



LIGHT UP PNG

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Impact Assessment Report



ACKNOWLEDGEMENTS

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This impact assessment report was undertaken by the Kokoda Track Foundation in partnership with SolarBuddy. Participants included children from two cluster distribution regions in Papua New Guinea - Kokoda in Oro Province and Kupiano in Central Province.

We would like to thank all students, teachers and parents who participated in the impact assessment and the teacher trainers and representatives from the Provincial Departments of Education who facilitated the interviews and survey collection.

Evaluation Leads: Dr Genevieve Nelson (KTF) and Simon Doble (SolarBuddy)

Evaluation contributors: Wilma Mavea (KTF), Grayson Kaumi (KTF), Leonie Vele (Central Provincial Department of Education)

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I really
hope this
will help
some night

INTRODUCTION

- SolarBuddy is an Australian charity that provides safe, reliable, effective and innovative solar energy solutions to communities around the world who suffer from energy poverty. SolarBuddy is ending energy poverty by lighting up the lives of one child at a time.
- KTF is SolarBuddy's in-country charity partner in Papua New Guinea. KTF's mission is to work with people and communities to improve the lives and futures of Papua New Guineans. PNG is Australia's nearest neighbour. Only 3.6km separates Australia and PNG and yet of all nearest neighbours in the world, no two have a greater disparity of poverty and wealth as PNG and Australia as measured by the United Nation's Human Development Index. KTF delivers sustainable development initiatives across four main program areas: education, health, livelihoods and leadership.
- SolarBuddy and KTF have been working together since October 2016. Over the past 2 years, they have distributed 13,973 SolarBuddy lights to children and teachers across remote and rural Papua New Guinea. SolarBuddy lights have been distributed to children living in remote communities in 6 Provinces across PNG's 22 Provinces. The partnership's aim is to reach all Provinces by 2020.
- This Impact Assessment Report was commissioned by KTF and SolarBuddy to measure the impact of the solar lights on a range of outcomes for recipients including time spent on homework, family savings, and use of kerosene.



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

– **UN Foundation**

BACKGROUND

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- Energy poverty is the lack of access to modern energy services; it especially affects people in 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. 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.

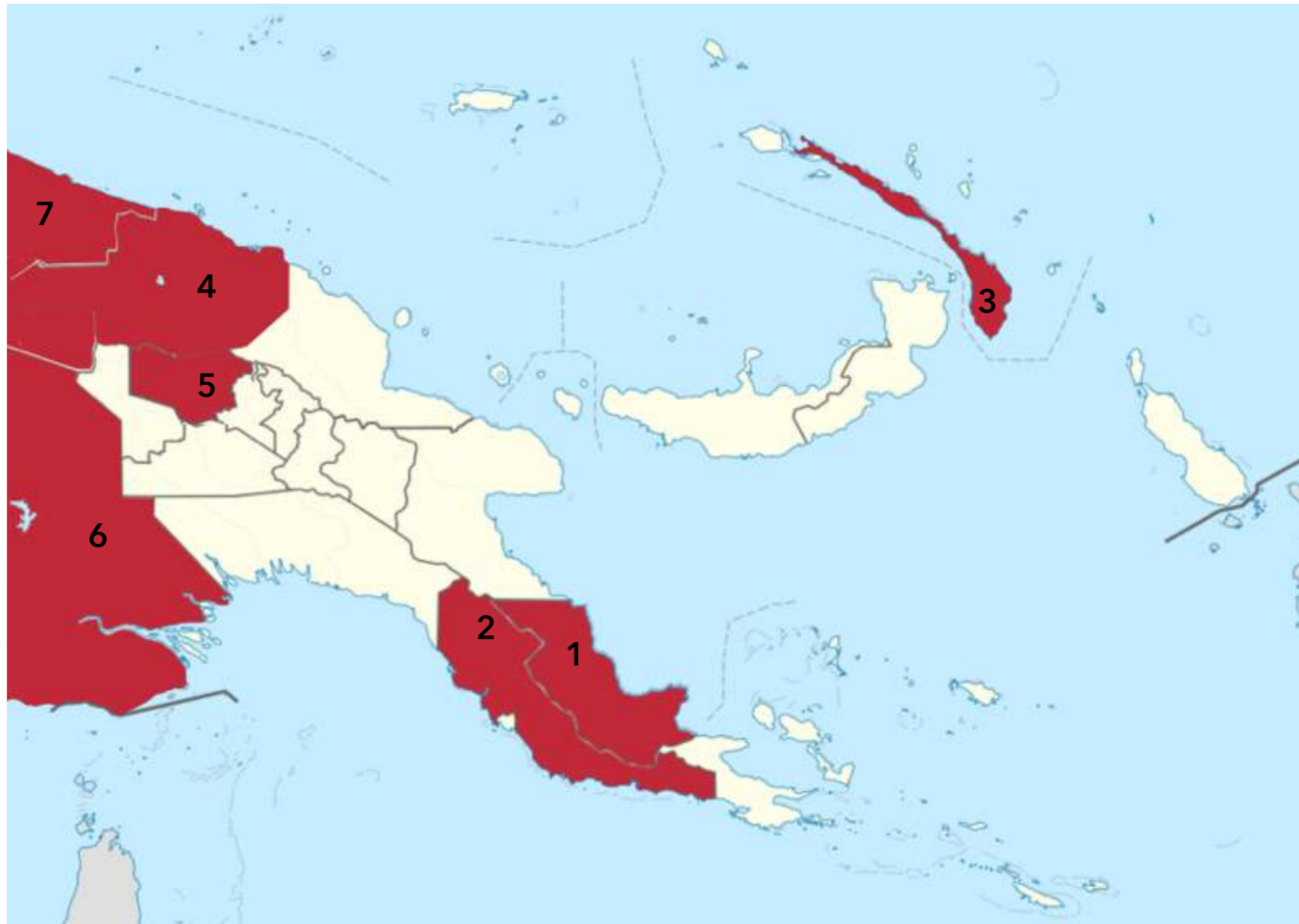
SOLARBUDDY'S MISSION

- SolarBuddy's mission is to provide safe, reliable, effective and innovative solar energy solutions to communities who suffer from the limiting effects of energy poverty. SolarBuddy believes that renewable energy has the ability to change lives forever, providing future generations with the opportunity to reach their full potential.
- SolarBuddy's school programs and partnerships aim to connect communities across the globe, combining learning and education with assistance and aid. SolarBuddy created the Buddy2Buddy Schools Program to connect Australian school communities who want to make a difference with other children and communities in areas throughout the world that live in energy poverty. Purchasing and building a SolarBuddy light at school teaches Australian children about the positive impact of renewable energy on communities living in energy poverty. Sending that light to a child in need, along with a personal letter, can make a huge difference to their life.
- To date, SolarBuddy and KTF have distributed almost 14,000 solar lights to people living in energy poverty in Papua New Guinea. SolarBuddy has distributed a further 26,000 lights to other countries across the globe.

GEOGRAPHICAL DISTRIBUTION

Our current geographical focus regions in PNG are:

1. Oro Province
(provincial capital, Popondetta)
2. Central Province
(provincial capital, Bautama)
3. New Ireland (provincial capital, Kavieng)
4. East Sepik (provincial capital, Wewak)
5. Enga (provincial capital, Wabag)
6. Western (provincial capital, Daru)
7. Sandaun (provincial capital, Vanimo)



DISTRIBUTION PHILOSOPHY

- Distribution to date has been undertaken in line with KTF's other education development activities via a cluster approach and existing supply chains. Between 2016 - 2018, KTF expanded its operations from two to sixteen Provinces in PNG. The significant driver of this expansion was the roll-out of KTF's Teach for Tomorrow project, whereby 2,700 elementary teachers were trained by KTF across 12 Provinces.
- Schools are identified in close consultation with KTF's teachers and Provincial Departments of Education personnel including trainers and inspectors of elementary and primary teachers across remote PNG. Schools are identified that are located in remote and rural Papua New Guinea where there is generally no connection to the electricity grid. The majority of the population in these locations make their living through subsistence farming and disposable income is limited.
- A cluster approach is taken whereby an entire school is illuminated at a time; and once a school is completed, all neighbouring schools in the immediate catchment region are then illuminated. The premise behind this cluster distribution is to enable KTF and SolarBuddy to track impact over time, to ensure that replacement batteries can be provided at a follow-up time (via sustainable micro-enterprises), and to ensure that the partnerships' focus schools are already aligned with KTF's other education activities to foster a holistic education intervention that can be monitored over time.

AIMS & METHOD

AIMS & METHODOLOGY

- This Impact Assessment was jointly commissioned by KTF and SolarBuddy to measure the impact of the solar lights on a selection of outcomes for a sample of children who have received SolarBuddy lights at some time over the past 12 months.
- A mixed-method approach was adopted including the administration of a short survey to a sample of students across two distribution cluster locations - Kokoda in Oro Province and Kupiano in Central Province. Semi-structured interviews were also conducted with a sample of students from the two locations.
- The survey collected demographic data on the student participants as well as a series of questions to elucidate the impact of the solar lights on study time, kerosene usage, family income and other measures of wellbeing. The survey is self-report and students were encouraged to source some information from their parents (e.g. weekly expenditure on kerosene) to contribute to their answers.
- Semi-structured interviews with children, parents and teachers sought to further elucidate the survey answers and provide additional context to the quantitative data.
- Survey and interviews were undertaken over a 3 week time period via in-country KTF personnel. Students participating in the evaluation had received their SolarBuddy lights sometime between 6 and 12 months prior.



KOKODA CLUSTER

- Kokoda village is located in Oro Province. It is a remote and rural area and is the start or finish point of the infamous Kokoda Track.
- There is no grid connection in Kokoda and whilst some families have access to generator power, the large majority of families use kerosene lanterns and fuel for their lighting needs.
- Some families in the Kokoda cluster 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 livelihood.
- 1,500 children have received solar lights in the Kokoda catchment region including students attending the following schools: Kokoda Primary, Kokoda Elementary, Kokoda High, Kebara Elementary, Kebara Primary, Gorari Elementary and Gorari Primary.
- 81 students from the Kokoda cluster participated in the evaluation.



KUPIANO CLUSTER

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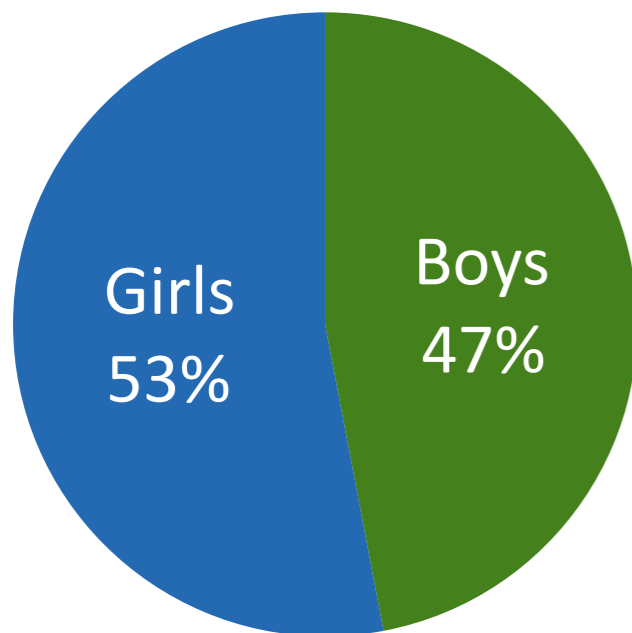
- Kupiano village is located in Central Province. It is a remote and rural area and is approximately 180km East of Port Moresby.
- There is no grid connection in Kupiano and families use a combination of generators, kerosene lanterns, battery torches and solar for their lighting and energy needs. Children however have never before had access to their own solar light for personal use.
- Employment opportunities in Kupiano include public service and fishing industry; however many families rely on subsistence farming for their livelihoods.
- 2,600 children have received solar lights in the Kupiano catchment region including students attending the following schools: Kupiano Primary, Kupiano Elementary, Kelerakwa Primary, Kelerakwa Elementary, Iopara Primary, Gavuone Primary, Gavuone Elementary, Gavuone SDA Primary and Gavuone SDA Elementary.
- 147 students from the Kupiano cluster participated in the evaluation.

FINDINGS

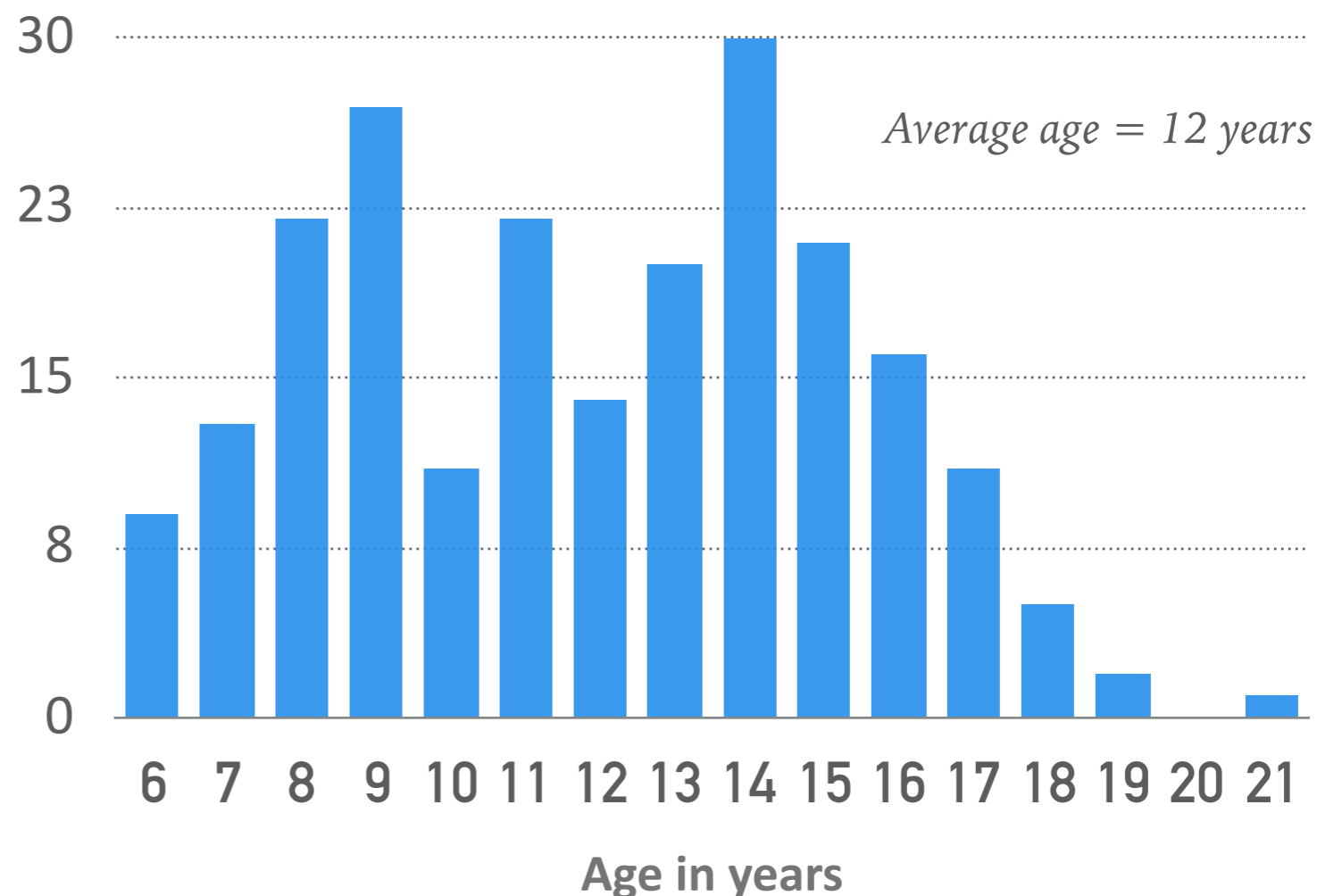
PART 1: DEMOGRAPHICS

- 228 students participated in the survey across two cluster regions: Kokoda and Kupiano. Additionally, 12 children, 6 parents and 6 teachers participated in semi-structured interviews across the two regions.
- The gender and age breakdown of the students was:

Gender



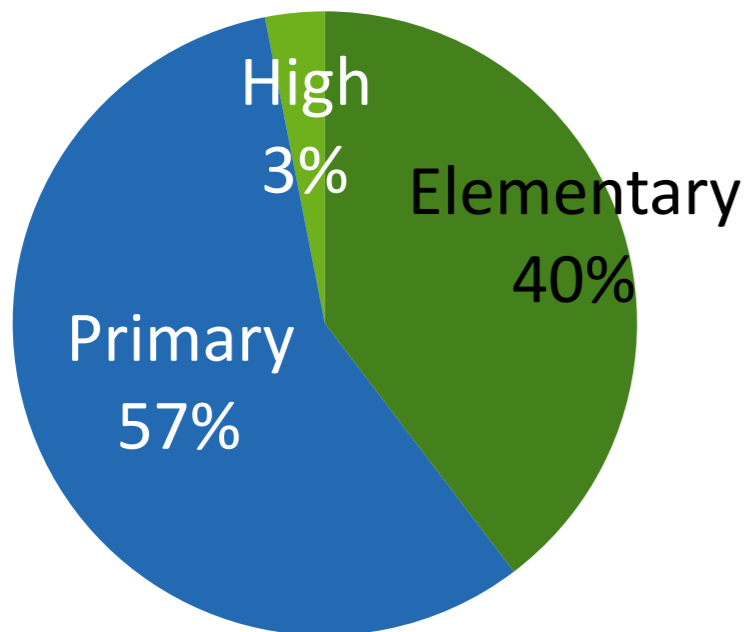
Age of Students



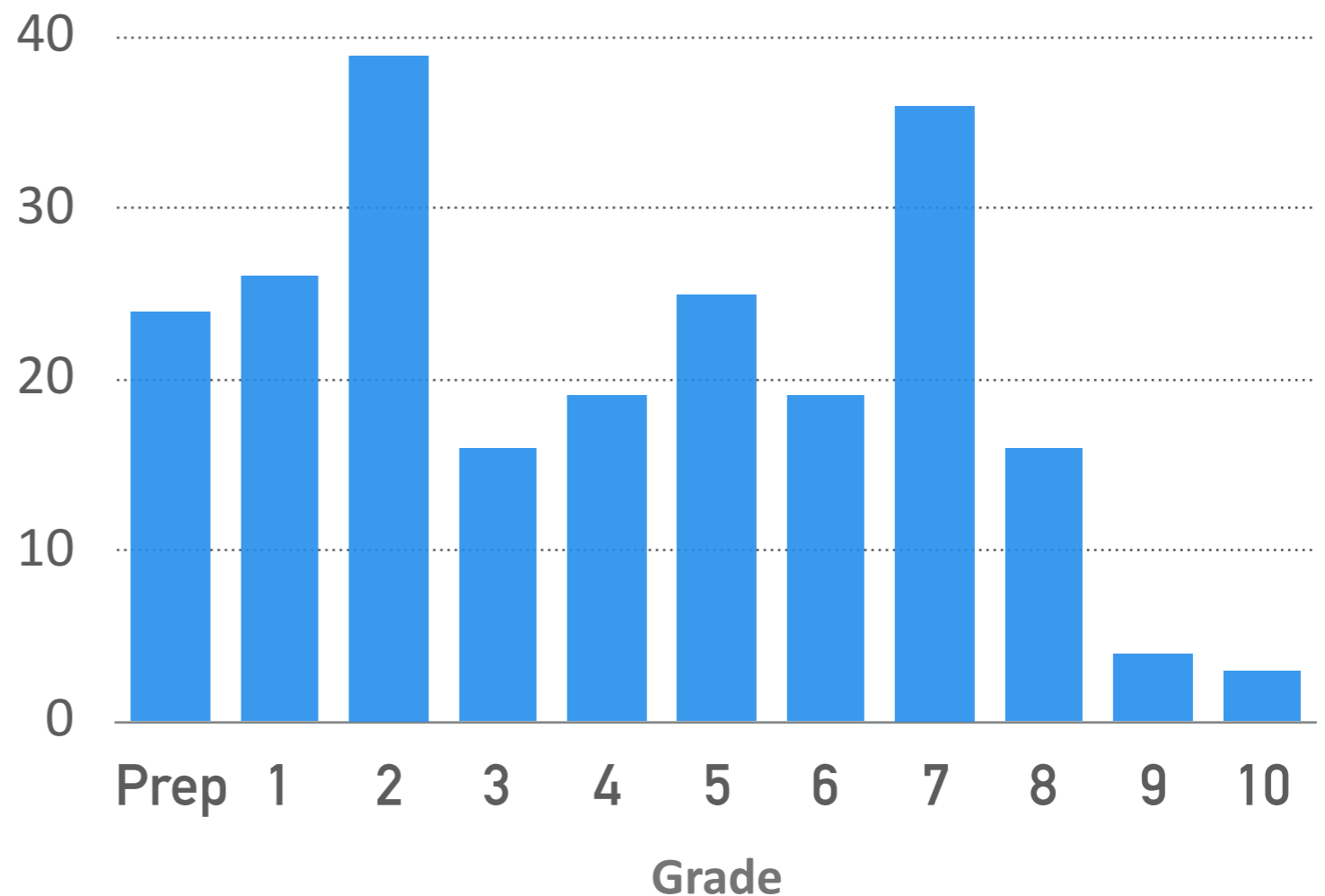
PART 1: DEMOGRAPHICS

- Students came from a combination of Elementary (Preparatory, Grade 1, Grade 2), Primary (Grade 3 - 8) and High (Grade 9 - 10) Schools across the two cluster regions.
- Across the two cluster regions, a total of 40 distinct villages were recorded by students. The breakdown across Grade is displayed in the following graphs:

School breakdown

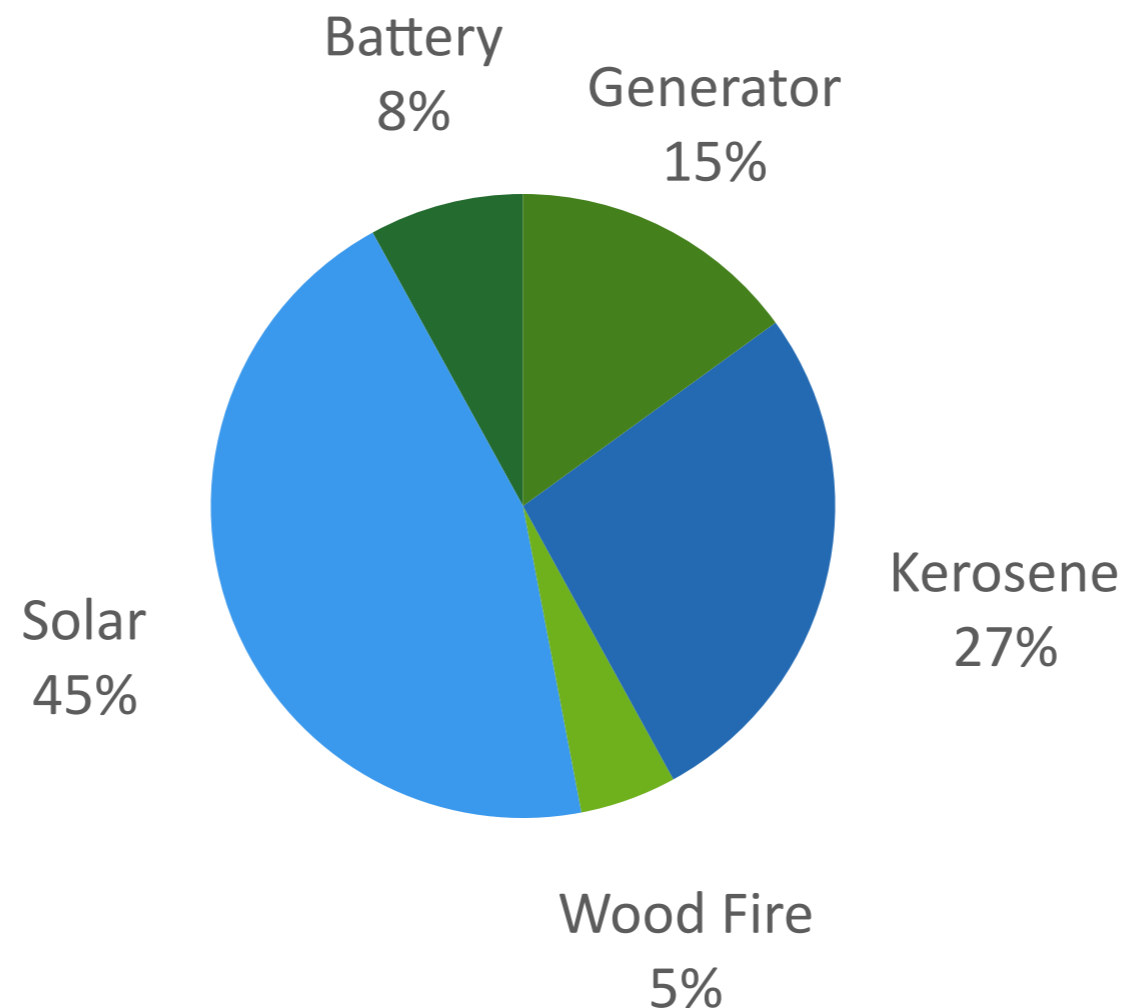


Grades of Students



PART 2: HOUSEHOLD INFORMATION

- Students were asked to report on the number of adult and child family members living in their household. Across the entire student cohort, the average number of adult males per household was 2, the average number of adult females per household was 2. the average number of child males was 2 and the average number of child females was 2.
- Students were also asked to report on what they used for lighting fuel prior to receiving their SolarBuddy light. The breakdown appears in the following graph. Qualitative interviews gave further context for the Kupiano setting. A number of families already utilised solar solutions in their households; but these were rarely available for the children to use for their homework and other activities. Qualitative interviews with children and parents stated that these solar lights were small handheld lights, of cheaper quality, and only used by an adult and were often not made available to children.





CASE STUDY 1: JENNA

Jenna* is a Grade 6 student from a primary school in the Kupiano region in Central Province. Jenna comes from a family of 6 including her two parents and two siblings. However, they share a house with extended family members and there are 2 male adults, 3 female adults, four boys and five girls living in the same house.

Prior to receiving the SolarBuddy light, Jenna's family relied mainly on kerosene and wood fire for their source of lighting. Wood fire is also used for cooking at a small outdoor kitchen. One of the adults in the family also had purchased a small handheld solar lantern from the local trade store. However this lantern was for personal use and Jenna wasn't able to use it.

Jenna received a SolarBuddy light in December 2017. During that time, she reported that she went from doing her homework for 45 minutes each evening to 2 hours each evening:

"The solar light is so important to me and my brothers and sisters. We have all received our own SolarBuddy light to own by ourselves and use for our personal needs. I use my light for doing my studies, walking around the house and finding things after dark."

"Even though one person in my house had access to solar before, this means that I had some understanding of how it works and how to use it. But having my own is my own experience and changes how I can get around and study after dark."

"The light lasts for late into the night if I need it to. Sometimes I only have to charge it every 2 or 3 days before it runs out depending on how much I use it for."

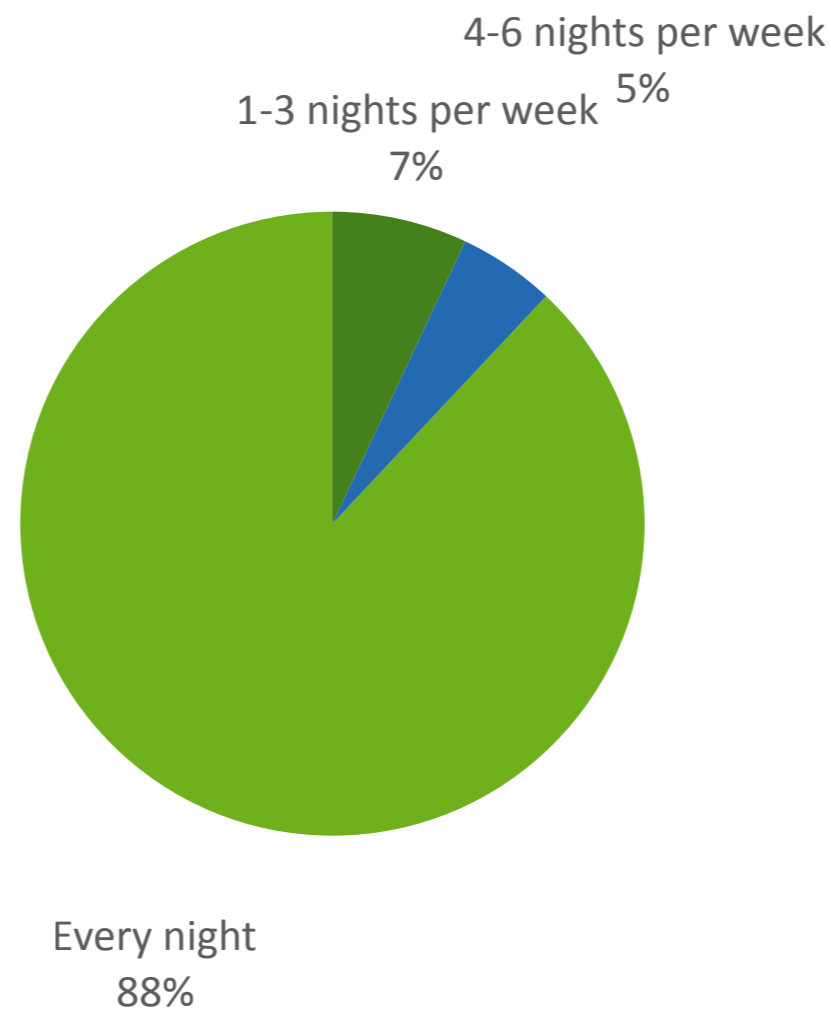
"I feel safer and I enjoy my life more having my very own solar light. I don't have to worry about not being able to see or do anything after dark, or spill kerosene on my skin or breathe its smoke. Solar is so much better."

**Names changed to protect privacy; photograph does not match the case study*

PART 3: USE OF SOLARBUDDY LIGHT

- Students were asked to report on the regularity of use of their SolarBuddy light. The large majority of students used their SolarBuddy light every evening (see below graph). This did not vary depending on the length of time the students had owned their solar light for.
- Qualitative responses provided further information about the types of use of the solar lights. Most students spoke about the use of lights to do their homework or to read books; but many students also used their lights to walk around their village safely at night, to walk to and from the toilet after dark, to prepare and eat dinner after dark, and to support their siblings and parents with other activities at night.

How often do you use your SolarBuddy light?



PART 4: TIME SPENT ON HOMEWORK

- Students were asked to report on the estimated impact of the solar lights on time spent on homework. Students were asked to self-report the amount of time (in hours and minutes) they would spend on homework each evening prior to receiving the SolarBuddy light; and then report the amount of time (in hours and minutes) they spend on homework each evening now that they have a SolarBuddy light.
- 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: 1hr 19 mins
- Average time spent on homework each night after receiving a solar light: 2hr 22 mins



= 78% increase in average time spent on homework

When broken down across elementary and primary students:

Elementary Students = 68% increase in average time spent on homework

Primary Students = 85% increase in average time spent on homework



CASE STUDY 2: SAMSON

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Samson* is a Grade 7 student at a primary school in the Kokoda region. He lives in a village that is approximately 30 mins away from the school and he walks to and from school each day.

Samson's village is remote and rural and there is no access to the grid or generator power. Samson's family burns wood fire and sometimes purchases kerosene to burn a kerosene lantern for a source of lighting. Samson's parents are subsistence farmers and they struggle to be able to afford kerosene.

"Ever since I received my Solarbuddy light, my family has not had to spend any money on kerosene. My brother and my two sisters are also at school and we have now all received a solar light from KTF and SolarBuddy. Now that there are four solar lights in the house, it means that my parents don't need kerosene any more. This is better as kerosene is very very dangerous and it hurts our eyes when we read and our chest when we breathe."

"The solar light is used for so many reasons. We sometimes read books at night to each other. We can do our school work after the sun sets because before the sun sets we are very busy - helping our parents in the garden or just sometimes having fun. Now we have more time in the dark to do homework so we don't have to rush to do it before dark."

"I also use my solar light to go to the toilet and walk around the village at night time. The toilet can sometimes be dangerous as you don't know where to step and now with a solar light it makes it easier and safer."

**Names changed to protect privacy; photograph does not match the case study*

PART 5: EXPENDITURE ON KEROSENE

- ▶ 154 of the students reported that their families spent income on the purchase of kerosene prior to receiving their solar light. Kerosene was used to fuel kerosene lanterns and utilised as the family's main source of lighting.
- ▶ Of those who were paying for kerosene prior to receiving the SolarBuddy light, the average weekly expenditure on kerosene fuel was K20 (\$8.50 AUD) per family per week; or K1,040 (\$444 AUD) per family per year.
- ▶ The average weekly expenditure on kerosene after the students received the SolarBuddy light reduced to K4 (\$1.70 AUD) per family per week; or K208 (\$89 AUD) per family per year.



= 80% reduction in average weekly expenditure on kerosene

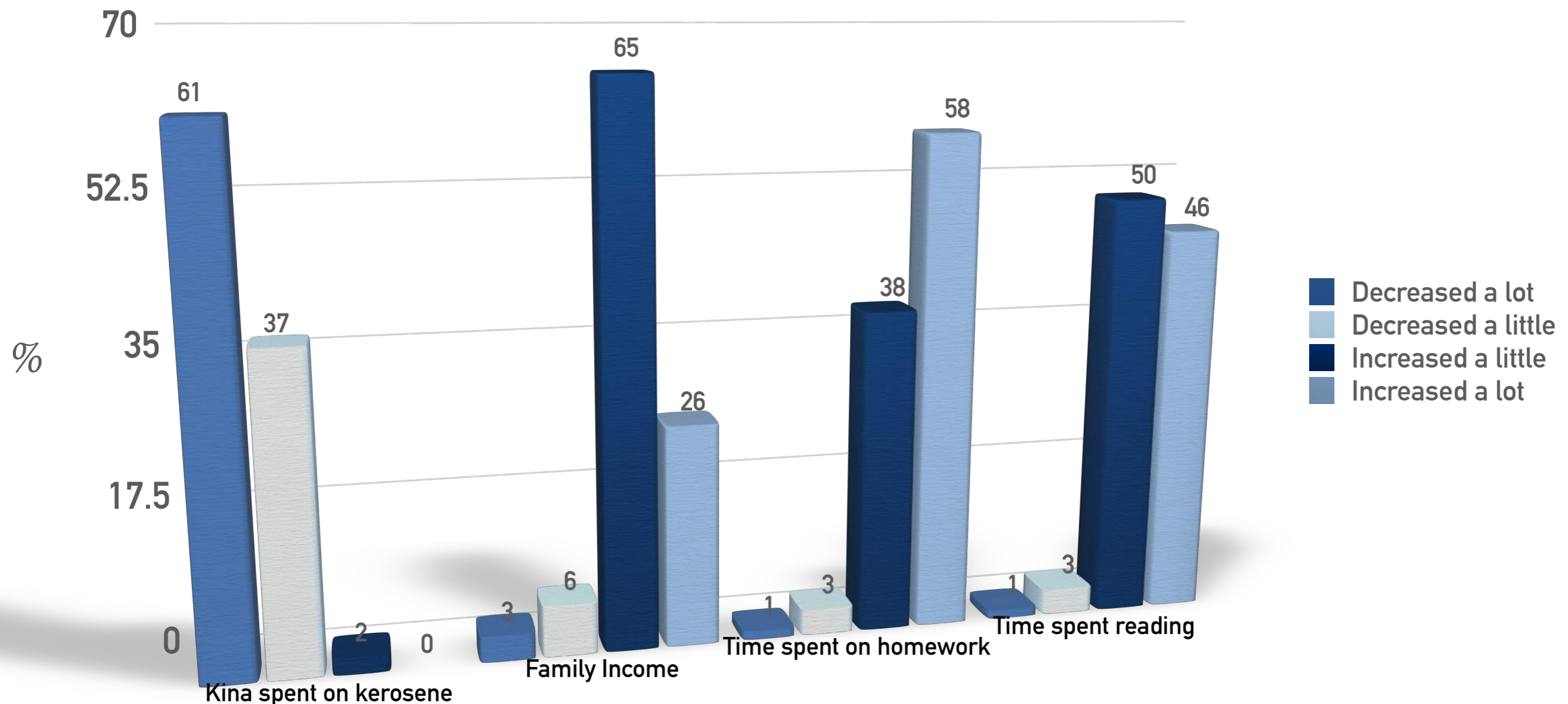
- ▶ Furthermore, 56% of the cohort who were previously purchasing kerosene fuel as a source of lighting prior to receiving the SolarBuddy light, reduced their expenditure on kerosene to Zero Kina per week after they received the SolarBuddy light. For this cohort:

Average weekly spend before solar light = K14 per family

Average weekly spend after solar light = 100% reduction = K0 per family

PART 6: SELF REPORT IMPACT OF SOLAR LIGHTS

- ▶ Students were asked to rate the impact of the SolarBuddy light on a 4-point Likert scale across the four dimensions of: Amount of Kina spent on kerosene; Family income; Time spent doing homework after dark; and Time spent reading after dark.
- ▶ The results indicated that the experience for the students was that the solar lights: (a) reduced the amount of Kina the family had to spend on kerosene; (b) increased the family's income; (c) increased the amount of time spent on homework after dark; and (d) increased the amount of time spent reading after dark. The % breakdown of each question is displayed in the following graphs:





CASE STUDY 3: DONOVAN

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Donovan* is a Grade 6 student attending primary school in the Kokoda region. He lives with his mum and dad in a remote village in the region.

“Our family finances have improved a lot. I don’t have to go running around to the store to buy batteries or kerosene anymore; we have the solar lights instead and this has saved us a lot of Kina.”

“Our productivity has improved a lot. One example is that our parents don’t have to spend money on kerosene or batteries anymore. They save this money and can spend it on other items that help improve our lives like school supplies and nice things to eat and have in our villages.”

“We’ve done away with kerosene because it makes the house very smelly and is unsafe; solar is a great alternative. Most people in this region have now done away with using kerosene. Some people used to have shortage of breath; this is now cut down. Using the lights is easier.”

“In case of emergencies, we grab our SolarBuddy lights. It’s much better when walking in the rain than using kerosene lights. We just hang it on the side of our bag and we walk.”

“We sit around at night studying and doing our homework. We do our own reading at night and then go off to sleep. My time on homework has increased by many hours. I use it until 10 o clock at night.”

“Solar light has had a great impact on me in terms of study, it doesn’t go off too quickly, and it’s nice and bright. It also makes things safe for me and my brothers and sisters. Sometimes I keep the solar light on all night and it’s much safe than sleeping next to a kerosene lamp.”

**Names changed to protect privacy; photograph does not match the case study*

PART 7: OTHER IMPACTS OF SOLAR LIGHTS

► Students were finally asked to rate the impact of the SolarBuddy light 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 SolarBuddy light on these areas of life	Not at all (%)	A little (%)	Neutral (%)	A fair amount (%)	A lot (%)	Average Score
Brightness of your home	0%	17%	13%	38%	33%	3.87
Amount you enjoy your home	1%	15%	9%	29%	46%	4.03
How safe you feel in your home	1%	13%	17%	21%	48%	4.02
How safe you feel in your village	2%	20%	18%	22%	39%	3.74
Increased time spent on homework	0%	14%	9%	22%	54%	4.14
Increased time spent on reading	2%	16%	10%	26%	46%	3.98
Reduced smoke in home	16%	14%	8%	17%	45%	3.61

DISCUSSION

DISCUSSION

- The overall results of the Impact Assessment were overwhelmingly positive. Whilst not all variables were measured in this preliminary evaluation, the lights seem to have had a positive impact on a number of education, health, safety and security outcomes for children living in remote and rural PNG.
- 96% of children surveyed reported that the time they spent on homework and the time they spent reading after dark had increased as a result of receiving a SolarBuddy light.
- The average amount of time spent completing homework after dark each evening increased by 78%; from an average of 1 hour 19 mins prior to receiving the solar lights; to 2 hours 22 mins after receiving a SolarBuddy light.
- This study did not measure the impact of receiving the solar lights on educational outcomes, i.e., student performance, attendance and progression through education. Further evaluations may seek to measure the direct impact of owning a solar light 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 the two organisations to adopt in the future.

DISCUSSION CONTINUED...

- There was a significant reduction in the purchase of and use of kerosene as a result of the introduction of the SolarBuddy lights. 56% of the population who previously purchased kerosene, stopped buying and using kerosene altogether. Also, there was an overall 80% reduction in the average weekly family's expenditure on kerosene once a solar light had been introduced into the household.
- 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 students in the PNG sample were not measured during this assessment, they were discussed indirectly during the semi-structured interviews. Some children spoke about the negative side effects of kerosene in their lives prior to receiving the SolarBuddy lights 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.

DISCUSSION CONTINUED...

- The solar lights 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.
- There were also positive results reported about the impact of the solar lights on financial outcomes for families. In addition to a reduction in expenditure on kerosene, 91% of students surveyed reported that their family income had either 'increased a little' or 'increased a lot' since receiving the SolarBuddy light.
- Finally, there were positive impacts of the solar lights on feelings of safety and security amongst the students. 69% of students reported an increase in how safe they felt in their home since receiving a solar light; and 61% reported an increase in how safe students felt in their village since receiving a solar light. These findings were further supported by the qualitative interviews and most students reported that it was easier, safer and more secure to walk around their villages after dark and access pit toilets.

RECOMMENDATIONS

RECOMMENDATIONS

- This preliminary impact assessment has identified a number of positive improvements in students' lives since receiving the SolarBuddy light including educational, health 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 students received the solar light and after;
 - Collection of base-line and follow-up data to more directly track changes in education, health etc outcomes.





KTF



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