LIGHT UP OECUSSE PHASES 1 & 2

IMPACT ASSESSMENT

BY SALLY BOLTON • KOPERNIK FELLOW • JULY 2011

KOPERNIK
SERVING THE LAST MILE

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Executive Summary

Kopernik sent 992 d.light solar lights to Oecusse, Timor-Leste and worked with its local partner, Fundasaun Esperanza Enclave Oecusse (FEEO) to ensure these solar lights reached remote villages in the enclave.

Kopernik Fellow Michael Woon (October 2010 - January 2011) designed a baseline lighting survey, and worked with the FEEO team to implement it. Sally Bolton (January - June 2011) took over the baseline survey from Michael, and worked with FEEO to complete a follow-up survey.

Oecusse is an isolated enclave on the north coast of Timor bordered by the Indonesian territory of West Timor. Very few people in Oecusse have access to electricity and 92 percent of households rely on fuel-powered lamps (mainly kerosene) for light. FEEO staff conducted baseline surveys with 258 people who purchased solar lights. Follow up surveys were conducted with 55 people who had participated in the baseline survey. Typically surveys were conducted after people had been using solar lights for between two and four and a half months.

The baseline survey confirmed that kerosene lamps are the primary source of lighting at night, but most people are not happy with this situation because:

- the kerosene is **expensive,**
- the kerosene lamps **produce black smoke**, which **makes people sick,** and
- the kerosene lamps provide **poor quality light.**

The d.light solar lights have significantly reduced, but not completely replaced, the use of kerosene lamps in the households surveyed. Before buying solar lights, households used an average of three kerosene lamps, although some used as many as five. After buying solar lights:

- **76 percent** of households reported that they **no longer used kerosene** lamps, and

- the **households which continued to use kerosene lamps were using fewer of them**.

The solar lights reduced weekly spending on kerosene, batteries, candles or gas, and quickly paid for themselves. Users commented that the solar lights offer a better quality of light than kerosene lanterns, do not produce smoke, and are simple to use.

Project Background

Project Objective

Kopernik is an online marketplace connecting people in the developing world with innovative, life-changing technologies.

Kopernik partnered with Fundasaun Esperansa Enklave Oecusse (FEEO) to make life-changing technologies available to people living in remote communities in the Oecusse district of Timor-Leste.

Through Kopernik's Fellowship programme, Michael Woon (November 2010-January 2011) and Sally Bolton (January –June 2011) were deployed to work closely with Kopernik's local partner organization. This report is the result of Michael, Sally and the FEEO teams' research on the impact of solar lights (d.light S10 and d.light S250) distributed in the region. The project was made possible by Kopernik's donors, who generously funded the purchase and shipping of the technologies.

The purpose of the impact assessment was to:

1. Develop a clear understanding of the status and needs of the customers,
2. Determine if the solar products are having a positive impact on the customers' lives.

This assessment was designed to test the following hypotheses:

Solar lights will:

1. Save people money on lighting fuel (and charging mobile phones)
2. Be a safer, healthier and more convenient lighting source
3. Increase the range of activities people can pursue in the dark
4. Increase the length of time people can spend on nightly activities
5. Ease pressure on the environment
6. Increase the use of mobile phone

This project was conducted alongside the Take A Load Off Oecusse project executed by Kopernik and another partner Centro Feto Enclave Oecusse (CFEO).

Snapshot of Location

Oecusse is an isolated enclave on the north coast of Timor, bordered by the Indonesian territory of West Timor. Approximately 45 percent of Oecusse's population of 67,000 live below the poverty line. Almost every household in the enclave reports that there is at least one month each year when they do not have enough food to eat.

Transport to and from Dili is limited, and the cost of basic goods is higher in Oecusse than in the capital. Transport within Oecusse is also difficult, especially during the wet season when the poor condition of the roads and bridges deteriorates even further.

Common Practices Relating to Technologies

Very few people in Oecusse have access to electricity and 92 percent of households rely on fuel-powered lamps (mainly kerosene) for light. When they can afford it, most people in Timor use 1.5 – 2 litres of kerosene a week. One litre of kerosene costs about US$1.25 in urban settings but in remote areas doubles to US$2 - $2.50.

A lack of light limits the amount of time communities can devote to income generating activities such as sewing, repairing fishing nets, weaving and cooking snacks for sale. It also affects school study, community meetings and general household lighting.

Our Local Partner: Hope Foundation of Oecusse Enclave

FEEO (Hope Foundation of Oecusse Enclave) is a local NGO founded in 2009 and based in Oecusse district. Itsupports the development of rural communities by mentoring self help groups, improving agricultural production and working to make local production methods sustainable. FEEO also supports youth groups to be active in cultural and sports activities, works to support women's participation in private and

public life, and strives to keep students in school.

Project Implementation

The Technology

The d.light S250 solar lantern is a white LED light equipped with an external solar panel that can also charge mobile phones. It has four brightness settings and can provide from eight to 100 hours of light after each full charge, depending on the brightness required. The product description from the manufacturer indicates that the lantern has a lifetime of five years or more when handled properly.

The d.light S10 is a high-quality solar LED lantern which offers a bright and durable replacement for kerosene lanterns. It provides lighting for the home, workplace, or ca be used while walking. Its solar panel is integrated into the lantern itself. When fully charged, it provides between four and eight hours of light depending on the brightness setting. The product's lifespan averages three years.

Distribution Mechanism, Pricing & Payment

In mid-2010 FEEO submitted a proposal to Kopernik for d.light solar lights. The first phase of the project was funded by September and the first shipment of solar lights arrived in Oecusse in December 2010.

Initial socialization of the lights was conducted in August 2010 when the co-founders of Kopernik and FEEO met with several community groups and presented a range of solar lights at a series of community meetings.

The prices charged for the lights were set by FEEO, taking into account the unit price of the technology, the capacity of households to pay, the value that households placed on the technology, and the savings in recurring expenses that the technology would bring. The prices were set as follows:

Technology	**Specification**	**member**	**Non-member**
S10 d-light 	Hours of Light (after 1 full day of charge): • 4 hours with HIGH setting • 8 hours of light with LOW setting	$5	$6
S250 d-light	Hours of Light (after 1 full day of charge) • 4 hours with HIGH setting (for studying/precision work) • 6 hours of light with MEDIUM setting (for cooking) • 12 hours of light with LOW setting	$10	$12

	(socializing) • 100 hours of light with BED setting (resting/sleeping)		

This price was determined appropriate because it was low enough for the lights to be accessible (on a repayment scheme) by even the poorest households.

Distribution

The solar lights were distributed in communities where FEEO works with self-help groups to support rural development. Community members were invited in advance to attend distribution days, when FEEO staff visited the villages to present the solar lights. The staff then fielded questions about how the lights work. Following the question and answer session people could buy the lights in cash, or on credit with a down-payment of 50 percent. Before receiving their purchase they were interviewed by a FEEO staff member for a baseline survey.

Merita, Director of FEEO explaining how the solar lights work

FEEO staff conducting surveys

Following the distribution, FEEO staff regularly returned to the village to collect payments for the items purchased on credit and to monitor any problems with the lights. The lights were also sold to people who visited the FEEO office in Pantemakassar.

Between December 2010 and April 2011 FEEO distributed 992 d-light solar lights in Oecusse: 745 S10 d-lights, and 247 of the larger S250 d-lights which also charge mobile phones. Phase two and three of the distribution commenced in May 2011.

Adoption

The solar lanterns were immediately very popular. They've presented a clear value proposition, as they reduce weekly spending on kerosene, batteries, candles or gas, and quickly pay for themselves. They also offer a better quality of light than kerosene lanterns, do not produce smoke, and are simple to use.

The distribution of these technologies commenced in late December 2010 and continued through the wet season, which runs from December until April. Travel in Oecusse during the wet season is difficult, as the roads deteriorate from heavy rain and villages become inaccessible as the rivers rise.

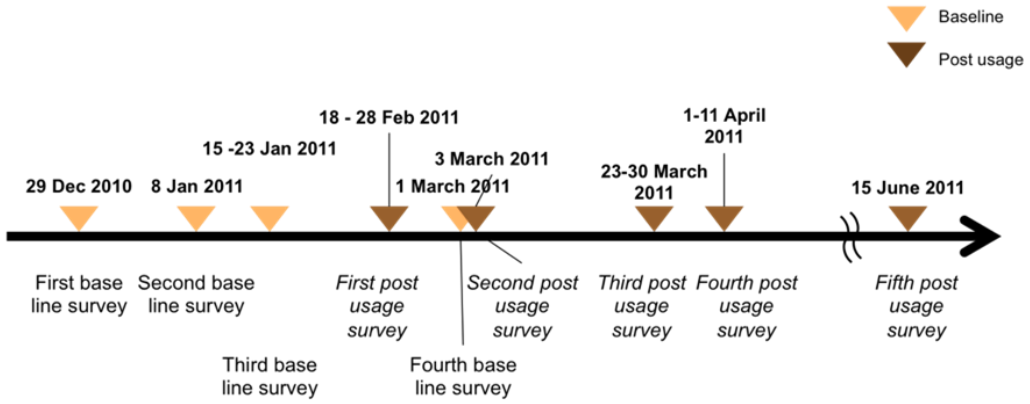
The conditions during the wet season made it difficult to visit some of the villages where distribution was planned, and to transport the lights. Remote villages had to be reached on foot.

The wet season did not deter adoption of the solar lanterns, and users did not report any problems with charging their lanterns despite cloud cover and rain.

Impact Assessment

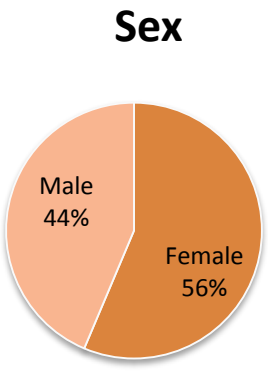
Process & Methodology

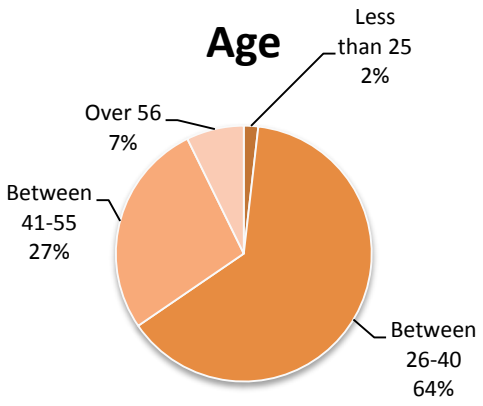
FEEO staff conducted baseline surveys with 258 people who purchased solar lights during the phase 1 project period. Follow up surveys were conducted with 55 people who had also participated in the baseline survey. Typically surveys were conducted after people had been using solar lights for between 2 to 4.5 months.



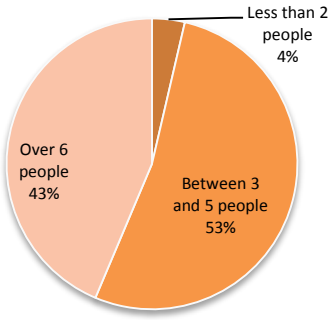
Results of Impact Assessment

Demographics

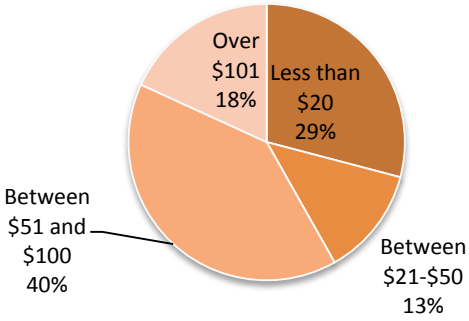




Household size

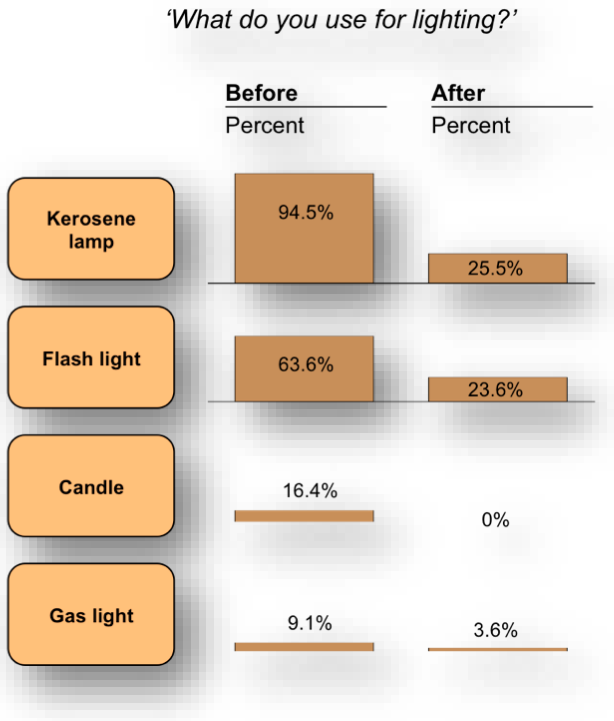


Monthly household spending



The respondents lived in 10 of the 18 *sukos* (administrative divisions) in Oecusse: Abani, Bene Ufe, Bobokase, Costa, Cunha, Lifau, Malelat, Naimeco, Suni Ufe and Taiboco. These *sukos* are spread across three of Oecusse's four sub-districts.

Sources of Light

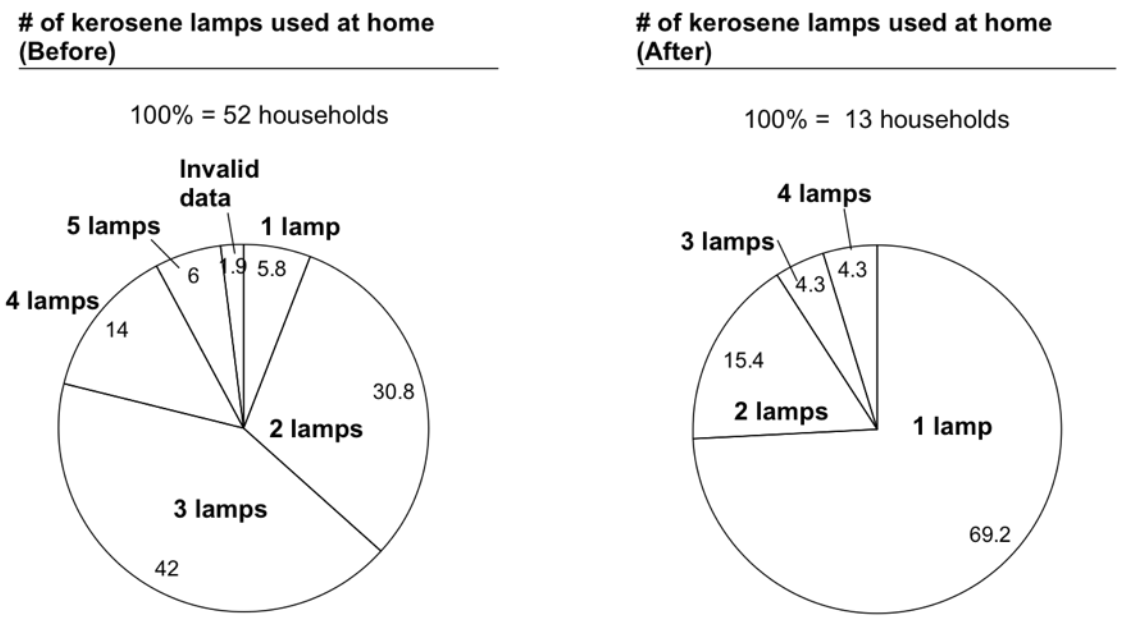


Prior to the introduction of solar lights, 94.5 percent of respondents reported using kerosene lamps for lighting. Almost all of the respondents who did not use kerosene lamps had access to electric lighting via a generator or the town electricity grid.

Respondents said that kerosene lamps were an important source of lighting at night, but most said that they were not happy with kerosene lamps because of the cost of kerosene and the kerosene lamps produced black smoke, which made people sick. They were also not happy with the quality of the light provided by the kerosene lamp.

After the introduction of solar lights, the conventional means of lighting have been significantly (but not fully) replaced by solar lighting.

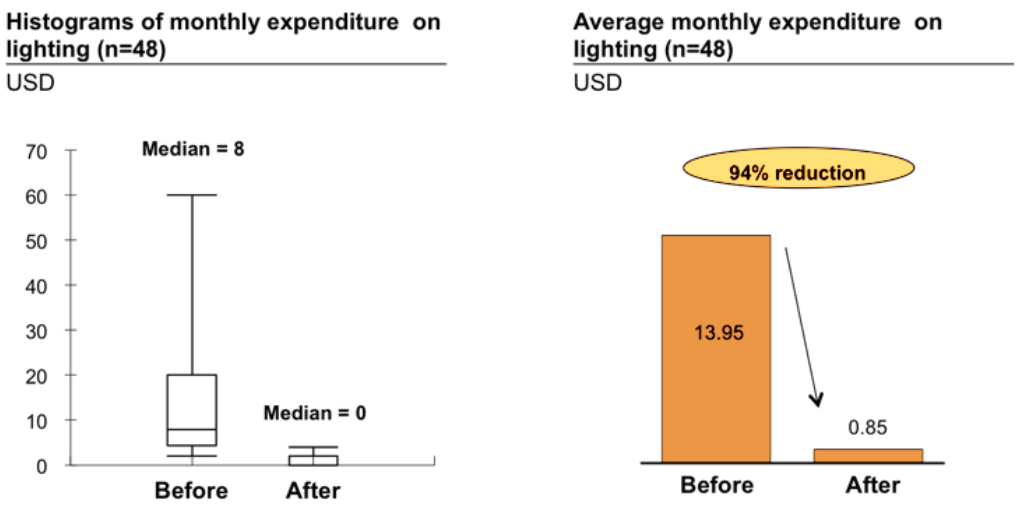
'How many kerosene lamps do you use at home?'



Before the solar lights, households used an average of three kerosene lamps, although some used as many as five. Afterwards, of those that continued to use solar lamps (13 households) the number of lamps used had decreased.

Expenditure

'How much do you spend for lighting per month?'

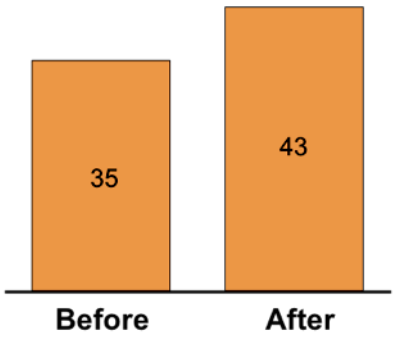


On average, over US$13 has been saved per month, accounting for a 94 percent reduction in expenditure on lighting.

Night-time activities - study

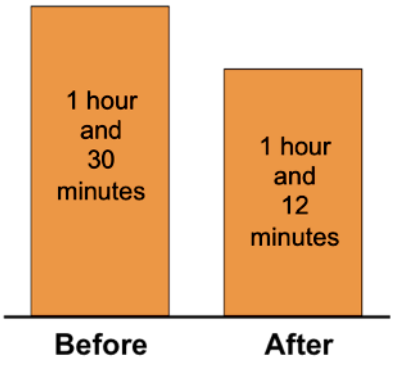
Number of families who answered 'study'

Families



Average number of hours spent on studying

Hours

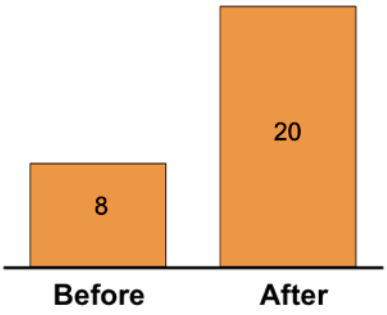


More families reported their children studying, but not for longer. It would be difficult to speculate why this is the case. The decrease in study time might be due to school exams (before) or more time spent on agricultural activities during harvest time (after), but we do not have the data to validate this hypothesis.

Income generating activities

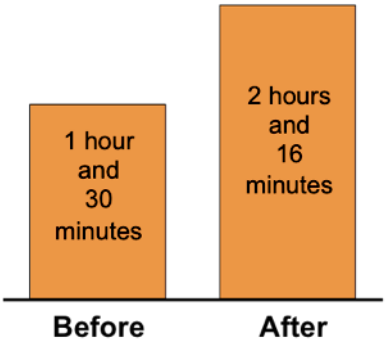
Number of families who reported income generating activities*

Families



Average number of hours spent on these activities

Hours

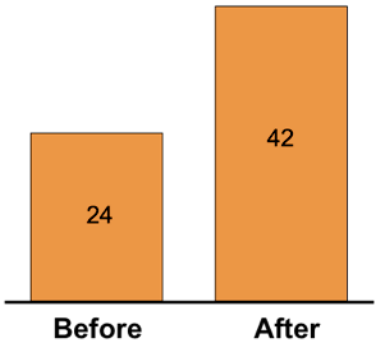


More households reported conducting income generating activities after dark. Activities include weaving *tais* (traditional cloth), mats, baskets and rope.

Night-time activities – tending to livestock

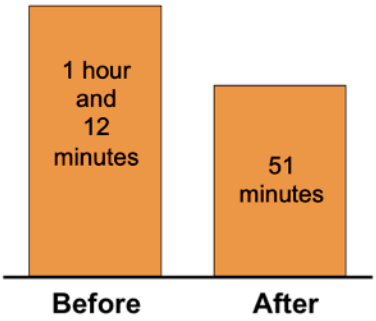
Number of families who reported agriculture/livestock related activities*

Families



Average number of hours spent on these activities

Hours



More households are tending to their animals after dark using the solar light. Activities include feeding the pigs, putting the goats into the pen, tying up horses, putting chickens to sleep for the night.

Conclusion

While more time is needed to evaluate the longer-term impact of the technology on the economic wellbeing of the community, early assessment has already clearly demonstrated the positive impact of the d.light on weekly expenditure and hours of productivity, including income generating activities. The technology has been well-received by the community with high adoption rate amongst the members.

Survey Limitations

The surveys were conducted by FEEO staff, following training by Kopernik Fellow Michael Woon. For some staff this was the first time they had interviewed respondents and recorded survey responses. Other staff had some experience conducting surveys for different projects they had worked on.

Some surveys were only partially completed, with a number of questions not answered. The Kopernik Fellows worked with FEEO staff to help improve the thoroughness of the responses and the quality of the data

Follow-up surveys were conducted with technology users when FEEO staff visited the villages to collect payments for items bought on credit. The staff interviewed the household member making the repayment, however this person was not always the same person who had been interviewed for the baseline survey.

Kopernik and FEEO aimed to conduct the follow-up surveys within one to two months of distribution. However at that time of year many of the baseline survey respondents were working in the fields when staff visited and were not available to be surveyed.

The baseline and follow-up surveys were designed in English, and initially translated into Indonesian, which is understood by FEEO staff and still considered a working language in Timor-Leste. FEEO staff conducted the surveys in Baikeno, the local language of Oecusse, and recorded the answers in Indonesian.

In February 2011 the survey questions were translated into Tetum, one of the national languages of Timor-Leste. The surveys continued to be conducted in Baikeno, as Tetum is not widely spoken in rural areas of Oecusse. Survey answers were recorded in Tetum. The survey data was later translated into English for analysis.

This complicated language environment was a significant challenge, with many points where errors in translation could occur.

Annex

Case Studies

Rozalina Taek & Tereza Neno

Tereza Neno lives in the village of Maquelab with her husband and three children. Before the d.lights arrived in Oecusse, Tereza used to use two kerosene lamps for three hours each night. She didn't like these lamps because they use kerosene and produce black smoke. Tereza bought one S10 solar lantern from FEEO, reducing her dependency on kerosene lamps. She now uses only one kerosene lamp for two hours each night, while she uses her solar lantern for five hours each night. Her children use the solar lantern to study for two hours each night. Tereza says that she really likes the solar lantern. "We use it at night for parties, for weaving *tais* and mats and other things".

Marta Bene weaving baskets at night

Marta Bene lives in the village of Maquelab with her husband and four children. She used to use two kerosene lamps for five hours each night, but she said that she didn't like this method of lighting because kerosene is expensive. She now uses two solar lights for four hours each night, and says that she really likes them because they provide good lighting and they don't use kerosene.

"The children study better now" says Marta, "and we use the solar lanterns when we make nets, baskets and *tais*".

From the Field

Kopernik in Action Blog 1

By Sally Bolton

How did you celebrate Earth Hour?

On the last Saturday in March in cities around the world millions of people turn off their lights from 8.30pm to 9.30pm in recognition of Earth Hour. This symbolic action is aimed at raising awareness of climate change and encouraging governments, individuals and businesses to take responsibility for their ecological footprint.

Meanwhile in Oecusse my colleagues at Fundasaun Esperansa Enklave Oecusse (FEEO), Kopernik's local partner organisation, have just finished five weeks of climate change socialisation in remote communities throughout the enclave.

As they prepared a report this week on their activities, my attempts to explain Earth Hour were greeted with much hilarity.

"But *mana*, in Oecusse we celebrate Earth Hour every *day*!" Agus told me.

Later I sat on my front porch watching the final light of the day seep from the sky and the rice paddies descend into complete darkness. An anxious time passed as I braced for another night without electricity, but eventually the town generator kicked into action and lights across Pantemakassar flickered on.

Outside of Pantemakassar it's a different story entirely.

Based on the baseline lighting survey that we are conducting, most people depend on kerosene lamps as their principle source of lighting. Some families will make do with just two kerosene lamps, which they use for a couple of hours each night to cook dinner and get ready for bed. In this way they can get by spending US$0.50 each week on kerosene for lighting.

If they can afford it, they will use three or four kerosene lamps for longer hours. Children will use the lamps to study for a couple of hours each night, while women may weave mats or *tais*, or the whole family may pray together.

Again if they can afford it, families will supplement kerosene lamps with other forms of

lighting. Flashlights are used to walk at night and for mobile activities such as feeding the pigs. They are used sparingly to conserve the batteries. Some families also use candles and gas lamps, while a very small number have generators.

The households we have surveyed spend on average US$4.50 a week on lighting, about a quarter of their average weekly budget. Some families spend more than half of their household budget on lighting.

I hate to make sweeping generalisations, but in this instance I'm going to make an exception. People are universally unhappy with this situation, not least because kerosene lamps are terrible devices in a whole host of ways.

"I don't like kerosene lamps because we have to spend a lot of money to buy kerosene" says Fransisca Timo, from the village of Boen Mes. "There's black smoke that makes us cough and feel sick" says Juana Ton from Hauboni. "The flame doesn't provide a lot of light" says Tomazia Beno from Maquelab. "When there's a big wind they blow out" says Jose Tacaci from Boen Mes.

Despite all of these complaints, people continue to use kerosene lamps because they haven't had any other viable options. Until now.

Since late December 2010 Kopernik and FEEO have distributed hundreds of solar lights to families in nine of Oecusse's18 *sukos* (tribal districts). We are finding when we return to conduct a follow-up survey that many families have stopped using kerosene lamps altogether and are now just using the solar lanterns. Other families are using a combination of the two, but are keen to buy more solar lanterns as soon as more are available.

"The solar light is great" says Lusia Cusi from the village of Oemolo. "There's no smoke, it provides good lighting, we use it to walk at night like a flashlight, and the children use it to study"

"It's very important for people like us living in rural areas because now we don't have to buy kerosene" says Julio Ton Coa from Maquelab, who has reduced his weekly spending on lighting from $10 to zero.

"The children are able to study better because the light is better" says Juliana Obe from Hauboni. The d-light S250, the larger of the d-light solar lanterns, provides a light that is ten times brighter than a kerosene lamp.

At the allotted hour last Saturday as people in other countries switched off their lights for Earth Hour, people in remote villages of Oecusse were enjoying a clean, economical and sustainable source of lighting for the first time. I hope that by the time Earth Hour comes around again next year, many more families will also have access to this technology

Kopernik in Action Blog 2

By Sally Bolton

The entire adult population of Timor-Leste now owns a mobile phone, just about. At least according to Timor Telecom. '500,000 mobile phone customers nationwide' trumpets the press release, which goes on to say that Timor Telecom aims to cover 95 percent of the country with a mobile network by 2012.

An admirable goal, but there's still a huge barrier to improving access to telecommunications services in Timor-Leste: nowhere near 95 percent of the country has electricity to charge mobile phones.

In some of the villages where we work in Oecusse people pay US$0.25 each time they need to charge their mobile phone from a neighbour's generator. But there are many villages where no one owns a generator, and this isn't even an option. On top of this, they frequently have to pay a lot more than the face value of *pulsa* (phone credit), for example US$1.25 for US$1.00 worth of credit. Not to mention often having to walk a considerable distance in order to pick up a mobile signal.

All great excuses for not calling your family as often as you should. Not that I am guilty of such a thing. But for people who actually do want to stay in touch with their family, owning a mobile phone does not necessarily mean you are linked in to a communications network.

So does Kopernik have a simple solution to this problem? Yes and no. The S250 d.light solar lantern we are distributing in Oecusse also functions as a mobile phone charger. It comes with charging adaptors to fit a range of commonly used phones including Nokia and Motorola. But not the cheap Alcatel phones that are used in abundance.

Thanks to a promotion a couple of years ago when Timor Telecom was practically giving phones away for free, the vast majority of phones used in the country are Alcatel.

As we collect feedback from people who are using the solar lanterns we keep on hearing the same thing – people want to be able to use the lights to charge their Alcatel phones.

“I really like this solar lantern because it reduces our expenses as we don’t have to spend money on kerosene”, says Silvester Bui from the village of Abani, in the mountainous sub-district of Passabe. “We use it to weave *tais*, make mats and other things. But if the light could charge Alcatel phones as well as other types of phones it would make all of us living in rural areas very happy”.

A quick email to the d.light team brings good news. They have recently tested the

charging capability of the S250 solar light with Alcatel phones, which are also very popular in Pacific island nations and in Haiti.

It is great to see the Kopernik mission in action. Kopernik is working to make innovative technologies available to people in the developing world, and also to provide feedback to technology producers on how their products can be refined and improved to better serve the needs of these communities.

Even better, it will soon be a little easier for the people we are working with in rural areas of Oecusse to stay in touch with their families. Next challenge: ensuring Timor Telecom comes through with their promise of an expanded mobile network. I'm not sure what Kopernik can do to make that happen, but maybe blogging about it will help.

Kopernik in Action Blog 3

By Sally Bolton

I have just a few short weeks left in Oecusse, so I'm trying to find time to enjoy the simple pleasures of enclave living.

Morning runs through the rice paddies in the cool of dawn. Lunchtime swims in the sea. Coconut water on the beach in the late afternoon. The slight chill in the air on a June evening. And gazing up at Oecusse's infinitely spectacular night sky.

What Oecusse lacks in night time entertainment options, it makes up for with a display of stars free of almost any light pollution.

I had plenty of time to take it all in last week, with overnight ferry trips to Dili and back to transport a new shipment of solar lanterns to Oecusse. Lying out on the deck of the Nakroma, staring up at the star-studded sky, I reflected on what we have achieved over the last few months here. By my calculations Kopernik technologies are benefiting more than 5,500 people and have reached almost all of the 18 *sukos* in the enclave.

Jose Sonet and I arrived back in Oecusse just before dawn, watching the stars fade as

we unloaded almost 1.5 tonnes of new solar lanterns onto the dock.

Surrounded by lights at the FEEO office

Tuesday we drove out to the western border at Citrana to distribute solar lanterns, fuel-efficient stoves and water purification units in villages that had been inaccessible during the wet season.

Although Citrana is only about 40km from Pantemakassar, it takes a good three hours to get there along a bumpy, bone-rattling road/track. It was a long day, and by the time we passed through Suni Ufe on our way back to town it was almost dark.

Suni Ufe is the first village where we distributed solar lanterns last December, and word had got around that the FEEO team had new lights for sale. We stopped twice in the village, each time quickly selling lights to a couple of dozen people who kindly used their new lanterns to give us light so we could write down their details and collect payments.

Driving out of Suni Ufe, it was easy to spot the distinctive white light of the solar lanterns in almost every house and kiosk along the road.

Bobbing lights in the distance revealed families who were using their solar lanterns to walk home from the fields.

A wide expanse of rice paddies was dotted with solar lanterns lighting up the small huts where people were resting after a day of harvest. We stopped and counted more than 20 lights across several hectares, the lights dotting the paddies mirroring the clear white light of the stars up above.

Crossing the Tono River we spotted fishermen using their solar lanterns to fish at the mouth of the river.

Suni Ufe is something of a model Kopernik village. The close ties that FEEO has with the community there have allowed Kopernik technologies to reach many people.

In the coming weeks and months my superstar FEEO colleagues will visit many more villages throughout the enclave, as roads damaged during the wet season are repaired by local communities. The new shipment of solar lanterns has arrived at a very good time indeed.

Kopernik in Action Blog 4

By Sally Bolton

On my final road trip to Passabe with FEEO's Kopernik team, we invented a new game. It was based on Spot-bug, a game I used to play on road trips as a kid. Spot-bug, as I remember it, involved yelling out each time you saw an old Volkswagen Beetle on the road. A variation called Punch-buggy involved meting out punches to friends or siblings if you were the first person to spot the VW.

In six months in Oecusse I haven't spotted a single VW Beetle, so we adapted the game into something I'll call Spot-light. The goal was to be the first person to spot a d-light solar lantern charging under the sun. We scored one point for the S10 d.lights, the smaller lanterns.

The S250 d.lights are larger and have a separate solar panel which is often wired in

place on the roof for charging, while the lantern remains hanging inside the house. As such, they can be harder to spot, so we decided to award three points for an S250 sight sighting.

The mountains have faded from a lush green to a dusty brown since the dry season took hold, and it was easy to spot the bright orange lanterns in many villages that we passed through. I quickly took a commanding lead in the game.

I will concede that I was sitting in the front passenger seat where it was probably much easier to see the lanterns first. Or maybe my colleagues were just indulging me because they know how much of a thrill I get from seeing the lanterns being used all over Oecusse, and this was our last trip together. Or possibly my years of experience dodging (playful) blows from my brothers in games of Punch-buggy had given me a competitive edge for these sorts of games.

Although I won't be he here in Oecusse to see it, the potential long-term, collective impact of the new technologies is equally exciting. Three months, six months, twelve months down the track, what will the reduced dependence on kerosene mean for household spending? What will the increase in income-generating work at night using solar lanterns mean for household incomes? What will changes in children's study patterns using solar lanterns mean for their education? What will the small group loans, reinvesting the money raised from selling the technologies, mean for micro-businesses in these villages? What sort of health benefits will come from reduced exposure to smoke?

I'm leaving the Kopernik-FEEO partnership in the very capable hands of Dedy Hanning, Kopernik Project Officer, until the next Kopernik Fellow arrives in Oecusse. I'm already looking forward to hearing how they go answering some of the questions above. I'm also looking forward to hearing if they manage to beat my top score on Spot-light. Given the cracking pace of distribution of the new shipment of d-lights, I imagine there will be plenty of opportunities to play Spot-light all over the enclave.

Mak ne'e deit. (That's all, from me, for now).