Tanzania school energy storage

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Ngarenanyuki school is sited in Tanzania, Arusha region, a quite rural area. In 2003, from wood and soil dilapidated buildings, a restructuring process started and today (2016) the school hosts about 500 students.

The electric grid was not available in the area and consequently in 2013 a first rough electric infrastructure was deployed. The power source of the school was a run-off-river Micro hydropower plant (MHP) based on a 3.2 kW Banki turbine coupled with 1-phase brushless synchronous generator (230 V, 50 Hz). The water flow to the turbine is diverted from a stream, which is managed by local farmers. Therefore, water availability resulted highly variable during the day and according to the season: this used to cause many blackouts.

The frequency regulation was based on a 4 kW dump load, which dissipates the excess power in air; similarly, voltage regulation was based on a very simple self-exciter in the synchronous machine.

Just for emergency, a 5 kW petrol generator was available; both generators are designed in order to operate in a grid forming modality only, i.e., it is not possible to operate them in parallel. The power supply was managed in the school control room by means of a toggle switch to select the power source, while a group of breakers used to permit specific loads to be connected/disconnected manually. Such a configuration resulted very simplified and not efficient, i.e., a lot of energy was dissipated in the dump load.

In 2015, thanks to the research project Energy4Growing (E4G), promoted and funded by Politecnico di Milano, in collaboration with EKOENERGY, a new microgrid architecture has been designed and deployed in Ngarenanyuki. An advanced interface converter and a control switchboard have been designed in a hybrid micro-grid architecture including: 3.2 kW micro-hydro system, 5 kW diesel genset, 3 kW PV-inverter and 70 kWh battery bank (30X202 Ah/12V lead-acid batteries).

Moreover, an advanced monitoring architecture coupled with a satellite data connection has been activated, i.e., data about the micro-grid system functioning are regularly collected. Such data are crucial for both scientific research and to monitor the behavior of the system. For instance, actual micro-grid variables (voltage, current, frequency, etc.) are sampled per second and managed via a PLC data-logger. They are then processed by the E4G group and shared, in order to promote scientific studies based on "real life" data.

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The Sustainable Kindergarten project in Hai District, Tanzania, provides approximately 60 children with a clean kindergarten equipped with solar panels and a rainwater harvesting system. TOOLS FOR LIFE supports the project with EUR10,000. The project was operationally carried out by our partner organization Engineers Without Borders e.V. and other local organizations.

The Trinity Academy, a preschool and primary school with 240 students, including 17% orphaned children, is committed to sustainable operations. Currently, the youngest students aged 3-6 years are housed in inadequate classrooms. Preparations for the construction of new classrooms began in August 2022. The site for the planned kindergarten is located on the school premises, and the foundation has already been poured according to the plans of a local architect. The project is being executed operationally by the partner organization Engineers Without Borders e.V. and local stakeholders.

In November of 2017, Amizade began a collaboration with the All People be Happy Foundation, and our Karagwe based community partner MAVUNO, to provide solar energy to 10 primary schools located in the North-West region of Tanzania. Over the course of 12 months MAVUNO, led by Program Manager Charles Bahati, identified 10 primary schools in need of solar energy and oversaw the addition of the solar panels to each building. None of the schools assisted by the solar energy project had any form of electricity prior to the introduction of solar panels.