UNHCR Kakuma Refugee Camp Peer Review – Executive Summary

The key findings and recommendations of the Peer Review conducted by the United Nations Environment Management Group on the corporate environmental management of UNHCR at its Kakuma office and the Kakuma refugee camp are presented here. The purpose of this summary is to share the lessons learned in the Peer Review process and to highlight possible areas of focus and collaboration among UN and related agencies in corporate environmental management.

For more detailed information on the report please contact the EMG Secretariat at emg@un.org

The Peer Review Process

The Peer Review is undertaken by a team comprising technical experts, representatives of UN entities, international organizations and local government authorities, with support and coordination provided by the EMG Secretariat. The Peer Review Team analyses data and information shared by the reviewed agency and gathered during site visit of the reviewed facility(ies). Achievements, challenges, good practices and lessons learned in approaches to corporate environmental management are then identified and compiled in the Peer Review Report, along with proposed recommendations. These recommendations focus on how the environmental performance of the reviewed entity could be improved, ensuring greater resource efficiency, and economic and social sustainability.

A peer review of the UNHCR Office in Kakuma

The peer-review of UNHCR was conducted with a visit to the premises on the 24-26th January and 14th-18th May 2018. The site visits allowed the peer review team to visit the facilities of UNHCR and Kakuma Refugee Camp in Kenya.

The Executive Summary shares the findings in terms of the status, achievements, challenges, and recommendations. The full version of the report presents the same topics more comprehensively.

In the spirit of the Peer Review, the recommendations are non-binding and subject to validation by the Peer Review Body. The good practices, lessons learnt, and the recommendations are expected to help UNHCR Kakuma in its efforts to improve its environmental performance. It is advisable that UNHCR conducts a more detailed analysis of the recommendations to confirm the expected environmental and economic benefits and their technical and organisational feasibility.

UNHCR Offices Kakuma

Facilities and Buildings

Challenges

Building Fabric: It was also found that many of the windows and doors on the campus do not close properly, as a result of misaligned frames due to ageing, which enables the infiltration of outdoor air into indoor air-conditioned spaces. This can lead to a financial cost of approximately US$15,000 a year in energy costs.

Recommendations

Building Fabric: It is recommended that the window-to-wall ratio is limited, to minimise heat gain through windows. This can also be supplemented through ensuring that window are glazed with a Visible Light Transmission of a minimum 35-40% to ensure good light transmission, while allowing protection from the glare of a blue sky.

Building Fabric: It is recommended that in a building which is normally air conditioned during the day, the roof is insulated to prevent solar radiation heat gain being transferred to the space below. However, if the building is normally empty during the daytime it is recommended not to insulate the roof. Following these guidelines would reduce the energy consumption of Kakuma UNHCR campus. This could be furthered through painting the buildings white where possible to increase their solar reflection.

Building Fabric: It is recommended that air leakages are minimised in air-conditioned spaces, and that free-cooling is utilised where possible, to reduce the energy used through air conditioning. There is potential to improve this further, through creating a cooler, conducive micro-climate within the campus through planting trees.

Energy Production and Consumption

Achievements

Solar Panels and Battery Storage: 96 solar panels are installed at the UNHCR office, which have the potential to produce a significant volume of solar energy for the facilities.

Challenges

Energy Production: UNHCR Kakuma Campus electricity is currently provided by diesel generators, at a cost of approximately US$0.28/kWh. This is significantly more expensive than using grid electricity in Kenya, but currently UNHCR is not connected to the grid power supply.

Energy Production: The diesel generator is currently operating at 24% of its installed capacity. Diesel generators are most efficient when operating at 100% capacity, and are recommended to operate at between 75-80% to allow for sudden power surges. If the diesel generator is operated at close to its peak capacity, its efficiency can increase from ~22% to over 35%. The efficiency can also be improved by ensuring that the maintenance door to the production plant is closed, and that minimal exhausted air is being circulated back into the production plant, to no longer restrict the clean air flow for the engine.

Solar Panels and Battery Storage: Although 96 solar panels are installed, each with 190Wp capacity, the battery bank they function with is not functioning.

Recommendations

Energy Production: It is recommended to operate the smaller 300 kVA generator during the daytime, when the electrical loads are relatively low. This would increase the efficiency from 22% to ~29%, and reduce the diesel consumption by around 25% while providing the same electrical output. Additionally, UNHCR could save up to 90,000US$ annually as a result.

Solar Panels and Battery Storage: As the solar panels are still operational, it is recommended that the panels are rewired to be used in tandem with the diesel generators to produce energy, reduce the load on the generators, and reduce greenhouse gas emissions. Due to the high solar radiation in Kenya, the payback time for rewiring the panels would likely be 1.5 years.

Energy Monitoring: UNHCR predominantly use energy to power air-conditioning, lighting, and the plug load of computers, refrigerators, and televisions. It is recommended that the electricity usage, demand, and production are measured and monitored in future, through a real-time energy monitoring system, to provide a greater understanding of electricity and energy usage throughout the campus. It is recommended to select a system that will provide automatic reporting in charts and graphs to show the real-time power usage of the facility and provide daily, weekly and monthly reports.

Energy Monitoring: It is also recommended to conduct a detailed energy audit by a team of professionals, with the findings potentially resulting in energy savings of around 25-30%.

Education and Awareness: Procurement staff should be educated on how to best select the most energy efficient equipment which can be used instead of replacing broken equipment with the same model.

Office Environment

Recommendations

Education and Awareness: All existing and incoming staff and occupants should be given an introduction to the sustainability programmes being implemented in UNHCR, to ensure that collective action is taken to ensure that energy and water resources are used efficiently within the compound.

Electrical Devices

Challenges

Phantom Load: Within the UNHCR facilities, it was observed that air conditioning systems, lights, and televisions were operational in empty rooms, using excess energy.

Air Conditioners: Air conditioning systems are typically low efficiency, and are also poorly maintained.

Lighting: Street lights were observed to be on during the day in some instances, and many were also installed above the tree line meaning that much of the light didn't reach the ground. As a result, the street lights were being used inefficiently.

Lighting: Metal halide technology was seen to be used by these street lights. Each one is approximately 250~400 watts.

Recommendations

Air Conditioners: It is recommended that air-conditioner sizes are selected based on the actual measurement of power consumption of the equipment, ideally on a typical hot day in an existing space. As air conditioners operate at maximum efficiency when they are the right size, this will increase the efficiency of the air conditioning system and reduce energy consumption.

Education and Awareness: It is also recommended that the facility management team receive some sustainability specific training, to ensure outdoor lighting is used effectively and when required. This could also be achieved through the installation of a timer to control the lighting hours, or an outdoor lux sensor could be installed to ensure that the outdoor lights are only used when necessary. This would increase the energy efficiency of the outdoor lighting significantly, and reduce greenhouse gas consumption.

Lighting: It is recommended to replace the metal halide lights with LED lights, as they will provide the same amount of lumen while reducing the energy consumption by over 60%. Further, the LED lights have a longer life span, so will require less maintenance and will provide greater safety on the ground.

Lighting: It is also recommended to replace the internal lights within the campus with LED lights where possible. Not only would this increase their energy efficiency, but provide a higher Light Output Ratio (LOR) when the original fittings are replaced with a purpose-built LED fitting.

Air Conditioners: It is recommended that a separate room is used for electronic equipment, including the servers and networking switches, and that a high efficiency inverter air-conditioning unit is installed in this room to ensure the temperature remains between 25 and 29 C.

Education and Awareness: It is recommended to focus on purchasing the highest-rated efficiency electronic devices when devices need replacing, with a payback time of up to 5 years being reasonable.

<u>Water Consumption</u>

Challenges

Sanitation: The normal water tank for toilets in the UNHCR campus uses around 12 litres of water each time it is flushed.

Sanitation: Many of the accommodation units have leaking shower heads, which also spray water in all directions – resulting in a significant volume of wasted water.

Water Monitoring: Water demand and consumption is not currently being monitored by UNHCR.

Recommendations

Sanitation: It is recommended to install fully functioning shower heads, to distribute water evenly, and ensure that water is used efficiently within the accommodation units.

Sanitation: It is recommended that for new installations, toilets with water efficient dual flushes are installed, as this can reduce the water consumption by between 4 and 6 times.

Sanitation: It is also recommended that in existing toilets, in both the campus and accommodation units, a brick, stone, or bottled water is placed in the water tank. This will reduce water consumption significantly, while still maintaining water pressure to ensure that the system continues to function effectively.

Irrigation: It is recommended that the use of water hoses to provide irrigation in UNHCR is replaced with drip irrigation systems, to reduce evaporation losses and spillages.

Water Monitoring: It is recommended that the water use within the campus is monitored in future, to identify patterns and potential inefficiencies within the water consumption. This could be achieved through installing a water sub-meter in all main branches of the water network. Doing so will allow for the water consumption within the campus to be reduced.

Waste Management

Achievements

Waste Disposal: UNHCR currently segregates plastic bottles from solid waste, to allow them to be recycled.

Challenges

Waste Disposal: The majority of solid waste is placed in a landfill site within the compound, with some of the solid waste being disposed of through open burning.

Recommendations

Waste Disposal: There is opportunity for food waste, landscape waste, and waste water resources to be treated by anaerobic digester to generate biogas and fertilizers. These resultant resources can then be used throughout the campus.

Waste Monitoring: It is advised that UNHCR implements a DEWATS wastewater treatment system to ensure that wastewater from the compound is both treated effectively, and disposed of safely. The treated water could also be used for irrigation for landscaping on the compound.

Kakuma Refugee Camp

Facilities and Buildings

Achievements

Building Fabric: The Community Centre in Kalobeyei successfully combined daylight harvesting and natural ventilations louvered are used on all windows and doors, both of which will work to limit the energy consumption of the building.

Challenges

Facilities: The air quality within the school kitchen area was found to be extremely hazardous, due to the use of firewood for cooking.

Facilities: The room temperature in the school was found to be uncomfortable for 95% of the occupants.

Facilities: The medical laboratories were operated without any mechanical outdoor air intake, meaning that the air was recycled without passing through medical grade air filtration devices.

Recommendations

Building Fabric: All shelters should have a dedicated outdoor cooking area with shading, to allow heat and pollutants to be easily ventilate away as opposed to being trapped indoors. This will help to ensure that all shelters are thermally comfortable, as will planting trees to shade houses, ensuring all roofs are insulated with at least a layer of aluminium foil, and ensuring walls are built from materials with a heavy thermal mass.

Building Fabric: The roof of the air-conditioned room should be insulated to reduce cool air losses and resultantly energy consumption.

It is recommended for future schools to be built so that all windows are exposed to the north and the south to reduce heat gain to the building, and avoid glare from direct sunlight.

It is recommended to install a mechanical system to provide outside air, as well as a filtration system with HEPA rated air filters for recirculated air in the medical laboratory. It is recommended to follow international minimum design standards for hospitals, at least for the laboratory in Kakuma and Kalobeyei.

Energy Production and Consumption

Achievements

Solar Panels and Battery Storage: The IRC Clinic Kakuma 3 has recently received support to switch for a diesel generator to solar power, and have opted for a 138 solar panel system with a total power generation capacity of 36.57kWp.

Lighting: The hospitals in Kakuma were found to be energy efficient, with daylight being used where possible, and air-conditioning only being used when necessary (e.g. medical storage, laboratory, operating theatres).

Challenges

Electricity Generation: The area has limited access to the national grid, and as a result is required to generate off-grid electricity.

Fuel: A key activity requiring energy in Kakuma is for cooking, and firewood and charcoal are predominantly used for this. As a result, users are exposed to large volumes of air pollutants and particulate matter – especially when used indoor.

Energy is also needed for electricity, and the current micro-grid systems is inefficient.

Electricity Generation: A diesel generator is recommended to continue being used as the primary night-time electricity producer in Kakuma, until lower cost-solutions are viable. Simultaneously, educating the local community is recommended to improve the efficiency of generators, through reducing excess wastage.

Energy Monitoring: Electricity is currently billed according to time of use by the micro-grid supplier, as opposed to metered. Overtime, this leads to inefficiencies in daily use, as the end-user will purchase the cheapest inefficient equipment that is available in the market.

Recommendations

Fuel: Continuing the introduction of bioethanol harvested from sugarcane molasses fuel for cooking is advised as it provides clean, sustainable, and low-cost cooking fuel. There is also potential for solar cookers to be introduced within the camp, due to the consistent solar intensity provided.

Solar Power and Battery Storage: It is recommended that Kakuma refugee camp should use solar power (photovoltaic systems) as much as possible during the day. The location of the camp means it has the potential for a very high PV yield. It is important to be aware of the potential of dust accumulation on the PV panels, and ensure that the dust does not build up as this will reduce the efficiency of the panels.

Energy Monitoring: It is recommended that affordable energy meters are purchased and installed, to allow the end-user to be billed for their actual energy consumption. This will likely reduce end-user wastage through providing an accurate representation of their energy use, and alter consumer behaviour through not encouraging the end-user to consume as much energy as possible during the set times for which they are being billed.

Fuel: It is also recommended that biomass is turned into biogas to be used for cooking, as it is an extremely efficient fuel resource for cooking.

Energy Monitoring: Real-time energy monitoring of the energy production, energy demand and energy storage should be provided along with better training of the facility managers in these hospitals to optimize energy use.

Electrical Devices

Achievements

Lighting: During the day time, people are naturally using daylight as opposed to electric lighting, and have also naturally implemented daylight harvesting into their building design.

Challenges

Refrigeration: The freezers and refrigerators used in the food warehouse are not energy efficient.

Lighting: T8 lights were used throughout the hospital, which is primarily powered by a diesel generator and also a solar-diesel generator hybrid. T8 lights were also found throughout the camp.

Recommendations

Education and Awareness: UNHCR should provide awareness and an educational program on energy efficiency for the refugees in Kakuma and Kalobeyei, as well as the wholesalers who purchase the refrigerators or freezers.

Lighting: It is recommended to install energy efficient LED lights during new installations or replacements within the hospital.

Air Conditioners: Air conditioning should be installed in the Community Centre, ensuring that it Is not facing the steel door and window frames, as this will cause unnecessary energy losses and condensation.

Water Consumption

Challenges

Resource Conflict: Water scarcity is a challenge in this region. Tensions between the host community and the refugees are present over the water resources. There are 18 boreholes, 7 of which are powered by solar energy which reduces the use of fuel and costs implications.

Water Infrastructure: Water leakages were observed along the distribution networks, particularly at valves and pipe joints.

Recommendations

Water Monitoring: It is recommended to sub-meter the water distribution network to allow a daily summation of water harvested from boreholes compared to the volume delivered to refugees. This will provide data on the volume of water leakages, and help to identify where the water leakages are occurring and allow them to be fixed.

Water Infrastructure: It is recommended to consider ‘Water ATMs’ which allow people to access potable water based on their needs, and ensure water resources are divided equally.

Water MonitoringIt is recommended that whenever the diesel engine is switched on and off, a reading should be made on the water meter. An analysis of such data will offer better tracking of the efficiency

change on both the solar PV and diesel engine, allowing maintenance to be conducted when necessary to maintain efficiency.

Waste Management

Challenges

Resource Conflict: Tensions exist between the host community and the refugee community due to inadequate waste disposal mechanisms.

Waste Disposal: Plastic waste is often burned, and sometimes used to cook food, which leads to human health issues and environmental damage. A key source of plastic waste is the use of plastic sheeting to waterproof shelters.

Waste Disposal: Latrine pits are the most frequent blackwater wastewater management system in Kakuma, which when full will be closed and buried.

Water Infrastructure: There is no drainage system to manage greywater – it is dumped and soaked into the ground.

Recommendations

Waste Disposal: It is recommended that paper recycling is considered within the camp as part of the Sanivation project, to use the waste paper as a binder for charcoal dust.

Wastewater Monitoring: It is recommended to implement a holistic DEWATS wastewater treatment system within each community, as this would treat wastewater naturally while also producing biogas and fertiliser which can be sold for profit.

Water Infrastructure: It is recommended to conduct research is conducted to build a cost-effective earth trench drainage system beginning with regions closest to rivers.

Sustainable Projects

Local economy: within the refugee camp, entrepreneurs trade various foods, electrics, charcoal, firewood, motorbikes, and more.

Sanivation's Waste-to-Value Project: seeks to reuse toilet waste with charcoal dust through processing to create a clean burning alternative.