MercyCorps

Household Energy Market Assessment

An assessment of household energy use and supply in Mandalay, Chin and Rakhine States, Myanmar







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1.0 Introduction

1.1 Purpose of Document

This document summarizes the key findings from Mercy Corps' recent energy poverty and market assessment in Myanmar. The assessment was conducted to gather evidence on the existing household energy use patterns and energy market dynamics in Mercy Corps target regions in order to influence the design and development of future energy programs. The assessment was also designed to gather and disseminate market information for private sector actors who are interested in creating and/or expanding operations in this sector.

1.2 Background

Mercy Corps is an international, non-governmental humanitarian relief and development agency with headquarters in the UK and USA. With current operations in 40 countries reaching close to 20 million beneficiaries, the agency exists to alleviate suffering, poverty and oppression by helping people build secure, productive and just communities. Mercy Corps' work emphasizes community-led, market-driven interventions through public, private and civic sector partnerships.

Since 2008, Mercy Corps has worked in Myanmar to support community recovery, increase economic opportunity and food security, improve public health and strengthen civil society networks. Mercy Corps is the lead agency for the Livelihoods and Food Security Trust Fund (LIFT) programming in Ayeyarwaddy Delta. Beyond the Delta, Mercy Corps is working with LIFT in food security in the dry zone and in Chin and Rakhine States, also with a sustainable approach that incorporates market incentives and protection of environmental resources. In March 2010, Mercy Corps began implementing an Energy Poverty program in the Ayeyarwady Delta region to promote widespread use of fuel-efficient stoves and social reforestation strategies to achieve sustainable reductions in household poverty and reversals in deforestation using a civil society driven and market-led approach.

Mercy Corps sees access to reliable, clean and affordable energy as a key building block for sustainable development, and energy poverty as a significant barrier to broader development efforts. Globally, Mercy Corps has substantial experience in implementing programs that look to address energy poverty, with a focus on developing robust market systems to enable the dissemination of appropriate clean energy products targeted at households, communities, and small to medium sized enterprises (SMEs) on a sustainable basis. Mercy Corps currently implements energy poverty programs worth over $8 million in six countries, including Uganda, Myanmar, Indonesia, Timor-Leste, DRC, and Haiti.

1.3 Context

Access to electricity varies significantly throughout Myanmar. The national grid has an installed capacity of 1.7 Gigawatts and currently serves 220 of the 396 main towns and just 7000 of the 64,000 villages, translating to

approximately 26% of the population. Figures from 2008[1] show 46% of this electricity stems from hydropower, much of which is seasonal in performance resulting in limited and unreliable supply throughout dry months of the year, and leaving those connected to the grid energy insecure and seeking alternative sources of light. This water scarcity will continue to be exasperated as rising temperatures endure and already vulnerable countries such as Myanmar continue to be highly impacted.

The vast majority of rural households and a significant proportion of urban and peri-urban households rely on biomass—largely firewood and charcoal— to meet cooking needs. This demand for fuel applies substantial pressure on forest resources, degrading land and reducing productivity with consequences for food security and livelihoods. Despite being home to Asia's most extensive tropical forest ecosystems and an impressive array of forest types, all of these forest systems are considered to be under major threat from a combination of commercial logging and gathering of firewood where local biomass collection outstrips regrowth of natural resources[2].

At the national level there is very little information available on the use of or access to clean energy products such as fuel efficient stoves (FES), solar lanterns, or village level mini-grids. A small number of NGOs and development entities, both national and international, have been active in the dissemination of FESs over the years, including the United Nations Development Program (UNDP). However these efforts have not used a market approach and therefore have not succeeded in stimulating large scale markets for quality FESs.

Solar technology for household use is available in urban areas across Myanmar, however high import tariffs have limited scale and much of the technology arrives informally into local markets and is often of inferior quality due to lack of quality control or regulation. At the international level, a range of high quality, affordable integrated solar lanterns are beginning to penetrate developing markets and have the potential to provide an effective solution to household lighting that is cleaner and more economic over the long term. Currently only one of these suppliers (D.Light) is importing products into Myanmar and is just in the start-up stage with effective distribution systems yet to be created.

The limited grid penetration into rural areas of the country has encouraged some groups to investigate the potential for localized electricity generation and distribution through mini-grids. The Environmental Conservation and Community Development Initiative (ECCDI), a Yangon based NGO, has been leading efforts to experiment with technology available within the country, including biomass gasifers and solar photo voltaic (PV). A few projects are currently in operation, and aim to generate initial lessons on feasibility of the technology and potential business models that can be applied successfully in Myanmar.

[1] Myanmar Electric Power Enterprise, 2008
[2] *Burma's Environment: People, Problems, Policies*. BEWG, 2011

2.0 Methodology

This assessment was carried out during June and July 2012 by Mercy Corps staff and supported by local partners. The assessment focused on a particular township in each of the states of interest, Pyawbwe Township in Mandalay State, Tonzang Township in Chin State, and Mrauk U Township in Rakhine State. These townships are located in regions where Mercy Corps or local partners are already active, and each provides representative insight to larger areas of rural populations whose households are mostly dependent on agriculture.

Demand side information was gathered through in-person household interviews conducted in the local language, and in villages of varying sizes and distance from the main town centers. In total, 610 households were interviewed, 200 in Pyawbwe, 210 in Tonzang, and 200 in Mrauk U. Concurrently, information on the supply side of the existing energy market was gathered by the Mercy Corps team using a market mapping technique, supplemented by interviews with key actors.

As with any information gathering exercise, a number of challenges were encountered by the Mercy Corps team. Limitations to movement and permission to collect data meant the surveys were conducted in a smaller area than originally planned, with the inability to collect data from households in the town centers. The latter posed a particular limitation. Lack of access for Mercy Corps staff leading the assessment to Chin State also meant that focus groups and interviews with supply side players could only be conducted in Pyawbwe.

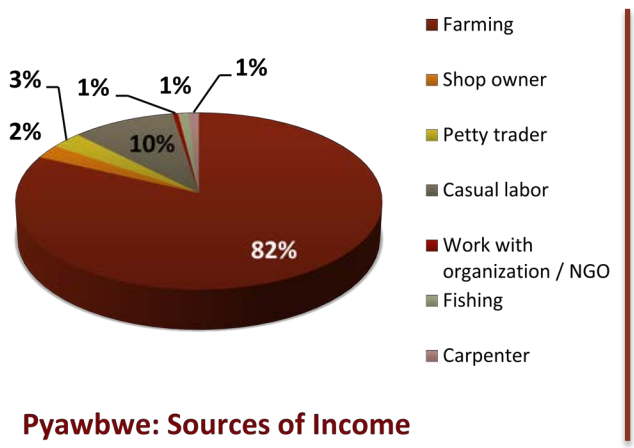
Gathering income data from rural household's reliant on agriculture is notoriously difficult given the seasonal variations and general lack of consistency. The assessment attempted to overcome this by asking respondents to estimate expenses in the previous month as a proxy. The figure is considered easier to estimate. It is acknowledged that this may not create a complete picture of household wealth, but the figures are sufficient and can be used as a guide to estimate potential demand through these regions of Myanmar.

3.0 Mandalay Region Assessment – Pyawbwe Township

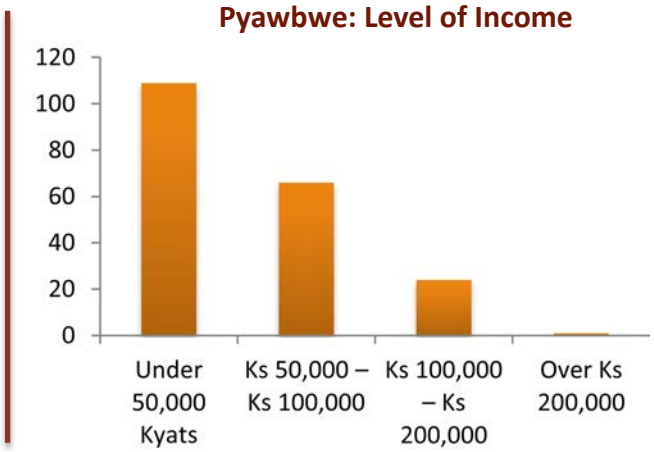
3.1 Demand Side Analysis

This section outlines the results of the household energy use survey in the Pyawbwe Township of Mandalay Region. The analysis reflects tremendous opportunity to have FESs and solar lanterns penetrate the market, largely due to the healthy level of awareness and interest in these products. The study indicates that there are significant cost-benefit opportunities for this predominately agriculture based township if more robust markets were established. However, market support functions are very limited, with access to finance for consumers a real barrier.

3.1.1 Household Wealth and Income Activities



Pyawbwe: Sources of Income

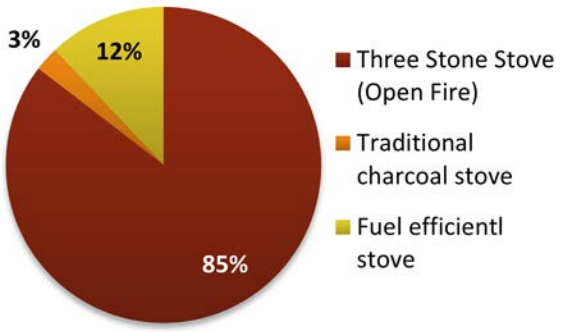


Pyawbwe: Level of Income

The results from Pyawbwe show that agriculture is the dominant source of income for rural households in the region, with ***82% deriving their household income from cash crops***. The remaining primary income source is casual labor, which provides for 10% of households. Traders of various forms made up just 6%, however this figure would be significantly higher for urban areas.

As explained in the methodology, the survey used expenditure as a proxy for income. According to this method, ***52% of all rural households fall into the bottom wealth bracket as defined by the survey, with monthly expenditure under Ks50,000 (US$59***). 37% fall into the next bracket, which means a total of 89% of households spend less than Ks100,000 (US$118) each month. Assuming an average household size of five, this is significantly below the international poverty line of US$1.25 a day per person. Just ***13% of households belong to any sort of savings group*** and almost no households claimed any cash savings at the time of the survey.

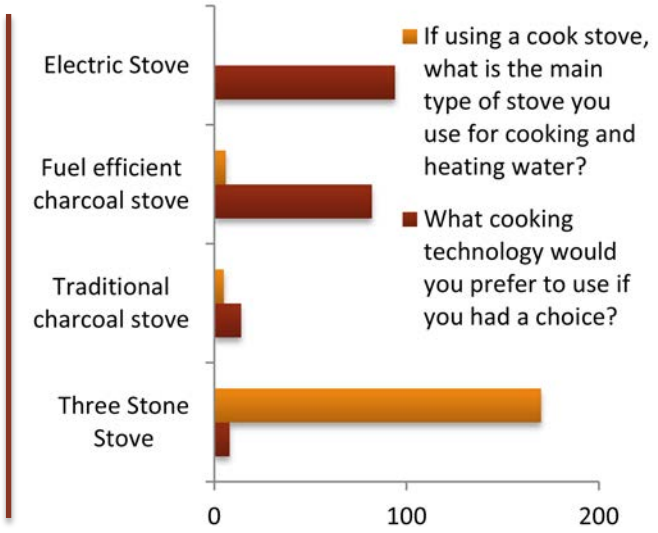
3.1.2 Cooking Habits



All rural households surveyed rely on biomass as the primary cooking fuel, with the vast majority relying on firewood. Observations in urban areas confirmed that almost all households also use biomass with very little Liquefied Petroleum Gas (LPG) or electricity being used for cooking. Although charcoal making is illegal, charcoal is far more prevalent in urban areas. The proportion of households using it is unknown. The use of natural gas or electricity for cooking appears to be rare. ***12% of households currently use a form of FES***, most of which are locally made clay stoves which burn either firewood or charcoal. ***The vast majority (85%) primarily cook on open fires***. Charcoal appears to represent an aspirational cooking fuel, with 44% of households identifying it as their preferred cooking method.

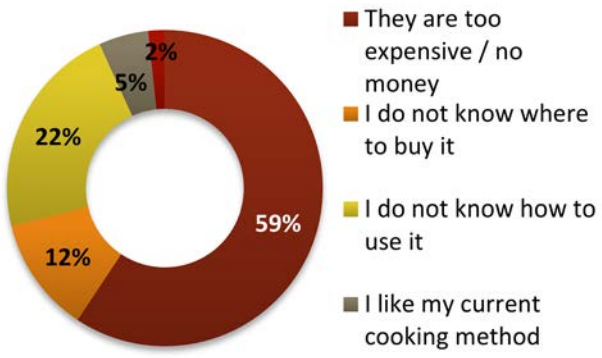
The vast majority of households (***91%) collect firewood on a regular basis*** and the remaining 9% purchase fuel (either firewood or charcoal for use in their stove of choice). Unlike other areas of the country, the bulk of the firewood collection in this region is done by adult males, with ***each trip taking an average of 160 minutes***. Focus group discussions in villages in Pyawbwe township suggested that on average household collects wood twice a week. It can be estimated that the average household spends 272 hours a year (11.5 days) collecting firewood.

Fuel Efficient Stoves



Although only used by 12% of households, FESs are reasonably well known with a third of respondents aware of them and ***80% of these saying FESs are available locally***. Of those participants that were familiar with FESs, ***41% would prefer to use FESs as their primary cooking method if they had a choice, and another 47% would prefer to use an electric stove, with a mere 4% selecting a three stone stove as their preferred method of cooking***. This data suggests that a market does exist, and, there is opportunity to continue to expand the market through additional market promotion and outreach. A large amount of the existing knowledge has come from NGOs and non-market forces; 54% of those familiar with FESs first heard about them through NGOs, the remainder have seen them in stores or learned of them through word of mouth. The relatively high penetration of information regarding FESs means that other barriers to purchasing exist.

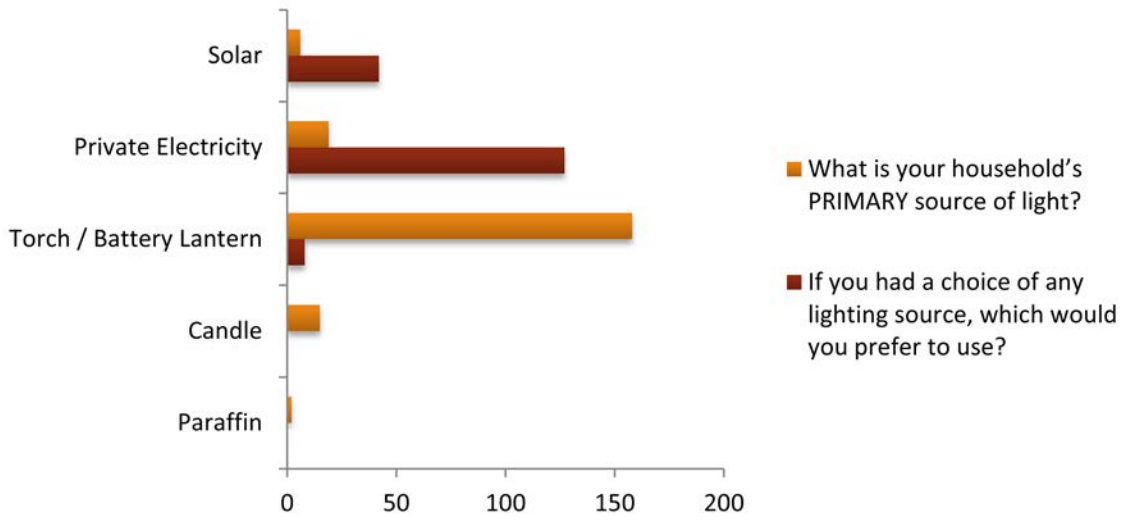
Though 67% of respondents familiar with FESs have considered purchasing one, many ***(59%) have not followed through claiming either the high price or lack of money as the reason for not investing***. However, the average price paid by FES owners is Ks1850 (US$2.18) which is estimated to be around ***3.1% of monthly household expenditure*** according to the data gathered. A further 34% cited a lack of knowledge over how to use them or where to get them, with just 5% claiming a preference of existing cooking methods. Again, this reflects the critical need for additional market awareness of cost savings and benefits of FESs.



Why have households not purchased an FES despite it being their preferred method if they had a choice?

3.1.3 Lighting Use

Household lighting is dominated by either torches or lanterns, both fueled by batteries purchased in town or sold by mobile traders. Candles and private electricity are the other common sources of lighting, with solar only penetrating a small number of households. ***Almost all households spend money on lighting, 72% spend Ks500 or less each week.***



The ***most common aspirational sources of lighting are grid electricity (70%) and solar (25%),*** demonstrating that awareness around advanced energy sources is high even in remote rural areas. A comparative analysis of wealth and primary lighting source shows very little variation among wealth bracket. Battery powered torches and lanterns provide lighting for the majority in each bracket, and even electricity is seen in the lower group. When asked to identify the main limitations of the current lighting method, ***lighting the way at night was identified as the biggest challenge by 85% of households, and homework by 35%***.

- 71% of respondents have heard of solar lanterns
- 29% say they are available commercially
- 8% of households own a solar lantern

Knowledge of solar lanterns has reached the rural areas of Pyawbwe, although it is not clear if a distinction is made between integrated solar units and large panels that people take batteries to for charging. ***71% claimed to be familiar with solar technology, and 29% of these have seen them in shops in the town cente***r. 70% have not seen them in shops but heard about them through family and community members, demonstrating that word of mouth is currently the major channel for product information.

Of those familiar with the products, ***73% have considered purchasing a solar lantern for their household***, data on reasons for not purchasing was not effectively gathered. This reflects the potential for a robust local market. A small but significant proportion of respondents (20%) have heard solar lanterns are unreliable and break too easily, indicating some penetration of low quality products into the market and the need for quality assurance throughout the supply chain.

3.2 Supply Side Analysis

Mandalay Region is located at the heart of the country and is relatively well served in terms of transportation. The major road from Yangon to Mandalay city provides a reliable link to commercial activity, giving township economies access to a good variety of goods and services. However, roads between townships off the main routes and the villages surrounding them are very poor, limiting the penetration of supply lines outside the main arteries. This section summarizes existing supply side activities for clean energy products in the township.

3.2.1 FES Market

The market mapping exercise located 3 retailers in Pyawbwe Township supplying FESs. Two of these retailers stock the same models that were bought from a village in Tharzi Township to the east of Pyawbwe. The final retailer made and sold a model of their own. The following table summarizes the stoves currently available.

Stove Model	Manufacturer	Distribution System	Costs and Pricing
Fired clay stove model, designed for either firewood or charcoal. Design untested for fuel savings.	4 manufacturers in Tharzi Township, each with a production capacity of 140 per week. Total production of 2200 a month.	Sold to distributors who collect from factory and deliver to retailers in townships across the state. No marketing or promotional activities are invested in.	Unit cost is Ks2500 plus labor. Sold to distributor at Ks800, and retailers Ks1100. Retailer price = Ks1500 (US$1.76)
Same design as above but with a sheet metal surrounding to add strength. Design untested for fuel savings.	As above, although production figures not currently known.	As above, although the design is new and distribution is only just beginning.	Unit cost is Ks1450 plus labor. Retailer price = Ks4000 (US$4.70)
Concrete charcoal burning stove with metal sheeting cover. Available in 2 sizes, both untested for fuel savings.	Single hardware store owning family in Pyawbwe Township. Capacity to produce 300 a month.	Made and sold by the same family through their own hardware shop. There is no investment in marketing or promotional activities.	Unit Costs Ks1000/ 1500 Retail price Ks2500/ 4000

The market mapping and follow-up interviews with market actors identified the Tharzi Township as a hub of FES knowledge and supply. These manufacturers were developed 15 – 20 years ago through a Forestry Department project aimed at reducing pressure on forest resources by spreading the use of FESs. The ongoing presence of four manufacturers in the township demonstrates a level of success; however production capacities remain small with each producer relying on manual labor for each stage of the production process. Each manufacturer demonstrated ambition to move towards a mechanized system that would support mass production, but highlighted the range of economic, governmental, and structural constraints to growth that currently exist.

Distribution channels are quite informal, with distributors purchasing products at the factory gate, and then supplying to retailers in townships across the state for a set mark-up plus a transportation fee. Credit is occasionally provided to trusted partners in the chain, although usually just for a single week. Consumer credit is not provided by retailers.

3.2.1 Lighting

Grid electricity is provided to most of the larger townships in Mandalay Region, with a small proportion of villages also benefiting, but the majority continue to lack any form of reliable electricity and continue to be energy insecure. Pyawbwe Township is served by a locally powered grid that can provide up to 2.5MW of electricity through a combination of hydropower and gas turbines. This supply is not sufficient for all households in the urban area, although data on the proportion served is not available. Grid electricity is reported to be unreliable, particularly during dry months when low water levels cannot support hydropower generation.

Beyond the urban area, this grid only extends to three of the 315 villages that fall under the Pyawbwe Township, making electric lighting extremely rare in rural areas. According to information gathered locally, none of these villages contain localized grids of any size.

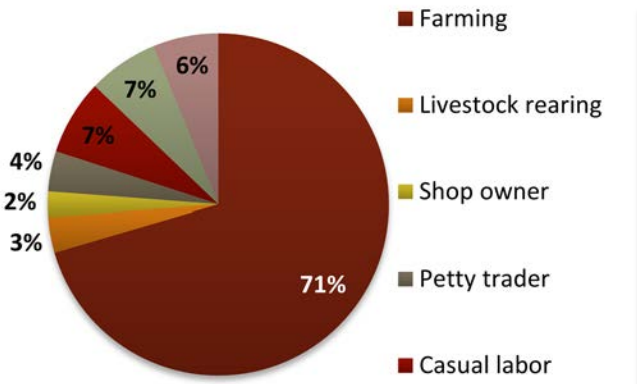
Interviews with retailers in Pyawbwe Township stocking electrical items revealed that solar panels are available on the market. Solar panels themselves are purchased in Mandalay in small numbers by retailers, who averaged selling 3 units a month to wealthier consumers who can pay cash up front. Integrated solar lanterns were not identified in any of the retail outlets, and retailers themselves were generally not familiar with the technology.

4.0 Chin State Assessment – Tonzang Township

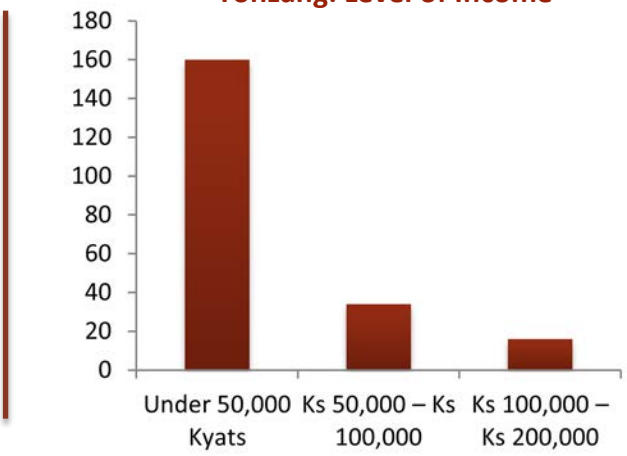
4.1 Demand Side Analysis

This section outlines the results of the household energy use survey around the Tonzang Township of Chin State. Though remote there is a high level of knowledge of FESs throughout the Township, but a minimal market to fulfill demand. Additionally, there was a high penetration of solar lanterns, with Tonzang having the highest number of consumers in the areas included in this study who relied on solar lanterns as their primary source of electricity. Again, the market is minimal, despite a strong familiarity and demand for such products.

4.1.1 Household Wealth and Income Activities



Tonzang: Source of Income

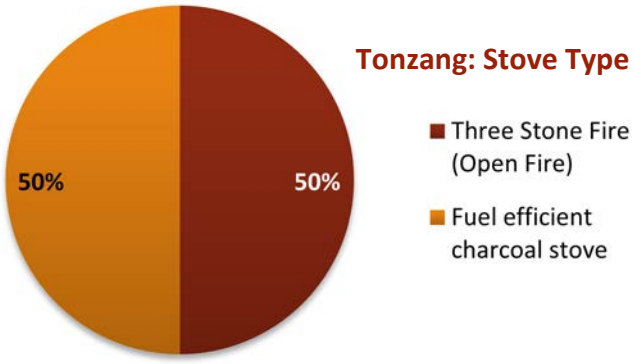


Tonzang: Level of Income

The dominant source of income across the region is agriculture, with ***71% of all respondents deriving their primary income from cash crops***. The remaining income sources are split evenly between traders and shop owners, working for NGOs or government bodies, and casual labor.

In terms of household wealth, ***43% of households fall into the bottom wealth bracket with monthly expenses of under Ks50,000 (US$59***), and 39% in the Ks50,000-100,000 (US$59 – US$118) bracket, meaning 82% of households spend less than US$118 each month. This again is significantly below the international poverty line. **35% of households in the region have cash savings**, the vast majority of which is held in local savings groups. This is unusually high for the income level and may be a result of local government programming.

4.1.2 Cooking Habits



Consistent with the remote and rural nature of Chin State as a region, ***100% of households rely on biomass*** as the sole cooking and heating fuel. ***50% of all households cook over open fires and the other 50% use some form of purpose-built FES cooking stove***. The stoves are either common metallic charcoal (which offer no fuel efficiency) or a version of the clay stoves designed locally for fuel efficiency. Unlike traditional three stone stoves, the FESs depend on charcoal, and no wood burning stoves seem to exists.

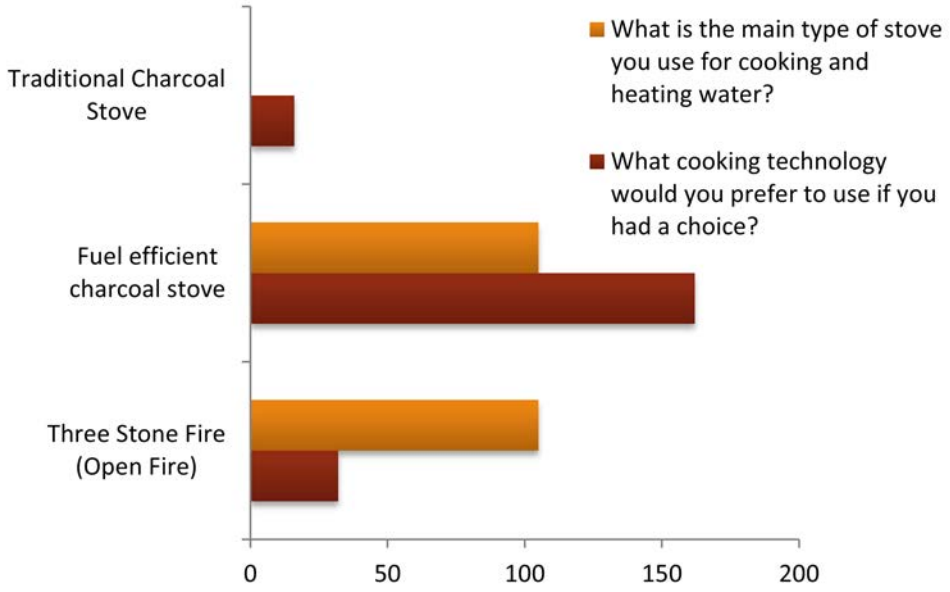
The primary cooking methods were analyzed against the monthly expenditure results to see whether household wealth is a determinant of primary cooking method. The results remained very consistent across the income groups identified above, suggesting that wealth does not directly lead to particular choices in cooking method.

- 100% of households collect firewood
- Women responsible for collection in 58% of households
- Average time taken to collect wood per year = 217 hours

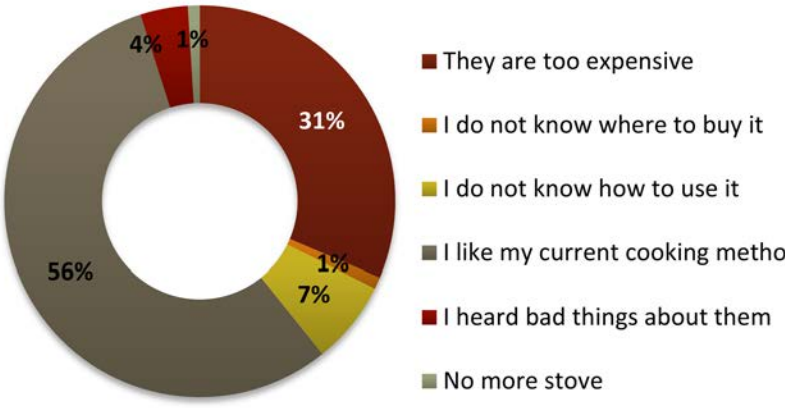
Despite 25% of households claiming to use a charcoal cook stove as their primary cooking method, ***100% of households claim to collect firewood,*** indicating that all households burn firewood at some point. This inconsistency is likely to mean households who use charcoal fall back on firewood and three stone fires when lacking resources to purchase charcoal or when not made available. The responsibility for collecting firewood is largely absorbed by adults in the household, with household ***women collecting 58% and men 37% of the time***. The average time taken to collect firewood was estimated at 125 minutes per trip. It was not possible to get a clear idea on the average number of trips, but a conservative estimate of 2 trips per week would mean each household invest ***250 minutes a week in firewood collection***. Calculated over a year, each household invests 217 hours (9 whole days), collecting fuel. This is a significant investment of time.

Fuel Efficient Stoves

Awareness of Fuel efficient stoves (FESs) exists among households in Tonzang; ***66% of respondents had heard of them and 26% currently own a stove they describe as fuel efficient***. These figures are high compared to the apparent lack of local availability, shown by the very small number of respondents with stoves available for sale in their community. Rather than from local markets, knowledge of FESs is arriving in the community via NGOs or people crossing the border to India, and is being passed around the community through word of mouth. ***38% of households had learned about FESs from NGOs***, 9% direct from India, and 48% from members of the community. These results provide a picture of a market lacking formalized commercial systems, reliant instead on informal systems and information channels – specifically word of mouth.



An analysis of FES owners indicates that wealth is a limiting factor for the local FES market, but it is unlikely to be the only barrier. There is a small correlation between wealth and likelihood to own a FES, with slightly higher proportions of households in the higher expenditure groups owning FESs, however no pattern is seen between the existence of cash savings and FES ownership. Of those households without a FES, 31% have considered purchasing one and highlight expense as the major barrier.



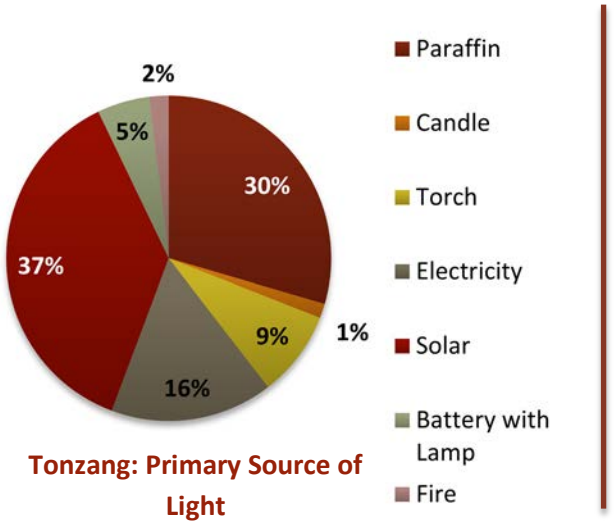
Why have households not purchased an FES despite it being their preferred method of they had a choice?

The majority of the FESs currently being used in Tonzang were provided for free by NGOs. The remaining stoves were either homemade with mud or purchased from India. The price of purchased stoves ranged from Ks1500 – Ks4500 (US$1.76 – US$5.29). Overall satisfaction with FESs among households is very high, with 92% claiming they were motivated by reduced fuel use, and 94% indicating they are very or somewhat satisfied with its performance. Health impacts appear to be very insignificant drivers of decisions around using FESs for cooking, with just 3% of owners stating health was a motivating factor.

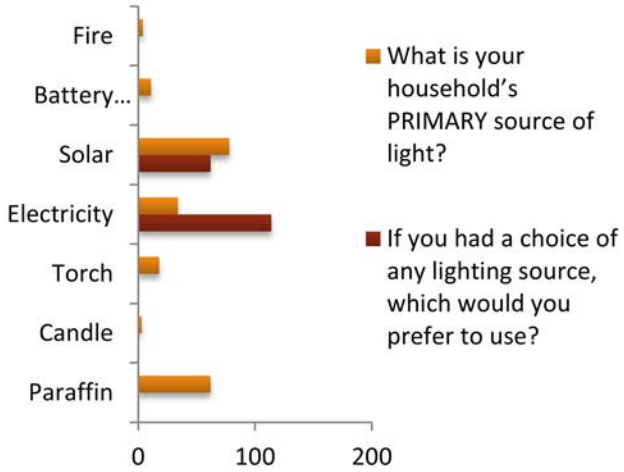
4.1.3 Lighting Use

Household lighting is obtained from a variety of sources in Tonzang Township. Survey results show that solar is the most common, with 37% of households using solar power (a combination of households with panels and

rechargeable batteries that are taken to solar charging stations). 30% of households purchase paraffin and 14% rely on battery powered lights. 16% of respondents claimed to use grid-electricity, which is supplied to certain villages in the region via hydro-powered mini-grids.



Tonzang: Primary Source of Light



Comparative analysis of wealth indicators show relative wealth to be correlated with lighting use, with households in the lower bracket more likely to use paraffin or battery torches, and those in the higher brackets using electricity or solar. The two main activities identified as being restricted by existing lighting use were homework (58%) and lighting the way at night (64%).

Solar lanterns are well known in the region, with over half of respondents claiming to be familiar with them, 80% of which heard about them from community members or have seen solar lanterns in the village. It is clear the products are not available on the local market. The lanterns that have penetrated the market appear to be of good quality, with 79% agreeing with the statement that lanterns are durable and reliable.

4.2 Supply Side Analysis

The remote nature of Chin State, and particularly the northern section around Tonzang Township, makes the supply of goods from other parts of Myanmar very difficult. However, proximity to the Indian border and the steady flow of migrant workers crossing into India to earn money as day laborers creates a commercial channel through which a variety of goods pass.

4.2.1 Cook Stoves

The results of the demand side market research demonstrate that commercial supply of FESs into the Tonzang Township is very limited. Only one local manufacturer was found in the region, making mud and concrete stoves on a very small scale. Sheet metal charcoal stoves are available on the market, supplied by traders bringing in goods from across the border.

NGO programs in the past have introduced low-cost or self-made mud stoves, including a UNDP effort to spread stoves through a trainer of trainer model. This effort has not been very successful in stimulating any stove making enterprises, and only a small number of household appear to have adopted the concept.

4.2.2 Lighting

Although the national grid does not extend to the majority of Chin State, grid electricity is present in some areas of Tonzang Township through local grids supported largely by hydro power which is abundant in this mountainous region. The table below summarizes the information gathered on existing grid capacity.

Category	Diesel Generators		Hydro Power		# Households
	# Generators	*Installed Capacity*	*# Stations*	*Installed Capacity*	
(Sub) Township	2	180 kW	2	400 kW	Unknown
Villages	-	-	15	67 kW	589

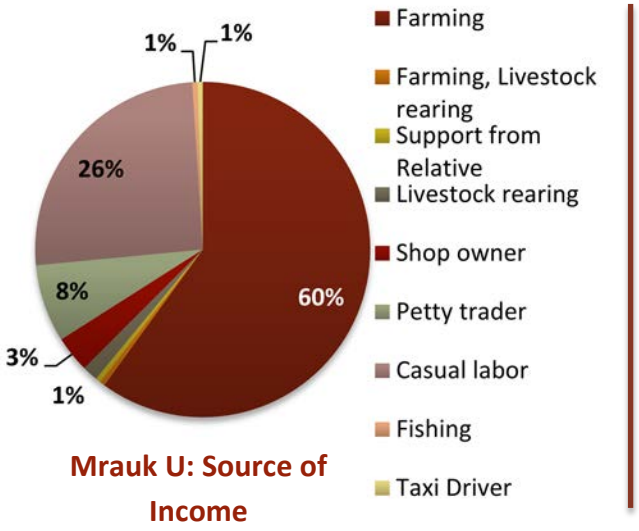
Tonzang Township has two relatively large hydropower stations which provide power for a set number of hours each day depending on available power. The number of households served is unknown. 15 villages have very small, dedicated systems serving an average of 40 households. Hydropower is typically available 8 months a year, with stream flow inadequate during summer months. These village systems are owned and operated by village committees and households pay a monthly fee of Ks 500 – 1000 for the service.

Significant proportions of households in the region were found to have access to solar energy, and solar panels are available in the local commercial sector. A total of four retailers regularly stocked solar panels in the region, two in Tonzang and two in sub-townships, stocking two large panel models made by Tata and sourced from India. Retailers purchase a small number of panels at a time from across the border and do not have formal supply systems. Many of these panels are sold to small businesses that set up battery charging stations for battery lanterns. Integrated solar lanterns are not available on the market in Tonzang.

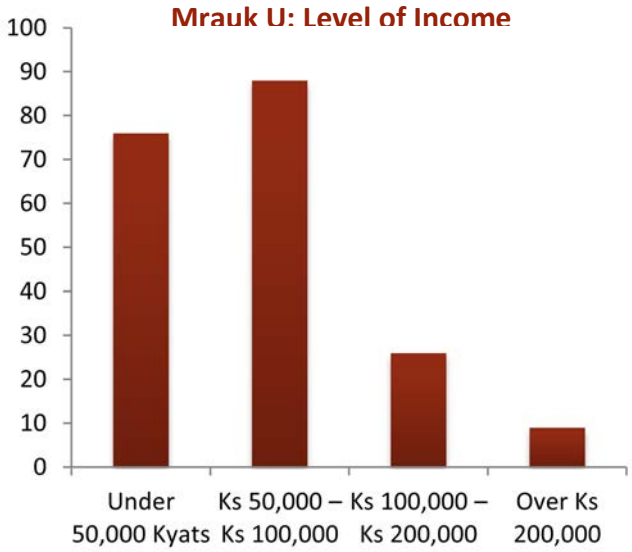
5.0 Rakhine State Assessment – Mrauk U Township

This section outlines the results of the household energy use survey in the Mrauk U Township of Rakhine State. The study reveals that this township has the strongest level of market penetration and future growth for FESs. This could be connected to past NGO efforts, which seemed to be successful in raising awareness of the benefits of FESs, but did not put the market systems in place to fulfill ongoing consumer demand once NGO efforts terminated. Lighting is dominated by battery powered lamps and some electricity. There is little penetration of solar in the township, but presents a huge opportunity for growth as the households of Rakhine have adopted other sustainably conscious methods such as the FESs.

5.1 Demand Side Analysis



Mrauk U: Source of Income



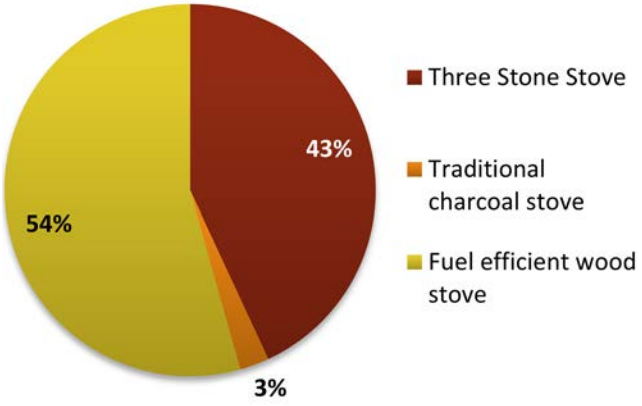
Mrauk U: Level of Income

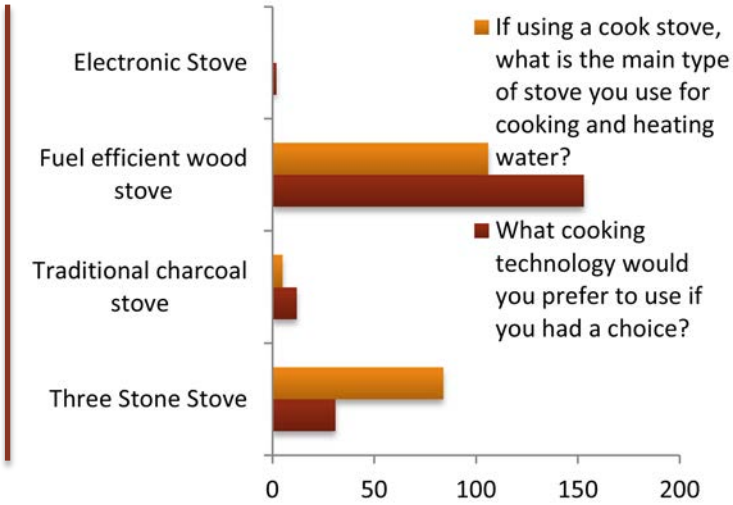
As was the case in the more rural Townships of Pyawbwe and Tonzang, the agriculture sector provides the dominant source of income for rural households in the region, with ***60% of households earning their income from cash crops.*** It should be noted that though it was where majority of households received their income, it was a somewhat significant lower percentage than the other two townships (22% lower than Pyawbwe and 11% lower than Tonzang). Casual labor follows as the second most prominent source of income at 26%.

38% of households fall into the bottom wealth bracket as defined by this survey, with monthly expenses at Ks50,000 (US$59). 44% fall into the next wealth bracket--between Ks50,000 (US$59) and Ks100,000 (US$118)--meaning that 82% of households in the Mrauk U region spend less than US$118 a month. Despite higher average expendable incomes than Pywabwe and Tonzang Townships, this is still significantly below the poverty line.

5.1.2 Cooking Habits

Mrauk U: Stove Type





98% of rural households depend on firewood as the primary cooking fuel. ***54% of households currently own and are using a FES*** and another ***43% are using a three stone stove***, with a very small minority using charcoal stoves. ***75% of respondents identified FES as their preferred method of cooking*** if given a choice. The high level of consumer awareness of FES could be attributed to the significant use and demand of FESs throughout the township compared to Pyawbwe and Tonzang. The high demand for FESs reflects a strong potential for a robust market within Mrauk U Township.

65% of households collect firewood. The adults in the household are responsible for the majority of firewood collection in the household. **91% of the male and/or female adults collect firewood.** The ***average time that it takes an individual to collect firewood is 240 minutes.*** Mercy Corps was unable to get a clear idea of how many trips an individual took per week, but a conservative calculation of two trips per week estimates that each household invests 416 hours (approximately 17 days) in the collection of firewood. This is extremely burdensome and significantly encroaches into other economic livelihood activities.

Fuel Efficient Stoves (FES)

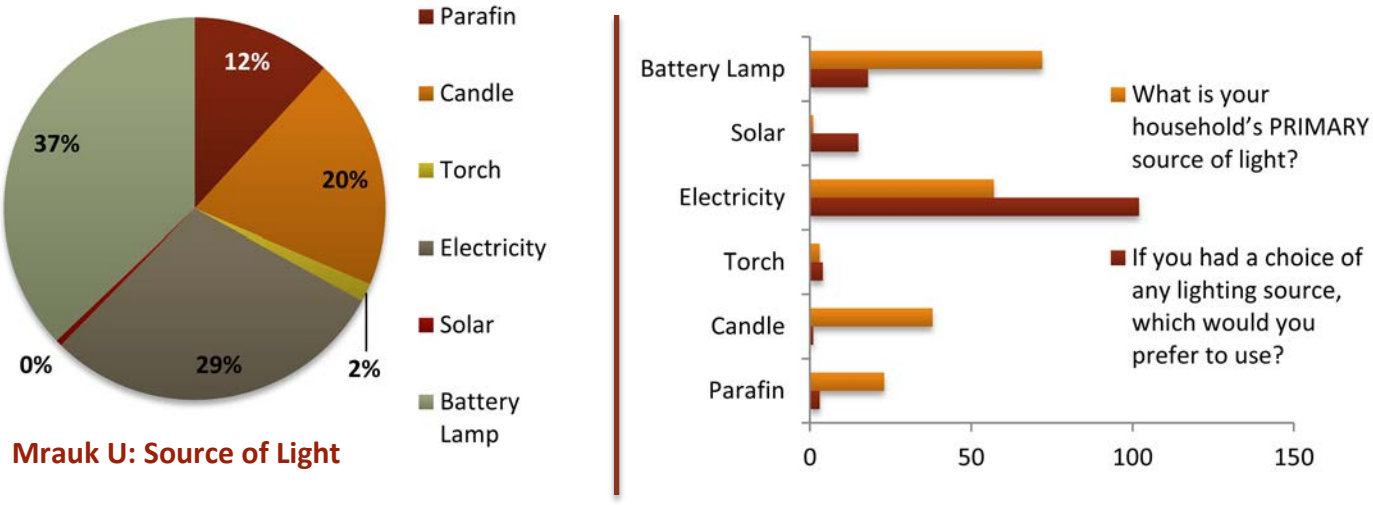
There is an extremely high awareness of FESs in the region; ***88% of households are aware of FESs, 50% of households own FESs***, and as mentioned previously 75% of households would prefer FESs as the main source of cooking. There is a positive correlation between those with higher incomes and those owning an FES. ***36% of those that had not purchased an FES identified the lack of funds available as the primary prohibitive reason***. Another 19% responded that they high price of FESs present a barrier to ownership, and 21% preferred their current method of cooking.

- The average cost of purchased of FESs is Ks1,670 (US1.93)
- The average cost of an FES is 2.5% of average monthly expenditure
- 100% of households are satisfied with their FES

The price of a FESs averages from Ks1500-1800 which is estimated to be around ***2.5% of monthly expenditure***. These statistics reveal that even though there is high demand for FES, there are still several types of barriers that lead to a household from purchasing an FES including further community outreach and education of the cost benefit analysis of FESs throughout the Mrauk U Township.

Virtually all (99%) of FESs that were purchased locally were mud stoves that the household had paid the only local manufacturer to make. ***84% have experienced no problems with their FESs***. The 100% satisfaction with FESs signifies that the locally available stoves are of good quality and probably indicates some significant fuel-use reduction. ***50% of households purchased their FES because of the significant reduction in fuel usage*** with only 12% of respondents purchasing an FES because it produces less smoke. Again, this signifies that awareness of the benefits of FESs is lacking among local communities, specifically about the health benefits that come from using FESs.

5.1.3 Lighting Use



Mrauk U: Source of Light

Household lighting in Mrauk U Township is generated by three main sources: Battery powered lantern (36%), grid and/or generator generated electricity (29%), and candle (19%). Of those surveyed, 71% would prefer to have electricity as their main source of lighting if given the choice, and 10% would prefer solar power. 74% of households identified not being able to complete homework and/or having light at night as the biggest challenges to not having accesses to reliable electricity.

Solar Lanterns

- 78% of respondents had seen or heard of solar lanterns
- 75% of households have considered purchasing a solar lantern
- 98% of respondents knew that solar lanterns were available locally for purchase

Households throughout the region are very aware of solar lanterns, with 78% of respondents saying that they are familiar with solar lanterns by word of mouth or by knowing that the lanterns are available for purchase locally. However, the market analysis did not reveal any local suppliers of solar lanterns, and this is reflected by the fact that only 2% of households actually use solar lanterns. It is not clear how these lanterns were obtained.

5.2 Supply Side Analysis

Unfortunately, due to restrictions on travel throughout the Rakhine State, Mercy Corps was unable to conduct an in depth supply side assessment at this time. However, the initial assessment indicates strong opportunity to establish a strong market for FESs and solar lanterns.

5.2.1 Cook Stoves

According to the initial market mapping undertaken, there is only one retailer throughout the whole township that makes and sells mud and concrete stoves in the township. The level of outputs is minimal and the full market potential is not being met.

The relatively high number of households currently owning FESs appears to be result of a push by the United Nations Development Program to introduce FESs to the region. Unfortunately this project does not seem to have built any sustainable market systems that could continue to fulfill consumer demand once the campaign ended.

5.2.2. Lighting

Though 29% of households get their light from electricity, it is unclear what the source of that electricity is. Further assessment would need to be conducted, in order to see if there is potential for extension of localized or the national grid. Despite that, a substantial percentage of households are already using part of their consumer spending power to purchase batteries for battery powered lanterns.

It was noted that there was one supplier in the region supplying solar panels 3 or 4 at a time to retailers originating from India, but the data did not reveal who is exactly purchasing these systems. This may not be a popular source of energy due to the high price relative to the average population's monthly income.

6.0 Key Lessons

This section summarizes the major barriers and bottlenecks identified by the assessment that are preventing growth of robust and sustainable markets for clean energy technology, the opportunities that exist for private sector actors, and the main recommendations for intervention options for Mercy Corps and other interested parties.

6.1 Market Summary

Below is a summary of the data that Mercy Corps has collected to help guide the implementation of programs in the Townships of Pyawbwe (Mandalay Region), Tonzang (Chin State), and Mrauk U (Rakhine State).

	Fuel Efficient Stoves			Solar		
	Potential Demand	Existing Supply	Existing Market Awareness	Potential Demand	Existing Supply	Existing Market Awareness
Pyawbwe	**37% of HHs** prefer to use an FES vs 3stone fire **59% have not** purchased because of financial barriers **91% of HHs collect firewood,** spending 320 minutes / week	**3** retailers in the region who supply clay, sheet metal, or concrete stoves **Price is between** US$1.76 and US$4.70	**12% of** HHs own an FES **31% of** HHs know of FESs **80% of** HHs say they are available locally	**25% of HHs** would prefer to have solar as their main source of lighting **73% of HHs** have considered purchasing solar lanterns **72% of HHs** purchase lighting fuel each week	**None** for solar lanterns. **Small supply** of solar panels available	**8% of** HHs own a solar lantern **71% of** respondents have heard of solar lanterns **29% o**f respondents know they are available locally
Tonzang	**48% of HHs** would prefer to use an FES vs 3 stone fire **31% have not** purchased because of financial barriers **100% of HHs collect firewood,** spending 250 minutes / week	**1 local manufacturer** making mud and concrete stoves **Price is between** US$1.76 and US$5.29	**26% of** HHs own an FES **66% of** households know of FESs	**35% of** HHs would prefer to have solar as their main source of lighting **80% of** HHs have considered purchasing solar lanterns **44% of HHs** regularly buy paraffin or batteries	**4 retailers** in the region supply solar panels **Tata is the** main brand, made in India	**37% of** HHs own a solar lantern **51% of** respondents have heard of solar lanterns

Mrauk U	**75% of households** would prefer to use an FES vs 3 stone fire **36% have not** purchased because of financial barriers **65% of HHs collect firewood,** spending 480 minutes / week	**1 retailer** in the region who makes mud or clay stoves **Price is between** US$1.76 and US$2.08	**54% of** households own an FES **88% of** respondents know of FESs **99% of** households say they are available locally	**10% of household** would prefer to have solar as their main source of lighting **75% of** households have considered purchasing solar lanterns **79% of HHs** regularly buy paraffin, candles or batteries	**None were** identified for solar lanterns. **One supplier** in the region for solar panels who only supplies 3 or 4 at a time	**2% of** households own a solar lantern **78% of** respondents have heard of solar lanterns

The thorough analysis has given us insight into the appropriate types of market strengthening programs to apply in each region. As seen in the table above, each region has distinct differences that absolutely need to be taken into consideration such as geographic contexts, level of awareness of the various market needs. Each region will require a market-based program that is tailored to their independent needs. Nevertheless, all regions reveal a significant suppressed demand for technologies that will lower monthly expenditures for average incomes that are already significantly below the international poverty line and will provide households with sustainable, safe, and healthy environments.

6.2 Main Barriers to Energy Market Growth

6.2.1 Demand Side

- *Knowledge and awareness:* A knowledge gap exists both on the existence of technology on the market and on the potential benefits involved – both related to FES and solar lanterns. Additionally a major knowledge gap exists regarding the potential harm of existing energy sources, particularly on the link to indoor health pollution from open fire cooking.
- *Cash savings and savings groups:* Access to cash savings is quite rare, particularly in Mandalay and Rakhine State. Membership of savings and loans groups is also uncommon; meaning the concept of repayments is new to many households.
- *Cell phone coverage:* The lack of cell phone usage limits the usefulness of solar lantern models with phone charging features that have proved popular in comparable settings.
- *NGO programming:* NGOs have been active in all townships providing community members with FESs for free. This undermines the value of the product and has probably limited the market penetration of local manufacturers. Additionally, past programming has not left behind a self-reliant and/or active market that can fulfill the demand and opportunity demonstrated in the report.

6.2.2 Supply Side

- *Market penetration:* High quality integrated solar lighting products have not penetrated the market in any location studied. FESs have penetrated the market in Mandalay, Chin and Rakhine State, but limited production capacity has created a barrier to growth and left existing demand unfulfilled.
- *Rural supply chains:* Poor transport infrastructure and very limited household cash means that supply chains for products to reach rural consumers are not developed, limiting the potential of capitalizing on existing channels.
- *New business models:* The undeveloped energy market means there is a lack of tried and tested business models that would encourage local investment and entrepreneurship. Existing private actors lack business training or acumen required to develop efficient business models.
- *Consumer and supply chain credit:* Low household resources means solar products are beyond the cash savings of most households. Informal supply chains for solar technology means credit is not embedded into systems and retailers are not accustomed to provide it.

6.3 Opportunities for Energy Market Growth

- *Current energy investment:* Existing sources of fuel for both cooking and lighting are a significant drain on household resources. Although it is clear that households are willing to pay for batteries or other lighting sources, the exact amount could not be gathered. It is likely to be enough to create a relatively short pay-back period for investment in solar lighting or potentially for mini-grid connection, allowing for clear economic arguments to be made. Although not covered by the assessment, charcoal was observed to be a major cooking fuel in townships. Unlike firewood, charcoal is not free and therefore fuel efficiency can have more clear direct monetary benefits for households.
- *Existing stove production:* Stove production in Mandalay Region is mature, but limited, with good quality models available at prices affordable for most households, providing a solid foundation for increasing production and market penetration.
- *Mini-grid success:* Village level mini-grids are operational in a number of villages in Chin State and appear to be operating sustainably, offering a great learning platform and the opportunity to develop business models appropriate for other locations.

6.3 Recommendations for Intervention

The objective of any intervention focused on alleviating energy poverty in Myanmar should be the development of an efficient market system capable of providing energy products and services to rural and peri-urban households. Market systems, as opposed to direct service provision by an intervening entity, are self-reinforcing and therefore sustainable, and support the continuous growth in energy demand associated with development.

These intervention recommendations are targeted at the bottlenecks and barriers that have been found in the existing market system. The results from the assessments in three townships in three distinct regions of the country demonstrate that market dynamics vary significantly from place to place, and therefore precise interventions will differ according to the relevant needs and opportunities of each location. However, activities will very likely fall under certain broad intervention areas.

Building Awareness through Social Marketing- Though a potent market for clean energy products does exist within the three regions assessed, consumers not only lack access to the product but awareness of the many benefits of adopting solar lanterns or FESs. Working to crowd-in suppliers is only one part of the equation; it will also be important to stimulate demand. Mercy Corps can catalyze demand and effectively disseminate information about the benefits of adopting various technologies through active community engagement strategies. This communication strategy will be interdisciplinary in approach and cut across the sectors of energy, forestry, gender, health, and climate change.

A nuanced approach to demand-pull is required. The gathered data demonstrates that some market segments will respond to messaging that targets the monetary benefits of fuel-savings. Other market segments, however, will require messaging targeted to the health benefits of FES adoption. This type of marketing should be pursued by suppliers themselves; however the actors relevant to this market do not have the resources or capacity to reach sufficient proportions of the market. Mercy Corps can play a valuable role in producing and disseminating general social messaging as well as pulling together private actors and facilitating coordinated action in order to maximize the impact of the limited marketing each actor is capable of investing in.

Facilitate Access to Finance- Limited financial resources inhibit the activities of all actors along the value chain. Though credit does exist within the value chain itself, it is only available for a small minority of actors. Manufacturers are unable to access the capital they need to grow their businesses to scale. Distributors and retailers are unable to access the capital required to build inventory and to expand their consumer base. Consumers are unable to pay for products in a single purchase.

Mercy Corps can accelerate the process by facilitating access to finance along the value chain by working with relevant actors to design innovative business financing schemes that reduce barriers to product availability, and catalyzing consumer demand. With respect to consumer finance, Mercy Corps can assist communities to develop support groups that could make bulk purchases and manage installment payments. Furthermore, Mercy Corps can identify micro-lenders with the capacity to take on the distributor role and connect them with product suppliers to help promote the product among members, and work with suppliers and distributors to help them to design and experiment with flexible financing options.

Strengthen Business Acumen- Developing retailer, distributor and supplier capacity to design innovative models and to manage successful businesses will improve access and adoption of clean energy products. Mercy Corps can lead capacity building for key stakeholders such as business support services, which would have a wide and longer-lasting impact on business skills for this and other business sectors. This training would focus on product knowledge, sales techniques, business management skills on distribution within rural areas.

Identify Commercial Models for Village Electrification- This study has identified an opportunity for the development of village level mini-grid schemes. Mercy Corps can play a valuable role analyzing existing business models and best practices being employed in Chin State and elsewhere, and work closely with community members and interested private actors in other locations to adapt these models to different locations and technologies. It is critical that any intervention includes a stakeholder such as Mercy Corps, to spur development and testing of commercial business models, identifying successful approaches and disseminating results to stimulate private sector activity, and establish a robust and sustainable local market that is inherently self-reliant.

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