C5. Solar Lighting

Inadequate lighting around WASH facilities reduces their usage at night, especially by women and children, primarily due to fear of violence and abuse. Poor lighting also makes it more difficult for the elderly and people with disabilities to access WASH facilities at night. In a camp setting, WASH agencies take responsibility for providing lighting around WASH facilities, while other agencies typically provide lighting for other public areas.

Vandalism, theft, and poor technical expertise and workmanship have hindered previous solar street light projects in Rakhine. Although former WASH agencies installed solar lighting around latrines in the Sittwe restricted area, all of the systems were in disrepair or fully non–functional at the time that OXSI took over as the WASH agency. When planning new solar installations, OXSI took a step back to evaluate how to install better designs and work with communities to reduce theft.

5.1 Pilot

A pilot can be helpful for new or technical interventions that are difficult for communities to design.

A pilot helps to identify problem areas in the design, protocol, and/or materials suppliers, and increases the likelihood of success during scale up. In the case of solar lighting, the OXSI pilot was essential for learning and led to changes in the design of the solar systems.

Things to consider when choosing a solar system include design options, cost, the availability of spare parts, lead time, maintenance and technical expertise requirements, community involvement and preferences, and more. After an assessment of the technical feasibility of installing solar lighting in the OXSI camps, two main viable designs emerged:

- A centralised system: solar panels, controller, batteries, and inverter are located in a central location, connected with wiring to lights on poles placed near latrines.
- Integrated units: each pole houses a solar panel, battery, light, and controller in a single, standalone unit placed near latrines.

Prior to the pilot, OXSI considered it best to install a centralised system in all camps and to supplement with integrated units in isolated locations where wiring from a central location would be inefficient. However, piloting each system in a separate, similarly–sized camp would clearly highlight the advantages and disadvantages of each design.

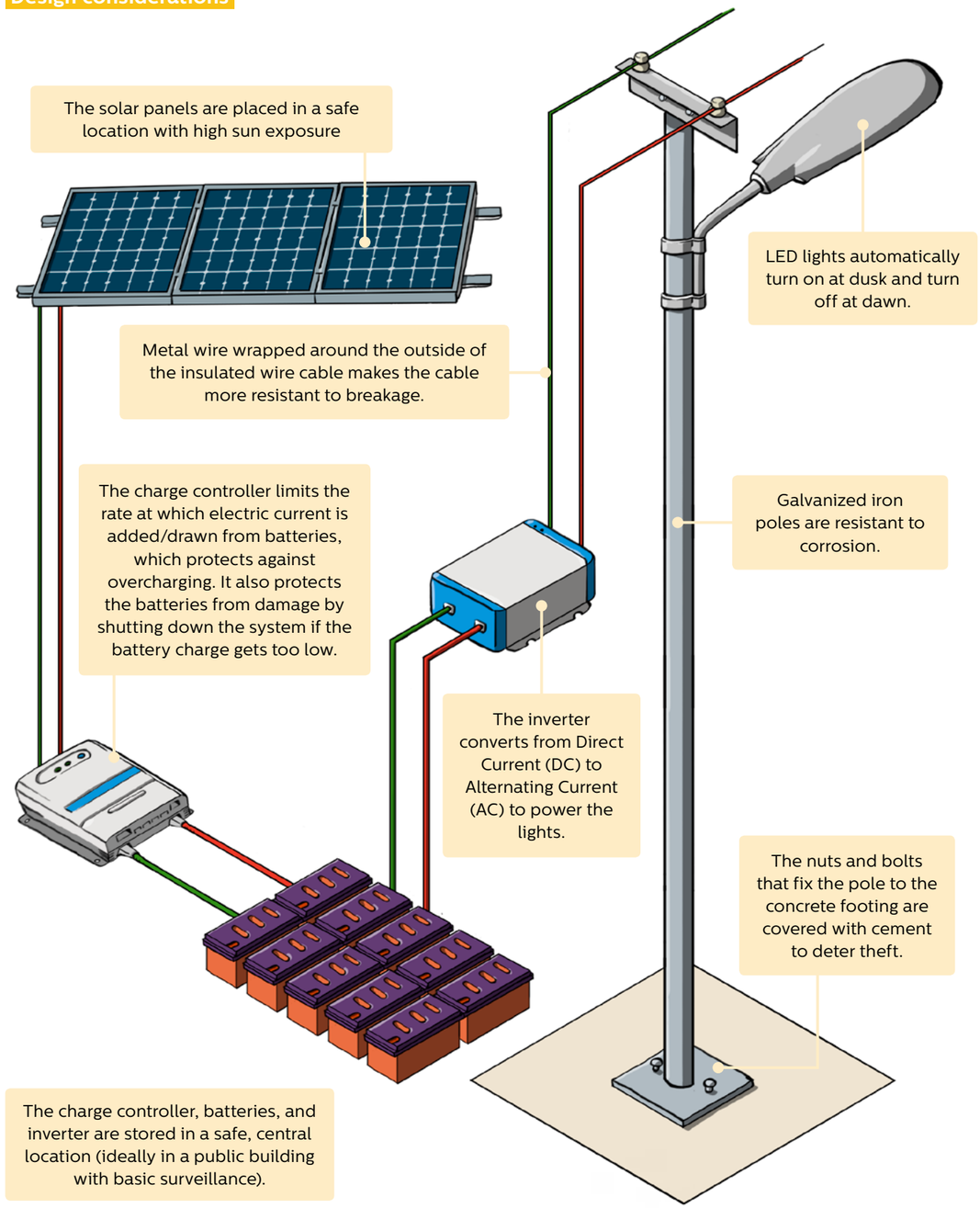
OXSI selected two camps with almost the same population and where OXSI had strong positive relationships with camp leaders to test the two solar designs.

Pilot 1

Although one camp already had a centralised system in place, the new centralised system pilot focused on exploring better quality equipment and a different supplier, as well as higher involvement of the community in the entire process to combat frequent breakage and theft. OXSI planned to pilot a hybrid system by installing integrated units to cover latrines that could not be covered by the centralised system; however, due to the small size of the camp, the centralised system adequately covered all of the areas that needed lighting and the hybrid system was not needed. Therefore, in Pilot 1, OXSI installed two centralised solar systems with nine solar lamps each.

A former men's ACE group that had expressed interest in working on solar lighting (see Section 4.1) worked closely with OXSI solar technical staff to identify locations for solar posts, as well as safe public buildings to install the solar stations. After approval from camp leaders, OXSI installed the solar stations in a school and a mosque. The ACE group continued to support the process by informing the community about the installation, making sure CMCs were informed and engaged, and committing to help keep the solar systems safe. Together with the CMC, the ACE group signed the handover certificate for the systems, pledging to take responsibility to recover looted items, report malfunctioning lights to OXSI, and monitor the systems regularly (for more about handover, see Section 5.3).

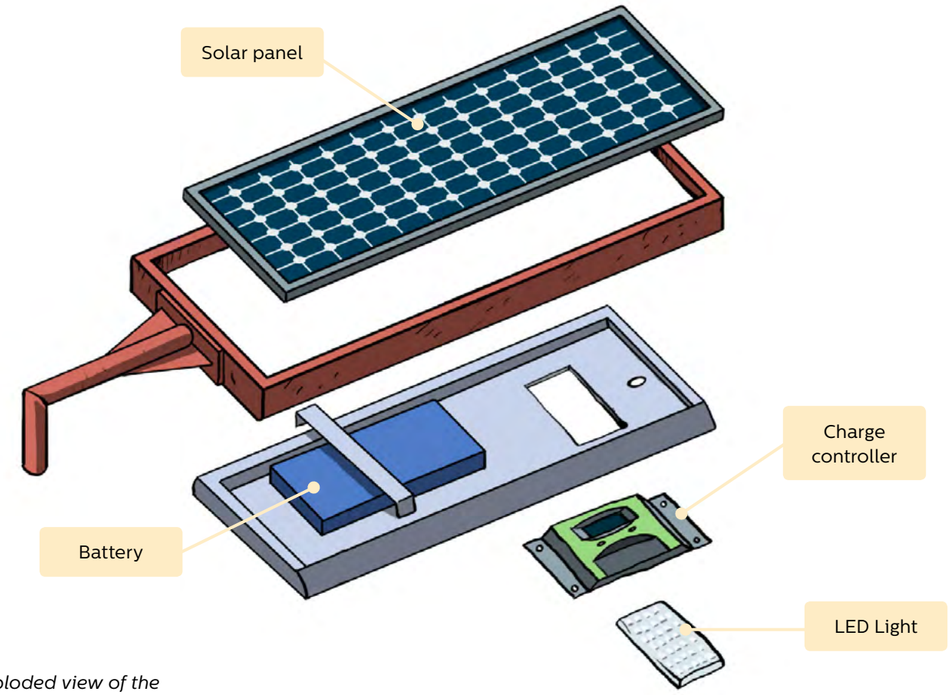
Design considerations



Pilot 2

In a Technical Working Group (TWG) organised for partners implementing solar lighting, OXSI and other agencies designed a second solar system: an integrated design featuring the solar panel, battery, light, and controller in a single, standalone unit that simply needs to be mounted onto a pole. Unlike the stand–alone solar units previously installed in several camps, where the components could be separated and used for other purposes (and thus were more useful if stolen), this truly integrated design means that the solar unit can only be used as a light.

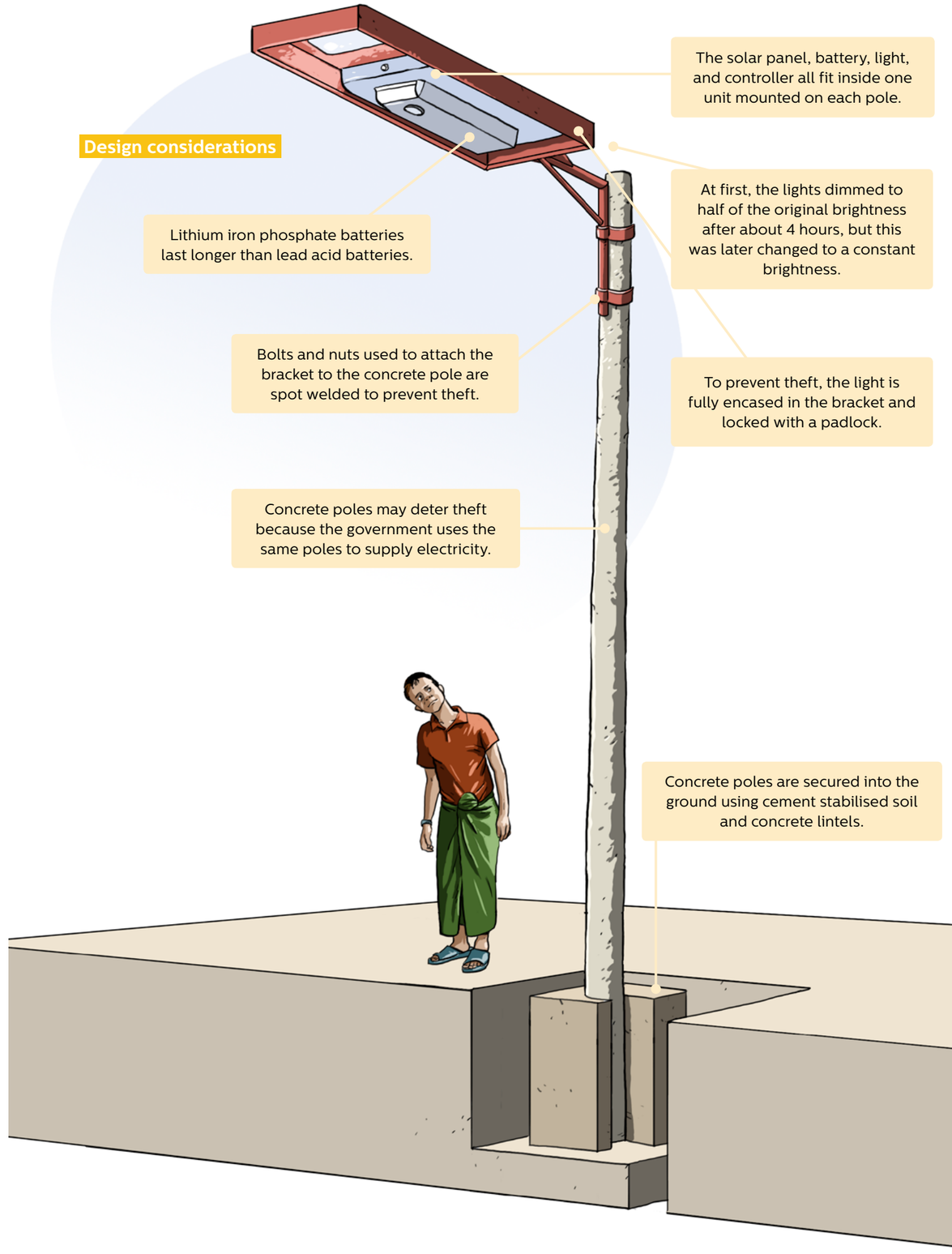
OXSI piloted this second design in another camp of a similar size to Pilot 1, again with a total of 18 units installed (two more units were later added in public spaces). As with Pilot 1, OXSI consulted with camp leaders about the design and location of the solar lights. Unlike Pilot 1, there was no need for a secure central location for the solar system components. The community agreed to monitor and take care of the solar units near their homes and report any issues to OXSI.



An exploded view of the integrated solar unit used in Pilot 2

OXSI Challenges	OXSI Solutions
High quality solar components are essential for solar systems to function as designed. For Pilot 2, the manufacturer initially provided lights that did not comply with the specifications provided, resulting in the lights turning off partway through night. In addition, the bracket covered part of the solar panel, which negatively affected the output of the panel.	These types of projects require technical expertise and research, either in–house or through the help of Technical Working Groups. OXSI worked with the supplier to swap the components with those that met the tender specifications, modified the bracket design, and changed the light angle to resolve all of the problems.

Design considerations



Pilot Results and Reflection

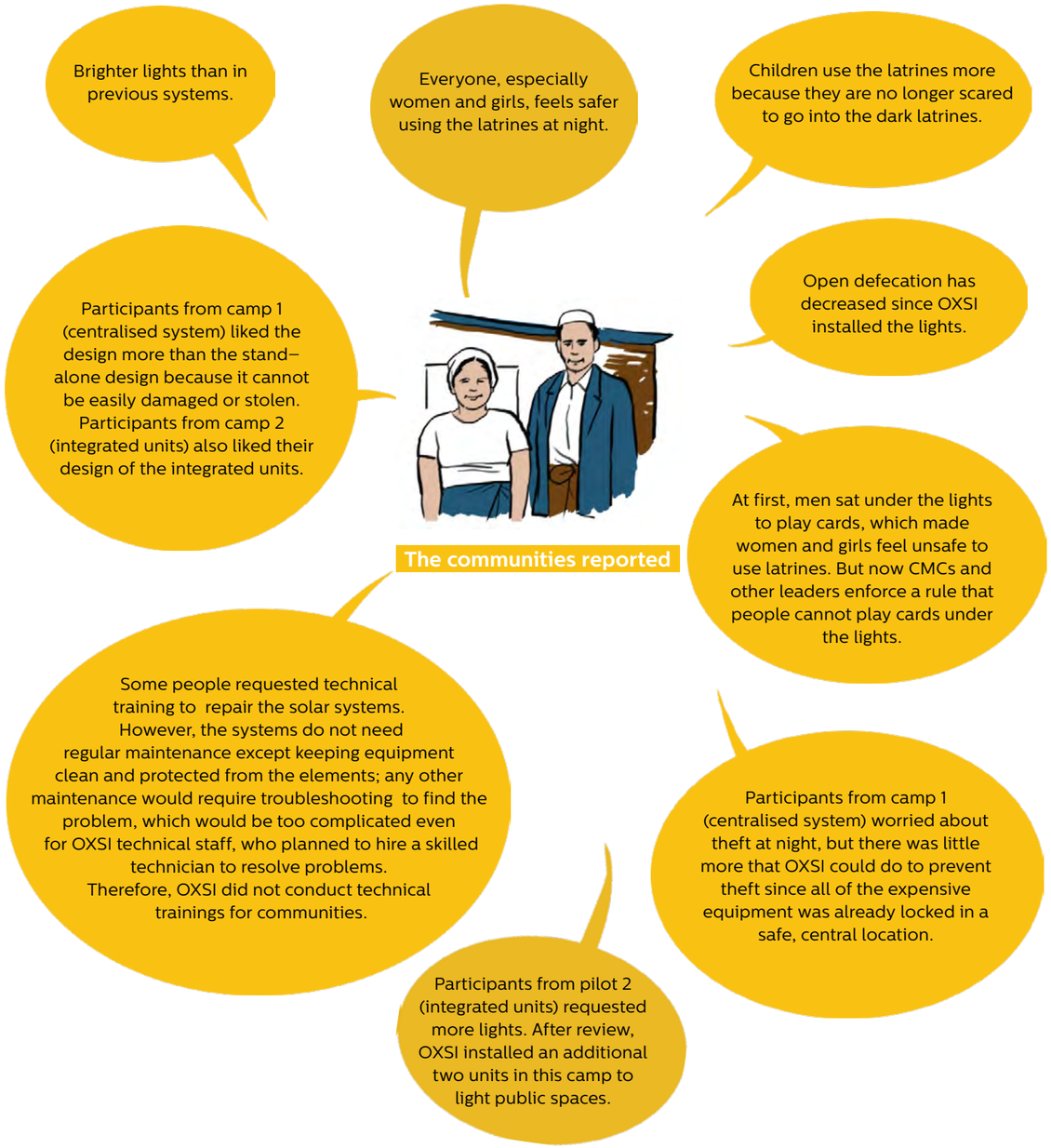
OXSI assessed the results of the two pilots, with special emphasis on technical and financial considerations such as cost, design life, installation difficulty, and efficiency.

A summary comparison of the two designs:

Criteria	Pilot 1: Centralised Solar System (Myanmar Solar Power)	Pilot 2: Integrated Solar Unit (Solar Solutions)
Cost (per light)	Higher (USD 560)	Lower (USD 311)
Warranty	Shorter (1 year)	Longer (3 years)
Design Life	Shorter (major components last about 2 years)	Longer (4+ years)
Battery	Bulkier, don't last as long, could be damaged by deep discharge (lead acid)	More compact, last longer, not damaged by deep discharges (lithium iron phosphate)
Solar panel type	Less efficient (polycrystalline)	More efficient (monocrystalline)
Efficiency	Low (110W solar panel for one light)	High (50W solar panel for one light)
Theft of electricity	Possible	Not possible
Theft of expensive components	Similar (greater use for lead acid batteries and solar panel, but these components are protected)	Similar (easier to steal, but less desirable; can only be used as a light)
Flexibility for pole placement	Similar (wiring to central power station, but doesn't require poles to be placed in sunny location)	Similar (no wiring needed, but requires poles placed in sunny location)
Installation difficulty	Moderate to hard (especially the requirement to secure expensive components in safe space; limited in camps)	Easy
Vulnerability to environmental hazards	Similar	Similar
Maintenance	Slightly harder (whole system shuts down if there is a problem, which requires troubleshooting to find problem, but some parts are available in Sittwe, which could make maintenance easier and faster)	Slightly easier (problem with one unit does not affect others, easier to find, very easy to replace entire unit. However, opening integrated unit and replacing individual components is difficult)
Local availability of spare parts	Similar (more parts needed; some parts available in Sittwe while others need to be ordered from Yangon, possibly imported by Yangon supplier)	Similar (spare parts need to be ordered from Yangon, possibly imported by Yangon supplier)

Community perceptions

During pilots, feedback from communities is more crucial than ever, because big and small changes alike are easier to make prior to full scale–up. The OXSI team conducted focus group discussions (FGDs) in the pilot camps with women, men, and children to listen to feedback on the two solar systems.



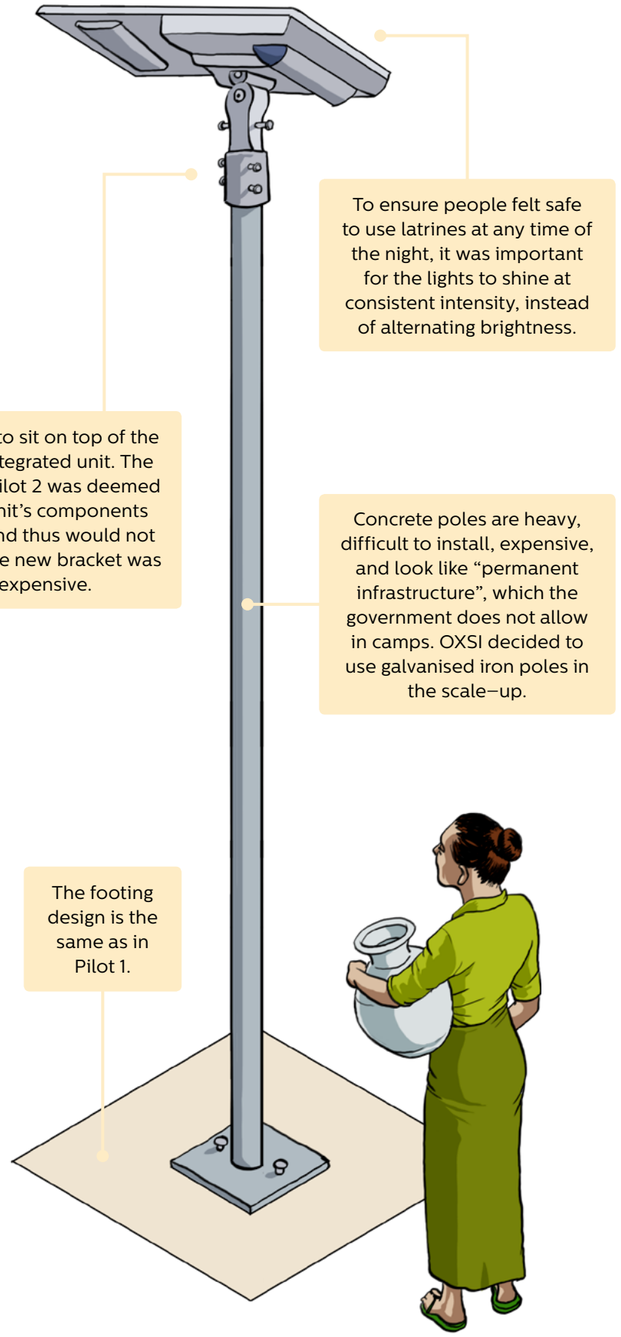
Several flaws of the pilot analysis emerged over time. First, OXSI did not pilot a hybrid system using both the centralised and stand–alone units in one camp, as originally planned. Second, it is possible that the centralised system could have been designed differently to be less expensive, which may have changed the final decision (however, the quality of the components would have suffered). Third, the two communities consulted could not meaningfully compare the pilot systems, since they each experienced only one system – because neither of the communities expressed dissatisfaction with their system, the results of the consultations were not used to decide between the two systems, but rather to tweak any problems highlighted by communities for the chosen system. Finally, the short duration of the pilots meant that longer–term maintenance, ownership, and management could not be meaningfully assessed. In the next programme, OXSI will continue to monitor and consult communities about the solar light installations to collect feedback for future programming.

Focus Group Discussions are an effective way to gather feedback.

5.2 Scale Up

Analysis of a pilot is used to inform any improvements and scale up of the intervention.

The assessments, observations, and consultations showed that the integrated units in Pilot 2 performed better overall, but the full solar design needed a few modifications. To scale up in the remaining camps, OXSI installed the integrated solar lights from Pilot 2, the galvanised iron poles and the footings from Pilot 1, and a newly designed bracket.



To scale up the design in the other camps, OXSI followed its usual steps of involving communities as much as possible, especially in the decision about the locations of the lights. Following the pilot and assessment period, the scale up to the remaining nine camps was relatively smooth and quick, with the remaining lights installed in about six weeks. (5A Solar Light BOQ)

OXSI shared the experience and final designs of the solar lights with other humanitarian agencies in Rakhine, and others are using the integrated solar design for light installations in and outside of camps. Depending on the demand for spare parts, these installations may influence the local market, bringing more spare parts and technical knowledge about solar lighting to Sittwe. Over time, this may positively affect the sustainability of the solar light installations in Sittwe camps.

5.3 Handover

With all newly–completed infrastructure, a ceremony for "handing over" infrastructure to users is vital to increase ownership and engagement, to answer questions, and to communicate important information about the infrastructure.

For the solar lights, the handover process differed slightly for the centralised system (Pilot 1) and the integrated units, but in both cases, the main concern of OXSI and the community was theft prevention.

During the handover, a group of households closest to the solar point (or, in the camp with the centralised system, those responsible for the mosque and school where the solar stations were secured) gathered with OXSI staff to learn more about the solar installation, ask any questions, and choose two solar point representatives to sign the handover certificate. Everyone gathered for the handover made a public commitment to keep the infrastructure safe from theft and to report any issues to OXSI. OXSI agreed to handle all of the repairs and maintenance. (5B Solar Light Functionality Check)

A snapshot of the certificate outlining the specific responsibilities is pictured below.

SOLAR LIGHT SYSTEM HANDOVER CERTIFICATE

CAMP NAME STMG

Oxfam

SOLIDARITÉS INTERNATIONAL

OF SOLAR POINT 3

Camp representatives agree to:

- Take responsibility for all materials included in the solar system mentioned in the handover certificate.
- Take responsibility to inform OXSI in case of material looting and/ or damage.
- Take responsibility for relevant action in case of solar material looting or destruction.
- Assume ownership of the solar system materials and take responsibility to get back the materials in case of looting and inform OXSI for required technical support to return the looted materials to the original place.
- Take responsibility to inform OXSI in case of non-functioning solar lights.
- Regularly check to see if the solar lights are functioning.
- Take care of the overall security of the solar system.

Oxfam + Solidarites International (OXSI) agree to:

- Provide fully installed solar systems with functioning lights in the pre-identified areas.
- Provide regular technical supervision of the solar system and technical support whenever it is needed.
- Replace damaged materials (if the materials are not stolen).

DATE JULY 8, 2019

OXSI representative:

Community representative:

(5C Solar Point Handover Certificate)

Focus on equity – gender, protection, and inclusion

Women, men, children, and the elderly should attend handover ceremonies to understand that the infrastructure belongs to them, not only to community leaders or those involved in WASH agencies' activities. During handover ceremonies, WASH agencies need to be clear about rules and responsibilities. In OXSI camps, for example, men and boys were forbidden from socialising under the solar lights, because this behaviour made women and girls feel unsafe to use the latrines, which defeated the main purpose of installing the solar lights. Women and girls feel more comfortable to report such behaviour if the rules are clearly outlined and if they feel ownership of the infrastructure.

One copy of the handover certificate is kept by the organisation and another is kept by one of the chosen community representatives.