Powering Agriculture: An Energy Grand Challenge for Development Mid-Term Innovators' Assessment

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Acronyms / Abbreviations

Acronyms	Definition
AFDB	African Development Bank
AOR	Agreement Officer's Representative
BAA	Broad Agency Announcement
BMZ	Bundesministerium Für Wirtschaftliche Zusammenarbeit (German Federal Ministry for Economic Development Cooperation)
CES	Clean Energy Solution
COP	Chief of Party
DARPA	The Defense Advanced Research Projects Agency
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
M&E	Monitoring and Evaluation
NGO	Non-governmental organization
O&M	Operation & Maintenance
PAEGC	The Powering Agriculture: An Energy Grand Challenge for Development
PASTO	Powering Agriculture Support Task Order
PAX	Powering Agriculture Xcelerator
R&D	Research and Development
SIDA	Swedish International Development Cooperation Agency
UGARF	University of Georgia Research Foundation
USAID	United States Agency for International Development
VIP	Village Industrial Power

1. Introduction and Background

This assessment has been conducted over December 2015 to May 2016 under the Powering Agriculture Support Task Order (PASTO). PASTO is funded by United States Agency of International Development (USAID) and implemented by Tetra Tech ES, Inc. PASTO provides support services to the Powering Agriculture: An Energy Grand Challenge for Development (PAEGC) and its Founding Partners to enable their effective management, monitoring and evaluation of the program. The views expressed in this information product are those of the authors [1] and do not necessarily reflect the views or policies of the PAEGC Founding Partners.

The Powering Agriculture: An Energy Grand Challenge for Development is a partnership between United States Agency for International Development, the Government of Sweden, the Government of Germany, Duke Energy Corporation and the Overseas Private Investment Corporation (the Founding Partners). The goal of PAEGC is to support new and sustainable approaches to accelerate the development and deployment of clean energy solutions [2] for increasing agriculture production and/or value in developing countries.

PAEGC utilizes the financial and technical resources of its Founding Partners to support organizations' implementation of clean energy technologies and business models that:

i. Enhance agricultural yields/productivity;

ii. Decrease post-harvest loss;

ii. Improve farmer and agribusiness income generating opportunities and revenues; and/or

iv. Increase energy efficiency and associated savings within the operations of farms and agribusinesses - while stimulating low carbon economic growth within the agriculture sector of developing countries and emerging regions.

Powering Agriculture has selected 12 innovators[3] and 13 innovators during its first and second global innovation call for proposals that took place in 2013 and 2015 respectively.

PAEGC conducts monitoring and evaluation (M&E) activities at the following three levels detailed in the program's Monitoring and Evaluation Plan.

- Meta-level - to measure and evaluate PAEGC's contributions to the overarching Grand Challenges for Development Goal
- Program-level - to measure and evaluate the aggregated contributions of PAEGC's interventions in achieving the program's goal. This is also referred to as the GCD-level

[1] The assessment has been written by the following PASTO personnel: Daria Mashnik -Renewable Energy Specialist, Ron Ivey- M&E Specialist and Jeannelle Blanchard- Chief of Party with inputs from other PASTO team members.

[2] In the PAEGC context, 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 a business model that addresses the clean energy demands of a select market.

[3] One award was cancelled in early 2014.

- Innovator-level - to measure and evaluate the progress and impact of PAEGC's individual innovators, and individual contributions to achieving the PAEGC goal

While the M&E Plan stated that PAEGC would undergo a mid-term performance evaluation, the Partners agreed to move forward on an effort that would be divided into two parts: (1) an assessment of the 2013 innovators to determine their progress to date to be conducted by PASTO and (2) an externa program-level evaluation incorporating the innovator-level assessment to be conducted by SYSPONS GmbH –contracted by PAEGC Partner–GIZ. The report's findings, conclusions and recommendations will enable the PAEGC Partners to make any necessary mid-course adjustments to improve the effectiveness of the PAEGC program and to accelerate the development and deployment of clean energy solutions of PAEGC's innovators.

This document describes the results of the mid-term performance assessment of the innovators selected and funded as a result of PAEGC first global innovation call in 2013.

Table 1: Winners of the First Global Innovation Call

	Innovator	Project Name	Country of Implementation	Award Value
1	African Bamboo	Biomass-Powered Thermal Processing of Bamboo	Ethiopia	$1,041,145
2	CAMCO	Building Markets for Efficient Biomass Power Provision	Benin, Tanzania	$999,805
3	The Earth Institute at Columbia University	Micro-Solar Utilities for Small-Scale Irrigation	Senegal	$1,082,161
4	EarthSpark International	Smart Grid on Main Street: Electricity and Value-added Processing for Agricultural Goods	Haiti	$1,091,315
5	ECO Consult	A Hydroponic Green Farming Initiative	Jordan	$1,149,707
6	iDE	Solar-Powered Pumps for Improved Irrigation	Honduras, Nepal, Zambia	$1,499,831
7	Motivo Engineering	Hybrid Vehicle with Exportable Power for Community-Based Agriculture Mechanization	India	$861,158
8	Promethean Power Systems	Reducing Milk Spoilage Through Solar-Powered Chilling	India	$992,980
9	Rebound Technologies	SunChill: Solar Cooling for Horticultural Preservation	Mozambique	$1,1375,853
10	SunDanzer	Solar-Powered Refrigeration for Dairy Farms	Kenya	$1,041,145
11	University of Georgia Research Foundation	Biogas-Powered Evaporative Cooling for the Dairy Industry	Uganda	$1,000,000
12	Experience International[4]	Solar-Powered Cold Storage and Ice Making Facilities for Fishing Communities in Eastern Indonesia	Indonesia	$1,000,000

[4] This award was cancelled.

The assessment is organized to generate insights on PAEGC from the viewpoint of the innovator by asking the following questions:

A. How well did PAEGC execute the procurement and award process?
B. How well did PAEGC manage the awards?
C. What are the impacts of the funded projects to date, including impact on farmers' agricultural production, gender impacts and climate change mitigation?
D. What is the likelihood of scalability and commercialization of the selected innovations?

The document presents findings, conclusions and recommendations for each of these questions and ends with final observations and recommendations. It also contains four appendices that include the mid-term evaluation scope of work (appendix A), a summary of the performance indicator data (appendix B) and the raw survey data (appendix C).

2. Assessment Methodology

This assessment was carried out through the following methods:

- Administration of a survey via the phone/ web conference addressing the four main assessment questions (see Appendix A)
- Data collection through check-in virtual meetings with the 2013 innovators
- Document review of award documentation, milestones, deliverables and progress reports
- Data verification and stakeholder interviews during project site visits
- Analysis of reported performance indicator data

The PASTO M&E Specialist and Renewable Energy Specialist conducted calls via web conference or telephone with the 2013 innovators from December 2015 to May 2016 during which

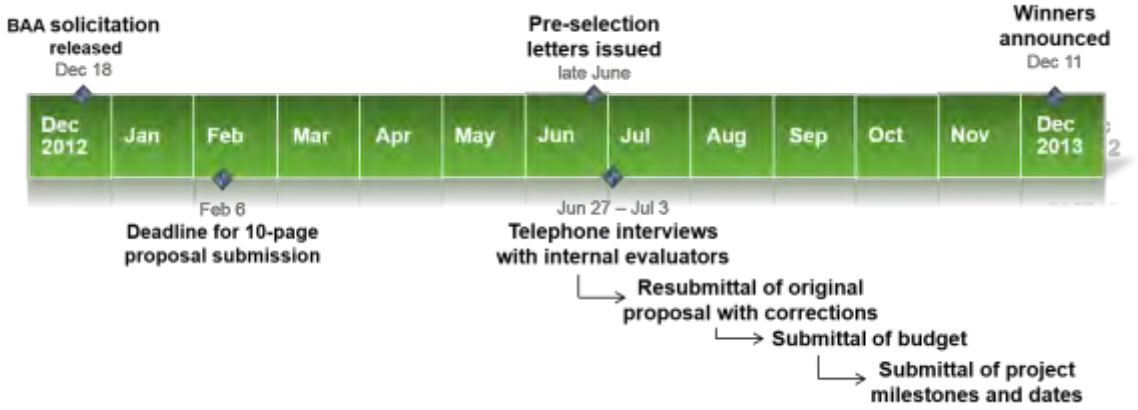
- The innovators were asked to provide a description of their technology and an update of progress to date.
- The survey was administered. Innovators were informed that their responses to questions on the procurement and award process and the award management process would not be attributable to individual innovators in order to encourage a frank discussion.
- Each performance indicator and the corresponding data submitted by the innovator was reviewed.

The calls ranged from one to three hours, and in some cases, one to two follow-up calls were required for the performance indicator data review. Subsequently, the quantifiable responses were tabulated and all other comments that resulted from asking specific questions were collated, sorted and analyzed. Not every question asked proved to be useful and only those with relevant insights were included in the findings.

3. The Procurement and Award Process

Powering Agriculture launched its first global innovation call on December 18, 2012 by issuing a Broad Agency Announcement (BAA). The call resulted in the submission of 473 proposal summaries from applicants representing 76 countries. There were a series of evaluative steps, portrayed in Figure 1 below and in December 2013, 12 winners were selected and announced. The procurement and award process lasted twelve months with the timeline illustrated below.

Figure 1: Global Innovation Call Round 1 Timeline and Process



The review process consisted of two stages as outlined below. Only those proposals that passed the Innovation Screening and satisfied the eligibility requirements had their Technical Solution Narratives evaluated.

Stage One:

- Innovation Screening: was based on the submission of responses to the following two questions:

  Question One: To what extent does the proposed solution accelerate the development and deployment of clean energy solutions for increasing agriculture productivity and/or value in low and middle income development countries?

  Questions Two: How is the proposed solution different from currently available technologies and/or practices in the proposed area of need(s) to qualify as innovative?

- Technical Solution Evaluation: evaluation of proposals undertaken by a panel of internal evaluators

Stage Two:

- Past Performance Review: the evaluation of feedback received from references provided by the applicants
- Cost Review: review of proposed budget

All evaluation criteria were weighted equally with the exception of the *Innovation Screening* which was counted as double the value of the other three individual criteria. The PAEGC BAA defined innovation as *"the extent to which the proposed solution demonstrated an unconventional and/or creative approach to applying clean energy technology to enhance agricultural productivity and/or*

value, in a manner that clearly differentiates from alternative approaches and remarkably improves upon existing practices in the target area of operation".

3.1 Call for Proposals Process

As part of the assessment, the 2013 cohort of innovators was asked a series of survey questions regarding how well PAEGC executed the procurement and award process and if the process was straightforward and logical.

The responses below demonstrate that majority of the innovators rated the call for proposals as quite good (4) or excellent (5) and found the process logical. Three of the 10 innovators[5] complimented the PAEGC process mechanics in comparison to other awards that they have applied to in the past. The positive and negative feedback on the procurement and award process is highlighted below. The raw responses to the questionnaire collected during the phone interviews are included in Appendix C of this report.

Figure 2: Rating of Call of Proposals

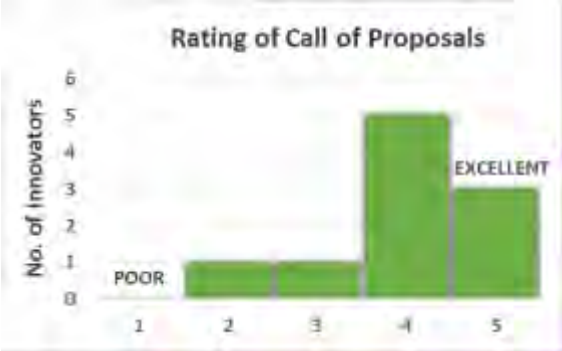
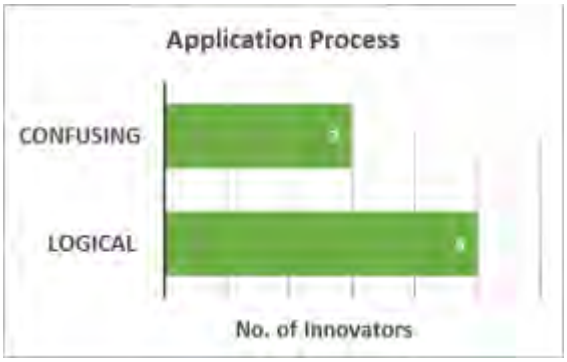


Figure 3: Application Process



Process shortcomings:

- Lack of clarity on key stages of the process and timeline
- Lack of communication and feedback during the application process
- Confusion during the final stages as to whether the innovator has been selected by PAEGC or not
- Slow procurement and award process and long waiting time until final announcement

Process strengths:

- A collaborative and partner-like approach, rather than being bureaucratic and overly rigid
- One of the best application processes in the experience of a few innovators

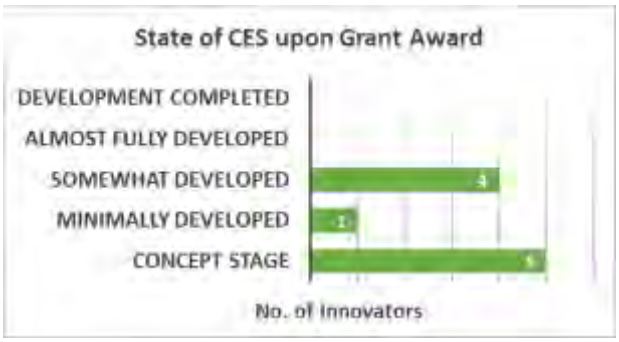
For many of the innovators the lack of communication and clarity on key stages of the process left them uncertain about where they were in the process at any point in time. Three of the 8 innovators noted the 12 month waiting time between the call and the announcement of the finalists was too long, particularly in the case of start-up organizations that have limited cash flow.

[5] The interviews were conducted with 10 innovators and one sub-awardee who was the actual technology developer and was the one interacting with the AOR, PASTO.

One of the innovators recommended a two-stage application process where the applicants submit a short expression of interest during the initial stage and a full application during the subsequent stage to reduce innovator's upfront time commitment.

3.2 Selection Criteria

Figure 4: State of CES upon Grant Award



During the first global call the PAEGC Partners funded innovators at different stages of the innovation process, with the primary focus on early stages of research and development (R&D) and projects that are difficult to finance commercially. Half of the funded clean energy technologies were in the concept stage upon issuance of the awards, as seen from the innovators' self-assessment shown on the right. Nine of the ten innovators defined their technologies as "high risk; high-reward" explaining that if their technology proved scalable and commercializable, their CES would deliver energy in pioneering and life-changing ways to many end-users in emerging markets.

Some of the innovators were unfamiliar with the selection criteria in the BAA, a few thought it was vague, and others thought it was well defined and suited their CES very well. One of the innovators was thankful that private investor investment was not a selection criterion in the call for proposals which enabled them to apply as an NGO with no private sector investment.

The principal recommendation from the innovators on selection criteria to improve the procurement process was to introduce more stage-specific selection criteria and requirements that would differentiate between the early stage of R&D innovators and those who have already demonstrated technical feasibility and/or market acceptance. This is in recognition that at different stages of development, prospective applicants' proposed solutions will have different levels of risk, technical and financial requirements, and data on which to base their potential for impact and scale.

3.3 Conclusions and Recommendations on Procurement and Award Process

The PAEGC award and procurement process of the first global innovation call that took place from December 2012 through December 2013 was assessed as "quite good" and "excellent" by the 2013 cohort of the innovators, 62% of whom found the process logical. The feedback received during the phone interviews varied greatly based on the individual innovator's previous experience with other award programs.

Most of the process shortcomings referred to in Sections 3.1 and 3.2 above were addressed by PAEGC in its second global call for innovation launched in November 2014. Based on the lessons learned from the first global innovation call, the Partners made some changes to the selection process, criteria and requirements, namely:

- Released the BAA with more detailed and more explicit description of the applicant selection process and timeline

- Simplified the first stage of the application process by requiring the submission of a 600-word concept note that succinctly described the CES and why it is appropriate for PAEGC funding
- Included external international experts, such as renewable energy technology-specific experts and members of in-country USAID, SIDA and GIZ missions and field offices, to evaluate the technological and contextual aspects of proposal submissions
- Reduced the procurement and award process from 12 months to 10 months
- Divided the available funding into the following two windows, reflecting that the financial and non-financial needs of prospective applications vary greatly according to the current state of development of their CES.

Table 2: Funding Windows in PAEGC Second Global Innovation Call

Funding Window	Award Value	Cost-Share
Window 1: Clean Energy Solution - Design	Up to $500,000	Up to 15% of award value
Window 2: Clean Energy Solution Scaling Up/Commercial Growth	$500,000 - $2,000,000	35% of award value (required)

One key finding from the interviews with the innovators was the critical importance of an operational local presence in the country/ies in which the innovators work for them to succeed. This was further confirmed during site visits. Rebound Technologies, one of the earliest R&D stage innovators and the highest 2013 recipient of funding, identified their lack of in-country partnerships and local expertise to take their CES from the lab to the target market as the main reason the organization has started to actively explore its CES as an "open-source" technology and allow other players to scale the technology[6].

Local presence is vital for establishing the ownership, operation and maintenance (O&M) mechanisms for the in-country installations as well as for building local private partnerships to enable scaling up and commercialization of the technologies. The BAA included "local presence" as one of the required features of all applicants' CES.

Other recommendations that could be implemented in future call for proposals are

1. Introduce more stage-specific selection criteria and requirements that would differentiate between early stage of R&D innovators and those who have already demonstrated technical feasibility and/or market acceptance.

2. Further streamline the applicant selection process and to reduce the duration to no more than six months.

[6] In this context Rebound Technology may make the technical design specifications of the CES freely available to the public. They may also never commercialize the CES.

4. The Award Management Process

4.1 Effectiveness of the AORs

Each PAEGC innovator was assigned an Agreement Officer's Representative (AOR), who is a full-time development professional working at USAID is its Energy and Infrastructure Office within its Bureau for Economic Growth, Education and Environment. In many cases, the AORs were changed repeatedly based on personnel decisions within USAID. Out of the 10 innovators interviewed, 5 had AOR changes—2 permanent and 3 temporary. The survey questions measured the quality of the relationship between each innovator and their respective AOR.

Figure 5: Rating of AOR Services

The innovators rated three of the AORs towards the high end of the five-point scale, and two scored towards the middle to low end, as illustrated above. This results in an average rating of 4.0 out of 5 for AOR services. It is possible that the AOR ratings may have an upward bias given that these responses would be reviewed by the AORs. An attempt to mitigate that bias was made by informing the innovators that their responses would be not be attributable to individual innovators.

The feedback on the capabilities of specific AORs ranged from unfavorable to very positive. Several of the AORs were described as responsive and proactive, non-bureaucratic and helpful with milestone revisions and handling of issues. The recurring negative feedback was on the lack of feedback or slow responsiveness to questions or requests for approval of documents submitted, primarily projects' award revisions requests. Seven out of 10 interviewed innovators have had their award agreements modified at least once since their award's inceptions including a revision of milestones, deliverables and/or targets. This explains why the lack of responsiveness in the review process was the most common criticism. There were also delays in the approval of milestones which affected disbursement of funds and impacted small organizations especially given their limited cash flow needed to pay for equipment, materials and labor. One of the innovators indicated that have had a pending milestone revision since June 2015, lasting more than 10 months as of April 2016. Conversely, several of the AORs were described as responsive and proactive, non-bureaucratic and helpful with milestone revisions and handling project issues.

Three innovators also discussed the importance of the AOR to critically review milestones, question the viability of certain aspects, provide in-depth technical feedback and identify essential milestones for inclusion in award tables such as a subcontract agreement between an innovator and its sub-awardee. One AOR was identified as adding beneficial value in examining and questioning one innovator's technical approach.

The innovators also indicated that they would have liked more support from AORs in the following areas:

- Leverage of local USAID Missions, SIDA and GIZ field offices
- Assistance with identifying local partners

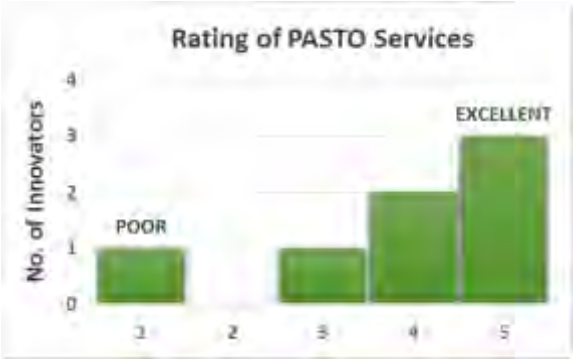
- Assistance with securing additional funding
- Assistance with additional deployment opportunities and product commercialization

When asked if any of the PAEGC Partners used their in-country presence to help the innovators, only 1 out of 10 innovators answered positively, referencing the local USAID Mission's assistance with customs clearance for equipment.

4.2 Effectiveness of PASTO

The innovators rated their experience with PASTO and identified which of its services they have utilized to date. A majority of the innovators scored PASTO as excellent (5) and quite good (4), as shown in the graph to the right, with an average score of 3.9 out of 5. It is possible that this rating may have an upward bias given that PASTO asked respondents about its own activities.

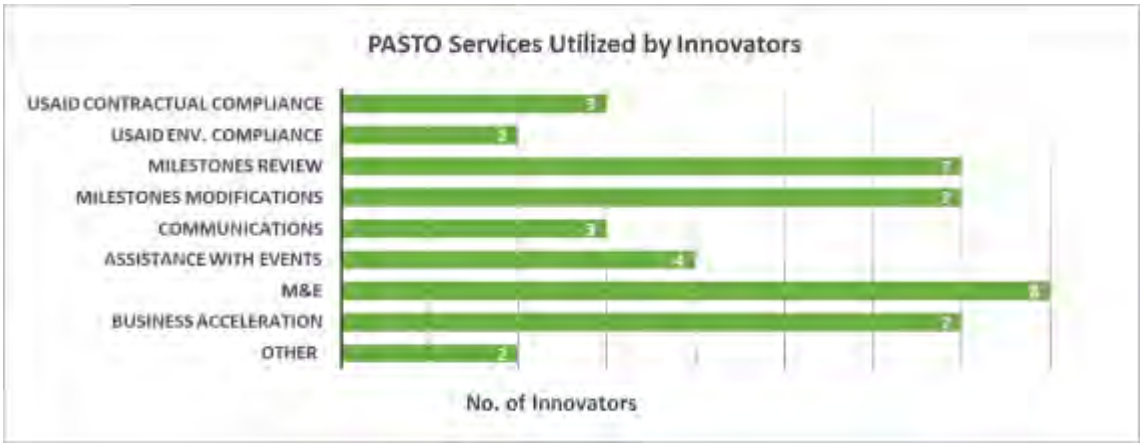
Figure 6: Rating of PASTO Services



The sole innovator who scored PASTO as "poor" explained that until October-November 2015 their relationship with PASTO had been non-existent. Two innovators noted that their interaction with the former PASTO Chief of Party (COP) were neither helpful nor productive and subsequently discouraged them from approaching PASTO. PASTO changed its COP in May 2015.

The services provided by PASTO that were utilized by the innovators were as follows:

Figure 7: PASTO Services Utilized by Innovators



During the phone interviews, several of the innovators expressed a lack of knowledge of PASTO's services prior to Powering Agriculture Xcelerator (PAX) workshop which took place in November 2015. A few innovators wished they had made more use of PASTO services and one innovator wanted a clearer distinction between the role of the AOR and PASTO.

While the innovators utilized PASTO to address M&E, project milestone and business acceleration questions, many innovators emphasized the usefulness and importance of business

acceleration support, in particular as a means to assist with scale-up and commercialization of their solutions. The innovators indicated that inclusion of these services from the initiation of the awards would have been most useful. This is the case with the 2015 cohort of innovators where PASTO has been involved from the start.

4.3 Effectiveness of WebMo

Figure 8: Is WebMo Useful?

WebMo is the Powering Agriculture online monitoring platform which enables the innovators to input their M&E performance indicator data and upload deliverables, reports and information substantiating completion of their respective milestones. Concurrently, it allows PAEGC Partners and PASTO to monitor the progress of the innovators. All innovators indicated that they had used WebMo. However, the innovators were evenly split regarding the web-based platform's usability. The responses varied depending on the individual innovator's level of usage and the innovators who had used WebMo the most were the ones who reported more feedback.

<u>WebMo shortcomings:</u>

- Not intuitive and confusing to use
- Controls are small and some fields, like the disaggregates, are easy to miss.
- Difficulty with registration

<u>WebMo strengths:</u>

- Provides document backup
- Central place for all data and documents
- Straightforward and intuitive to use

One of the innovators suggested that WebMo should be enabled in a way that would allow innovators to look at each other's data. Another innovator recommended National Science Foundation's online website, FastLane, as a better alternative to the WebMo.

4.4 Conclusions and Recommendations on Award Management

PAEGC's management of the awards of the 2013 innovator cohort was mixed, but there were some common threads in most of innovators' responses.

1. Despite the award administrative requirements placed upon the innovators by PAEGC, none of the innovators expressed that these requirements were unnecessary or that they hindered project implementation. Some of the innovators indicated that even though PAEGC was promoted as less of a traditional development model, the award requirements still followed the standard USAID award requirements that are inherently bureaucratic.

2. One of the shared opinions among the innovators is the wish for additional programmatic support to help scale up and commercialize their innovative CES. While PAEGC is seen as a good seeding mechanism that encourages ground-breaking clean energy developments in the agricultural arena, it did not provide clear and systematic guidance for the innovators on how to get from one development stage to the next. This supports the utility of the Powering Agriculture Xcelerator and the need for the launch of the financing facility that was originally envisioned under the commercial financing component of PAEGC. The utility of PAX was underscored by some of innovators who would have liked it in place at the start of their award since some of the 2013 cohort awards will end this year.

3. Many innovators highlighted the wish to ultimately be connected to local USAID Missions, SIDA and GIZ field offices. While many CES are too early-stage to reach a large number of beneficiaries, these connections can help link the innovators to key potential local partners and stakeholders who can assist in disseminating and financing the technologies. The Missions and field offices can also provide an understanding of the local development context that some of the innovators lack.

4. The responsiveness of the AORs on milestone approval and award modification requests was a major issue and was further compounded by the fact that many of the innovators had never worked with USAID regulations and that the original award documents were poorly structured and not consistently written. In PASTO's experience assisting with milestone reviews and award modifications, the milestones a) were not in a logical order based on activities to be implemented in the field, so the innovators completed milestones out of order, and that complicated their payments and b) were not as significant as the money associated with their completion, which resulted in overpayment by PAEGC for the level of effort and impact. This was further confirmed during the milestone review site visits, when the innovators indicated that they were unclear as to how to develop their milestone table and even what some of the milestones in their agreement meant.

Some of the findings and conclusions above have been addressed for the 2015 cohort of innovators by actions that PAEGC has already taken, namely 1) having just 1 AOR for all 13 innovators, who can identify recurring issues, 2) having PASTO more involved in the development of the milestone tables in the original award agreement, 3) introducing PASTO and its services (including PAX) to the innovators from the beginning of the award and 4) the creation of an award modification guide and template as well as other contractual guidance.

The following are additional recommendations to improve the management of the awards;

- Improve the continuity of the AOR by having a formal handover meeting with the innovator, and the old and new AORs to ensure consistency
- Ensure AORs respond to innovators' questions, approve milestones, deliverables and award modifications in a timely manner, and perform more of a validity check on milestones rather than a compliance sign-off
- Link the innovators from the beginning of award to local USAID Missions, SIDA and GIZ field offices to help the innovators with identifying local partners, additional deployment opportunities and financing mechanisms.
- Continue to utilize PASTO to provide assistance to the innovators

- Conduct a survey of innovators on items that could make WebMo more intuitive, user-friendly and encouraging for the innovator's continued use.
- Allow the 2013 cohort, whose awards have ended in 2016, to continue to access PAX services for at least one year.

5. Innovators' Progress and Impact

This chapter outlines the primary findings from the assessment questions that focused on progress and impact since the inception of PAEGC. It also presents data on each innovators' current status that PASTO systematically gathered information during eight project site visits conducted over November 2015 to May 2016.

5.1 Progress of Innovators

The current status of each innovator funded in 2013 is summarized in the table below. It shows that six out of nine innovators interviewed and/or visited have conducted field testing of their technologies. One of them, University of Georgia Research Foundation (UGA), just started the field testing process in March 2016. Motivo Engineering plans to start the process in late 2016 due to a six to eight month customs delay.

The awards of two innovators ended in the spring of 2016: Earth Institute at Columbia University and Rebound Technologies. The latter never fully completed the development or field testing of its prototype, and is in the process of exploring its CES as an open-source technology in order to allow other innovators to complete testing and to scale the technology.

One innovator, CAMCO, has stalled in its implementation efforts due to lack of agreement with its sub-awardee. However, their sub-awardee and the developer of the CES, Village Industrial Power (VIP), is continuing to do field testing of a third generation of units on their own.

EarthSpark International, has been field testing its solar powered micro-grid to provide electricity access to residential customers. While the innovator's agricultural activities were identified from the beginning, the organization has just recently started to pilot and evaluate their appropriateness, profitability and effectiveness.

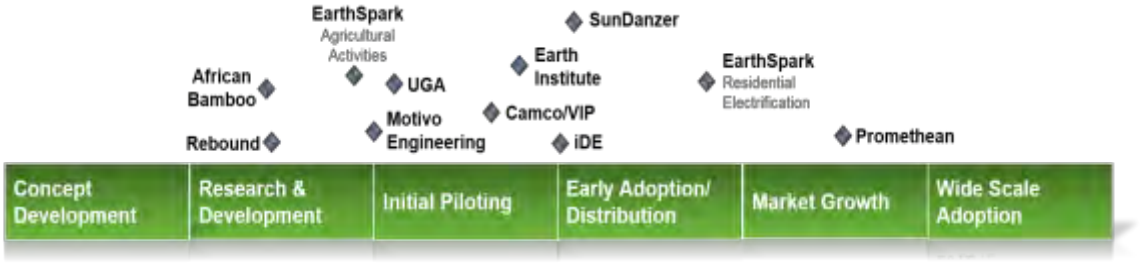
One innovator out of the 2013 cohort, Promethean Power Systems, has reached commercialization of their CES with sale of more than 162 units. However, this success is not in line with the original proposal for the PAEGC award. Originally the CES units outlined in the proposal were solar powered, however due to changes described in more detail in this chapter, the units installed are instead energy efficient due to their innovative cooling design and only 6 out of 162 units have a solar component. Earth Institute and EarthSpark also have paying customers as they charge tariffs per hour of pumping and per kWh of electricity, respectively; however, the tariffs are not cost-reflective.

Table 3: Implementation Status of the 2013 Innovator Cohort

	Innovator	Project Name	Country	Implementation Status
1	African Bamboo	Biomass-Powered Thermal Processing of Bamboo	Ethiopia	Testing production process on bamboo in Germany and Italy.
2	CAMCO	Building Markets for Efficient Biomass Power Provision	Benin, Tanzania	Implementation has stalled; VIP, sub-awardee and CES developer, continues with field testing outside of PAEGC.
3	The Earth Institute at Columbia U.	Micro-Solar Utilities for Small-Scale Irrigation	Senegal	Award finished; completed a long period of field testing.
4	EarthSpark International	Smart Grid on Main Street: Electricity and Value-added Processing for Agricultural Goods	Haiti	Field testing the residential micro-grid; just starting to evaluate and test agricultural applications.
5	ECO Consult	A Hydroponic Green Farming Initiative	Jordan	Not Interviewed as administered by USAID Jordan.
6	iDE	Solar-Powered Pumps for Improved Irrigation	Honduras, Nepal, Zambia	Completed a long period field testing; transitioning to scale up
7	Motivo Engineering	Hybrid Vehicle with Exportable Power for Community-Based Agriculture Mechanization	India	Just shipped two test unit; will start field testing in later 2016.
8	Promethean Power Systems	Reducing Milk Spoilage Through Solar-Powered Chilling	India	Over 160 units sold; ramping up sales of units.
9	Rebound Technologies	SunChill: Solar Cooling for Horticultural Preservation	Mozambique	Award finished; prototype and field testing incomplete.
10	SunDanzer	Solar-Powered Refrigeration for Dairy Farms	Kenya	Completed a year of field testing; transitioning to scale up
11	U. of Georgia Research Foundation	Biogas-Powered Evaporative Cooling for the Dairy Industry	Uganda	Started field testing at in March with two units.

To summarize the status of the innovators' progress, the figure below categorizes them along the innovation timeline.

Figure 9: 2013 Innovators and Their Innovation Stages as of Spring 2016



5.2 Benefits and Drawbacks of Funded Technologies

Each innovator provided feedback concerning the advantages and potential drawbacks of their CES, which are summarized individually below. One of the recurring issues referenced by the innovators was the need for a certain level of technical competence for the operation of their units and the need for more thorough training for the operators. One of the innovators noted that they should have selected a different country as the point of entry for their technology due to the lack of technical capacity and personnel capable of operating and maintaining the prototype units.

Four out of 10 innovators, Earth Institute at Columbia University, iDE, Promethean Power Systems and SunDanzer stated that their technologies save beneficiaries money based on the their field testing activities to date. In most cases, the innovators needed to collect more in-field data to quantify the savings.

Promethean Power Systems and SunDanzer said that their field testing demonstrated an increase in agricultural production and improved agricultural quality, which were attributable to the CES. Earth Institute reported improvements in produce quality due to the reduction of diesel fumes from conventionally used diesel pumps. However, the quality improvements have not contributed to farmers' increased revenue because the vegetable prices are not quality-based but set by the market.

Two of the innovators reported that their technologies resulted in time savings for the beneficiaries: Earth Institute and Promethean Power Systems. Earth Institute's pilot units saved on irrigation time, particularly for those farmers who irrigated their land manually prior to project implementation. Promethean Power Systems' milk chilling technology significantly decreased the time travelled by dairy farmers to reach the nearest collection center with milk cooling capabilities.

The individual innovator responses highlighting the benefits and drawbacks of their respective technologies are as follows. More innovator-specific information on their progress is offered in Table 7.

Table 4: Benefits and Drawbacks of First Call Technologies Funded Under PAEGC

Innovator	Benefits	Drawbacks
African Bamboo	"Our bamboo production process reduced the energy consumption considerably in comparison to the traditional process carried out in China."	none reported
The Earth Institute at Columbia University	"We have developed a shared system with no battery storage, which results in a higher utilization rate of solar panels. The shared photovoltaic (PV) systems removes the burden of upfront costs with the farmers making small payments to access the pump water every day."	"The large system requires an operator who needs to be trained and paid, which adds to the operating costs, plus the size of the system has become an issue."
EarthSpark International	"Homes in the community have electricity and save about 6.5% of their income by not using candles and kerosene for lighting."	"Despite low consumer prices ($1 to $2 per month), 100% adoption by all residents has proved difficult."
iDE	"The ease of use is a clear advantage,	"The pump is heavy and we're

Innovator	Benefits	Drawbacks
	as the design is based on a treadle pump, cutting reliance on fuel and energy. This pump can be used with shallow water levels. Also, it eliminates the bus rides to obtain fuel. Agricultural production is not changing, but the advantage is that little by little the farmers are replacing their diesel pumps".	working on reducing the weight, therefore increasing the mobility of the unit and decreasing the cost in the process. Another drawback is that the pump moves a much lower volume of water than a diesel powered pump. Also, it takes a while for the farmers to adopt the technology and be okay with relying solely on solar power."
Motivo Engineering	"Operational units are projected to save money over conventional fossil fuels."	none reported
Promethean Power Systems	"The milk cooler is resulting in sales increases for milk farmers. The farmers are also not carrying milk to market, allowing more time for agricultural production. The CES is reducing diesel consumption which would be powering the pumps moving the milk from the collection center to the tanker."	none reported
Rebound Technologies	"When the innovation is completed, we will be able to improve the quality of produce through cooling. We estimate that this technology will reduce the energy costs to 1/10th as compared to a diesel or grid-powered cool storage unit. All materials can be sourced locally."	none reported
SunDanzer	"The ability of the dairy farmer to market 10 to 40 liters of evening milk to a processor can raise the family income substantially and result in the payback of the purchase price in less than one year."	"The array needs to be grounded to protect the unit from lightning strikes."
U. of Georgia Research Foundation	"Milk cooler concept fits well into the farmers' ecosystem".	"The CES users require training to operate the technology".

All of the clean energy solutions, with the exception of one, contribute to reducing greenhouse gas (GHG) emissions and mitigating climate change. Six clean energy technologies are replacing diesel consumption, which would otherwise be used to pump water, generate electricity or fuel tractors. UGARF's technology reduces methane emissions which have a 25 times greater negative impact on climate change than carbon dioxide (CO_2)[7]. EarthSpark International reduces emissions associated with burning kerosene and charcoal. SunDanzer is the sole innovator with a project that does not reduce fossil fuel use because no diesel powered milk coolers are used by individual farmers in Kenya. The innovators working on solar-powered irrigation solutions explained that the complete transition from diesel pumps to solar pumps sometimes takes a long

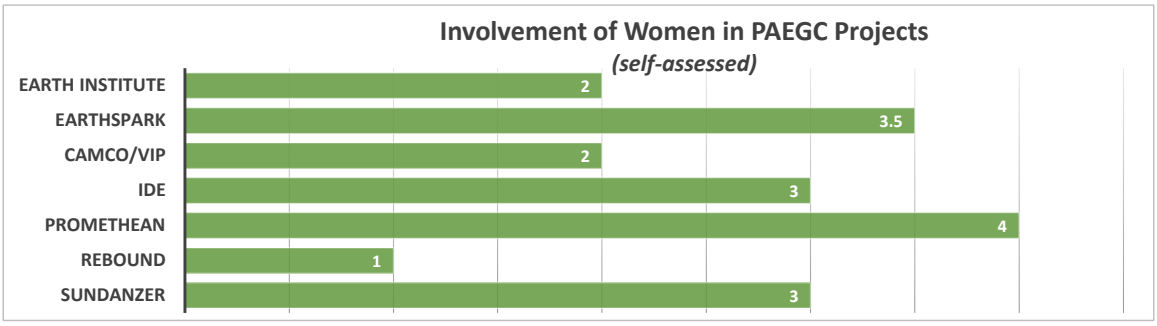
[7] EPA (2010). Methane and Nitrous Oxide Emissions from Natural Sources.

time for many farmers. This was confirmed by PASTO during project site visits where some farmers continued using their diesel pumps as a back-up. Therefore, this results in the reduction of GHG emissions associated with these pumping solutions from being fully realized at this time.

5.3 Impact on Gender

The graph below illustrates how the 2013 innovators rated their level of women's involvement and promotion of gender equity in their projects. The innovators who had not started their field testing at the time of the interviews were excluded from this question due to lack of input on the subject[8]. The scoring ranged from 1 (poor) to quite good (4), with an average of 2.6 out of 5. None of the innovators were collecting any additional gender-related impact data in addition to the disaggregates of the required PAEGC performance indicators; however, many welcomed suggestions from PASTO. There was a clear increase in innovators' awareness on the importance of gender inclusivity since the Powering Agriculture Innovator Showcase in November 2015, however, many did not know how to actually integrate gender inclusion activities into their ongoing in-country field testing.

Figure 10: Involvement of Women in PAEGC Projects



While the degree to which women are involved in PAEGC projects was rated "poor" during the phone interviews, the project site visits revealed many examples of women directly benefitting from the CES installations in the communities. Several innovators including Earth Institute, iDE and EarthSpark are working with female cooperatives or other unofficial, women-led groups as their direct beneficiaries. Earth Institute has agreed to provide a loan to the women's collective to cover the initial capital investment for cultivating land and to make use of their available solar pump. EarthSpark has trained 8 out of 3000 women in a cooperative with whom they are partnering, Association of Women of Les Anglais, on the use of the electric corn thresher and breadfruit fryer as pilots for productive uses of electricity that their mini-grid is providing. Another direct benefit, mentioned among EarthSpark's mini-grid users related to women and children, was the greatly improved indoor air quality due to reduction of fumes from kerosene lamps.

SunDanzer is another innovator having a notable impact on female farmers that was observed during PASTO's field visit interviews in February 2016. The women use the additional income from increased milk sales as a result of the CES milk chilling to pay for their children's books and school fees, and to invest in their farms through other means such as purchasing extra cow feed and purchasing additional and higher producing dairy cows. One female beneficiary, who

[8] Africa Bamboo, Motivo Engineering and University of Georgia Research Foundation

operated a male-owned farm, attributed an increase in her salary due to the farmer's additional earnings from the evening milk production.

While traditional cultural roles and gender segregated labor markets limit women's participation in many of PAEGC innovator activities, PASTO observed fluidity in gender roles in some of project site communities visited. As husbands migrate abroad for unskilled labor opportunities, women remain to run the farms and make the essential decisions as the heads of the households. This situation was noted during project site visits to Kenya, Uganda and Nepal where as a result of the additional profits from the CES, the female farmers had savings and spending money apart from what their husbands were bringing in.

Below are innovators' responses to how gender equity was being addressed within their activities:

Table 5: First Call Innovators' Responses on Gender Activities

Innovator	Responses on Gender
African Bamboo	"Our intention is to employ 40% of women in our factory which has a target operation start time of June 2017. Considering the current situation in Ethiopia, where you don't find women employed in the industry, we would give a rating of 4 out 5, once we're operational."
The Earth Institute at Columbia University	"We are working with an existing women's collective and have agreed to provide them a loan to help them purchase the equipment they need to cultivate their shared plot of land. In Senegal women do not own much property and traditional cultural roles limit women's participation"
EarthSpark International	"Fifty-seven percent of the signed contracts by consumers connected to the grid had been done by women. Our mini-grid ambassador in Haiti is a woman."
iDE	"Most of the users of our pumps are heads of the households which are men. There is a group of women, a cooperative that is growing vegetables and irrigates with our pump. In our experience women are better at keeping track of operational information and finances."
Motivo Engineering	"Our technology, a tractor, is gender neutral. At present, as field testing has not been initiated in India, no women have been involved. As the tractor will be used on family farms, it is anticipated that women will benefit from the tractors and we plan to collect data on usage pattern differences by gender to inform the next generation design."
Promethean Power Systems	"Women are involved in all dairy farm activities. However, given the culture and dominance of men, women are difficult to involve and we are hampered because the real interface with the villages is the milk processors. We did have one NGO-run chilling center where all the members were women."
Rebound Technologies	"We coordinated with an NGO to create a little exposure for women, however we only showed them various components of our technology."
SunDanzer	"We did not originally ask for dairy cooperatives with whom we are working to target female farmers. After PASTO's visit in February 2016, we have been giving women participation more emphasis. One third of the dairy farms involved in the field testing is owned by women and one half of the operators of the chillers is women. There is a woman in Kenya key to our field testing effort and we employ a woman as #2 under our general manager in Kenya."
U. of Georgia Research Foundation	"We anticipate half of the beneficiaries to be women. We plan to involve women through the existing women's networks in the communities and use women to demonstrate the CES units to others. We anticipate that women will be using the milk chiller and will become responsible for making the time payments."

5.4 Scalability and Commercialization of Funded Innovators

Out of the ten innovators reviewed in this assessment only one demonstrated commercial viability, that is, having paying customers that are purchasing their CES. However, that one innovator's CES did not align with the original proposal at the time of the PAEGC award. Promethean Power Systems initially envisioned having their milk cooling units charged by a PV solar array for off-grid regions in India, however soon after the start of the award it became apparent that the primarily solar solution was not viable due to the following reasons:

- The large size of the solar array (4kW capacity) needed to power the refrigeration unit, the compressor in particular, makes the siting of the system in the villages difficult.
- The dairy processors purchasing the CES equipment do not benefit from installing the milk collection centers in very remote and off-grid areas due to the large distances to the central chilling centers.
- The high cost of solar PV makes the CES less attractive to invest for the dairy processors.

As a result, the innovator shifted its focus to develop and implement a robust, highly energy efficient grid-powered milk chilling solution (with cooling capacity of 500L to 2,000L) that can be tailored to each customer's projected utilization. The customer can add a 1kW solar array component to power the unit's controls and the pump that transfers milk from the chiller to the truck when grid electricity is unavailable. Demand for this product by processors has been brisk and Promethean is currently producing 25 units to meet an order from a dairy processor. ***[Information here has been removed from the public version as it is considered Sensitive But Unclassified (SBU), and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** In addition to their work in India, they have partnered with Fonterra, the dairy co-operative behind Anchor milk brand, to introduce their milk chilling technology to Sri Lanka. The reason for Promethean's success vis-à-vis the other innovators is that they were already selling units at the start of their PAEGC award and they knew their market and its entry points.

Two other innovators, iDE and SunDanzer, claimed that they too successfully demonstrated the commercial viability of their CES. However, both organizations have provided their CES at no cost, are still engaged in figuring out customer financing and securing additional funding before they can begin actual sales.

Through a set of questions designed to assess the innovators' progress in scaling up or commercialization, the innovators identified the following main steps required to move their CES closer to commercialization:

- Acquiring additional funding to address any remaining field testing, O&M or local training activities
- Development of the CES supply chain
- Identification of best private sector partners, ideally with high market penetration
- Evaluation of potential customer financing mechanisms
- Development of marketing strategies to achieve sale targets

Below are the main obstacles defined by the innovators in achieving commercialization:

- Lack of funding, particularly low-cost capital

- Lack of sales talent needed to market the technologies
- Slow adoption of CES technologies by the farmers
- Inadequate training on new technologies for operators, system users and maintenance professionals
- High customs and duty fees on renewable energy and agriculture equipment imports

In the process of commercialization, the unit cost of the technology and its affordability directly impacts the willingness of farmers and agribusinesses to purchase and use the CES. The table below lists the CES unit retail costs based on innovators' estimates. Two innovators, African Bamboo and EarthSpark International, involve large investments. African's Bamboo's PAEGC award represents less than 1/15th of the total cost of the bamboo flooring producing factory. Other donors have stepped in to support its investment: GIZ at $1.4 million, African Development Bank at $750,000 and Dutch organization at $842,000. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]***

Table 6: Estimated unit costs of clean energy technologies of the 2013 innovators

	Innovator	CES Unit Description	Unit Retail Cost*
1	African Bamboo	Bamboo flooring producing factory, runs on biomass waste;	***[Redacted]***
2	CAMCO	Micro steam combined heat and power (CHP) plant, runs on biomass and bamboo waste;	***[Redacted]***
3	The Earth Institute at Columbia U.	Shared battery-less solar irrigation system, powers seven pumps;	***[Redacted]***
4	EarthSpark International	Solar-powered mini-grid, electrifies households and a few agricultural activities;	***[Redacted]***
5	iDE	Solar powered irrigation pump;	***[Redacted]***
6	Motivo Engineering	Hybrid solar tractor with electricity storage;	***[Redacted]***
7	Promethean Power Systems	Grid-powered energy efficient milk chilling unit with thermal storage (500L – 2,000L in scale); solar PV component available.	***[Redacted]***
8	Rebound Technologies	Solar-thermal cooling horticulture system;	***[Redacted]***
9	SunDanzer	Solar powered refrigeration unit for dairy cooling (farmer scale);	***[Redacted]***
10	U. of Georgia Research Foundation	Biogas powered evaporative cooling unit for dairy farmers.	***[Redacted]***

**estimated by innovators*

All innovators stated they are working on ways to reduce the cost of their CES units by evaluating one or more of the following options:

- Scaling down of the system's size
- Assembling CES locally
- Manufacturing CES components locally

- Using more affordable system components, whether by outsourcing specific parts or using locally sourced materials

Below are summaries of each innovator's progress with scaling up or commercialization of their CES based on phone survey responses and data collected during PASTO's site visits:

Table 7: Progress on Scaling Up and Commercialization

Innovator	Scaling up and commercialization progress
African Bamboo	This innovator is in the middle of testing various production processes in Germany and Italy with local bamboo feedstock to establish a consistent quality bamboo flooring product. There are two individuals working on scalability efforts, and a marketing specialist was just hired to look at potential markets and develop marketing strategies. The African Development Bank (AFDB) is assisting them in developing a more elaborate business plan and a financial model. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** The concept of wholesalers and retailers is inappropriate for this operation, at least at the country level
CAMCO	This innovator's implementation efforts have stalled. However, their sub-awardee and technology developer, VIP, continues implementation on their own. They are continuing the field testing of the four prototypes installed under PAEGC with funding from FactorE, which provides them scaling-up support to initiate commercialization. VIP states that they are ready to sell 15 to 20 units this year and plan to make 75 sales the following year. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** VIP claims to have a business model which has been difficult to implement due to lack of financing. Since it is a new technology and they have no proven record, it has been difficult to attract investors. To secure additional funding they have done a pitch presentation to Shell Foundation in March 2015. The high import duties and taxes on their CES, which adds to an already high capital, has been another challenge.
The Earth Institute at Columbia University	This innovator's main objective was to prove the workability of a shared solar pump system that uses no battery storage, and they have achieved that. However, they are not at a point where they can approach an investor and have a large number of units deployed, but have a good idea on how to get much closer to that. They have not developed a full business model but have looked at the cost of the system and potential payback periods. They are collaborating with one of the rural electrification organizations that is interested in testing their system to irrigate a large banana plantation. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** Their original payment plan included using mobile money, however because the communities have set up a local way to pay for the services and it seems to be working, mobile money is no longer a priority. The organization is currently waiting to hear back from additional funding from the USAID Senegal Mission that would allow them to demonstrate their CES technical viability in another location with different soil conditions.
EarthSpark International	This innovator has not demonstrated commercial viability for their mini-grid but they are charging an electricity tariff to their customers. They are adjusting the business model as they progress along with implementation based on lessons

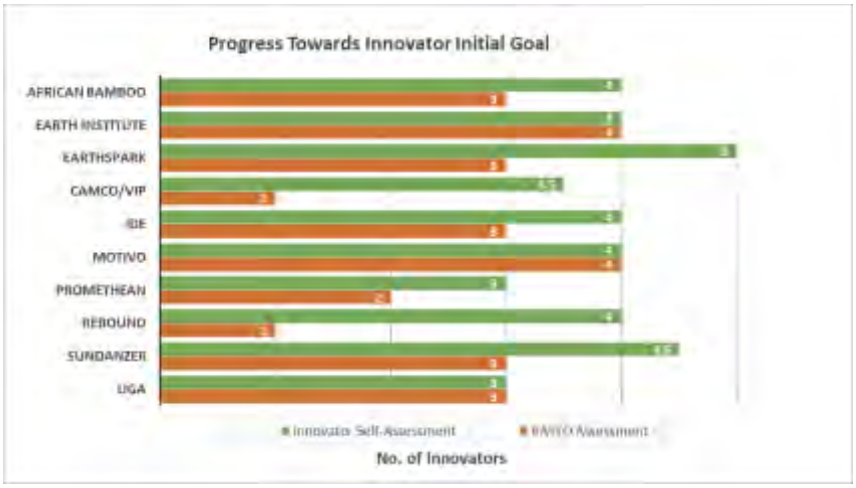
Innovator	Scaling up and commercialization progress
	learned. Their ultimate goal is to have 80 mini-grids, each servicing 500 households, which eventually pay for themselves. They just finished a U.S. Trade and Development Agency funded study where they identified 94 other towns in Haiti with demand for similar mini-grids. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** Two years ago they spoke with the Ministry of Energy Security and Ministry of Public Works about the grid O&M and are presently looking for more local partners. EarthSpark's field testing has allowed their technology partners SparkMeter, a smart meter developer, and Zero Base Energy, a mini-grid developer, to spin off and effectively commercialize their products.
iDE	This NGO had not reached the original scale of targeted installations but has built and developed all the components, partnered with a pump manufacturing company (Futurepump) and identified in-country retailers and distributors. Their field testing has also allowed their technology partner and PAEGC 2015 innovator, Futurepump, to start commercialization. One of the strengths of this organization, validated by the project site visits, is their extensive network of local stakeholders. All of their pilot units have been donated and they are currently working on developing a financial approach. Recently they submitted a challenge to a "Poverty Hackathon" event for people to develop an innovative payment scheme for their CES. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** Their next steps for commercialization include identifying the right private-sector partner and building their capacity to offer the "after-sale service", their most important criteria. They are also looking to secure additional funding.
Motivo Engineering	This organization's innovation is a shareable tractor with a battery pack that can be rented "on-demand" through text messaging. Motivo Engineering had estimated that 100,000 small tractors are sold annually in India at a cost of about $4,000 each, which is their market. They experienced very long shipping and custom delays and as a result plan to start field testing in late 2016. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** They have a draft business plan which involves iteration of the technology, establishment of a manufacturing plant and a sales organization, and setting up Motivo Engineering as the R&D unit. They are not working with any wholesalers and retailers at this point and foresee their next challenges to be product adoption and training of involved partners and end users.
Promethean Power Systems	This company have sold 162 grid-powered milk chillers to dairy processors in India. Six of them have a solar component, which was proposed as the main source of power originally in its proposal for the award. Promethean estimates that 230,000 communities could use village-level milk chillers across India. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** They are looking to lower the system cost by outsourcing the steel tank production. By purchasing greater volumes of higher quality milk from smallholder dairy farmers, the dairy processors can recapture their investment faster. The company's biggest hurdle is finding sales talent to market the technologies.

Innovator	Scaling up and commercialization progress
Rebound Technologies	This organization has not fully developed its prototype and has only partially field tested it. The field testing has not included any actual pre-cooling of agricultural produce because although two main technical components have been demonstrated, a fully integrated system capable of pre-cooling produce has not been fully realized. The engineering aspect of the technology is 95% complete and the pilot project is 5% complete. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** They have not developed a business model. The innovator stated that they never anticipated selling their system directly to the farmer. At present they have not contacted wholesalers and retailers or any potential partners who could provide maintenance services to the technology. Their plan is to patent the technology as open-source in order to allow other innovators to complete testing and to scale the technology. They have also incorporated the lessons learned into their IcePoint™ technology and recently completed testing a demonstration unit at a Whole Foods near Denver, Colorado.
SunDanzer	This organization have tested 40 dairy chillers in the field with farmers but have no actual sales. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** Their next steps towards commercialization include increasing the cost-share from the farmers, figuring out customer financing, affordability of their technology, and developing the supply chain around the innovation. They are working with the national credit association, who have recently received a Development Credit Authority guarantee from USAID, to set up a program to enable the purchase of the units. The credit association plans to run a pilot lending program with 10 farmers. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** The company anticipates that out of the five million dairy farmers present in East Africa, a potential of 850,000 customers may opt to upgrade their operations with a solar chiller. They are looking for a partner with high market penetration who can help them enter this market.
U. of Georgia Research Foundation	This organization started testing its two CES units in March 2015 and they have applied for a grant extension until July 2017 due to the initial target number of units being unrealistic. They stated their main focus is to create a good product. It is too early for them to know if there is intrinsic value demonstrated through the prototype testing, but they imagine there will be demand in countries like Rwanda, Burundi and Malawi. ***[Information here has been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the company/ies involved.]*** Currently there is no marking plan but UGARF intends to market the units themselves with the sales being set up in incremental payments because generally dairy farmers do not have liquidity. They envision owning the units while the female farmers use the chillers and gain revenue to make small payments. They plan to train women to collect grass for the units' energy source, which runs on biomass, so they can operate the units during the dry seasons when the milk prices are most profitable. They have not contacted any wholesalers or retailers, as they are too early stage, but have made connections with potential partners who can provide O&M services.

5.5 Conclusions and Recommendations on Innovators' Progress

All the 2013 innovators have made some progress towards their initial objectives. Below is a graph illustrating how the innovators assessed their progress towards their initial goals, which were outlined in their work plans, compared to PASTO's assessment based on the conducted site visits.

Figure 11: Progress Towards Innovator Initial Goal



All of the innovators have advanced along the innovation ladder as a result of PAEGC support, however the majority of the cohort did not meet their targets as initially planned. The reasons are multifaceted, and include unforeseen equipment delays, changes to the manufacturing processes, prototype optimization to address specific technical shortcomings, absence of well-researched financial approaches specifically applicable to the local context, and inadequate financing to make a leap from the initial piloting stage to the adoption and market growth stage. In addition, lack of local partnerships with market access prevent the innovators from finding the most effective market entry points. Only Promethean Power Systems had actually achieved commercialization because the company had already demonstrated technical feasibility, market acceptance and had sales channels set in place at the time of PAEGC's initiation. For greater level of commercialization among its innovators, PAEGC could focus on funding later stage organizations in the future.

Part of the challenge of scaling up and commercialization, which was confirmed during the site visits, was the innovators being too far removed from the CES end-users and the lack of streamlined communication between the innovators and their on-the-ground partners. PASTO observed that many of the innovators had not conducted detailed interviews with their end-users before, as well as after, the implementation of their innovations, resulting in a non-user centered design. Furthermore, for local users to come to trust the innovative technologies and change their usual behavior requires comprehensive and often continual training, as well as time.

To avoid some of the obstacles many of the innovators have faced during implementation, PAEGC could consider additional intensive, up-front review of proposal documentation by external technical experts who have deep understanding of in-country context and are capable of providing expertise on the viability of the proposed clean energy solutions, business models and financial mechanisms. These experts may also provide technical assistance on whether the proposed project timelines and targets are realistic, and can help the innovators assess the local

policy environment, which could benefit the scaling up efforts in the form of subsidies or duty-free exemption of certain types of equipment.

Interestingly, even though many of the innovators are in the initial stages of their scaling up efforts, some of their partners have benefited from the implementation of their PAEGC award and have reached early adoption or commercialization of their technologies. These partners include SparkMeter and Zero Base Energy partnered with EarthSpark International, Futurepump of iDE, and VIP, the sub-awardee of CAMCO. Rebound Technologies incorporated the lessons learned from their R&D efforts into development of their IcePoint™ technology.

*Motivo's assessment is based on the phone interview, as no project site visit has taken place due to the delays in shipping of the CES equipment.

6. Final Observations and Recommendations

The progress and likely outcomes for PAEGC 2013 cohort are consistent with other grand challenges or open competitions that source and develop high potential solutions to overcome critical barriers to development through the application of scientific, technological and engineering methods. One of the oldest such competitions, which has been in existence since 1958, is the U.S. Federal Government Defense Advanced Research Projects Agency (DARPA) which funds "high risk/high gain" initiatives. This implies that there is an expectation that some of the funded initiatives can fail and in fact, DARPA's success rate is only 10% or less. Despite such a low success rate, DARPA has laid the basis for many important innovations, such as the internet, and the U.S. Government considers this approach so important to basic scientific research that it funds the DARPA activity at about $2.9 billion annually. Another way to look at such research is through the eyes of venture capital investors, who based on a study of 2000 companies that received investments of $1 million each during the 2004-2010 period only had a success rate of 25%[9].

The innovations selected by PAEGC could also be considered high risk/high gain due to their potential to be transformative. Therefore, the most important factor in assessing PAEGC is not whether the individual clean energy solutions fail or do not achieve their original goals; rather, it is whether the grand challenge is supporting truly innovative research and testing, and that those activities that are successful, or have a high likelihood of success, receive the support necessary to test, adapt and validate new models of clean energy generation for agriculture. If the above examples provide the parameters for such an effort, the Partners should expect a success rate of 10% to 25% and must take steps to support these potentially successful innovations to get from one step to the next.

The 2013 innovators are generally engineers or technical specialists, and that has resulted in a heavy focus on technology to the exclusion of the customer/end user and the business model. Therefore, the following should continue to be the areas of PAEGC support to the innovators to enhance the chances of success:

1. Monitoring and evaluation. The innovators need to measure the effectiveness of their clean energy solution, document the performance over time and substantiate their results with evidence in order to communicate those results to potential impact investors. Many of the 2013 innovators still do not understand the value of collecting data during the field-testing phase and are missing this opportunity. The site visits conducted by PASTO presented an opportunity to collect substantial information that was not always available to or collected by some innovators, particularly those situated outside of the country of implementation, or those without strong local partners.

2. Business acceleration. Many of the 2013 innovators are only now starting to identify their business model and need to think through key partners, value propositions, market demand, customer segments, willingness of customers to pay, delivery channels, cost structure and revenue streams.

3. Gender Integration. PAEGC has been building the awareness of the importance of the role of gender dynamics the development and deployment of the clean energy solution.

[9] The Venture Capital Secret: 3 Out of 4 Start-ups Fail, Wall Street Journal, September 20, 2012

Innovators now need assistance to integrate specific gender-mainstreaming actions into their individual projects.

4. Partnerships. The innovators that have made the most progress have excellent in-country networks. Leveraging of the in-country connections of the PAEGC Partners is critical to successful implementation and scale-up.

Based on the findings from the assessment, the recommendation with regard to PAEGC support to specific innovators is as follows:

- Intensify business acceleration support—SunDanzer, iDE and Promethean
- Support the documentation of field testing results through M&E support—UGA, Motivo, African Bamboo
- Cease support—EarthSpark, Earth Institute and Rebound

In closing, the lessons learned from the assessment are as follows:

- The survey should have been tested in order to eliminate redundancies, add clarity and precision to questions, and establish a more logical order.
- Decoupling the questionnaire and the M&E data verification into two separate calls would have been less confusing to the Innovators.
- There is a limitation to an assessment done virtually. It would be better if the survey had been administered during the site visits.
- The assessment would have been enhanced by first completing all the site visits and have a fuller picture of the on the ground activities.
- PASTO is not the best mechanism to undertake the next assessment if it needs to be truly independent and impartial given Tetra Tech's role as a USAID contractor and hence PASTO's close relationship with the innovators.

Appendix A: Mid-Term Evaluation Scope of Work

PAEGC MIDTERM EVALUATION SCOPE OF WORK

March 1, 2016

Purpose of the Midterm Evaluation

The Powering Agriculture: An Energy Grand Challenge for Development (PAEGC) is a partnership between USAID, the Government of Sweden, the Government of Germany, Duke Energy Corporation and the Overseas Private Investment Corporation. The goal of PAEGC is to support new and sustainable approaches to accelerate the development and deployment of clean energy solutions for sustainable approaches to accelerate the development and deployment of clean energy solutions 10 for increasing agriculture production and/or value in developing countries.

The PAEGC Monitoring and Evaluation Plan stated that PAEGC would undergo a performance evaluation and at the 2015 PAEGC Partners meeting the Partners agreed to move forward on a midterm performance evaluation. It is desirable to undertake a midterm evaluation at this point, as a second set of innovators has been chosen who will be initiating their activities. The evaluation results and recommendations will enable the PAEGC Partners to make mid-course adjustments to improve the results created by both the initial 11 innovators and the subsequent group of 13 innovators.

The midterm performance evaluation of PAEGC will follow evaluation guidelines listed in its PAEGC Monitoring and Evaluation Plan. The purpose of the evaluation, based on technical direction from the PAEGC Program Manager, is to determine:

- How well PAEGC executed the procurement and award process, from the viewpoint of the innovators
- After the award, how well PAEGC managed the awards
- Based on their CES application, what the innovators have achieved since the award
- How well the innovators addressed gender equity through their innovations and subsequent award activities.

Methodology

For PAEGC, Monitoring Activities are conducted at three different levels for different purposes:

- Program-level: to measure the aggregated contributions of PAEGC's interventions in achieving the program's Goal. This is also referred to as the GCD-level.
- Innovator-level: to measure the progress and impact of PAEGC's individual innovators, and individual contributions to achieving the PAEGC goal.

[1010] 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 a business model that addresses the clean energy demands of a select market.

The midterm performance evaluation will be conducted in two stages:

- Stage 1 will focus on the on the program-level and will be conducted by an external consultant to be contracted by PAEGC Founding Partner BMZ/GIZ. It will conducted from April 2016 to June 2016.
- Stage 2 will focus on the innovator level and will be conducted by the Monitoring and Evaluation (M&E) Specialist of the USAID funded Powering Agricultural Support Task Order (PASTO). It will be conducted from January to April 2016.

Stage 2: Innovator Level Performance Status Report

The innovator level performance status report will focus on the assessing the performance of the 2013 innovators. It will be primarily qualitative in nature and will entail analysis of interview responses and reported performance indicator data. The evaluation will consist of:

- An analysis of reported performance indicators
- Trip reports of visits to innovator project sites
- Document reviews of innovator proposals, award documents, milestones, deliverables and reports
- Interviews with the innovators, PASTO personnel, and USAID Agreement Officer Representatives (AORs)

The interviews will take place in conjunction with a data verification process that will also be undertaken by PASTO over January to April 2016. The interview responses will be confidential and not attributable to the interviewees. Specific evaluation questions were previously developed as a part of the PAEGC Monitoring and Evaluation Plan.

Innovator Level Performance Status Questions

Questions on Procurement, Award Process and the Management of the Award

1. In your opinion, how well did you feel the call for proposals was executed by PAEGC?
   Rate execution by PAEGC as 5-excellent; 4-quite good; 3-good; 2-not so good; and 1-poor. Please explain.
2. Were appropriate selection criteria used by PAEGC? Y/N/Maybe
   Please explain.
3. What additional selection criteria might have been used?
4. Was the application process straightforward and logical or was it confusing? Y/N
   If the process was confusing, what would have improved the process? *Please explain.*
5. Were there significant barriers/delays caused by PAEGC prior to your organization receiving an award? Y/N/Maybe
   If yes, what were the barriers/delays that your organization faced?
6. Were these barriers/delays addressed by PAEGC? Y/N
7. Were any barriers/delays not adequately addressed by PAEGC? Y/N
   Please explain.
8. Were the annual milestones that you set for your organization realistic or not? Y/N
   Please explain.
9. To what extent was your CES developed and implementable upon award of the award?
   Rate it 5 to 1 (5-development completed; 4-almost fully developed; 3-somewhat developed; 2-minimally developed; 1-concept stage only)
10. Have any of the PAEGC Partners used their in-country presence to assist and complement your activities? Y/N
    If yes, what did they do?
11. Would you consider your CES to be high-risk, high-reward? Y/N

Please explain.

12. What is the name of your AOR?
13. How would you describe your relationship with your AOR?
    Rate on a scale of 5 to 1 *as 5-excellent; 4-highly positive; 3-good; 2-not so good; and 1-poor or non-existent.*
14. What else could your AOR do to be of assistance to your organization's activities in the Powering Agriculture program?
15. Were there unnecessary or undue requirements placed upon the innovators by PAEGC that hindered implementation? Y/N/Maybe
    Please specifically identify such requirements and tell why they were unnecessary or burdensome.
16. Do you have any specific suggestions that would improve PAEGC's award management practices? Y/N
    Please explain.
17. How would you rate the assistance PASTO has provided you on a scale of 5 to 1?
    5-excellent ___; 4-highly positive; ___; 3-good___; 2-not so good; 1-poor or non-existent
18. What areas has PASTO best assisted your needs?
    (1-USAID Contractual Compliance; 2- USAID Environmental Compliance; 3-Milestones review; 4-Milestone Modifications ; 5-Communications ;6-Assistance with Events ;7-M&E ;8-Business Acceleration; 9-Other(explain))
19. Have you used WebMo? Y/N
    Is this a useful tool for reporting your results? Y/N
    Please explain.

Questions on Performance under the Intermediate Results

The Monitoring and Evaluation work carried out by the innovators includes self-reporting on a series of indicators under three Intermediate Results:

- IR1: Increase in farmers and agribusinesses' access to and/or use of clean energy solutions
- IR2: Increase in agricultural production and/or value among famers and agribusinesses
- IR3: Increase in support for low carbon economic growth within the agricultural sector

Data associated with these indicators are entered into WebMo, an online monitoring platform, by the innovators and reviewed by the USAID and PASTO. These data will be analyzed by the M&E Specialist as part of the evaluation and conclusions will be developed regarding innovator performance to date. Other questions regarding the innovator's performance on the three Intermediate Results (IR) indicators, similar to those shown below.

IR1: Increase in farmers and agribusinesses' access to and/ or use of clean energy

1. In your opinion, was your organization able to successfully demonstrate your CES's commercial viability? Y/N/Not yet
   Please explain.
2. In the country/ies in which your organization is working, what is the total estimated demand for the CES supported by PAEGC? No. of units _____ $ sales _____
   Don't know_____
3. Have wholesalers and retailers undertaken to sell your CES to farmers or agribusinesses? Y/N
4. Are other service providers leasing your CES to users? Y/N

5. What is the CES retail or prototype price in relation to farmer and agribusiness average annual income? ___%
   Do you consider that the product is affordable? Y/N
   Please explain.
6. Is your organization making additional changes to achieve affordability? Y/N
   If yes, what changes are you undertaking?
7. So far, have there been actual CES sales to farmers and agribusinesses? Y/N
   How many units? _____
8. If no sales have been achieved, what further steps are you making to bring effective clean energy solutions to commercial scale within the agriculture sector of developing countries?
   Please explain.
9. If you are at prototype and not sales level, have you been able to test to your CES prototype successfully? Y/N/Not yet
10. If you are at prototype and not sales level, has your CES prototype been tested with actual farmers and agribusinesses? Y/N/Not Yet
11. How many women have access to the CES on your farm or agribusiness?

IR2: Increase in agricultural production and/or value among farmers and agribusinesses

1. Have you been able to demonstrate through your field testing *or* product roll-out that your CES increases either agricultural production or value, or both? Agricultural production Y ___ N ___ Product value Y ___ N ___. Please provide quantities of production or value if you know them: Agricultural production increases (%)____ Product value increases (%)___
2. What is the level of women's involvement in the use of your CES?
   5-very high;; 4-high; 3-medium; 2-not so high; 1-low or nonexistent
3. If your users are agribusinesses, what total volume (in standard units used as the Indicator) and sales value of farm products was handled by them while utilizing your CES? Provide total volume and sales volume statistics: production units_____ sales (US$)_____
4. Have the volumes and sales value increased/remained the same/decreased? By what percentage? Volume _____% Sales (US$) _____%
5. According to your knowledge, are there other similar CES technologies or systems utilized in the countries where you are working result in increased agricultural production or decreases in post-harvest losses? Y/N
   Please give the country and CES type

IR3: Increase in support for low carbon economic growth within the agriculture sector

1. Have there been increases in country-level investments supporting production of your CES? Y/N/Not yet
   Please elaborate, if yes.
2. In your opinion, based on your organization's activities has there been investment in other similar CES devices for agricultural or agribusiness applications? Y/N/
   Please explain.
3. Based on your analysis, will your CES have impact on mitigating the adverse effects of global climate change (GCC) within the agriculture sectors of country/countries in which your organization is working? Y/N
   Please explain.

Innovator Overall Performance: In your opinion, how would you rate your progress towards your initial goal when you applied for the grand challenge? Rate execution by PAEGC as 5-excellent; 4-quite good; 3-good; 2-not so good; and 1-poor. Please explain your answer

Final Interview Question: Is there some other comment that you would like to make regarding the effectiveness of the PAEGC program

Additional questions may be introduced by the M&E Specialist during the conduct of the interview, which may generate a more complete understanding of innovator performance.

Duration

The midterm innovator level performance status report will be carried out over 40 person-days, spread over January to April 2016 including time spent on interviews, data collection, analysis and drafting of the report. The PASTO M&E Specialist will not undertake field work, but rather the data collection will be carried out by direct personal interviews when the person is located in Washington, D.C. and virtually for those interviewees located elsewhere in conjunction with the data verification process. The first draft will be submitted on April 15, 2016 and once comments are received from the PAEGC Partners, the M&E Specialist will finalize the report and submit the final to the Program Manager by May 15, 2016.

Report Contents

The output shall be an innovator performance status report which will form part of the larger evaluation. The innovator performance status report will set forth important findings, conclusions, and recommendations. It will include an executive summary and be no more than 30 pages, not including tables, charts and annexes. It will contain the following sections:

A. Introduction
B. Procurement and Award Process
C. Award Management Process
D. innovator Performance (by IR1, IR2 and IR3)
E. Conclusions
F. Lessons Learned
G. Recommendations

Appendix B: Performance Indicator Data, Fiscal Year 2015

Below is the M&E indicator data gathered from the 2013 cohort of innovators based on PASTO's site visits, interviews with the local partners and phone calls to verify the data submitted on WebMo. This table reflects the field testing activities up to the end of September 2015. Since the majority of the innovators have started substantially field testing their units this year, their impact is not reflected in the table below. Some data, as indicated by the color coding is still in the process of being collected, analyzed or updated by the innovators.

	IR 1.1	Development Stage	Units Deployed	IR 1.2	# of women	IR 1.3	# new	IR 1.4 MW	IR 1.5	# of women	IR 2.1	% change	IR 2.2 Savings in FY15 $ per beneficiary	IR 2.2 Annual Savings $ per beneficiary	IR 2.3 Savings in FY15 MJ per beneficiary	IR 2.3 Savings in FY15 MJ	IRR 2.3 Annual Energy Savings MJ per beneficiary	IR 3.1 $	IR 3.2 tCO2 eq.
African Bamboo	1	field testing	0	0	0	3	0	0	0	0	0		0		0	0	0	$3,251,447	0
CAMCO	1	fiel testing + R&D	5	15	0	3	3	0.035	9	1	0	0	0	0	0	0	0	$ 400,000	0
Earth Institute	1	field testing	3	4	0	8	3	0.0164	36	0	1.3 t/ha	4.3%	$ 128	$ 256.16	1,014.2	4,056.7	3,381	$0	1.16
Earth Spark	1	commercialization	1	408	233	5	5	0.093	890	233	0	0	0	0		42,830.0		$480,000	987
iDE	1	field testing	26	26	10	13	0	0.00208	42	10								$0	14.5
Motivo Engineering	2	R&D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0	0
Promethean	1	field testing	51	2720	773	124	2	0.002	73	1				1.37			-13	$0	
Rebound	0	R&D	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
SunDanzer	1	field testing	40	46	6	2	0	0.0204	94	20	17 L/day	20.0%	$ 918	$ 2,203	-972	-38,880	-2,333	$0	0
UGA	1	field testing	0	0	0	0	0		0	0	0	0	0	0	0	0	0	$0	0

Verified by a site visit
Under review by PASTO with the innovator
Verified by phone
Not verified
No data reported

The PAEGC M&E plan defines the performance indicators as follows:

IR 1.1: Type and number of clean energy solutions developed (and state of development)
IR 1.2: Type and number of beneficiaries (farms/agribusinesses/customers)
IR 1.3: Type and number of wholesalers/retailers/maintenance professionals accessible to beneficiaries for selling/servicing clean energy solutions

IR 1.4: Clean energy generation capacity installed or rehabilitated (in MW)
IR 1.5: Number of persons attending trainings/demonstrations on CES technology
IR 2.1: Change in agriculture production attributed to use of PAEGC Innovators' clean energy solution
IR 2.2: Change in income attributed to use of PAEGC Innovators' clean energy solution
IR 2.3: Expected life of project savings from energy efficiency or energy conservation (annual)
IR 3.1: US Dollar amount of investment mobilized, from public or private sources, for climate change
IR 3.2: Greenhouse Gas (GHG) emissions, estimated in metric tons of CO2e, reduced, sequestered, and/or avoided (annual tCO2 eq.)

Appendix C: Raw Survey Data

[Innovator responses have been removed from the public version as it is considered SBU, and contains sensitive financial and/or technical information that could damage the competitive advantages of the companies involved.]

The Procurement and Award Process:

1. In your opinion, how well did you feel the call for proposals was executed by PAEGC?
   Rate execution by PAEGC as 5-excellent; 4-quite good; 3-good; 2-not so good; and 1-poor. Please explain.

2. Were appropriate selection criteria used by PAEGC?
   Y/N/Maybe. Please explain.

3. What additional selection criteria might have been used?
   Y/N. Please explain.

4. Was the application process straightforward and logical or was it confusing?
   Y/N. If confusing, what would have improved the process?

5. Were there significant barriers/delays caused by PAEGC prior to your organization receiving an award?
   Y/N/Maybe, If yes, what were the barriers/delays that your organization faced?

6. Were these barriers/delays addressed by PAEGC?
   Y/N

7. Were any barriers/delays not adequately addressed by PAEGC?
   Y/N. Please explain.

8. Have you used WebMo? (Y/N).

8b. Is this a useful tool for reporting your results?
   Y/N. Please explain.

9. Were the annual targets that you set for your organization realistic or not?
   Y/N. Please explain.

10. To what extent was your CES developed and implementable upon award of the award?
    Rate 5 to 1 (5-development completed; 4-almost fully developed; 3-somewhat developed; 2-minimally developed; 1-concept stage only).

11. Have any of the PAEGC Partners used their in-country presence to assist and complement your activities?
    Y/N. If yes, what did they do?

12. Would you consider your CES to be high-risk, high-reward?
    Y/N. Please explain.

Award Management Process:

1. What is the name of your AOR?

2. How would you describe your relationship with your AOR? (5 to 1; 5 –excellent, 1 – not so good)
3. What else could your AOR do to be of assistance to your organization's activities in the Powering Agriculture program?

4. Were there unnecessary or undue requirements placed upon the innovators by PAEGC that hindered implementation?
   Y/N/Maybe. Please specifically identify such requirements and tell why they were unnecessary or burdensome.

5. Do you have any specific suggestions that would improve PAEGC's award management practices?
   Y/N. Please explain.

6. How would you rate the assistance PASTO has provided you on a scale of 1 to 5? (5 to 1)

7. What areas has PASTO best assisted your needs? *(1 – USAID Contractual Compliance, 2-USAID Environmental Compliance, 3-Milestone review, 4-Milestone Modifications, 5-Communications, 6-Assistance with Events, 7-M&E, 8-Business Acceleration, 8-Other). Please explain.*

Innovator Overall Performance:

1. Now that you've answered these questions, how do you rate your progress towards your initial goal when you applied for the grand challenge?
   Rate execution by PAEGC 5 (high) to 1 (low)

2. Is there some other comment you would like to make regarding the effectiveness of the PAEGC program?

Innovator & CES performance:

1. In your opinion, how would you rate your progress towards your initial goal when you applied for the grand challenge?
   Rate 1(low) to 5(high). Please explain.

2. What have you observed to be advantages and disadvantages of your CES?

3. Have you been able to demonstrate through your field testing or product roll-out that your CES saves the beneficiaries money, as compared to the traditional technology?
   Y/N.

3b. What is the source of savings?

3c. What are the savings? ($_____, %_____)

4. Have you been able to demonstrate through your field testing or product roll-out that your CES increases agricultural production?
   Y/N/Don't know.
   What is the agricultural production increase? (Production unit_____; Volume %_____, Sales %_____)

5. Have you been able to demonstrate through your field testing or product roll-out that your CES improves quality of agricultural production?
   Y/N/Don't know.

5b. If yes, do the beneficiaries earn more income from selling higher quality goods on the market?
   Y/N. Please explain.

5c. What is the product value increase? ($_____, %_____)

6. Have you been able to demonstrate through your field testing or product roll-out that your CES result in time savings when compared to the traditional technology?
   Y/N.

6b. If yes, how many hours per day/week?

6c. What do the beneficiaries do with the gained free time?

7. If your users are agribusinesses, what total volume and sales value of farm products was handled by them while utilizing your CES?

7b. Provide total volume and sales volume (production units_____, $_____).

8. According to your knowledge, are there other similar CES technologies or systems utilized in the countries were you are working that result in increased agricultural production or decrease in post-harvest losses? *Y/N*

8b. Please describe CES and note the country.

Additional questions for irrigation projects:

1. Does your CES utilize an innovative payment scheme?
   Y/N. Please explain.

2. How does the CES affect the ground water table in the area? How do you know?

3. Is the payment scheme based on water consumption or solely on electricity consumption?

Scaling up & commercialization of the CES:

1. Are there personnel within your organization who are responsible for your scaling up activities?
   Y/N

1b. How many? _____)

2. In the country(ies) in which your organization is working, what is the total estimated demand for the CES supported by PAEGC?

3. Has your organization developed a business model?
   Y/N. If yes, please describe.

4. In your opinion, was your organization able to successfully demonstrate your CES's commercial viability (i.e. it can be sold in the local market?
   Y/N. Please explain.

5. So far, have there been actual CES sales to farmers and agribusinesses? Y/N.

5b. How many units? _____

6. Have wholesalers and retailers undertaken to sell your CES to farmers or agribusinesses? Y/N.

7. Are other service providers leasing your CES to users?
   Y/N.

8. What is the actual CES retail price? ($_____, NA)

9. Or what is the estimated prototype price? ($_____, NA)

10. What is the CES retail or prototype price in relation to farmer and agribusiness average annual income? (%_____)

10b. Do you consider that the product is affordable?
   Y/N. Please explain.

11. Is your organization making additional changes to achieve affordability? (Y/N)

11b. If yes, what changes are you undertaking?

12. If you are at prototype and not commercialization stage, have you been able to test your CES prototype successfully?
   Y/N/Not yet.

13. If you are at prototype and not commercialization stage, has your CES prototype been tested with actual farmers and agribusinesses?
   Y/N/Not yet.

14. If no sales have been achieved, what further steps are you taking to achieve commercialization?

15. What other hurdles is your organization facing in scaling up of your CES?

16. Are you receiving support for scaling up your CES?

16b. If yes, what type of support are you receiving and from whom?

16c. Are you satisfied with the level and quality of these services? (Y/N)

17. Have you found any potential partners or stakeholders to support the operation and maintenance of your CES installations and to scale up the CES in the region or support its adoption elsewhere? (Y/N)

17b. How did you identify these partnerships? What is their operational/financial capacity?

Impact on gender:

1. What is the level of women's involvement in the use of your CES?
   Rate 1 (low) to 5 (high). Please explain.

2. Does your organization collect any gender-related impact data in addition to the required disaggregates?

3. Does the project have any additional plans to further incorporate the equitable participation of women and men in the field activities? (Y/N)

3b. If yes, how?

4. At what stage in the value chain where you CES is being applied are women involved (e.g. management, carrying our training or demonstrations, selling of the units, repair)?

5. What are the barriers in the way of women benefiting more from the CES in the community?

5b. If it is lack of financial resources, does the project or local partners have any plans to facilitate overcoming this barrier?
Y/N. Please explain.

Impact on low carbon economic growth:

1. Based on your analysis, will your CES have impact on mitigating the adverse effects of global climate change within the agriculture sectors of country/countries in which your organization is working? (Y/N, explain_____)