3.2 Powering Agriculture Impact

Powering Agriculture has continued to have a positive impact as the Innovators conduct the field testing of their clean energy solutions and some of them scale up and start selling commercially. The data presented in this section is based on their self-reporting against Powering Agriculture’s 10 performance indicators.

Performance Results: Table 3.1 depicts the progress made by the Innovators against Powering Agriculture’s performance indicators in FY 2017 and over the life of the grand challenge.¹

<table>
<thead>
<tr>
<th>IMPACT</th>
<th>FISCAL YEAR 2017²</th>
<th>POWERING AGRICULTURE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 clean energy solutions developed (technologies and/or business models)</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>619 kW of clean energy generation capacity was installed</td>
<td></td>
<td>857 kW</td>
</tr>
<tr>
<td>1,395 clean energy systems deployed through Africa, Asia/Pacific, Latin America and Middle East</td>
<td></td>
<td>1,902</td>
</tr>
<tr>
<td>19,750 beneficiaries reached, such as farmers, households and agribusinesses, as a result of Powering Agriculture support.</td>
<td></td>
<td>30,090</td>
</tr>
<tr>
<td>Between 4% and 300% increase in yield obtained by beneficiaries, as a result of Powering Agriculture support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USD $2.3 million additional funding leveraged from public and private investments by innovators as a result of Powering Agriculture</td>
<td></td>
<td>$9.2 million</td>
</tr>
<tr>
<td>1,580 tCO₂e reduction, as a result of innovators field activities</td>
<td></td>
<td>1,810 tCO₂e</td>
</tr>
<tr>
<td>2,960 people trained on O&amp;M of clean energy systems and their benefits, including 1,020 women</td>
<td></td>
<td>4,610 people 1,130 women</td>
</tr>
<tr>
<td>15,670 people increased their knowledge on clean energy technologies through attending demonstrations, as a result of Powering Agriculture support, including 5,800 women</td>
<td></td>
<td>37,170 people 13,270 women</td>
</tr>
<tr>
<td>540 professionals provided services to clean energy system users, as a result of Powering Agriculture support, including 110 women</td>
<td></td>
<td>1,040 professionals 170 women</td>
</tr>
</tbody>
</table>

¹ These results were aggregated among innovators, based on Powering Agriculture’s review of innovators’ self-reported data available to date.
ECO Consult is excluded because its award was managed by USAID Jordan Mission with a different performance indicator framework.
² FY FY 2017 data includes partial data from SunCulture; complete data was not received by the time of this report’s publication.
Innovators Contribution to FY 2017 Results: The following graphs illustrate results achieved by the Innovators aggregated by their agricultural focus as per below.

The results are presented for both FY2017 and for the life of the grand challenge. The 2017 fiscal year been the most active year for the installation of clean energy systems under Powering Agriculture, as demonstrated in Figures 3.3 and 3.4. This is because both the 2013 and 2015 cohorts of innovators were in installation mode; the 2013 cohort was finishing up and the 2015 cohort was ramping up.

The scale of the systems installed ranged greatly, from an 80 Watt pump to a 200 kW roof-top and ground-mounted hybrid solar PV system. The largest capacity of clean energy has been installed to provide general decentralized power, primarily due to the size of the mini-grids compared to other technologies supported by Powering Agriculture. Ariya Capital has been the biggest contributor to the capacity installed under the program, its 2 systems more than tripling the total amount of kilowatts installed in 2016\(^3\).

Solar PV powered irrigation represents the second largest amount of kW installed under the program, as a consequence of the high number of pumps deploying in the field, shown in Figure 3.4. This reflects that a number of these innovators, namely Futurepump, iDE, and SunCulture, who have already reached distribution or market growth stages according to the self-reported categorizations depicted in Figure 3.1.

\(^3\) 65 kW was installed under Powering Agriculture in Fiscal Year 2016.
Powering Agriculture has already begun to positively impact households, farmers, and agribusinesses as beneficiaries benefit from the deployed CES units under operation or in use. The largest number of systems deployed has been for irrigation, in part due to the number of innovators in this category who are further along the innovation ladder (as noted above).

Cold storage represents the next largest number of systems deployed under the program, due in part to the fact that these technologies are household-scale, all under 1 kW in size. The only exception is Promethean Power’s industrial scale milk cooler⁴.

⁴ While Promethean’s coolers are large in capacity, the solar component of their design is only 1kW, serving as a power source for a pump transporting the milk from the cooler to the tank.
The largest number of beneficiaries have been reached in the area of cold storage. A large portion of these results are due to the contribution of Promethean Power focused on providing cold storage to the regional milk collection centers, rather than directly to individual dairy farmers. Each system benefits between 40 and 85 farmers, who bring their milk to the distribution points. The projects in Irrigation have also resulted in significant beneficiaries, however since this technology is dominated by household-scale technologies, it tracks closely with numbers of systems deployed.

The lowest number of beneficiaries reached is in the area of aeration as there is only one innovator is within that sub-sector and they have just started initial piloting of their technology this year. Similarly, only 7 decentralized power units have been deployed this year as majority of the innovators in that area continue working through the research and development or initial piloting stages of their innovations.

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5 For the purpose of Powering Agriculture, beneficiaries are defined as households, agribusinesses or commercial customers who benefit from having access to the Powering Agriculture funded clean energy solutions (CES). This number only counts direct beneficiaries. Indirect beneficiaries, such as all members of households, are not included in these counts.
Motivo has been working with the KVK Foundation to pilot its HARVEST electric tractor to a group of 47 farmers in the village of Maharajpet outside of Hyderabad, India. The farmers share the two HARVEST tractors that take turns preparing fields for the monsoon growing season and recharging via a 2.25 kW solar array. The farmers have quickly adapted to the unconventional feature set and form factor of the HARVEST and have realized that it serves a valuable role on the farm. One group of farmers who are orchard owners now use the HARVEST to clear brush and spray in between their mango trees, an area too confined for diesel tractor use and work that was traditionally done manually. Another group of farmers who grow onions, chilies, and other vegetables use the tractor to grate their fields and then haul the churned-up grass to the market to be sold as cattle feed. In addition to its functionality as a tractor, HARVEST’s high-powered flood lights are frequently used to light remote portions of the farm for critical or emergency tasks that must be carried out at night such as bore well repairs. Already, three of the farmers that use the tractors have inquired with Motivo where they can purchase HARVEST for themselves.
3.2.2 Success Stories

Jaber Hamed Mahmoud Battah lives on a farm in Zarqa, Jordan, along with his family of nine. The family-owned farm produces squash, eggplant, and cauliflower which are sold at the market, as well as fodder for a handful of animals living on the farm. One of the farm’s biggest challenges is the high cost of diesel necessary to irrigate the land—which is why Jaber decided to participate in ICU’s PV Drip Irrigation and Fertigation Systems project.

ICU not only supported the installation of the system, but also brought together agricultural public agencies, private companies, and credit institutions, which allowed Jaber to have a 10kW drip solar irrigation and fertigation system installed. Without access to finance, which allows Jaber to pay for the system over 5 years, he would not be able to afford the switch to solar-powered irrigation. In a mere 3 months of the system’s operation he has saved over $300, which will go towards his family’s expenses. Looking ahead, Jaber wants to invest into expansion of his family farm. He is a proud owner of the new technology and hopes it will catalyze knowledge sharing in his community, particularly among students.
3.2.3 Innovator Progress on Gender Integration
Innovators have been actively working to collect sex-disaggregated data, hire more women in key technical positions, integrate gender into baseline surveys with CES surveys, and create entrepreneurship opportunities for women to use or sell CES. Out of the 12 innovators who responded to a recent survey (with 55% response rate), 89% reported that they have collected and reported sex disaggregated data in the past year. Over half (56%) reported that they hired more women in key technical/professional positions, while 44% integrated gender into baseline surveys with CES users and consulted with both male and female users regarding CES development. Close to one-quarter of the innovators (22%) reported that they created entrepreneurship opportunities for women to use or sell their CES, as well as captured sex-disaggregated impact data on time and labor savings.

All innovators are collecting sex-disaggregated data when reporting about people – some more effectively than others. Two out of the 19 innovators being supported by Powering Agriculture in financial year 2017 have achieved 50/50 gender parity in working with men and women either as CES beneficiaries, trainees, or technical staff made available to the beneficiaries; the majority are still working.

Figure 3.6 Responses are from 12 innovators who responded to a recent Powering Agriculture survey implemented by PAX that included questions regarding gender integration (more than one response was allowed per innovator). The response rate of innovators was 55%, so this is illustrative rather than representative.

A survey implemented by PAX in September 2017 included questions regarding gender integration. The response rate of innovators was 55%, so the results were illustrative rather than representative.
on closing this gap. The majority of the Innovators (9 out of 19) are only reaching between 20% and 50% women, and 8 out 19 Innovators are reaching less than 20% women. The innovators have been most successful at reaching women through training sessions on their clean energy technologies, with three innovators exceeding a ratio of 50% women.

When it comes to direct beneficiaries, only UGA has exceeded 50/50 gender parity, while 50% of the innovators providing improved energy services to beneficiaries this year only reached between 0% and 20% female beneficiaries. Below are descriptions of how several of the innovators are actively working to close this gender parity gap.

**FIGURE 3.7 INNOVATOR ENGAGEMENT WITH WOMEN DURING FY 2017**

![Figure 3.7](image)

*Figure 3.7 Data is based on aggregated sex-disaggregated data (cumulative to date) reported by PAEGC innovators. Only a portion of innovators are at a stage where they are collecting data about people, out of which a minority did not report sex-disaggregated data.*

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7 This data is based on self-reported disaggregates of Powering Agriculture performance indicators for 2017 fiscal year available to date.
Innovator Gender Integration Lessons Learned in 2017

Gender analysis improves marketability of a product—and can also ensure product design is fit for purpose.

SimGas revised their marketing survey to include collection of gender analysis information in 2016. After collecting data in 2017, they learned critical information to inform their marketing and product design:

1. Men and women’s roles caring for cows varies by household, which means they need to do a careful intake survey with both the man and woman in each household farm to identify how much manure is being produced—and bio-gas generated—which is lower seasonally when cows graze.
2. Women are predominantly in charge of cooking—and once they use cook stoves with biogas, they don’t want to go back—which also means they are unhappy when they run out of bio-gas.

Equipped with this knowledge, SimGas went back to the drawing board to redesign their biogas digester to consume less bio-gas. They knew if they did not take this into consideration that women who would potentially use the bio-gas fed cookstoves would not be interested in their product. Recognizing that men and women work together as dairy farmers, they tested the milk chiller prototype with 10 dairy farms in Kenya and Tanzania with 10 couples, intentionally working with both husband and wife.

UGA previously produced a butter-churner CES that failed in its first iteration because it was designed for people standing; they quickly realized through consultation with women that they churn butter while sitting—so they redesigned the technology for use while sitting. UGA applied this learning to their EvaKuula design and marketing process, emphasizing that it is critical to pay attention to gender in design because the product will be “dead on arrival” if the female-friendly factors are not incorporated. They find it critical in product design to hold focus group discussions with women, present products, “let them tear it apart,” and redesign accordingly. UGA also recognizes the important role household decision-making plays in this process. They don’t look at a household as a whole, but rather at the individuals within it—men, women, and children. For example, they know that if they want to meet with women in Ghana, they can only meet Sundays after church because their spouses would not allow them to meet on Mondays.

It is a powerful marketing strategy to identify women already organized in groups to introduce CES products, as women organize socially and naturally spread the word.

UGA strategically selected women as both of their “star farmers” to demonstrate the EvaKuula. Women naturally organize themselves in relational social groups, so they see it as a strategic marketing approach to work with women as they naturally spread information through word-of-mouth. Although UGA does not systematically seek out women’s groups to market their product to, they are delighted when they find an already organized one to work with. Women who are already organized in a formal or informal village savings and loans association (VSLA) pool money together and are attractive...
as a target market. UGA observed that when women are organized in a group, the decision-making process is driven by camaraderie—and also insulated from nay-saying negative comments about the technology from their husbands. However, UGA finds that it is critical to listen to a women’s group narrative and work only with those that are internally motivated, rather than an externally motivated group that may not be enthusiastic if payback is required for the technology.

In the future UGA plans to implement a “church lady model” to market the EvaKuula, building trust among influential church members; strong community relationships and word-of-mouth are key to reaching their target markets in sub-Saharan Africa.

Achieving meaningful female participation and decision-making often does not occur naturally, but rather requires deliberate activities and a gender-responsive monitoring and evaluation plan to drive teams toward identifying and overcoming challenges in women’s participation. These include identifying and addressing critical issues such as gender-based violence.

UVG was successful in achieving 50% active female participation in conducting town hall-style community meetings to ensure that every aspect of the project is discussed transparently with all members of the community and stakeholders, and that the communities agree to each step of the process. However, this required deliberate action. For example, UVG carefully counted and made intentional efforts to empower women as meeting participants and decision-makers in a variety of different consultation meetings they organized. Across all trainings, the number of women participants exceeded that of men (59 women vs. 39 men).

In an agribusiness training program with the 9 de Enero Mayan community, with the purpose of providing training to community members to establish/expand their own agribusinesses, UVG divided community members into 3 groups of: 7 men, 14 women and 14 youth. The training course also utilized practical, “real life” examples to support learning of all participants. In another community meeting on project costs, UVG reported that 12 of the 43 participants were women, 10 of whom who had voting power.

These activities are underpinned by UVG’s commitment to integrating a gender-specific outcome in their M&E plan: *Accelerators support gender equality in access to and benefit from clean energy in target communities*. They made a specific target—that 50% of beneficiaries of new income generation opportunities created by the Accelerators will be female, and chose to measure the percentage of producers utilizing value addition processes who are female and the percentage of Accelerator operators who are female.

As project roll-out continues, UVG plans to engage women in the community, including: interviewing women to ensure trainings are compatible with their time availability; better understand female expectations and needs regarding CES, including specific safety issues concerning access to and use of energy; conducting a safety audit of the accelerator to ensure that it can be safely used by women (prevention of gender-based violence); recruiting women as CES operators; holding special training and business incubation sessions with women; and including women in the design of the accelerator’s organizational structure.
CES can reduce women’s labor and time—but may displace their paid labor; recognizing this and identifying alternative income-generating and entrepreneurship opportunities is critical.

Horn of Africa (HOA)’s biodigester will significantly reduce the labor- and time-intensive coffee drying process, which is disproportionately performed by women. However, this means that women may lose their jobs—and income source. Using the slurry from biodigesters creates another income-generating opportunity through mushroom production and sales. HoA identified that their CES creates a slurry by-product from the biogas that may be utilized in mushroom cultivation. Horn of Africa (HoA), supported by the PASTO gender integration specialist, is in preliminary stages of formulating a gendered market analysis to identify the feasibility of supporting female entrepreneurs to cultivate and sell mushrooms. HoA will explore the possibility of supporting cooperatives with the female laborers to purchase the slurry and produce and sell mushrooms. A gender analysis will identify barriers and opportunities for women becoming successful entrepreneurs in mushroom production and sales through the mushroom value chain. This will include assessment of the women’s skills, desire, household decision-making, and other cultural norms to identify gaps. Potential partners will be identified that may address barriers.

Customer intake surveys that collect gender-specific data from both women and men from the same household can help target appropriate distribution of CES in pilot phases.

University of Toronto, with Powering Agriculture’s technical assistance, tailored surveys to give to both men and women individually within one household, with additional questions to provide more information regarding gender roles on fish farms. In 2017, surveys were implemented monthly, and to ease the survey process and make items accessible to women, University of Toronto hired a new female staff member. The survey results identified that more than 1/3 of farms currently have female participation; this information was used to select fish farmers to participate in the study. UT will continue monthly surveys, collecting data from both male and female household members once the devices are installed, ensuring that the female staff person collects data from the female farmers. These surveys will provide more background on gender-based challenges with the technology.

CES can serve as a disruptive technology that promotes gender equality—but timing is critical when entering traditional communities to first establish trust and gain traction with CES.

Claro Energy’s mobile irrigation technology relies on cab drivers operating from village to village. In the rural Indian context, it is culturally taboo for a local village woman to drive them. As they just recently introduced the CES with 24 men and 11 women, they intentionally did not attempt to disrupt this cultural barrier. However, they will be observing differences in behavior and CES adoption between women and men, and once the CES gains traction hopes that women will also take on the mobile service vehicle on their own. Claro is in preliminary stages of identifying foundations and organizations that may support them in further identifying and tailoring engineering solutions and products to meet women’s needs. Claro has
identified one location where there is an existing woman-only self-help group of 200 women. Claro is engaging with Powering Agriculture to identify strategic entry into this female-only market with their mobile irrigation technology.

**Innovator Plans for Gender Integration in 2018**

Out of the 12 innovators (55%) who responded to a recent survey, 11 (92%) have plans in the upcoming year (2018) to conduct any type of gender integration activity. The majority of innovators (64%) plan on creating entrepreneurship opportunities for women to use or sell their CES, 55% plan on consulting with both male and female CES users on product development, 46% plan on hiring more women in key technical/professional positions, and 36% intend on collecting and reporting on sex-disaggregated data. Approximately one-quarter of innovators reported plans in the coming year to engage in other gender integration activities, such as conducting a gender analysis, writing a case study about gender impacts of their technology, developing marketing materials showing female users of CES, introducing flexible financial solutions for purchasing CES, capturing sex-disaggregated time and labor savings data, and integrating gender equality into CES user surveys.

**Figure 3.8 Percentage of Innovators Reporting Planned Gender Integration Activities in 2018**

- Write a case study about CES impact on gender equality: 18
- Conduct a gender analysis/assessment: 36
- Develop marketing materials showcasing women using CES: 46
- Develop/introduce flexible financial solutions for women and men to purchase or use CES: 55
- Capture impact data on time and labor savings disaggregated by sex: 64
- Include gender related questions in an intake, baseline or field survey: 18
- Collect and/or report sex-disaggregated data: 36
- Hire more women in key technical/professional positions: 46
- Consult with male and female CES users on product development: 55
- Create entrepreneurship opportunities for women to use or sell CES: 64
- Include gender related questions in an intake, baseline or field survey: 18

*Figure 3.8 Responses are from 12 innovators who responded to a recent Powering Agriculture survey implemented by PAX that included questions regarding gender integration (more than one response was allowed per innovator). The response rate of innovators was 55%, so this is illustrative rather than representative.*
Out of the 12 innovators (55%) who responded to a recent survey, nine expressed interest in learning more and/or receiving additional support about specific CES topics. Half of the innovators expressed desire to further understand relevance of gender equality in CES, one-third to overcome challenges working with women in male-dominated areas, 20% in financial products and M&E, and 10% in product development, human resources, marketing, including women throughout all stages of CES, and determining if women are lower risk customers compared to men. Efforts will be made to offer tailored support through remote technical assistance and through the upcoming PAX workshop in January 2018.

**FIGURE 3.9 PERCENTAGE OF INNOVATORS INTERESTED IN LEARNING ABOUT GENDER INTEGRATION IN SPECIFIC CES TOPICS**

- (Other) Determining if women are lower risk customer/partners than men
- (Other) Concrete steps to include women in all stages of sales, marketing, installation
- Marketing
- Human Resources
- Product Development
- Monitoring and evaluation
- Financial Products
- Overcoming challenges working with women in male dominated areas
- Understanding relevance of gender equality in CES

*Figure 3.9 Responses are from 12 innovators who responded to a recent Powering Agriculture survey implemented by PAX that included questions regarding gender integration (more than one response was allowed per innovator). The response rate of innovators was 55%, so this is illustrative rather than representative.*