ELIMU. SUPPLYING WATER AND ELECTRICITY TO A PRIMARY SCHOOL IN KENYA USING SOLAR ENERGY JOINT SOCIAL PROJECT BETWEEN THE UNIVERSITY OF LAS PALMAS DE GRAN CANARIA AND THE UNIVERSITY OF NAIROBI

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Abstract

The University of Las Palmas de Gran Canaria (ULPGC), through the Escuela de Ingenierías Industriales y Civiles (EIIC), has carried out a cooperation project in Kenya for the self-supply of energy and water for an primary school. The initiative, which has been carried out with the collaboration of the University of Nairobi, has counted with the involvement of faculty members and students of the ULPGC, for the installation of photovoltaic panels for self-consumption of the Timboni primary school, in the district of Kilifi. In this document a description of sustainable energy initiatives and facility improvements implemented at the school is presented. This project constitutes an outstanding contribution to the promotion of sustainability and the improvement of conditions for learning and working in this educational institution.

Keywords: Solar PV; water scarcity; primary school; education; social project.

1. INTRODUCTION

Africa is a continent with great natural resources, especially in terms of renewable energies. in Kenya, solar energy is transforming rural life. On the other hand, education has a renewing effect on society. Any improvement in this area has a revitalizing effect

on society, health, the progress of communities, etc. It is therefore essential that all children have access to education with minimum resources. But in resource-poor communities, such as many of the villages in Kenya's Kilifi district, school conditions are very deficient. It is not uncommon to find schools without enough classrooms or desks, and with no access to electricity and drinking water.

In September 2023, a group of faculty members and students from the University of Las Palmas de Gran Canaria and the University of Nairobi carried out a project aimed at addressing some of these minimum needs at the Timboni Primary School in Kilifi. The school hat at that moment circa 850 students and 16 teachers, no electricity and no drinkable water. Figure 1 shows one of the main buildings of the school.

Figure 1. One of the main buildings of the school.

The objectives of the project have been following:

- Installation of solar panels for lighting and to generate electricity in the head teacher's office and three classrooms, which are in the same block.
- Installation of solar panels to generate power for the electric pump which provides water for general use in the school.

- Flooring and painting of the staff room.
- Building shelves and desks for the staff room.

The following sections aim to provide a comprehensive overview of the sustainable energy initiatives and facility improvements carried out at the school during the period [1/09/2023 – 16/09/2023]. This project represents a significant step towards promoting sustainability and enhancing the learning and working conditions at this educational institution.

2. METHODOLOGY

This section is divided into three main parts. The first part outlines the installation of solar panels to generate electricity the head teacher's office and three classrooms that are in the same block.

The second part describes the installation of solar panels for a water pump that supplies the school, along with infrastructure improvements. This initiative ensures a consistent supply of clean water and contributes to the overall well-being of the school community.

The last part describes the staff room renovation. Construction work has been carried out in the staff room, including floor renovation and the creation of custom-made furniture, with the intention of creating a more comfortable and functional workspace making a better teaching and learning environment.

A comprehensive view of the planning, implementation, and results achieved in each project is presented here.

2.1. Installation of solar panels to provide electricity.

In the building accommodating the head teacher's office and three classrooms, an integrated electrical system has been established to ensure efficient lighting and electrical access. This system encompasses lighting fixtures, electrical sockets, switches, and renewable energy components.

Solar Panels: Comprising six solar panels have been mounted on the roof to generate the electricity. Figure 2 shows the installation of the solar panels on the roof of the building, in progress.

Figure 2. Installation of the solar panels on the roof of the building in progress.

Lighting Infrastructure: The illumination of these spaces is achieved through strategically placed light fixtures. The head teacher's office is equipped with three light bulbs, while each classroom is provisioned with either three or four light bulbs, tailored to the room's size and lighting requirements. These bulbs deliver the necessary luminance for a conducive working and learning environment. figure 3 shows some moments of the installation process.

Figure 3. Installation of the lighting infrastructure.

Electrical Sockets: Electrical sockets are instrumental for con-

necting various electronic devices such as phones, laptops or fans. The head teacher's office is outfitted with three sockets, and each classroom has two sockets.

Light Switches: Two switches are installed in the head teacher's office, while each classroom features a single switch. These switches enable users to activate or deactivate the lighting system as required.

Table 1 sumarizes the number of bubls, sockets and switches installed in the building.

Table 1. Number of Bulbs, sockets and switches installed in the building.

	Head teacher's office	Classroom 1	Classroom 2	Classroom 3
Bulbs	3	4	3	3
Sockets	3	2	2	2
Switches	2	1	1	1

Wiring Process: To establish a functional electrical network, meticulous wiring was undertaken. This involved the installation of electrical cables running from a central electrical panel to each light bulb, socket, and switch. This wiring configuration ensures the seamless distribution of electrical power to the designated areas within the building, offering precise control over lighting and electrical access.

Inverter and Battery System: To enhance the system's resilience and sustainability, an inverter and a bank of six batteries were integrated into the electrical infrastructure.

- *Inverter:* The inverter serves as a critical component that facilitates the conversion of direct current (DC) electricity generated by solar photovoltaic panels into alternating current (AC) electricity compatible with conventional electrical appliances and fixtures. Placed strategically within the system, the inverter optimizes the utilization of solar energy, ensuring a reliable power supply even in the absence of grid electricity.
- *Battery Array:* Comprising six high-capacity batteries, this array functions as an energy reservoir. During periods of abundant sunlight, excess electricity generated by the solar panels

is stored in these batteries. Subsequently, when solar production is limited, such as during nighttime or inclement weather, the stored energy is tapped to sustain the lighting and electrical requirements of the building.

2.2. Installation of solar panels to power the pump which provides water.

A borehole, already equipped with a water pump, is located next to one of the school buildings. The installation for the provision of electricity for the water pump has just consisted of the solar panels, the inverter, and the wiring. The solar panels have been installed on the roof of this building. It was not necessary to install batteries, as the pump is not expected to be in operation during the night. Figure 4 shows the water pump and the access to the borehole.

Figure 4. Water pump and access to the borehole.

Solar Panels: Ten solar panels have been mounted on the roof to generate the electricity. Pictures of the process are shown in Figure 5.

Figure 5. Installation of the solar panels for driving the water pump.

Inverter: The inverter facilitates the conversion of direct current (DC) electricity generated by solar photovoltaic panels into alternating current (AC) electricity.

Wiring: Electrical cables running from the inverter to the water pump were installed.

2.3 Staff room renovations

The staff room went through a renovation project that involved three main components:

- *Flooring:* The existing flooring was upgraded with a durable and visually appealing red floor powder finish. The situation of the floor of the staff room before the renovation are presented in figure 6. The final result is shown in Figure 7.

Figure 6. Floor of the staff room before the renovation.

- *Painting:* The entire room was painted in a clean and bright white color, enhancing the room's spaciousness and versatility.

Figure 7. Restoration of the staff room.

- *Furniture:* Custom 16 desks, individual cupboards for each teacher, 16 in total, and 2 big shelves were constructed to provide functional workspace and storage while contributing to the room's overall aesthetic. Figure 8 shows the furniture

Figure 8. Furniture of the staff room.

3. CONCLUSION

This project presents the actions carried out to improve the fa-

cilities of a Primary School (Timboni) located in the district of Kilifi, Kenya. The work carried out has provided access to drinking water and electricity for the school's 850 students and 16 teachers.

This project constitutes an outstanding contribution to the promotion of sustainability and the improvement of conditions for learning and working in this educational institution.

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