

# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHTS



*Image caption: Successful grantee Taita Ngetich, CEO, Synnefa*

## **Agritech Call**

The Efficiency for Access Research and Development Fund awarded \$1.7million in funding to 11 organisations for the development of clean energy agricultural technologies.

**July 2024**

Efficiency for Access Coalition

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# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Amped Innovation

First Affordable Direct Current (DC) Solar Generator for Maize Mills, Water Pumps, Freezers and More

### Project Summary

The project will enable Amped's development of an affordable, rugged DC solar generator to power agricultural equipment including maize mills, water pumps, freezers, and more.

### Project Description

Micro and small retailers in East Africa lack access to reliable electricity. Amped is developing an affordable DC solar generator that can be used for multiple purposes. This includes powering productive use appliances during the day, and running fans, lights and charging mobile phones at night. Amped is addressing this unique market need for high-power agricultural solar-powered appliances.

Existing DC generators are limited to low voltages (typically 12 volts), which is not enough to power larger productive-use loads. Some 48 volts (V) DC solutions exist but are few and too expensive. AC solar generators are more costly and energy inefficient for high-power agricultural usage. This is because efficient appliances are all designed for brushless DC motors in the 12-48V range.

To date, Amped has built and deployed over 220,000 solar systems and recently launched its EasyFreeze product line. Amped will use its power electronics expertise to design a drop-in DC solar generator system that costs one-third of current market options. The system will have an integrated battery bank, a 1kW true Maximum Power Point Tracking (MPPT) charge controller, and a 48V output for various high-power agricultural appliances. It will also be modular, easily field repairable, and expandable.



### R&D Partner

Amped Innovation

### Organisation Founded

November 2016

### Technology

DC Solar Generator for agricultural equipment

### Project Location

East Africa



# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## aQysta

Enhancing Solar Drying with Night-time Capabilities

### Project Summary

This project will conduct a feasibility study on innovative solar drying technology. It extends drying time to night-time, increasing efficiency and improving the quality of dried products.

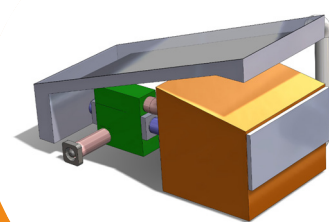
### Project Description

Existing solar dryers are inefficient and rely heavily on direct solar radiation. It limits drying times and makes them less competitive for large-scale drying than electric dryers. This project aims to develop efficient solar dryers that can operate 24/7. The feasibility study will:

- Extend drying duration to night-time
- Reduce the total drying time of crops
- Improve the quality of dried crops
- Create a cost-effective, environmentally friendly solar drying solution for rural off-grid communities.

The project uses a combination of sensible, latent, and thermo-chemical heat storage principles along with a desiccant. This innovative approach harnesses solar energy to dry food products at night.

Solar drying helps reduce food waste by providing an alternative to traditional sun drying methods. Farmers can export dried fruits to meet the increasing demand in developed countries. This boosts the competitive edge of exports from landlocked nations, such as Nepal and Malawi.



### R&D Partner

aQysta

### Organisation Founded

July 2023

### Technology

Solar Dryers

### Project Location

India, Malawi, Nepal and  
the Netherlands





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## CoolVeg Foundation

Mobile Forced-Air Evaporative Cooling Chamber for Smallholder Farmers and Produce Vendors

### Project Summary

This project will develop and field-test forced-air evaporative cooling chambers for storing fruits and vegetables. These chambers are designed for both stationary and transportation applications in arid regions.

### Project Description

Cooling fruits and vegetables immediately after harvest is a crucial yet often neglected stage in the post-harvest supply chain in low-income communities. Leaving produce in field conditions, often around 35°C, for just one hour can reduce shelf-life by about one day. Forced-air cooling rapidly cools produce during this critical stage. However, the high equipment costs and energy consumption of conventional refrigeration are barriers to deploying these technologies in low-income communities. Evaporative cooling-based systems are effective in arid climates, use simpler equipment, and are four times less energy-intensive than conventional refrigeration.

This project will develop and deploy a system that combines the rapid cooling of forced-air cooling with the low cost and energy efficiency of evaporative cooling. The modular system can be tailored to a user's storage needs and mounted on a vehicle. This allows it to be affordably deployed near the farm gate, used in transportation, and increase produce shelf-life for vendors. Pilot chambers will be designed and deployed in Nigeria and India to evaluate their effectiveness and ability to meet the needs of target users.



### R&D Partner

CoolVeg Foundation

### Organisation Founded

October 2023

### Technology

Solar walk-in cold room

### Project Location

USA, Nigeria and India





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## East African Smart Villages and Rural Mobility

SMART-COLD: A Scalable and Modular Approach for Real-Time Cold Chain Management using IoT and LEVs

### Project Summary

East African Smart Villages and Rural Mobility aims to develop and integrate Internet of Things (IoT) enabled cold chain into their off-grid powered, light electric vehicle (LEV) with the aim of enhancing market access for smallholder farmers produce. It boosts climate resilience and food security, creates rural jobs and optimises energy and logistics through smart technology.

### Project Description

East African Smart Village and Rural Mobility will develop an IoT -enabled, decentralised and mobile cold chain hardware platform to extend cold chain support to rural Africa. This cold chain will always be monitored and managed through a network of affordable sensors and switches using their soon-to-be-deployed low-power, wide area networking protocol (LoraWan) network. This project will unlock innovations for smallholder farmers and in doing so contribute to the following:

- Unlock export markets: Improve access to lucrative export markets through aggregation and supply chain visibility
- Off-grid power: Use off-grid power for batteries and refrigeration units, reducing reliance on fossil fuels and poor grid access
- Energy efficiency: Smaller vehicles require less energy for cooling and have less heat dissipation
- Smart energy management: Optimise energy consumption and vehicle performance using smart sensors and controllers to monitor and adjust according to conditions
- Routing and scheduling: Use real-time data and analytics for optimal routing and scheduling based on traffic, weather, demand, and availability of distributed energy
- Excess energy use: Use excess energy when solar batteries are at capacity, support demand-side management of electricity, prioritise cooling over speed when out of range, and alert for dispatch of a backup battery
- Granular pricing: Enable granular pricing based on energy used for cooling per unit mass per unit distance



### R&D Partner

East African Smart Villages  
and Rural Mobility

### Organisation Founded

October 2021

### Technology

Mobile cooling

### Project Location

Kenya





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Ecozen

Development of a cost-efficient thermal energy storage platform for off-grid solar freezers in Africa

### Project Summary

Leveraging the patented Thermal Energy Storage (TES) technology, Ecozen Solutions will build a TES platform for the solar freezers for the informal sector in Africa.

### Project Description

According to the World Bank, 536 million people in Africa lack access to grid electricity, leading to over 40% of food being lost annually due to inadequate cold chain infrastructure. Proper post-harvest handling and refrigeration are essential to maintain food freshness and nutrition. The demand for cooling solutions is high among households and small businesses for food storage and retail, but current options are insufficient.

Ecozen Solutions specialises in off-grid cold chain solutions using patented low-cost thermal energy storage. We aim to develop a thermal energy storage platform for freezers, covering volumes and temperatures for both new and existing freezers in the African market for storing frozen meat and fish.

They will use their energy storage and Internet of Things (IoT) expertise to create smart solutions tailored for the African market, starting with Nigeria. Nigeria's 50+ million people lack access to electricity and face increased petrol costs due to reduced subsidies. By conducting thorough market research and developing prototypes, they plan to support over 10 million small retailers with off-grid cold chain solutions, reducing their reliance on petrol or diesel and boosting their income.



### R&D Partner

Ecozen Solutions

### Organisation Founded

October 2010

### Technology

Solar freezer

### Project Location

India and Nigeria



# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Koolboks

Improving Affordability of Cold Chain Storage Using Internet of Things (IoT) Technology

### Project Summary

This project will develop and embed Internet of Things (IoT) into Koolboks' solar freezers with the aim of improving overall functionality. It will enable predictive maintenance, temperature control and battery analytics and Koolboks will field-test 180 of their solar-powered freezers with the new functionalities. It will address technical and service issues, understand customer affordability, and test the viability of the cooling-as-a-service model.

### Project Description

The project is an eight-month pilot programme in the South West of Nigeria. It covers Ekiti, Kwara, Lagos, Ogun, Ondo, Osun and Oyo States. The project aims to conduct field tests with smallholder farmers, specifically catfish and livestock farmers. It will deploy and evaluate 180 solar-powered IoT-embedded Koolboks Solar Freezers to directly address critical business needs.

In off- and weak-grid regions of Nigeria, smallholder farmers struggle to preserve catfish and livestock. This results in high daily expenses (approximately \$5) for purchasing diesel and petrol. Previous pilots of off-grid Pay As You Go (PAYG) solar refrigerators were effective but had limitations, particularly in addressing sudden breakdowns in remote locations, causing substantial losses for farmers.

Koolboks aims to improve the existing design by developing an advanced IoT platform for remote monitoring. This includes a robust online PAYG system for affordability, preventive maintenance features for unit longevity, and access to the carbon credit market.

In the initial six months, Koolboks will focus on developing, designing, and manufacturing 180 IoT-embedded solar-powered freezers. These will incorporate IoT sensors and connectivity for remote monitoring, billing, preventive maintenance, and carbon credit tracking. The products will then be transported to Southwest Nigeria, where the following six months will be dedicated to sales and field testing, using partnerships for distribution.



### R&D Partner

Koolboks

### Organisation Founded

March 2018

### Technology

Solar freezer

### Project Location

Nigeria





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Productive Solar Solutions

High Efficiency AC Permanent Magnet Motors Driving Agri-Machinery for Off- and Weak-Grid Areas

### Project Summary

This project will develop and deploy high-efficiency Permanent Magnet Synchronous Motors (PMSMs) to power agricultural machinery in off- and weak-grid areas. The aim is to improve efficiency and reduce startup power surge.

### Project Description

Productive Solar Solutions (PSS) is leading research and development to innovate and deploy PMSMs for small-scale agricultural machinery in off- and weak-grid areas. Currently predominately using AC induction motors, PSS recognises their energy inefficiency and high inrush currents. PSS has successfully deployed Brushless DC (BLDC) motors for off-grid scenarios but recognises the need for AC-enabled PMSMs to meet the growing demand for efficient machinery in both off-grid and on-grid areas.

The project aims to produce 14 PMSMs with matched drivers, designed to reduce inrush currents and enhance operational efficiency. These motors will be integrated into 20 different agricultural and food processing machines to demonstrate practical functionality. The initiative supports Efficiency for Access' objectives by improving the availability, affordability, and performance of off- and weak-grid appliances. By addressing high inrush currents, the project promotes sustainable energy use, lowers system costs, and boosts food system productivity.

In collaboration with local and international partners, the project seeks to transform agricultural practices, support rural development, and promote gender and social inclusion.



### R&D Partner

Productive Solar Solutions

### Organisation Founded

August 2021

### Technology

Agricultural processing

### Project Location

China, Kenya, Malawi,  
Tanzania and Uganda





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Rural Aquaculture Development (RAD)

RADiCool - Low-cost mobile refrigerated transportation for perishable goods in Africa

### Project Summary

This project will develop a low-cost refrigerated system, the RADiCool box, to transport and store fish in Uganda.

### Project Description

RADiCool is a low-cost refrigerated system for Uganda's fish industry. The system uses optimised Internet of Things (IoT)-cold boxes with phase change materials instead of onboard refrigerators and PV-driven freezer hubs. These materials can be refrozen in urban centres and then loaded into the RADiCool boxes for fish transport.

Fish is a vital food source for over 10.2 million Ugandans, primarily supplied by small-scale fisheries. Despite the industry's growth in Uganda, fish loss remains high at 20-40% due to insufficient cold chain logistics. Efficient 'first' and 'last mile' transport is essential to extend fish shelf life, reduce food waste, ensure sustainable food transport, and improve livelihoods. This also creates economic opportunities in off-grid and weak-grid areas.

Over 12 months, the project will model, build, test, and refine three prototype fish transport appliances. RAD, an SME aquaculture farm in Western Uganda, will test these prototypes to support local smallholder farmers. Working with partners, the project will design, model and manufacture the solution and ultimately aim to scale and bring it to market. This affordable solution, ideal for motorbike transport in Africa, has significant potential for transporting perishable goods to off-grid areas across the continent.



### R&D Partner

Rural Aquaculture  
Development (RAD)  
Rukungiri

### Organisation Founded

June 2023

### Technology

Mobile cooling

### Project Location

Uganda





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Savanna Circuit Technologies

Eco-Sav Universal Chiller - Innovating Cooling-on-the-Go in East Africa

### Project Summary

This project will reduce fish and milk spoilage and increase income for smallholder farmers in East Africa through innovative mobile cooling technology.

### Project Description

Savanna Circuit Technologies (SCT) introduces the EcoSav Universal Chiller, a mobile chiller powered by solar energy, coupled with a centralised ice-water dispensing unit. Designed for use in East Africa's Lake Victoria and Arid and Semi-Arid Lands ASAL regions, this chiller helps farmers keep their fish, meat, and milk fresh. Operating between 5°C and -22°C, the chiller includes real-time monitoring to ensure quality.

The EcoSav Chiller addresses the significant problem of food spoilage, which affects 20% to 47% of harvests. By keeping produce fresh, it helps farmers reduce waste, secure better prices, and improve their incomes. This project supports food security and economic resilience.

SCT will develop and test the EcoSav Chiller in Kenya's dairy and fish areas and involves research, prototype development, and field testing.

Founded in Kenya in 2017, SCT has its manufacturing hub in Nairobi and has a successful history of creating mobile solar coolers. Their MaziwaPlus Prechiller increased farmers' incomes by 37%. With their manufacturing facility in Nairobi, SCT are ready to bring the EcoSav Chiller to market, helping farmers thrive and promoting sustainable agriculture.



### R&D Partner

Savanna Circuit Technologies

### Organisation Founded

July 2017

### Technology

Mobile cooling

### Project Location

Kenya



# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Simusolar Limited

Solar-powered Agri-processing Equipment with Pay-As-You-Go (PAYG) Financing

### Project Summary

This project will develop Pay-As-You-Go (PAYG) control systems for agricultural processing machines, and enable financed, affordable, solar-powered processing equipment to farmers and rural processors.

### Project Description

Simusolar has identified a range of agricultural equipment needed by farmers in East Africa to gain value from their harvests, reduce transportation costs and cut post-harvest losses. However, this small-scale equipment has been slow to gain traction because of cost, availability and running expenses. Farmers struggle to get asset financing from financial institutions due to high risk factors.

Simusolar aims to solve the problems of access, affordability and service for solar-powered productive equipment. Using their unique PAYG control systems, which are Internet of Things (IoT) enabled for remote operation, they provide financing of productive use agricultural equipment. They have successfully introduced solar water pumps to the market in Tanzania. This project will develop a new product line, using processing equipment that has not been offered with financing before. Simusolar's objective is to develop controls for both grid or solar-powered equipment so they can finance equipment that is used in both settings.

The combination of financing and energy access paves the way for smallholder farmers and rural small and medium-sized businesses to increase productivity and incomes, supporting the rural economy.



### R&D Partner

Simusolar

### Organisation Founded

May 2014

### Technology

Agricultural Processing

### Project Location

Tanzania and Uganda





# RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

## Synnefa

Precision Drying for Sustainable Agriculture; Smart Drying Solution

### Project Summary

A smart drying solution for extending the shelf life of food and reducing post-harvest losses, enhancing efficiency for smallholder farmers.

### Project Description

Synnefa is developing a smart drying solution that includes proprietary hardware and software components designed to extend the shelf life of food and reduce post-harvest losses. The centrepiece is the greenhouse solar dryer, ensuring efficient and controlled drying for safe, nutritious and hygienic large-scale drying.

The greenhouse solar dryers feature FarmShield, an advanced electrical appliance, and integrated with FarmCloud, Synnefa's record-keeping software platform. FarmShield uses solar-powered sensors to monitor humidity and temperature. It automatically controls the solar-powered heating, ventilation, and air conditioning (HVAC) system to maintain optimal drying conditions inside the greenhouse solar dryers.

FarmShield is equipped with a cellular internet SimCard or a Satellite Internet Module for areas without internet access, sending real-time data to FarmCloud. FarmCloud allows farmers to monitor greenhouse conditions, track inputs, harvest quantities, generate drying reports and connect to markets. It is accessible via a user-friendly web app or Unstructured Supplementary Service Data USSD platform.

The solution will promote co-owned greenhouse solar dryers for smallholder farmers, enhancing affordability and efficiency through a cooperative ownership model. This model reduces individual financial burdens and fosters community collaboration.

The smart drying solution aims to:

- Increase the volume of dried products for smallholder farmers
- Reduce production losses by shortening drying times from 5-7 days to 3-4 days
- Increase market accessibility for farmers to improve incomes

By using solar energy, our project addresses challenges in off-grid and weak grid settings, supporting smallholder farmers in achieving greater productivity, profitability, and food security.



### R&D Partner

Synnefa

### Organisation Founded

January 2014

### Technology

Solar dryers

### Project Location

Kenya

