KTF

VILLAGE CONNECT

Interim Evaluation Report, May 2019

ACKNOWLEDGEMENTS

This interim evaluation was undertaken by the Kokoda Track Foundation (KTF) between March - May 2019. Participants in the study were recipients of KTF's Village Connect project, which aims to connect 2,000 households to solar lighting and energy solutions by 2020. Participants came from villages along and around the Kokoda Track in the Central and Oro Provinces.

We would like to thank all people who participated in the evaluation and the staff from KTF who facilitated the interviews and survey collection.

We would also like to thank our generous supporters of the Village Connect Project: the Kokoda Initiative (Australian Department of Foreign Affairs and Trade) who funded 78% of the household systems and 100% of the facilities systems); and Mundango Abroad, the George & Josie Palmer Fund, and Back Track Adventures who funded the additional 22% of household systems. We are also grateful to SolarBuddy, On Track Expeditions, Kokoda Initiative, PNG Air and the Cronulla Sharks for their in-kind support with freight, logistics and installation. We are also grateful to PNG Solar Solutions for their support of procurement of the systems and their generous provision of discounted purchase prices.

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MUNDANGO ABROAD

INTRODUCTION

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- KTF is an International Development NGO that has been working in PNG since 2003. KTF delivers development programs across four main program pillars: education, health, livelihoods and leadership.
- In 2017, KTF commenced its Village Connect project which aims to connect 2,000 households across the Kokoda Track catchment region to sustainable solar solutions by 2020. The project aims to connect remote villages to improved solar lighting and energy solutions, providing a cost effective and environmentally friendly source of lighting and energy. With only 5% of the PNG rural population connected to the electricity grid, installation of the Sunking and Barefoot lighting systems will positively impact lives and livelihoods of remote communities across the Kokoda catchment region.
- This interim evaluation report was commissioned by KTF to measure the impact to date of the Village Connect project on a range of outcomes for recipients including time spent on homework, family income, and use of kerosene.
- This is part of a larger research program that will investigate the impact of the solar technology on outcomes over a period of time.

“Energy poverty condemns billions to darkness, ill health, unfulfilled futures and repeated cycles of poverty.”

— UN Foundation

BACKGROUND

BACKGROUND

- Energy poverty is the lack of access to modern energy services; it especially affects people developing countries whose wellbeing is negatively affected by very low consumption of energy, use of dirty or polluting fuels, and excessive time spent collecting fuel to meet basic needs.
- Energy poverty impacts a third of humanity — some two and a half billion people do not have access to electricity or modern energy services. The vicious cycle of energy poverty begins with the lack of access to affordable energy. Those who rely on traditional fuels, such as firewood, must spend several hours each day collecting fuels. This burden falls disproportionately to women and children, and it robs them of education and income-generating work (Nathwani, 2018).
- The International Energy Agency predicts that by 2040, two billion people globally will lack electricity and access to modern fuels for cooking such as natural gas. The IEA also predicts that the cost of providing universal access to energy by 2030 would require annual investment of $35 billion. This is much less than the amount provided annually in subsidies to fossil fuels.
- The UN Sustainable Development Goal 7 — a call for action to improve “access to affordable, reliable, sustainable and modern energy for all” —may simply remain an aspiration. According to the IEA and UN, if we focus on extending the electrical grid, as we have in the past, we are not on track to meet the goal.
- Instead, we need a significant commitment to new investments in distributed energy systems, combined with scientific and technological breakthroughs to improve affordability, by an order of magnitude, if we are to scale-up these technologies rapidly.

VILLAGE CONNECT: KOKODA TRACK

- 6.3 million people in PNG live without access to the electricity grid. Solar lighting and energy technology presents a significant opportunity to provide clean, sustainable and affordable lighting solutions to off-grid communities in PNG. Improving PNG's solar infrastructure benefits education, income generation, the environment and health outcomes for local people.
- Our project illuminates homes in remote and rural PNG through the installation of lighting and energy systems for entire homes. Each system lights up 3 to 4 rooms and contains an outside bright light and a charging station for families to charge mobile phones and other USB powered devices.
- As well as installation of the systems, we also deliver a solar energy education program to people receiving the household solar systems and train local women and men to install, undertake maintenance, and understand the science and benefits behind solar technology and other renewable solutions. These systems reduce the need to burn toxic kerosene for a source of light, as well as reduce the need to spend precious and hard earned income on expensive torch batteries. The benefits for education, health, safety and environment are impressive.
- To date, KTF has installed household solar systems onto 805 households and facilities systems onto 57 schools, aid posts, churches and community centres. These systems have provided clean energy and lighting to more than 4,000 people in the remote catchment area of the Kokoda Track.

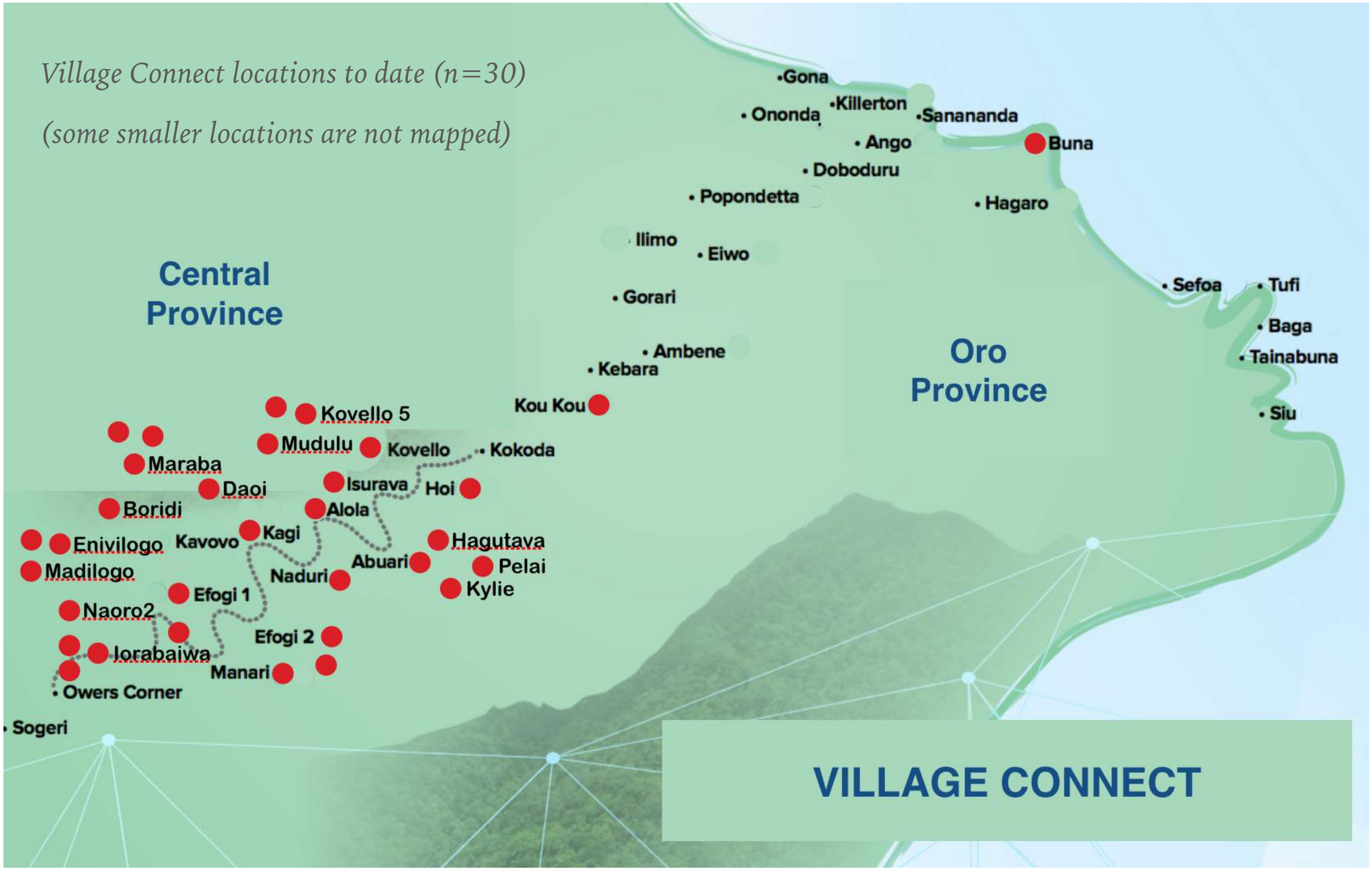
DISTRIBUTION PHILOSOPHY

- Distribution to date has been undertaken in line with KTF's other education development activities via a cluster approach and existing project supply chains.
- KTF's initial Phase 1 focus for Village Connect was for all villages located along the Kokoda Track. In Phase 2, the focus was expanded to the immediate catchment region.
- There a numerous links to other KTF development projects:
    - In 2019, KTF commenced tablet-based learning at its Kokoda College facility which delivers the Flexible Open Distance Education program in partnership with the Oro Provincial FODE office and National Department of Education. This was the first tablet based FODE centre in the country and in 2019, KTF enrolled 125 students into the College program. These students require power solutions at home in order to continue their self-directed learning between face-to-face classes at the College. Phase 2 and 3 of the Village Connect project are particularly focused on lighting up the villages of the students enrolled at the Kokoda College.
    - KTF's PNG Schools and Healthy Communities projects support the operations of elementary and primary schools and aid posts and health centres across the Kokoda Track catchment region. KTF's support to date includes training and postings of teachers and community health workers, infrastructure support, and regular resourcing. These schools and health facilities benefit from solar lighting and energy solutions for improved service delivery; and communication between KTF and its teachers and health workers is improved with access to lighting and power.
- We also worked closely with a number of our co-delivery partners including the Kokoda Initiative (Department of Foreign Affairs and Trade) and No Roads to Health (NGO) to determine which areas should be focus areas for the project in order to enhance our collective development aims across the region.

VILLAGE CONNECT: KOKODA TRACK

Village Connect locations to date (n=30)

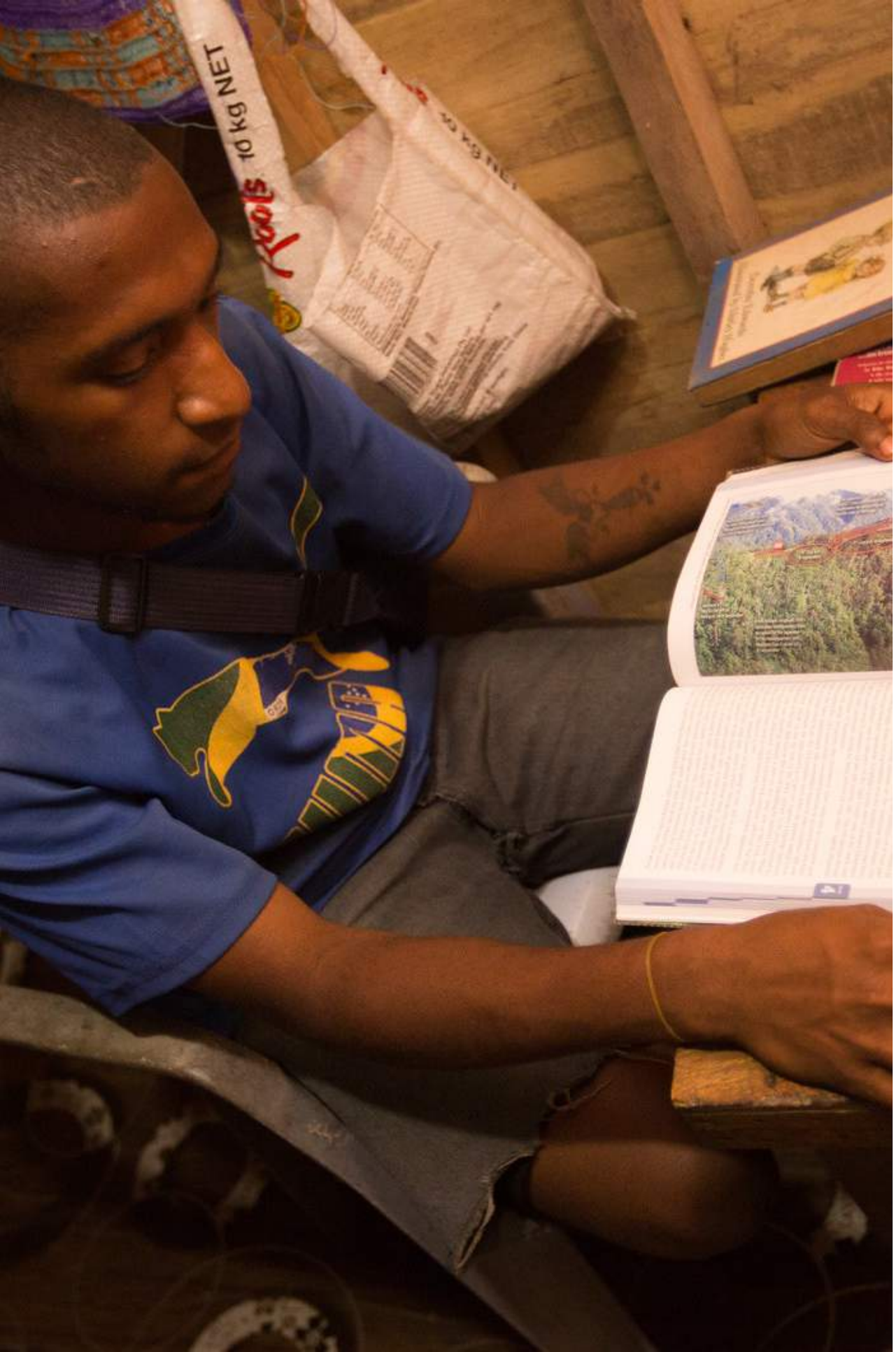
(some smaller locations are not mapped)



AIMS & METHOD

AIMS & METHODOLOGY

- This interim evaluation was commissioned by KTF to measure the impact of the household solar lighting and energy systems on a selection of outcomes for a sample of participants who have had systems installed onto their homes during the past 6 months.
- A mixed-method approach was adopted including the administration of a short survey to a sample of household owners across the catchment region. Semi-structured interviews were also conducted with a sample of participants across the region.
- The survey collected demographic data on the households as well as a series of questions to elucidate the impact of the solar lighting and energy systems on student study time, family kerosene usage, family income and other measures of wellbeing. The survey is self-report and participants were encouraged to discuss their answers in small groups within each household. Survey delivery was facilitated via translators and interpreters to ensure respondent comprehension of all questions.
- Semi-structured interviews with household owners and dwellers sought to further elucidate the survey answers and provide additional context to the quantitative data.
- Surveys and interviews were undertake over a 5-week time period via KTF's in-country personnel. Participants in the evaluation had received their solar lighting and energy systems sometime between one and five months prior.



KOKODA TRACK REGION

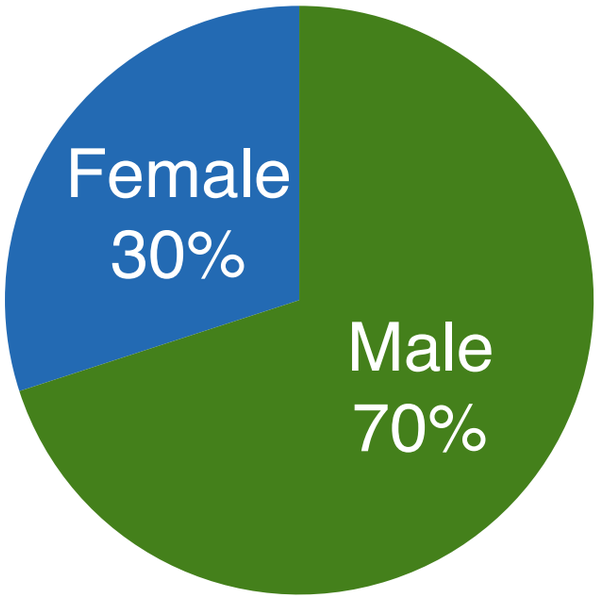
- The Kokoda Track spans two Provinces in PNG - Central and Oro. There are 12 main villages located along the Track, with additional smaller campsites inhabited by families. There are a further 18 villages in the immediate catchment region of the Track, but which do not receive regular (if any) visits from the trekking industry.
- There is no grid connection along the Kokoda Track and whilst some families have access to generator power, the large majority of families use expensive battery torches and kerosene lanterns and fuel for their lighting needs.
- Some families in the catchment region have access to paid employment via the trekking industry (porters, guesthouse owners etc); however the large majority of families rely on subsistence farming for their livelihoods.
- To date, KTF has installed household solar lighting and energy systems onto 805 houses across 30 villages in the catchment region. In addition to houses, 57 facilities systems have been installed onto schools, aid posts, churches and community centres across the region.
- 81 people from the 30 communities have also been trained in system installation and maintenance.
- 218 people representing 12 villages across the catchment region participated in the current evaluation.

FINDINGS

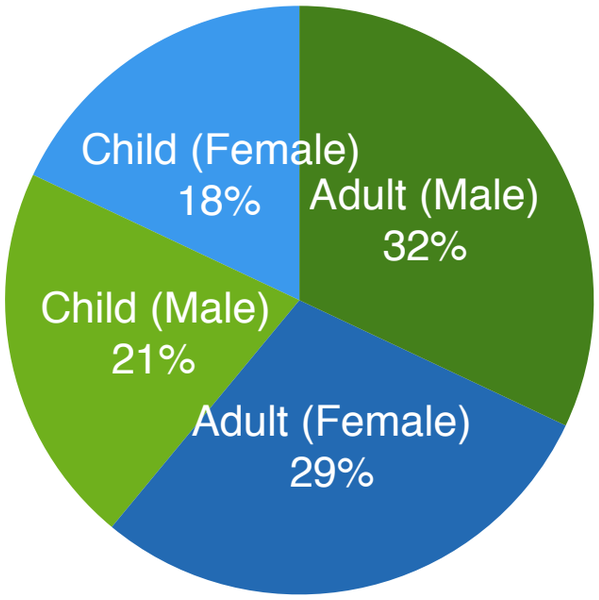
PART 1: DEMOGRAPHICS

- 218 people participated in the survey across the Kokoda Track catchment region.
- Additionally, 10 people participated in semi-structured interviews and case studies across the region.
- The gender breakdown of the research participants is displayed in the chart below. Whilst the number of males who participated in the study was substantially higher than the number of females, this is not representative of gender split of beneficiaries of the lighting systems. The % of males versus females and average number of adults (male and female) and children (male and female) per household are displayed in the second and third charts.

Gender, survey participation



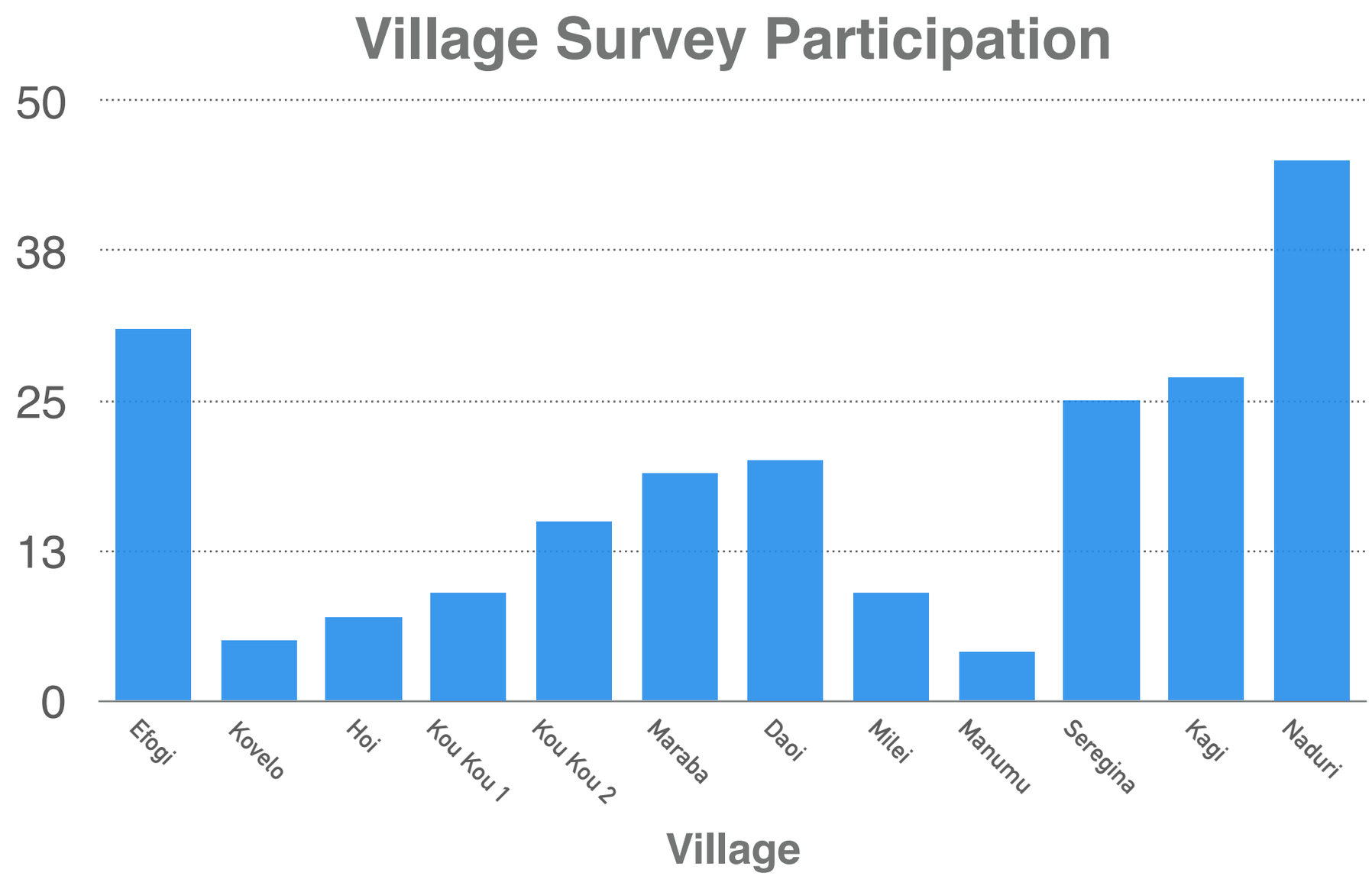
Gender, household data



Average # of people per household	
Males (adult)	1.56
Females (adult)	1.45
Males (child)	1.02
Females (child)	0.89
Total household average	4.93

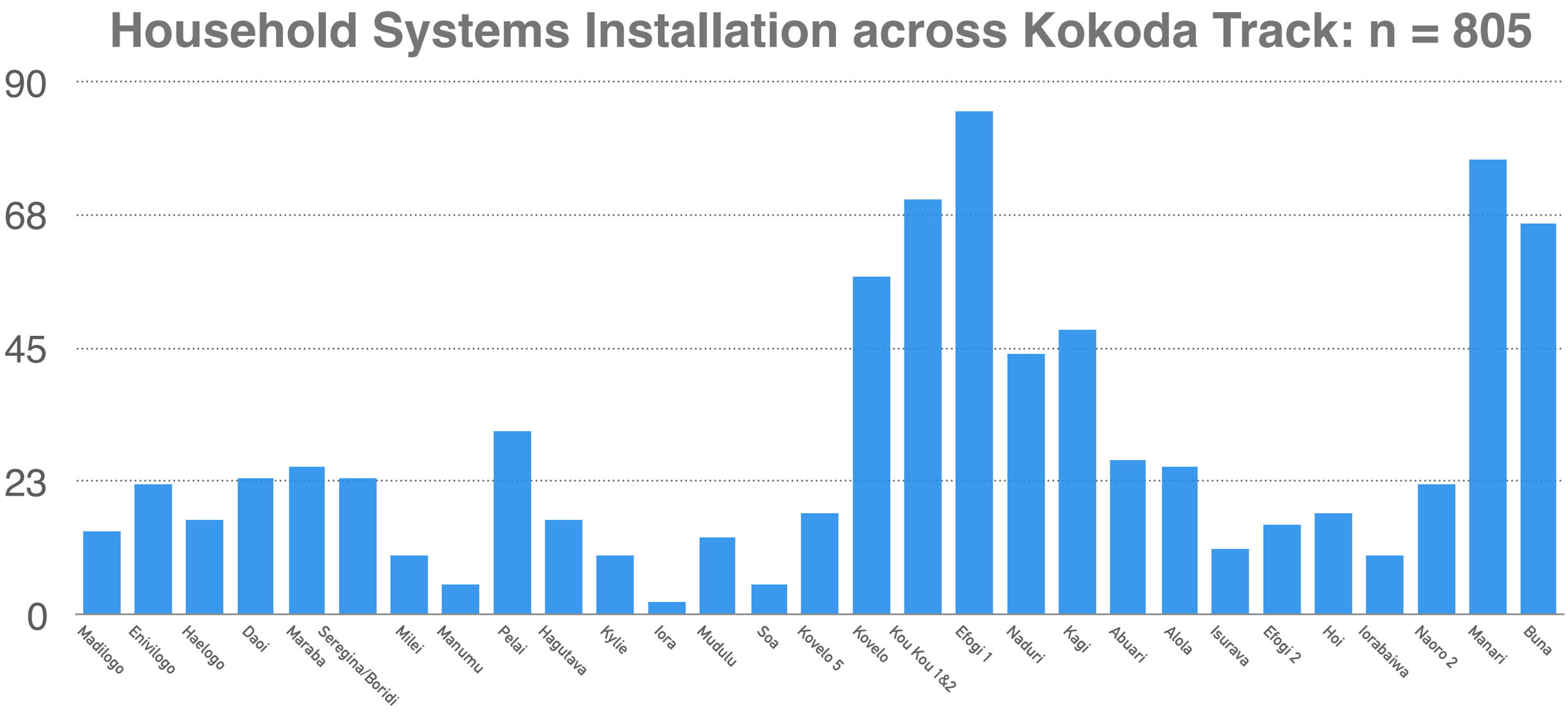
PART 1: DEMOGRAPHICS

- The average age of the survey participants was 43 years.
- Participants in the survey represented 12 of the 30 villages that have been illuminated to date with the household and facilities systems. The village participation breakdown of the survey respondents is displayed in the following chart:



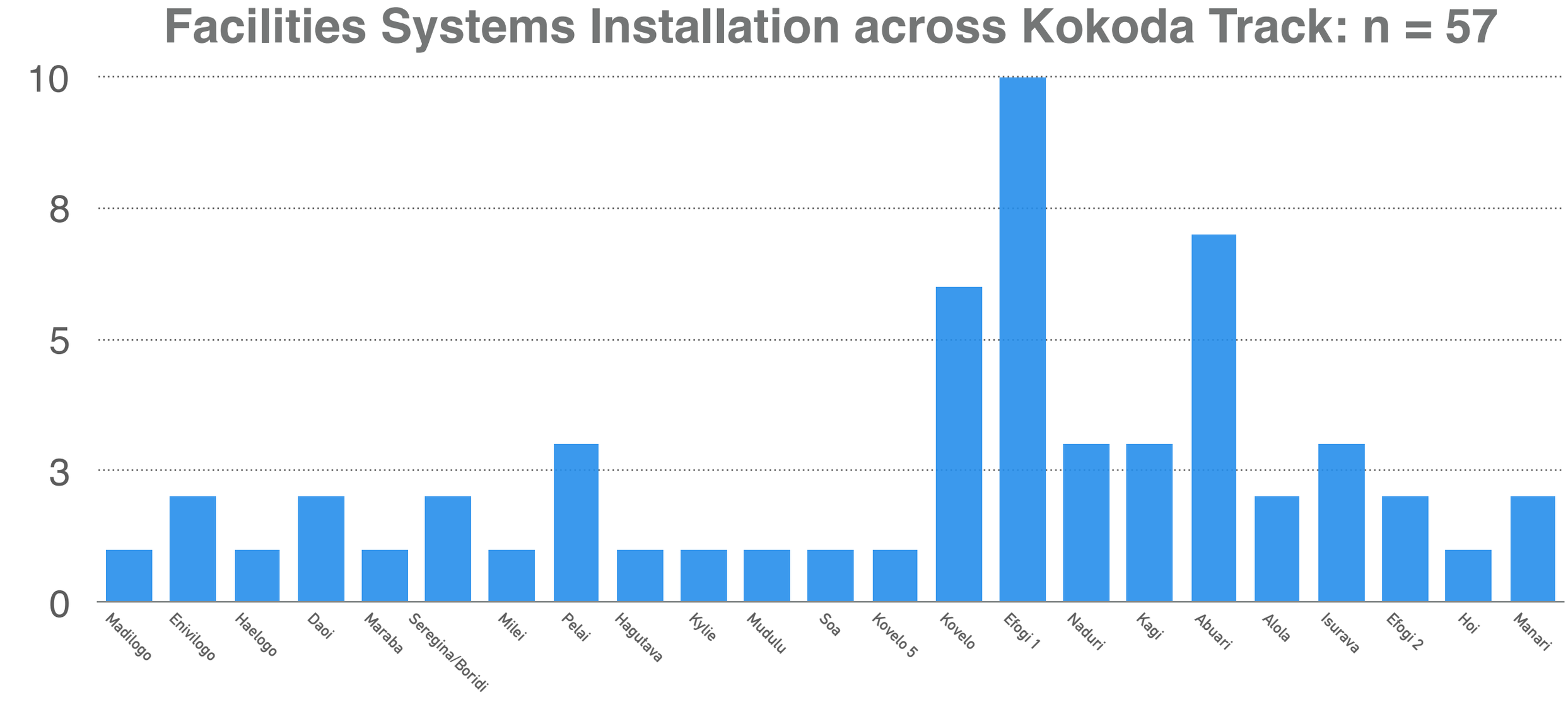
PART 1: DEMOGRAPHICS

Since the project's inception, 805 household systems have been installed by KTF across 30 villages. The spread across villages is displayed in the following chart.



PART 1: DEMOGRAPHICS

Since the project's inception, 57 facilities have been installed by KTF across 23 villages. The spread across villages is displayed in the following chart.



PART 2: HOUSEHOLD INFORMATION

- Participants were asked to report on what they used for lighting and energy prior to receiving their household solar systems. The breakdown appears in the following graph.
- Qualitative interviews provided further context. Families along the Track used a combination of battery torches and kerosene for their lighting needs. Battery torches are extremely expensive and it is difficult to access and afford a reliable supply of batteries given the remoteness of the Track communities.

What did communities use for light prior to receiving their household systems?

Source of Light	% participants who reported usage
Generator	2%
Battery Torch	87%%
Kerosene	56%
Wood fire	88%
Solar	3%

What did communities use for energy prior to receiving their household systems?

Source of Energy	% participants who reported usage
Generator (cost K2 per charge)	18%
Solar	5%
Other (base radio)	64%

CASE STUDY 1: GAISE

Gaise Badia is a student from Abuari village who attends Abuari Community School.

He built his own home and lives by himself away from his family. Since receiving the household solar system he has been able to set up community study groups in his house and can undertake group study sessions after dark.

“A lot of my mates come and we do our homework, assignments and just hang out me with here, now that I have the solar system. Beforehand, only sometimes at night, if I have torch lamp and batteries we can still stay up and work together, but most times we sit by the fire to do our school work. The fire hurts our eyes and we cannot concentrate for long on our studies.”

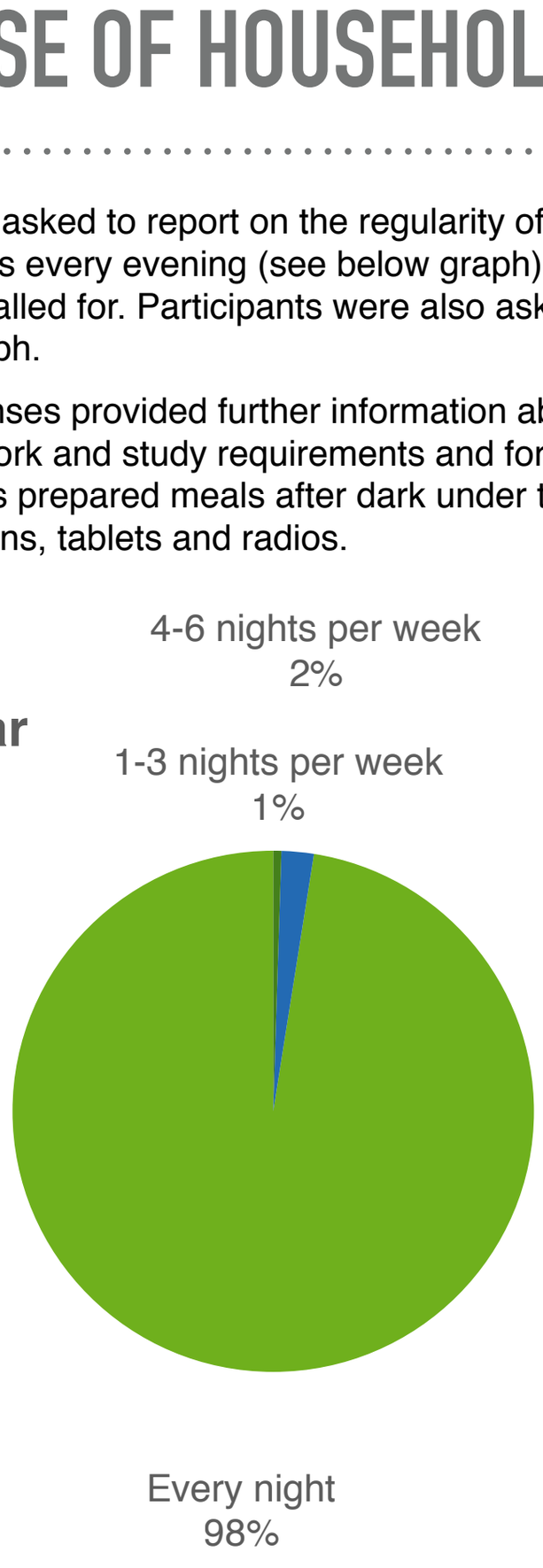
“But today I am happy I will not need to pay for torch batteries nor struggle to do my homework by the fire place. I can sit comfortably in my room and do my homework and work with my friends.

Tenkyu KTF!”

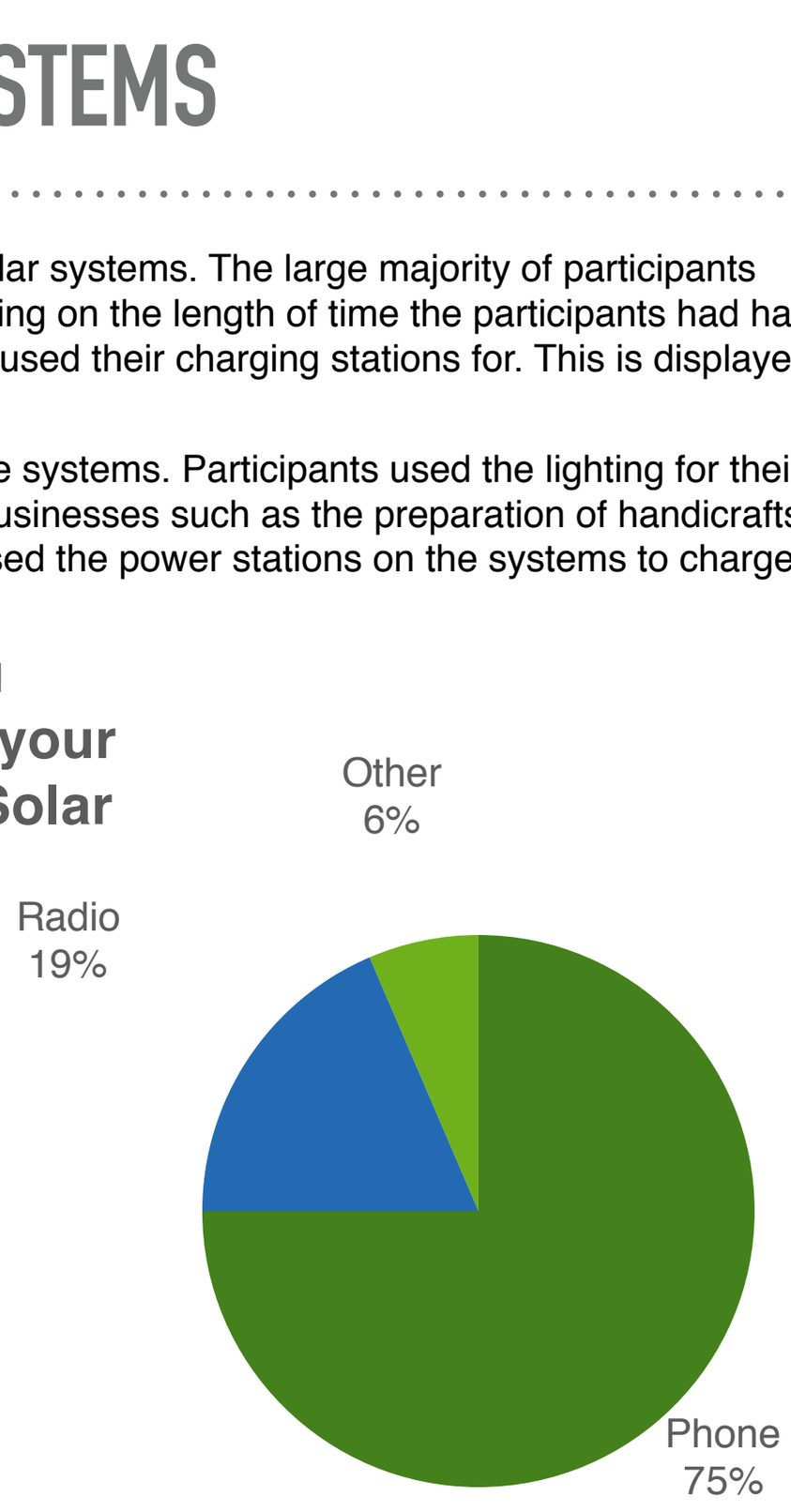
PART 3: USE OF HOUSEHOLD SOLAR SYSTEMS

- Participants were asked to report on the regularity of use of their household solar systems. The large majority of participants used their systems every evening (see below graph). This did not vary depending on the length of time the participants had had they systems installed for. Participants were also asked to report on what they used their charging stations for. This is displayed in the second graph.
- Qualitative responses provided further information about the types of use of the systems. Participants used the lighting for their children's homework and study requirements and for adults to work on small businesses such as the preparation of handicrafts and bilums. Adults prepared meals after dark under the solar lights and also used the power stations on the systems to charge mobile phones, fans, tablets and radios.

How often do you use your Household Solar System?



What do you charge with your Household Solar System?



PART 4: TIME SPENT ON HOMEWORK

- Participants were asked to report on the estimated impact of the household solar systems on time their children spent on homework. Participants were asked to self-report the amount of time (in hours and minutes) their children would spend on homework each evening *prior* to receiving the household solar systems; and then report the amount of time (in hours and minutes) their children spend on homework each evening now that they have a household solar system.
- It is important to note that self-reporting methodology was utilised and baseline data was not collected to verify this information. Further impact assessments should collect baseline data and control group data to further elucidate the impact of the solar lights on time spent on homework.
- Average time spent on homework each night before receiving a solar light: 20 mins
- Average time spent on homework each night after receiving a solar light: 49 mins

= 141% increase in average time spent on homework

CASE STUDY 2: ARON

Aron Sega is a KTF supported Elementary Teacher at Alola Elementary School. Aron is a multi-grade elementary teacher and teaches classes across Preparatory, Grade 1 and Grade 2. Aron is also a local church elder.

“I previously owned a small portable solar light to help me do my lesson preparation and prepare for Church activities. Or sometimes I would spend any Kina I had on fuel so that I could use my small kerosene lamp or on very special occasions, use someone’s generator in the village. It was tough and expensive to have lighting and power in the village.”

“To receive a Barefoot system for my school and for my church plus my own home is installed with a Sunking system, I am beyond happy! I can now work at my classroom and I can also play videos on the television screen for kids to captivate their interest and learn from what others are doing from the outside world.”

“I can now without worry charge my mobile phone and also watch videos or read files previously downloaded to help me with my class preparation or church report writing. I can also enjoy family time, playing and enjoy my evenings with my wife and kids unlike before, and safely move to the toilet with the extra lamp outside of our home.”

PART 5: EXPENDITURE ON KEROSENE

- 125 of the participants reported that they spent income on the purchase of kerosene prior to receiving their household solar system. Kerosene was used to fuel kerosene lanterns and utilised as the family's main source of lighting.
- Of those who were paying for kerosene <u>prior</u> to receiving the household solar system, the average weekly expenditure on kerosene fuel was K15 ($6.50 AUD) per family per week; or K780 ($338 AUD) per family per year.
- The average weekly expenditure on kerosene <u>after</u> the participants received the household solar system reduced to K1 ($0.43 AUD) per family per week; or K52 ($24 AUD) per family per year.

= 92% reduction in average weekly expenditure on kerosene

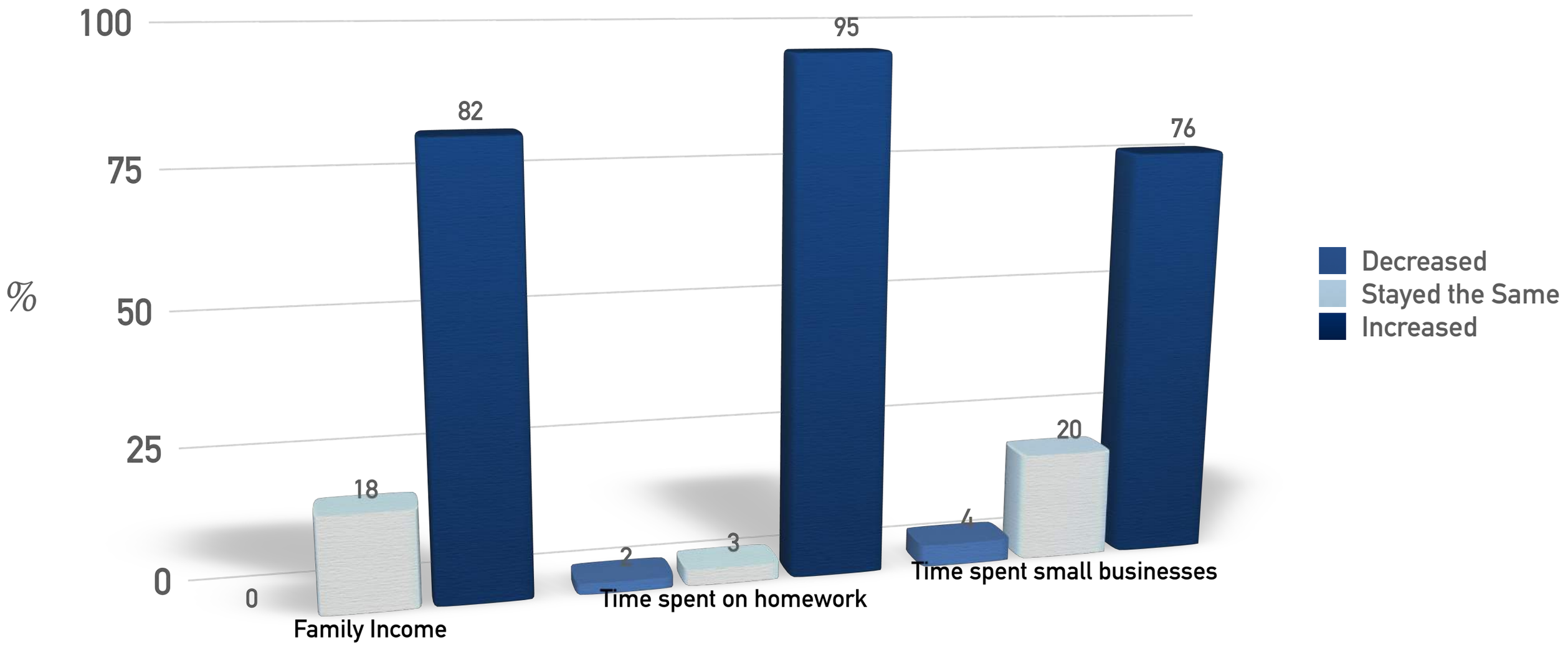
- *Furthermore, 96% of the cohort who were previously purchasing kerosene fuel as a source of lighting <u>prior</u> to receiving the household solar system, reduced their expenditure on kerosene to Zero Kina per week <u>after</u> they received the system. For this cohort:*

Average weekly spend <u>before</u> solar system = K23 per family

Average weekly spend <u>after</u> solar system = 100% reduction = K0 per family

PART 6: SELF REPORT IMPACT OF SOLAR LIGHTS

- Participants were asked to rate the impact of the solar systems on a 3-point Likert scale across the three dimensions of: Family income; Time spent doing homework after dark; and Time spent on small businesses after dark.
- The results indicated that the experience for the participants was that the solar systems: (a) increased the family's income; (b) increased the amount of time spent on homework after dark; and (c) increased the amount of time adults spent working on small businesses after dark. The % breakdown of each question is displayed in the following graphs:



CASE STUDY 3: MRS WAGIA

Mrs Wagia is a community member in Abuari village along the Kokoda Track. Her husband passed away 5 years ago and her children are grown up and live in Port Moresby.

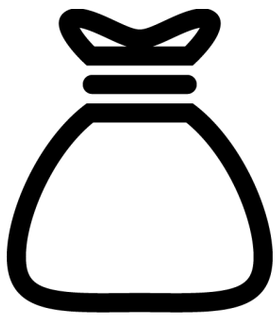
“I live with my cousin who has assisted me for many years with collecting firewood and tending to my garden. I also have two grand-daughters who are living in the village and are attending Abuari Primary School.”

“Life was extremely difficult before receiving my SunKing system. I wished very much to own my own solar light but I could not afford it. Sometimes my family would purchase a little bit of kerosene to fuel my lantern so that I could have light at night - but this was expensive and was only a sometimes thing.”

“Today I am very happy that KTF has come into our community and given this service for free. The solar systems have changed my life. For the first time in my life, I have light in my house and I have tears of happiness every day. Tenkyu tru! This is a lot!”

PART 7: FAMILY INCOME

- Participants were asked to report on whether the introduction of the household solar systems had an impact on their ability to earn an income. 62 participants responded to this question and reported an increase in family income as a result of having the household solar systems. Qualitative discussions found that families were able to work on small businesses after dark that they previously did not have time to work on. They were also able to charge their phones which enabled them to communicate with a range of customers, suppliers, clients when mobile reception was available (which is becoming more available in sections along the Track)
- Of those who were earning an income prior to receiving the household solar system, the average weekly income was was K18 ($7.76 AUD) per family per week; or K936 ($404 AUD) per family per year.
- The average weekly income after the participants received the household solar system increased to K37 ($16 AUD) per family per week; or K1,924 ($832 AUD) per family per year.



= 105% increase in average weekly income

PART 8: OTHER IMPACTS OF SOLAR SYSTEMS

- Participants were finally asked to rate the impact of the household solar systems on a 5-point Likert scale across seven dimensions. These were:
  - Brightness of your home; Amount you enjoy your home; How safe you feel in your home; How safe you feel in your village; Increased amount of time spent on homework; Increased amount of time spent reading; and Reduced amount of smoke in home. The results are displayed in the table below along with the average score across the scale:

Impact of Solar Systems on these areas of life	Not at all (%)	A little (%)	Neutral (%)	A fair amount (%)	A lot (%)	Average Score
Brightness of your home	0%	0.5%	0.5%	14%	85%	4.83
Amount you enjoy your home	0%	1%	0%	8%	91%	4.90
How safe you feel in your home	0%	1%	0%	4%	95%	4.94
How safe you feel in your village	1%	2%	0%	6%	91%	4.83
Increased time spent on homework	0%	1%	0%	11%	88%	4.87
Increased time spent on reading	0%	1%	1%	12%	86%	4.84
Reduced smoke in home	1%	2%	0%	11%	86%	4.77

DISCUSSION

DISCUSSION

- The overall results of the interim evaluation of the Village Connect project were overwhelmingly positive. Whilst not all variables were measured in this preliminary evaluation, the household solar systems have had very positive impacts on a number of education, health, safety and wellbeing outcomes for people living in remote and rural catchment region of the Kokoda Track.
- 88% of people surveyed reported that the time their children spent on homework after dark had increased a lot since receiving the systems; and 86% stated that the time they spent reading after dark had increased a lot as a result of receiving the systems.
- In addition, the average amount of time spent completing homework after dark each evening increased by 141%; from an average of 20 mins prior to receiving the solar systems; to 49 mins after receiving the solar systems.
- This study did not measure the impact of receiving the systems on actual educational outcomes, i.e., student performance, attendance and progression through education. Further evaluations will seek to measure the impact of the introduction of the the systems across the region on student grades and commitment to and enjoyment of their education.
- Further semi-structured interviews and focus groups should explore the longer term impact of studying via solar lights instead of kerosene lanterns on student performance and educational outcomes. The relationship between homework and educational outcomes is complex regardless of the educational setting; and so a qualitative approach may be the most appropriate for adopting in future evaluations.

DISCUSSION CONTINUED...

- There was a significant reduction in the purchase of and use of kerosene as a result of the introduction of the household solar systems lights. 96% of the population who previously purchased kerosene, stopped buying and using kerosene altogether. Additionally, there was an overall 92% reduction in the average weekly family's expenditure on kerosene once the household solar systems had been introduced.
- The health benefits of reducing kerosene use in households have been widely documented (WHO, 2014; Pollinate, 2014; IFC, 2010; Lam et al., 2012). Exposure to kerosene is a proven risk factor for respiratory disease, lung cancer and other illnesses. The reduction in kerosene use by households represents a positive step towards a reduction in the prevalence of these diseases.
- Whilst the direct health benefits arising from a reduction in kerosene to the families in the current evaluation were not measured during this assessment, they were discussed indirectly during the semi-structured interviews. Adults and children alike spoke about the negative side effects of kerosene in their lives prior to receiving the household solar systems including making their 'eyes sore', 'lungs hurt', and breathing in 'toxic smoke'. Some people spoke about how these symptoms were reduced as a result of no longer having to burn kerosene simply as a source of light.
- Further assessments should undertake to measure changes in health outcomes as a result of reduced kerosene usage - either experimentally or via self-report methodologies. Further studies should also explore reduction in use of wood fires for burning and and how much dependence still relies on wood fires for cooking in the region. This may determine future project design and interventions.

DISCUSSION CONTINUED...

- The solar systems also hd a positive impact on family income and across the sample, participants reported a 105% increase in family income since receiving the systems.
- The solar systems were also seen to have a positive impact on a number of other variables including: brightness of the home, the amount students enjoyed being in their home, and to a lesser extent the amount of smoke in the home. These factors all contribute to a person's wellbeing.
- Finally, there were positive impacts of the solar systems on feelings of safety and security amongst the participants. 95% of participants reported an increase in how safe they felt in their home since receiving a solar system; and 91% reported an increase in how safe they felt in their village since receiving a solar system.
- These findings were further supported by the qualitative interviews and participants reported that it was easier, safer and more secure to walk around their villages after dark and access pit toilets due to the outside light which is installed as part of the system.

RECOMMENDATIONS

RECOMMENDATIONS

- This preliminary impact assessment has identified a number of positive improvements in participants' lives since receiving the household and facilities solar systems including educational, health, safety, financial and wellbeing improvements.
- Moving forward, a number of additional outcomes should be measured in order to further understand the impact that solar interventions can have in remote PNG communities. These should include:
    - Impact on educational outcomes, including student performance, attendance and commitment to schooling.
    - Impact on environmental and health outcomes including kerosene usage (litres used/saved per family in addition to expenditure changes); CO2 reductions; direct report health improvements.
    - Impact on understanding of solar technology and likelihood for students, parents and others to commit to sourcing renewable sources of lighting and energy rather than reverting to kerosene and wood fires.
- A number of improvements to the methodology can also be made for future impact assessments. Recommendations include:
    - Self-report should be used alongside other more direct outcome measurements including school grades, attendance records, health records, kerosene usage, family incomes and family savings;
    - Survey improvements should be undertaken to remove some sections of double negatives and further improve clarity around reporting before participants received the solar systems and after;
    - Collection of base-line and follow-up data to more directly track changes in education, health etc outcomes.

FROM THE PEOPLE...

TELL US HOW YOUR LIFE HAS CHANGED SINCE RECEIVING YOUR SOLAR SYSTEMS?

"I used to use torches and fire light. Now I don't have to do that. I can sit on my table long hours to do my work and I also feel secure at night."

"My life has changed a lot as a senior teacher. I can do a lot more work such as program planning and marking of papers. Thank you."

"You have brought a big change in our life. Now our children have lights to do their assignment during nights not like before. Thank you so much KTF!"

"We are lost but now we are found. Thank you so much KTF, you the best always!"

"Living in the dark made life very hard by always looking for firewood to light up the house at night time. With solar, life has become easier for us and especially for my wife, who is an Elementary teacher to do her teaching plans for the day. My family appreciate your work and kind support in helping us with the solar lights. Thank you so much."

"Solar lights have changed our lives. We now don't need much wood for light, stopped buying batteries for torches. Our kids are also very happy, we thank you so much for helping us with solar lights."

"Makes life easy to cook breakfast very early in the morning for kids to go to school, and for them to do their studies at night time, thank you very much for the job well done."

"On behalf of the Daoi Elementary school, I as the head teacher of the school would like to thank you very much for your generosity in donating this solar to our school. The solar system is improving our learning environment to become better citizens of this village. Thank you so much for the solar system."

"My family were happy because it gave them a new start to life, tenkyu so much KTF."


GUINEA
sunking HOME 120
RAPID SOLAR CHARGING


Barefoot connect
Installer Pack


Barefoot Power
22" Digital LE

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