ESRES Baseline survey; Pricing, access and affordability issues

Somaliland is dependent on it natural resources. It also has some of the highest electricity costs in the world, with privet electricity providers using ageing and expensive diesel generators. Household commonly pay $ 1 to 0.8 USD per Kilowatt-hour (kWh), making appliances and business applications beyond reach for many and places substantial constraints on consumption and economic development. Moreover, it has the potential for significant renewable energy generation, particularly solar and improvement.

Energy Security and Resource Efficiency in Somaliland (ESRES) is tackling both the enabling environment in the energy sector and supporting private operators to generate more renewable capacity. The ESRES pilot programme is providing funding for Technical Assistance to the Ministry of Energy and Mineral Resources (MoEM) to develop the enabling and regulatory environment and to selected Implementing Partners (IPs) across Somaliland to install solar energy generating capacity. There are 6 pilot sites that are installing hybrid mini-grids. This current phase is a pilot that ultimately aims to increase the generation of Renewable Energy is Somaliland, reduce the cost of electricity and to improve access to electricity.

Baseline Survey

The baseline study outlines the existing situations in the 6 of the ESRES sites before the implementation of the Hybrid Mini-Grids. Real-Time Learning (RTL) reviewed documents and collected field information at 3 of the ESRES sites: Gabiley, Sheikh and Burao between 1-7 April 2017. Qualitative and quantitative data collection methods were used to gain a better understanding of electricity usage, pricing, accessibility, and affordability among low-income households, businesses, and public institutions. The study also looked at stakeholder perceptions regarding energy service provision and awareness on the ESRES project. Gathering baseline and end line data will allow RTL to determine project outcomes and recommendations for phase 2. A similar 'end-line' study will be conducted in 2018, after the Hybrid Mini Grid Systems have been installed.

Methodology

The baseline study was conducted by a team of two international and two local researchers. Qualitative data collection consisted of Key Informant Interviews (KIIs) with the Energy Service Provider (ESPs) and public/private institutions. Quantitative (micro) surveys were administered among households and businesses using mobile data collection devices. Survey data was cleaned and analysed using STATA and Excel.

Household survey: A total of 30 households (HHs) were interviewed across 3 ESRES sites. Households were selected purposively based on their location and income. Enumerators were instructed to select HHs across different districts in each town and a community facilitator helped identify HHs from different economic backgrounds. The team surveyed 10 households at each site, of which approximately four were classified as low-income households, three as average-income, and three as high-income. The classification of HHs was done by the community facilitator. This subjective classification methodology however matches HHs within the statistically representative Somalia High Frequency Survey (SHFS Wave 1, 2016) conducted by the World bank in collaboration with Altai Consulting. Within each HH, the head of the household or next best-able to answer person was interviewed for approximately 30 minutes.

Business survey: 30 businesses were included in the sample. The selection process was purposive, where the team conducted a walk-through of the main business districts, selecting businesses that had relatively high reliance on electricity. Across the sample 37% of the businesses were metal and wood workshops, 20% were supermarkets, 13% were restaurants or hotels, 10% were street vendors with non-permanent structures, 10% fell under the category 'business service' (e.g. tailoring, or businesses providing combined services), and the remaining 10% were small shops (kiosks).

Key Informant Interviews: Were conducted among ESPs and public and private institutions such as schools, hospitals, and orphanages (see Annex 2 for details). Focus Group Discussions (FGDs) were conducted with female and male groups. There were 5 participants in each of these FGDs, selected

with the help of a community facilitator; the selection criteria were income (aiming for lower income groups), and usage of electricity. 8 KIIs were conducted across the three sites and 6 FGDs. Respondents were selected based on availability, and based on a snow-ball sampling method with the help of the ESP.

Limitations: The HH and business survey was based on a small sample of households and business located across three sites of interest. With a limited sample size, randomization could only be performed to a limited extent and therefore the statistical representativeness of the sample remains low. However, as mentioned previously, HHs within the sample are very comparable to larger surveys in terms of monthly consumption basket, and HH composition. KIIs were conducted through a snowball sampling method but were sometimes limited in terms of time and the availability of the correct person to be interviewed. Findings form the KII and FGDs are qualitative. The 3 sites were chosen due to security, logistical and budget considerations and because the 3 sites are representative of the 6 ESRES sites. One is a large urban area (Burao) with a significant HH and business customers, other are more rural locations where the number of customers is lower, there are few businesses and pricing structures are different.

Pricing of Electricity

Tariff and customer charging for electricity is complicated, with multiple tariffs being applied and with non-standard discounts. Currently the standard tariff charged by Electricity Service Providers are high across Somaliland (ranging from just over $1 USD/kWh to $0.79 USD/kWh). The tariffs paid for electricity in these sites is expected to reduce significantly because of ESRES funding.

Th tariff structure in the 6 ESRES sites typically have:

- Minimum flat tariff for usage below 10 kWh (USD 8-10 /month)
- Standard variable tariff for usage above $10 kWh (typically USD $1 to $0.79/Kwh).
- Negotiated discounts for some users
- Industrial tariffs which are lower than the standard variable rate (typically $0.7 to $0.5/Kwh)
- Free tariffs, for users such as mosques, government buildings or other

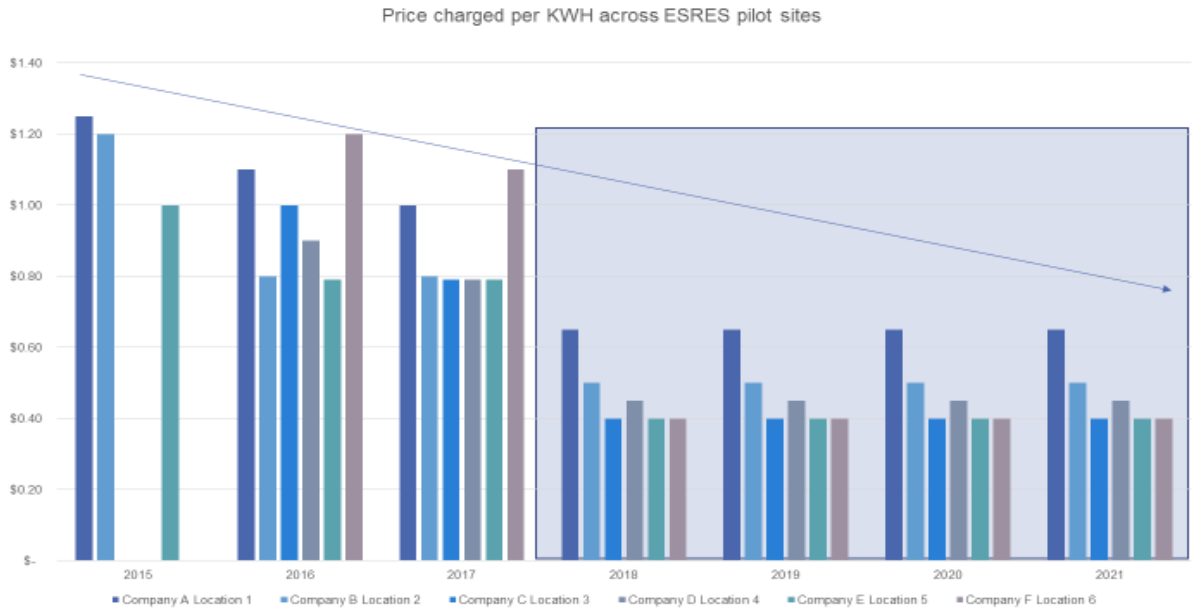
Customers on the minimum tariff are among the poorest households, yet pay the highest rates for electricity. When electricity usage is high, ESP often offer negotiated discounts. Moreover, some community institutions such as police station, mosques or government assets pay a reduce rate.

Customer billing data was analysed for Beder, Sheikh shows that:

- 38% of households are on the fixed minimum tariff (USD $9/month).
- These customers pay high rates for electricity, commonly over USD $1/Kwh. Indeed, 12% of people are paying more than USD $3 /kWh (i.e. those on minimums tariffs).
- 45% of customers are on the standard variable tariff USD $0.89/kWh.
- Average monthly bills are over $15 USD for all customers
- Average usage is 13 kWh/customer/month.

ESRES is set to reduce the rates customers are paying. The prices currently charged and those the IP expect to charge after commissioning of the Hybrid Mini Grids are outlined in the proposals submitted to ESRES. This proposed change to the standard variable rate and to the minimum tariff.

Figure 1: ESRES IP standard variable rates before and after commissioning of Hybrid Min Grids



Many households cannot afford a connection and many can only afford the minimum tariff. Households' incomes are not stable or predictable, and there is limited space within household budgets to support electricity expenditure. Expenditure is focused on basic food requirements with charcoal, rent, education and healthcare and other miscellaneous spending being important. It was observed that the major needs are likely to be for lighting then fridges, fans and TVs. Taken in this context, changes to the standard variable rate do not directly translate into lower prices for all customers (for example those on minimum charges or daily rates, or with discounts) and improved access for the poorest communities. How ESRES is able to influence these complex payment structures is an interesting question. If 40% of users are on minimum tariffs, with more on daily rates, which are unaffected then the poorest customers may not benefit at all from the ESRES programme.

Household Survey Findings

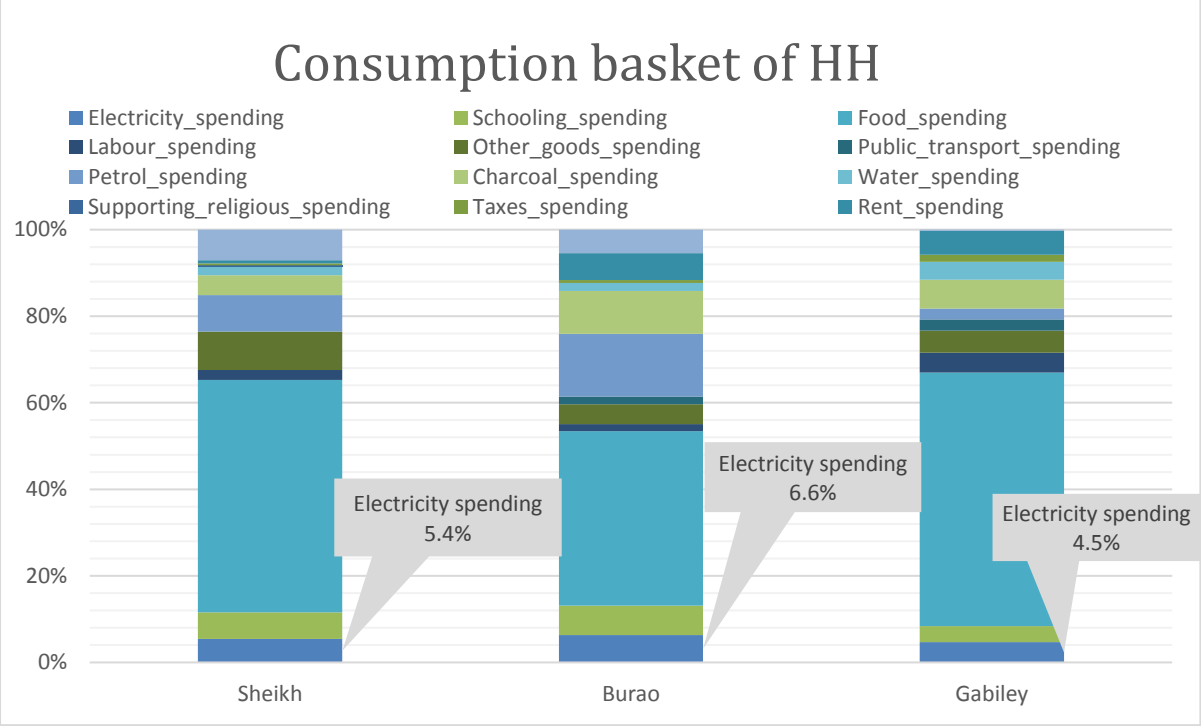
The average expenditure on electricity for households is 5.5% of total monthly expenditure[1]. Total expenditure for household averages $ 330 to 390 per month, with electricity bills of between $14 and $26 per month.

Table 1 - Total HH expenditure and Electricity spending

Location	Average electricity bill per month	Average HH expenditure	% of electivity expenditure of total
Sheikh	$ 20.40	$ 333	5.36%
Burao	$ 26.00	$ 394	6.60%
Gabiley	$ 14.00	$ 331	4.57%

[1] This is in line with the Somali High-frequency Survey (SHFS 2016), which found an average HH expenditure on electricity between 3-6% of total expenditure.

Figure 2: Consumption basket of households at three IP sites (RTL survey



When compared to other countries in the region, this is high: low-income household expenditure on electricity in neighbouring countries. The RTL survey shows that expenditure on electricity in Somaliland is 27.5 times as high as the expenditure on electricity of low-income households in Kenya, who according a World Bank study in 2010, spend on average 0.2% on electricity2. The same study showed that low-income households in Uganda spent 0.4% on average on electricity. In Bangladesh and India low-income households spend 1.1% and 2.4% respectively on electricity. The highest comparable figures came from Pakistan and Thailand, where households spend 3.8% and 3.4% respectively on electricity.

Expenditure on other household fuels such as charcoal seems to be greater than that on electricity. This suggest there could be economic gains from switching cooking appliances and switching other HH fuels.

Note that during the time of the survey Somaliland is experiencing a severe drought which has implications for domestic food prices

The price of electricity was cited by customers as the key factor in preventing them from utilising electricity to the extent they would like to and most of the households use few appliances. Only 12 types of appliances were found in all of the households interviewed, and only three (light bulbs, cell phones and TV's) were found in more than half of the households. Other common electrical appliances for households were washing machines, irons, and fridges. TVs were the most common HH appliance used across the sample, even the poorest households would own and extensively use a TV. With an exception of a water heater owned by one wealthy household, goods that stand out as consumed by most affluent households are the blender and fans.

Appliances are often used to generate income: Refrigerators and freezers were commonly also used for income generating purposes by HHs. Refrigerators are also used to generate revenue, by cooling and selling drinks, as well as home-made ice-cream. Washing machines were also reported as income generating assets, albeit to a lesser extent. Almost all households own mobile phones and energy saving bulbs. Interestingly, only the poorest households rarely use energy-saving bulbs and tend to use fewer appliances. Only the poorest households use non-energy saving bulbs, probably because these

[2] Robert Bacon et al. (2010). *Expenditure of Low-Income Households on Energy: Evidence from Africa and Asia*. Extractive industries for Development Series # 16, page 39-40. Online available at: http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1266963339030/eifd16_expenditure.pdf

are cheaper to purchase and because future energy/cost savings from efficient bulbs are discounted by consumers.

Day time and Evening/Night time usage of appliances:

- **Day time:** Washing machines and irons are mostly used during the day. Washing-machines are generally used early morning until early afternoon utilisation. As laundry becomes ready in the afternoon, household members start ironing from early afternoon until early evening. Fans, which are only used by wealthier households, are also used mostly during day time.
- **Evening/Night time:** At around 5 pm households start using TVs, and turn on lights and refrigerators if they have them. They operate those devices until they go to sleep at around 11pm - 12pm. TVs, lights and refrigerators are mostly used in the evening.

Customers are generally satisfied with the quality of electricity they receive. This is true for all sites and working with all providers and expressed an improvement in terms of quality since last year. Even so, Beder is the least well performing ESP in both categories. The generally poorer perception of Beder may be related to its reluctance to negotiate tariffs (on top of having highest per kWh rates and highest minimum amount).

The relationship between customer and ESP provider, is an important feature influencing the perception of the customer. Flexibility in payment, and the ability to acquire credit are perceived as important aspects of the ESPs services. This flexibility was found to exist where the customer has a long-standing relationship with the ESP for example with Sompower in Gabiley.

Connection fees are high and determined by the ESP. Connection fees vary per site, and are dependent on the length of the electricity cable needed to connect the dwelling to the nearest pole, and b) cost of the meter, which may vary between models and supplier. Prices of meters ranged from $15 to $18, the most common brand of meter was the DEA analogue meter, model DD826-2[3]. These are old model analogue meters. Households were also responsible for purchasing of the transmission cables, which cost approximately $1 per meter. All the interviewed women had to purchase a meter that needed a subsequent validation from the ESP.

There are varying perceptions regarding meter accuracy. Mixed perceptions were recorded in all sites regarding the accuracy of meters but HH tend to hold moderate to sceptical views. Customers in Sheikh reporting the highest levels of scepticism and the most positive answers were recorded by Sompower customers in Gabiley, pointing towards high levels of trust between service provider and customer. An interesting observation in the household survey in Sheikh revealed that poor households paying less than $10.00 per month (i.e. under the flat rate), and small businesses had their meters sealed with industrial glue, while all the households consuming more than 10 units per month, typically did not have their meters sealed by the ESP. This suggests a low-level of trust between the ESP and customers on minimum tariffs.

Awareness of the ESRES programme is low: Except for Sheikh, most people included in the sample have heard of and are aware of the term ‘solar power’. However, some respondents, particularly those in Sheikh (50%), have never heard of it. Low levels of awareness of the ESRES project were observed among respondents across all locations.

Business Survey Findings:

Electricity expenditures is a significant component of the cost structure across businesses and was estimated to be 10% to 18% of total monthly expenditure. Workshops, supermarkets, and hotels tend to spend the most money on electricity (on average 18% and 13% respectively). This is due to the high-usage in fridges, fans, and workshop equipment. Among smaller businesses, electricity commonly accounts for roughly 10% of total expenditure. Moreover, a few large companies experience significant month-to-month variations in electricity bills, which is indicative of variable usage patterns.

Larger business institutions commonly have a generator or solar panels installed in order to reduce electricity expenditure. The study found numerous businesses that used a diesel generator.

All businesses adopted some form of coping mechanism to lower the cost of electricity, either by running less appliances, or reducing the amount of time appliances run. A significant number

[3] Specifications for this meter: 240r/kWh, 220/240V, 10(60)A, 50Hz, IEC62053-11.

of businesses already operate using electrical appliances at the minimum level, and are unable to reduce it further. Business adopt a range of electricity cost saving mechanisms, such as 'using their own generator', 'limiting the number of hours they run appliances', and 'limiting the number of appliances they run'. In Sheikh, which charges the highest rate for electricity to businesses ($0.89 per kWh), businesses tend to spend the least on electricity suggesting that higher prices have a bearing on consumption.

Small businesses commonly own electrical appliances such as energy saving bulbs and mobile phones. Many businesses owning welding equipment, fridges, and other productive assets like drills, jigsaws, hydraulic pumps, and ovens.

Businesses were generally satisfied with the quality and consistency of electricity provided to them. In Sheikh, the highest number 'somewhat satisfied' answers were observed. This dissatisfaction was mostly related to the price, and lack of flexibility of the ESP, rather than the quality of the service.

Most businesses pay for electricity in cash at their place of business. From the survey, Beder is the only ESPs which has a significant number of clients paying using mobile money.

All businesses in the sample expressed a willingness to change the time slots during which they use appliances if electricity were available cheaper during that time. The shift of electricity usage would likely be more difficult for businesses in the hospitality sector, who need to run fridges, fans, and TVs in the evening hours when guests frequent their venues. The use of devices is closely associated with opening hours of businesses, most commonly at 8:00 am, 11:00 am, 3:00 pm, and 5:00 pm. A major dip in the use of electricity occurs between 12:00 pm and 3:00 pm, as well as after 6:00 pm. This is contrary to households, where electricity usage peaks in the early evening.

Focus Group discussions:

Institutional users were interviewed as well as groups of female and male focus groups.

Table 2: Key informant interviews and Focus Group Discussions:

Location	Method	Respondent type	Institution type
Gebiley	FGD	Female group	HH
	FGD	Male group	HH
	KII	Gebiley general Hospital	Public Hospital
	KII	Galax Secondary School	Public School
	KII	Local government (local authority)	Local Gov.
Burao	FGD	Female IDPs (with connection)	HH
	FGD	Female IDPs (without connection)	HH
	KII	Dayaxa primary and Secondary School	Private School
	KII	Urtehagen International Orphanage	NGO
	KII	Sinekare Petrol station and supermarket	Private business
Sheikh	FGD	Female group	HH
	FGD	Male group	HH
	KII	Beder Electricity Company	ESP
	KII	Sheikh City Hospital	Public Hospital

We have summarised the most relevant qualitative information from these discussions as follows:

Perceived challenges related to electricity: Electricity was perceived to be low on the list of general problems when compared to drought and lack of economic opportunities. However, when looking specifically at challenges related to electricity, cost was always mentioned first, followed by access problems, and maintenance issues within the dwelling. The inability to have flexible payment arrangements, and disputes with the ESP over inaccurate metering were perceived to be the fourth and fifth most important challenges, depending on the location[4].

Consequences of high cost of electricity: Participants saw the high price of electricity as a blockage or prevention for them to purchase new electrical appliances and from utilizing the ones they already have. Cheaper electricity would prompt them to buy and use more appliances (kitchen and income generating appliances were mostly mentioned). The high cost of electricity also acts as a barrier to households purchasing income generating appliances such as refrigerators, freezers, and washing machines.

Coping mechanisms: The most important coping mechanism to the high cost of electricity is to minimize the use of electrical appliances, for example, running a freezer for just one hour a day to cool down ice cream to sell in the morning. Other HHs mentioned using their washing machine only once a week, and for two hours' maximum. Some women in Sheikh reported investing in solar lamps ($30 per unit) to off-set the price of electricity. One woman mentioned that this saved her approximately 50% on her monthly electricity bill.

Use of household appliances: Other than income generating appliances commonly used by wealthier HHs, most HH appliances were used for entertainment and lighting purposes only. Other than IDP HHs, most participants reported owning a TV and use it daily for about 2-3 hours in the evenings. It is the most significant energy consumer for most households. Which also explains why household demand for electricity is highest at night.

Women Groups

Women see the high price of electricity as a blockage or prevention for them to purchasing new electrical appliances and from utilizing the ones they already have. In other words, women cited high costs and inaccurate metering as key issues with electricity supply and stated that cheaper electricity would prompt them to buy and use more appliances (they mentioned kitchen appliances mostly).

Electricity was generally low on the list of general problems, however when looking specifically at electricity challenges, then cost was always mentioned first, followed by access problems, and disputes with the ESP over inaccurate metering, and late and inflexible payment of bills.[5]

When compared to other expenditure items, food is by far the most significant item in households' consumption basket. Women reported spending between $6.0 – $6.5 on food daily (approx. $188 a month). The second most significant expenditure for interviewed households was cooking fuel. Some of the households use gas and some use charcoal, and in both cases the monthly expenditure is approximately $30. Rent and water were also cited as area of considerable expenditure.

The most important coping mechanism to the high cost of electricity is to minimize the use of electrical appliances, for example, running a freezer for just one hour a day to cool down ice cream to sell in the morning.

Many women use their appliance, for example washing machines, as income generating assets - operating small home launderettes. Among the female-headed households, fridges and washing machines were noted as the most common types of income generating assets that require the use of electricity.

Other commonly used appliances were mostly for entertainment and lighting purposes. All the participating households have a TV and use it daily for about 2-3 hours in the evenings. It is the most significant energy consumer for all participant households: a phenomenon observed across different

[4] Paired-wise ranking outcomes was used for problems with electricity service provision and for general problems experienced in the community.
[5] Paired-wise ranking outcomes was used for problems with electricity service provision and for general problems experienced in the community.

sites and socio-demographic groups. Also, largely due to the use of TVs and lighting evenings are the time when the load of electricity is the most significant.

Male groups:

Generally, the men we interviewed had a limited understanding of household expenditure and intimate knowledge of personal expenditure. When asked for a breakdown they were unable to provide a coherent answer. They were however aware of their person expenditures, which are dedicated to Khat and fizzy drinks. They reported spending of between $1.5 to $10 per day on Khat.

Institutional users:

We interviewed a variety of institutions, such as schools, hospital and businesses to understand specific issues with electricity. During these interviews, the following summary issues were raised:

- **Subsidized tariffs:** There is currently no standardized policy on subsidizing public institutions, these are arranged on an ad-hoc basis between the institution, the Government, and the ESP.
- **Competition between energy service providers:** Competing companies tried to gain a competitive edge through: a) their distribution network, b) the quality of the service, and c) by offering flexible payment arrangements to customers. Competition was not practiced through competitive pricing of electricity.
- **Unregulated extension of distribution poles:** A negative spin-off effect to the competition was unregulated extension of distribution poles. This prompted the local Ministry of Public Works in Gebiley to introduce guidelines for further extension of electricity distribution poles.
- **Own-generation:** Large institutions that require high consumption of electricity would commonly purchase a generator or solar panels to compensate for high costs of on-grid electricity. Poor quality of batteries bought on the Somali market would mean rapid diminishing returns on investments of solar systems.
- Significant monthly electricity bills. Some had invested in solar panels or diesel generators to reduce electricity costs. One business saves an estimated $900 USD per month by using its own diesel generator.

Discussion of the Highlights, Challenges and Lessons:

The tariff and payment structures are important for poorer households: IP tariff and charging systems are complex and can work against the poorest who cannot afford a connection of are on minimum tariffs: those on minimum or nightly tariffs pay a high price for electricity, sometime over USD $3 /kWh. How these are changed over the long term, and how ESRES can encourage the IPs to alter pricing systems, will be important to discuss with IPs.

Electricity costs are high, with households and business spending large amounts on electricity, and are leading people to minimise use and find alternatives. All households, particularly those on lower incomes strictly manage electricity consumption. The surveys suggest that high electricity cost is acting as a barrier to people using appliance and consumption for households and is acting as a brake on businesses. However, other costs are also high such as for charcoal and particularly for food. The most important coping mechanism to the high cost of electricity is to minimize the use of electrical appliances for HHs and small businesses, for larger businesses and institutions that use a lot of electricity, the use of diesel generators and/or solar panels is a common way to reduce high costs.

Will lower electricity prices lead to more appliances and more consumption? The traditional assumption is that cost reductions will lead to increases in demand and vice versa. Price reduction would lead to increases in electricity consumption by households and business if prices were lower – unlocking suppressed demand in the electricity market. From RTL information gathering the most common appliances would likely be leisure appliances like TV's and fans on the one hand, and income generating appliances such as washing machines, fridges, and freezers on the other (e.g. selling drinks, ice creams, laundry services, mobile phone charging, and cooling areas utilized by clients e.g. small shops, restaurants etc). We found that most households minimise the number of appliances running simultaneously or the duration of usage to save on electricity costs. This suggest that the most likely outcome of price reduction would be to increase the number of hours for which they use devices.

Load management could be possible for some appliances: Solar generation through ESRES will reduce costs of electricity. Cheaper solar is however, only produced during the day with diesel remaining in place to meet needs when the sun is not shining. At night, where demand peaks from 6-9pm, ESPs will still use conventional diesel generators. Our findings suggest that the use of light and TV are likely to be largely fixed to evening use. Some appliances such as washing machine and fridges could be used at different times and perhaps to a different extent. This is true for businesses as well as households. Peak load management among small workshops will likely be easily realized as users are flexible with usage times during the day.

Customers value payment flexibility with the IPs: We heard from many customer groups that payment flexibility for bills was very valuable to them. If finances are limited one month, the ability to pay partially or to defer payments is useful to them.

There is a common issue with the perception of quality and accuracy of meters: Customers and IPs alike seem concerned with the quality and accuracy of the meter. While the ESP often allow users to choose the brand of the meter, it can insist that they must be purchased from one supplier. Meter tampering has been raised an issue by the IPs and customers and we observed industrial paste being applied to some meter to prevent tampering.

Awareness of ESRES project is low: ESPs could do more to create awareness of the ESRES project and its intended objectives. With the arrival of Hybrid Mini Grid equipment, it will be interesting to observe how ESPs manage expectations and raise awareness at the same time, not only for the project, but also for shifting usage patterns.

Recommendations

A. **Engage with the IPs on pricing and tariffs for customers:** Make suggestions to the IPs on simplifying pricing structure and adopting models that are commercially viable but do not overly penalise consumers with low usage. This could be done by limiting the use of minimum charging, methods to identify low-income user groups to target with lower tariffs, and flexible payment arrangements and payment models. This can be done with the ESRES IP and the Somaliland Electricity Association (SEA).

B. **Engage with IPs on options for standardized meters:** Most meters used are old analogue meters bought on the local market. Other options may be that IPs purchase standard quality meters and include these additional costs in the tariff structure. This may solve the misconception problem, tampering issues, and would likely save the ESP costs in the long run. Similarly, for cables, there are currently multiple types of cables on the market, consumers, particularly low-income HHs will mostly settle for the cheaper one.

C. **Work with IPs on providing price incentives for using electricity during the day time:** This could influence people to use more electricity and short consumption patterns to the day for some appliances. Differentiated prices (for day time and night time usage) could be possible if meter could differentiate between day time and night time usages (linked to the above).

D. **Engagement with IPs on marketing campaigns** to a) inform customers of price changes, b) mitigate misconceptions surrounding inaccurate metering, and c) raising awareness on solar energy (ESRES project) to shift usage patterns.