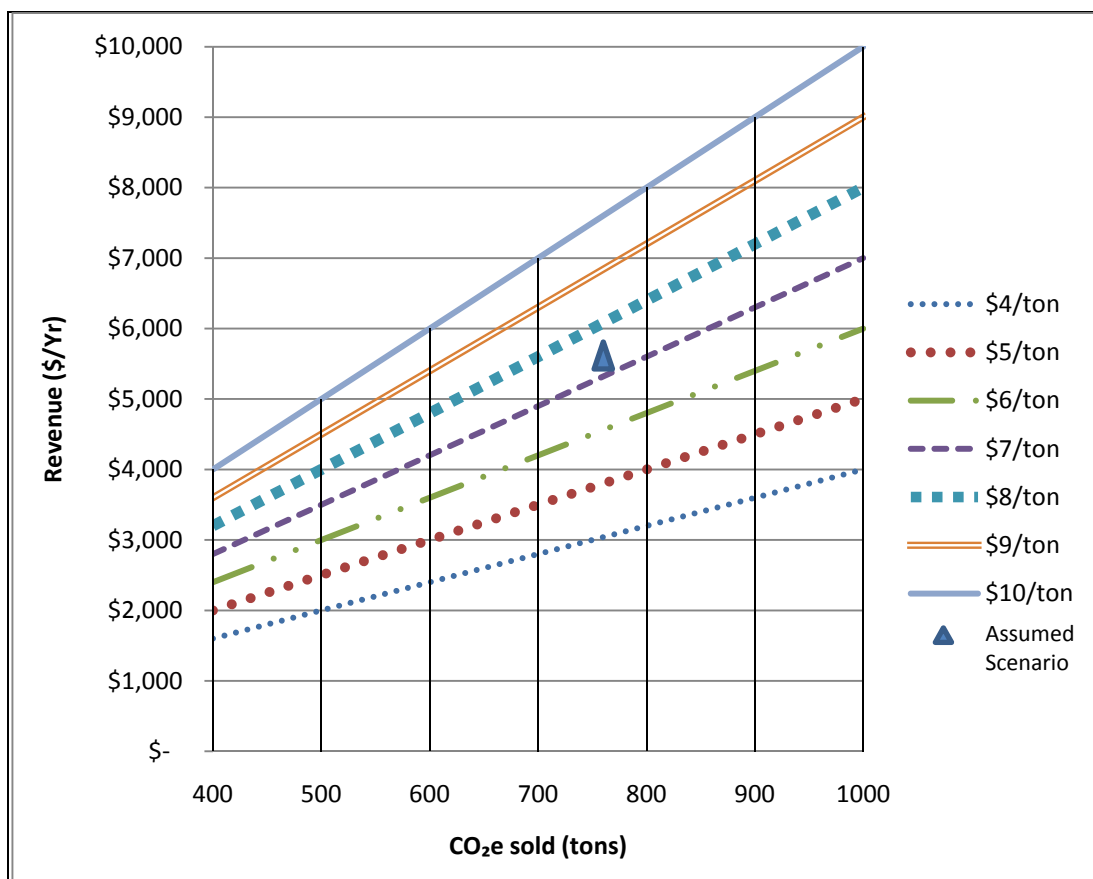


Figure 6. Revenue sensitivity to price and quantity sold of CO<sub>2</sub>e

Recommended use of carbon credit revenue: The misunderstanding of technology in its early stages can lead to a project's failure because of disrepair or faulty installation (Preston 2002, CEDECAP 2008). Specifically, Eaton (2009) writes that his improved design is meant to improve reliability, reduce installation time, and allow for more varied installation sites. While this reliability is important, more measures must be taken to assure long-term use.

Carbon credits can help advance small renewable energy projects by reducing their capital costs via either CERs through the CDM or VERs through voluntary markets. With my program, the high value of carbon credits with respect to bio-digesters and methane (in comparison to solar and other technologies) leads me to recommend another path. Instead of using carbon credits as a partial funding vehicle for bio-digesters and cook stoves in Chiapas, I recommend that the carbon credits (in this case VERs) be used to increase the long-term viability of the project through a separate program and incorporate the value of VERs for ongoing expenses over a five-year time-frame.

The separate program should be set up to establish value for the carbon credits and should use that money to pay for program operations (loan collection, on-going maintenance, verification of use, and user equipment and environmental education). The important piece of this model is for IRRI and EduPaz to structure an arrangement for a field representative from either IRRI or EduPaz to accomplish the task of collection, on-going maintenance, verification of use (monitoring), and equipment and environmental education. I explain those tasks more deeply in "Recommended tasks for carbon revenue" later in this section.

Through interviews with EduPaz, IRRI, and FORO, I have established the cost of one field representative to accomplish the ongoing tasks for the program on a per visit basis and show the costs in Table 8. As the field representative will be paid out of the revenue from carbon sales, it does not matter who that person works for as a paid employee, IRRI or EduPaz. However, an obvious segue would be to have one of IRRI's field installation people trained during installation of the units. That person would have knowledge of the units, the user, and the community and be able to quickly come up to speed on the most efficient methods necessary. If this is the case, a subcontracting arrangement would need to be put in place between IRRI and EduPaz for this service in addition to any sale and installation agreement for the units.

The next issue I address is setting an appropriate wage for the field representative in Chiapas. The per capita GDP for Mexico in 2008 was approximately US\$14,200 (Central Intelligence Agency, 2009) and for Chiapas the income is estimated to be the equivalent of US\$1,440 annually (US\$4.80 per day).<sup>52</sup> I have budgeted an annual salary of US\$2,160 (150% of the state average) and additional costs (travel, meals) of US\$1,500<sup>53</sup> annually for each position assuming that person handles the four tasks for about 100 systems based on the assumptions of an average of four system visits per day (Table 8). Both EduPaz and IRRI have given me feedback through Alex Eaton that the proposed wage is very fair. As demonstrated in Table 9 you can see that the assumed value of the carbon credits can more than pay for one position to accommodate this

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<sup>52</sup> [http://www.sipaz.org/data/chis\\_en\\_02.htm](http://www.sipaz.org/data/chis_en_02.htm)

<sup>53</sup> Based on interview with Alex Eaton, Director of IRRI and Javier Inda, founder of EduPaz in August 2009

Table 8. Use of carbon credit revenue (in US\$) and assumptions over five years

<b>Base assumptions</b>	
Number of systems in zone	100
Number of systems visited/day (avg)	4
Total system visits per year	1200
Visits per year per system	12
Field days per year	300
<b>Field representative pay and expenses</b>	
Field representative pay (US\$/day)	\$ 7.20
Field representative pay every two weeks	\$ 83.08
Field representative pay per year (US\$)	\$ 2,160.00
Field representative travel expenses every two weeks	\$ 57.69
Field representative travel expenses per year	\$ 1,500.00
<b>Total field representative expenses per year</b>	<b>\$ 3,660.00</b>
<b>Present value of field representative expenses for five years</b>	<b>\$ 16,736.95</b>
Field representative pay and expenses per system per year	\$ 36.60

Table 9. Comparison of EduPaz carbon revenue and field representative expenses over five years (in present value US\$)

Carbon revenue	\$ 24,581.26
Field representative expenses	\$ 16,736.95
<b>Net revenue</b>	<b>\$ 7,844.31</b>

program on a present value basis. In fact, using conservative estimates, there is even room to build up a small insurance fund for the bio-digester and cook stove equipment or personnel training.

One option is to use the carbon credit revenue to pay down the initial cost of implementing the biodigesters and cook stoves in Chiapas through EduPaz. However, the high value of the carbon credits for the biodigesters and cook stoves (in relation to other technologies) and the benefits of creating a financially sustainable on-going collection, maintenance, monitoring and education program presents another option. I recommend using the revenue generated through the sale of VERs to establish an on-going collection, maintenance, monitoring and education program. Using the carbon credit revenue for this program makes even more sense since there are subsidies available should the project need those subsidies for the equipment to be more affordable for the farmers. This on-going program has the potential to be instrumental in long-term biodigester and cook stove acceptance by the farmers.

Transaction cost comparison with like-sized Clean Development Mechanism (CDM) project: There are two relevant comparisons for transaction cost reduction. The first is to compare the proposed EduPaz carbon revenue model transaction costs with the costs of a similar-sized CDM project to provide the same services. The second is to compare the proposed EduPaz carbon revenue model with a different approach in which the tasks (collection, monitoring, maintenance and education) are separated into four visits as opposed to one person accomplishing all of them in one visit. It must be noted that CDM projects have several differences. First, there are greater up-front costs with the



CDM, but there is also a difference in the value of the carbon credits. CDM certified emission credits (CERs) are certified through a more rigorous methodology and thus have a higher value than voluntary credits (VERs) which are the type of credits I am using for the EduPaz carbon revenue model. There is currently a fairly large price difference between the two groups (currently \$4.32/tCO<sub>2</sub>e)<sup>54</sup> and I have priced the comparison as such.

Assumptions for comparison:

- 100 bio-digesters are assumed to be installed.
- Five years of carbon credits are used.
- All tasks (maintenance, monitoring, collection, education) would be done individually and cost approximately the same per visit.
- CDM transactions costs are based on the same amount of CO<sub>2</sub>e and a normalized program.
- CDM registration costs are the low-end average of \$60,000 per project (UNDP, 2006)
- CDM transaction costs are based on low-end calculations (UNDP, 2006).
- CDM CERs are based on \$11.22 per ton CO<sub>2</sub>e.<sup>55</sup>
- MEC VERs are based on \$6.80 per ton CO<sub>2</sub>e.<sup>56</sup>
- CDM cost estimates are the smallest possible.
- For present value calculations, I have used 3.6% discount rate.<sup>57</sup>

In Table 10, I exhibit the revenue and expenses for a CDM project of similar size to the proposed EduPaz carbon revenue model. In Table 11, I show the revenue and expenses of the proposed EduPaz carbon revenue model. In Table 12, I show the financial difference between the two models. In comparison with a like-sized CDM project, there is a dramatic cost benefit advantage to the EduPaz carbon revenue model

<sup>54</sup> Arrived at by subtracting the CER price (\$11.12) from the VER price (\$6.80)

<sup>55</sup> CER prices fluctuate, the pricing is based on data as of February 20, 2010 <http://www.ecx.eu/CERemindx>

<sup>56</sup> Interview with Tamar Azous, Client Relationship Manager of MEC in November of 2009

<sup>57</sup> 3.6% is Mexico's inflation rate for 2009 <https://www.cia.gov/library/publications/the-world-factbook/geos/mx.html>

over 5 years. With the same 7.75 tons of CO<sub>2</sub>e abated per household digester and cook stove per year as in the EduPaz carbon revenue model example, the CDM project loses \$84,129. I included the same cost for maintenance, collection, and education, in the CDM model as the proposed EduPaz carbon revenue model, even though there would be no collection in the CDM model and audit costs are already included. Maintenance and education would still be needed so I included the cost of a visit for an equal comparison.

Currently, there are higher prices for CDM carbon credits (CERs), as they are certified. However, the transaction costs (mainly up-front) are fairly large, dictating that larger projects must be normally initiated. The EduPaz carbon revenue model is immediately financially sustainable at a 100 system scale because of annual carbon sales and no up-front costs. None of these cost comparisons include equipment costs as they are separate.

Performing these tasks of collection, maintenance, monitoring and education together must also be compared with performing the tasks independently. Instead of independently performing these tasks, the EduPaz/IRRI field representative will be accomplishing all four at the time and expense of one visit, thus avoiding duplicate transaction costs (assuming it would take four people to accomplish these tasks individually). There are no competing interests here and the requirement of MEC to keep systems working eliminates any conflict of interest with payments, etc. Thus, my proposed program of bundling collection, monitoring, maintenance, and education would cost \$16,736.95 over 5 years in present value dollars, compared to four times that amount (\$66,947.80) if done separately and using the same assumptions for salary and expenses.

In Table 12, I compare the difference between the CDM model and the EduPaz carbon revenue model and show the EduPaz carbon revenue model is \$92,479.03 more financially attractive over five years. One assumption that I make is that the digesters would perform similarly under both scenarios. Where that cannot be pinpointed exactly, once installed I have factored in the same type of on-going maintenance, monitoring, audit and collection for both models. This implies the digesters will be running and maintained in a similar fashion by an outside organization.

Table 10. CDM carbon revenue and expenses for 5 years (UNDP, 2006)

		<b>Present value at 3.6% for 5 yrs.</b>
<b>Revenue</b>		
Revenue 100 systemsx\$11.22/tx7.75t	\$ 8,695.50	<b>\$40,559.08</b>
Revenue per system for 5 years	\$ 86.96	\$ 405.59
<b>Upfront expenses</b>		
Feasibility assessment	\$ 5,000.00	\$ 5,000.00
Preparation of project design document	\$25,000.00	\$ 25,000.00
Registration	\$10,000.00	\$ 10,000.00
Validation	\$10,000.00	\$ 10,000.00
Legal work	\$20,000.00	\$ 20,000.00
<b>Annual expenses (5 years)</b>		
Registration	\$ 5,000.00	\$23,321.88
Monitoring and verification	\$ 3,000.00	\$13,993.13
Success fee for sales of CERs(5%)	\$ 204.00	\$951.53
Risk mitigation(1%)	\$ 40.80	\$190.31
Collection, maintenance, and education expenses for 100 systems		\$ 16,736.95
<b>Total expenses</b>		<b>\$ 125,193.80</b>
Expense per system for 5 years		\$ 1,251.94
<b>Net revenue for 100 systems</b>		<b>\$ (84,634.72)</b>

Table 11. EduPaz carbon revenue and expenses for 5 years

		<b>Present value at 3.6 % for 5 yrs.</b>
<b>Revenue</b>		
Revenue 100 systemsx\$6.8/tx7.75t	\$ 5,270.00	<b>\$24,581.26</b>
Revenue per system for 5 years	\$ 52.70	\$ 239.57
<b>Expenses</b>		
Technician and expenses (paid twice monthly)	\$ 140.77	\$ 16,736.95
<b>Total expenses</b>		<b>\$ 16,736.95</b>
<b>Net revenue for 100 systems</b>		<b><u>\$7,844.31</u></b>

Table 12. Difference between CDM and EduPaz revenues and expenses over 5 years

Net Expense of CDM model		<b>\$ (84,634.72)</b>
Net Revenue of EduPaz model		<b>\$ 7,844.31</b>
Difference between both models		<b>\$ (92,479.03)</b>

While the CDM is the largest and most established method of using carbon credits for rural clean energy systems, it is not the most viable for EduPaz. Because of the large upfront costs, it is more expensive than the model I present. In addition, the CDM does not provide an ongoing collection, maintenance, monitoring, and education program for the technology it helps finance to assure user continuity and project longevity. The proposed EduPaz carbon revenue model affords smaller programs like EduPaz the ability

to access carbon credits while the use of the funds for the carbon credits provides services that insure the longevity and production of the biodigesters and cook stoves over 5 years.

Recommended tasks for carbon revenue fund: With the revenue from the carbon sales, it is recommended that EduPaz bundle all four necessary services into one position either as its own employee or subcontracted thru IRRI. The position will be paid as discussed above and the description of each task is as follows:

**Collection:** Once a month, the employee will record the payments collected and record it in a ledger. This is a fairly simple process, but combining the payment collection with maintenance, verification, and education gives it greater value to the loan recipient. The main reason is the recipient will realize the benefits of maintenance and user/community education as he or she is making the payment.

**Verification/Monitoring:** The verification process is mainly for EduPaz to have on-going understanding that the systems are in use and producing gas and the stove is working (Appendix E). It is a requirement for MEC to know they are in good working condition and reducing methane and CO<sub>2</sub> emissions. The parameters and training of the verification will be coordinated with IRRI upon installation of the units.

**Maintenance:** The maintenance of the systems will be carried out using a proactive approach to make sure the digester and cook stove are being used properly, are not under undue stress because of location and/or installation, and have no physical stress points (like rocks or other items leaning or lying on the biodigester). In addition, proper mixing procedure for the digester by the user will be promoted as well as correct inflow and outflow. According to Mr. Eaton, repairs early on are fairly simple and can be

reduced by simple training on the mixing process. Eaton (2009) has discussed how a poor mixing process can lead to tears or undue wear on the biodigester systems.

Education: The education portion of the program will have two components. The first is educating the user (and anyone else interested) on the simple mechanics of the biodigester and stove system and their purpose. The second component will involve educating the user about other environmentally useful and sustainable practices such as water catchment and best practices for the outflow of biodigester slurry for farming. Holding classes to teach the latest best practices in local appropriate technology and opportunities for those that do not have the technology will be left up to EduPaz after determining how much time the individual has, the geographic concentration of the units, and the value of the carbon credits.

This model solves a few problems already established with biodigesters and cook stoves, mainly system longevity due to lack of maintenance and user education. It uses the carbon credits to establish a separate fund to pay for loan collection, on-going maintenance, verification of use, and user education. By establishing ongoing interaction (between either EduPaz or IRRI and the end-user), the approach couples the benefits of loan collection with the steps to assure system use, reliability, monitoring, and education. All of this is done with one interaction between the household and the field personnel. During early meetings, the field person will show the user how to test for methane production and train them on the mixing and care procedures. Thus, this user interaction will prove valuable during the crucial early stages of the project. Establishing a routine of visiting to collect payment, maintain and monitor the systems, and educate the user will

create a valuable methodology within the community to use the digester and cook stove and connect its use with fuelwood cost savings and future savings accounts.

#### Step 6. Collection and transfer of user information

While in the previous sections we have established the process for pinpointing the costs structures for the program, in this section we must focus on capturing the appropriate user information. In order to establish the proposed program, EduPaz must collect and provide the organizational information necessary for both Kiva and MEC (see Appendix E, F, and G for requirements for Kiva and MEC). The process for collecting information will be agreed upon in advance. In order to facilitate information collecting, it makes sense to add several key questions to the EduPaz user application form. User files will be set up and a communication strategy with MEC and Kiva will be established based on the requirements of each organization. User name, location, loan amount, loan use, repayment terms, a photograph and short description of the project will change from user to user. Also, a formal release should be incorporated into the EduPaz document to let both groups (Kiva and MEC) use the project information and provide it on their respective websites. Both Kiva and MEC use client information on their website to help identify their clients. Thus, it is important this information is collected and agreed upon for use by the loan recipient and technology user.



Step 7. Presentation to subsidy funders

After a critical mass of users (determined by EduPaz, but at least ten) has agreed to purchase the technology, all of the agreements and the financial breakdown of the entire project will be presented to various funders to solicit funds to cover the subsidy portion of the project, if necessary.<sup>58</sup> There is the possibility of funding this project without subsidies depending on monthly payment and length of loan. In other words, a user may be able to afford a certain monthly payment yet agree to a longer payment term, thus contributing more total dollars to the project. This monthly payment and length of loan should be uniform for a particular region. IRRI will provide technical requirements for the technology and the proposed subsidy amounts (see Table 3). The complete funding package should be pre-sold to the funding groups based on certain parameters to limit the lead time necessary for funding, etc.

An important part of my EduPaz Energy Finance Program is the ability to overlay grants and subsidy funding to make up any cost shortfall for these projects. There are many local worldwide organizations, both public and private, that fund small development projects. The important point to be noted is that these organizations tend to fund projects in certain areas of need like climate change, health, and development.

EduPaz's strategy should be to identify various organizations that fund small development projects, but for different reasons and values other than the avoided costs. For example, this model saves villagers substantial costs for fuelwood. But, the

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<sup>58</sup> It is implied with this model that a subsidy is necessary. However, the subsidy may or may not be necessary depending on the user payment commitment.

community currently places no economic value (although they do place a social value) on indoor air quality. Thus, approaching organizations for subsidy that focus on the costs and benefits of indoor air quality would be practical. Key potential partners include the World Health Organization, Partnership for Clean Indoor Air, the United Nations Environment Programme, the United Nations Development Programme, and the World Bank, as well as many research institutions and non-governmental agencies around the world (WHO, 2009). Most of the groups mentioned tend to fund projects involving much larger transactions, so EduPaz should steer the projects toward independent groups that fund smaller projects. Those independent funding groups change from year to year and tend to be region specific. EduPaz should contact some of its current funders with project specifics if necessary. In addition, the Mexican government has strengthened its relationship with Inter-American Development Bank (2009) and renewed its commitment to climate change projects. However, the size range of the projects being funded is difficult to determine.

A good example of a program that funds small climate-related projects is the GEF Small Grants Programme (UNDP, 2009). The program aims to deliver global environmental benefits in its focal areas, one of which is climate change. In particular, it has an operational programme called OP6—Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. In this program, 1,023 projects have been funded for a total of \$23,469,467 (UNDP, 2009). The average

value of each project is \$22,941.81<sup>59</sup> and the projects are well-represented geographically. While the GEF Small Grants Programme is not currently funding any projects in Mexico, they have several funded projects in neighboring Guatemala and other Central American countries.

Finally, the largest opportunity for the EduPaz Energy Finance Program is general development funds. The United Nations Development Fund (UNDP) is a massive organization that funds the GEF Small Grants Programme. The UNDP funds programs around the world for poverty reduction (UNDP, 2009). Accessing the UNDP, as well as other small development groups that focus on Mexico, is a good strategy.

#### Step 8. Fund disbursement to EduPaz

Once all funding (loans, carbon credits, and grants or subsidies) has been committed, loans made for the equipment (via MFI funders) and grants or subsidies should be dispersed into two funds that can be drawn from to pay for the equipment and the collection/maintenance employee(s). Also, once all funds have been dispersed, the process of hiring and training the appropriate field representative(s) to collect, educate, maintain, and monitor the equipment will commence. It is assumed that a fund disbursement slowdown for a week or two will not have a major effect on the project implementation timeframe. The actual disbursement of funds to IRRI, as well as the receipt of funds from MEC and Kiva, must be agreed upon in advance between EduPaz and those three organizations.

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<sup>59</sup> \$23,469,467/1023

Step 9. Installation of equipment, disbursement of monies to IRRI, and project Commencement

Equipment will be installed by IRRI and paid for by EduPaz. Follow-up processes (maintenance, monitoring, collection, and community education) will commence within three to four weeks of the installation date.

Step 10. Formulation of audit, collection, maintenance, and education schedule

Based on the number of systems committed, EduPaz and IRRI will design a schedule that accommodates the costs and timing of one person to handle all four tasks in the job description attached (Appendix J). The first payment will be approximately three to four weeks after installation. The maintenance and education component must be established first through IRRI to build the appropriate timing and routine into the process. To aid in the production of biogas, the first visit should be three to four weeks after the system is installed to make sure all the processes are working and the digester is being properly loaded and mixed. Thus, that schedule and the expectation of a visit must be determined in advance by IRRI and EduPaz. I recommend that IRRI handle the hiring, training, and managing of this part of the project with agreement from EduPaz. The main reason to have IRRI handle this part is that it makes sense to treat this part of the project as a subcontract. In conversations with IRRI, they thought the person hired would be involved in the installation process and thus already have consumer contact and a basic understanding of the individual digesters.

Step 11. Implementation of audit, collection, maintenance, and education schedule

The implementation of the audit, collection, maintenance, and education schedule is crucial. Building predictability into the process with the community is the most important first step. The first visit sets the stage for expectations. While payment and terms would be agreed upon up-front, confirming expectations for payment and date and what the visits will entail are good first steps. A possible three-month overview follows:

First visit—three to four weeks after install
Collect Payment
Maintenance schedule that IRRI recommends
First education meeting to cover points that were not covered during installation
Make sure bio-digester is working properly

Second visit—seven to eight weeks after install
Collect Payment
Maintenance schedule that IRRI recommends
Second education meeting
Make sure bio-digester is working properly

Third visit—approximately 12 weeks after install
Collect Payment
Maintenance schedule that IRRI recommends
Confirmation of gas and demonstration of first use
Education and demonstration of possible correct uses of methane

## Step 12. Project review and administration process

I recommend that EduPaz review the program on a monthly basis to maintain appropriate records. MEC requires quarterly updates to insure that the bio-digesters (and sometimes cook stoves) are working properly. Kiva requires updates and repayment notices also. I also recommend that EduPaz build its own internal methodology to accommodate the necessary communication with these two groups in addition to any funders.

## Summary

This EduPaz Energy Finance Program I outlined in this thesis is a roadmap for EduPaz to implement an energy-services microfinance program that aids the affordability of biodigesters and cook stoves in Chiapas. The roadmap identifies the various tools available today (micro-loans, subsidies, and carbon credits) that are available for larger MFI programs and shows how they can be used by EduPaz in an acceptable manner for its organizational structure. The EduPaz Energy Finance Program includes a separate fund for carbon credits to be used for system maintenance, monitoring, payment collection and education. Since the EduPaz Energy Finance Program is a framework, it has the ability to accept further steps in the program to make it more viable if necessary. Finally, the EduPaz Energy Finance Program meets the three goals I set out to meet at the beginning of my thesis research.

## How The EduPaz Energy Finance Program Meets Thesis Goals

By designing the EduPaz Energy Finance Program, I set out to achieve three goals in addition to aiding in the affordability of renewable energy technology for low-income farmers in Chiapas, Mexico. My first goal was to create a financial model that shows community stakeholders are willing to participate financially in the project, yet allow the program to receive outside subsidy funding if necessary. My second goal was to develop a financially sustainable maintenance, monitoring, collection, and education program using voluntary carbon credits that can be managed by a Mexican NGO. My third goal was to identify and discuss areas of this project that can potentially be replicated or modified in other regions to achieve the first two goals of this program. The following discussion shows how these three goals were achieved.

### Goal #1.

My first thesis goal was to create a financial model that shows community stakeholders are willing to participate financially in the project, yet allow the program to receive outside subsidy funding if necessary. One basic premise of the EduPaz Energy Finance Program is the use of small loans (micro-loans) to facilitate affordability and show some stakeholder willingness to participate in the project financially. While Eaton (2009) has done much work to show the ongoing economic and environmental value of bio-digesters, this particular technology does no one any good if small farmers in Chiapas are not willing to pay for it. If poor farmers pay for something, they apply value to it. Using repayment of microloans as a measurement of stakeholders' willingness to

participate financially is one way to approach this premise. For a population with an average income of US\$1,752, paying \$19.23 a month displays their willingness to financially participate in the project. It seems over-simplistic, but if farmers are willing to pay that amount, they want and value the technology.

Microloans are a tool for local communities. They are available to small users worldwide and simply meant as a tool to enhance independence and reduce poverty. By using that microfinance tool, farmers are both empowered with choice and engaged in the process. They want the products if they are willing to pay back the loans and those repayments imply local willingness to participate financially. The farmers want the biodigesters and cook stoves even if subsidized and even if there is a financial offset in fuelwood savings.

One can also use in-kind labor or a barter system to measure willingness to participate. However, with the EduPaz Energy Finance Program, the willingness to take out a loan and agree to repay it is the most simple, easily tracked and measurable approach. The individual families will be paying a substantial amount for these digesters over 16-32 months. The target payment amount of US\$19.43 per month represents 13.3% of the average monthly income for the state of Chiapas.

While establishing a financial commitment is not the only way to measure and assure stakeholder participation in this case, it is a very tangible and measurable form of participation. This project satisfies my first goal. Most importantly, the EduPaz Energy Finance Program gives the stakeholders a chance to contribute at least partially from a



financial standpoint, yet allows enough flexibility for other funds to aid the project without making it a completely donated (and sometimes unvalued) project.

#### Goal #2.

My second thesis goal was the development of a financially sustainable maintenance, monitoring, collection, and education program using voluntary carbon credits that is locally run by stakeholders. I have shown how EduPaz can separate the revenue from carbon credits to pay for a financially sustainable maintenance, monitoring, collection, and education program. I have also shown the benefits of each aspect of the EduPaz Energy Finance Program and how they can be implemented. Most importantly, this ongoing carbon revenue program requires no other financial inputs and can help inject money (however small) into the local economy. The carbon revenue program helps assure the use of the technology over the long-term through payment collection, maintenance and monitoring without any extra cost. Finally, the carbon revenue program takes advantage of community visits to disseminate current environmental education practices that can help these communities build a more environmentally sustainable future.

The programs paid for through carbon revenues are meant to be run by NGOs such as IRRI in a subcontracted arrangement through EduPaz. It is IRRI's intent to have a regional employee hired for each group of digesters so the individual comes from near the community being served.

My second goal is satisfied by my work on this project and shifts the discussion from simply providing technology to actually providing a financially sustainable technology program along with it.

Goal #3.

The last goal of my project is to identify and discuss areas of this project that can be potentially replicated or modified in other regions to achieve the first two goals of this model. There are three areas where replication and/or modification can potentially be accomplished. I will detail the potential changes that can be made to these areas and the appropriate reasons for the potential changes.

Financial model: This is a key area for replication and modification. Kiva as well as various grant organizations (IMF, USAID, World Bank) work on six continents and have a fairly steady presence in those areas. Since the EduPaz Energy Finance Program is a hybrid between micro-loans and grants or subsidies, there is the luxury of changing the level of personal financial involvement of the user with respect to the subsidy amount. The key component in the balance between microloans and subsidies is to have the individual pay something through the loan process that shows a willingness to participate financially in the project. The household payment amount must be established FIRST as that payment portion has the greatest economic impact on the user and all other cash flows are calculated from there.

Where it is not particularly evident what share of a project an individual must contribute to qualify as a willingness to participate financially, it is more than zero. Thus,

the individual organization that is managing the program must determine the level of payment based on the user's ability and willingness to pay. The organization must determine this with the knowledge that the closer the payment gets to zero, the greater the likelihood of the project being viewed as charity. This balance between participation and charity is one that an organization with local relationships and an understanding of the economic implications can assess.

Because of the flexibility of the model, the EduPaz Energy Finance Program can accept monies from various international groups based on their motivation. For example, this program addresses climate change, respiratory health, development and agriculture. Any organization (or combination of organizations) that has as its charter to address these issues can step in and subsidize the program if necessary. In addition, groups across the political spectrum can make claims that the EduPaz Energy Finance Program fits their political ideology. For example, conservatives at times promote personal responsibility and economic development. Small business generation and the farmers paying something would interest those with that conservative ideology. Progressive parties have been a proponent of climate change mitigation and could support the project based on that ideology. The ability to address multiple political ideologies could potentially open up a whole new area of funds (and possible mute political infighting as there may be something for both parties to support) for such projects.

In addition, any organization that initiates this model must be able to modify its approach and administration to be able to receive these funds. This modification can be accomplished by creating a professional environment, achieving some success in

projects, and in the micro-finance and micro-energy credit market, obtaining a credible audit.

Carbon credit model: The carbon credit model is the most innovative component of this project. Most carbon credits have been used to pay down a portion of the technology (or in some cases increase the corporate profits of the equipment provider). No organization currently has earmarked the carbon credit revenue to pay for a collection, monitoring, maintenance and education program for the technology generating the credits. The ability to use the carbon credit revenue effectively relies on two variables. The first variable is the value of the carbon credits with respect to the cost of living in the country. For example, the high value of bio-digester credits and the low cost of living in Chiapas both contribute to the possibility of the financially sustainable maintenance, monitoring, collection and education program I have proposed. Lowering of the value of the carbon credits, or increasing the cost of living (and associated pay scale necessary) in the area where the MFI operates will surely reduce the scale of services that can be provided. The second variable is that the market value of carbon credits going forward will determine the amount of money available to design and maintain on ongoing program of collection, monitoring, maintenance and education in their respective countries.

Because of the low carbon value yet pervasive deployment of PV technology worldwide, a smaller, less intensive program should at least be considered for home solar products. In cases like Nicaragua, for example, because of the low maintenance aspect of the panels involved, the revenue from carbon credits could perhaps be used only for

collection, battery education, or insurance. The salaries could be lower for the technicians, the battery life could be extended by insurance or user education, or the technicians can check on and perform low-level maintenance (like checking water level) on the batteries. I experienced many problems of this sort in Nicaragua and an ongoing program, though less comprehensive than the digester program, would do more to assure project success than just a small reduction in price. However, there is a question if there is enough money in Photovoltaic (PV) carbon credits to accomplish this.

When discussing use of carbon credits for PV systems, it is important to provide a comparison with biodigesters. I did not include the cook stove in this comparison as not all communities can take advantage of new cook stoves. A 35 watt PV system avoids about .313 tons CO<sub>2</sub>e per year (Appendix H). An unsubsidized 25 watt system in Nicaragua costs US\$610 (or \$24.40/watt) while an unsubsidized 50 watt system costs \$875 (or \$17.50/watt) as shown in Appendix A. Using an averaging model  $(\$610 + \$875) / (25w + 50w) = \$19.80/w$  for a total cost of \$693 for a 35 watt system in Nicaragua and assuming retail pricing is similar in Mexico. Using those calculations, the bio-digester avoids .0093 tons of carbon equivalent annually ( $6.5tCO_2e / \$700$ ) per dollar spent and a 35 watt household PV system avoids .00045 tons of carbon equivalent annually ( $.313tCO_2e / \$693$ ) per dollar spent. Thus, the bio-digester model avoids 20.56 times the carbon equivalent per dollar when compared to a household PV system. Because of this difference in carbon equivalent per dollar, the revenue alone from PV system carbon sales of similar size and cost would be much less for PV than biodigesters. When comparing carbon credits, one should at least consider using the carbon credit

revenue for PV systems for battery education. However, by using simple assumptions similar to the digesters (10 systems a day checked, \$6.80/tCO<sub>2e</sub>, .313tCO<sub>2e</sub>/yr), 250 household PV systems of 25 watts would generate only \$532 annually. As a standalone service, battery education would be hard to pay for and implement in Mexico. However, the high value of biodigester carbon credits makes a strong case for organizations in Mexico (and countries with a cost of living and technology that is less than or equal to Mexico's) to analyze the possibilities of implementing such a program using biodigesters.

Local involvement: As I have shown, the level of local involvement in these small projects is instrumental. That level can vary depending on MFI skill set, demand for product, and funding. Since this approach targets smaller, underserved MFIs and NGOs, either the NGO or MFI can be modified as detailed above or successful traits of other organizations in the field can be added to these groups. Either approach is viable, yet the local involvement is the key component. Only a local NGO or MFI can determine the crucial payment amount of the loan with confidence. The design and technical aspect of the project can possibly be outsourced, but the appropriateness of the technology and how it impacts the cultural and economic aspects of the community should be left up to those closest to the stakeholders.

Most importantly, this local control gives the community a chance to access global climate change funds and microloans without compromising the control of the project. They have a hand in determining their future and the costs associated with it, while accessing funds from organizations that may want to help limit global climate change, benefit respiratory health, aid development, or impact agriculture.

While I have identified three key areas that could be modified while using this model elsewhere, they are not necessarily the only three. They represent the three areas that allow for participation in global markets, while maintaining local control and input and building some longevity into the technology to aid adoption. Small modifications to these three components can allow bigger and smaller underserved communities worldwide to participate in a cleaner and greener future at their choosing.

Satisfying these three goals in addition to aiding the affordability of renewable energy for farmers in Chiapas is an integral part of my thesis project. Too often projects can be catered specifically to a location or technology and not benefit from the struggles overcome by previous groups. These three goals will help other organizations that try to implement similar technology.

## CONCLUSION

Small renewable energy projects have gone from a donation mentality to sometimes letting small poor communities fend for themselves. The program proposed here offers a middle path. It utilizes current financial tools to access global funds for climate change and other issues, yet relies on the participation and direction of locally run organizations to give it local control.

My key finding is by providing EduPaz a solid roadmap for this proposed program, EduPaz can show fund providers for this technology (microlenders, subsidy providers, and carbon credit funds) that the monies available will be used appropriately. In addition, EduPaz can strongly rely on its own expertise and understanding of local conditions while helping to implement a more sustainable future for its community members that choose to participate. The EduPaz Energy Finance Program examines most aspects of this undertaking for EduPaz and provides a framework for making renewable energy systems more affordable via an energy services finance program.

The adaptable, yet professional and predictable nature of this approach gives information and structure to a process that for the most part, leaves small poor communities out of the global climate change discussion. The EduPaz Energy Finance Program gives small communities that do not have the size or wherewithal to access CDM investment or research current market opportunities, potential access to those funds. As the world becomes smaller with increased dissemination of technology, the ability to deploy simple successful methodologies in a smaller fashion will empower



communities to take the action necessary to develop their communities in a way that contributes to their sustainable future.

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## APPENDIX A

### TRANSLATION OF COLLATERAL MATERIAL FOR TECNOSOL

The solar credit program is to provide credit for the purchase of solar panels. This program is funded by the Ministry of Energy and Mines (MEM), the company TECNOSOL is responsible for providing and installing solar systems.

The credit is provided through micro financial accredited by the MEM, who handed the money to TECNOSOL proceed to install energy in home through solar panels.

How much does the solar system that need to install in your house? The solar systems financed by the MEM for half of micro financial and installed by the company TECNOSOL have a special price. Since these have a grant awarded by the government of Nicaragua.

The solar systems that we are offering the loan program with solar, has the following:

- A solar panel (You can choose power, from 25 to 100 Watt)
- A deep cycle battery
- A driver loading
- Luminaires of 12 volts. (The number of lights depends on the solar system you choose).
- Kit electrical accessories.
- Manpower for installation.



## Prices

The prices of solar systems are as follows:

25 Watt solar system with three lamps.

Market price \$ 610.00

Special Price for the Project U \$ 486.00

## Contributions

50-Watt Solar System with five lamps.

Market price \$ 875.00

Special Price for the Project U \$ 695.00

## Contributions

75 Watt Solar System with six lamps.

Market Price \$ 1,090.00

Special Price for the Project U \$ 910.00

## Contributions

Solar System with eight of 80 Watt lamps.

Market Price \$ 1,230.00

Special Price for the Project U \$ 1,040.00

## Contributions

Solar System with ten 100-Watt lamps.

Market Price \$ 1,435.00

Special Price for the Project U \$ 1,230.00

## Contributions

How is the operation of the system?

Under the project, the solar system will be installed by technicians duly accredited by the company TECNOSOL, who installed systems following the rules laid down for connecting solar system, with teams and guarantee high quality certified.

How to access a Solar System?

Families interested in having a solar panel, to lift a list of interested parties and submitted to the offices of TECNOSOL closer. That will give you all the information needed to purchase the solar system under the program. TECNOSOL will provide and install the solar system, either to credit or cash. TECNOSOL has a line of credit for the purchase of solar systems through micro financial giving better conditions. To facilitate access to solar panels, credit is given to a low interest rate and for a time between 1 and 3 years.

## APPENDIX B

Notes from interview with Jose Domingo, Mari Elena, and Javier Inda of EduPaz on 8/17

These notes are an appendage to the interview notes from 2007. We sat down on 8/17/09 with Jose Domingo, Mari Elena, and Javier Inda of EduPaz. Alex Eaton helped guide the conversation and provided translation. We used the original interview as a guide and I will incorporate that into this later.

EduPaz is a non-profit and was formed in 1998. Shortly thereafter, EcoPaz was formed and designed as an MFI. There is a high-level of accounting and transparency between them but are essentially the same organization. For the sake of discussion, I will refer to EduPaz throughout the summary as decisions are made by these three people democratically.

There are other MFI-like organizations (that either lend or give money to small businesses and women) in Chiapas with maybe 20 in Comitán.

Banco Azteca

Compartamos Banco

Apoyo de Mujeres

Pro-Campo(farmers)

DESMI

EduPaz essentially lends to women, groups and cooperatives. Groups can include spouses of the women. A cooperative is a group but with one common project. The

groups are made up of mainly poor people. Javier stated “We work with the poor, but not the most poor. We understand with our small resources we will not be able to solve poverty.” Currently there is 250,000-300,000 pesos outstanding from the old program with a handful of non-payers. The most current program has 150-180 people, mainly in 12-15 groups and only two people are not paying. There is approximately 300,000 pesos outstanding and is working well.

**Borrowers:** The following characteristics apply to both individuals and groups. Groups are mainly 6-10 people. Everyone receives money as a group but they use it individually. 2-3 women are put in charge of the groups. Groups guarantee all of the loans and individuals sign an Acta Interna, or an agreement within the groups. The interest rate is 2% monthly on the unpaid principal and MUST be paid every month. The group agrees to a payment schedule in advance and principal payments can be skipped.

**Payment/Collection:** At the time of the original interview, EduPaz had about a 5% rate of delinquency amongst its borrowers. That has currently changed to close to 100% as the group has used methods to enhance payment. Those methods include but are not limited to more aggressive collection tactics such as legal enhancements (enhanced level of formalization), group collateral, and detailed payment plans. These more aggressive tactics are to set an example for the community that responsibility is important and those that are responsible with this program will benefit.

The legal enhancements include contracts. They have included a payment schedule with the loans and the borrowers are asked to fill out an application and sign the document. They have engaged an attorney to look over their processes.

Group collateral is essentially like Grameen Bank. Meaning individuals in the group are collectively responsible for repaying the loan and no future loans can be made to any member of the group if they are delinquent.

The detailed payment plans are meant to eliminate the habit of individuals and groups to borrow more money than is needed for equipment or an asset and use the remainder on consumption. Javier used an example where the person borrowed 5000 pesos, paid 2000 pesos for equipment and the remaining 3000 pesos for consumer goods. He stated he wanted to eliminate that option, require the use of the funds be declared, and will be hesitant if the funds are not either helping to produce cash flow for the lender through income generating activities or cost reduction. Again Javier states “We work with the people that want to work but do not have access to bank funds. We work with people with initiative. How can helping 20-30 people affect this sea of poverty? We hope that the few people will lead by example.

Payments are made monthly to EduPaz. When payments are made to EduPaz, three copies of the receipt are produced. One copy each goes to the borrower, the accountant, and the file (EduPaz office).

Audit/Administration: The last official external audit for EduPaz occurred in 2007. It does not happen every year and costs around 15000 pesos. Administering the system takes approximately one-half the time of a full-time staff member. A full-time person costs about 6000 pesos a month so in effect the cost of administration is approximately 3000 pesos per month.

EduPaz and EcoPaz have 4 bank accounts (2 each). One is for pure interest payments and expenses to the program come out of that. The other is for principal capital to be paid back and credit comes out of that account.

We discussed our program with him and he liked the idea. Ultimately, he would want this program to be its own independent fund.

Miscellaneous: a technician to handle the collection, maintenance, audit, and education would cost about 200 pesos a day or 5000 a month (check numbers with Alex as that is 30 days of work). Food, travel and lodging would be extra. A less trained person would cost around 4000 pesos a month.

## APPENDIX C

Notes from meeting with Adriana Alcazar and Xanchu of FORO on Aug. 15<sup>th</sup> and 18<sup>th</sup>

We met with the people from FORO, Adriana Alcazar and one of her village contacts Xanchu. We met twice and discussed their program as well as our ideas.

FORO has a unique MFI model that centers around micro-lending for basic needs, greenhouses, latrines and cook stoves. It is both a credit and savings program. Since 2007, they have become more systematic in their approach. They mainly work in 5 areas but have many groups. The main areas or towns are Zinacontun (where they have been for 7 years and serve about 250 women mainly in groups of 5-20). The others are Ocosingo, Yajalon, Comitán, and Benamito de las Americas. Their basic program is to lend 500 pesos and the person pays it back over 6 months. The payback amount includes 50 pesos of interest and 100 pesos of savings. This philosophy is meant to encourage savings and financial management amongst the villagers and the savings aspect is a very big motivation among the borrowers.

The women are mainly organized into groups but not exclusively. The groups have 5-20 women and they elect a President and Secretary. They meet every 15 days to collect money and that money is paid to FORO once a month per their agreement. The interest rate is 20% annually.

The savings is like collective collateral. Whereas most borrowers are in groups, they do not discourage individual borrowing. However, the group lending and savings

allows the group to lend their own money and is an independence tool. They cannot receive more money without paying off an existing loan.

The straight loan structure of 1500 pesos has the money disbursed and paid back in increments of 93 pesos every two weeks. The repayment includes an interest “fee” of 300 pesos, a personal savings account of 262.5 pesos and a group savings account of 262.5 pesos. At the end of the year, the people get their individual savings back if their loan is paid back. If the group keeps its savings in then it can receive more loans and it acts as collateral. If all the individual loans are paid off and any groups loans are paid off then both savings accounts can be given back.

The motivation to keep the money in savings is to make the program work and provide security/insurance for the family. Interest is not paid to the savings account holders.

The stoves cost 1500 pesos with 500 pesos down and two payments of 500 pesos. The 1500 pesos comes through grants. A “tarea” is a cubic meter of fuelwood and costs about 600 pesos. Adriana confirmed the efficient woodstoves cuts the wood consumption in half. Villagers buy on average 10-14 tareas a year so the stove can save on average 3000 to 4200 pesos a year not to mention the carbon savings.

In addition, men encourage women to participate and tell other men their wives are healthier because of less smoke and there is value in that healthier environment.

Adriana contends we could have a savings program along with our program and 278-300 pesos a month is workable. Xanchu works part-time and they have an accountant



and a driver. They average 7000 pesos a month in operating expenses. She says 40% interest would have to be charged to the 250 groups to cover the 7000 a month.

## APPENDIX D

### NOTES FROM MEETING WITH DESMI ON 8/20/09

I met with Asela Sun Roman of DESMI in her office in San Cristobal. DESMI is a 40 year old organization that gets funding from many organizations with IDEX a primary source. The funds are now considered DESMI funds whereas before they were managed by the donors. Asela has been with them for 9 years and lived in the states for six months. Her English was good and between English and Spanish we arrived at many answers. I confirmed most answers in both English and Spanish. They have 10 employees, 8 full-time and the employees are regionally responsible.

DESMI has primary clientele in Zapatista villages like Tiopisco, Soltocanango, and others south of Comitan. The main thrust of their efforts is to combine a revolving fund for agriculture projects and some cow and pig projects with what she called *acompañamiento* which consists of organic agriculture best practices (including agrochemicals), education and empowerment. However, she emphasized the process was both ways and DESMI workers learn much from working with the farmers. They provide *acompañamiento* alone, but will not provide loans without it. It is integral. Essentially, the loans are provided for one year for corn crops and for two years for cattle to coincide with when the crops and cattle can be sold. Sale of products within the local community is encouraged. The entire amount and interest are due at the end of the loan period with no payments due beforehand. The annual rate is 6% and that is down from

12% annually as recently as 2007. It has coincided with a tightening of restrictions to have more routine and predictability.

The loan is mainly delivered in a cooperative fashion. They have 200 cooperatives within 132 communities with anywhere from 5-800 people in the cooperative. The cooperatives elect people to manage the process, but it is not required. It is a revolving fund with small loans to individuals. Therefore, payback is encouraged to stimulate economic solidarity. The revolving funds have limitations per region if they are not being paid back. They will only loan 50% of the entire project and the budget for the project is analyzed before the money is disbursed normally in increments of 20000-30000 pesos per cooperative. The land must be held in a collective fashion. Sometimes loans are “recommended” or guaranteed to promote activity.

## APPENDIX E

### MEC MEMORANDUM OF UNDERSTANDING

Entered into on <<Date>> by and between:

MICRO ENERGY CREDITS, CORP., a  
corporation organized and existing under the laws of Delaware (“MEC”) and  
MFI, a for-profit microfinance  
institution operating under the laws of  
MFI Country (“MFI”)

#### I. PURPOSE

This Memorandum of Understanding (the “Memorandum”) is intended to enable MEC and MFI to work together for the mutually beneficial purpose of sourcing and selling Emission Reduction (VER) Carbon Credits (as defined below).

#### II. PROPOSED PROJECT

MEC and MFI will conduct the following activities (the “Project”).

MEC will pay MFI a fixed price for VER Credits (as defined below) on a per Product basis. MFI will use the proceeds from the credits for market development activities with the goal of expanding and sustaining the local market for clean energy.

These activities may include, but are not limited to:

- providing enhanced customer service and maintenance;
- providing end user training in system use and maintenance; and
- providing community awareness of the benefits and availability of renewable energy products to improve their incomes and their quality of life.

### III. DEFINITIONS

Unless the context otherwise requires, the following capitalized terms shall have the following meanings wherever used in this Memorandum and its recitals:

Institution Rating is a calculation of the accuracy of MFI's reported assessment of ongoing maintenance of the Products. The purpose is to project the accuracy of the maintenance status of the Products based on reports MFI provides. It is based on a comparison of audit findings with MFI - reported results. It will be developed based on discrepancies between the audit findings and data recorded in the Credit Tracker Data Form (Exhibit A).

Project or Projects means the project activity or activities described in this Memorandum, as amended by mutual agreement of the Parties on a quarterly basis.

Project Rating is a calculation of the robustness of products in a given project. The purpose is to project the likely number of Product failures. It is based on audit findings and MFI-reported results. It will be measured based on a calculation gauging the number of MFI Products out of repair.

Purchase Price is the price MEC shall pay MFI for the VER Credits as set forth in Section IV.

VER and VER Credits mean "Voluntary Emission Reduction Carbon Credits," which are expressed in units of tons of CO<sub>2</sub> equivalence, arising out of any greenhouse gas reduction, and calculated and subsequently verified through generally accepted methodologies published by international bodies and modified by MEC to take into

account both local conditions and specific product characteristics, as published and modified by MEC from time to time.

#### IV. PURCHASE AGREEMENT

MEC shall pay MFI the Purchase Price for the VER Credits on a per Product basis, as set forth in a purchase agreement between the parties, which shall include the following terms:

- (i) MEC shall pay MFI the Purchase Price payable with respect to the VER Credits for each purchased Product effective upon the sale by MEC of such VER Credits, within 30 days after MEC receives payment from such sale. The Purchase Price, subject to all terms and conditions set out in the purchase agreement, shall be agreed upon by the Parties at the beginning of each project undertaken by MFI.
- (ii) The Purchase Price shall be equal to 80% of the price that MEC receives for the corresponding VER Credits, multiplied by the Institution Rating and the Project Rating.
- (iii) If a Product falls out of use (e.g. with a particular customer), it must be replaced with a new Product by MFI before another credit payment can be received.

#### V. RESPONSIBILITIES OF THE PARTIES

##### A. Responsibilities of MEC

MEC agrees to perform the following activities in support of the Project:

- (i) MEC shall originate VER Credits for the Project. This includes Project development, validation, registration and verification of the VER Credits.
- (ii) MEC shall receive the VER Credits for the Project.
- (iii) MEC may sell the VER Credits to a purchaser of its own choosing.

- (iv) MEC shall assist MFI staff to upload data to MEC's web application for reporting purposes. MEC shall also provide MFI with location aware electronic devices (e.g. GPS units) to record location information for the installed Products.
- (v) MEC shall provide additional technical assistance to MFI as the parties may agree to accomplish the objectives of this Memorandum.

B. Responsibilities of MFI

MFI agrees to perform the following activities in support of the Project:

- (i) Prior to the commencement of the Project, MFI shall provide MEC with the following documentation:
  - Audited financial statements from the previous year and one year prior if possible;
  - Unaudited quarterly financial statement for the current year;
  - Rating reports and background information [if rated]; and
  - Financial projections
- (ii) MFI shall announce and publicize the Project only as explicitly agreed with MEC in advance.
- (iii) Any use of MFI information, the MFI name or marks, or any use of information as to or photographs of MFI clients shall be subject to the prior written permission of MFI and, as the case may be, of the MFI client.
- (iv) Within thirty (30) days of commencing the Project, MFI shall provide MEC with the following materials and information or carry out the following activities:
  - (a) MFI will seek to obtain permission of a client to use a photograph of the client pictured with his/her Product, the name of the photographed client and a short description of the photograph. This will be a onetime obligation for publicity purposes;
  - (b) The total number of clients, staff members and MFI office branches;
  - (c) The region MFI serves; and

- (d) A copy of MFI's most recent annual report.
- (v) MFI shall maintain a "Credit Tracker Data Form" materially in the form attached to this Memorandum in Exhibit A which tracks information regarding each transaction (sale of Product, loan of money, etc.) done within the context of the Project. MFI shall email, or upload to MEC's website, a current version of the Credit Tracker Data Form to MEC on a bi-monthly basis. The Credit Tracker Data Form and Monitoring shall include the following pieces of information for each transaction:
  - (a) Name of loan officer;
  - (b) Name of household;
  - (c) Household address;
  - (d) Household location (including the latitude and longitude);
  - (e) Product size and characteristics;
  - (f) Date of purchase;
  - (g) Status of Product; and
  - (h) Date of Status Check.
- (vi) MFI shall record all new loans for Products in the Credit Tracker Data Form within ten (10) days of the loan recording.
- (vii) MFI shall monitor the Products and update the "status" section of the Credit Tracker Data Form at least once every three (3) months to indicate whether each Product is "functional," "faulty but in use" (suffering from temporary disrepair) or "out of use" (stolen, irreparable, no longer used). The status updates may be phone calls rather than onsite visits, if MFI deems that provides reasonable information. If MFI is no longer willing or able to monitor the status of a Product, it may change the status of that product to "out of use". MFI will monitor the product for the lifetime of the carbon credit. MFI may elect the lifetime of the credit, which may be up to the full useful life of the Product, or 5 years whichever is shorter.
- (viii) If a Product falls "out of use," then MFI shall book a substitute Product before resuming payment for credits. This value will be automatically deducted from future payments, and will not require special action from MFI.



- (ix) MFI will, with the assistance of MEC, upload information to MEC's website in order to maintain proper records.
- (x) MFI shall permit MEC to audit a random sample of Project clients upon reasonable notice to and arrangements with MFI and shall make all information available to MEC for purposes of the audit. The parties anticipate that such audits will take place on average once a year. MEC will bear cost of the audit. Audits shall be conducted in a way that they are not disruptive to Project clients or to MFI's relationships with such clients.
- (xi) MFI shall provide MEC with quarterly updates on clients with energy Products, MFI will provide MEC with audited financial statements on an annual basis.

#### C. Negative Covenants

- (i) MFI shall not sell, dispose of, licence, encumber or permit to be encumbered by, through or under it, or otherwise deal or attempt to deal in or with all or any part of the VERs save in accordance with the provisions of this Memorandum.
- (ii) Neither MFI, nor any of its affiliates or its customers, shall claim any VERs or any part thereof as part of its own carbon inventory, footprint, or other carbon statement or declaration.

#### VI. CONFIDENTIALITY

Each party shall maintain in strict confidence and safeguard any information obtained from the other party of a confidential nature, including personal or other information as to the Project clients or their identities. Each party shall use any such information only for the purposes of this Memorandum, and may only disclose it to its officers, directors, employees and agents with a need to know for purposes of carrying out this Memorandum and provided that such persons to whom the information is provided are made aware of and agree to accept such confidentiality restrictions. Information shall not be considered subject to such confidentiality restrictions to the extent that: (i) it is publicly available through no fault of the party intending to disclose

the information; (ii) it is obtained from other sources who do not hold it subject to confidentiality restrictions; or (iii) under governmental or judicial mandate; provided that upon notice of demand for provision of such confidential information, the recipient of the confidential information shall provide the other party with immediate notice so that it can take steps to protect against or limit disclosure, and shall make only such disclosure as necessary to comply with such mandate.

MEC reserves the right to disclose relevant information about MFI clients to actual and potential buyers of VERs generated under the scope of this Memorandum. MFI shall not disclose the terms of this Memorandum to any Third Parties without prior consent from MEC, which shall not be unreasonably withheld.

#### VII. TERM AND TERMINATION

This Memorandum will terminate 6 years from the date of the execution of this Memorandum. MFI may terminate this Memorandum at any time provided they give sixty (60) days notice, or for cause. If MFI terminates this Memorandum, any VER purchase or sale previously agreed upon survives the termination of this Memorandum. MEC shall have the right of first refusal if MFI should receive an offer from another buyer.

#### VIII. GOVERNING LAW

This Memorandum shall be governed by the laws of the state of New York, other than provisions relating to conflict of laws.

#### IX. DISPUTE RESOLUTION

All disputes arising out of or in connection with the present Memorandum shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with the said rules in force at the time of the dispute. Such arbitration shall take place in MFI Country, where MFI is headquartered. Such arbitration shall take place in English. Any award shall be final and non-appealable, and fully enforceable in accordance with the terms of the award.

X. MISCELLANEOUS

A. Costs

Each party agrees to be responsible for the payments of its own costs and expenses, including reasonable attorney's fees and expenses, in connection with the transactions contemplated by this Memorandum.

B. Notices and Addresses

All notices or other communications permitted or required under this Memorandum shall be directed to the address, facsimile or email provided below. All such notices must be in writing in the English language and must be delivered by personal delivery, facsimile, e-mail transmission or by commercial express courier service postage prepaid, and shall be deemed given upon personal delivery, or three (3) days after deposit with commercial express courier service, or upon acknowledgement of receipt of facsimile or e-mail transmission, whichever shall first occur.

If to MEC: April Allderdice  
Director  
MicroEnergy Credits Corp.  
1418 Monroe St. NW  
Washington DC 20010

Facsimile No.: +1 866 880 8093

Email: april.allderdice@gmail.com

Telephone No.: +1 202 549 790

If to MFI: [●]

[●]

[●]

Attention: [●]

Facsimile No.: [●]

Email: [●]

Telephone No.: [●]

with a copy to: [●]

[●]

[●]

Attention: [●]

Facsimile No.: [●]

Email: [●]

Telephone No.: [●]

## XI. ASSIGNMENT

This Memorandum may not be assigned or otherwise transferred by either party in whole or in part without the express prior written consent of the other party. The Memorandum shall benefit and be binding upon the successors and assigns of the parties hereto.

## XII. SCOPE OF MEMORANDUM

The parties understand that this Memorandum constitutes a non-binding statement of the parties' respective intentions with respect to the Project. However, the parties also understand and acknowledge that this Memorandum does not contain all matters upon which agreement must be reached in order for the proposed Project to be consummated, and therefore does not constitute a binding commitment or agreement with respect to the proposed Project itself. Any such binding commitment or agreement with respect to the proposed Project will result only from the execution and delivery of the definitive agreements with respect to the Project, subject to the terms and conditions expressed therein. Notwithstanding the foregoing, the parties agree that Section VI shall be binding on the parties.

IN WITNESS WHEREOF, the parties have entered into this Memorandum as of  
the date stated above.

Micro Energy Credits, Corp.

MFI

By:

By:

---

---

Name:

Name:

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APPENDIX F

KIVA PRE-APPLICATION FORM

Section 1: GENERAL INFORMATION	
Are you a representative from a microfinance institution?	
Does your microfinance institution currently serve at least 1,000 active borrowers with microfinance services?	
Is your organization legally registered in its country of operations?	
Does your organization have at least 1 year of audited financial statements?	
Is your organization willing and able to manage currency risk?	
Can your microfinance institution legally accept US dollar debt from a foreign lender and repatriate funds?	
Is your organization willing and able to write client profiles, take client pictures and post them online?	
Are representatives from your microfinance institution able to communicate via email and access the Internet regularly?	
Do any representatives (specifically senior management) from your microfinance institution speak and write English, Spanish, Portuguese or French?	
Section 2: COMMITMENT TO SOCIAL PERFORMANCE	
Does your organization have an established history (at least 2 years) of lending to poor, excluded or vulnerable people with the goal of alleviating or reducing poverty?	
Does your organization abide to a Code of Conduct/ Code of Ethics?	
Do you agree to abide to Kiva's Pro-Consumer pledge?	
Section 3: COMMITMENT TO TRANSPARENCY	
Is your organization willing and able to provide regular financial reporting to Kiva?	
Is your organization willing to accept informational audits by Kiva auditors?	
Is your organization willing and able to provide details on interest and fees charged to borrowers?	
Will your organization agree to get borrower consent before posting their information to the Kiva website?	

If you do not know the answer, write down “?” and we can help as needed.  
 If the field is not applicable or no data is available, write down “N/A”.  
 When complete, please email this application to [partnerships@Kiva.org](mailto:partnerships@Kiva.org).

#### Section 4: GENERAL INFORMATION

##### Main Contact Information

Last name (or family name)	
First name (or given name)	
Title	
Primary email address	
Alternate email address	
Office phone	
Mobile phone	
Skype name	

##### Organization Details

Name	
Primary country of operation	
Other countries of operation	
Physical address	
Mailing address	
Website address (URL)	
MIX Market profile (URL)	
Briefly describe the mission of your organization:	



General Portfolio Information			
Number of active borrowers		As of (date)	
Gross loan portfolio (GLP) <i>Please enter in currency of disbursal</i>		As of (date)	
Currency of loan disbursal			
Please briefly describe how you manage currency risk	<p>We do not hedge __</p> <p>We provision to cover currency losses __</p> <p>We make loans in the foreign currency we borrow in __</p> <p>We use swaps, forwards, back to back loans, or guarantees to partially hedge the currency __</p> <p>We use swaps, forwards, back to back loans, or guarantees to fully hedge the currency __</p> <p>Other (please provide details) __</p>		
Operational Structure			
How many branches or points of service do you have in your organization?			
Number of rural branches			
Number of urban branches			

Regulation and Legal Status			
Enter the date when your organization's operations began :		Enter the date when your MFI begin providing microfinance services:	
Legal status:			
Is your MFI regulated?		If yes, regulated by:	
Network Affiliation			
Is the MFI a member of a microfinance network?			
If so, please provide the name(s) of the network(s) below.			
Network Affiliation 1			
Network Affiliation 2			
Network Affiliation 3			
Systems			
Please enter your management information system (MIS) used for client/loan tracking:			
Are your client tracking and financial tracking systems the same or linked?		If not, what system are you using for your financial management?	

Communication Preferences						
What is your preferred language for communication?						
What is your preferred language for posting borrower profiles and progress updates to the Kiva website?						
Section 3: FUNDING INFORMATION						
Name of Funder	Type of Funding Received	Amount of Funding	Disbursement Date	Currency	Term if Loan	Interest Rate if Loan
Additional Information						
If accepted as a Kiva field partner, what do you plan to do with Kiva's 0% funding?						
What are your estimated MFI debt financing needs in the next 12 months?						
What is your estimated need for Kiva funding in the next 12 months?						
Does your organization have the ability to access debt capital from the market and if so, at what rates?						

**Section 5: LOAN PRODUCTS**  
 Please enter the information below for all loan products. You may answer in ranges (for example \$150-\$300 as necessary)

name	Do you expect to post borrowers with this loan product to the Kiva website?	If yes, what percentage (%) (of the number of loans)?	Is this a group or individual loan?	If it is a group loan, is the group responsible for repaying loans from members that are delinquent or in default?	If it is a group loan, do you collect individual loan amounts within a group loan?	Average loan size for this loan product (in currency in which the loan is disbursed)	Currency of loan disbursement

**Section 5: LOAN PRODUCTS (continued)**  
 Please enter the information below for all loan products.

name	Average loan term (in months)	Is there a grace period before borrowers must begin repaying the loan?	If yes, how long is the grace period?	Repayment schedule (i.e., once a week, once a month)	Is this product linked to a mandatory savings product?	Annual effective interest rate, including all fees (i.e., overhead, financial costs, margin, etc.)	Is the interest rate calculated on a flat or declining basis (also known as a simple basis)?

Other Loan Product Information	
Money Lender Rate What is the estimated average annual money lender rate in your organization's operating areas?	
Please list other Products or Services (such as Savings, Insurance, Business development, training, etc.)	

APPENDIX G


KIVA FIELD PARTNER APPLICATION





Section 1: DOCUMENT REQUEST - Financial and Portfolio Reports			
<b>AUDITED FINANCIAL STATEMENTS</b>			
Please submit audited financial statements for most recent five years (if audited financial statements are not yet available for most recent year, please submit unaudited financial statements). Please submit at least one year of audited financial statements.			
<input type="checkbox"/> Audited	<input type="checkbox"/> Unaudited	<input type="checkbox"/> Unavailable	Year:
<input type="checkbox"/> Audited	<input type="checkbox"/> Unaudited	<input type="checkbox"/> Unavailable	Year:
<input type="checkbox"/> Audited	<input type="checkbox"/> Unaudited	<input type="checkbox"/> Unavailable	Year:
If the financial statements from the most recent year do not include liabilities broken out between current liabilities and long term liabilities, please submit these separately for the most fiscal recent year			
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Year:	
If the financial statements from the most recent year do not include total liabilities and total assets in foreign currency, please submit these separately for the most fiscal recent year			
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Year:	
<b>MANAGEMENT LETTERS</b>			
Please submit management letters accompanying audited financial statements for most recent three years (if applicable) - <i>Note: We will be contacting your external auditors in the next 6 months to confirm the presence or absence of management letters.</i>			
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Year:	
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Year:	
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Year:	
<b>PORTFOLIO REPORTS</b>			
Please submit portfolio reports, including an aging analysis of the portfolio, for the last two quarters of the most recent fiscal year.			
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Quarter:	Year:
<input type="checkbox"/> Attached	<input type="checkbox"/> Unavailable	Quarter:	Year:

## APPENDIX H

### MICROENERGY CREDIT CASE STUDY

Estimation of carbon offsets - verified emission reduction credits (VERs)



 info@microenergycredits.com  
 +1 206 274 6457  
 +1 866 880 8093  
 1752 NW Market Street, No 105  
 Seattle, WA 98107 USA

**Project Information**

<b>Organization</b>	MFI
<b>Country</b>	Mexico
<b>Technology</b>	Solar Home System
<b>Additionality</b>	Without this program, these products would not be available to the end user
<b>Use of Carbon Finance</b>	Improve ongoing customer service and maintenance
<b>Monitoring</b>	MEC monitoring protocol
<b>Auditing firm</b>	To be chosen by MEC
<b>Date of estimate</b>	January 19th, 2009
<b>Tons CO2e/HH/Yr</b>	0.31

**Carbon Offset Summary**

Tons carbon offset per HH per year: **0.313**

Price per ton: **\$6.80**

**Expected system installations by year**      **Cumulative Volume of Offset**

Year 1	20,000	20,000	20,000	20,000	20,000				
Year 2		30,000	30,000	30,000	30,000				
Year 3			45,000	45,000	45,000				
Year 4				67,500	67,500				
Year 5					101,250				
<b>Cumulative systems</b>	20,000	50,000	95,000	162,500	263,750				
<b>Tons of carbon</b>	6,269	15,672	29,776	50,933	82,668				
<b>Expected revenues</b>	\$42,627	\$106,567	\$202,478	\$346,344	\$562,143				

**Total revenues over five years: \$1,260,161**

*Note: This estimation is for business planning purposes only.*

The most popular system is 35 W, which runs 2 9 W florescent lamps and a small appliance (from Ashden Awards Case Study)  
 The larger system is a 70 W panel with 4 9W cfls  
 Both systems provide a minimum of 4 hrs of light per day, although in practice they give up to 8 hrs of light.  
 Systems also support a mobile phone charger/ b&w tv and/or dc fan

Equivalent # 5 W CFL:	3.6	(9 W CFL * 2 lights/small system /5W)
Avg hrs of light per day	4	
Equivalent # 5 W Appliances	3	(typical b/w tv 15 watts)
Avg hrs of equipment use per day	2	(35 W system *4 sun hrs/day=140 Wh /day/75% efficiency= 105Wh available -(18W *4h= 72 Wh use up by lighting)=33 Wh for appliance/15 W per TV =2.2 hrs of usage left per day)

Case Study affirms 8 liter per month of kerosene typical for Indian HH prior to using solar.





## APPENDIX J

### JOB DESCRIPTION FOR EDUPAZ MONITOR/MAINTAIN/COLLECT/EDUCATE

The following job description for monthly field visits is meant to achieve four goals. The first is to monitor the bio-digester systems in villages in Chiapas to make sure they are functioning properly. Next, it is necessary for the person monitoring the systems to be able to make any major and minor repairs to the system to insure its production and use of methane gas. In addition, collection of micro-loans can be handled at that time. Finally, a component of user and community education can be implemented during the same visit.

While the details must be worked out between IRRI and EduPaz, during my discussions with Alex Eaton, we discussed the basic necessities of a bio-digester monitor and maintenance program needs a few key steps. The first being making sure the digester is producing methane gas. There are many reasons if this is not occurring properly (improper mixing, load rate, etc) (Eaton, 2009) and the field person will determine the appropriate course of action.

If the bio-digester has failed mechanically for any reason, the field person in charge of this process will have replacement parts and repair mechanisms for the digester. These include but are not limited to, tape, valves, hoses, and other pieces that may have failed. It is important to distinguish between product failure and misuse for ongoing training for the user.

One of the more important reasons for a field visit is to collect the loan payment from the user. It is suggested the field person schedule visits on a monthly basis to collect and record payment for the digester. While there may be a necessity for other visits to repair the system, the timing of the collection piece should coincide with basic preventative maintenance and an individual and community education piece.

The education piece has several components. The first piece is an on-going education of the digester to assure its use and production of methane. This will be covered by a detailed discussion with the user family as to how the digester works and how to maintain its production of methane through anaerobic digestion. In addition, the user will be coached on proper methods for uses the slurry that is provided by the digester for fertilization. Further suggestions of efficient use will be a bi-product of these meetings. The second piece will be an environmental education component that demonstrates the benefits and costs of the digester technology to those who do not have it yet. It is an on-going process to allow other users to take advantage of the program. In addition, other best practices for environmental sustainability will be available based on the discretion of IRRI and EduPaz.

## APPENDIX K

### MEC CREDIT DATA TRACKER FORM

#### Micro Energy Credits

##### Instructions

These forms are to be used to create bookings and also to monitor the energy systems.  
 There are two paper forms which can be printed and brought to the field with loan officers  
 Use the "paper booking" form to record information when a system is installed. This form also includes the title release signature.  
 Then use the "booking computer entry" form to enter information from that form to the computer.  
 When you enter a booking give each entry a unique ID number. Sequential is fine. For reference you may want to put that number on the hard copy form.

Monitor the systems every 3 months to confirm they are working  
 Use the "paper monitoring" form to record monitoring activity in the field  
 Then use the completed paper monitoring form to enter the monitoring data in the "monitoring computer entry" form  
 Email the completed "booking computer entry" and "Monitoring computer entry" forms to MEC by the end of each month.

Please only input numbers in cells that are color coded yellow.  
 It is not required to use the paper forms, we will only use the electronic forms. However it is necessary to retain the title release signature in paper.

KEY : Provide Lookup Values

MEC-ID for your MFI is

<<MFI>> Solar

001

#### Field (loan) Officer Key

MEC-ID	Family Name	First Name	Other Names	Values as assigned by MFI		Status
				ID of Field Officer	Branch name or ID	
001						
002						
003						
004						
005						
006						
007						
008						
009						
010						
011						
012						
013						
014						
015						
016						

add rows as necessary



