ENERGY FOR FOOD SECURITY

WFP
World Food Programme
SAVING LIVES
CHANGING LIVES

Clean cooking solutions in Malawi

Malawi faces significant environmental, energy, and food security challenges:

- Widespread **deforestation** due to heavy dependence on biomass (98%) for cooking results in habitat loss, soil erosion, and diminished biodiversity. It also leads to rising **scarcity of** traditional fuels, such as **firewood** and charcoal, which impacts the cost of cooking and households' food security.
- **Climate change** which exacerbates agricultural challenges, such as water scarcity threatening food security.
- Inefficient biomass stoves causing **air pollution**, leading to severe respiratory and cardiovascular **health issues**, especially for women and children, and high levels of **CO2 emissions**, contributing to climate change and global warming.

To counteract these trends, WFP has introduced cooking solutions powered by renewable energy in School Meals Program (SMP). In Chikwawa, ten schools have been equipped with biogas cooking systems and in Kasungu three schools received electric cooking appliances powered by solar

February 2025

photovoltaic systems. Both projects will serve as proof of concept, demonstrating the viability, acceptability, scalability and cost-benefits of these technologies in the context of public primary schools in Malawi.

COOKING WITH BIOGAS

Biodigesters operate according to circular economy principles converting organic waste, such as cow dung, into valuable resources, biogas and biofertilizer, through anaerobic digestion. By avoiding firewood collection, and thereby deforestation in the areas surrounding the schools, this technology significantly reduces the environmental footprint of school meals cooking. Further, it avoids indoor and outdoor air pollution, a considerable threat to the health of cooks and students. Importantly, it also enhances food production thanks to the slurry, a by-product of the bio-digestion process. This is an effective biofertiliser, which can be exchanged for organic waste, labour or sold to farmers, thereby becoming an income-generating opportunity for the schools and attracting interest from famers involved in the SMP.

The project is implemented with Ecogen, a private service provider, who is supplying and installing Sistema.bio biodigesters at the ten schools in Chikwawa, directly benefiting over 9,500 students. The biodigester's capacity has been selected to meet the individual schools' needs, either using the Sistema.bio 30 or Sistema.bio 40 models. The installations include the biogas reactor, gas-burner, biogas piping,

biogas filter, feeding tank, pressure relief valve, PVC connections, and a tank. Ecogen has trained the school-appointed committees and cooks responsible for managing the biodigesters and cooking with the biogas. The school has identified local farmers interested in exchanging their cow dung and other organic waste for biofertilizer, ensuring a reliable and continuous feed of raw materials. The remaining slurry will be used in the school gardens and further sold to local farmers, overall supporting the communities with increased food production. The service provider, Ecogen, will additionally continue to monitor and maintain the systems for up to three years after installation with the support of a Ecogen technician based in Chikwawa. The system's reactor is covered by a ten years warranty, while other parts up to one year. The project supports Malawi's green energy transition by aligning with its "Vision 2063" as part of the African Union Agenda 2063, and the Mission300 Energy Compact, while providing a replicable model for other regions. In collaboration with the Government, the project will explore the financial potential of carbon revenues.

The introduction of biodigesters in Malawi's schools is innovative in several ways. It provides a clean way of cooking as well as a different source and availability of fertiliser. Due to the technical and organizational complexity of the operation of biodigesters, the integrated agro-energy delivery model needs to be carefully designed and implemented to reach sustainability.

With little research available on the topic, this project aims to acquire evidence over socio-cultural, environmental, technological and economic viability of the system in a rural institutional context. To this end an assessment was conducted in all schools prior to transitioning to biogas gathering baseline data. High dependence of schools on biomass fuels, 100 percent using firewood exclusively, was confirmed, with one kilogram of firewood consumed per student amounting to a total of 400 tons of firewood per year for the ten schools. Further, in 50 percent of the schools, up to 10-15 volunteers spent over two hours per week on firewood collection. Cooks in average arrived at the schools at 03:00 am, spend 2,5 hours from lighting the fire to finalising the cooking, and served breakfast between 06:00 - 06.30 am. An endline assessment is planned to complete the data set and provide information about the effectiveness and impact of transitioning to biogas technology. Data analysis will concern four main aspects relevant to the applicability and scalability of biogas in primary schools under the SMP in Malawi.

The first focus area looks at the effectiveness of biogas as a replacement for firewood, tracking factors such as adoption and satisfaction rate of cooks, staff and students with the new gas stoves. It will also consider quantitative indicators such as time and energy savings, and qualitative information on health impacts as well as deforestation rates in the area.

A second research area is to estimate the impact of biodigester technology on agricultural productivity and food security. The effect of biofertilizer on land productivity in school gardens, orchards, and woodlots, will be estimated through field trials comparing crop yields with and without biofertilizer and measuring crop growth parameters with the support of agricultural experts from local academic bodies. Results will be used for educational purposes, showcasing agricultural impacts to farmers and community members.

Further, the study will investigate the socio-economic sustainability of biogas centred models. A cost-benefit analysis will consider the costs incurred in operating the system (for example through community members and farmers paid in-kind) with the revenue generation due to the commercialization of the biofertilizer. It will asses the biofertilizer market competitivity and the viability of the cow dung supply chain. It will also review community engagement models to inform the design of sustainable and scalable models. Insights from surveys and focus group discussions with community members, will serve to understand opportunities and challenges to scale biogas in primary schools.

Lastly, the study will assess the emission reduction potential of shifting from traditional biomass cooking to biogas in schools and will conduct a feasibility analysis for the setup of a carbon scheme that could generate revenues to support the sustainability and scaling of clean cooking in SMP projects. Findings will provide guidance, recommendations and a roadmap for the Government and other stakeholders to derive economic benefits from the transition of schools to clean cooking. WFP's work on clean cooking to reduce wood extraction, indoor air pollution, and greenhouse gas emissions, presents a concrete opportunity to monetize emission reductions through carbon markets.

COOKING WITH SOLAR POWERED ELECTRIC PRESSURE COOKERS (EPCS) IN KASUNGU

WFP Malawi is introducing solar powered cooking in three off-grid schools in Kasungu. Importantly, in addition to eCooking, the standalone off-grid energy hubs are able to increase energy access for the wider community surrounding the schools. The main energy service enabled at the school level is electric cooking with institutional size EPCs. Similarly to biogas, solar power is a renewable energy source, significantly reducing the environmental footprint of cooking school meals and the impact on close-by forests. Further, with an efficiency higher than that of any other cooking technologies, EPCs will save considerable time spent on cooking, while improving the health of cooks and students by eliminating exposure to smoke. Faster cooking mean that cooks can start preparing food later in the morning, avoiding the exposure to risks associated with walking at night (arriving at the schools before 03.30 AM) in the dark, only lightened by torches or phone lights.

The PV systems installed provide electricity to light classrooms, teachers' offices, kitchens, storage rooms and teachers' houses, enabling teachers and students to study and prepare lessons after dark. Additionally, the systems include water pumping, to move water from boreholes to a 10,000 litres water tank providing clean water for cooking, drinking and irrigation for the school gardens. It has been estimated that during mid-season approximately 3,000 litres of water are needed daily for the kitchen and the 400 sqm garden. Solar irrigation increases production from school gardens, strengthening food security, and plays an educational role demonstrating to farmers and students the effect of irrigation to increase crop production and thereby enhancing economic outcomes.

Particular attention has been devoted to designing a sustainable model, in the medium to long term. In this case WFP has shifted its procurement modality from sourcing equipment, to tendering for the provision of an "energy service". This means that the company is responsible for the electricity generation, its supply, the provision of all equipment necessary to use the electricity, the whole system installation, operation, maintenance, repair and

upgrade. It is therefore in the company's interest to provide a satisfactory energy service, ensuring customers continued payments. The social enterprise DIFFER Community Power (DCP) was selected to provide energy for cooking, lighting and irrigation at the schools. As DCP's primary business goal and revenue model is to provide energy access to rural communities, they look at independently expanding the scope of their services increasing their customer base, which also has added value to the communities. A systematic market mapping carried out by DCP led to the design of additional energy services. Lighting and general charging was identified as a priority for households, which prompted the setup of a charging station kiosk, equipped with 50 portable batteries (25 Wh), managed by DCP. Batteries are rented to power lanterns or to charge phones and other small appliances, and fees can be paid either cash or with mobile money using SteamaCo's smart prepaid meter. Productive uses of energy also emerged as an unmet need. A model devised by DCP in collaboration with WFP, the schools and the local government, is being trialed to increase food production and security. It consists of leasing land owned by the school to local smallholder farmers, including irrigation powered by the solar systems. Revenues are shared between the school and DCP. In addition, maize mills and cooling will be installed at the school's premises and operated by DCP's employees, serving the local community and generating revenues for both DCP and the schools. Income from these activities will make the business model sustainable for DCP and provide further income for the schools, while increasing food production and access to energy services for the local communities. The upfront investment needed to provide these additional services is paid for by DCP to expand their market-base in the rural communities.

Both the biogas and electrification projects include an extensive training component to ensure adoption and appropriate use, optimizing energy use and preparing healthy recipes.

PLANET FRIENDLY SCHOOL MEALS

Investing in planet-friendly school meals offers a substantial and cost-effective way to enhance communities' climate adaptive capacity and foster the development of low-carbon agricultural production. Unsustainable agricultural practices have led to environmental degradation and climate change, necessitating a shift towards sustainable food systems. School meals present a unique opportunity to promote this transformation. By emphasizing planet-friendly menu changes, clean cooking solutions, waste reduction, food system education, and sustainable supply chains, school meals can foster healthier diets, support local agriculture, and enhance economic equity. Utilizing renewable energy sources, such as solar and biogas, alongside sustainable agricultural practices, such as efficient irrigation and the use of biofertilizers, significantly contributes to global climate mitigation efforts. These initiatives not only reduce carbon footprints but also promote healthier ecosystems and more resilient food systems.

SCHOOLS MEALS AND SOCIAL PROTECTION

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PHOTO CREDITS

Cover: WFP/Malawi, School Meals Programme

Page 2: Left: WFP/Malawi Biogas cooking in Chikwawa by volunteers; Right: WFP/Malawi: Bioigestor installation in primary school in Chikwawa.

Page 3: WFP/Malawi: Biogas burner with biogas produced at primary school in Chikwawa. Right: WFP/Malawi: Preparation of school meals by volunteers

Page 4: Left Up: WFP/Malawi: Preparation of school meals by volunteers. Left below: WFP/Malawi: Solar panel installation primary school in Kasungu. Right: Electric pressure cooker installed in primary school kitchen in Kasungu.