Switching from candles to solar energy for lighting: A gender perspective

Energy Briefing Paper

This briefing paper, based on primary research conducted in rural Chin State in Myanmar, explores the economics of candle use in rural areas and the non-economic incentives for women and men to switch to electric sources of lighting such as solar energy.

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Introduction

According to the latest census, 26% of households in rural areas of Myanmar relied on candles for lighting in 2014.[1] Candles are an expensive and often dangerous source of lighting.[2] Switching from candles to solar energy systems for lighting can provide a safer, higher quality and a cheaper source of lighting.

Methodology

The aim of this paper is to improve understanding of the economics of candle use in rural areas and the economic and non-economic incentives for switching to electric sources of lighting such as solar energy. The findings are based on primary research conducted in rural villages in Kanpetlet Township, Chin State. Data was collected from 10 workshops as well as interviews with shopkeepers and civil society organisations. In total, 155 people from 5 villages participated in the workshops. Separate workshops were held for men and women. An economic model was then developed to compare the economics of candles and solar energy, using information from the workshops to validate the input parameters.

Household spending on candles

Of the households that participated in the workshops, 65% had already switched from candles to solar energy for lighting. Nevertheless, households with solar panels often used candles as a backup and there were many households that still only used candles and pinewood for lighting. Workshop participants were asked to estimate their monthly household spending on candles. Figure 1 shows the results.

Figure 1: Household spending on candles per month

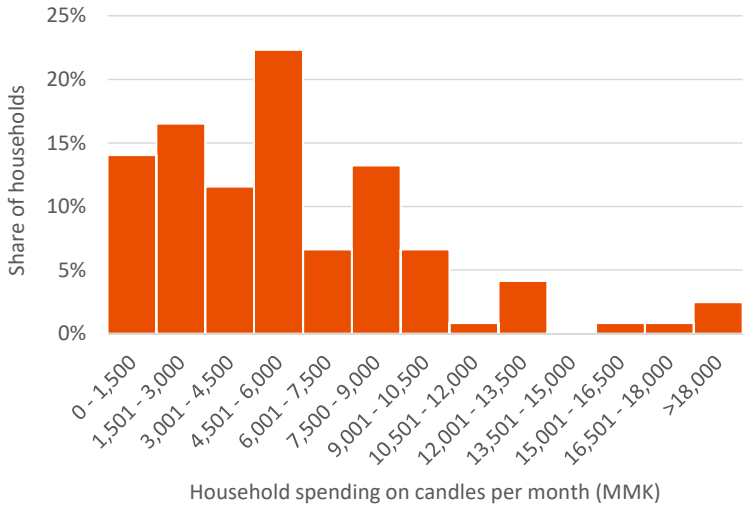
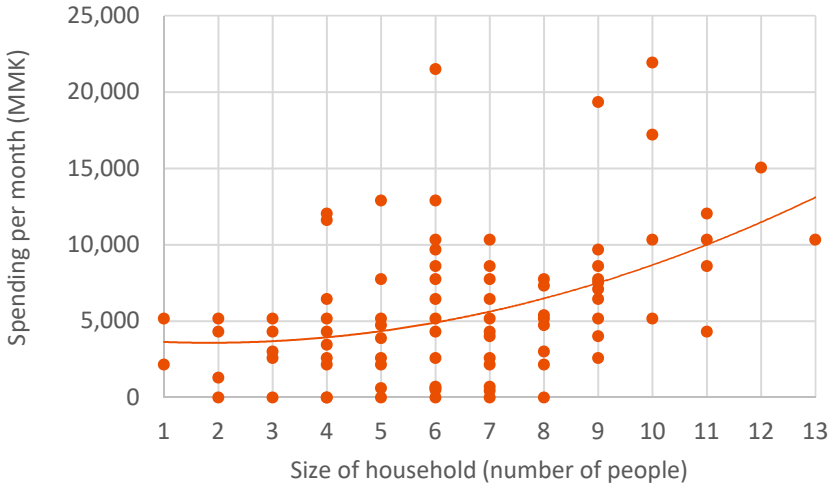


Figure 2: Household spending on candles per month by size of household



The average household spending on candles per month was 5,600 MMK, which equals approximately 2 packs per week. Each pack typically consists of 6 large candles and costs between 500 and 600 MMK. Spending on candles is likely to account for a significant share of monthly household expenditure for low-income households in this township.

Figure 2 shows the relationship between household size and monthly spending on candles. Larger households tend to spend more money on candles but the relationship is not linear. For some small and medium-sized households the monthly spending on candles is surprisingly high. For example, one household of six reported spending 21,500 MMK per month on candles. The reason for this might be because families with children tend to spend more on candles than families without children. 80% of workshop participants reported that their primary reason for buying candles is to use them for children's education.

Household spending on solar panels and batteries

Solar panels and batteries are bought mostly from shops in Kanpetlet, Mindat and Mandalay. The solar panels available range from small solar panels costing between 12,500 and 30,000 MMK to medium and large solar panels costing up to 300,000 MMK. The most common type of battery used with the solar panel is a small motorbike battery that costs 10,000 to 12,000 MMK. Households with large solar panels

tend to use medium to large batteries that cost between 30,000 and 100,000 MMK.

Trends in candle and solar panel sales

"CN" is the only candle brand found in shops in Kanpetlet. Their candles come in three sizes (small, medium and large). Large candles are mainly used to provide lighting for education and other household tasks, while small candles are mainly used to decorate the household Buddha statues or for other religious purposes. Small to medium-sized shops purchase their stock of candles from large shops that make prearranged orders from the original CN candle supplier in Mandalay.

Surprisingly, none of the five shopkeepers interviewed reported candle sales to be a significant share of their total sales. Candles are sold with just a small margin of profit, and all of them sell a variety of different foods and commonly-needed articles that are more profitable than candles. All the shopkeepers reported that their customers include people from the surrounding villages who depend on candles for lighting as well as people from Kanpetlet who buy candles to use as backup lighting when needed.

All of the shopkeepers interviewed reported a drastic decline of candle sales since the grid arrived in Kanpetlet in June 2017. They perceive a clear link between more people getting grid electricity and declining candle sales, and estimate that candle sales were cut in half after the grid arrived. Several shops have even stopped selling candles altogether. Solar panel sales have also strongly declined since the grid arrived. While households from the surrounding villages are switching from candles to solar panels, households in Kanpetlet are switching to grid electricity and the net effect appears to be a decrease in solar panel sales.

"People here have started to use colourful electric lights to light up their Buddha instead of candles so there really is less use of candles today, even the small ones."

Shopkeeper from a large shop in Kanpetlet

According to the shopkeepers interviewed, people from Kanpetlet usually buy small candles for religious purposes and it is predominately women who buy the candles. However, people from the surrounding villages usually buy large candles and both men and women buy the packs. This may be partly because many households in the villages still rely on large candles as their primary source of lighting, and also because most people in the villages are Christians and therefore use fewer small candles for religious purposes. Whoever goes into town from the village (whether male or female) is often asked to come back with candles.

Table 1: Model scenarios and input parameters: candle scenarios

	Candles, low use, low quality	Candles, low use, high quality	Candles, high use, low quality	Candles, high use, high quality
Price of one pack of candles (MMK)	500	600	500	600
Packs of candles used per week	2	2	8	8
Burn time of one candle (hrs)	1.5	2.5	1.5	2.5
Luminous flux of one candle (lumens)	12.6	12.6	12.6	12.6

Table 2: Model scenarios and input parameters: solar scenarios

	Small solar, high use, low quality	Small solar, low use, high quality	Medium solar, high use, low quality	Medium solar, high use, high quality	Large solar, high use, low quality	Large solar, low use, high quality
Price of solar panel (MMK)	12,500	12,500	100,000	100,000	320,000	320,000
Lifetime of solar panel (yrs)	5	20	5	20	5	20
Price of one battery (MMK)	10,000	18,000	30,000	50,000	80,000	120,000
Lifetime of one battery (yrs)	2	4	2	4	2	5
Number of light bulbs installed	2	2	3	3	4	4
Price of one light bulb (MMK)	500	850	500	850	500	850
Light bulb use per day (hrs)	4	2	6	4	10	6
Lifetime of one light bulb (hrs)	2,000	2,000	2,000	2,000	2,000	2,000
Luminous flux of one light bulb (lumens)	200	450	200	450	200	450

Economic modelling: lifetime cost of lighting

An economic assessment of using candles and solar energy systems for lighting in Kanpetlet Township was carried out using two indicators. First, the lifetime cost of lighting (MMK per month) was considered in different scenarios. An economic model was developed with four candle scenarios and six solar energy scenarios (see Tables 1 and 2). The candle scenarios assume that the household only uses candles for lighting and the solar energy scenarios assume that the household only uses solar energy for lighting. The model factors in the maintenance costs of solar energy systems (i.e. the costs of buying new batteries and light bulbs). Data collected during the fieldwork trip was used to validate the input parameters.

The lifetime cost of solar energy has three components: (i) the up-front cost of the solar panel (converted to a monthly figure by dividing the up-front price by the lifetime of the panel); (ii) the cost of batteries during the lifetime of the solar panel; and (iii) the cost of light bulbs during the lifetime of the solar panel. As shown in Table 2, the model assumes that high quality solar panels last for 20 years and high quality batteries last for 4 years, while low quality solar panels last for 5 years and low quality batteries last for 2 years. It also assumes that high quality candles burn for 2.5 hours and low quality candles last 1.5 hours.

Figure 3 shows that monthly spending on solar energy is lower than candles in nearly all scenarios. The results demonstrate that even households that only use two packs of candles per week typically end up paying substantially more on lighting per month compared to households that use small or medium-sized solar energy systems. However, though the lifetime cost of solar energy is low, the up-front cost of buying solar panels and batteries can be high and this makes it difficult for many households to purchase them.

Figure 3: Lifetime cost of lighting in ten model scenarios

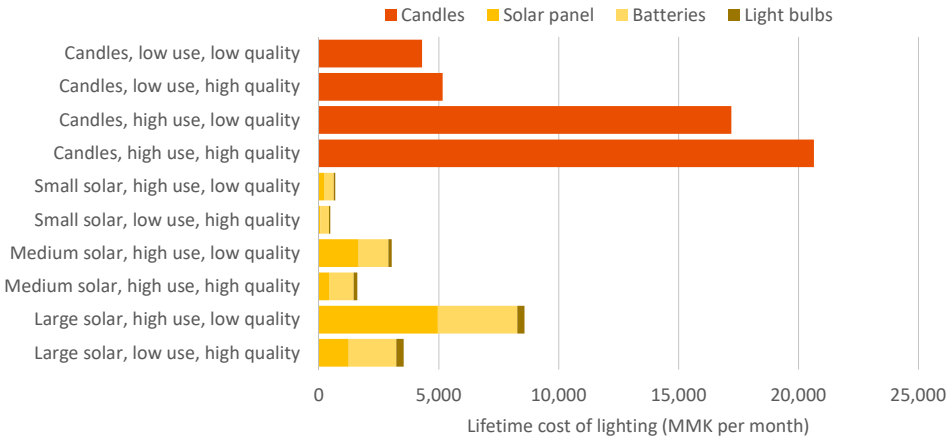
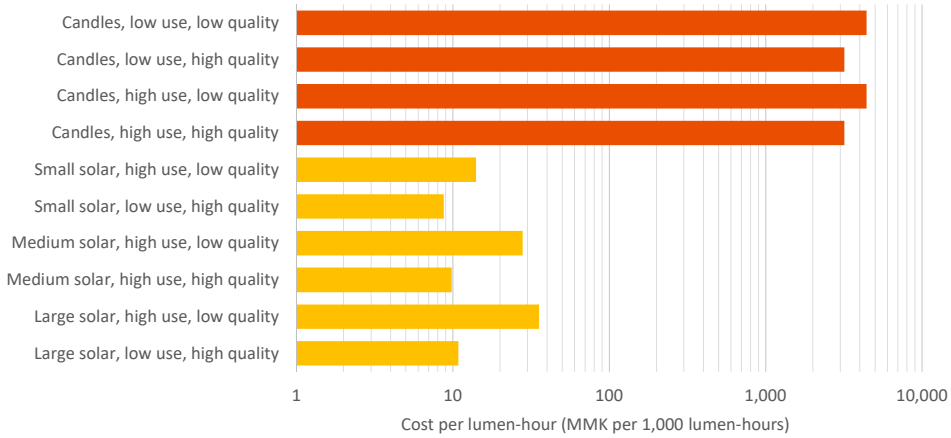


Figure 4: Cost per lumen-hour in ten model scenarios



Economic modelling: cost per lumen-hour

The lifetime cost of lighting is a measure of household expenditure on different energy sources. However, it does not take into account the quality and brightness of light provided. Therefore, a second indicator was considered: the cost per lumen-hour[3] (MMK per 1,000 lumen-hours).

Electric light bulbs provide much more light per hour than candles. Figure 4 shows that when the quality of light provided is considered, the cost per lumen-hour of solar energy is much lower than that of candles. The economic case for switching from candles to solar energy is therefore even greater than Figure 3 suggests.

Non-economic factors

There are also various non-economic factors influencing household decisions on which energy source to use for lighting. To better understand how people perceive candles compared to solar and other sources of lighting, the 155 workshop participants, separated into groups of men and groups of women, were asked about their positive and negative perceptions of different energy sources. The results are shown in Figure 5.

There are two important findings from Figure 5. Firstly, while looking at both men and women, the results show that solar is generally

perceived as the safest, most reliable and cleanest source of lighting whereas candles are seen as dangerous, unreliable and dirty. Interestingly, small hydro power was generally perceived as being an unreliable, expensive and dangerous source of lighting despite the fact that none of the five villages visited had a functional small hydro system installed.[4] Therefore, non-economic factors contribute to shaping the energy map of villages.

Secondly, and of great importance, Figure 5 shows how women and men perceive energy sources differently. For example, the women perceived candles as the cheapest energy source whereas the men perceived solar energy to be the cheapest. Also, men were more likely than women to view candles as an unreliable and dirty source of lighting. The results suggest that in rural areas such as Kanpetlet Township, women may need more convincing than men of the benefits of switching from candles to solar energy.

Figure 5: Women and men's perceptions of different energy sources for lighting

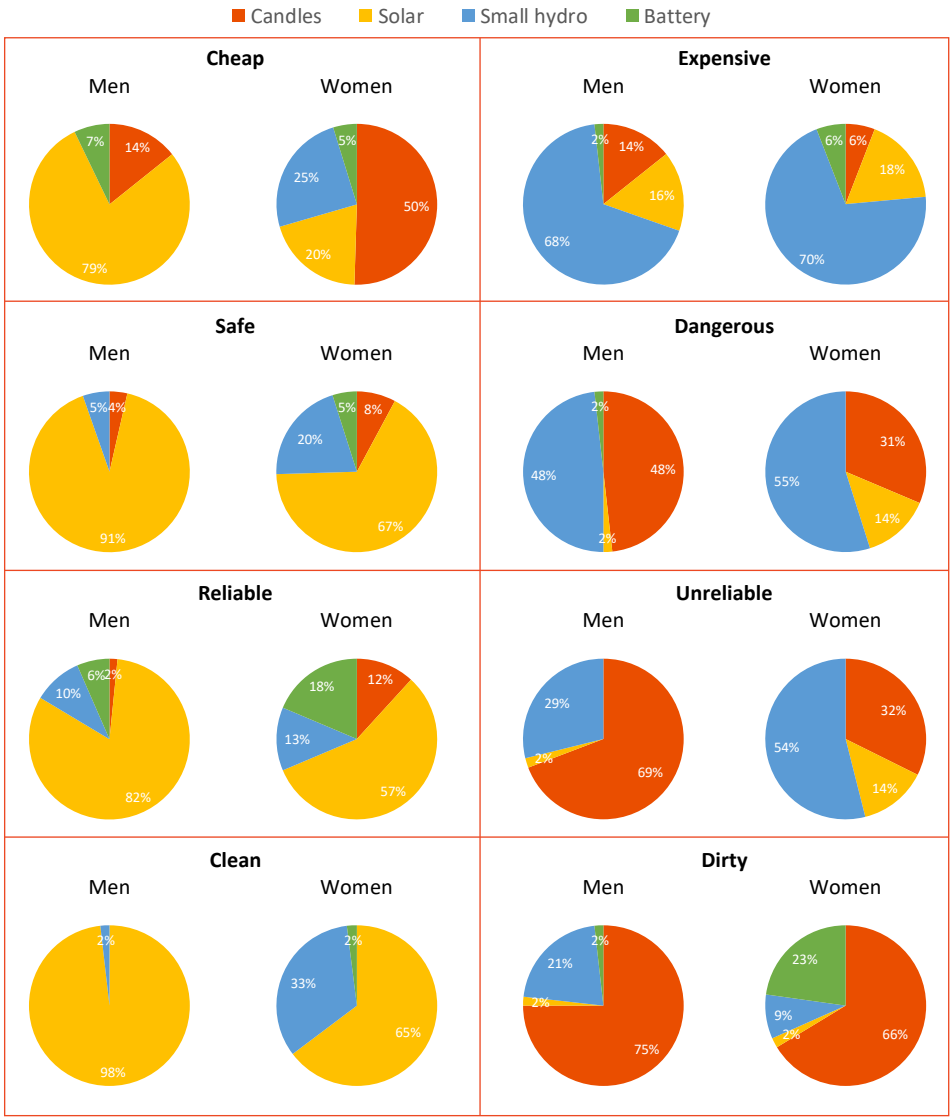
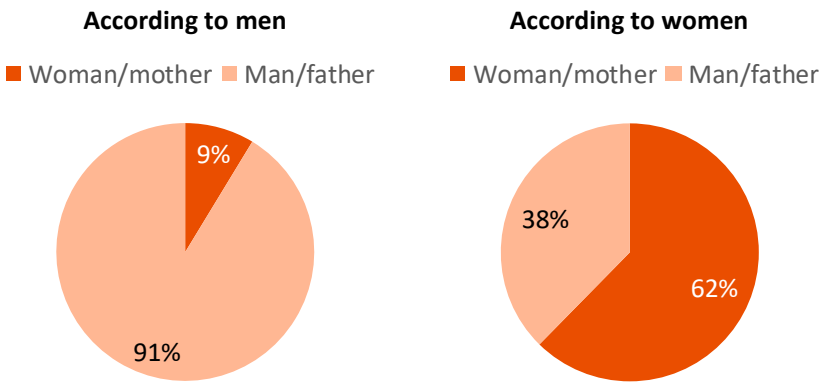


Figure 5 also shows that women are more likely than men to perceive batteries as a dirty source of lighting. This might be because women are often in charge of the maintenance of batteries in the household and may be more aware than men of the safety risks for children of battery acid.

Figure 6 displays what women and men said when asked who most commonly buys the candles in the household. Most men said that the man or father of the household buys the candles while most women said that the woman or mother of the household does it. Other evidence gathered by the research team (such as interviews with local civil society organisations and shopkeepers) suggests that the women were correct and it is most commonly them who buy the candles.

Figure 6: Who most commonly buys the candles?



Notes and references

1. National Energy Management Committee (2015), Myanmar Energy Master Plan.

2. IIASA (2012), "Chapter 19: Energy Access for Development", Global Energy Assessment.

3. The lumen is the standard unit for measuring the brightness of a light source. Lumen-hours are the amount of light provided in one hour.

4. One village had a small hydro system installed but it was broken.

Photo by Gregory Briner

Recommendations

- **Solar energy is significantly cheaper than candles in terms of lifetime cost of lighting and the cost per lumen-hour, though the up-front costs of solar energy can be higher. Scaled-up financing programmes are needed to help people pay the up-front costs of solar panels and batteries.**
- **Candles are perceived as dirty, dangerous and as an unreliable source of lighting, whereas a potential switch to solar energy, would mean a switch to a clean, more reliable and safer source of lighting for people living in rural villages in Myanmar.**
- **Men tend to view solar energy more favourably than women. Organisations involved in renewable energy programmes in Myanmar should take this into account and adopt gender-sensitive approaches when promoting solar.**
- **The development of quality standards for solar panels and related equipment in Myanmar would be highly beneficial.**

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