



Ovo 1 PILOT PHASE ENDLINE REPORT

September 2019



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Introduction

- This report presents findings from the endline survey conducted between 2nd and 13th of September 2019 for Ovo 1 Pilot Phase which benefited 20 institutions in Turkana and Kilifi counties in Kenya.
- The purpose of this report is to inform the foundation on the impact the solar PV systems had on education and healthcare in the 16 schools and 4 clinics. In the conclusion, key highlights are discussed on how to strengthen project sustainability and the support to be provided to the institutions going forward.
- In this report, data from Remote Monitoring Systems (RMS) installed in August 2018 was used to assess utilization of the PV systems.
- The impact indicators selected for the survey aimed at evaluating the performance of institutions and the PV systems since installation in January 2018 (*See Annex 4*).

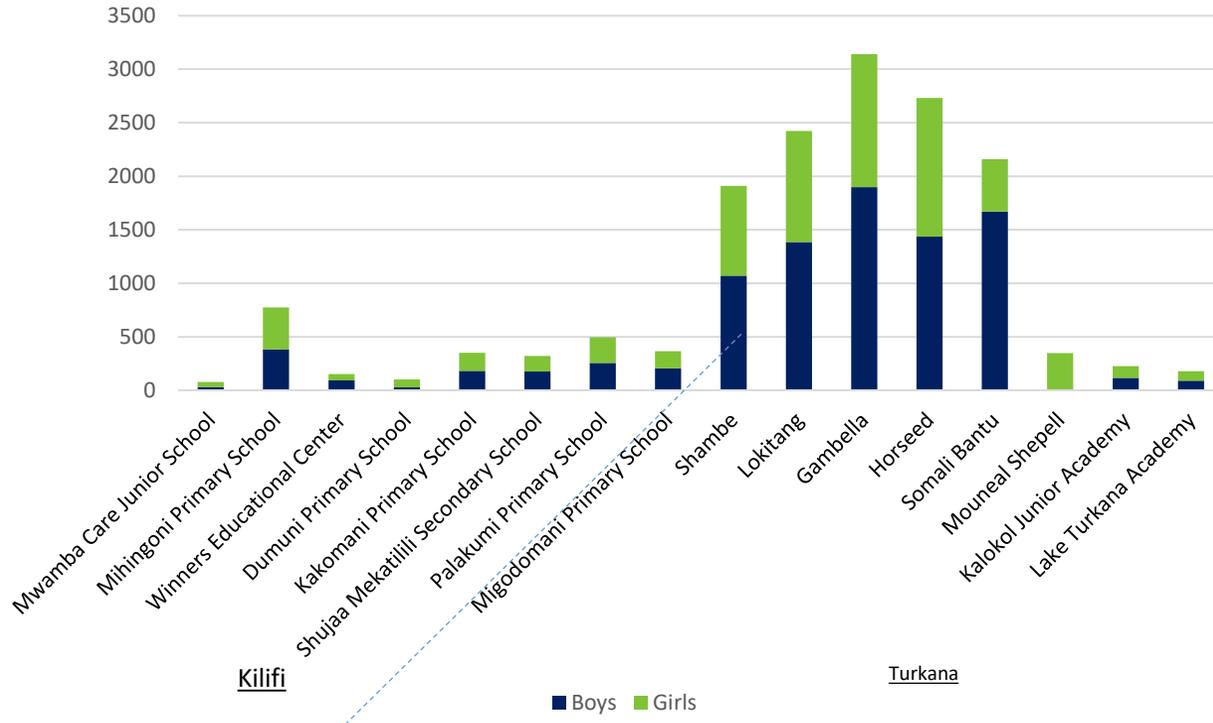
Abbreviations

- **KCPE:** Kenya Certificate of Primary Education
- **KCSE:** Kenya Certificate of Secondary Education
- **TSC:** Teachers Service Commission
- **O&M:** Operations and Maintenance
- **IGA:** Income Generating Activities
- **ICT:** Information and Communications Technology
- **E4I:** Energy 4 Impact
- **PV:** Photovoltaic
- **NHIF:** National Health Insurance Fund
- **CCTV:** Closed-circuit television
- **NGO:** Non-governmental Organisation
- **PUE:** Productive Use of Energy

Overview of Schools

Overview of Schools: Size & Attendance

School Size – Student Enrolment

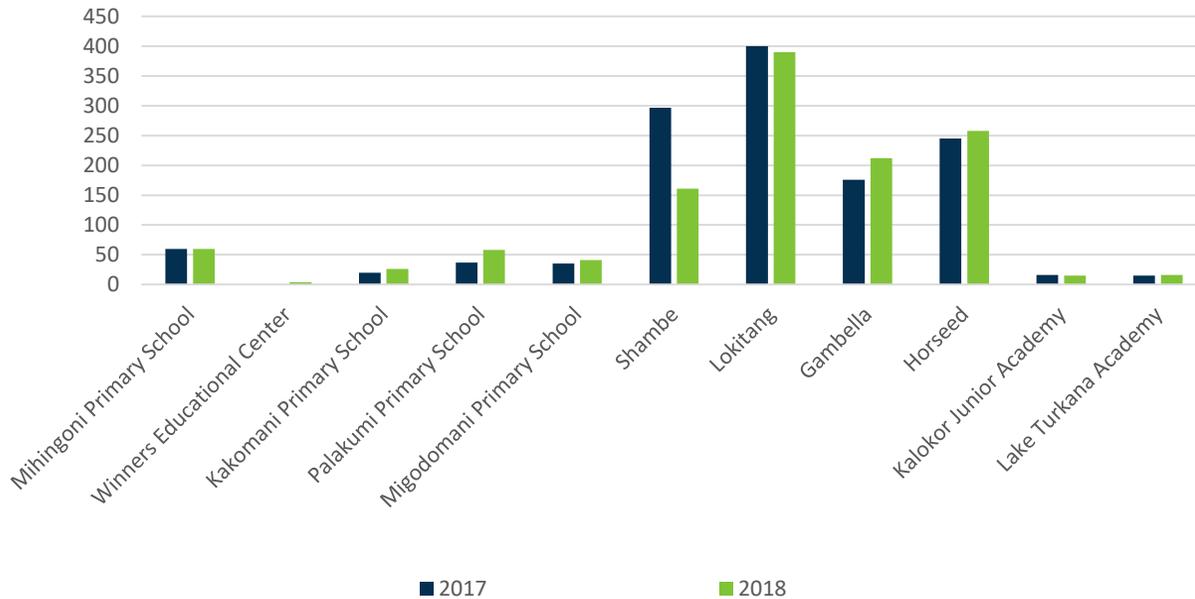


- Remedial Attendance:** The overall number of students who remained in schools after normal school hours to study increased from 574 to 1134 students since the installation of PV systems.

- Enrolment:** The overall number of students enrolled at the 16 schools increased from 14,499 in February 2018 to 15,742 in September 2019. An additional 573 male and 670 female students are benefitting from the power provided by Ovo 1 Pilot PV systems. However, 6 schools experienced a drop in enrolment as explained further in the findings
- Class Attendance:** The average school attendance for day students has increased by 3% from 73% to 76% while that of boarding students remains at 100%.
- Study Time:** Since the installation of power at the schools, there has been additional study time available to students with an average of 1.30 hours available in the morning and an average of 2 hours in the evening in addition to the average 6.30 normal school hours available per day.
- Early Morning Classes:** The number of schools offering early morning classes to students increased from 7 to 12. Early morning classes start from 4:30am or 5:00am to 8:00am.
- Evening Classes:** The number of schools offering evening classes to students increased from 6 to 14. Evening classes start from 6:00pm to 9:00pm or 11:00pm

Overview of Schools: Candidates Performance

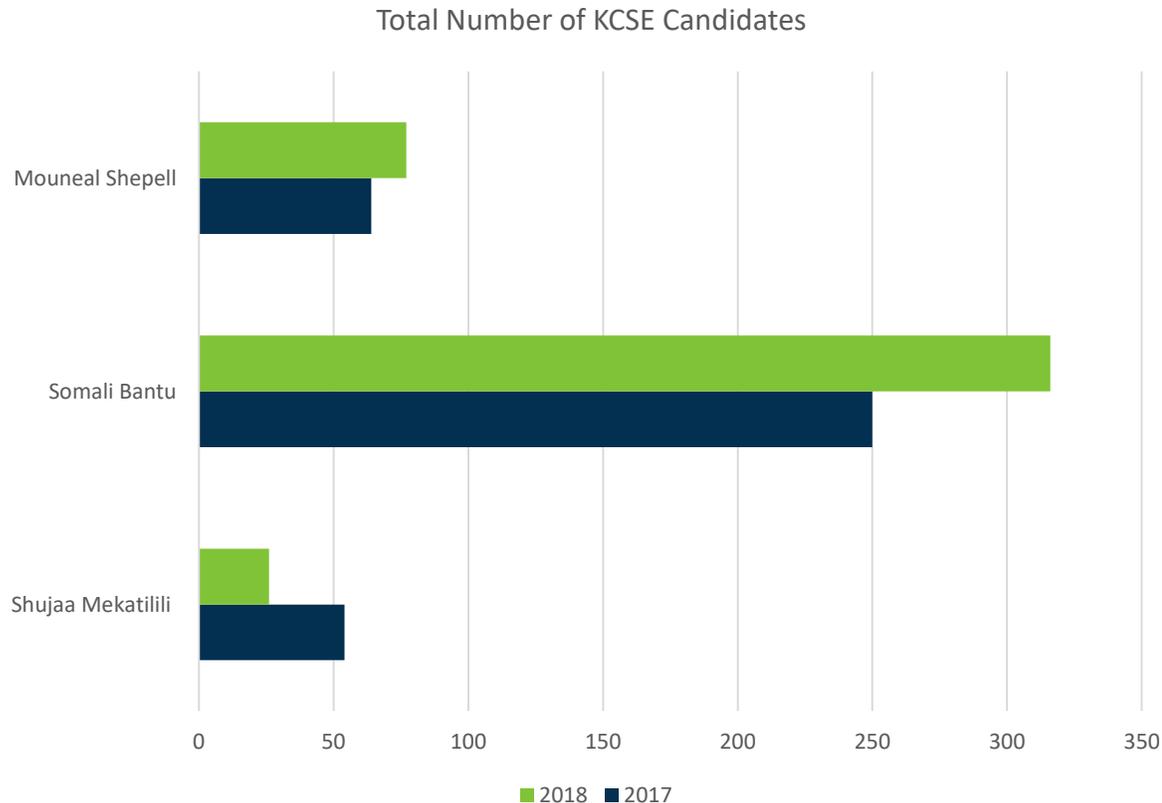
Total Number of KCPE Candidates



- National Examinations:** KCPE is the apex test for primary level which was used to measure student performance. 250 points out of 500 serves as a pass score for the primary level examination.
- KCPE Candidates:** 1,241 students from 11 out of 13 primary schools sat for the KCPE national examinations in 2018 compared to 1,301 in 2017. There are 13 primary and 3 secondary schools. Out of 13 primary schools, only 11 schools go up to class 8 - the apex level.
- School performance:** 3 schools recorded a decrease of 147 in the number of students who scored less than 250 points while 7 recorded an increase by 87 students. The overall number of students who scored below the pass score decreased by 60 since installation of the PV systems.
- Gender performance:** The total number of male students who scored less than 250 points increased in 2018 by 58 students however, the number of female students who scored less than 250 decreased by 22 students.

Mwamba Care School and Dumuni Primary did not have any candidates as both are classified as Early Childhood Development Centres which caters to students generally in the lower apex in primary (below Class 5).

Overview of Schools: Candidates Performance

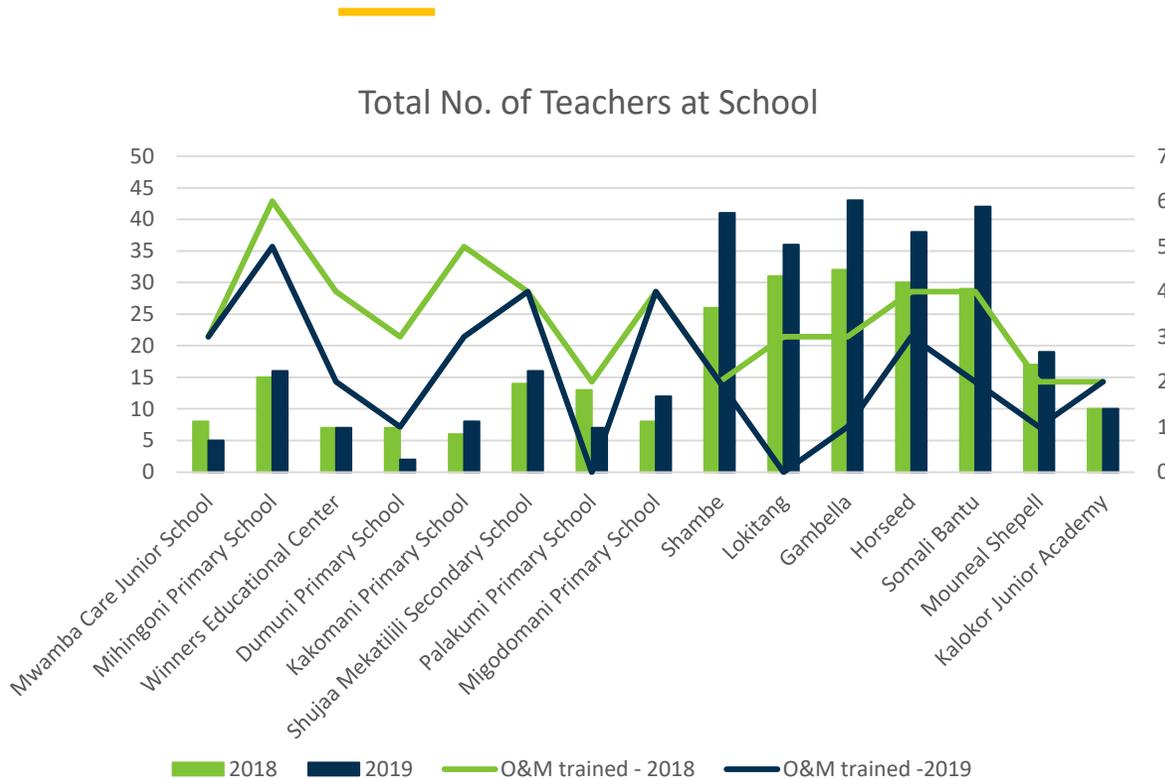


- **National Examination:** KCSE is the apex test for secondary level which was used to measure student performance. An (A) grade being the highest grade while a D+ grade is a pass score.
- **KCSE Candidates:** 419 students from the 3 secondary schools sat for the KCSE national examinations in 2018 compared to 368 in 2017.
- **School performance:** Mouneal Shepell and Shujaa Mekatilili recorded an improvement in performance with a reduction in the number of students who scored less than D+ grade in KCPE by a total of 38 students. There was no change in number of students who scored less than D+ in Somali Bantu.
- **Gender performance:** The overall number of male students who scored less than D+ declined for both male and female students by 24 and 14 students respectively.

Schools: Key Findings

- **Enrolment:** Most of the schools have registered an increment in overall enrolment. Whilst there are many factors that contribute to enrollment of students at schools, accounts from management show a direct correlation between power availability and this increment since the installation of the system. At Winners Educational Centre, the Head Teacher pointed out that since the installation of the system, more female students have enrolled at the school. The security lights at the school have provided assurance to parents of their female children's safety. The increment is an indication that more students in those communities are gaining access to learning opportunities offered at the schools. 4 of the schools that registered a drop in enrolment are located in a refugee camp, a setting prone to numerous variables which can affect enrolment.
- **Class attendance:** The slight change in day students' attendance is affected by long travel distances between school and home or lack of feeding programmes. With consistent attendance, students are able to optimally benefit from educational modules. Other factors include cultural practices (pastoralism, early marriages) early pregnancies, as well as drought and insecurity.
- **Study Time:** Without adequate lighting, it is impossible for learning to take place during dark hours in early morning or at night. The PV systems have helped increase study time availability by facilitating early morning and evening classes. Its also evident that more students are remaining at school after normal hours. As one head teacher observed, 'a well lit environment is more secure and hence parents have more confidence in pupils participating in after- dark learning sessions.'
- **Candidates and performance:** It remains unclear whether the installation of PV systems has an impact on candidate performance as only one test for each school level has been done since PV installations. It is however projected that increased study time, class attendance and better transitions across the grades will lead to higher entries for apex exams and better grades going forward. Secondary schools have registered an increase in candidates and an improvement in performance while primary schools registered a slight decline in both indicators between 2017 & 2018. The 1 year post intervention monitoring period was too short however, the actual impact is expected to crystallize in subsequent tests.

Overview of Schools: School Staff



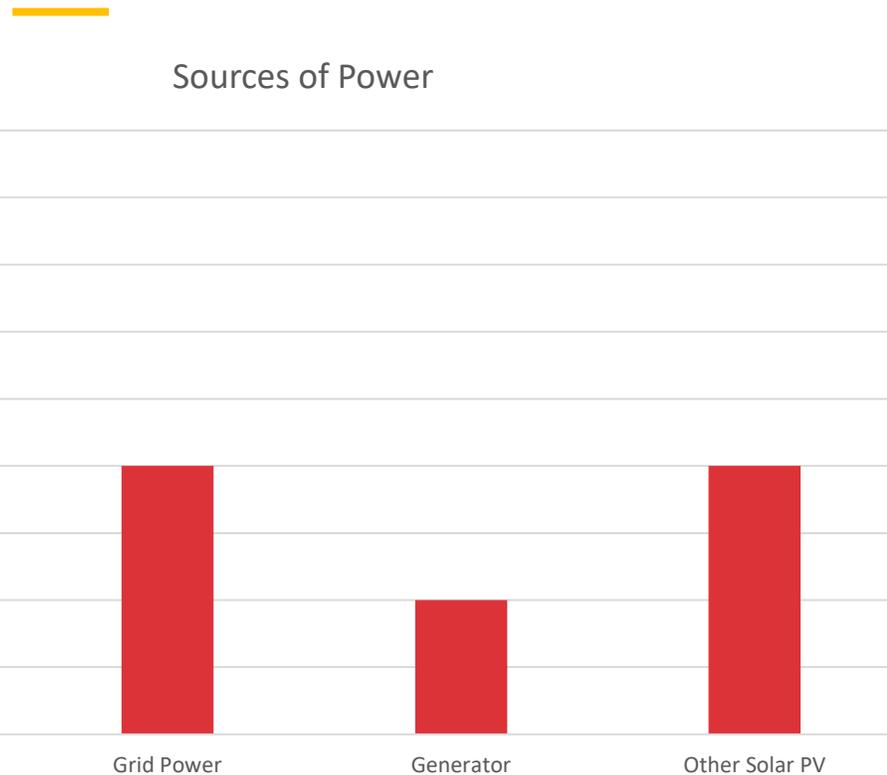
- **Teaching Staff:** The total number of teaching staff at the schools increased from 261 in 2018 to 307 in 2019 – A 15% increase since the installation of the PV systems.
- **Average daily teacher attendance:** Out of the total 307 teachers at the school, an average of 295 (96%) attend school per day.
- **O&M Trained Staff*:** A total number of 53 staff members received O&M training during installation of the PV system. Each school has an average of 2 E4I-trained staff member.
- **Teaching staff housing:** The number of schools providing staff housing remained at 4. The overall number of teaching staff residing at the school remained the same as well since the installation of PV system.
- **Non-teaching staff housing:** The overall number of non-teaching staff increased by 1 to bring the total to 8 staff members.
- **Non-Teaching Staff:** The total number of non-teaching staff declined by 11 from 101 to 90 since the installations of the PV system. However, the daily average attendance is at 100%.

**Mwamba Care School, Migodomani Primary, Shambe, Kalokol have the same number of O&M trained staff since the installation of the PV system. Currently, Palakumi and Lokitang have no E4I trained O&M trained staff at the school due to staff turnover*

Schools: Key Findings

- **Teaching staff:** Electrified schools are able to attract and retain competent teaching staff (Diniz et al (2006)). This is on account that lighting, charging and other ICT related services are accessible at the school. The findings corroborate this fact as there has been a considerable overall increment in teaching staff (15%) since system installations. Provision of staff housing could also be a factor that plays a part in increasing number of teaching staff at the schools.
- **Staff turnover & effect on O&M:** The staff turnover on staff trained on O&M is quite low as an average of 2 has left the schools since installations. Mwamba Care School, Migodomani Primary, Shambe, Kalokol have the same number of O&M trained staff since the installation of the PV system. Currently, Palakumi and Lokitang have no E4I trained O&M trained staff at the school. All trained staff in 2 schools have since left. Staff turnover in public schools is often influenced by Teachers Service Commission (TSC) which determines teacher transfers and replacements. For sustainability and as a lesson learnt, its important to schedule frequent refresher trainings complemented by comprehensive O&M reference materials as a mitigation measure.
- **Teaching & non-teaching staff residing at the schools:** Number of teachers accommodated within school premises remained constant while non-teaching staff increased by one person. This status is however understandable given that expansion and construction of staff quarters is a major investment which would require substantial resources that are often mobilised over a long period of time, power availability notwithstanding.

Power at Schools: Source & Functionality



- **Source of Power:** The institutions use 4 different sources of power with 2 of schools using Ovo 1 Pilot PV systems as their only source of power. The other 2 supplemented Ovo 1 Pilot PV power with either Grid Power, Generator and other Solar PV.
- **Systems functionality:** All systems were found to be operational with exception of Palakumi Primary where the inverter malfunctioned and was dispatched to Sollatek’s workshop for inspection and subsequent repair/replacement.
- **Additional Power:** Since the installation of the PV systems in 2018, Somali Bantu is the only institution that got connected to additional power (Solar PV). However, the new Solar PV malfunctioned a month after installation and it is exclusively relying on Ovo 1 Pilot PV.
- **Cabling Infrastructure:** All wiring done by E4I support at the schools is in good condition. No E4I support was provided at Palakumi Primary school for wiring since it was already wired.
- **Additional Cabling Infrastructure:** 18 additional rooms and spaces are now lit courtesy of power supplied by Ovo 1 Pilot PV system. (See Annex 1).

**Grid Power – (Mwamba Care, Kakomani, Palakumi and Mihingoni) Generator – (Mounel Shepell and Shujaa Mekatilili) Other Solar PV – (Somali Bantu, Mounel Shepell, Migodomani and Mihingoni)*

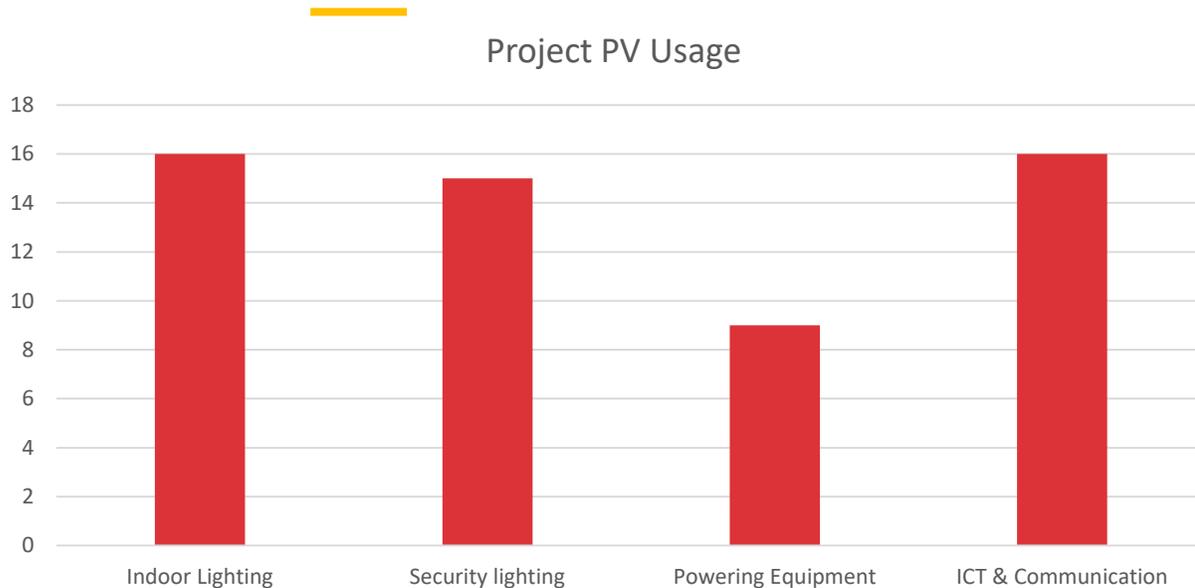
**The generator at Shujaa Mekatilili malfunctioned at the beginning of Term 1 in 2019, the school has in the recent past relied on Project Jua PV*

**No E4I support was provided at Palakumi Primary school for wiring.*

Schools: Key Findings

- **Systems functionality:** The state of the systems and the cabling infrastructure is an indication that the schools appreciate the value delivered by the systems and as a result are taking good care of them. The sense of ownership and responsibility will transcend the pilot phase in the medium and long term.
- **ICT & Communication:** Integration of ICT in education has delivered positive impacts at the schools. The use of projectors in Somali Bantu has enhanced efficiency in teaching in huge classrooms with a high student number. The classrooms in refugee camp schools are so much congested that some students do not have a good view of the teacher. The full potential of ICT integration in learning, however, cannot be fully exploited without internet connectivity. Internet provides a medium of accessing invaluable information repositories and interacting with outside world. At the moment 4 schools have access to an internet connection.
- **Administrative functions:** Printers and photocopiers have proven viable in carrying out administrative duties and education related tasks such as preparation of examination and revision materials. Access to these appliances has contributed to improved student performance. As one teacher at Shujaa Mekatili observed, *“ it would be prohibitively expensive and almost practically impossible to run a secondary school which has no access to in-house printing & photocopying equipment”*.
- **Lighting:** Proper illumination of indoor and outdoor spaces has led to an extension of study hours for the students and boosting of security in the schools and environs.
- **Acquisition of additional appliances:** 6 schools acquired additional appliances since installation of Ovo 1 Pilot power. The appliances are for varied applications - ICT, communication, learning appliances - and are certainly contributing to the school's overall capacity and well being. Its noteworthy that 4 of the schools did not have any power prior to Ovo 1 Pilot, which shows that power availability has activated this acquisition. The other 2 schools had power that which was unreliable or too expensive. The acquisition may not have been influenced by Ovo 1 Pilot PV installation.

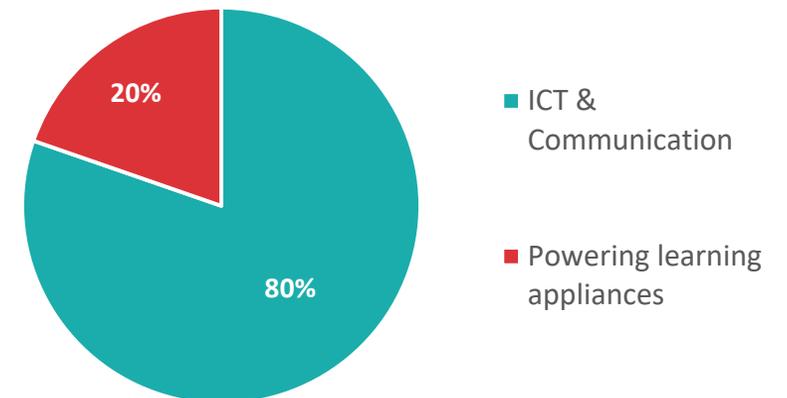
Power at Schools: Usage & Adequacy



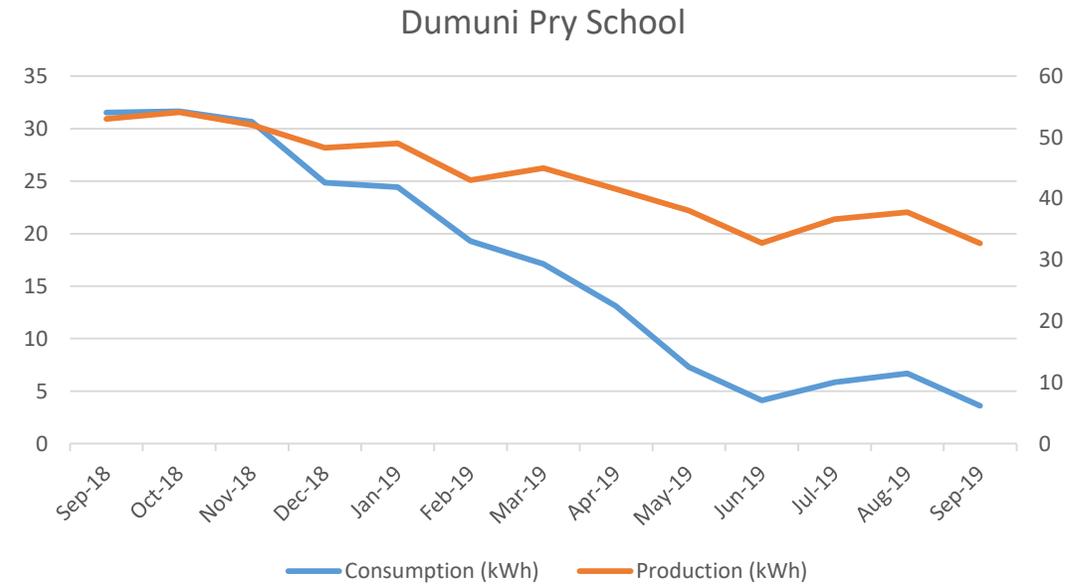
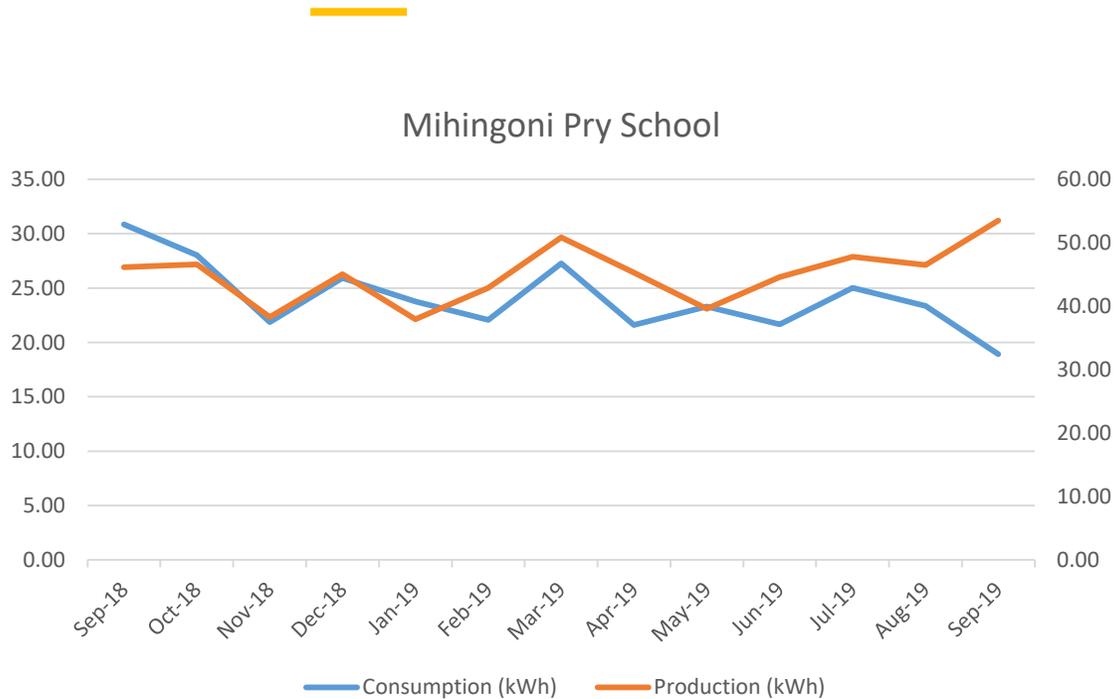
- **Adequacy:** 50% of the schools stated that Ovo 1 Pilot PV met their current power needs. However, the other 8 schools stated the PV system was not adequate as they have since acquired new appliances and the system does not power appliances when used at the same time.
- **Usage:** All schools used Ovo 1 Pilot PV system for indoor lighting, ICT and communication and security lighting. 9 of these schools also used the PV system for powering learning equipment
- **Appliances:** 6 schools acquired a total of 61 appliances since the installation of the PV systems (*See Annex 2*)

- **Appliance Charging:** Teachers are allowed to charge their phones and laptops at the schools. However none of the schools allows students to charge any of their appliances at school.
- **Internet Connectivity:** 4 out of the 16 schools have access to an internet connection. Shujaa Mekatilili, Somali Bantu and Mouneal Shepell have access to Wi-Fi connection whilst Kalokol has access to Mobile-3G services.
- **ICT & Communication:** Out of the 61 newly acquired appliances, 44 are learning equipment and were all powered by the PV system.

Category of New Appliances Acquired

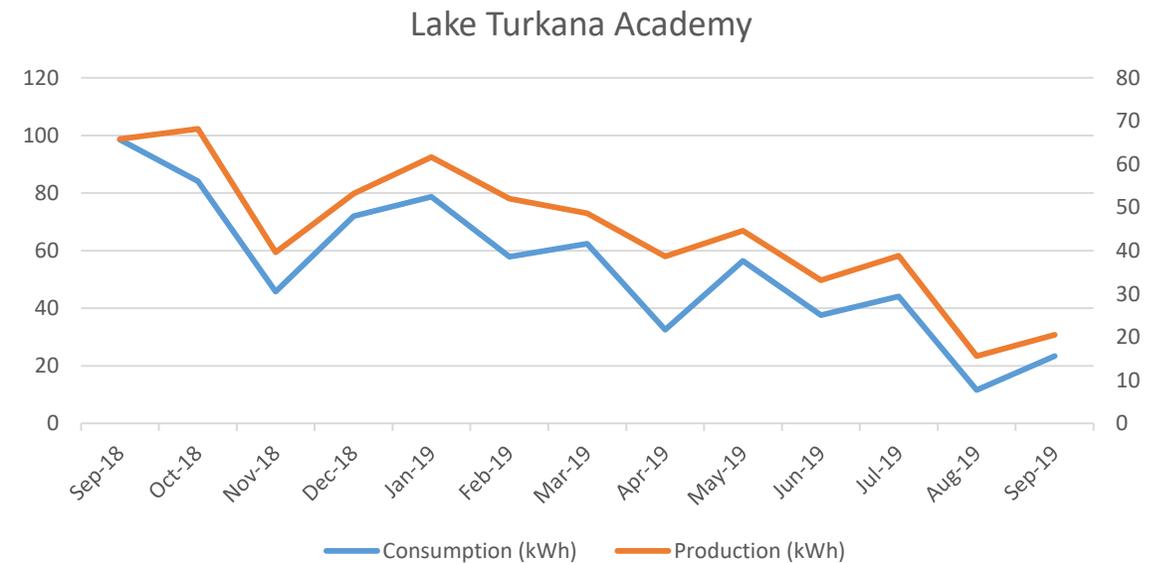
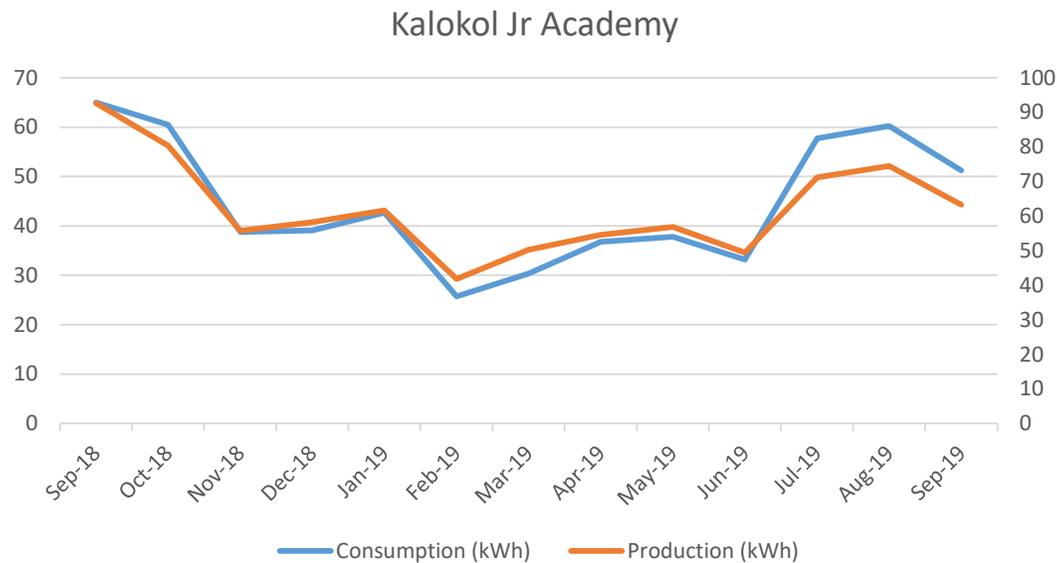


Power at Schools: Production vs Consumption



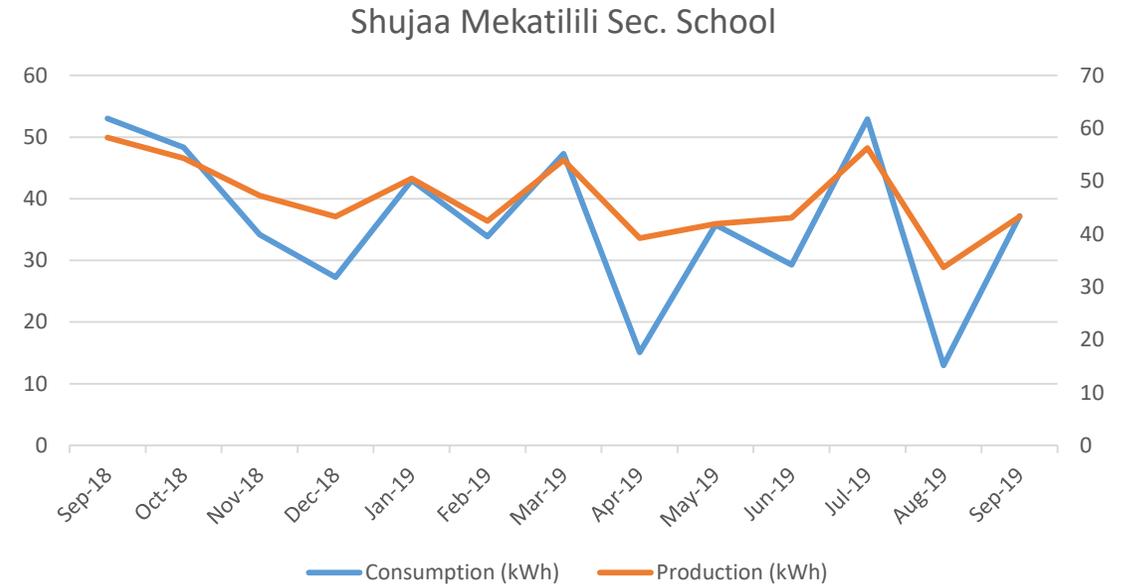
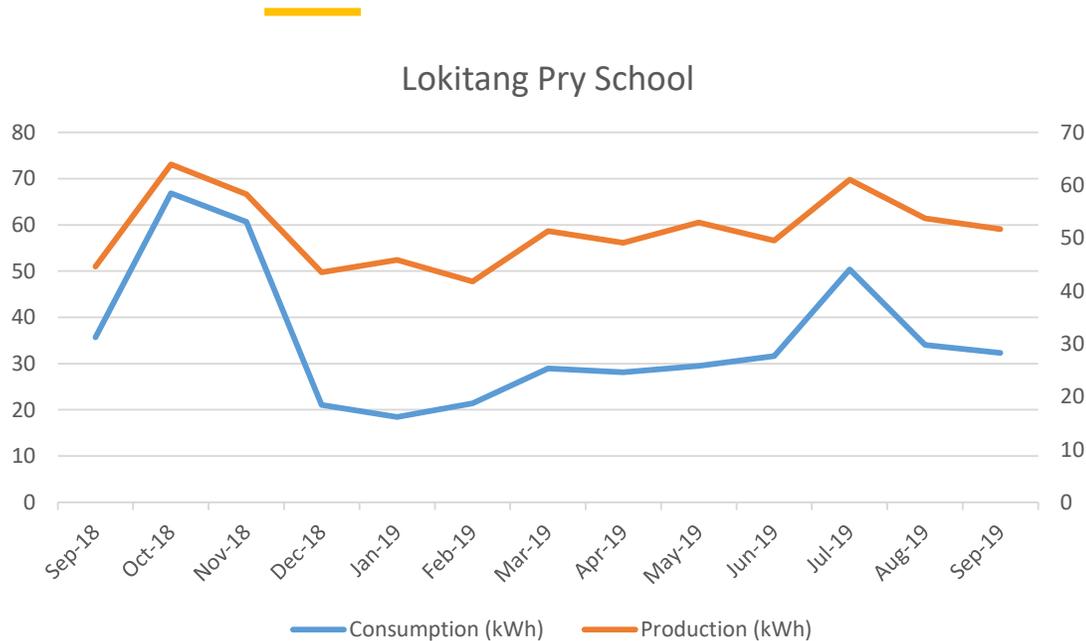
- **Mihingoni Pry School:** Consumption has been relatively stable throughout the year at an average of 24kWh per month.
- **Dumuni Pry School:** Consumption has been on a decline, averaging 16kWh per month. A decline in consumption and production was as a result of the cold and rainy season between March 2019 to July 2019. No new appliances were acquired since the installation of the PV system.

Power at Schools: Production vs Consumption



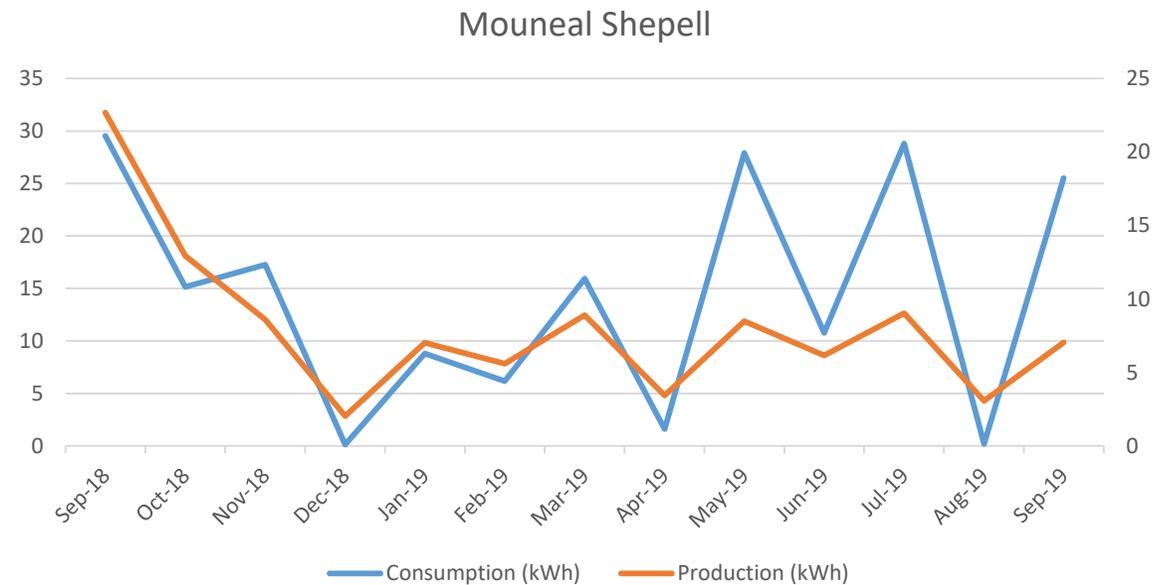
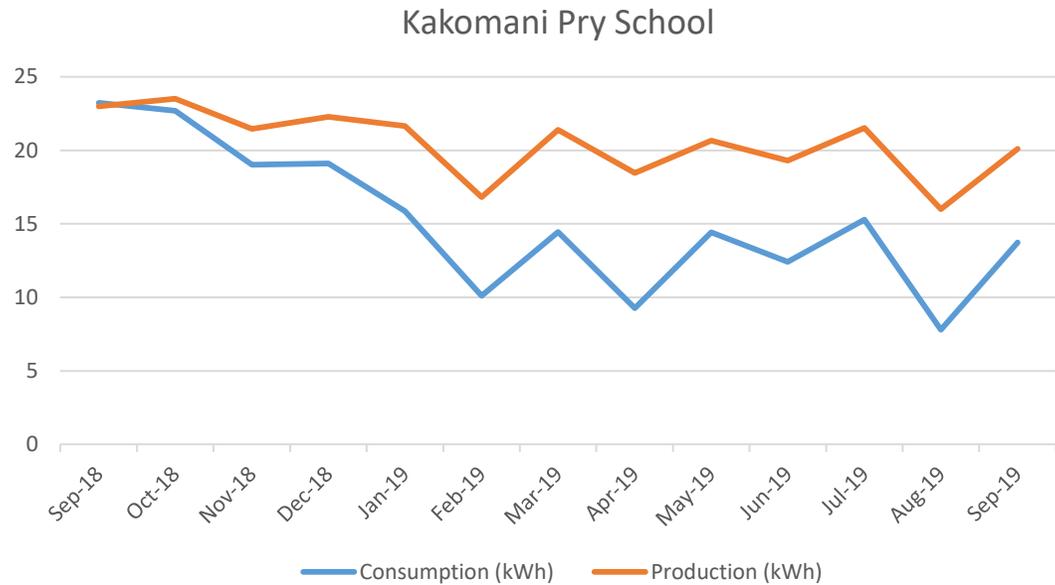
- **Kalokol Jr Academy:** Consumption has been fluctuating throughout the year but remained steady at an average of 44kWh per month. A restaurant was set up in June and got connected to Ovo 1 Pilot PV system. The use of new appliances acquired resulted in an increase in consumption from 49kWh in June to 71kWh in July.
- **Lake Turkana Academy:** Consumption has been on a decline, averaging 54kWh per month. The decline is resulting from school closure in April and August for holidays.

Power at Schools: Production vs Consumption



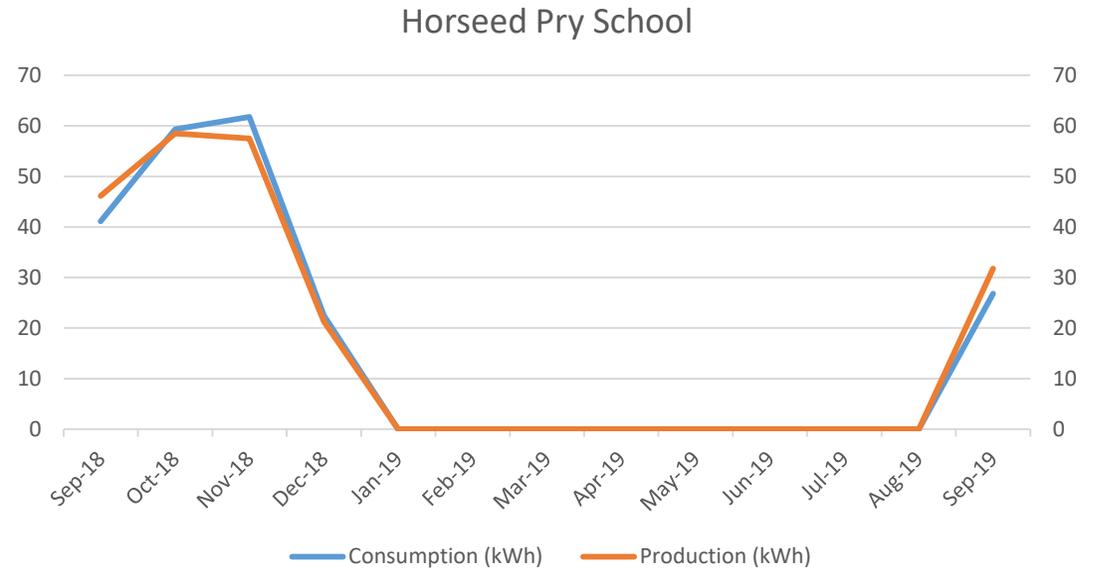
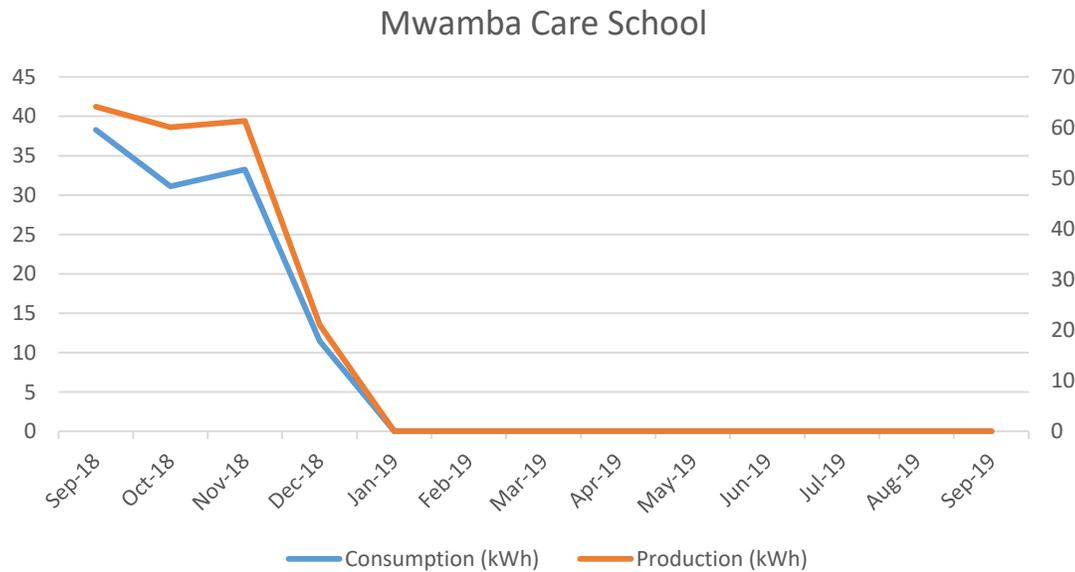
- **Lokitang Pry School:** Consumption remained relatively stable throughout the year at an average of 35kWh per month, recording a decline in consumption during school holidays in December, April and August. The spike in consumption resulted from the use of newly acquired appliances at the school.
- **Shujaa Mekatilili:** Consumption was erratic throughout the year exceeding production in certain months which resulted from the use of new appliances acquired and increased study time at night. Consumption also declined sharply during school holidays. The school consumed an average of 36kWh per month.

Power at Schools: Production vs Consumption



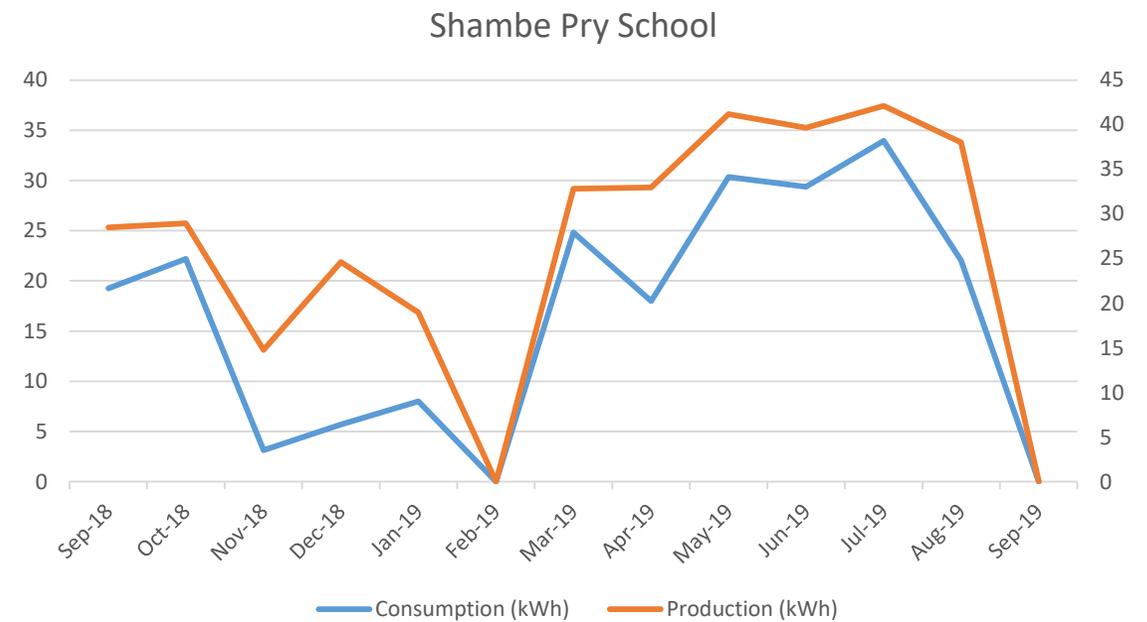
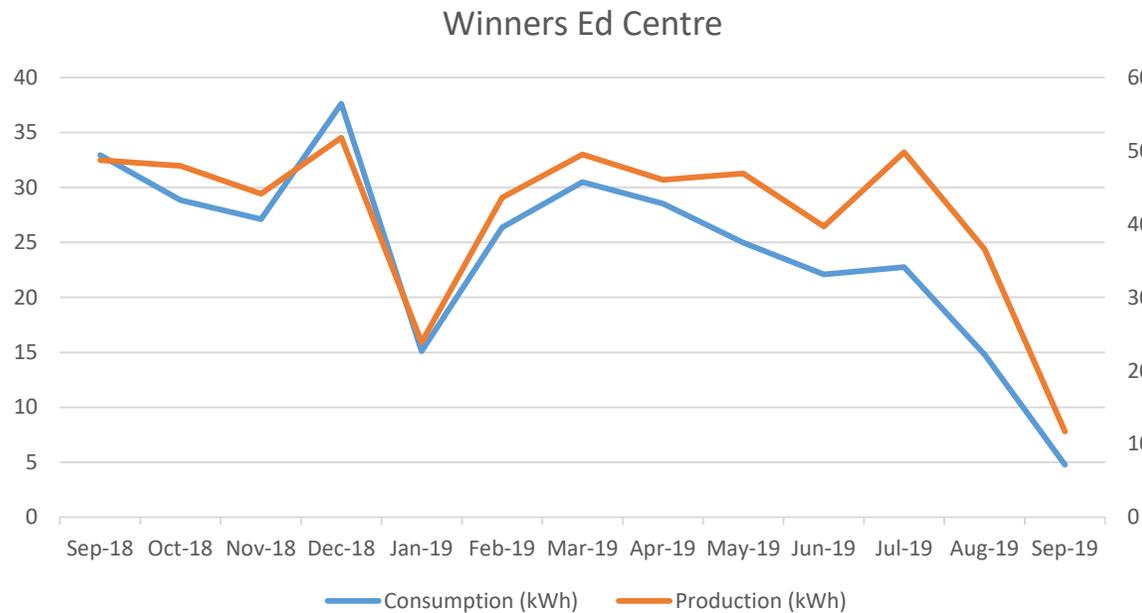
- **Kakomani Pry School:** Consumption fluctuated from month to month averaging 15kWh per month. Declined sharply during school holidays in December, April and August.
- **Mouneal Shepell:** Consumption was erratic often exceeded production in various months, averaging at 14kWh per month. Declined in December, April and August during holidays. Production remained low during the cold and rainy season Between April and July.

Power at Schools: Production vs Consumption



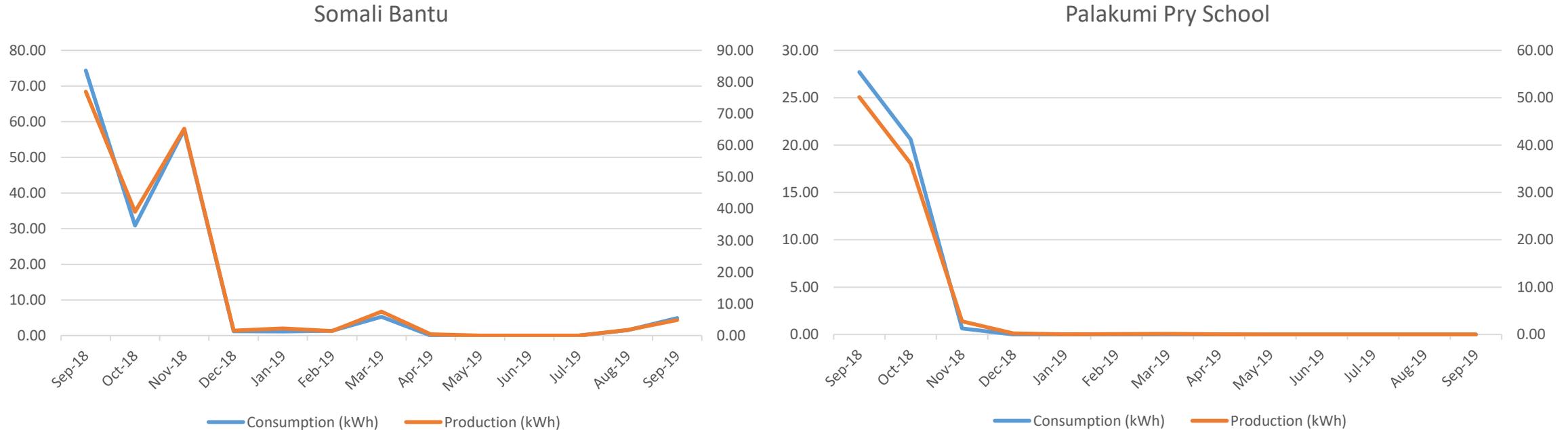
- **Mwamba Care School:** The average consumption in the 4 months was 28kWh per month. Due to technical challenges with the RMS, data between January and September was not transmitted. The faulty RMS was replaced with a new one.
- **Horseed Pry School:** The average consumption is 42kWh per month. No data was transmitted between January and July due to technical challenges with the RMS. The faulty RMS was replaced and data was transmitted in September. The school acquired new appliances as well therefore consumption is likely to increase.

Power at Schools: Production vs Consumption



- **Winners Ed. Centre:** The average consumption was 24kWh per month but with fluctuations from month to month. Consumption experienced a drop during school holiday months in December, April and August.
- **Shambe Primary School:** Consumption was erratic and fluctuated from month to month recording a monthly average of 16kWh. No data was transmitted in February and September.

Power at Schools: Production vs Consumption



- **Somali Bantu:** Part of the monthly data was not transmitted consistently between December and September due to a fault with RMS. However, for the first 3 months the average consumption was 54 kWh per month. The school acquired new appliances therefore consumption is likely to increase.
- **Palakumi Primary School:** Due to mal-functioning of the inverter, no data was recorded between December and September 2019.

Power at Schools: Production vs Consumption



Figure 15: Gambela Pry School

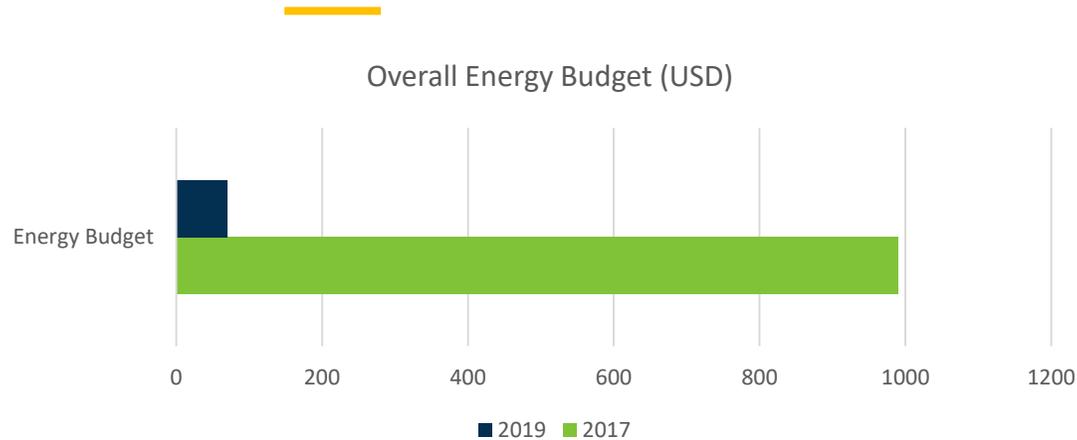
Figure 16: Migodmani Pry School

- **Gambela Pry School:**
- **Migodmani Pry School:**

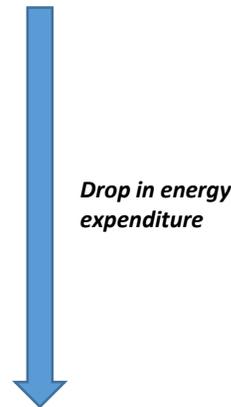
Schools: Key Findings

- **Systems adequacy:** Due to an increase in energy consumption from additional appliances at the school, it can be inferred for the purposing of informing similar interventions which implement standardized/non-customized PV solutions, that a 800Wp system may not be adequate for secondary and day & boarding primary schools. A bigger system would be recommended.
- **Systems usage:** ICT & communication, powering equipment, indoor and security lighting are the main areas of power usage. All these are critical areas of power utilization in a school.
- **ICT & Communication:** Integration of ICT in education has delivered positive impacts at the schools. The use of projectors in Somali Bantu has enhanced efficiency in teaching in huge classrooms with a high student number. The classrooms in refugee camp schools are so much congested that some students do not have a good view of the teacher. The full potential of ICT integration in learning, however, cannot be fully exploited without internet connectivity. Internet provides a medium of accessing invaluable information repositories and interacting with outside world. At the moment 4 schools have access to an internet connection.
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- **Lighting:** Proper illumination of indoor and outdoor spaces has led to an extension of study hours for the students and boosting of security in the schools and environs.

Power at Schools: Energy Budget



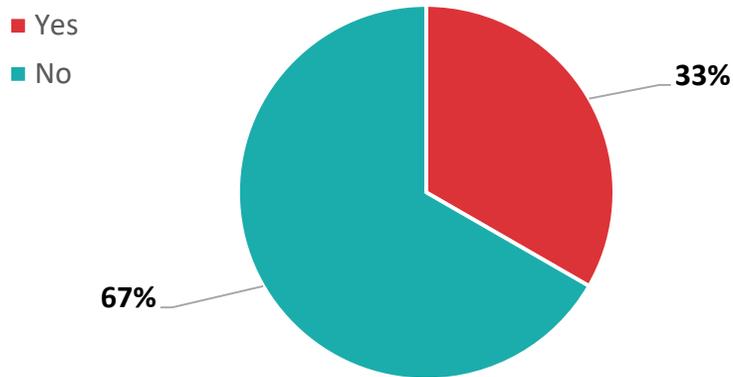
School	Energy Budget/Term 2017	Energy Budget/Term 2019
Mwamba Care Junior School	\$90	\$45
Kakomani Primary School	\$10	\$5
Shujaa Mekatilili Sec. School	\$580	\$0
Palakumi Primary School	\$20	\$20
Mouneal Shepell	\$290	\$0
Total	\$990	\$70



- **Energy Expenditure:** Before installation of the PV systems, 5 schools had access to power from the grid or generator, which resulted in an overall energy budget of \$990 per term in 2017. Since the installation of the PV systems, the overall energy budget has reduced to \$70 per term in 3 out of the 5 schools in 2019.
- **Highest savings:** Shujaa Mekatilili had the highest energy budget of \$580 – which has seen a 100% decrease since installation of PV systems.
- **Energy Budget:** Mwamba Care and Kakomani Primary have halved their budgets to \$45 and \$5 respectively since both schools are still connected to the Grid. Due to the mal-function of the inverter, Palakumi largely uses Grid power and its energy budget is at \$20.
- **Energy Budget for Ovo 1 Pilot PV system:** The schools that had no power before the intervention, still have no recurring energy expenditure resulting from the use of the PV system.

Income Generating Activities

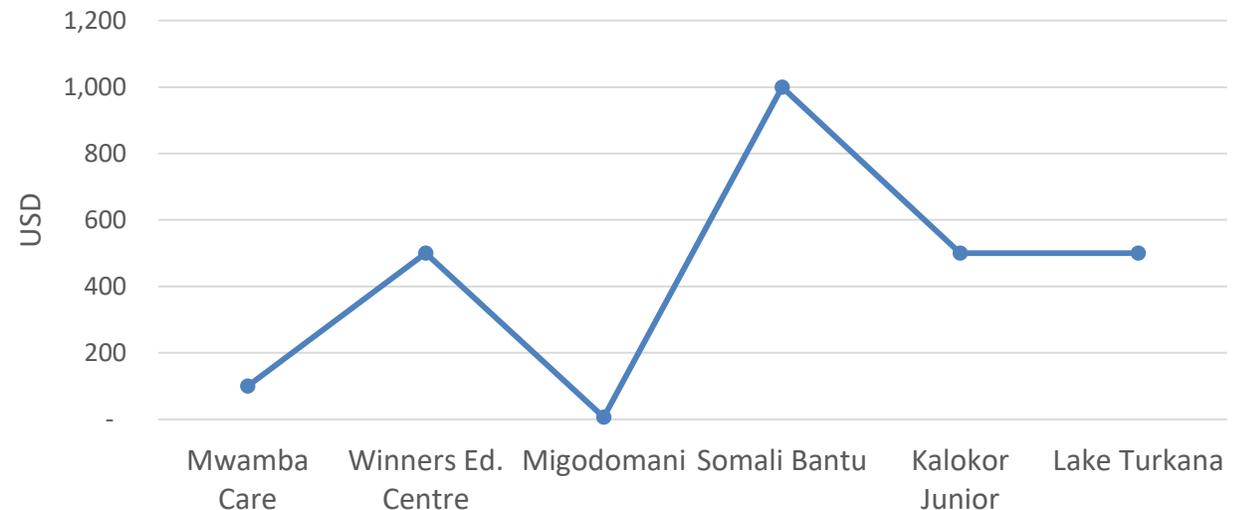
Income Generating Activities



Type of Income Generating Activities (IGA) at the Schools include:

- Payment of tuition fees for private or partly sponsored schools;
- Phone charging services to local community members;
- Contribution fee by students for minor school development activities; and
- Sale of food and beverage at a restaurant in the school*

IGA Earnings per School



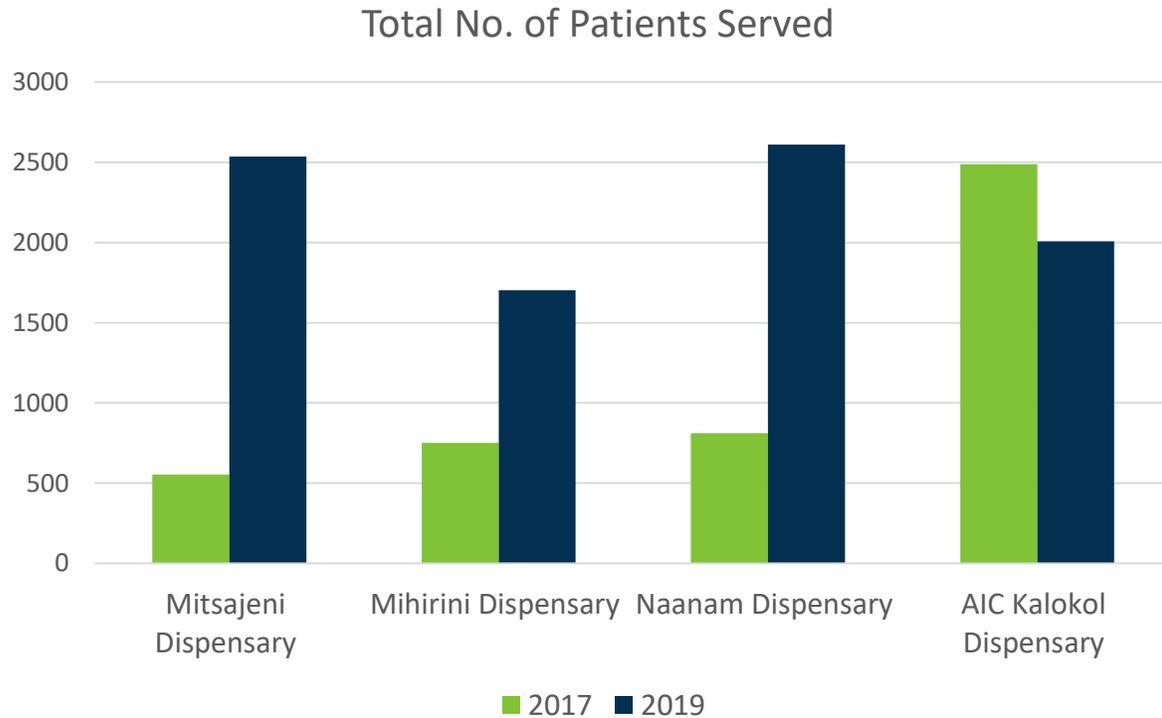
- 6 out of the 16 schools engage in Income generation activities
- The schools receive an average of \$435 per month from the IGAs.
- Somali Bantu receives \$1,000 per month from its IGA which results from payment of a contribution fee by students for school development activities.
- Migodamani receives \$6 per month which is earned from offering phone charging services to community members.
- Mwamba receives \$100 per month while Winners, Kalokol and Lake Turkana each receive \$500 per month from payment of tuition fees by students.

Schools: Key Findings

- **Energy budget:** For the 5 schools which either relied on grid power or generators, there has been an overall tremendous cost saving that saw the overall budget decrease 14-fold as a result of Ovo 1 Pilot intervention. These type of schools are always resource constrained, and these sort of savings are desirable and instrumental in alleviating their financial burdens. The reduced energy budget reflect that the solar PV intervention provided financial benefits to these institutions.
- **Income Generating Activities (IGAs):** It's not common for public schools in Kenya to have IGAs since primary and day secondary education is fully subsidized by the government (Muyanga et al 2010). This explains why Dumuni, Kakomani, Palakumi Migodomani & Shujaa Mekatilili do not have IGAs. Somehow, Mihingoni is able to generate some little revenue from phone charging.
- In the case of schools in the refugee camp such as Somali Bantu, though public, are not strictly bound by stringent government rules and policies therefore record a high number of schools engaging in IGAs.
- Private schools normally charge fees and have the liberty to engage in IGAs. The proprietor of Kalokor Junior Academy recently opened a restaurant which is being powered by Ovo 1 Pilot power in a bid to augment the revenue streams (*See Case Study*).
- IGAs can contribute to the budget for maintaining the PV systems. Where feasible, schools should be encouraged & propped to engage in IGAs.
- **Facilitation of community co-benefits:** Ovo 1 Pilot has created multiplier impacts which have been extended to host communities. Members of community can charge their phones at some of the schools, Mwamba Care hosts students from nearby schools for evening studies, Kalokor Junior hosts a church congregation on Sundays where sound systems are powered by Ovo 1 Pilot PV and as mentioned above, the proprietor recently opened a modern clean eatery which has refrigerated drinks.

Overview of Clinics

Overview of Clinics: Patients & Operations



- Patients served:** Before installation of the PV systems in February 2018, the overall number of patients served at the clinics was 4604. In September 2019, the total number nearly doubled to bring the total to 8857. An additional 1189 male, 2321 female and 743 children are benefitting from the power provided by Project Jua PV systems. There was a slight drop in number of patients served at Kalokol.
- Day vs Night Patients*:** The overall number of day patients served increased from 4322 to 8362 since the installation of the PV system while that of night patients increased from 282 to 494.
- Patient Attendance:** The clinics attended to an average of 1476 patients per month (1393 day; 83 night).
- No. of births:** The overall number of births at the clinics before PV installation was 136. In September 2019, the total number increased to 160. An additional 24 women received maternal care since the installation.
- Day vs Night births**:** The overall number of day births decreased from 84 to 74 while that of night births increased from 52 to 86.
- Clinic Operations:** The overall number of hours available for clinic services increased by an average 7 hours per day after PV installations. Outpatient clinics operate for an average of 10 hours per day. Clinics offering both outpatient and inpatient services now operate 24/7.

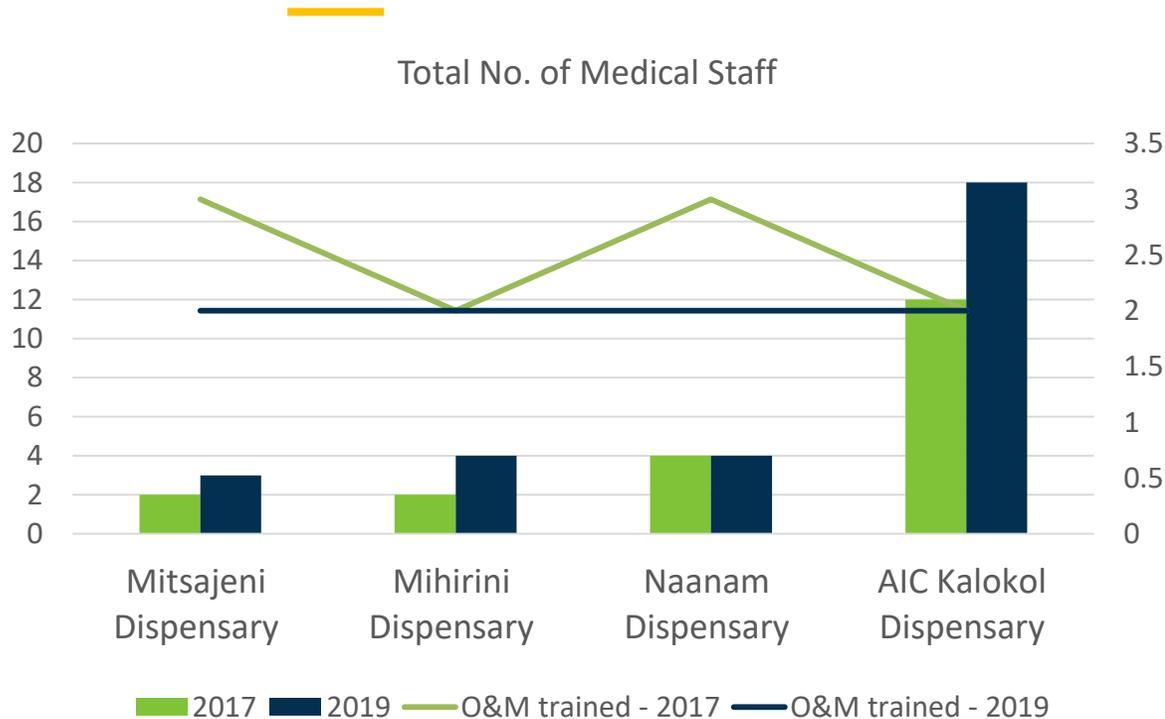
**Mitsajeni and Mirihini Dispensaries mostly operate during the day. However, due to lack of proper record keeping, the number of patients served at night at Mirihini is unknown but the number was on an upward trend before installation.*

***Mitsajeni Dispensary recorded no births in 2017 however, it began offering maternity services just before PV installation late 2017.*

Clinics: Key Findings

- **Patients served:** There has been a significant increase of 48% on the number of patients treated at the 4 facilities since Ovo 1 Pilot intervention. The fact that more patients are seeking health services denotes improved access to health services and consequently better health status for served communities.
- Naanam and Mitsajeni which had no power prior to Ovo 1 Pilot intervention registered the highest increments of attended patients. This underscores the centrality of power in provision of medical services since diagnosis, procedures, treatment etc. have to be supported with medical appliances which in turn need power.
- The number of night patients at the facilities has significantly increased, a development directly attributable to presence of proper lighting. As a nurse in Naanam dispensary observed, *“It was exceptionally difficult to respond to night cases in complete darkness, and when done, the quality of service was compromised. Imagine performing such a delicate procedure as delivery with illumination from a flashlight. So many things can go wrong.”* However, due to lack of proper record keeping, the number of patients served at night at Mirihini is unknown but the number was on an upward trend before installation.
- **Maternity services:** The night births have also increased, affirming the fact that adequate lighting and deployment of essential appliances such as suction machines and oxygen concentrators have made it possible to perform medical procedures safely and conveniently.
- **Referral patients:** The clinics are still referring patients to higher level facilities. The referral has both positive and negative dimensions. On positive end, it shows that patients are seeking medical services. On negative, it means the facilities lack sufficient capacity in skills and equipment. None of the clinics has emergency transport services which exacerbates the situation. Possible capacity building in this respect would be recommended.

Overview of Clinics: Clinic Staff

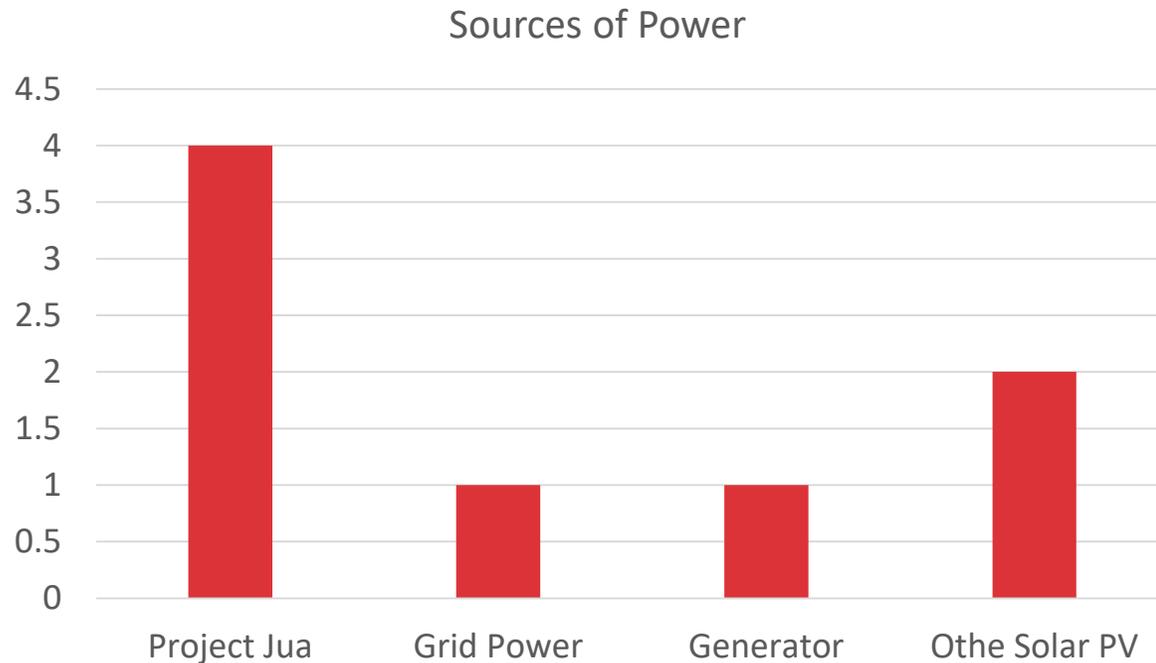


- **Medical Staff:** The total number of medical staff at the clinics increased from 20 in 2017 to 29 in 2019 before the installation of the PV systems.
- **Average daily attendance:** All medical staff members at all the clinics attend work daily.
- **O&M Trained Staff:** A total number of 10 staff members received O&M training during installation of the PV system. Each school has an average of 2 E4I-trained staff members.
- **Staff housing:** The overall number of staff residing at the clinic premises increased from 19 to 22 since the installation of PV system.
- **Non-Teaching Staff:** The total number of non-teaching staff declined from 25 to 23. However, the daily average attendance is at 100%.

Clinics: Key Findings

- **Clinic staff:** There was an overall increment of staff members working at the clinics since Ovo 1 Pilot intervention. Whilst there are many non-power related factors which influence staffing such as staff transfers, salaries etc, power availability does improve the quality of life and other work related tasks and this can act as a 'pull force' to attract and retain staff at the facilities.
- **Staff housing:** There was a slight increase of staff residing within the premises. Provision of staff housing , more so for medical staff, is desirable for purposes of prompt response to emergencies and general convenience while attending to duties. All facilities except Mitsajeni have staff quarters. Construction of staff houses at Mitsajeni is underway.

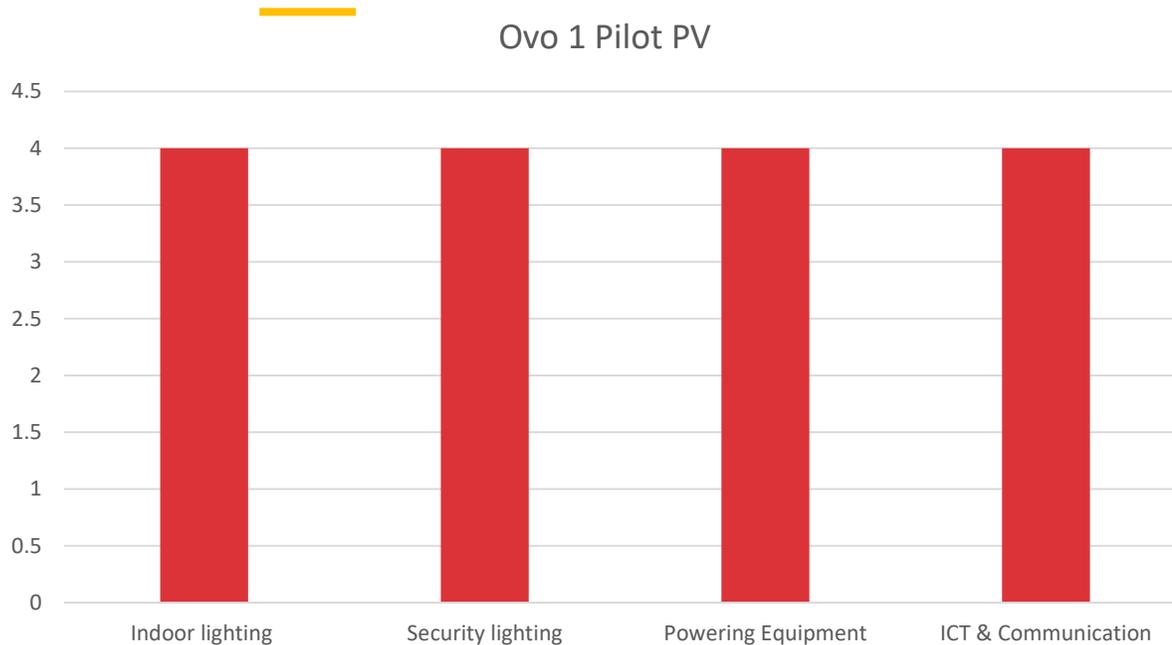
Power at Clinics: Source & Functionality



- **Source of Power***: The institutions use 4 different sources of power with 1 clinic using Ovo 1 Pilot PV systems as its only source of power. The other 3 substitute Ovo 1 Pilot PV power with either Grid Power, Generator and other Solar PV systems.
- **Systems functionality**: All systems were found to be operational and in good condition.
- **Additional Power**: Since the installation of the PV systems no clinic has acquired an additional source of power.
- **Cabling Infrastructure**: All wiring done by E4I support at the clinics is in good condition.

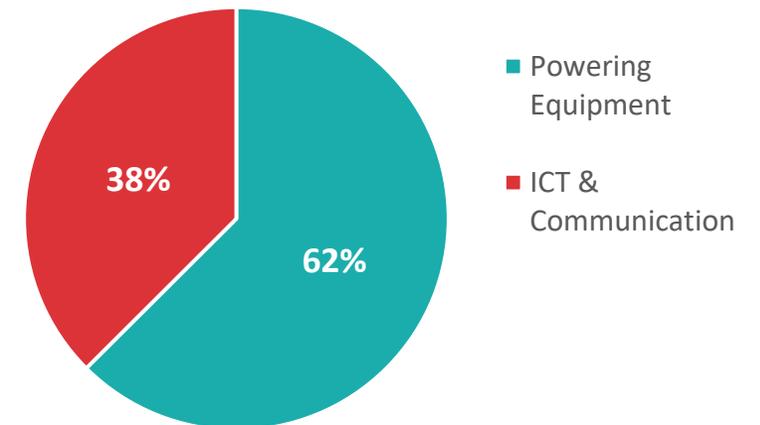
**Grid Power – (Mirihini Dispensary) Other PV – (Kalokol Dispensary and Naanam Dispensary) Generator – (Kalokol Dispensary)*

Power at Clinics: Usage & Adequacy



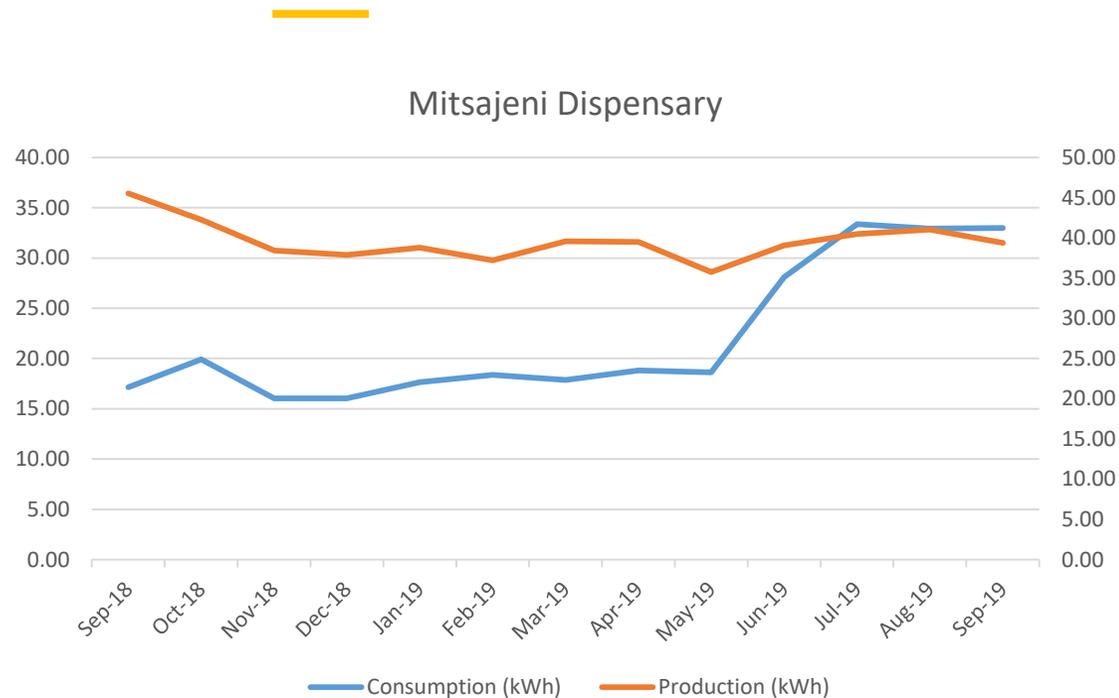
- **Adequacy:** All clinics stated that Ovo 1 Pilot PV does not meet their current power needs since. The clinics acquired new equipment which the PV system is unable to sustain the usage of all appliances at the same time.
- **Usage:** All clinics used Ovo 1 Pilot PV system for lighting, powering equipment and ICT and communication.
- **Appliances*:** A total of 8 appliances were acquired since the installation of the PV systems (*See Annex 2*)

Category of New Appliances Acquired



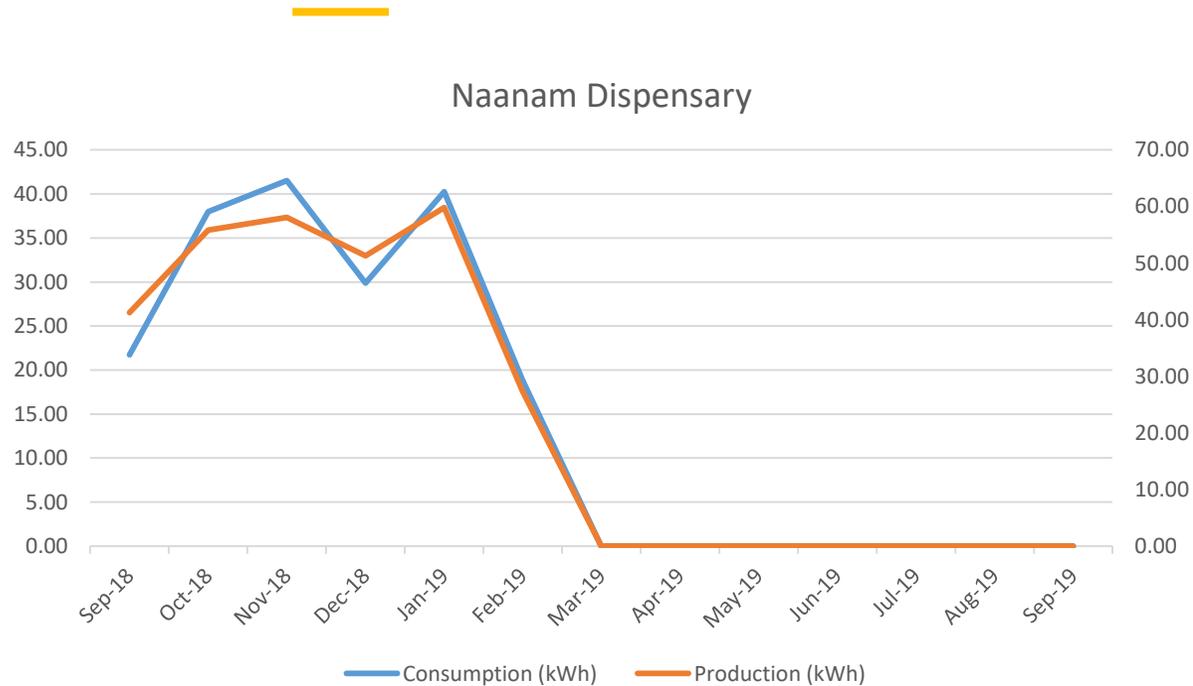
- **Internet Connectivity:** All clinics are yet to access to Wi-Fi connection. However, Mirihini Dispensary has access to Mobile-4G services.
- **Powering Learning Equipment:** Out of the 8 newly acquired equipment, 5 are medical equipment all powered by the PV system.
- **Charging Appliances:** All staff members charge their appliances at the clinics.

Power at Clinics: Production vs Consumption



- **Mitsajeni Dispensary:** Consumption increased steadily between September and May then recorded an increase in subsequent months. On average, the clinic consumes 24kWh per month. The sharp increase between May and June from 18kWh to 28kWh was as a result of use of new appliances.
- **Mihirini Dispensary:**

Power at Clinics: Production vs Consumption

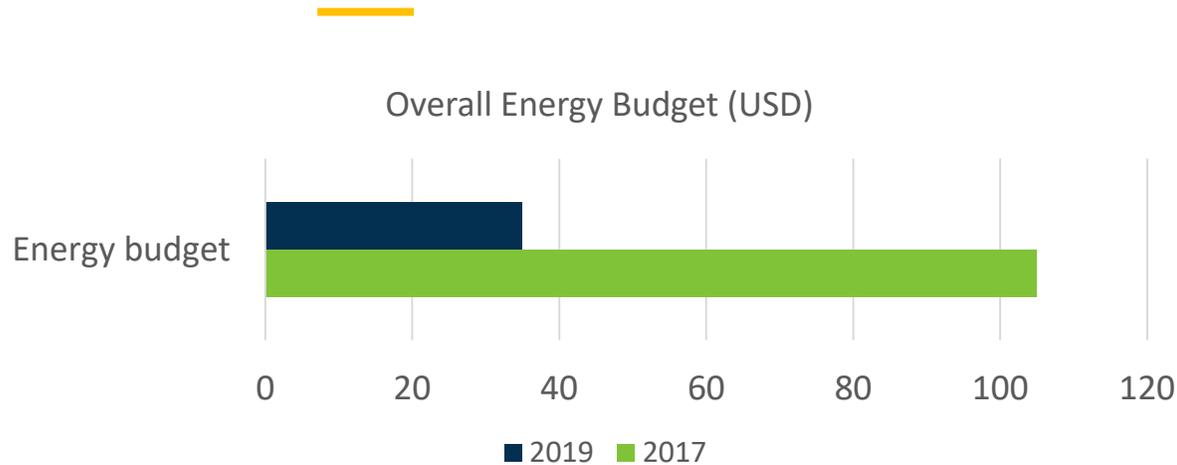


- **Naanam Dispensary:** No data was transmitted between March and September however the data transmitted shows the clinic consumes an average of 32kWh per month.
- **Kalokol Dispensary:**

Clinics: Key Findings

- **Systems functionality:** All systems were found to be in good working condition. Naanam had experienced short circuit fault in the cabling infrastructure in July 2019, which affected power utilisation. This fault was fixed during annual maintenance exercise in September and the system restored. This is an indication that the clinics are finding value in the systems and as a result taking good care of them. This is good for project sustainability.
- **Systems usage and adequacy:** Naanam and Mitsajeni are relying wholly on Ovo 1 Pilot power. Though AIC Kalokor has other PV systems, its registry, inpatient and maternity units use Ovo 1 Pilot power, backed up by a Genset. Mirihini had a PV system and was connected to grid at the time of project intervention. The grid power is unreliable and experiences downtime for hours in a day. Ovo 1 Pilot power is therefore the main source of power in all 4 clinics at moment.
- The feedback across all clinics is that this system is inadequate. This is not unexpected given that some of the appliances in use such as autoclaves and incubators have power ratings of between 0.7 – 1.5 kW (*from field observations*). Where RMS data is available, this feedback has been corroborated. For clinics therefore, bigger systems of 3kW and above would be recommended.
- **Acquisition of additional appliances:** All 4 clinics have acquired additional appliances. Access to power from Ovo 1 Pilot systems played a major role in catalysing the acquisition since 2 facilities did not have power before installation while the other 2 had power which was either inadequate and or unreliable.

Power at Clinics: Energy Budget



Clinic	Energy Budget/month 2017	Energy Budget/month 2019
Mirihini Dispensary	\$30	\$20
AIC Kalokol Dispensary	\$75	\$15
Total	\$105	\$35

↓
Drop in energy expenditure

- **Energy Expenditure:** Before installation of the PV systems 2 clinics had access to power from the grid or generator, which resulted in an overall energy budget of \$105 per month in 2017. Since the installation, the overall energy budget has reduced to a total of \$35 per month for the 2 clinics.
- **Highest savings:** Kalokol Dispensary had the highest energy budget of \$75 – which has seen an 80% decrease to \$15 since installation of PV systems.
- **Energy Budget:** Mirihini Dispensary has decreased its budget by \$10. Mirihini used Grid power and its energy budget reduced from \$30 to \$20.
- **Energy Budget for Ovo 1 Pilot PV system:** The clinics have no recurring energy expenditure resulting from the use of the PV system.

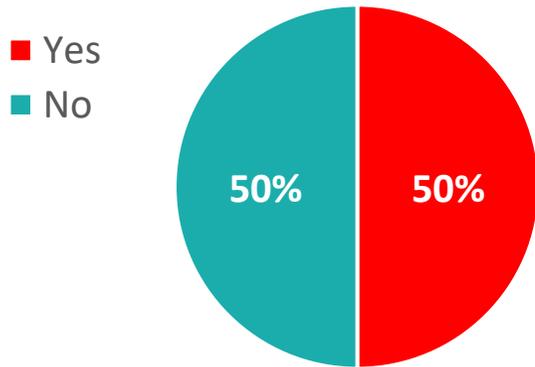
Clinics: Key Findings

- **Energy budgets:** Kalokor AIC which primarily used a generator and Mirihini which relied wholly on grid power have both registered a considerable reduction in their average monthly energy budgets since the installation of the systems. The cost savings resulting from Ovo 1 Pilot PV usage has relieved off financial pressures for both clinics. For AIC Kalokor, a reduction in fuel consumption also translates to lower carbon emissions into the atmosphere.
- **Income Generating Activities:** In public hospitals, engaging in IGAs is not a common occurrence. However, *Naanam clinic, a public facility, is generating revenue from offering printing & photocopying services to the community. Initially, the services were free but as the demand increased, the management decided to introduce a fee. This indicates there could be an opportunity for these kind of income streams in these contexts which can augment the overall budgets.
- Mirihini is also raising some money from deliveries conducted for mothers registered with NHIF scheme then claims the fee from NHIF. The claims must however be well supported with necessary documentation which is made possible by reliable power from the PV system. This is another opportunity that clinics can look into, particularly in areas with high subscription to the NHIF.

**Naanam clinic is located in an off-grid area and the near-by town where such services are available is 35 km away.*

Income Generating Activities

Income Generating Activities

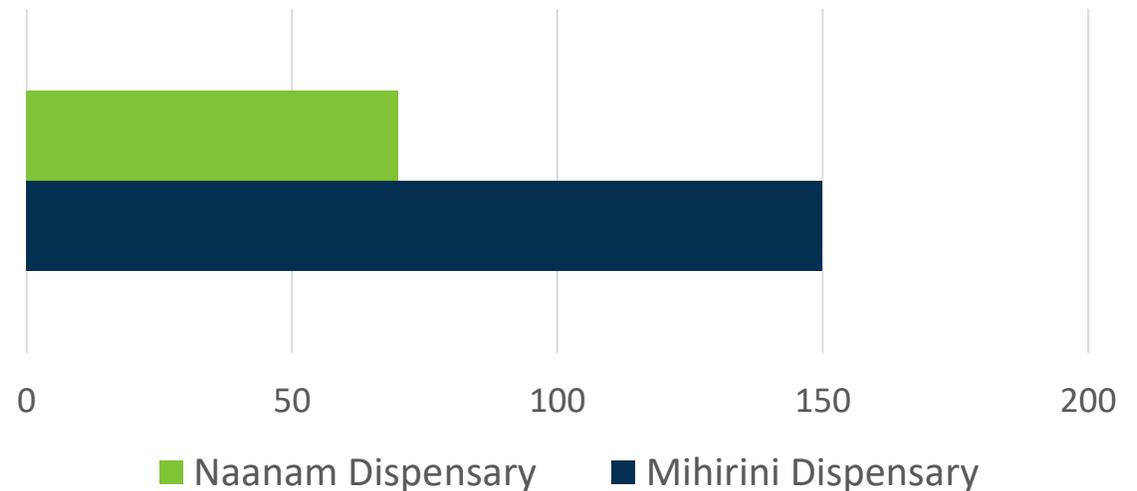


Type of Income Generating Activities (IGA) at the Clinics include:

- Claims from *NHIF for every delivery made at the clinic through **Linda Mama program.
- Printing and photocopy services for community members.

- Mirihini and Naanam Dispensary engage in IGAs and earn a total of \$220 per month.
- Mirihini receives an average of \$150 per month from its IGA which results from NHIF delivery claims.
- Naanam receives an average of \$70 per month which is earned from its photocopying and printing services provided to community members.

IGA Revenue/month (USD)



Impact: Schools and Clinics

Impact: Schools and Community

Impact on Schools - feedback from Management

Impact on Community - feedback from Management

SCHOOLS

- Availability of early morning and evening classes
- Able to file TSC tax returns which saves time and money that could have been spent at cyber cafes.
- Savings spent on academics.
- Teachers can charge their appliances at the school
- Increased enrolment for female students – changing cultural beliefs.
- Enhanced security around the school.
- Enabled ICT integration in learning and administrative work for teachers.
- Better school record keeping.
- Provision of boarding facilities.
- Harmonious co-existence amongst different nationalities residing in school boarding facilities.
- Introduction of IGAs to generate income for the clinics e.g. restaurant
- Reduced student transfers, which has led to maintaining consistent enrolment.

- Other students from nearby schools have access to the school (Mwamba Care & Winners Ed. Centre) for their evening studies.
- School hosts other communal & social events such as bible studies, weddings and fundraisers when the school is on holiday.

Impact: Clinics and Community

Impact on Clinics - feedback from Management

Impact on Community - feedback from Management

CLINICS

- The clinics now offers maternity services and are able to conduct night deliveries.
- Medical procedures that require proper and targeted illumination can be conducted.
- Staff can charge their gadgets at the school
- Enhanced security at the clinics
- Power makes it possible to process documents for NHIF's Linda Mama Program to claim back monies for maternity services.
- Better illumination has enabled full operationalisation of inpatient wings.
- The clinics are now able to attend to patients at night, particularly night deliveries
- Vaccines and nutritional supplements can be safely stored in the fridges.
- Power is now available in staff houses
- Staff members are able to prepare and print reports and other documents at the clinic without having to go to town centres

- Community sensitization campaigns are held at the clinics
- Participation of clinic staff in community outreach programmes in areas not close to the clinic e.g. Immunisation
- Residents do not have to travel to the town centre to print and photocopy documents.



Lessons Learnt

Lessons Learnt

- **Income Generating Activities:** There are opportunities for beneficiaries of such interventions to engage in productive activities to generate extra incomes which can be channeled to system maintenance and or other areas. Power installations should therefore be followed up with mentorship support to identify PUE activities.
- **Proper power utilization scheduling/ load management:** This is key for optimal utilization of available power in PV systems. Where possible, usage of high power consuming appliances such as printers, desktop computers etc. should be scheduled to coincide with hours of optimal sunshine to allow time for replenishing the charge for use in dark hours.
- **Strengthening linkages between institutions and technical support services:** The technical and support services post-installation and post-training should be reliable. Constant communication should be maintained between the institution staff and the technical team to urgently and effectively address any arising issues to minimise system downtime.
- **Advise on equipment purchase & utilization:** The institutions should be provided with recommendations on type/size of equipment to purchase and utilize to ensure the system can effectively power the equipment.
- **Staff turnover:** Staff turnover at the institutions is inevitable and patterns unpredictable. Staff trained on systems operations may exit the institutions leaving it without support on matters O&M. To mitigate against the risk therefore, it good to schedule routine refresher trainings which should be reinforced with comprehensive reference materials.
- **Power availability can catalyse appliance acquisitions.** The common denominator in institutions that acquired more appliances is they either had no power or where present, it was inadequate or too expensive. Without additional power, therefore, they would not have been compelling to add the new appliances, notwithstanding the means which financed the acquisition.
- **Ownership:** All the systems are functional and well taken care of despite having been provided at no cost. This postulates that a sense of ownership and responsibility in these sort of assets can be only be guaranteed whenever a full or partial payment is made during acquisition. Our findings show that as long as the beneficiaries can derive true value, they will own and take good care of systems.

Project Sustainability

Project Sustainability

- **Way forward:** The institutions were duly informed that the pilot phase has ended and there will be minimal interactions with E4I staff going forward.
- **Staff turn-over & project sustainability:** There has been turnover on staff trained on O&M. However, all the institutions still do have training materials disseminated during hand-over process. It was explained that they should refer to the materials more frequently to gain more knowledge and understanding of how the system works and its maintenance.
- **Warranties:** Warranties for batteries, inverters, charge controllers and solar panels remain valid until the end of January 2020. The management team was made aware of the warranty and advised to contact the technicians from Sollatek when they experience challenges with the system within the warranty period.
- **E4I Support:** The management team was informed of the continued relationship with E4I field officers for any assistance. This assistance will however be offered remotely. It is worth noting that given the scale up of Ovo 1 Pilot is being implemented in the two counties, there will be occasions when support could be extended.
- **Income Generating Activities:** The beneficiaries were educated on benefit of engaging in IGAs that can contribute to generation of O&M funds.
- **Transfer of O&M to county government:** E4I is considering engaging with the respective counties to take over the project's O&M now that the donor, the Ovo Foundation and E4I are reducing their interactions with the institutions

Case Study

A new restaurant at Kalokor Junior Academy powered by Ovo 1 Pilot system.

- The restaurant was opened in June this year by the school's proprietor, Mr. Peter Onyango. It's a modern clean eatery. This area is off-grid. To supply the place with power, Mr. Onyango had to lay an underground cable, passing through the road and neighbouring households all the way from the school to the hotel, a distance of about 150m.
- The hotel has a fridge, a TV and lights. He employs a robust load management schedule where computers at the school and the fridges at the hotel are switched on during day time during peak sunshine hours. At night, only the TV and lights are put on. When E4I field officer visited the eatery in early evening, it was well lit and the patrons were watching the TV as they had their freshly prepared meals. The proprietor says the venture has provided a critical revenue stream for the school. (A link to the video of the restaurant will be provided)



Annex

Annex 1: Additional Lit Rooms/Spaces

School	Name of Rooms/Spaces	Means of Financing
Mwamba Care Junior School	4 security bulbs	Through school's own mobilized finances
Palakumi Primary School	2 dormitories, kitchen, store	School's own funds
Migodomani Primary School	3 dormitories, 6 classrooms, 1 toilet	Funded by a board member
Shambe Primary School	2 classrooms	With support from a local NGO
Kalokol Junior Academy	A restaurant with 2 rooms and 1 security space.	Through a debt facility from a financial institution.

Annex 2: List of New Appliances Acquired

School/Clinic	New Appliances Acquired	Means of Financing
Mwamba Care Junior School	5 mobile phones	N/A
Shujaa Mekatilili Sec. School	1 Television set, 2 laptops	School's own funds
Lokitang Primary School	1 laptop, 2 tablets	Support from UNHCR
Horseed Primary School	2 laptops	Support from UNHCR
Somali Bantu	1 internet router, 33 tablets, 1 photocopier, 3 laptops, 1 fan, 1 radio, 3 sound amplifiers	Support from UNHCR and school's own funds
Kalokor Junior Academy	2 fans, 1 TV, 1 laptop, 1 fridge	School's own funds
Mitsajeni Dispensary	1, 185W fridge; 1, 800W room heater	Support from County Government
Mirihini Dispensary	1 suction machine	Support from County Government
Naanam Dispensary	1 desktop, 1 printer	Support from County Government
AIC Kalokol Dispensary	1 refrigerator, 1 laptop	African Inland Church

Annex 3: Power and Non-Power Support

Power Support	Frequency of Request	Non-Power Support	Frequency of request
Ovo 1 Pilot PV System upgrade	4	Boosting of feeding program	3
Appliance acquisition e.g. tablets, laptops, printer	4	Construction of staff houses	1
Installation of CCTV cameras	1	Construction of more buildings/rooms/school fence	7
Internet connection	2	Provision of proper water and sanitation facilities and related infrastructure and equipment e.g. piping, water storage	4
		Provision of school uniforms	1
		More delivery beds	1

Annex 4: Areas of end-line evaluation

Schools

- Impact on study time availability
- Impact on enrollment
- Impact on attendance
- Impact on number of candidates and performance
- Impact on teaching and non-teaching staff
- Current sources of power & energy budget
- Additional power installed at the school post Ovo 1 Pilot
- Systems' functionality
- Systems usage and adequacy
- Acquisition of additional electrical appliances post Ovo 1 Pilot
- Internet connectivity
- Management accounts on PV system's impact on the school
- Charging of students appliances
- Desired support to enable maximum utilization of available power
- Status of cabling infrastructure provided with support from Ovo 1 Pilot
- Income generating activities
- Desired non-power related support

Clinics

- Impact on duration of availability of medical services
- Impact on number of patients served at the clinic
- Impact on maternity services
- Impact on patient referrals
- Impact on medical and non-medical staff
- Current sources of power & energy budget
- Additional power installed at the school post Ovo 1 Pilot
- Systems' functionality
- Systems usage and adequacy
- Acquisition of additional medical appliances post Ovo 1 Pilot
- Internet connectivity
- Management accounts on PV system's impact on the school
- Desired support to enable maximum utilization of available power
- Status of cabling infrastructure provided with support from Ovo 1 Pilot
- Income generating activities
- Desired non-power related support



Figure 5: A Doctor attending to patients at Mirihini Dispensary



Figure 6: A Doctor working on the computer at AIC Kalokol Dispensary



Figure 7: A suction machine at Mirihini Dispensary



Figure 8: A Doctor attending to patients at the pre-natal ward at Naanam Dispensary



Figure 9: Fridges at Mitsajeni Dispensary



Figure 10: A Teacher at Shujaa Mekatilili Secondary School printing documents



Figure 11: Students at Kalokol Junior Academy attending an evening class



Figure 12: Students at Lake Turkana during a class



Figure 13: A Teacher at Migodmani Primary School working on his laptop

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