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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHTS

OPEN CALL

NOVEMBER 2019

EFFICIENCY FOR ACCESS COALITION

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

AGSOL

AN EFFICIENT & AFFORDABLE INTERNET OF THINGS (IOT) ENABLED MILL

This project aims to develop the most efficient, maintenance free and affordable small-scale maize mill ever made. To accomplish this, Agsol will develop a specialised brushless DC (BLDC) motor, smart power electronics and the mechanical design for a small multi-household size mill.

Solar milling technologies have the potential to deliver social impact and energy access at scale. Many of the one billion people without access to modern electricity rely on agricultural production for their livelihoods. By linking productive agricultural machines with scalable solar power, Agsol aims to kickstart a new off-grid revolution in productivity led energy access.

Agsol began developing a village scale machine platform in 2017 and have since carried out additional market research and field pilots. Agsol's work has revealed real need for a smaller, multi-household sized off-grid milling solution for rural communities. Under this project, Agsol wants to improve on its current village scale machine design, to create a smaller and more affordable, super-efficient solar mill.

Over the life of the project, Agsol aims to:

- Develop a custom high-speed direct drive BLDC motor and controller;
- Re-design the structure and mechanics for a smaller scale multi-household mill;
- Incorporate internet of things (IoT) hardware onto the control unit;
- Pilot ten of these new super-efficient, small-scale mills.

AT A GLANCE

R&D Partner

Agsol

EforA Funding

£166,060

Additional matched funding from Agsol

£175,861

Project Location(s)

China, Kenya

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

AZURI TECHNOLOGIES

DEVELOPING A SMART FAN

This project will develop a fan and a fan control system for off-grid use that optimises energy consumption according to charging conditions and historical usage patterns.

Fans available in the off-grid market today are typically variants of products developed for use in the grid-connected world. As a consequence, designs are not optimised for continuous, extended use where the availability of energy is limited.

For a solar-powered appliance, the total system cost is a combination of the price of the appliance and the PV module and battery required to power it. In the case of a fan, the cost of the off-grid power source can be many times higher than the cost of the fan itself. However, a potentially modest increase in the cost of the fan to provide smart control can result in much larger savings in the cost of the power, reducing the overall system cost considerably.

The aim of the project is to develop an AI control system that takes advantage of existing hardware and computing resources in the solar home system to optimise fan speed automatically, and therefore power consumption, according to factors such as charging conditions, historical usage patterns, and time of day.

AT A GLANCE

R&D Partner

Azuri Technologies

EforA Funding

£93,703

Additional matched funding from Azuri Technologies

£62,468

Project Location(s)

Nigeria, United Kingdom

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

BASIL ENERGETICS

HIGH-EFFICIENCY, LOW-COST PMSM MOTORS FOR LIVELIHOOD APPLIANCES

This project will develop high efficiency, low cost PMSM motors for use in energy efficient appliances, which enable greater access to energy services for people in remote and rural areas.

Basil Energetics has previously developed solar-operated DC appliances, including refrigerators, fans, freezers, air conditioners and pumps, using brushless DC (BLDC) motors. These appliances are super-efficient and hence use smaller solar arrays to run compared with other appliances, resulting in lower overall equipment costs to users.

In this project, Basil Energetics plans to develop a range of axial flux permanent magnet synchronous motors (PMSM), from 0.37 kW to 3.7 kW in size. These PMSM motors have a different topology from conventional BLDC motors, which will result in enhanced efficiency and reduced costs. They can be used for pumps and other livelihood equipment like small machine tools, compressors & power looms. They will be able to run from DC solar power, ensuring operation for at least one shift per day using solar power. The PMSM motors can also be used for electric vehicles.

AT A GLANCE

R&D Partner

Basil Energetics Private Limited

EforA Funding

£192,557

Additional matched funding from Basil Energetics

£82,525

Project Location(s)

India, Togo

EFFICIENCY FOR ACCESS

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

BBOXX

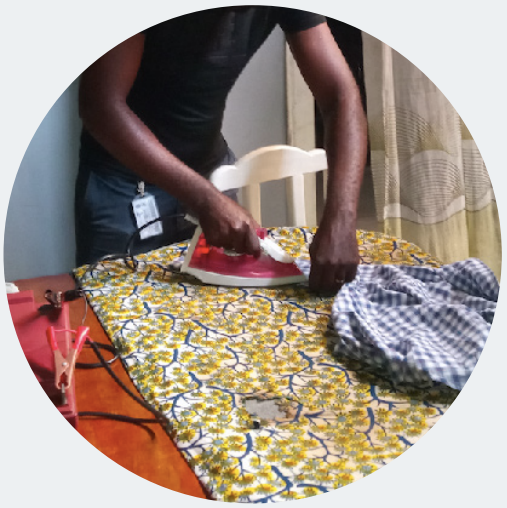
AN EFFICIENT AND SAFE IRON FOR THE OFF-GRID MARKET

This project will develop a safe and efficient DC iron that can be used with solar home systems in off-grid and weak-grid areas.

For many populations living in off-grid or weak-grid locations, ironing clothes is of high importance. Neat, ironed clothing allows people to work in professional environments, and is viewed as important to dignity in many places. Current ironing solutions can be a harmful, often unsafe, and energy inefficient. Women and children are particularly affected by the lack of reliable and efficient clothing irons as they take on a large burden of the associated work.

Despite this need, very few solar home system providers currently offer an iron. In most off-grid regions, people depend on charcoal irons that are dangerous, expensive and polluting. Ironing with charcoal is also extremely time-intensive. In weak-grid areas, power outages often lead to people ironing far ahead or ironing at night, making the activity not only time-consuming but also risky.

This project is focused on developing an efficient and safe DC iron that works with solar home systems. The project will benefit women and children in particular, by reducing the risk of accidents and increasing the amount of free time they have. It will also have a positive environmental impact, and will improve the quality of life and dignity of off-grid and weak-grid populations.



AT A GLANCE

R&D Partner

BBOXX

EforA Funding

£50,000

Additional matched funding from BBOXX

£50,996

Project Location(s)

Democratic Republic of the Congo, China

EFFICIENCY FOR ACCESS

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

DGRID ENERGY

COLD CHAIN DEVELOPMENT THROUGH SOLAR COLD CUBES

This project will deploy Solar Cool Cubes to develop cold chain infrastructure that supports small-holder farmers in the Democratic Republic of the Congo (DRC).

DGrid Energy is implementing a pilot project in the Kinshasa area of the DRC. DGrid Energy and the community agriculture organisation, CEPROSEM, will pilot a solar cold storage facility for a large farm with 60 beneficiaries and a major agricultural innovation/education centre.

Many farmers are unable to commercialise their products due to high post-harvest loss (40-60%) and lack of cold storage from the field to the farmers market. This pilot will provide a 3rd party logistics model, offering cold storage services for a fee. This will create employment, increase economic income and help with the preservation of perishable products.

DGrid Energy will also develop a prototype for a non-verbal interface for controlling temperature to address the language and illiteracy barriers that prevent correct operation and use of technologies. DGrid Energy will test non-verbal control systems and maintenance instructions that empower those who are unfamiliar with an international language or that lack the ability to read, beginning with a refrigerator temperature control system. This project will enable better opportunities and higher incomes for small-holder farmers and will spur the clean energy revolution through technology transfer and workforce development.

AT A GLANCE

R&D Partner

DGRID Energy

EforA Funding

£52,502

Additional matched funding from DGRID Energy

£64,169

Project Location(s)

Democratic Republic of the Congo, United States

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

INNOVEX UGANDA

TRANSFORMING OFF-GRID SOLAR THROUGH IoT SMART METERING

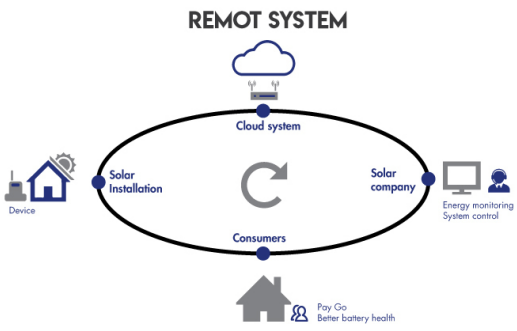
This project will develop low cost Internet of Things (IoT) technology for monitoring and control of off-grid solar systems, solar equipment and productive use appliances.

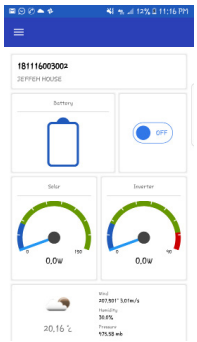
A key driver of that growth in the off-grid solar sector is the increasing uptake of solar home systems large enough to power household appliances and increasing awareness of the potential for distributed renewable energy systems to power productive use appliances.

This project aims to accelerate access to solar systems, solar equipment and solar appliances in low income off-grid communities. Innovex's data driven digital technologies will spur solar companies to adopt better business models and reduce their overall business risk.

Innovex will develop low cost cellular based hardware embedded with sensors for remote performance monitoring and diagnosis of solar systems, solar appliances and solar equipment. The hardware will be made available in various ranges for monitoring motors, solar water pumps and DC loads. The hardware will include remote switching to enable PAYGo functionality.

The project will also develop artificial intelligence algorithms for remote monitoring, including the use of machine learning techniques to analyse the data collected from the devices and perform diagnosis on the systems and appliances.





Remot system moniotring on phone

AT A GLANCE

R&D Partner

Innovex Uganda Limited

EforA Funding

£70,116

Additional matched funding from Innovex Uganda

£30,020

Project Location(s)

Uganda, Kenya

EFFICIENCY FOR ACCESS

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

M-KOPA

SMART BATTERIES: KEYSTONE TO AFFORDABLE, EFFICIENT & ROBUST DC APPLIANCES

This project will develop and test smart battery chips to enable optimal battery sizing, pre-emption of battery maintenance and maximisation of value to customers.

Batteries are core to the delivery of reliable energy service for off-grid solutions. As battery sizes increase, so does the complexity and commercial risk of remotely managing battery fleets at scale.

Currently, embedded chips in devices powering larger appliances do not capture granular readings of the battery's parameters such as voltage, current, accurate capacity, and state of charge. Without this, customers can have interrupted power that results in material costs, the return of devices, or impacts on creditworthiness if they cease paying for service.

Smart batteries can mitigate this risk and: 1) Increase affordability by supporting optimal system designs and cost efficiencies across a growing portfolio of large, low-energy appliances; 2) Improve efficiency by providing realtime reporting of battery state of health to pre-empt/prevent service and thus maximise uptime and lifetime for customers; and 3) Lower ownership costs through effective battery monitoring and management that results in the avoidance of two significant costs for low-income customers – transport to return faulty devices and premature expiry of high value appliances.

Thus, this project fills a major tech gap for suppliers challenged to design large, reliable productive use appliances for low-income, off-grid consumers.

AT A GLANCE

R&D Partner

M-KOPA UK, Ltd.

EforA Funding

£91,905

Additional matched funding from M-KOPA

£91,906

Project Location(s)

Kenya, Uganda, United Kingdom

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

SOLARIS OFFGRID

AN OPEN-SOURCE STANDARDISED PAYGO APPLIANCE COMMUNICATION PROTOCOL

This project will develop an open-source standardised PAYGO appliance communication protocol, to facilitate PAYGO appliance interoperability throughout the industry.

OpenPAYGO Link is a free and secure, open-source technology that aims to provide the industry with a standardised ecosystem in order to facilitate the integration of PAYGO devices with a wider range of appliances, unlocking modern energy services for the world's poorest.

Off-grid appliances do not currently have a common system to communicate within. Manufacturers individually adapt their appliances to communicate with different PAYGO hardware. This lack of interoperability leads to significant R&D expenses for manufacturers in the off-grid sector, restricts distributors to appliances locked to a single PAYGO system, and limits customers in their choice of appliances.

Through a standardised communication protocol, OpenPAYGO Link enables automatic activation and deactivation of PAYGO devices, verification of electrical compatibility to prevent damage to the appliances, and custom data reporting. The technology gaurantees the secure activation and deactivation of appliances based on the PAYGO status of the solar home system.

Once adopted, OpenPAYGO Link will provide a wider range of appliances for PAYGO distributors to select from and a larger market for appliance manufacturers to engage with. End-users will find more products to choose from in a more competitive market. The technology will also help to address distribution challenges by allowing usage or performance data to be analysed via any PAYGO software platform.

AT A GLANCE

R&D Partner

Solaris Offgrid

EforA Funding

£92,000

Additional matched funding from Solaris Offgrid

£39,594

Project Location(s)

Spain

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RESEARCH AND DEVELOPMENT FUND PROJECT SPOTLIGHT

SURE CHILL

AN OPTIMISED CONTROL PLATFORM FOR OFF-GRID DOMESTIC REFRIGERATORS

This project will develop an innovative refrigerator control platform and compressor combination suitable for integration with a solar home system and deliver a prototype device suitable for scaling to mass production.

Existing compressors and controllers for DC-powered refrigeration are not optimised for use in energy constrained solar home systems (SHS). An electronic control platform designed specifically for this application would be cheaper and make more effective use of available solar energy.

The use of brushless DC motor compressors in grid-powered refrigerators has grown rapidly in the last decade, but their application to off-grid use has been mainly limited to the leisure market and specialist medical equipment. Existing devices have little in the way of intelligent load control or are intended for use with large battery systems. Sure Chill technology removes the need for a battery by storing thermal energy, but existing compressor controllers are not optimised for cost or energy use in a direct-drive application.

The new control platform will work with a range of compressors and be adaptable for applications from small SHS with limited battery capacity to solar direct-drive (no battery). By including the capability to monitor both the state of the fridge and the power supply, compressor operation can be optimised to maintain cooling without compromising other loads. The control platform will include a communication module to enable it to integrate with existing PAYGO SHS.

SURE CHILL

AT A GLANCE

R&D Partner

Sure Chill

EforA Funding

£196,781

Additional matched funding from Sure Chill

£84,335

Project Location(s)

United Kingdom

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