USAID WEBINAR

Making the case for solar-powered water systems: USAID's experience facilitating investment in Kenya and Zambia

Wednesday, June 21, 2023, 8:30 AM -10:00 AM (UTC-05:00) Eastern Time

Questions & Answers

Q1: Will the PPTs and a link to recording of this seminar be shared, via email?

A: Yes. The materials are posted on GlobalWaters.org (linked here) and shared with participants via email. Sign-up for the GlobalWaters.org mailing list to stay up to date on future webinars and other information from USAID's Water, Sanitation, and Hygiene Finance 2 (WASH-FIN 2).

Q2: What procedures do you have in place to ensure service providers measure the impact of increased pumping rates from solarization on the water stock? Are there any concerns with overtaxing groundwater resources?

A: The sites selected for solarization were pre-existing boreholes that were unable to pump to their original design capacities due to unreliable electricity supply from the grid. In cases where supply hours increased, this brought boreholes up to their design capacity in line with approved water abstraction rights. The pumping facilities are fitted with bulk water meters to allow monitoring of water abstracted, which is monitored by local regulators to ensure they stay within their approved abstraction limits.

Q3: Were hydrogeological constraints considered as part of site selection? Your results indicate significant increases in water production overall - are impacts on groundwater levels (locally / regionally) considered as part of the ongoing monitoring?

A: Please refer to the response to Q2.

Q4: Are there creditworthy WSP in Kenya that serve rural communities or is this mainly focused on urban or peri-urban communities?

A: There may indeed be creditworthy rural WSPs, but WASH-FIN 2's focus is on urban and peri-urban communities. Other USAID programming focuses on rural communities.

Q5: What has been your approach to managing the negative externalities resulting from excessive groundwater pumping that often plagues solar water pumping systems?

A: Please refer to the response to Q2.

Q6: Given that we are hearing about the similar weaknesses of solar and grid / generator energy sources, i.e., break in service due either to grid failures, unpaid WSP energy bills, or cloud cover impediments, is there any move to introduce energy storage systems...or will this be too prohibitive?

A: For WASH-FIN 2's work with water service providers in Kenya and Zambia, the team determined that additional energy storage infrastructure would make the initial capital investment cost prohibitive in light of budget constraints and also was not required to meet the primary goal of increasing production to design capacity by maximizing daytime pumping. In most of the systems, existing elevated water storage is sufficient to ensure service continuity during periods when grid electricity and solar are both not available. In cases where storage is insufficient or non-existent, there may be times when service is not provided if solar and grid-derived power are not available. In addition to increased capital cost, energy storage systems increase space requirements and operational complexity. Decisions regarding energy storage require evaluation of individual site conditions and needs.

Q7: Could you further elaborate on what you mean by underdeveloped solar installer markets in Zambia? Specifically focusing on what you found were the constraints to growth and scaling the solar installer markets.

A: Underdeveloped refers to three aspects: (1) the number of solar provider companies that exist within the country, (2) their ability to provide services for the required scope, and (3) the availability of materials for construction. During procurement, WASH-FIN was able to identify fewer than 10 companies in Zambia that could bid for the services. Among these, only 6 attended the site visits, and 5 submitted bids. The quality of the bids showed a lack of experience and understanding of proposal development requirements and in some cases, design capacity. The project implementation experienced a challenge related to insufficient conservatism in wind loading design which required corrective action by the contractor. Furthermore, critical materials needed to be procured from outside Zambia such as pumps, inverters, and telemetry systems, increasing the cost.

Q8: Are WSPs able to sell excess solar power back to electric utilities operating the grid, to reduce "net cost"? If not, why not? What advocacy or policy change would be needed for this to occur?

A: The systems were sized to meet existing pumping requirements and not produce additional capacity to feed into the grid. In both Kenya and Zambia, the regulatory regime is not yet favorable for grid-tied systems. In Kenya, policies are not established to sell electricity back to the grid and in Zambia there is a limitation regarding the minimum size of systems that can be connected to the grid. Although advocacy in concert with increased demand may help change this situation, some of the challenges associated with net metering are less related to policies and more related to the capacity of the physical electricity grid

infrastructure to accept power from distributed generation sources, and issues related to safety and power quality.

Q9: From the government side, are there incentives or programs to promote the adoption of solar energy in water systems in Kenya?

A: Yes. For example, the Finance Act 2021 was amended to exempt solar components from Value Added Tax (VAT), currently at 16%. This directly affects the price and cost of imported solar components such as solar pump units, solar pump controllers (inverters), solar panels, and solar PV protection devices.

Q10: Do you have similar programming for rural WASH?

A: USAID has similar rural WASH programming, though not under the WASH-FIN 2 program, so we will aim for sharing those experiences in the future! Stay tuned for USAID webinars at globalwaters.org. If you would like more information about USAID's rural WASH programming, please see our technical briefs on Rural Water Services and Rural Sanitation.

Q11: How is the quality and standardization of solar energy systems ensured for water systems in Kenya? Are there specific licensing or certification requirements for individuals / organizations involved in the installation / use of solar-powered water systems that can be referenced?

A: Solar Installation activities in Kenya are regulated in accordance with Energy Regulations of 2012 that require accreditation of all installers, importers, and contractors in the value chain. The regulations also provide for standard minimum warranties, field surveillance monitoring by the regulator before license renewals, and safety requirements.

Q12: Is financial readiness / risk the primary deterrent for scaling solar systems specifically, or is that true for any / all type of water service?

A: We heard from the Managing Director of Eastern Water and Sanitation Company of Zambia that they have plans and opportunity to upscale solar given favorable climatic conditions, but accessing finance remains their most critical constraint to rapid scaling given the initial capital costs of solar systems and relatively long payback period in the current Zambia context. Capacity has been built within the water service providers, however, to enable them to design procurements, manage and supervise delivery, and operate and maintain the systems.

Q13: Comment: From panel comment, it seems USAID's WASH-FIN 2 has a strong role to advocate for central govt. and utility policies that provide for net metering and sale of solar to the grid.

A: Yes, WASH-FIN 2 intends to continue to engage service providers, regulators, and policymakers to influence policy in a way that makes it easier for water and sanitation utilities to develop renewable

sources of energy to reduce operational cost and improve service. However, as noted above, some of the challenges associated with net metering are less related to policies and more related to the capacity of the physical electricity grid infrastructure to accept power from distributed generation sources, and issues related to safety and power quality.

Q14: Do the water users have to pay for the water?

A: Yes. The examples presented were for relatively large water utilities providing piped water directly to customers who pay water bills.

Q15: Do they pay only if the systems break down, or do they pay for example a monthly contribution, or do they pay per jerrycan / liter?

A: The examples presented were for relatively large water utilities which provide piped water directly to customers who pay water bills. In the case of "cash-and-carry" water kiosks or tap stands, payment modalities can vary widely, but ideally include regular customer payments in advance of breakdowns.

Q16: Is there a possibility that such rural systems can be discussed?

A: Yes! But WASH-FIN 2 is focused on the urban and peri-urban water space. USAID will look into this as there is a lot of interest, and also engage other partners working in the rural space to present! Thank you for your interest.

Q17: Has there been any move to calculate the potential for GHGs reduced comparative to prior fossil fuel used as a selection criterion for investment?

A: We are in the process of collecting data that will allow for such a detailed calculation of GHG reduction for these cases but intend to do so in the future. However, the systems highlighted in the case examples previously relied on electricity from the grid, which in turn is derived from various sources including hydropower. Therefore, GHG reduction would vary widely (e.g., a system that previously used diesel generators would have far greater GHG reduction than one which previously relied on hydropower).

Q18: Do you see potential for a dual water-energy utility, leveraging solar as a power source for both water supply and the community energy needs?

A: This has not been explored under WASH-FIN 2 thus far, but with large-scale solar energy proliferation, it can make sense to leverage improved electricity reliability from existing grids resulting from municipal or regional solarization projects. This is a good example of why it is important for water sector practitioners to engage with other development actors, notably including energy utilities, city planners, and national planning authorities.

Q19: Instead of new grants in Ghana (or elsewhere) which is a high use of funds, perhaps USAID will consider working with central govt. and banks to stimulate better lending programs. USAID might provide a business model support for banks, even country-bank guarantees for lending programs, low interest, etc.

A: Indeed, WASH-FIN 2 is always searching for the most optimal financing sources and does not encourage the use of grant financing when there are other funding options available, notably local commercial financing solutions and bank guarantees such as those offered by the US International Development Finance Corporation (DFC). The WASH-FIN 2 project seeks to leverage these types of solutions and the influence of USAID and other actors to stimulate more attractive lending terms. That said, in Ghana, we would have to be creative and innovative given the macroeconomic context including very high current interest rates which poses significant challenges in the short term, and which are beyond the project's ability to influence directly. However, there are opportunities to partner with other large initiatives that are seeking to address these challenges, such as an African Development Bank program which is working to make financing more affordable. Our new program in Ghana will seek to partner with the African Development Bank and other partners in this regard.

Q20: Did you do an assessment of previous solar powered water systems in Kenya and Zambia before your interventions? If yes, what were the key findings and lessons for your solarization program?

A: Yes.

In Zambia, for instance, we learned that several installations experienced security issues (e.g. vandalism or theft of solar panels or other equipment), so site selection took into consideration security concerns, and we provided all our sites with substantial security fencing. Lessons also informed technical specifications such as inclusion of system protectors (e.g. surge protection, lightning arrestor). We also obtained a good deal of information on the cost of developed systems which we used in our own internal cost estimates. Data collection and management was also a challenge, so we incorporated telemetry systems which allow for automatic transmission of operational data (e.g. pumping rate, borehole and tank water levels, energy production from PV modules, energy used from the grid) to a central location.

In Kenya, we were familiar with quite a few existing systems and learned that many of them were experiencing a variety of issues. For example, two systems in Nakuru and Eldoret were both grid-tied systems, meaning they were designed to sell excess power back to the grid, but this had been problematic, which led us to opt for a simpler, hybrid configuration that would maximize use of solar output in the day, but not attempt to feed it back into the grid, or feed excess production to battery storage.

One WSP we worked with in Isiolo had solarized another borehole, but this one wasn't even functional when we started as the water was overly saline. This emphasized the importance of following our water quality assurance standards and USAID's requirements.

In general, Kenya's various experiences also emphasized the importance of undertaking the entire process in close partnership with the service provider to ensure buy-in, their capacity to maintain the system, and also support our long-term monitoring of the systems' performance.

Q21: In many countries, there has been a process in the past in standardizing technologies for handpumps to facilitate / structure supply chains and maintenance services. Do we see examples of countries doing the same for solar?

A: This may be something worth exploring as there can be many benefits to standardizing technologies. However, a significant number of studies and installations ought to be made to understand suitability of technologies versus site characteristics and make informed contributions.

Q22: What was the main consideration for tapping commercial finance for these types of water systems rather than the Green Climate Fund?

A: Good question. The cases presented were small pilots, but in the scale up, we can consider other types of financing like the Green Climate Fund (GCF). Part of the issue is the long timeline to obtain funding from GCF, and another consideration is the size of the projects themselves. The scale of investments described in our case examples, which are intended to demonstrate feasibility, can be attractive for local commercial lenders, which we would prioritize where feasible. Local lenders also utilize local currency which makes it easier for service providers to repay.

Q23: Are these systems supported by batteries? If yes, how often do they get replaced, and what is the protocol for disposing of used batteries?

A: No, we opted for hybrid grid connected solar without battery storage, mostly due to cost considerations and the existence of grid electricity. Please refer to our response to Q6.

Q24: In rural and peri urban areas, do you fund and facilitate solar mini grids? I am aware of the African Mini Grids firm in So Africa that sells ready-to-use customized systems - panels, metal building, inverters, and programming to suit smaller communities. Please investigate this and add to your program. This seems to be a very capable consortium, including African entrepreneur working with Silicon Valley solar expert.

A: Thanks for the suggestion! We will look into it!

Q25: What about the cost of equipment and services offered by Davis & Shirtliff?

A: We unfortunately are not certain as to what this question is referring to specifically. Costs of equipment and services are reflective of the individual country markets in which they operate.

Q26: What is the legal framework regarding power net-metering in Zambia?

A: Refer to response to Q8, a link is provided here to the Zambian regulator's website here: The Energy Regulation Act 2019 Net-Metering Regulation

Q27: Are we also thinking about the environmental impacts of solar panels manufacturing and their disposal?

A: The sub-contractor's construction quality assurance plans and the manuals submitted to the water service providers address environmental impacts of construction and disposal of materials. We did not factor in the impact of solar panel manufacturing, but this could be done as part of overall GHG impact analysis in the future.

Q28: In your experience what have been the major barriers to scale for the businesses that sell the water pumping technology?

A: WASH-FIN 2 did not explore this issue in-depth, but customer demand, the enabling environment, and financing are important factors related to why solar pumping businesses would flourish or flounder.

Q29: How can we add Liberia to get solar water systems as well?

A: USAID invested in solar-powered water treatment and distribution systems in three secondary city systems in Liberia (Voinjama, Robertsport, and Sanniquellie) which serve an estimated 30,000 people. The systems rely primarily on solar power, with diesel generators as backup (given the lack of functional electricity grids in these cities). In general, we are promoting solar where it is appropriate and where it's feasible, globally.

Q30: Can you talk about the management burden (e.g., skills, supply chain, costs) of solar vs. conventional power sources?

A: The water service providers indeed must add new skillsets related to management of solar systems. However, maintenance of the system demands relatively little effort in cleaning that has been embedded in the regular site monitoring activities of existing operators. Furthermore, telemetry allows for remote monitoring, which allows for tracking of operational parameters (e.g. pumping rates, water levels, energy production) and rapid response to any breakdown. The scope included the training of operators, provision of operation manuals, and spare parts.

Q31: As the systems get up and running, do you think there is the market for increased investment from GoK or GoZ, impact investors, or institutional investors who could support the water service providers to expand the solar systems to meet other communities?

A: Yes. WASH-FIN 2 intends to support demonstration of the feasibility and benefits of these solutions, notably including cost reduction, revenue enhancement, expanded service delivery, and improved customer satisfaction. The project also intends to coordinate with other donors and investors to encourage increased investment in solarization.

Q32: Did you have to conduct geo-resistivity studies to identify viable groundwater sources? Or are these existing boreholes already? Were there specific requirements on the source of the technology (e.g., US or Europe)

A: These were all existing boreholes. There were no specific requirements for the source of technology, they just could not be any of the US Government's prohibited sources.

Q33: Where can I find the source for this "Energy costs often account for more than 50 percent of water service providers' operating costs. Introducing solar energy to power water systems can reduce costs while also improving reliability of service delivery."?

A: Hello, here is a WASH-FIN reference for Kenya: WASH-FIN Update on Electricity Costs for Service Providers in Kenya | Globalwaters.org

Q34: How [can/should] government help in this scheme [solarization]?

A: Governments can play an important role in promotion of solarization through development and implementation of related policies and regulations to create a supportive enabling environment such as establishment of design and equipment quality standards, promotion of public private partnerships [PPP], and incentives such as tax breaks. Governments can also help by conducting research and promoting knowledge sharing, upgrading, and improving existing electricity grids to facilitate increased solarization, and facilitating cooperation among the energy and water sectors.

Q35: Can you clarify your conclusion that electricity is cheap in Zambia? Electricity cost for water utilities is high in relation to the revenue.

A: This statement was made regarding the relative cost of electricity in Zambia compared to Kenya. Cost recovery is indeed related to a variety of factors such as: electricity costs; metering, billing, and collection ratios; water tariff rates; staffing costs; and other factors. However, we should note that electricity in Zambia is cheap in part due to the reliance on hydropower for over 80% of energy needs. This leads to relatively cheap electricity, but also some challenges with consistent supply, especially in the dry season.

Q36: To what extent did the installation of solar and hybrid systems contribute to percentage reduction of O&M cost?

A: Our focus on data analysis thus far has been on reduction of energy costs, increased production, and improved customer satisfaction. As part of longer-term analyses, we will look more closely at the impact on overall O&M costs, which requires review of data throughout at least a year including consideration of added cost of maintenance of the solar systems (they make use of existing personnel), although viability assessments conducted prior to construction predicted savings. We are also hesitant to provide a definitive response without additional analysis over a longer time period to ensure consideration of seasonality. However, we are seeing a significant reduction in energy costs ranging from 18%-62% in the two countries depending on local site conditions. Given that energy is commonly the largest non-labor cost faced by many water utilities, this will have a significant impact on overall O&M cost reduction.

Q37: What is the design like, do you store energy, by this I mean provision of batteries or it's only pumping during sunny hours?

A: The system does not incorporate storage. Pumping occurs during the day using solar energy and at night using the grid. When solar is not available, the systems typically use the grid when it is available.

Q38: Did the hybrid system enable O&M to be recovered fully? If not, to what extent it did?

A: Please refer to Q36.

Q39: How can we demonstrate our solar powered water well drill where the power for the water pump is used to drill the well? Is there a location that would like to have this system tested?

A: This sounds like an interesting innovation for new sources. However, in our case studies, we were solarizing existing water supply wells and did not do any new well drilling. You could provide information on your technology to USAID for consideration in development of new sources in the future.

Q40: I understand under this project there has not been enough time; however, I'm wondering if there is any data on the longevity/sustainability of the systems themselves?

A: The solar panels have a useful life of 25 years but can produce up to 80% after this. The panels have an equipment warranty of 20 years while a controller has a warranty for 10 years. There are many individual pieces of equipment to the systems that may need replacement before this period of time. Proactive maintenance is critical to ensuring the systems achieve their rated lifespan.

Q41: Is there a contact number for GlobalWaters? We have the tools and funding for a Water Neighborhood and would like to install it somewhere in Africa or Asia. How do I find an area to install? I personally traveled to Delhi and offered to furnish 3 drilling rigs and the training of 3 crews to USAID, all for free. They were rejected. Is there someone in your area of the world that would accept free drilling rigs and training? I don't want to waste my

time and money again. By the way, there are no obligations. So, I am at a loss as to why USAID rejected my offer. I have posted my information under the UN Action Agenda where we offer our plan to furnish water to 400 million people before 2030. You might read that plan; it could be useful to USAID. We have now drilled over 650 water wells. It would be good if USAID recognized what we do even if they are not interested in helping or funding. Is USAID interested in learning more? Is there a contact number, email, or web contact that I may use to speak directly with someone in leadership? I would love to support and help USAID. Together we can furnish water for all before 2030.

Thank you very much for your comments and offer of support. GlobalWaters.org is a knowledge platform supported by the USAID Bureau for Resilience and Food Security's Center for Water Security, Sanitation, and Hygiene in support of the Agency's Plan under the U.S. Global Water Strategy. WASH-FIN 2, a global USAID program working through USAID Missions globally, conducted the work described during the webinar. The webinar and case examples included solarization of existing boreholes and did not include new source development. You can contact USAID at UnsolicitedProposals@usaid.gov to discuss potential future opportunities for collaboration. Be sure to clearly outline interest in WASH to help ensure your email reaches the Center for Water Security, Sanitation, and Hygiene.