Streetlights in Refugee Settings

Case Study: Bangladesh

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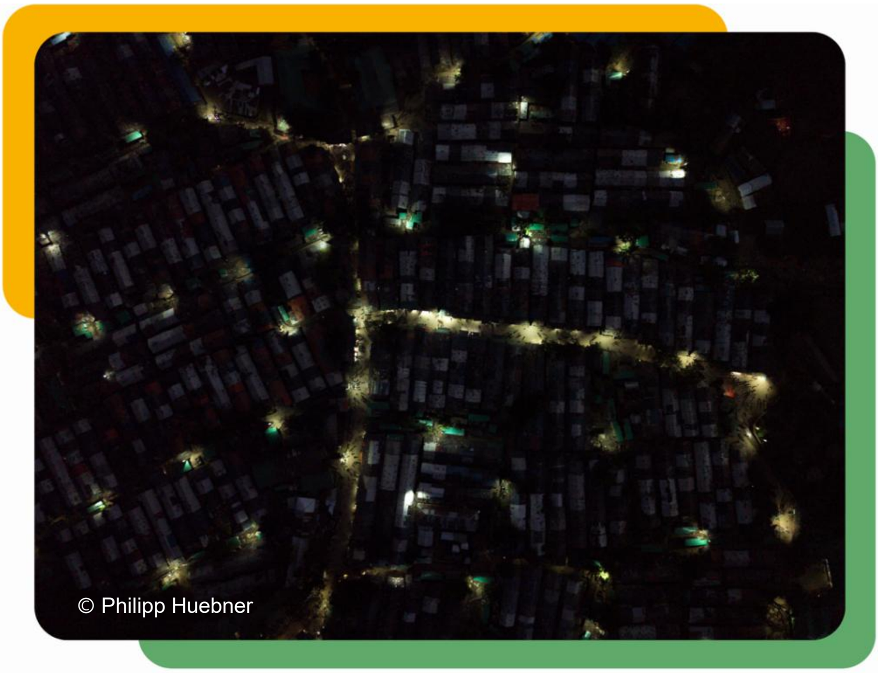
It's 3 am in Cox's Bazar as you blink your eyes awake, slip out of bed, and untie the rope securing your tarpaulin door. Outside, the night is still, stiflingly humid, and dark. You look across the camp to the nearby WASH facility, some 500m away, illuminated by bright LED lighting. The path that winds its way up to the toilets is less well lit; the poles of 20 streetlights line the way, but only a couple of them throw down their bright white cones of light; little islands of illumination over a black sea.

Your hand moves up to grasp your solar lantern hanging nearby from the bamboo rafters, but suddenly you recall stories from neighbours and friends about recent late-night attacks: other young women set upon and shamed whilst making similar journeys. Might your solar lantern guide your way, or be a beacon for predators? You decide secrecy is your safest option and set out quietly along the way.

Halfway along the journey, you come to the first halo of light from a working streetlight, which casts an isolated circle on the ground. Another decision to be made. Whose eyes might be watching silently from the shadows? 'Better to be safe than sorry', you tell yourself, stepping off the path to skirt around the light's edge, hoping that your presence continues to go unnoticed.



Solar street lighting, when properly implemented and appropriately maintained, can deliver significant positive impacts to the refugee communities by improving safety and facilitating increased nighttime activity. However, such technology is prone to malfunctioning, which can inadvertently heighten feelings of vulnerability by exposing individuals to visibility and potential surveillance.

The following case study examines solar streetlighting in Cox's Bazar, Bangladesh. It focuses on why fewer than half of the 23,000 installed streetlights are fully operational. It also highlights key insights gained over the eight years since their initial deployment. This case study is one of seven featured in the forthcoming report *"Course Corrections: Learning from the Past to Design for the Future"*, which aims to improve effectiveness and efficiency in humanitarian energy interventions.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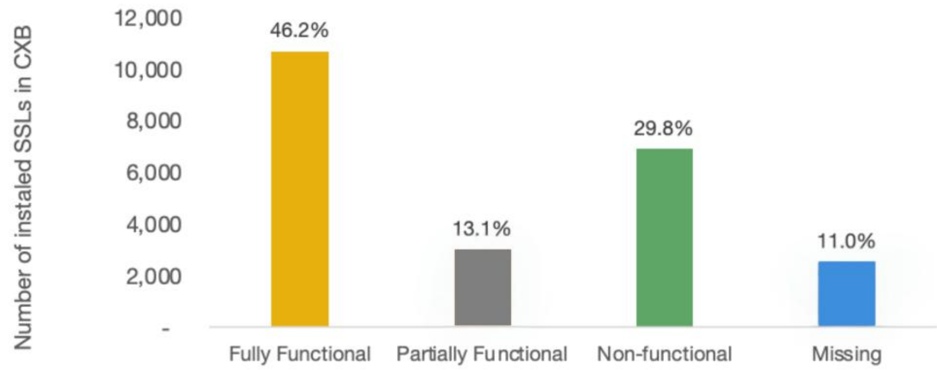
Background and Context

Since the expansion of the Rohingya refugee camps in Cox's Bazar (CXB) in 2017, over 23,000 solar streetlights (SSLs) have been installed by approximately 60 implementing agencies.

Figure 1 Functionality of SSLs in CXB [1]



Data from EEN (Data Update Apr. 24).

While many of these installations have improved perceptions of safety and nighttime access, particularly for women and girls, fewer than half of the SSLs remain fully functional (see Figure 1).

To meet established coverage standards for nearly 190,000 households and critical camp infrastructure including latrines, health centres, and pathways, an estimated 37,700 SSLs are required. With approximately 10,700 fully operational SSLs, a significant functionality gap of around 27,000 units persists. Reactivating the 9,900 non-functional SSLs represents a substantial opportunity to improve coverage without additional installations.

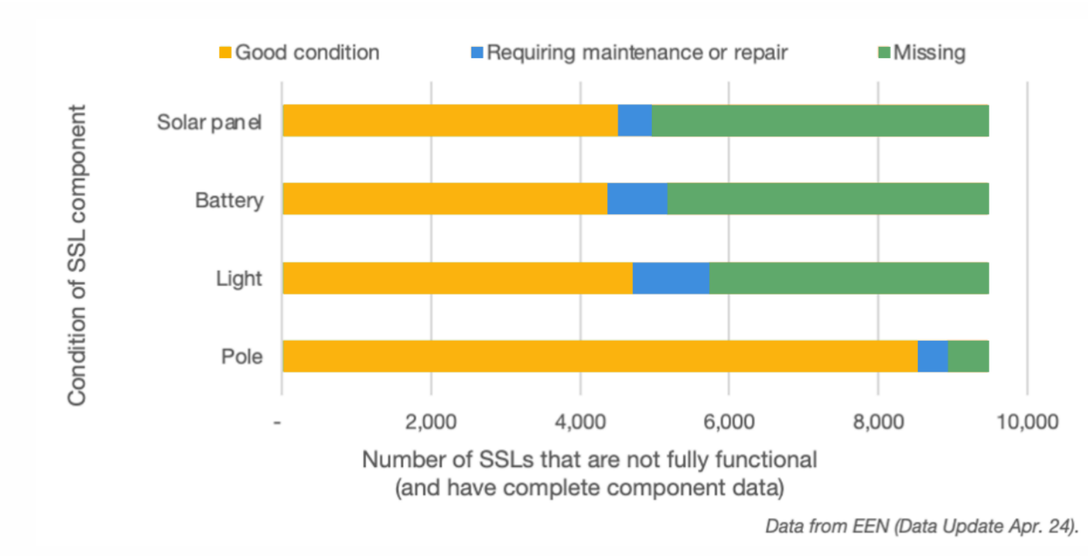
Causes and Conditions

The multi-project nature of the SSL implementation programme in Cox's Bazaar led to a fragmented landscape, characterised by a wide range of technologies deployed and inconsistent approaches to operations and maintenance (O&M). This uncoordinated procurement and implementation have resulted in inconsistent warranties, limited standardisation of spare parts, and unstandardised training for repairs. The absence of repair budgets from some installers and short-term funding cycles has compounded the problem.

Most SSLs could have a lifespan of up to 10 years, but in practice, many are deteriorating within 4–5 years due to irregular cleaning, poor battery maintenance, and exposure to theft or vandalism. Theft of SSL components has also been a major issue. However, installing anti-theft measures has proven to be an effective way of maintaining functional SSLs.

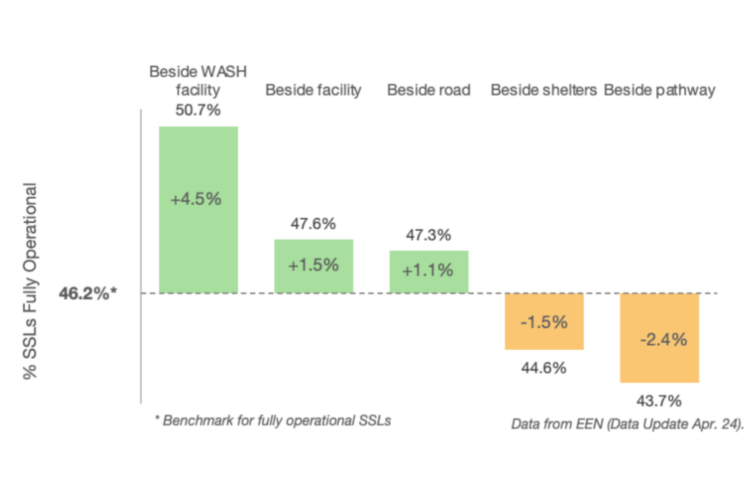
Of the 9,900 SSLs that are not fully functional, 48% are missing panels and 46% batteries, as shown in Figure 3. These components are widely used in other electrical applications and have a high resale value: large groups of people have occasionally been known to gather suddenly at SSL sites and forcibly remove equipment, even mid-repair.

Figure 3 Condition of SSL components for non-functioning SSLs



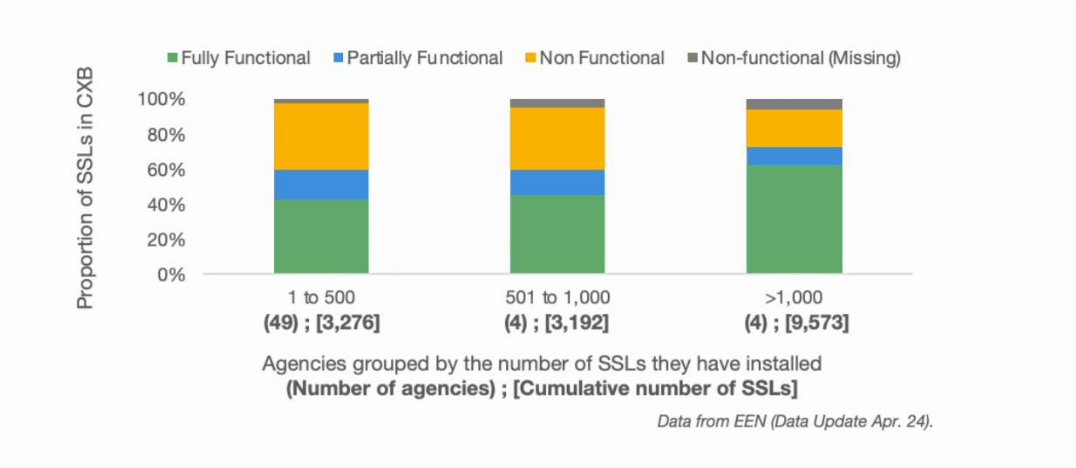
Location also affects functionality. SSLs near WASH facilities perform better (51% fully operational) than those along pathways (44%), as shown in Figure 4. These differences may stem from targeted theft, or varying levels community engagement in maintenance activities for SSLs, such as cleaning solar panels, based on their location. Both potential causes underline the importance of inculcating a strong sense of community ownership.

Figure 4 Impact of location on SSL functionality



Implementer experience also plays a role. Agencies that have installed more than 1,000 SSLs each – collectively responsible for over 9,500 streetlights – report a 62% functionality rate. This is well above the average for smaller implementers (43–45%) as shown in Figure 5. These findings highlight the value of economies of scale and the potential for knowledge sharing between agencies.

Figure 5 Impact of agency installation numbers on functionality



Wisdom Gained

The shortcomings outlined above have been acknowledged by several implementing agencies. Recent efforts have focused on improving coordination, standardising technology, and embedding maintenance responsibility to sustain SSL performance. The Solar Lighting Guidelines, developed by the Energy & Environment Network (EEN), now serve as a shared technical framework across agencies, stipulating that implementing actors must either maintain their installations or formally delegate this responsibility to a qualified partner. A dashboard that is maintained by EEN allows for visibility of SSL functionality across the camp, even if the last update was over a year ago.

As the donors' priorities increasingly shift to outcomes (more hours of lighting) from outputs (number of streetlights erected), donor teams are more commonly including warranties and dedicated operations and maintenance budgets in agency contracts, addressing a major weakness of earlier deployments.

Some agencies have begun separating the procurement of poles and foundations from core components (lights, panels, batteries), maximising opportunities for local sourcing and cost savings. Others have been encouraged by the high-performance rates that mini grid powered lights and local maintenance approaches can offer.

Community-based maintenance models have been piloted in several areas, training residents to clean panels and proactively report faults. These initiatives reinforce local stewardship and contribute to theft deterrence.

UNHCR-managed camps have established a Centralised Information Processing Platform that enables community members to submit service requests for issues such as non-functioning streetlights, thereby facilitating timely repair interventions.

While SSL functionality remains uneven, these efforts represent a clear pivot toward a more coordinated, technically sound, and sustainable approach to community lighting.

This blog previews a report soon to be published, commissioned by Innovation Norway's Humanitarian Innovation Programme (HIP Norway) and the Global Platform for Action on Sustainable Energy in Displacement Settings (GPA), two entities at the forefront of advancing sustainable energy access in humanitarian contexts.