

POWERING AGRICULTURE:

AN ENERGY GRAND CHALLENGE
FOR DEVELOPMENT

Annual Report Financial Year 2014



Executive Summary

This annual report describes the key activities of Powering Agriculture: An Energy Grand Challenge Grand Challenge for Development (PAEGC) implemented over the period of September 2013 to October 2014.

Powering Agriculture: An Energy Grand Challenge for Development represents a partnership of the United States Agency for International Development with the Government of Sweden, Duke Energy Corporation, the Government of Germany, and the Overseas Private Investment Corporation. It was launched in 2012 with the goal to support new and sustainable approaches to accelerate the development and deployment of clean energy solutions for increasing agriculture productivity and/or value in developing countries. Powering Agriculture will

- Support clean energy technology and businesses model innovations for agriculture.
- Ensure that financial intermediaries have the capital they need to help organizations scale their innovations and reach the farmers and farm-related businesses that need these technologies.
- Develop partnerships with public and private sector organizations that want to support the goals of the Powering Agriculture program.
- Serve as a clean energy and agricultural information resource for people around the world.

Some of the main activities that were implemented during the reporting year period include

- The launch of the first global innovation call resulting in 475 submissions from 76 countries and the selection of 12 winners who will work in 13 countries.
- The hosting of DevelopmentXChange: a winners announcement and conference held on December 11, 2013 in Washington DC with 300 attendees.
- Public awareness raising activities including the www.poweringag.com website, the Powering Agriculture Portal on energypedia.info, the e-newsletter, the twitter presence, articles in leading publications and sessions and exhibitions at several conferences.
- A symposium on Sustainable Energy for Food: challenges and solutions for sustainable energy use in the agriculture and food industry on June 12, 2014 in Germany.
- Public private partnerships in Pakistan, Egypt and Kenya to promote tested and proven methodologies, involve a wider private sector audience, and encourage effective business models.
- Three market studies focused on technology advancements within the clean energy/agriculture nexus.

Powering Agriculture has provided various types of support to the awardees during their first year of implementation and many have indicated that it has been useful in promoting their product and business.

In the next year, Powering Agriculture plans to implement the second round of the Global Innovation Call for which the solicitation will be released in November, 2014 and the selection of the winners and the awards will be issued in September 2015. Powering Agriculture also plans to launch a call for public private partnerships and launch the global LIFT financing facility in partnership with other Grand Challenges.

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Acronyms and Abbreviations

AC	Alternating Current
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
CIS	Clean Irrigation Solution
DC	Direct Current
ESCO	Energy Service Company
GCD	Grand Challenges for Development
GIC-RI	Global Innovation Call – Round 1
GIC-R2	Global Innovation Call – Round 2
HARVEST	Hybrid Agriculture/Road Vehicles with Electricity Storage and Transformation
FY	Fiscal Year
MOU	Memorandum of Understanding
OPIC	Overseas Private Investment Corporation
OST	Office of Science and Technology
PAEGC	Powering Agriculture: An Energy Grand Challenge for Development
PASTO	Powering Agriculture Support Task Order
PV	Photovoltaic
PVR	Photovoltaic refrigerator
SIDA	Swedish International Development Cooperation Agency
SNNPR	Southern Nations, Nationalities, and Peoples' Region
UGARF	University of Georgia Research Foundation
USAID	US Agency for International Development
VIP	Village Industrial Power
WCA	West and Central Africa

I. Introduction

This annual report describes the key activities of Powering Agriculture: An Energy Grand Challenge Grand Challenge for Development (PAEGC) implemented over the period of September 2013 to October 2014.

Powering Agriculture: An Energy Grand Challenge for Development represents a partnership of the United States Agency for International Development (USAID) with the Government of Sweden, Duke Energy Corporation, the Government of Germany, and the Overseas Private Investment Corporation (OPIC); collectively known as, the ‘Founding Partners’. The goal of Powering Agriculture is to support new and sustainable approaches to accelerate the development and deployment of clean energy solutions¹ for increasing agriculture productivity and/or value in developing countries.

Powering Agriculture follows the Grand Challenges for Development (GCD) model which focuses on defining problems, identifying constraints, and providing evidence-based analysis for a variety of development issues. The Grand Challenges for Development initiative is rooted in two fundamental beliefs about international development:

- Science and technology, when applied appropriately, can have transformational effects; and
- Engaging the world in the quest for solutions is critical to instigating breakthrough progress.

I.1 The Problem

Throughout developing countries, agriculture remains the most prominent source of livelihood for most households. As our population expands, farms and agribusiness will need to produce, process, and transport an increasing amount of food. The UN Food and Agriculture Organization estimates that at least 70% more food will need to be produced on the same amount of agricultural land. Identifying means in which clean energy technology can be used to intensify agricultural production will be crucial in meeting this demand.

Increasing the agricultural sector’s access to clean energy technologies will enable farmers to mechanize their operations, add value to commodities through processing, and store fresh produce in refrigerated containers to extend its shelf-life. These advancements will lead to more food in the market, increased incomes for farmers and traders, and decreased dependency of the agriculture sector on fossil fuels.

¹ In the context of PAEGC, the term ‘clean energy’ is defined as: Usable energy (i.e. electricity, illumination, heating/refrigeration, mechanization) that is derived from renewable sources and supports a reduction in fossil fuel use, increase in efficiency, and/or limitation of greenhouse gas emissions. Clean energy sources include – solar, hydro, wind, geothermal, sustainably harvested biomass, and biogas. The term ‘clean energy solution’ is defined as: A combination of appropriate technology and business model that addresses the clean energy demands of a select market.

Unfortunately, significant barriers exist that hinder the integration of clean energy technology in agriculture development:

- Farmers are not aware of the variety of new technologies that may be appropriate for them.
- Clean energy technologies are relatively new, therefore farmers have limited access to distributors for installation, parts, and service.
- Farmers often do not have the means to cover high capital costs associated with clean energy upgrades - and financing is seldom available.

Likewise, clean energy enterprises seeking to serve these farmers face a number of barriers:

- Limited access to debt and equity to support business development and growth.
- Farmers are not aware of the economic and environmental benefits of the technology, and therefore demand for clean energy technology is low.
- The client base of agricultural communities is remote, scattered, and often very poor;
- There are few examples of successful business models that have been effective in delivering clean energy solutions to the agriculture sector in developing countries.

These issues create an unproductive cycle, in which suppliers and buyers are not connected, and farmers and agribusinesses are unable to leverage more cost-effective clean energy technologies. Strengthening the links between modern energy service providers and the agriculture sector will create positive feedback loops to increase productivity along major components of the agricultural supply chain: (1) on-farm productivity, (2) cold storage, (3) transport, (4) post-harvest agriculture processing, and (5) agriculture waste for energy applications.

I.2 The Solution

In order to solve the challenges described in section I.1 above, Powering Agriculture was launched in 2012 to

- Support clean energy technology and businesses model innovations for agriculture
- Ensure that financial intermediaries have the capital they need to help organizations scale their innovations and reach the farmers and farm-related businesses that need these technologies
- Develop partnerships with public and private sector organizations that want to support the goals of the Powering Agriculture program
- Serve as a clean energy and agricultural information resource for people around the world

The activities of Powering Agriculture will run through 2017.

I.3 The Work of Powering Agriculture

Powering Agriculture’s programmatic interventions are grouped under the following four Technical Components:

- **Technology and Business Model Innovation Component:** Financial support primarily in the form of grant funding to private/non-profit/academic entities to design, pilot and deploy innovative technologies and business modules to further integrate clean energy solutions within agricultural supply chains in developing and emerging countries.
- **Commercial Financing Component:** Provision of grant funding, guarantees, and other incentives to financial intermediaries to encourage private sector equity and debt investments within the clean energy/agriculture nexus.
- **Mainstreaming and Acceleration Component:** Catalyzing private-sector investment and associated technical assistance and training to bring proven clean energy solutions for enhancing agricultural productivity and/or value to commercial scale. Efforts are made through this Technical Component to pursue a ‘nexus’ approach to supporting PAEGC Partners’ ongoing/planned energy and agriculture programs.
- **Knowledge Management Component:** Collecting, analyzing, and disseminating knowledge gained through the implementation of PAEGC interventions and other activities within the clean energy/agriculture nexus.

Figure I. PAEGC’s Technical Components and Illustrative Activities



I.4 The Founding Partners

The Founding Partners have made financial and in-kind contributions to finance the activities of Powering Agriculture. In-kind contributions are technical assistance resources that individual Partners have committed to support the goal of Powering Agriculture but are managed by the individual Partners themselves. USAID serves as the administrator of Powering Agriculture managing the disbursements of the finances. Below is a description of each Founding Partner.

Table I. PAEGC Founding Partners

Organization	Description
United States Agency for International Development	The American people, through the USAID, have provided economic and humanitarian assistance worldwide for nearly 50 years. www.usaid.gov
Government of Sweden	Sida, the Swedish International Development Cooperation Agency which is an authority under the jurisdiction of the Swedish Ministry for Foreign Affairs, focused on improving living conditions for developing nations around the world. http://www.sida.se/English/
Duke Energy	Duke Energy, one of the largest electric power companies in the United States, supplies services in a sustainable manner - affordable, reliable, and clean. http://www.duke-energy.com/
The Overseas Private Investment Corporation	OPIC is the U.S. Government's development finance institution. It mobilizes private capital to help solve critical development challenges and in doing so, advances U.S. foreign policy. Because OPIC works with the U.S. private sector, it helps U.S. businesses gain footholds in emerging markets, catalyzing revenues, jobs and growth opportunities both at home and abroad. OPIC achieves its mission by providing investors with financing, guarantees, political risk insurance, and support for private equity investment funds. http://www.opic.gov/
Government of Germany	The BMZ, Federal Ministry for Economic Cooperation and Development, develops the guidelines and the fundamental concepts on which German development policy is based. It devises long-term strategies for cooperation with the various players concerned and defines the rules for implementing that cooperation. These are the foundations for developing shared projects with partner countries and international development organizations. All efforts are informed by the United Nations' Millennium Development Goals, which ambitiously aim to halve poverty in the world by 2015. http://www.bmz.de/en

2. Highlights

The following are highlights of the main activities implemented under Powering Agriculture during the reporting period.

2.1. First Innovation Call

Powering Agriculture launched its first global innovation call in December 2012. The global call for proposals focused on creative solutions that address an identified development problem, that is, farmers and agribusinesses' limited ability to sustainably maximize agricultural production and value due to limited access to modern energy services. Through the global innovation call, Powering Agriculture sought solutions within the clean energy/agricultural nexus that:

- (i) Could achieve scale;
- (ii) Were adoptable within the context of emerging markets;
- (iii) Were sustainable, and can ultimately progress without outside assistance; and
- (iv) Utilized modern, evidence-based science and technology approaches.

The Powering Agriculture Global Innovation Call was a success and generated a response from innovators around the world, resulting in:

- 475 submissions from 76 countries; 55% of applications were from developing countries
- The selection of 12 winners who will work in 13 countries; awards to each winner of between \$800,000 and \$1,500,000

In September 2013, USAID issued the following three-year awards (October 2013 – September 2016) to the 12 winners.

Table 2. Global Innovation Call: Round I Funded Awards

	Awardee	Project Name	Country of Implementation
1	African Bamboo	Thermal treatment of agricultural goods based on a demand driven and energy-efficient biomass combustion unit	Ethiopia
2	Camco Advisory Services	Biomass Mini-Grids for Palm Oil Producing Communities in Benin and Tanzania	Benin, Tanzania
3	The Earth Institute at Columbia University	Micro-Solar Utilities for Small-Scale Irrigation in Senegal	Senegal
4	EarthSpark International	Smart Grid on Main Street: Powering Agricultural Processing with Sustainable Energy Services	Haiti
5	ECO Consult	Hydroponic Green Farming Initiative	Jordan

	Awardee	Project Name	Country of Implementation
6	iDE	Clean Irrigation Solution (CIS) for Increased Agricultural Productivity	Honduras, Nepal, Zambia
7	Motivo Engeering	Hybrid Agriculture/Road Vehicle with Electricity Storage and Transformation (HARVEST)	India
8	Promethean Power Systems	Solar-powered Milk Chilling in Rural India	India
9	Rebound Technologies	Solar Cooling for Horticultural Preservation	Mozambique
10	SunDanzer Refrigeration	Sustainable Milk for Africa through Refrigeration Technology	Kenya
11	University of Georgia Research Foundation	Renewable Energy-Powered Evaporative Cooling for Small-Holder Farmers	Uganda
12	Experience International	Solar Powered Cold Storage and Ice Making Facilities for Fishing Communities in Eastern Indonesia	Indonesia

The Global Innovation Call culminated in DevelopmentXChange: a winners announcement and conference which was held on December 11, 2013 in Washington DC and had about 300 attendees from donors, the international development community, private sector, and civil society.

The program included

- A DevelopmentXChange Marketplace where the Powering Agriculture winners exhibited their clean energy solutions.
- A special presentation by: William Kamkwamba, a Malawian inventor and author of “The Boy Who Harnessed the Wind” who gained fame when, in 2002, he built a windmill to power a few electrical appliances in his family's house using blue gum trees, bicycle parts, and materials collected in a local scrapyard.
- Technical seminars on smart irrigation, clean energy usage in agricultural production and processing, strengthening the clean energy cold chain, and clean energy finance for suppliers and end users.



Participants at Development XChange Marketplace Source: USAID

A two day accelerator workshop for the winners was also held as part of DevelopmentXChange. The workshop matched the winners with various mentors from the business, energy, and agricultural space to provide practical advice on using the award for business expansion and scaling of the clean energy solution to achieve maximum impact.

2.2. Awardee Accomplishments

The following provides a snapshot of each awardee's clean energy solution, their expected impacts, and their progress to date.

The awardee projects are generally focused on new clean energy technologies and business models that show promise of being viable in supporting the objectives of PAEGC, but have yet to demonstrate their proven applicability in a developing country context through extensive field tests. The activities of the projects are focused on the early stages of research and development and are using PAEGC funding to refine/improve the design of the technologies, establish proof of concept, pilot field tests, and adapt technologies/business models for new markets. Many of the awardees have spent the first year of implementation focused on refining the design of their solution and do not have field results to show as yet.

2.2.1 African Bamboo

PROJECT Biomass-Powered Thermal Processing of Ethiopian Bamboo

COLLABORATOR(S) Heartland Global (USA)

LOCATION APPLIED Southern Nations, Nationalities, and Peoples' Region (SNNPR), Ethiopia

WEBSITE www.african-bamboo.com

ORGANIZATION: African Bamboo is a forestry, wood, and bio-energy company located in Addis Ababa, Ethiopia, among Africa's largest reserves of bamboo, African Bamboo develops innovative applications for bamboo, particularly for industrial and commercial uses. The company was established in 2012 as a subsidiary of Fortune Enterprise PLC which, since 1961, has been a manufacturer of wood and metal products in Addis Ababa.

PROBLEM/ OPPORTUNITY: In Ethiopia, there are more than one million hectares of bamboo. Recognized as a fast-growing and largely sustainable raw material, there is an increasing global demand for bamboo as a wood substitute for a variety of construction and furnishing applications. However, bamboo resources are often poorly managed. Most in the industry have limited knowledge of modern value-added processing techniques, which limit their earning potential.

CLEAN ENERGY SOLUTION: African Bamboo is developing an environmentally friendly bamboo thermal modification process called ThermoBoo. Through this chemical-free process, decay factors such as rot and insects are virtually eliminated, and the thermally-modified bamboo fiber can be further processed into sturdy panels that can be marketed to a range of domestic and international buyers. The ThermoBoo process involves the combustion of biomass dust – a

technological approach that is completely new to Ethiopia. Through the project's successful implementation of a pilot processing facility, African Bamboo envisions developing a replicable model that can lead to prospective business opportunities throughout the region.

IMPACT: The success of this project will lead to new opportunities for export, employment, and manufacturing in Ethiopia. In addition to its socio-economic impact, bamboo cultivation of native species plays a significant role in reforestation by stabilizing soil. African Bamboo uses environmental impact assessments to ensure the continued promotion of bamboo's environmental benefits, and the minimization of the company's ecological footprint.

PROGRESS TO DATE: During its first year of implementation, African Bamboo developed a lab-scale thermal modification phase plan, completed the system design for the thermal modification facility and completed the system engineering. The thermal modification phase plan for Ethiopian highland bamboo has been successfully transferred, adapted, and optimized from the lab-scale and process optimization completed. The desired energy efficiency of the renewable energy plant has been achieved, quantified and proven by measurements. African Bamboo also utilized remote-sensing technology to take stock of the bamboo resources available within the Sidama zone under Southern Nation and Nationality Peoples Region and surrounding highland areas within the adjoining Oromia region. African Bamboo was also able to generate interest from the beneficiaries and added another 50 farmers as bamboo suppliers

African Bamboo has not yet achieved one of its milestones for FY2014. It was delayed in entering into purchase agreements with equipment suppliers because preliminary results from African Bamboo's product development efforts – being jointly undertaken at facilities in Ethiopia and Fraunhofer WK in Germany – indicated a major shift in terms of technologies that needed to be deployed for the thermal modification plant, associated renewable energy plant, and hot presses. African Bamboo is moving forward to address these issues, and anticipates having the purchase agreements secured in March 2015 after further modification testing of about 18 tons of bamboo is conducted. African Bamboo will request an amendment to its milestone schedule to address these delays.

2.2.2 Camco Advisory Services

PROJECT Biomass Mini-Grids for Palm Oil Producing Communities in Benin and Tanzania

COLLABORATOR(S) Gazogen, Inc., (USA)

LOCATION APPLIED Oueme region in Benin, and the Kigoma region in Tanzania

WEBSITE www.camcocleanenergy.com/africa www.villageindustrialpower.com

ORGANIZATION: Camco Clean Energy is a sustainable energy development company with offices across Africa. It is experienced in providing rural electrification through solar, biomass, small hydro, and biofuel technologies, addressing traditional charcoal production and consumption. Camco will co-implement activities with Gazogen, Inc – a firm that specializes in the development of biomass fueled cogeneration plants.

PROBLEM/ OPPORTUNITY: In rural areas of Benin and Tanzania, access to modern energy services is extremely limited. Without electricity, farming communities are slow in their adoption of modern agriculture practices– resulting in sparse irrigation, lagging food production, and few opportunities for value-added processing and refrigerated storage. Though some communities depend on fossil fuel-based technologies to meet their energy needs, perpetually escalating fuel costs - coupled with adverse environmental impacts - necessitate the exploration of more affordable and sustainable options.

CLEAN ENERGY SOLUTION: Village Industrial Power (VIP) Plants are mini-grid systems powered through the combustion of biomass waste produced at local agricultural processing facilities. The VIP Plants generate mechanical/electrical/thermal energy for use in a diverse range of agricultural activities - processing fruit, palm, rice, and cocoa; dairy pasteurization; purifying water; and powering irrigation pumps. The VIP Plants will be assembled/sold in partnership with local manufacturers, and owned/operated by local Energy Service Companies (ESCOs).

IMPACT: The project will result in the establishment of 50 agro-processing centers and village mini-grids capable of producing between 10 and 50kW of electricity for homes, social services, and businesses. It is anticipated that the VIP Plants will service more than 5,000 agrarian families. This clean energy solution will contribute agricultural development and low-carbon economic growth that improves food security, financial stability, environmental sustainability, and women’s empowerment through new entrepreneurship opportunities.

PROGRESS TO DATE: During the first year of implementation, Camco focused on generating interest in and demand for the VIP technology but had to make adjustments to its target beneficiaries in Tanzania. The project was designed to initially target palm oil processing businesses and communities but early on the project team discovered that the palm oil processing sector in the project site, the Kigoma Region, was severely underdeveloped and manual at best and there was not enough business to generate enough palm oil waste (fibers, shells, etc.), while simultaneously produce palm oil mechanically, to provide a logical market for the VIP. Camco also discovered that coffee is the predominant business in the region with well-organized village coffee producing cooperatives and decentralized “pulperies” or village processing centers which operate on diesel generators due to the lack of electricity. Therefore, Camco decided to target the coffee market in Kigoma, while diversifying to other geographic and agro-processing markets in Tanzania such as the timber industry. In Benin, the initial hypothesis remained and the VIP technology found

a ready market among small holder/palm oil processing businesses.

As a result of the outreach efforts, Camco is installing the first VIPs at

- three palm oil processing businesses in South Eastern Benin
- one village in Southern Tanzania at the heart of the timber industry, to be used to power a village grid
- the central headquarters of Kanyovu Coffee Curing Company in the Kigoma Region of Tanzania, using coffee parchment as feedstock to provide electricity for a secondary school and hospital.



VIP Plant in use in a village processing center in Tanzania.
Source: Camco

2.2.3 Earth Institute - Columbia University

PROJECT Micro-Solar Utilities for Small-Scale Irrigation in Senegal

COLLABORATOR(S) The MDG Center West and Central Africa (Senegal)

LOCATION APPLIED Potou, Senegal

WEBSITE www.earth.columbia.edu

ORGANIZATION: The Earth Institute at Columbia University harnesses scientific research, education, and practical solutions to create a more sustainable world through innovation and critical thinking. Earth Institute has partnered with The MDG Center West and Central Africa (WCA) – an organization established to assist WCA countries develop and implement operational strategies aimed at achieving the Millennium Development Goals.

PROBLEM/OPPORTUNITY: In Senegal, farmers currently use two practices for watering crops: the labor intensive method of flood irrigation with wells and buckets, or the cost- and energy-intensive method of using diesel-powered motor pumps. Neither of these options is ideal in a country with immense solar resources that can be harnessed and used to transform irrigation practices in the country and region.

CLEAN ENERGY SOLUTION: Earth Institute's solution will enable a small group of farmers to use a central solar energy unit to power multiple alternate current (AC) pumps for irrigation. The proposed solution takes advantage of the benefits of solar without the high costs associated with direct current (DC) powered pumps and battery storage. This power will be accessed by farmers

with prepaid electricity cards issued by a micro-utility, and sold through local vendors who will benefit from a small commission. Recognizing that a major obstacle to technology adoption is financing, a tariff-based financing model will allow customers to cover their appliance loans in small payments added into their micro-utility bills.

IMPACT: This innovation will reduce the price of energy for irrigation significantly while reducing the carbon intensity of irrigation and the labor expended on it. These benefits are particularly powerful when looking at the demographics of Senegal's agricultural workforce, which is more than 85 percent women.

PROGRESS TO DATE: During the first year of implementation, the Earth Institute has designed the solar array for the first pilot installation to provide 8 kW-peak power which will allow for the simultaneous operation of at least seven 0.75kW pumps at midday, accounting for expected system losses. The solar AC pump controller has been modified to meet the needs of the off-grid setting with multiple pumps and a single inverter. The controller was tested and modified to ensure it will work with the pre-paid payment software and that it can truly handle multiple, separately controlled pump loads. This is a first significant step towards finding the technological solution to solve the problem of using a single photovoltaic (PV) array/single inverter to power multiple pumps with separate metering for each pump. The Earth Institute has selected the village of Gabar, located within the Millennium Village Project site of Potou, as the site for the first pilot installation. Baseline data collection on farmers' energy use, current agricultural production, and number of solar maintenance technicians is underway. A solar technician has also been hired to oversee field testing and pilot phases.

Implementation remains about six weeks behind schedule due to the late arrival of the solar AC pump controller. Nevertheless, the first pump controller unit has been sent to Senegal and the second controller has been paid for and construction is expected to be much faster than it was for the first unit. However, a milestone adjustment is needed to account for the delay in the first unit.

2.2.4 EarthSpark International

PROJECT Smart Grid on Main Street: Electricity and Value-added Processing for Agricultural Goods in Rural Haiti

COLLABORATOR(S) Entreprises La Foi (Haiti)

LOCATION APPLIED Les Anglais, Haiti

WEBSITE www.earthsparkinternational.org

ORGANIZATION: EarthSpark International is a U.S.-based, nonprofit organization with over four years' experience working with communities, businesses, and government to bring energy access to Haiti's unelectrified population. Through its local brand Enéji Pwóp, EarthSpark is an established and recognized brand in Haiti with the track record and infrastructure to scale up its clean energy and micro-grid activities. For this project, EarthSpark has partnered with the Haitian agro-processing company Entreprises La Foi.

PROBLEM/OPPORTUNITY: Seventy-five percent of Haiti's population lacks access to electricity, and farmers frequently lose value of their crops for want of infrastructure and processing equipment. Where processing facilities do exist, they are typically diesel-powered and expensive to operate. This imposes a severe limitation on farmers' ability to process agricultural goods, maximize the value of their products, and improve their livelihoods.

CLEAN ENERGY SOLUTION: EarthSpark has developed a solar-diesel hybrid micro-grid system that will increase access to affordable, reliable electricity for value-added agricultural processing. By providing technical guidance and facilitating access to financing for local partners, EarthSpark will assist agribusinesses in upgrading to efficient electric mills so the processing of rice, sorghum, coffee, and corn can be modernized. The project first focuses on breadfruit crops that typically rot due to lack of processing. Converting the fruit to flour or chips extends the shelf life by months and significantly increases its value and marketability.

IMPACT: By reducing agricultural waste and enabling value-added processing, the project will boost agribusiness incomes as well as provide surrounding residents with access to electricity, through a pre-paid smart metering system. The project will demonstrate a sustainable business model for operating a local micro-grid, for agribusiness' upgrading to efficient electric mills, and for breadfruit processing.

PROGRESS TO DATE: During the first year of implementation, EarthSpark has identified its customers and their projected load in Les Anglais to enable them to appropriately design their solar-powered mini-grid. They identified the top three agro-processing technologies, including milling and grain storage, and prepared a baseline market study of current agro-processing activities. EarthSpark is significantly behind their milestone schedule. Of the 17 milestones scheduled to be completed by the end of FY14, nine have been completed. Two additional milestones scheduled for FY15 – a feasibility study and business plan for a breadfruit processing enterprise - have been completed in advance, which will enable a large milestone payment to be made. This should help alleviate EarthSpark's reported financial stress of making upfront large capital expenditures related to the micro-grid. EarthSpark will be requesting a revision of its milestone table to include revised deadlines and a more logical ordering of milestones.

2.2.5 EcoConsult

PROJECT A Hydroponic Green Farming Initiative

COLLABORATOR(S) El Wir Farm in Zarqa River and one large farm in the Highlands. The community households cluster will be identified during the feasibility study

LOCATION APPLIED Jordan; Middle East and North Africa region

WEBSITE www.ecoconsult.jo

ORGANIZATION: Established in Jordan in 1995, ECO Consult is a leading development firm with more than 15 years of experience working in Jordan and the Middle East. Past work includes projects in public sector reform, private sector development, local governance and development zones, energy, water, and environment.

PROBLEM/OPPORTUNITY: Jordan is considered to be one of the ten most water-scarce countries in the world. As water becomes scarcer, its availability for agriculture is expected to decrease. Hydroponic technology, an intensive form of agriculture, uses much less water than conventional farming and offers an excellent opportunity for farmers to increase their income while reducing their water use. Although farmers have expressed their interest in this new technology, its application in Jordan is still limited.

CLEAN ENERGY SOLUTION: ECO Consult has developed an integrated model of hydroponic and photovoltaic farming to compete with conventional greenhouse technology and drip irrigation systems. To make the technology attractive to large-scale commercial farms, ECO Consult will retrofit a multi-span greenhouse with advanced hydroponic technologies and photovoltaic panels to generate enough power to operate the lighting, pumping, and air moderation systems.

IMPACT: ECO Consult's beneficiaries include large commercial farms as well as small household farms. As more farms adopt these new technologies, the value of their agricultural produce will increase, while their use of scarce natural resources will decrease. Simultaneously, as more rural households adopt this technology at a small-scale, they will realize additional sources of income and new employment opportunities for women and youth.

PROGRESS TO DATE: During the first year of implementation, ECO Consult was able to make significant progress. They organized a national advisory group for hydroponic farming that included stakeholders from educational and research institutions, pioneering farmers, key private sector representatives involved in hydroponic agriculture, and the National Center for Agricultural Research and Extension. In consultation with the advisory group, ECO Consult designed indigenous hydroponic systems that incorporated materials readily available in Jordan to increase

the likelihood of broader adoption and fiscal accessibility. They also developed selection criteria for the demonstration sites and selected four sites for installation of the hydroponic systems.

- Na'our commercial farm to grow tomato and sweet pepper using drip hydroponics
- Zarqa commercial farm to grow lettuce using raft hydroponics
- Madaba household farm to grow tomato, cherry tomato, and sweet pepper using drip hydroponics
- Bani Kananeh women- led community based organization to grow thyme using drip hydroponics

ECO Consult provided the systems on a cost-sharing basis with the site owner to promote ownership and encourage better management. The planting process at each greenhouse is now underway.

2.2.6 iDE

PROJECT Solar-Powered Pumps for Improved Irrigation in Honduras, Nepal, and Zambia

COLLABORATOR(S) PRACTICA Foundation (Netherlands), Futurepump Ltd (UK)

LOCATION APPLIED Honduras; Nepal; and Zambia

WEBSITE www.ideorg.org

ORGANIZATION: iDE has over 30 years' experience in developing appropriate agricultural products and engaging the private sector to supply these products to smallholder farmers, improving long-standing agricultural practices. This project is implemented in partnership with PRACTICA Foundation – a Dutch organization that supplies the commercial application of technology in the field of water and energy, and Futurepump Ltd. – a UK manufacturer of efficient irrigation pumps.

PROBLEM/ OPPORTUNITY: Globally, there are more than 800 million smallholder farmers, many of whom each manually lift and haul over four tons of water daily to irrigate their farmland. These farmers can drastically decrease their labor and expand their irrigable area by employing motorized pumps. Currently, the most accessible and affordable pump solutions are four to seven horsepower pumps powered by increasingly expensive fossil fuels. Consequently, many farmers are either unable to provide sufficient irrigation to their crops, and/or must allocate a sufficient portion of their income to environmentally-hazardous fossil fuels.

CLEAN ENERGY SOLUTION: iDE's Clean Irrigation Solution (CIS) can compete with fossil fuel pumps both in terms of cost and enhancing agricultural productivity. CIS's universal piston pump can run on a variety of power sources –solar steam power, photovoltaic power, and grid-connected AC where available. The system accesses groundwater from deeper depths than conventional pumps, and maintains a slow, steady discharge rate. iDE will work with local businesses to sell and service the CIS.

IMPACT: iDE's goal is to compete with fossil fuel-powered pumps currently on the market, and ultimately shift farmers' preference toward clean energy pumping solutions. This consumer shift would have a remarkable environmental and socio-economic effect on agrarian communities. Use of the Clean Irrigation Solution (CIS) instead of a fossil fuel engine can reduce annual carbon emissions by 0.5 a ton. With a 10 year lifespan, each pump reduces CO2 emissions by 5 tons.

PROGRESS TO DATE: iDE and its partner, the PRACTICA Foundation, redesigned the PV version of the CIS to be more sleek, have fewer moving parts, and be more streamlined for optimal use. The redesign of the pump has transformed the product into something that can be manufactured at scale and appears to be sleek and desirable for iDE's target customers. This redesign also simplifies the manufacturing process. Furthermore, iDE and its partners have established manufacturing facilities in India along with quality control protocols to ensure that and quality standards will be met in the future as pump production is scaled up. iDE has shipped 20 pumps to Nepal in preparation for field testing.



Kesha Raj Neupane testing the pump in his field. Source: iDE

2.2.7 Motivo Engineering

PROJECT Hybrid Vehicles with Exportable Power for Community-Based Agriculture Mechanization

COLLABORATOR(S) The KVK Foundation (India); Feuerlabs (USA)

LOCATION APPLIED West Godavari, Andhra Pradesh, India

WEBSITE www.motivoengineering.com

ORGANIZATION: Motivo Engineering specializes in electro-mechanical systems to solve complex challenges across diverse market segments. Motivo's partner, the KVK Foundation, will draw on their extensive rural development experience in India to introduce new technologies to rural villages, while its partner Feuerlabs will offer their expertise in remote data connectivity to develop a management platform for new technologies.

PROBLEM/ OPPORTUNITY: Although farm productivity in India has grown steadily over recent decades, crop yields are still just 30-60 percent of the best crop yields in many other countries. Agricultural productivity could be significantly boosted by creating more accessible agricultural machinery, and by providing a mobile energy source that runs on inexpensive renewables to meet multiple farm needs such as harvesting, cold storage, and transportation.

CLEAN ENERGY SOLUTION: Motivo is developing a “Swiss-Army Knife” system – the Hybrid Agriculture/Road Vehicles with Electricity Storage and Transformation (HARVEST) - that solves a wide range of agricultural mechanization and power-related problems. HARVEST is a multi-purpose platform that provides power for plowing, well-drilling, cold storage, and transporting crops to market. The system utilizes power from varied energy sources such as solar panels, wind turbines, micro-hydro turbines, or the grid to enable increased productivity all along the agriculture value chain. The entire system is operated at the community level, and facilitated by mobile communication technology for scheduling, billing, and payments.

IMPACT: HARVEST democratizes opportunity in agriculture by making available to entire communities huge gains in productivity that are enabled through mechanization and reliable power. Varied energy sources will reduce reliance on increasingly-expensive imported diesel, and the system itself will create new skilled jobs for men and women in rural areas in deploying, managing, and maintaining the HARVEST equipment.

PROGRESS TO DATE: During the first year of implementation, Motivo prepared a conceptual design review that captured the key aspects of the HARVEST system. They then completed a preliminary design review that described how the key technical and developmental challenges will be addressed. They presented a text messaging demo video that showed how the text message based vehicle reservation, payment, and pricing control system works. In March 2014, they filed provisional patents for its unique combination of batteries, power electronics, and network connectivity devices that make up the HARVEST power platform. The system architecture finalization and patenting enables Motivo to seek additional funding to accelerate HARVEST deployment. Motivo’s implementation is on schedule except for the preparation of a marketing datasheet highlighting key HARVEST capabilities. This will be completed once the project is closer to deploying the HARVEST system in the field.

Motivo has selected Maharajpet, a village outside of Hyderabad, India, for initial field trials of the HARVEST tractor, based on field visits by Motivo and its in-country partner. The selection was based on the village’s small size, proximity to Hyderabad, and identification of strong in-village advocates who provided a letter of intent. Discussions with potential customers both domestically and in India and has found a high degree of interest in HARVEST.

2.2.8 Promethean Power Systems

PROJECT Reducing Milk Spoilage through Solar Powered Milk Chilling in Rural India

COLLABORATOR(S) Hatsun Agro (India), Orb Energy (India)

LOCATION APPLIED India

WEBSITE www.coolectrica.com/impact

ORGANIZATION: Promethean Power Systems designs and manufactures refrigeration systems coupled to their thermal batteries for agricultural commercial refrigeration applications in off-grid and partially electrified areas of developing countries. Promethean is working in partnership with the Hatsun Argo – India’s largest private dairy company, and Orb Energy – a leading solar energy system provider in India.

PROBLEM/ OPPORTUNITY: In India, \$10 billion worth of perishable foods are wasted annually because of unreliable cold-chain supply networks. A major obstacle in setting up cold chain networks is the lack of reliable electricity to run refrigeration systems in villages and farming areas. Diesel generators are often used to provide electricity for milk chilling, a non-ideal solution with high operating costs and negative environmental impact.

CLEAN ENERGY SOLUTION: Promethean’s refrigeration solution uses a thermal energy battery pack that charges on solar power and/or a few hours of grid electricity. This provides cold storage around the clock despite inconsistent access to electricity. Dairy processors can collect raw milk from remote dairy farmers and keep it cold in a rapid milk cooler, reducing the time that milk is unchilled by 75%. Promethean will design and deploy the refrigeration systems in collaboration with India’s largest private dairy and one of India’s largest solar installers.

IMPACT: India is the largest producer and consumer of milk in the world. Increasing access to milk while decreasing bacteria and spoilage supports food security and consumer health in India, where 42% of children under the age of five are malnourished. This project will improve access to forward markets, higher income for the dairy farmers, and wealth creation through increase in herd size.

PROGRESS TO DATE: On June 28th, 2014 Promethean commissioned its first solar installation on a Rapid Milk Chiller in cooperation with Amul dairy in Dalonde Village, India. It dramatically reduces the operating costs for farmers to chill milk by ensuring that none of the milk they deliver gets spoiled and that they get paid for that milk.



Farmers using the solar powered milk chiller.
Source: Promethean

2.2.9 Rebound Technologies

PROJECT SunChill: Solar Cooling for Horticultural Preservation in Mozambique
COLLABORATOR(S) Colorado State University; TechnoServe; Mozambique Organicos
LOCATION APPLIED Inhambane Province, Mozambique
WEBSITE www.rebound-tech.com

ORGANIZATION: Rebound Technology develops tailored refrigeration technologies designed to meet global energy market dynamics while reducing fossil fuel dependence. To successfully design, build and deploy SunChill technology, Rebound will leverage critical partnerships. The Energy Institute's (Colorado State University) product development experience will support research and development, TechnoServe's business solutions focus will drive host nation outreach/support, and Mozambique Organicos research farm will provide the primary venue for SunChill deployment and in-field testing.

PROBLEM/ OPPORTUNITY: Post-harvest, physiological obstacles such as ethane production, respiration and microbial attack make getting high quality horticultural products to market a significant challenge. Removing field heat from these products can double shelf-life and reduce spoilage rates that often exceed 40 percent in developing countries. Unfortunately, current off-grid cooling technologies are expensive, energy intensive, and difficult to maintain.

CLEAN ENERGY SOLUTION: SunChill is a novel, off-grid refrigeration solution enabling increased agricultural productivity by: (i) removing field heat from crops immediately following harvest, and (ii) providing continued product cooling at local markets and/or central processing facilities. This clean energy solution transforms 50°C solar thermal energy into 10°C refrigeration using water-based refrigerants, zero electricity and local, non-precision components. These characteristics enable production of a low cost, low-maintenance technology that reduces spoilage and benefits smallholder farmer livelihoods.

IMPACT: SunChill is one of the first developing world technologies that reliably removes field heat without a high-cost electrical supply. The low-cost system enables increased horticultural production both for domestic and export consumption, generating additional income for smallholder farmers and increased access to nutritional fruits and vegetables while generating both manufacturing and service based employment.

PROGRESS TO DATE: The process of the developing the technology is advancing. Double-walled, waterproof test components were 3D-printed with 1mm wall thickness which was a key breakthrough in the design of Rebound's proprietary, 3D-printed heat exchange. In September, 2014 prototype testing was conducted, including circulation of water through the system. A formal research agreement was signed with Fraunhofer ISE in Freiburg, Germany to continue developing the required deaerated, air-gap membrane necessary for SunChill™ operation. The value proposition was refined after an on-site visit to farmers in Mozambique and the primary demonstration site was selected.

2.2.10 SunDanzer Refrigeration

PROJECT Solar-Powered Refrigeration for Kenyan Dairy Farms

COLLABORATOR(S) Winrock International (USA)

LOCATION APPLIED Nakuru Region, Kenya

WEBSITE www.sundanzer.com www.winrock.com

ORGANIZATION: SunDanzer has 14 years of experience with off-grid refrigeration needs, including developing the world's first battery-free solar powered refrigerator. Winrock International is a leader in agricultural development and has more than a quarter century of experience with renewable energy based rural electrification. It has supported the installation of more than 80,000 rural renewable energy systems around the globe and has three offices in Kenya.

PROBLEM/ OPPORTUNITY: Due to limited electrification in rural areas, 85 percent of Kenya's 800,000+ dairy farms do not have access to refrigerated storage and transportation. This deficiency in the distribution chain results in less than half of the milk produced reaching dairy processors. Of the milk that is processed, up to 30 percent of it may spoil without appropriate cold-storage options. Consequently, many dairy farmers and processors unnecessarily may lose significant earning potential from their operations.

CLEAN ENERGY SOLUTION: Recognizing the need for affordable cold-chain technologies, SunDanzer is developing a small-scale portable cooling system tailored for use in the Kenyan dairy market. The system comprises a photovoltaic refrigerator (PVR) that uses solar energy to cool a chest refrigerator. This technology may use a battery for energy storage or phase-change materials – substances which are capable of storing and releasing large amounts of energy - or a combination of both. SunDanzer will evaluate freezing phase-change material into “milk packs”. The portable milk packs retain their cold temperature overnight, and in the morning, farmers use them to keep collected milk cold in sterilized aluminum milk containers as they transport it to dairy processing facilities.

IMPACT: This clean energy solution aims to increase dairy farm productivity and income by significantly decreasing milk spoilage. Effective cold-chain storage lowers bacteria count and improves milk quality for consumers. These improvements can play a major role in the livelihoods of approximately one million smallholder dairy farming families in Kenya.

PROGRESS TO DATE: In July 2014, Sundanzer had a successful demonstration of its small scale, solar powered chilling system (refrigerator) for dairy farmers and processors in emerging regions such as Kenya. Sundanzer then signed a Memorandum of Understanding (MOU) with

Happy Cow Dairy in Kenya to deploy and analyze the tangible impacts of its solar powered chilling system (refrigerator) for rural Kenyan dairy farmers and processors.

In late October 2014, SunDanzer shipped its 40 refrigerator systems to Kenya. This milestone was originally scheduled to be completed in September 2014, but was delayed by about five weeks due to delays in procuring parts for 20 of its 40 refrigerator systems. SunDanzer has started selection of farmers to participate in its field trials and is expected to complete training by the end of January 2015.

2.2.11 University of Georgia Research Foundation

PROJECT Biogas-Powered Evaporative Cooling for Uganda's Dairy Industry

COLLABORATOR(S) Smallholder Fortunes (Uganda)

LOCATION APPLIED Wakiso District, Uganda

WEBSITE www.ovpr.uga.edu/ugarf

ORGANIZATION: The University of Georgia Research Foundation (UGARF) is a nonprofit entity housed within the University of Georgia in the United States that enhances UGA's excellence as a research and higher education institution. Smallholder Fortunes is a small scale dairy farm located in Wakiso District, Uganda.

PROBLEM/ OPPORTUNITY: Throughout sub-Saharan Africa, the dairy industry suffers from lack of proper refrigeration options. Large dairies cannot export milk to neighboring markets due to international standards requiring milk be cooled within four hours of production. Small farmers may lose 20-50 percent of milk to spoilage due to lack of cold-chain facilities. There is limited access to electricity for refrigeration units, and kerosene and solar-powered options have proved too expensive and difficult to operate.

CLEAN ENERGY SOLUTION: UGARF has developed a refrigeration unit powered on biogas – which is extracted from cow manure. The unit regenerates zeolite plates which retain their capacity to capture water vapor from the evaporative milk chilling process. Partnered with Smallholder Fortunes, UGARF is refining the design of the refrigeration unit, and testing it with farmers in Uganda. UGARF will work with local manufacturers to secure financing and bring production of the units to commercial scale.

IMPACT: This project has numerous social, economic, and environmental benefits. Refrigeration units will benefit dairy farmers by decreasing milk spoilage and increasing production and profits. Captured biogas can be used for lighting and cooking – saving income that would otherwise be

spent on kerosene, and replacing the use of wood and charcoal for cooking. Also, by extracting biogas from cow manure, greenhouse gas emissions from fermenting cow manure is mitigated.

PROGRESS TO DATE: A volunteer advisory board has been established and six staff have been hired to work on the project. Local clearance has been received from both the Uganda National Council for Science and Technology and the Research Secretariat of the Uganda President's Office to proceed with project implementation. Local fabrication capabilities have been established and sources for the imported component pieces to allow for local manufacture have been established. Moreover, UGA is currently conducting a Zeolite screening and regeneration with biogas testing.

It should be noted that the training material development for UGA's refrigeration systems has been delayed as UGA has faced difficulties hiring staff to develop the material and in identifying farmers to participate in the pilot study. A survey has been developed and administered to smallholder dairy farmers of Wakiso District, to enable the identification of project participants as well as to collect baseline data. Furthermore, UGA has been able to secure staff support from the university to create these training material, and it is expect that this new hiring will remedy the approximately four months delay in the creation of the training materials. A milestone adjustment is still needed to account for this delay though.

2.2.12 Experience International

PROJECT Solar Powered Cold Storage and Ice Making Facilities for Fishing Communities in Eastern Indonesia

COLLABORATOR(S) Contained Energy (Indonesia)

LOCATION APPLIED Indonesia

PROGRESS TO DATE: The award to Experience International has been terminated by USAID. Experience International was unable to finalize an agreement with Contained Energy and USAID did not believe that the project could be effectively executed without a suitable technology provider.

2.3 Awardee Support

Powering Agriculture has provided a various types of support to the awardees during their first year of implementation. The support has included media training, networking opportunities, technical advice, organizational management advice, business plan development, communication information, access to finance/investors, and assistance on USAID compliance. Eight of the eleven awardees have indicated that being selected as a Powering Agriculture awardee has afforded them an opportunity to promote their product and business. The DevelopmentXChange and accelerator workshop were also considered very useful to the awardees with many of them citing the opportunity to network with other awardees and make contacts as helpful.

The awardees also received support under the Powering Agriculture Support Task Order (PASTO) which is implemented by USAID contractor, Tetra Tech. Seven of the eleven awardees consider PASTO as a resource. Key assistance provided to the awardees included:

- 10 templates/manuals/guides on compliance with USAID rules and regulations were developed for the awardees' use
- 10 instances of assistance on compliance issues provided to awardees
- 13 instances of assistance on technical and business issues provided to awardees
- 17 referrals /linkages /partnerships /connections provided which assisted awardees with specific needs as a result of USG assistance.

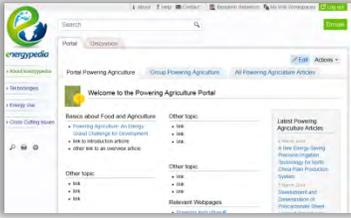
2.4. Mainstreaming the RE/AG Nexus

Powering Agriculture undertook several activities to mainstream the renewable energy and agriculture nexus including using various communication tools, launching public private partnerships and conducting research studies.

2.3.1 Raising the Public's Awareness

Powering Agriculture utilized multiple approaches to communicate the program objectives, activities, and results during the reporting period. These included various online platforms and communication tools detailed in table 3 below, press stories and participation in conferences and workshops.

Table 3. PAEGC Communication Platforms

Platform	Purpose	Contents
<p>Powering Agriculture website</p> <p>www.poweringag.com</p>	 <p>Powering Agriculture's primary public website; Communications and Outreach for Information Dissemination about the program</p>	<p>Official documents Calls for Proposals Outreach information (press releases, news articles, videos, event information)</p>
<p>Powering Agriculture Portal on energypedia.info</p> <p>www.energypedia.info/wiki/Portal:Powering_Agriculture</p>	 <p>Networking with experts; Research; mutual knowledge exchange</p>	<p>Thematic pages Articles and reports Studies Event announcements</p>
<p>Powering Agriculture E-Newsletter</p>	 <p>To raise awareness of Powering Agriculture, its activities and the successes of its awardees</p>	<p>News Success Stories Event announcements</p>
<p>@Poweringag Twitter Account</p>	 <p>To raise awareness of Powering Agriculture, its activities and the successes of its awardees</p>	<p>News Event announcements</p>

Powering Agriculture through the greater Grand Challenge for Development initiative was publicized in a press campaign to tell a more compelling story on the work of Grand Challenges for Development. This resulted in articles in leading publications such as:

- <http://www.theguardian.com/sustainable-business/2014/jun/13/cleantech-developing-world-solar-power-refrigeration>
- <http://inhabitat.com/green-design-predictions-for-2014/bill-mckibben-3/?extend=1>
- <http://news.nationalgeographic.com/news/energy/2013/13/131223-earthspark-solar-micro-grid-haiti/>
- <http://www.roadandtrack.com/features/web-originals/motivo-engineering-takes-wacky-sci-fi-ideas-and-makes-them-practical-realities>

Powering Agriculture hosted sessions and exhibited at several conferences such as:

- Nexus 2014: Water, Food, Climate and Energy Conference in March 5-8, 2014 where Powering Agriculture was introduced and https://energypedia.info/wiki/Portal:Powering_Agriculture; a virtual repository and knowledge-sharing site, for research, studies, and technological advancements on the nexus, was presented.
- USAID Frontiers in Development, September 18- 19, 2014 where information on the clean energy solutions was shared.

Powering Agriculture partner BMZ held a symposium on Sustainable Energy for Food: Challenges and solutions for sustainable energy use in the agriculture and food industry on June 12, 2014 in Germany. The symposium focused on answering the question of how more food could be produced while using as little energy as possible and increasing the share of renewable energy. There were also working groups that held in depth discussions on three aspects of the nexus namely Cooperation with the Private Sector; Energy Efficiency – A Potential Gain for Agro Industries; and Optimizing Agricultural Irrigation from an Energy Perspective.

2.3.2 Public Private Partnerships

Powering Agriculture Founding Partners USAID and BMZ are currently implementing various public private partnerships which promote tested and proven methodologies, involve a wider private sector audience, and encourage effective business models. Examples of public private partnerships that have been launched during the reporting period include

- A program of USAID and dairy companies in Pakistan to establish construction standards for biogas plants, develop the capacity of biogas construction companies, develop financing mechanisms to address the high upfront cost of biogas plant

construction and install at least 300 commercial biogas plants to generate electricity at dairy farms for various farm operations, including milk chilling.

- A program of BMZ and Ashoff Solar to promote the use of PV pumping systems in irrigated agriculture in order to support cost effective and sustainable desert farming in Egypt.
- A program of BMZ and the Kenyan Tea Development Agency Ltd. and Taylors of Harrogate, a UK based merchandise outlet specializing in Tea and Coffee to reduce energy use in tea processing facilities in Kenya and CO₂ emission in the supply chain.

2.3.3 Research and Studies

Powering Agriculture is funding a number of research projects and market information studies on impact and technology advancements within the clean energy/agriculture nexus. The following studies were commissioned:

- An Analysis of Solar Irrigation Systems which will present various technological solutions and a set of tools to select the best economic, environmental, and technological option in a given situation.
- Energy Studies of Rice and Palm Oil Value Chains to produce a methodology to quickly assess the best way to add value for efficiency or alternative technology investment depending on the technological solutions used and energy sources available.
- A Database of Prominent Clean Energy Technologies and agricultural practices to be used by practitioners to learn how to reduce energy input in agriculture and increase the use of renewable energy be it before, within, or after the farmgate.

Powering Agriculture is also tackling the need for training programs to convey the potential benefits of clean energy solutions and hence prompted the acceleration of their adoption by farmers and agribusinesses in development countries. In June 2014, Powering Agriculture Partner BMZ launched a pilot call for training institutions in Africa to conduct trainings for local stakeholders on sustainable energy use in agriculture and food production. Research has determined that many training institutions do not offer a practical nexus approach within their current offerings. BMZ will select three winners who will receive monetary and technical support to integrate sustainable clean energy solutions into their offerings.

3. Challenges

Since its launch in 2012, Powering Agriculture has developed into a dynamic partnership characterized by a number of concrete activities currently in the design and implementation phase. Under the Grand Challenge model, each partner is encouraged to implement program elements aligned with their institutional strengths. During this past year, this vision began to take shape with Sida assuming a leadership role on the financing facility, BMZ focusing on a number of knowledge management activities and designing a Public Private Partnership program component, and USAID implementing the technology and business model innovation component. A dynamic partnership such as Powering Agriculture will inherently face challenges in coordinating activities amongst partners and conforming to the unique implementation modalities of each of the partner organizations. Frequent email correspondence and periodic partner meetings have proven to be an effective, but time consuming means of coordination to date and we must continue to explore options to maximize information sharing while minimizing partner effort. The pending launch of WebMo should help to facilitate communication by providing a one-stop shop for up-to-date awardee performance and financial information and other program documents. More frequent teleconference between all partners would also be an effective means to streamline information sharing in the coming year.

Implementation of the Powering Agriculture awards has proceeded as expected. Early stage innovation projects are inherently risky and the awardees have demonstrated the entire spectrum of exceeding and underperforming expectations as detailed in section two. USAID is committed to maximizing the potential of each awardee through ancillary support and we continue to work to identify the most effective and efficient way to deliver such diverse services. We have also worked with awardees to modify agreements to align with unforeseen opportunities or challenges. USAID will not hesitate to terminating projects that no longer show promise for success, such as the award to Experience International. Failure is part of the innovation process and USAID and the partners should not hesitate to identify and learn from both successful and unsuccessful endeavors throughout the Grand Challenge Program.

4. Looking Forward

Powering Agriculture plans to implement the following activities over the next financial year of October 2014 to September 2015.

- Global Innovation Call Round 2: Powering Agriculture expects to issue a second global innovation call for proposals of clean energy solutions that can increase agricultural productivity and value. The solicitation will be released in November 2014 with the selection of the winners and the awards issued in September 2015.
- Private-Public Partnerships Facility (BMZ)
- Global Lift Financing Facility (Sida)